Leuze electronic

the sensor people

MSI 200

Programmable Safety Controllers

EN 2011/05 - 700932

USER MANUAL

Leuze electronic GmbH + Co. KG
In der Braike 1
D-73277 Owen - Teck / Germany
Phone: +49 7021 573-0
Fax: +49 7021 573-199
http://www.leuze.com
info@leuze.de

Leuze electronic

User Manual

Device description, configuration, and startup of the MSI 200 safety controller with the MSI-EM200-8I4IO4 extension module

2011-05-26

Designation: MSI 200

Revision: 01

Order No.: 700932

This user manual is valid for

Designation	Order No.
MSI 200	
MSI 201	547803
MSI 202	547813
MSI-EM200-8I4IO	
MSI-EM201-8I4IO	547804
MSI-EM202-8I4IO	547814

Please observe the following notes

In order to ensure the safe use of the product described, you have to read and understand this manual. The following notes provide information on how to use this manual.

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.

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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 messages that follow this symbol to avoid possible injury or death.

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.

The following types of messages provide information about possible property damage and general information concerning proper operation and ease-of-use.

NOTE
This symbol and the accompanying text alerts the reader to a situation which may cause damage or malfunction to the device, either hardware or software, or surrounding property.

This symbol and the accompanying text provides additional information to the reader. It is also used as a reference to other sources of information (manuals, data sheets, literature) on the subject matter, product, etc.

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Published by

Leuze electronic GmbH & Co. KG
In der Braike 1
73277 Owen
Germany
Phone +49 - (0) 7021 573-0
Fax +49 - (0) 7021 573-199

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1 For your safety

1.1 Purpose of this user manual

This user manual should enable the user to configure and start up the MSI 200 safety contoller 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 MSI 200 safety contoller, the MSI-EM200-8I4IO safe extension device, and the associated MSIsafesoft configuration software, and finally explains the necessary steps for configuration and startup.

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

The MSI 200 configurable safety contoller is referred to in this documentation as "safety contoller" for short.

1.2 General safety notes

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

Please observe all the safety notes outlined in this section when using the MSI 200 safety contoller.

Requirements

Knowledge of the following is required:

- The MSI 200 safety contoller used and the I/O devices (extension devices, sensors, actuators)
- The MSIsafesoft configuration software
- The safety directives for the field of application

Qualified personnel

WARNING: In the context of the use of the MSI 200 safety contoller with MSIsafesoft configuration software and safe functional blocks, the following operations may only be carried out by qualified personnel:

- Planning, parameterization, configuration (development of 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 safety in the workplace 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 functional blocks are used correctly (see "Intended use" on page 1-6).

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 MSI 200 safety contoller and the MSI-EM200-8I4IO safe extension device can detect various errors within the safety equipment (e.g., cross circuits).

Observe startup behavior

Some of the safe functional blocks in the MSIsafesoft 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 contoller or the MSI-EM200-8I4IO safe extension device.

Use these parameters in the MSIsafesoft configuration software to monitor the startup/restart of the safety contoller.

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 Leuze electronic immediately.

WARNING: It is not permitted to make repairs to the MSI 200 safety contoller or the extension modules. The housing must not be opened.

1.3 Electrical safety

DANGER: Hazardous body 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

Protection against direct and indirect contact according to DIN VDE 0100-410 must be ensured for all components connected to the MSI 200 safety contoller or extension devices. In the event of an error, parasitic voltages must not occur (single-fault tolerance).

Safe isolation

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

Power supply unit

Only use power supply units with safe isolation and PELV conforming to EN 50178/VDE 0160 (PELV). These units prevent short circuits 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 thus be observed.

Draw up and implement a safety concept

In order to use the system described in this document with the associated safe functional 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 and category according to EN 954-1 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 functional blocks should be used in the safety logic (The safety logic is created using the MSIsafesoft configuration software.)

Within the safe control system used, the safe functional blocks support the following safety integrity requirements:
– Up to SIL 3 according to standard IEC 61508
– Up to SILCL 3 according to standard EN 62061
– Up to Category 4 acc. to standard EN 954-1
  or PLe acc. 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 1-4).

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 MSIsafesoft safe configuration software.

Use your test report to ensure that:
– The safe sensors and actuators are connected correctly in the MSI 200 safety application. To do this, use the "Wiring check" function in MSIsafesoft (see page 2-11).
– The inputs and outputs of the MSI 200 safety contoller 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 2-8).
– All safe functional blocks and functions in the MSIsafesoft configuration software are connected correctly.

1.5 Directives and standards

The manufacturers and operators of machines and systems in which the MSI 200 safety contoller is used are responsible for adhering to all applicable directives and legislation.

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

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 safety-related electrical/electronic/programmable electronic 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 MSI 200 safety contoller according to the information listed in this section.

MSI 200

The safety contoller and all extension modules must only be used in industrial applications subject to conformance with standards IEC 61508, EN ISO 13849, EN 954, and EN 62061.

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

The safety contoller can only perform its safety-related tasks if it has been 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 in the user manuals and online help listed in "Documentation" on page 1-7. In particular, you must only use the safety contoller in accordance with the technical data listed in Section 3.9.

MSI-EM200-8I4IO

The MSI-EM200-8I4IO safe extension module is an extension to the safety contoller. It provides additional configurable inputs and outputs. When working with the MSI-EM200-8I4IO safe extension module, please also ensure compliance with the technical data listed in Section 4.5.

MSIsafesoft

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

Safe functional blocks and functions in MSIsafesoft

The safe functional blocks and functions available in the MSIsafesoft configuration software for creating the safety logic are designed solely for use within the safety contoller and support specific safety functions.

The safe functional 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 functional block. Theoretical examples of the use of the safe functional blocks are described in "Application examples".

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

In order to fully execute a safety function, it is your responsibility to connect the inputs and outputs of the safe functional blocks/functions in the MSIsafesoft 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 contoller

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 functional 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 contoller, device parameterization, wiring, sensors, actuators, single-channel or two-channel operation, etc.) starting from the "functional block I/O" 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 MSI 200 safety contoller, 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 contoller
– In the technical description of the MSI-EM200-8I4IO safe extension device
– In the user documentation for I/O devices (e.g., sensors/actuators, etc.) connected to the safety contoller and connected to safe functional blocks in the safety logic (MSIsafesoft configuration software)
– In the online help for the MSIsafesoft safe configuration software (see also Figure 1-1) and for each of the safe functional 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.

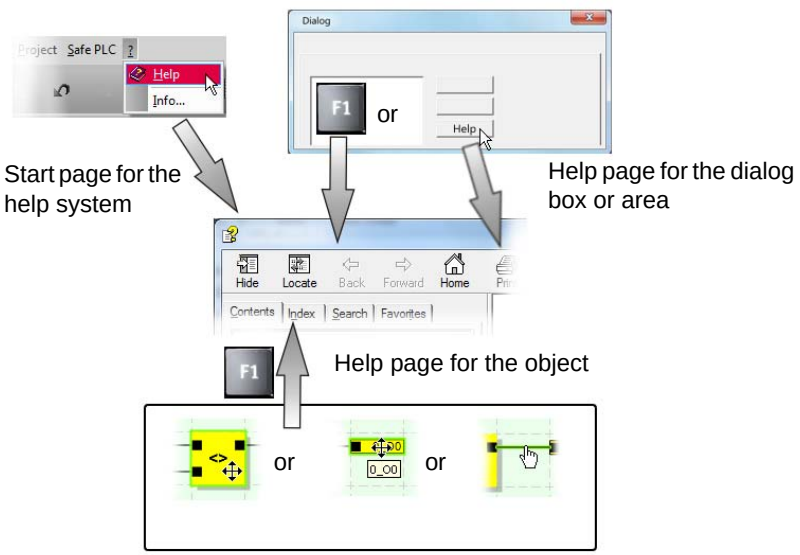


Figure 1-1 Calling the online help in the configuration software MSIsafesoft

2 System description

2.1 Method of operation and structure of the MSI 200 safety system

The overall system: Hardware and software

The MSI 200 safety system consists of the following components:

– The MSI 200 safety contoller
– Optional MSI-EM200-8I4IO safe extension modules
– The MSIsafesoft configuration software
– Suitable safe control devices, sensors, and actuators (depending on the application)

The MSI 200 safety contoller is designed for monitoring and evaluating safety-related control devices in machines and systems (see "Intended use" on page 1-6). The safety contoller monitors the safe control devices and safety sensors connected at its inputs and at the inputs of the safe extension modules (if there are any). It evaluates the incoming signals according to its configuration, and controls the outputs accordingly.

The MSIsafesoft configuration software is used to configure the MSI 200 safety contoller and the MSI-EM200-8I4IO safe extension module; it provides the relevant editors as well as suitable startup and diagnostic tools for this purpose.

The diagram below illustrates the overall system in an application example.

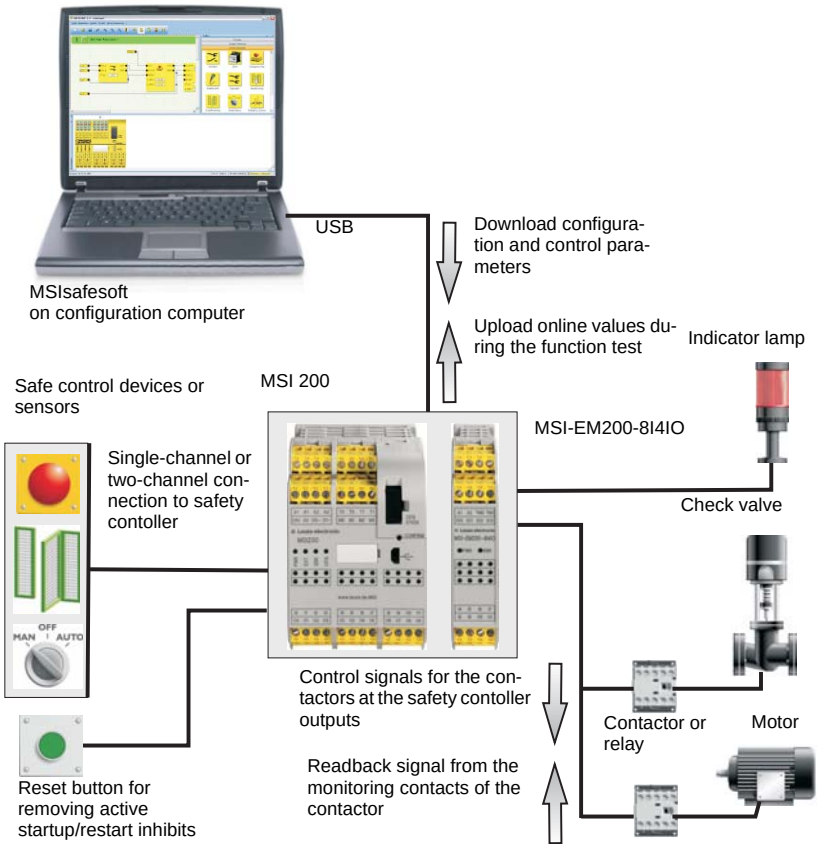


Figure 2-1 Example safety system structure

Hardware: MSI 200

The MSI 200 safety contoller offers 20 digital safe inputs for connecting a maximum of 20 single-channel or 10 two-channel safety-related sensors and control devices.

The MSI 200 has 4 digital safe outputs, each of which is set up as a semiconductor output (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 2-5).

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

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

The MSI 200 safety contoller can be used both with and without extension modules.

Hardware: MSI-EM200-8I4IO

The MSI-EM200-8I4IO safe extension module has eight safe digital inputs and four signals, which can all be configured as safe inputs or all 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 detector unit (e.g., a signal lamp). Test clock outputs can be used to implement cross-circuit detection for input signals.

For more detailed information about the MSI-EM200-8I4IO safe extension module, please refer to the device description in Section 4.

Software: MSIsafesoft

The MSI 200 safety contoller and the MSI-EM200-8I4IO safe extension modules can only be configured and parameterized using the MSIsafesoft 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 functional blocks to the inputs and outputs of the safety contoller. 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 MSI 200 safety contoller and the MSI-EM200-8I4IO safe extension modules.

A special online mode supports a detailed **function test** of the safety logic executed in the MSI 200 safety contoller. Current signal values can be read from the MSI 200 safety contoller, transmitted to the configuration software, and displayed there "live" in the connection editor.

For more detailed information about the configuration software, please refer to the software description in Section 5.

Safe communication

Communication between the MSI 200 safety contoller and the configuration software is via a USB interface.

There is communication between the two components in both directions:

– PC → safety contoller: The configuration data and device parameters are downloaded from the configuration PC to the safety contoller. Configuration data refers to the application logic, which was created using MSIsafesoft.
  The configuration can also be downloaded using the plug-in data memory module. Please refer to "Downloading the configuration from MSIsafesoft" on page 6-4 and "Downloading the configuration using the AC-MSI-CFG1" on page 6-7.
– Safety contoller → PC: For diagnostic purposes, online values can be read from the MSI 200 safety contoller via the USB interface and displayed "live" in the software. For more detailed information, please refer to "Function test" on page 6-10.

Communication via the TBUS DIN rail connector

The MSI 200 safety contoller (master module) is equipped with an interface for the TBUS DIN rail connector. The Leuze electronic DIN rail connector can be used to connect up to ten extension modules like the MSI-EM200-8I4IO, for example. Communication with these modules is then established automatically via the connector on the DIN rail connector. Safety-related cross-wiring is not required (see also "Mounting the safety contoller" on page 3-13).

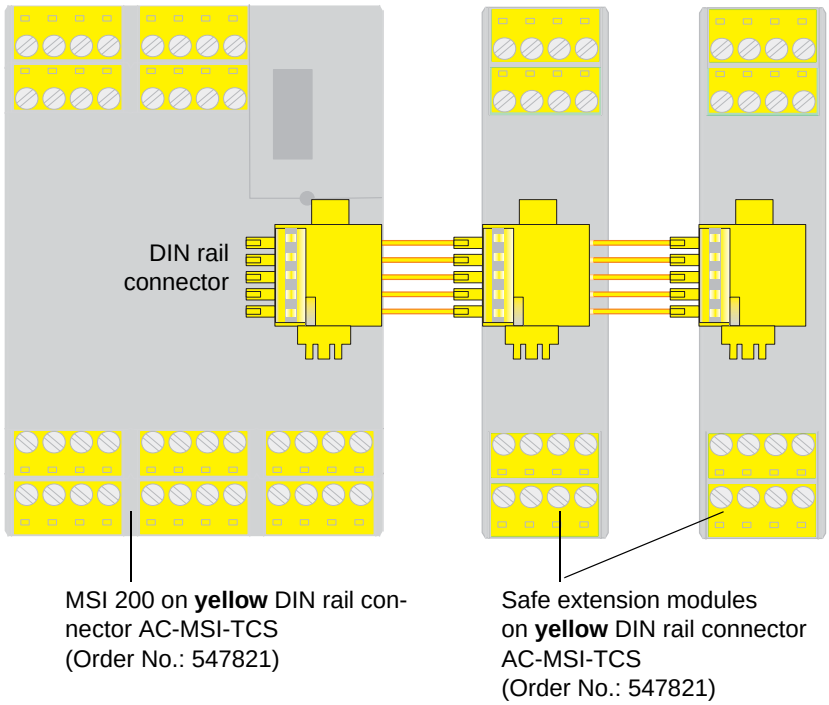


Figure 2-2 TBUS DIN rail connector from Leuze electronic

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

2.2 Using the system

The MSI 200 safety contoller configured with MSIsafesoft is designed for monitoring and evaluating safety control devices and safety sensors in machines. Optional safe extension modules (MSI-EM200-8I4IO) provide additional safe inputs for the connection of safe control devices/sensors.

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 equipped conforming 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 thus 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 contoller can be configured flexibly. For the creation of the safety logic, it has safe functional blocks, which are part of the system. The MSI 200 can be used to implement various safety functions in different safety circuits. Just some of the most important options are listed below:

- 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 contoller 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 safe functional blocks connected in the safety logic: Only if the module output is connected **directly** to the enable output of a safe functional block, which executes stop category 0 at its output, can the module output also meet this category.

Example

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

Figure 2-3 on page 2-7 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 for 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 both the results of the risk analysis and the signal path.

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

2.3 System startup and restart behavior

Startup

"Startup" refers to the behavior of the MSI 200 safety contoller (and, therefore, also to that of the safe extension devices used) after switching on (or applying the supply voltage) and following configuration via USB interface or data memory module.

Unless a startup inhibit is configured, the safety contoller 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 contoller and the safe extension devices after the safety function is triggered and following a return to normal operation (unlocking the emergency stop control device, for example), 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 an undesired 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 2-5), the startup and restart behavior of the safety contoller 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 used at the same time to exit the error state once the error cause has been removed.

Implementation using safe functional blocks

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

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

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

Functional 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-stage interlocking	Startup inhibit, restart inhibit
GuardMonitoring	Monitoring of a safety door with two-stage 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** connected in the safety logic to the output of a safe functional 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 functional block. The OUT enable output for the functional block is connected directly to safe output O0, where O0 offers a restart inhibit and a startup inhibit. (EmergencyStop executes stop category 0 at the output, which is also transmitted to O0 by the direct connection.)

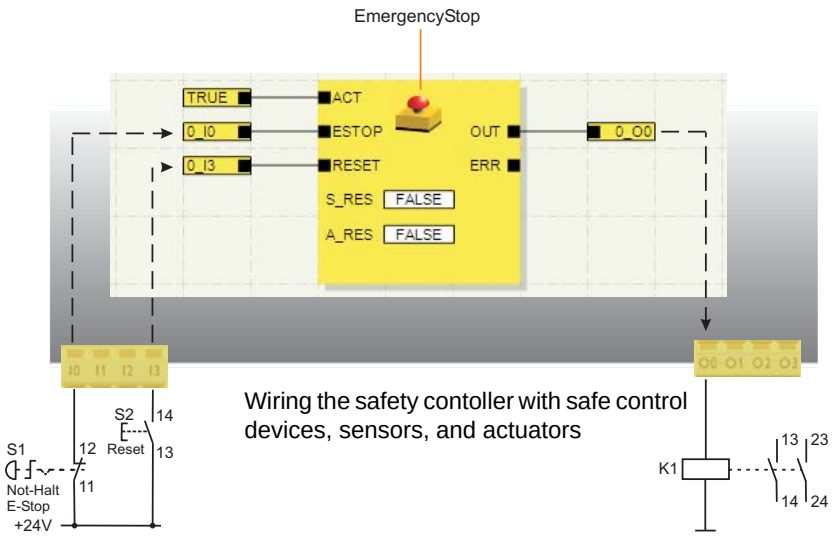


Figure 2-3 Implementing a startup inhibit, restart inhibit, and stop category 0 for safe output O0

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.

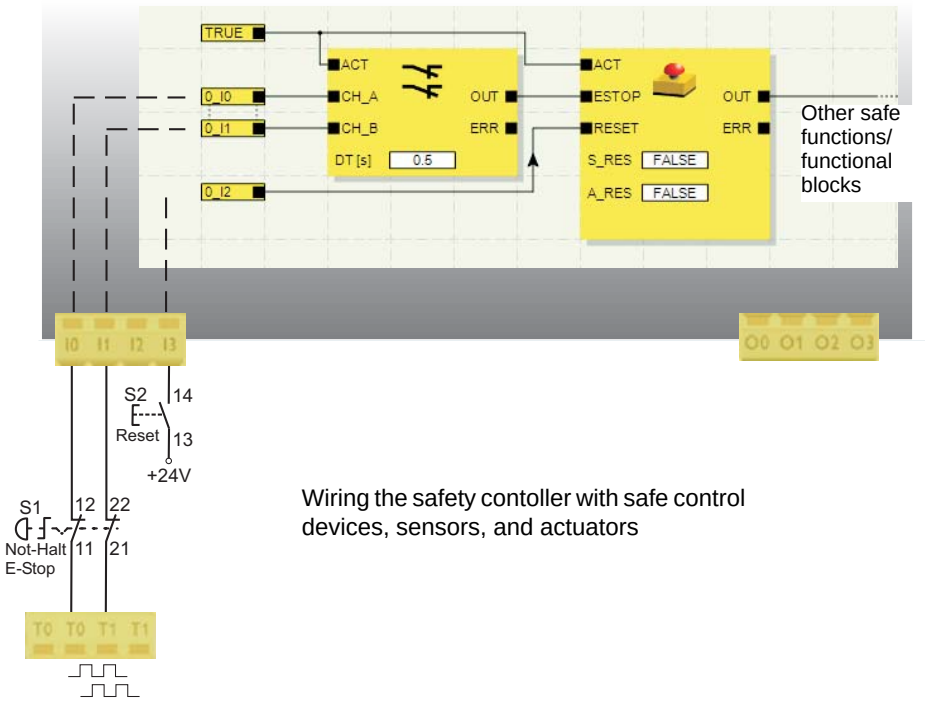
A cross circuit is an unintentional, incorrect connection between redundant circuits.

Clock outputs T0 and T1

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



Wiring the safety contoller with safe control devices, sensors, and actuators

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

Parameterization editor in MSIsafesoft

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

Activating cross-circuit detection for the safety contoller inputs:

1. Open the parameterization editor by double-clicking in the MSIsafesoft 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 MSI-EM200-8I4IO safe extension module. The TM0 and TM1 module outputs must be configured as clock outputs for this purpose. For further information about cross-circuit detection in the MSI-EM200-8I4IO safe extension module, please refer to the device description in Section 4.

2.5 Diagnostic tools

For an overview of the diagnostic and status indicators, please refer to Table 3-1 on page 3-5.

The MSIsafesoft configuration software, the MSI 200 safety contoller, and the MSI-EM200-8I4IO safe extension module provide various tools that can be used to diagnose the active configuration on the safety contoller:

– Hardware diagnostics in the event of a safe functional block error
– Wiring check
– Diagnostic and status indicators on the safety contoller
– Online tool tips in the connection editor

Hardware diagnostics in the event of a safe functional block error

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

For further information, please refer to the descriptions of the safe functional blocks in the MSIsafesoft online help, particularly in the corresponding "ERR output" help topic.

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

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

This function enables hardware errors to be located even without a PC. An error is indicated by the LED(s) at the inputs of the safety contoller flashing. The project documentation enables conclusions to be drawn regarding the relevant safe functional 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 contoller. The status of the N/C contacts is monitored by the Equivalent safe functional block. In our example, the functional block reports an error (ERR output = TRUE, the icon for the functional block is surrounded by a red border with the configuration software in online mode).

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

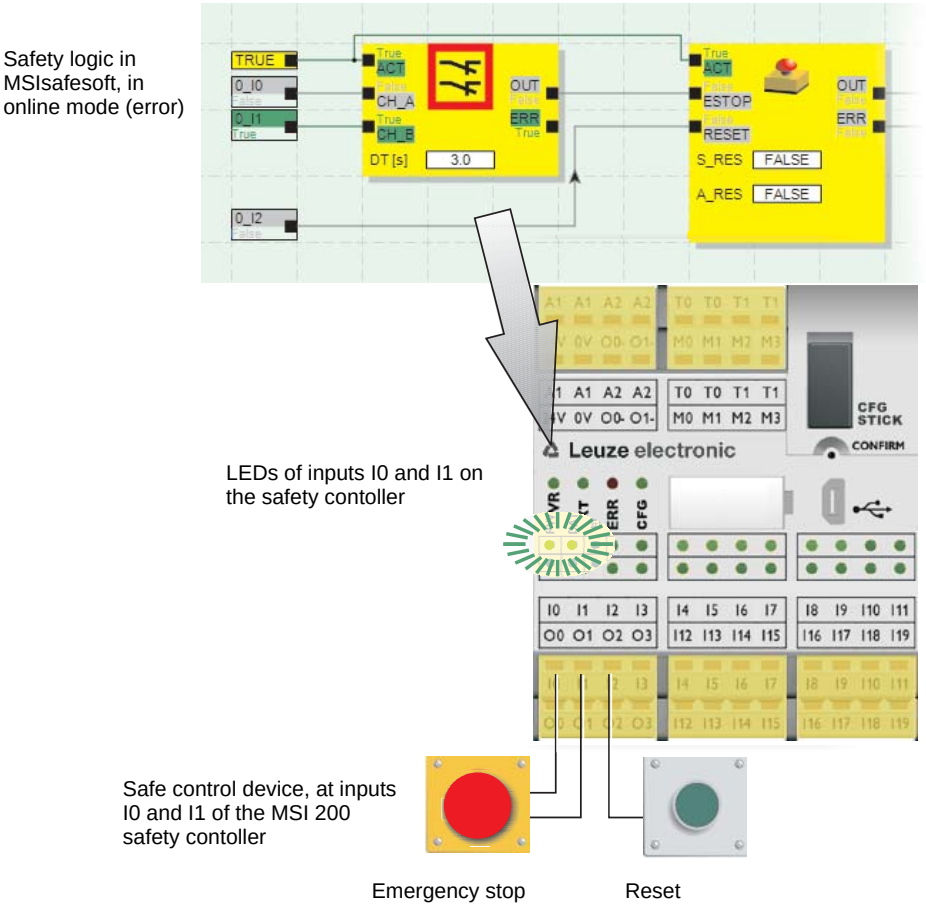


Figure 2-6 Hardware diagnostics in the event of a safe functional block error

Hardware diagnostics is also possible for inputs and outputs of safe extension devices (e.g., MSI-EM200-8I4IO).

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. A graphical link directs the user to the right position and provides a better overview of the control cabinet.

1. **Requirements:** The MSI 200 safety contoller 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 contoller or on the corresponding safe extension device.

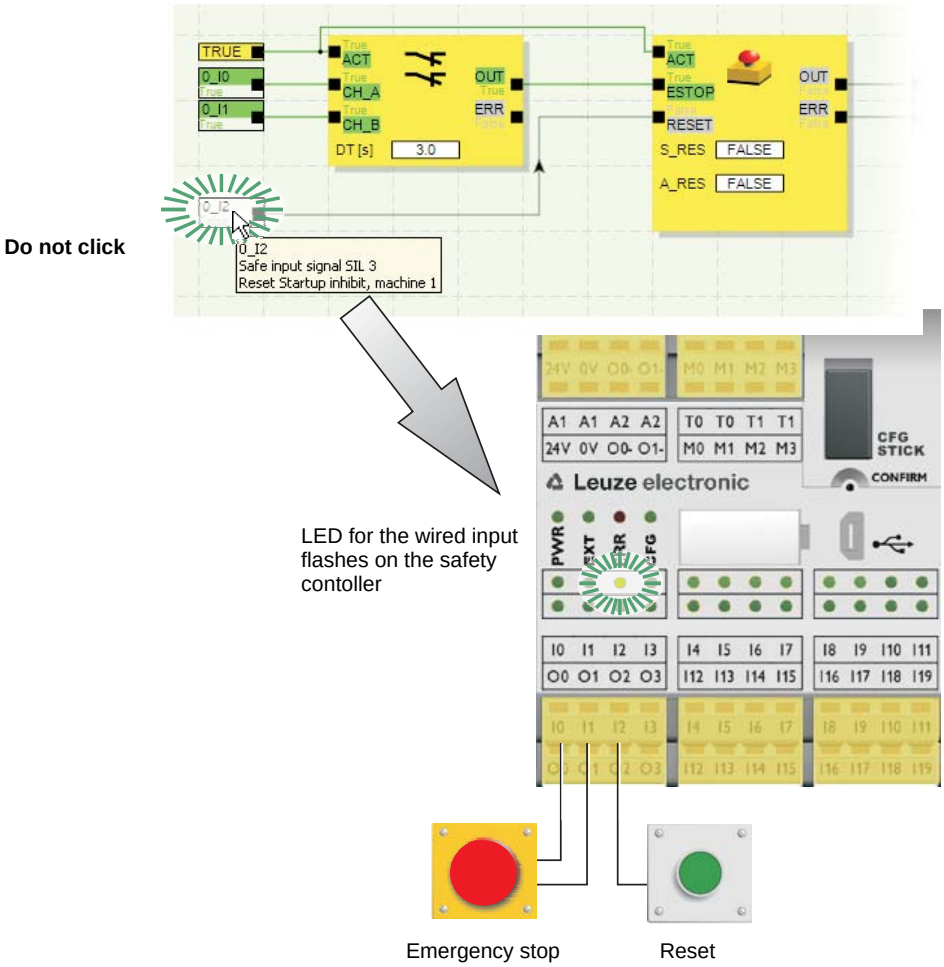


Figure 2-7 Simplified schematic view: Wiring check

A wiring check is also possible for inputs and outputs of safe extension devices (e.g., MSI-EM200-8I4IO).

Diagnostic indicators on the safety contoller

There are four diagnostic indicators on the MSI 200 safety contoller.

- PWR (green): Indicator for the power supply of the safety contoller
- EXT (green): Indicator for communication with extension modules (with/without TBUS)
- ERR (red): Error display
- CFG (green): Indicator for the configuration status and communication via the USB interface

The LEDs indicate the status of the safety contoller.

For a detailed list of possible indicator combinations and their meanings, please refer to "Diagnostic and status indicators" on page 3-4.

Diagnostic indicators on the MSI-EM200-8I4IO safe extension device

There are two LEDs on the MSI-EM200-8I4IO safe extension device.

– PWR (green): Indicator for the power supply of the extension module
– ERR (red): Error display

Online tool tips in the connection editor

In online mode, when the MSIsafesoft configuration software reads signal values from the MSI 200 safety contoller and displays them "live" in the connection editor, the safe functional blocks indicate their status and, in the event of an error, a description of the error as a tool tip as soon as you position the cursor over the icon for a functional block.

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

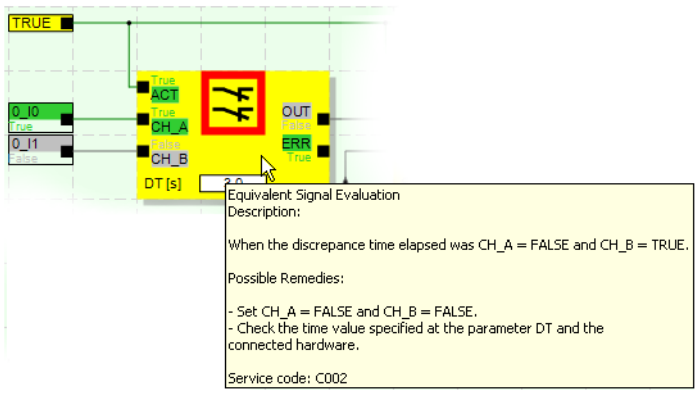


Figure 2-8 Example of an online tool tip in the event of an error

Offline tool tips

Tool tips are also available while editing the safety logic in the connection editor. For all functional 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.

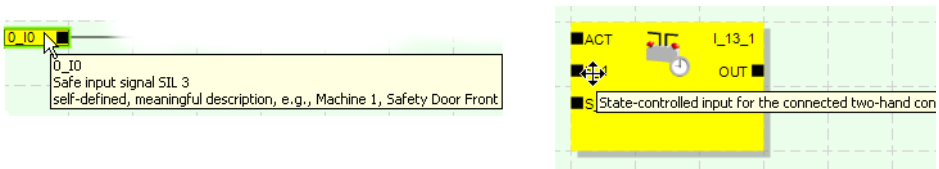


Figure 2-9 Examples of tool tips in the connection editor in offline mode (while editing the safety logic)

2.6 Password protection

MSI 200 and MSIsafesoft use two passwords to offer dual protection against unauthorized modifications to the configuration and the project in the configuration software.

Figure 2-10 Password protection for MSI 200 and MSIsafesoft

Controller password

The controller password protects the configuration on the MSI 200 safety contoller against unauthorized access and the safety contoller itself against unauthorized changes of operating mode. However, online values can be read from the safety contoller and displayed in MSIsafesoft without entering the controller password. However, a new configuration or new device parameters can only be downloaded to the safety contoller (and the safety contoller can only be launched accordingly) once the controller password has been entered.

When an unconfigured MSI 200 safety contoller is connected to the configuration computer for the first time, MSIsafesoft automatically prompts the user to specify a controller password. This password can be modified later if required.

Project password

The project password protects the configuration project in MSIsafesoft against unauthorized modifications 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 due to a long period of inactivity in MSIsafesoft

If no user activity is detected in MSIsafesoft 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.

This also applies to the MSI 200 safety contoller: If no user activity is detected for a prolonged period of time, you will have to enter the controller password again in order to continue to communicate with the safety contoller in MSIsafesoft.

During automatic logoff, for safety reasons the safety contoller 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 further information about password protection, please refer to the online help for MSIsafesoft.

2.7 Ordering data

Products

Description	Type	Order No.	Pcs./Pkt.
Configurable **safety contoller**			
Module with screw connections	MSI 201	547803	1
Module with spring-cage connections	MSI 202	547813	1
Configurable safe **extension module**			
Module with screw connections	MSI-EM201-8I4IO	547804	1
Module with spring-cage connections	MSI-EM202-8I4IO	547814	1
Data memory module for MSI 200 (supplied as standard with the safety contoller).	AC-MSI-CFG1	547820	10

Accessories

Description	Type	Order No.	Pcs./Pkt
MSI TBUS standard connection plug (for fieldbus gateways)	AC-MSI-TC	547823	10
MSI TBUS safety connection plug	AC-MSI-TCS	547821	10
MSI commissioning set including MSIsafesoft configuration software, configuration cable (USB), and Quick Start Guide	MSI-SWC1	547825	1
MSI USB cable MSI-PC, 3 m	AC-MSI-USB	547822	1

2.8 System requirements for the configuration software MSIsafesoft

Under Windows Vista/Windows 7	Minimum	Recommended
CPU	1 GHz x86 architecture	2 GHz x86 architecture
Main memory	1 GB	2 GB

Under Windows XP/2000 (SP4/SP2)	Minimum	Recommended
CPU	1 GHz x86 architecture	1 GHz x86 architecture
Main memory	512 MB	1 GB

All operating systems	Minimum	Recommended
Hard disk	1 GB free memory space	1 GB free memory space
Monitor/resolution	SVGA/800 x 600	SVGA/800 x 600
Mouse	required	required
CD-ROM drive	required	required
USB interface	required	required
Internet Explorer 5.5 or later	required	required

3 Safety contoller MSI 200

3.1 Device description

The MSI 200 safety contoller is a configurable safety controller 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 MSIsafesoft configuration software and downloaded to the safety contoller via USB interface.

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

In addition, the safety contoller has four non-safety-related digital alarm outputs (M0 to M3); these 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 contoller, as described in "Error detection in I/O devices" on page 2-8.

All connection terminal blocks are plug-in. The individual terminal block bases are mechanically keyed to prevent incorrect connection. The safety contoller is available either with screw connections (on the left in Figure 3-1) or with spring-cage connections (on the right in Figure 3-1).

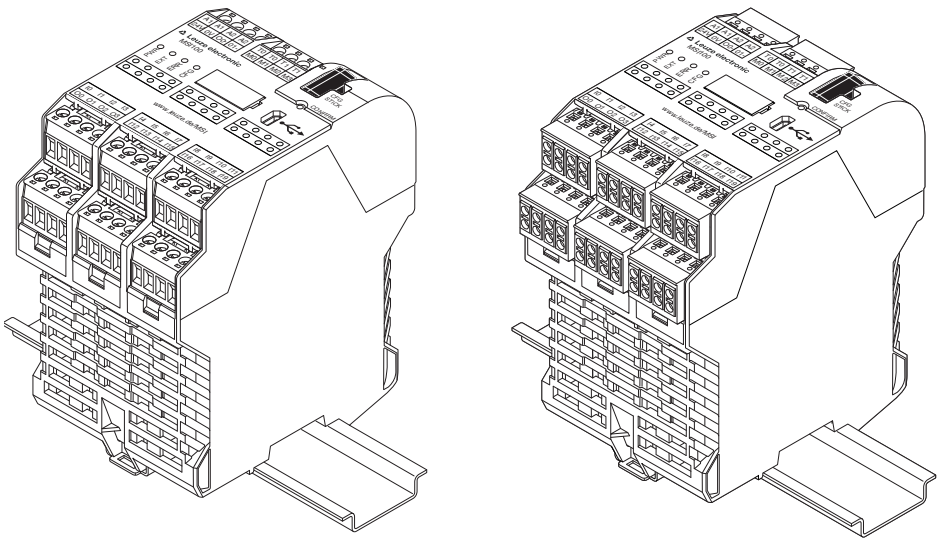


Figure 3-1 Screw connection (left) and spring-cage terminal blocks (right)

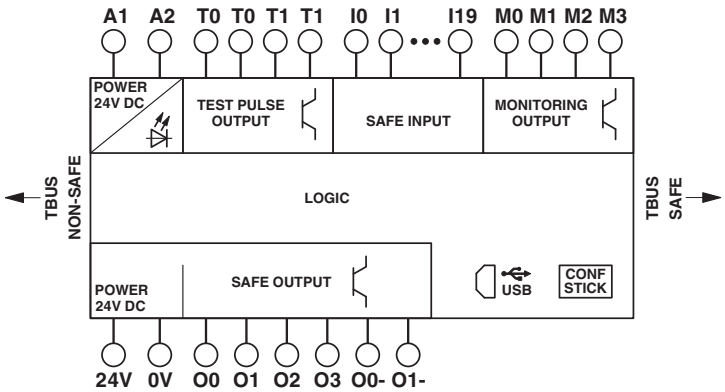


Figure 3-2 Block diagram of the MSI 200 safety contoller

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

3.2 Operating modes (status) of MSI 200

The diagram below illustrates the possible operating modes (status) of the MSI 200 safety contoller 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 MSIsafesoft configuration software.

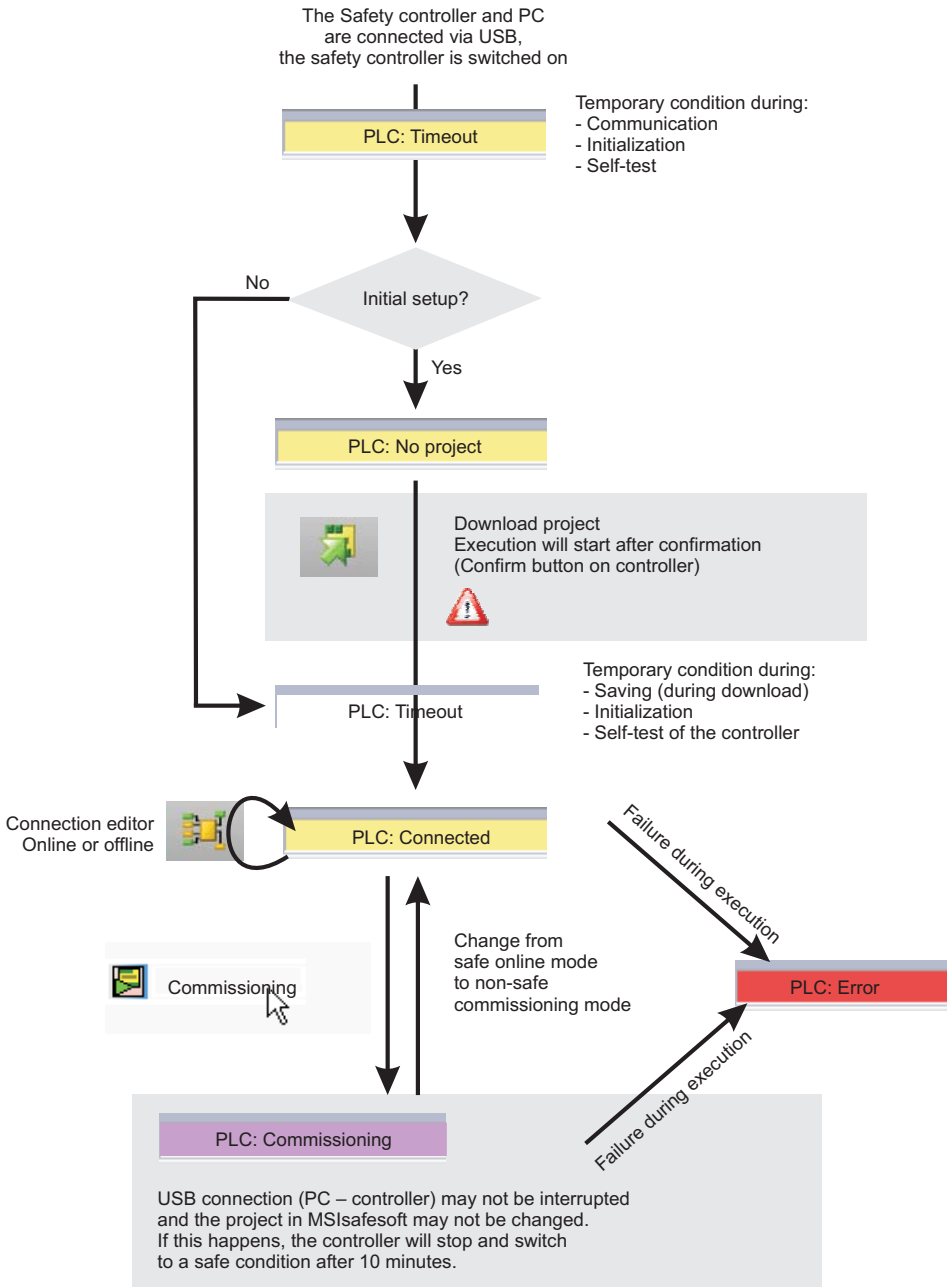


Figure 3-3 Possible operating modes (status) of the safety contoller

3.3 Operating and indication elements

All operating and indication elements for the MSI 200 safety contoller are located on the front of the device. The elements are described in the following sections.

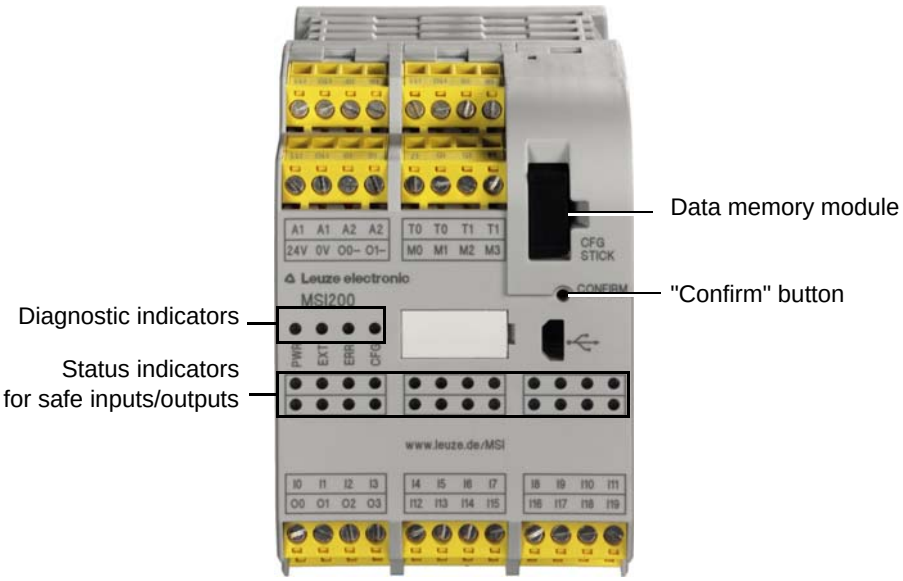


Figure 3-4 Operating and indication elements of the safety contoller

3.3.1 Diagnostic and status indicators

Diagnostic indicators

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

– "PWR": Indicator for the power supply of the safety contoller
– "EXT": Indicator for communication with extension modules (with/without TBUS DIN rail connector). This LED is only on if a TBUS device is connected.
– "ERR": Error indicator
– "CFG": Indicator for the configuration status and communication via the USB interface

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

The LED symbols in the table mean:

LED OFF ●

LED ON ☼

LED flashing ☼/●
Slowly = 1.7 Hz
Fast = 6.3 Hz

Table 3-1 Meaning of diagnostic indicators

PWR (green)	EXT (green)	ERR (red)	CFG (green)	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 the "Confirm" button on the device.
☼	●	●	☼/● 6.3 Hz	Acknowledgment of new configuration required after transmission via data memory module. → For sequence, refer to 6.3 on page 6-7.
☼	☼	●	☼/● 1.7 Hz	Extension device replaced: acknowledgment required. → Press the "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.
☼	●	●	☼	Default upon delivery. No configuration data on the data memory module. → Download project with MSIsafesoft.
☼	●	☼	☼	No data memory module. → Insert data memory module and apply power supply.
☼	●	☼/● 6.3 Hz	●	An error has occurred. → Read out the error code with MSIsafesoft.

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 2-9)
	☼/● Long ON Short OFF	Wiring check at an active input or antivalent input
	☼/● Long OFF Short ON	Wiring check at an inactive input or antivalent input.
For each output ("O0" to "O3")	●	Output inactive
	☼	Output active
	☼/●	Diagnostic error (see page 2-9)
	☼/● Long ON Short OFF	Wiring check at an active output or antivalent input.
	☼/● Long OFF Short ON	Wiring check at an inactive output or antivalent input.

3.3.2 "Confirm" button

Confirming the new configuration

The "Confirm" button is located at the front of the MSI 200 safety contoller on the right-hand side, 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 contoller.

See also "Downloading the configuration from MSIsafesoft" on page 6-4.

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. As part of the warm start process, all outputs are initially set to the safe state FALSE and pending error messages are reset as long as their cause has been removed. The device then enters the initialization phase.

Replacing the data memory module

The "Confirm" button also plays an important role when replacing the data memory module. To download a new configuration by replacing the data memory module rather than via the USB interface, press and hold down the "Confirm" button while removing and inserting the data memory module using the specified procedure.

For the precise procedure, please refer to "Downloading the configuration using the AC-MSI-CFG1" on page 6-7.

3.4 Signal connections

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

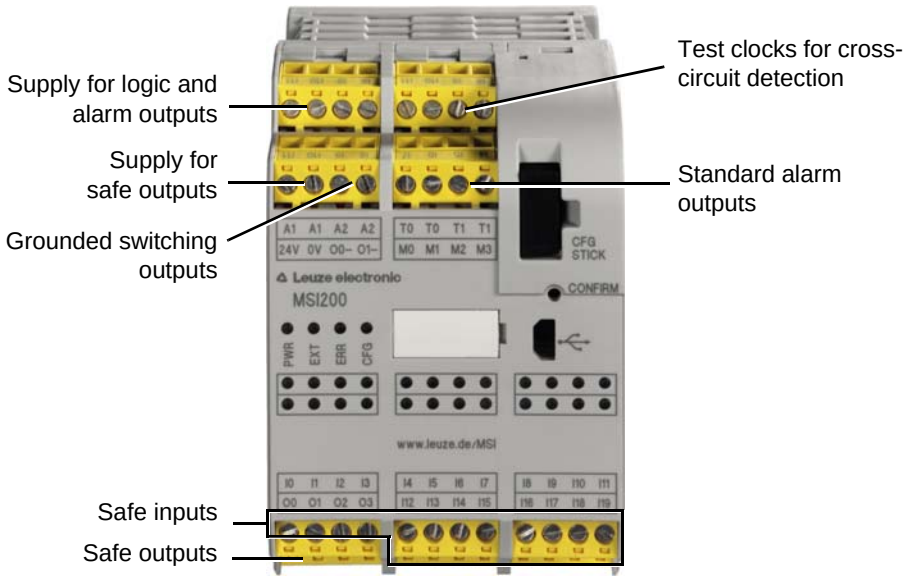


Figure 3-5 Signal connections MSI 200

The various signal connections are described in the following sections.

3.4.1 Signal inputs

The safety contoller 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 MSIsafesoft configuration software. See also "Inserting and connecting functions, functional blocks, and signals" on page 5-13.

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 MSIsafesoft safe configuration software. This is indicated in the representation of the safety contoller 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 single signals.

Dual signals are not connected to one another internally; they are simply grouped together.

As input signals with even and odd IDs are processed in different ways in the safety contoller, using dual signals ensures that the safety contoller 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 contoller 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 contoller 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 MSIsafesoft configuration software specifies the clock signals to be used: Cross-circuit detection is implemented with test clock T0 for "even" inputs (I0, I2, I4, ... I18). 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 2-8.

3.4.2 Safe outputs

The 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 them in the connection editor of the MSIsafesoft configuration software. See also "Inserting and connecting functions, functional blocks, and signals" on page 5-13.

To increase cross-circuit protection, outputs O0 and O1 can also be used in connection with grounded switching outputs O0- and O1-, see "Grounded switching outputs O0- and O1-" on page 3-10.

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

The 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 detector unit (e.g., a signal lamp).

As is the case for safe inputs and outputs, the alarm outputs are linked in the connection editor of MSIsafesoft (see "Inserting and connecting functions, functional blocks, and signals" on page 5-13).

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 test clocks T0 and T1 output 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 MSIsafesoft).

The MSIsafesoft configuration software specifies the clock signals to be used: Cross-circuit detection is implemented with test clock T0 for "even" inputs (I0, I2, I4, ... I18). 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 3-7 and "Error detection in I/O devices" on page 2-8.

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 contoller and the clock and grounded switching outputs with power.

3.4.6 Supply connections A1 and A2

The supply connection A1/A2 is used to supply the logic of the safety contoller 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 contoller (U_{nom} = 24 V DC).

For 3-wire sensors, ensure that the GND potential of the sensor/control device matches the GND potential of the safety contoller.

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 Grounded switching outputs O0- and O1-

The grounded 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 disconnect a contactor connected to the safety contoller via both the output and ground.

Grounded switching output O0- can only be used in connection with output O0, grounded switching output O1- can only be used in connection with output O1.

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

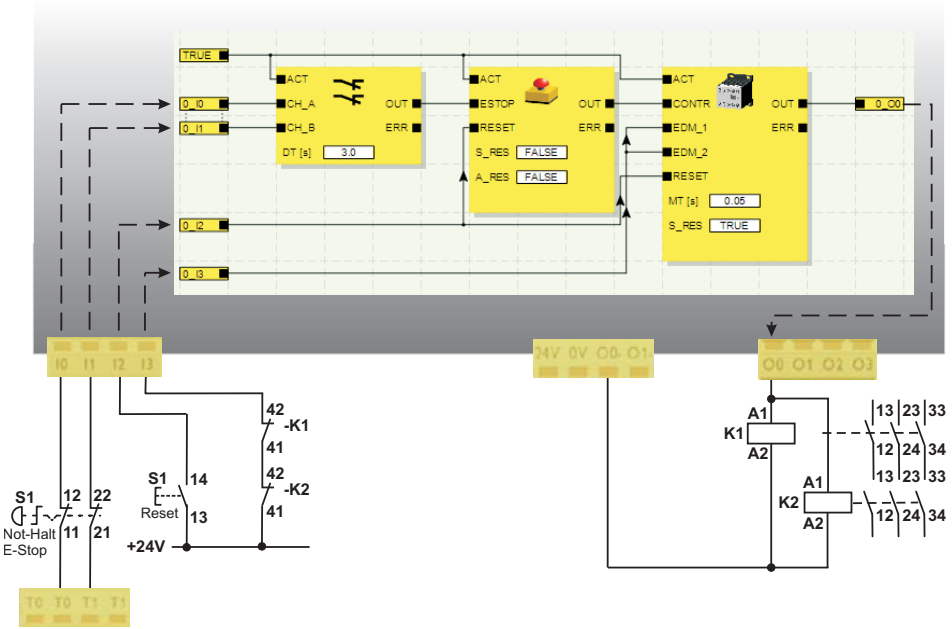


Figure 3-6 Example application for grounded switching outputs O0- and O1-

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

3.5 USB interface

The USB interface (Standard USB 2.0) is used for communication between the safety contoller and the MSIsafesoft configuration software.

This includes:

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

Before the safety contoller is connected to the configuration PC, the MSIsafesoft configuration software must be installed, with the associated USB drivers for the module.

NOTE: Electrostatic discharge

The safety contoller contains components that can be damaged or destroyed by electrostatic discharge. When handling the USB interface, take 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 connector, 5-pos., maximum cable length 3 m) has been connected, the appropriately configured PC detects the safety contoller automatically.

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

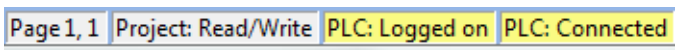


Figure 3-7 Status bar in the MSIsafesoft safe configuration software (safety contoller already contains a configuration project)

3.6 Data memory module (AC-MSI-CFG1)

The safety contoller is equipped with a plug-in memory module, the AC-MSI-CFG1.

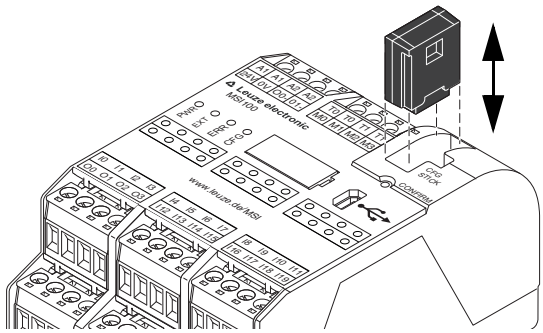


Figure 3-8 Data memory module AC-MSI-CFG1 on MSI 200

Data memory module as a hardkey

The data memory module **must** be inserted in the safety contoller both during normal operation and for downloading configuration data from MSIsafesoft via the USB interface.

If no data memory module is inserted in the safety contoller or if it is removed, the safety contoller behaves as follows:

- If no data memory module is inserted when downloading configuration data, the configuration cannot be downloaded and MSIsafesoft outputs an error message.
- If no data memory module is inserted when the safety contoller is started, all outputs remain deactivated and the safety contoller indicates an error. The safety contoller does not execute any functions.
- If the data memory module is removed during operation, the safety contoller deactivates all outputs and indicates an error. The safety contoller does not execute any more functions.
- If the data memory module is removed from the safety contoller and reinserted as described in "Downloading the configuration using the AC-MSI-CFG1" on page 6-7, the safety contoller deactivates all outputs and does not execute any functions until the IFS-CONFSTICK is inserted again correctly. The safety contoller **does not indicate an error**.

As an alternative to downloading the configuration via the USB interface, it can be downloaded to the safety contoller using the -IFSCONFSTICK. For a description of this procedure, please refer to "Downloading the configuration using the AC-MSI-CFG1" on page 6-7.

3.7 Installing the safety contoller

WARNING: Serious personal injury or material damage.

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

Only qualified personnel may connect the power, start up, and operate this device.

According to the safety instructions in this documentation, 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 contoller

CAUTION: Danger of injury and material damage.

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

For standard extension modules, the safety contoller is equipped with an interface for the TBUS DIN rail connector on the mounting side (see page 2-4).

3.7.1.1 Mounting

CAUTION: Danger of material damage due to incorrect mounting.

During mounting, observe the following notes:

– Use only the yellow TBUS DIN rail connector (Order No. 547821) to connect the MSI 200 safety contoller. Connection with another DIN rail connector is not permitted.
– Use only the yellow TBUS DIN rail connector (Order No. 547821) 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 grey TBUS DIN rail connector (Order No. 547823) 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 MSI 200 safety contoller, proceed as follows:

Mounting a 35 mm DIN rail

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

Mounting TBUS DIN rail connectors (optional)

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

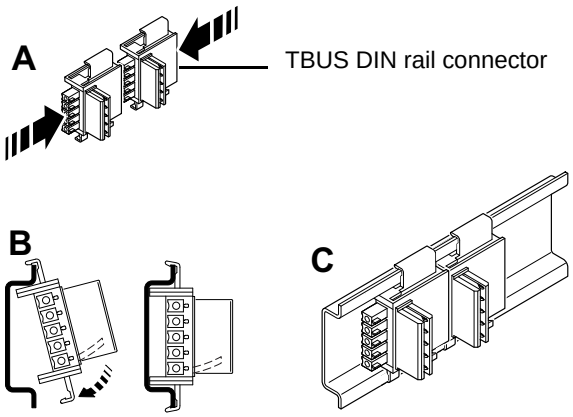


Figure 3-9 Mounting TBUS DIN rail connectors

Mounting the MSI 200 safety contoller

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 is hooked onto the top edge of the DIN rail.
   When using DIN rail connectors, ensure that the contact opening in the base of the module is aligned correctly over the contact block of the DIN rail connector.

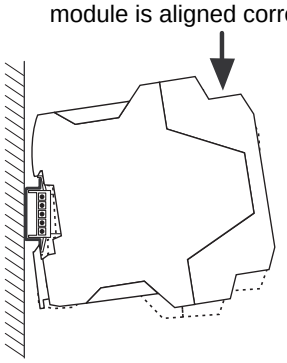


Figure 3-10 Snapping the MSI 200 safety contoller onto the DIN rail

4. Push the lower part of the module that is furthest from the DIN rail towards the DIN rail until it engages with a click.
5. Check that the module is fixed securely on the DIN rail.

6. When mounting additional modules on the DIN rail (e.g., gateway extension modules or power supply unit), 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 contoller.
7. End clamps should 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 MSI 200 safety contoller, 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 contoller 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 grounded switching outputs are supplied via connections 24V/0V.

Once the "PWR" status indicator is permanently on, the safety contoller 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 3-9).

3.7.2.1 Direct connection of the supply voltage to the MSI 200

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

1. Supply voltage for the safe module outputs and the grounded switching outputs to terminal block contacts "0V" and "24V"
2. Supply voltage for the logic of the safety contoller and the clock and alarm outputs to terminal block contacts "A1" (24 V) and "A2" (0 V).

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

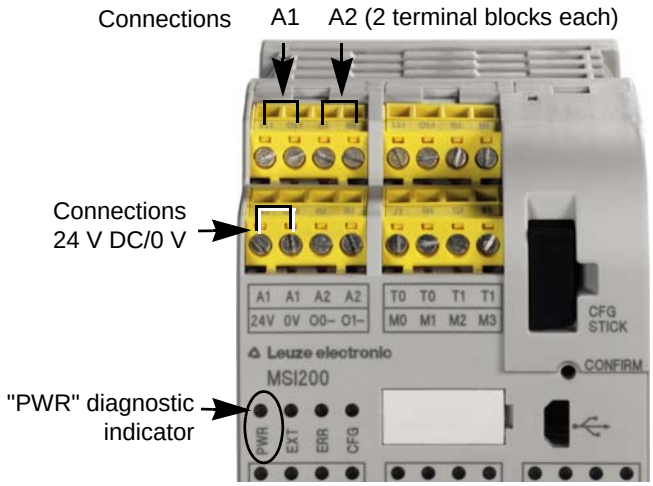


Figure 3-11 Connecting the supply voltage at A1/A2 and 24V/0V

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 contoller. Please refer to "Signal inputs" on page 3-7.

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 3-8).

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:

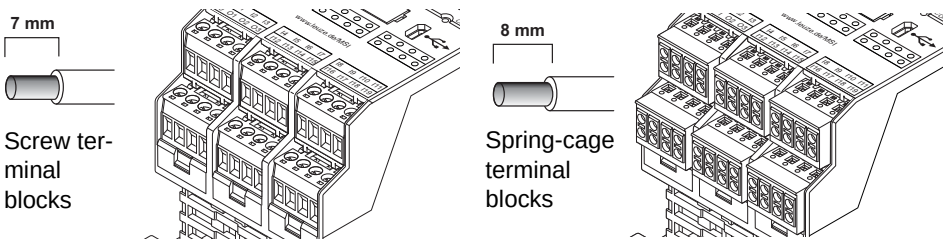


Figure 3-12 Connection to screw terminal blocks (left) and spring-cage terminal blocks (right)

3.8 Firmware update for MSI 200

The firmware for the MSI 200 safety contoller can be updated using the MSIsafesoft safe configuration software.

You can download the latest firmware version from the Leuze electronic download page.

Only the firmware for the safety contoller can be updated. The firmware for extension devices, e.g., MSI-EM200-8I4IO, 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 contoller 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 operation to update the firmware, you must not disconnect the USB cable or switch off the safety contoller. Interrupting the connection between the PC and safety contoller during the firmware installation can damage the device.

A faulty or incomplete firmware installation can render communication between the PC and safety contoller impossible. In this case, the faulty installation cannot be corrected with the assistance of MSIsafesoft.

CAUTION: Standard operation during firmware update!

While the firmware update is in progress, the MSI 200 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 MSI 200, 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 Requirement for firmware update

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

– The MSI 200 is connected to the PC via the USB cable and is switched on
– An data memory module is inserted in the MSI 200
– A project for the MSI 200 safety contoller is loaded in MSIsafesoft
– Simulation mode is deactivated in MSIsafesoft
– "Controller: Connected" and "Controller: Logged off" are displayed in the status bar of MSIsafesoft
– "Project: Write-protected" is displayed in the status bar of MSIsafesoft

3.8.3 Running a firmware update

To start the firmware update in MSIsafesoft, select the "Safe controller > Firmware update" menu command. 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 contoller)" listed in the help contents (please also refer to "Online help" on page 5-2).

3.9 Technical data MSI 200

Connection method	
Plug-in screw terminal blocks	MSI 201, Order No. 547803
Plug-in spring-cage terminal blocks	MSI 202, Order No. 547813

Logic input data	
Nominal input voltage U_N	24 V DC (A1/A2)
Permissible range	0.85 ... 1.1 x U_N
Typical current consumption at U_N	110 mA
Maximum response time	< 30 ms
Buffering of voltage dips	20 ms
Recovery time restart	< 10 s
Diagnostic indicator	4 LEDs (green, red)

Inputs (IN)	
Number of safe inputs	20 (up to SIL 3/IEC 62061)
Nominal voltage U_N	24 V DC (to ground A1/A2)
Typical current consumption at U_N	4 mA
Signal level at "0"	< 5 V
Signal level at "1"	> 11 V
Status indicator	20 LEDs (green)

Output data	
Safe semiconductor outputs	4 (Cat. 4/EN ISO 13849-1/EN 954)
Grounded switching outputs	2
Nominal voltage	24 V DC (24 V/0 V)
Permissible range	0.85 ... 1.1 x U_N
Limiting continuous current	2 A (see Derating)
Maximum capacitive load [1]	1 µF
Test pulses	< 1 ms
Short-circuit protection	Yes
Status indicator	4 LEDs (green)

[1] When using electromechanical components (e.g., contactors), the capacitive load can be disregarded.

Clock outputs	
Number	2
Nominal voltage	24 V DC (A1/A2)
Limiting continuous current	100 mA
Test pulses	1 ms, approx.
Short-circuit protection	Yes

Alarm outputs	
Number	4
Nominal voltage	24 V DC (A1/A2)
Limiting continuous current	100 mA
Short-circuit protection	Yes

General data	
Permissible ambient temperature	
Operation	-5 °C ... +45 °C
Storage	-20 °C ... +70 °C
Nominal operating mode	100% operating factor
Degree of protection according to VDE 0470-1	
Housing	IP20
Connection terminal blocks	IP20
Installation location	IP54, minimum
Electrical isolation	Yes, between power supply for logic (A1/A2) and power supply for safe outputs (24V/0V)
Surge protection	Suppressor diode
Air and creepage distances between the circuits	According to EN 50178:1998-04 1 Basic insulation
Rated voltage	50 V
Rated surge voltage	0.8 kV
Pollution degree	2
Surge voltage category	III
Mounting position	Horizontal
Dimensions (W/H/D)	
MSI 201	(67.5/114.5/99) mm
MSI 202	(67.5/114.5/112) mm
Conductor cross-section	
Screw connection	0.2 ... 2.5 mm^2 (24 - 12 AWG)
Spring-cage connection	0.2 ... 1.5 mm^2 (24 - 16 AWG)
Housing material	Polyamide PA, non-reinforced

Safety-related parameters	
Category according to EN 954-1	4
Performance level according to EN ISO 13849-1	e
SILCL according to EN 62061	3
Safety Integrity Level (SIL) according to IEC 61508	3

4 Extension module MSI-EM200-8I4IO

4.1 Device description

The MSI-EM200-8I4IO safe extension module is an extension device for the MSI 200 safety contoller. It provides the safety contoller 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 contoller, the inputs and outputs of the safe extension module are connected in the MSIsafesoft configuration software. During operation, the safe outputs of the extension module are controlled dependent upon the safety logic executed in the safety contoller.

The extension module has eight digital safe inputs (I4 - I11) and four signals (IO0 - IO3), which can be configured as either safe digital inputs or outputs. The signal direction (input or output) can only be changed 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 2-8).

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

All connection terminal blocks are plug-in. The individual terminal block bases are mechanically keyed to prevent incorrect connection. The extension module comes with a choice of screw connections or spring-cage connections.

Figure 4-1 Extension module with screw connections

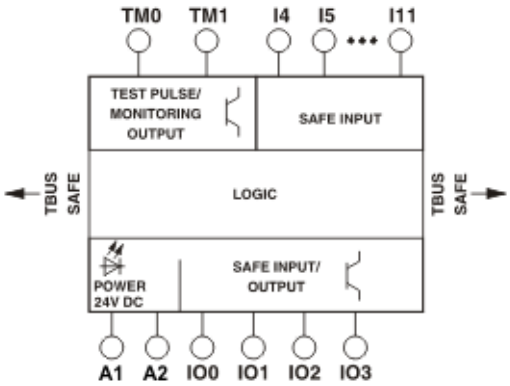


Figure 4-2 Block diagram MSI-EM200-8I4IO

4.2 Diagnostic and status indicators

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

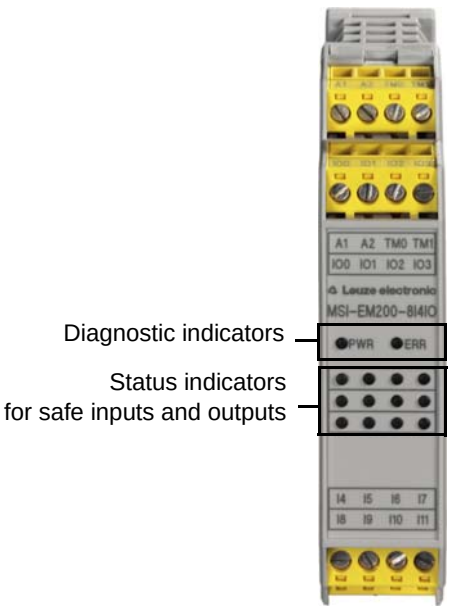


Figure 4-3 Diagnostic and status indicators on the extension device

Diagnostic indicators

The two diagnostic 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 contoller
– "ERR": Error indicator

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

The LED symbols in the table mean:

LED OFF ●

LED ON ☼

LED flashing ☼/●
Slowly = 1.7 Hz
Fast = 6.6 Hz

Table 4-1 Meaning of the diagnostic 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 MSIsafesoft.

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 2-9)
	☼/● Long ON Short OFF	Wiring check at an input or antivalent input.
For "IO0" to "IO3", if these are configured as safe outputs	●	Output inactive
	☼	Output active
	☼/●	Diagnostic error (see page 2-9)
	☼/● Long ON Short OFF	Wiring check at an output

4.3 Signal connections

All of the inputs and outputs are connected using plug-in and keyed connection terminal blocks.

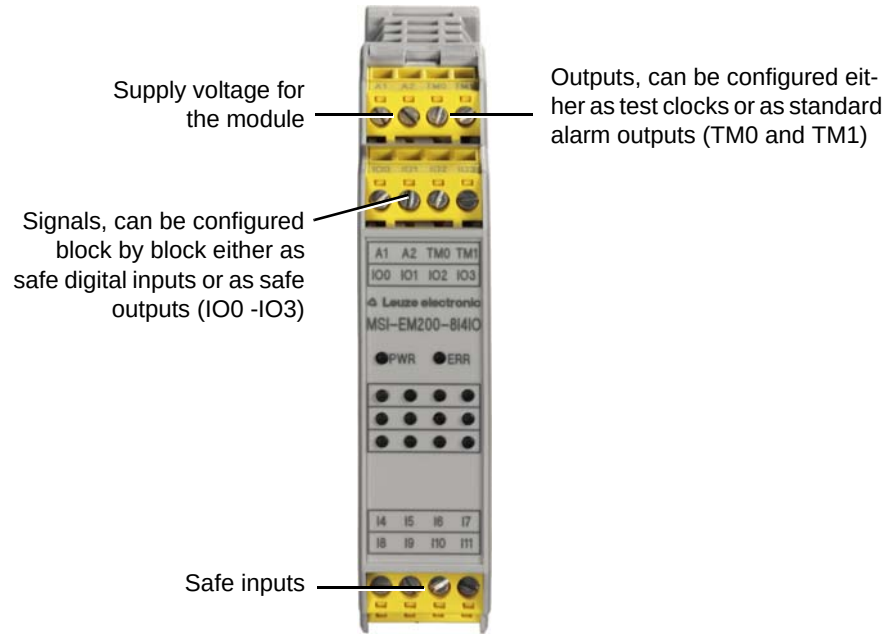


Figure 4-4 Signal connections MSI-EM200-8I4IO

The various signal connections are described in the following sections.

4.3.1 Signal inputs

The MSI-EM200-8I4IO 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 4-5).

The parameterization editor (see "Device parameterization in the safe parameterization editor" on page 5-17) is used to set the input and output parameters and thus to select the configuration.

The safe inputs are linked to the safety logic in the connection editor of the MSIsafesoft configuration software. See also "Inserting and connecting functions, functional blocks, and signals" on page 5-13.

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 MSIsafesoft 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 single signals.

Dual signals are not connected to one another internally; they are simply grouped together.

As input signals with even and odd IDs are processed in different ways in the safety contoller, using dual signals ensures that the safety contoller 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- 1Category 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 extension module offers the TM0 and TM1 signals, which can be configured as clock outputs, to help detect 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 MSIsafesoft configuration software specifies the clock signals to be used. Cross-circuit detection is implemented with the test clock at TM0 for "even" inputs (IO0 and IO2 as well as I4 ... I10). For "odd" inputs (IO1 and IO3 as well as I5 ... I11), the test clock at TM1 must be used for cross-circuit detection.

Configuring the I/Os as inputs: If the I/Os (IO0 to IO3) are configured as inputs, the cross-circuit detection function supported by the extension module MUST be used; in other words, power must be supplied to the inputs concerned via the clock outputs TM0 and TM1 of the extension module. See also "Clock/alarm outputs TM0 and TM1" on page 4-6.

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 2-8.

4.3.2 Safe outputs

Signals IO0 to IO3 can be configured as safety-related outputs. They are dimensioned as digital semiconductor outputs for 24 V DC/0.5 A (2 A total current), each 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 them in the connection editor of the MSIsafesoft configuration software. See also "Inserting and connecting functions, functional blocks, and signals" on page 5-13.

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 MSI-EM200-8I4IO 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 5-17) is used to set the input and output parameters and thus 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 the TM0 or TM1 output 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 dimensioned 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 detector unit (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 MSIsafesoft (see "Inserting and connecting functions, functional blocks, and signals" on page 5-13).

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 the TM0 or TM1 output 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 the configuration settings have been made accordingly) are used for cross-circuit detection at the inputs of the same extension module. The test clocks T0 and T1 output 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 MSIsafesoft).

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

If the I/Os (IO0 to IO3) are configured as inputs, the cross-circuit detection function supported by the extension module MUST be used; in other words, power must be supplied to the inputs concerned via the clock outputs TM0 and TM1 of the extension module (see "Clock/alarm outputs TM0 and TM1" on page 4-6).

Please also refer to "Signal inputs" on page 4-4 and "Error detection in I/O devices" on page 2-8.

4.3.4 Supply connection A1/A2

Voltage is supplied to the MSI-EM200-8I4IO safe extension module via supply connection A1 (24 V)/A2 (0 V) (see also "Connecting the supply voltage" on page 4-7).

4.4 Installing the safe extension device

WARNING: Serious personal injury or material damage

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

Only qualified personnel may connect the power, start up, and operate this device.

According to the safety instructions in this documentation, 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 contoller (see "Mounting the safety contoller" on page 3-13).

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" diagnostic 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).

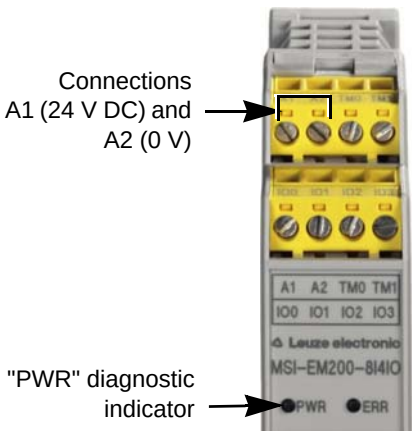


Figure 4-5 Connecting the supply voltage

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 contoller. Please refer to "Signal inputs" on page 4-4.

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 4-5).

The signal lines are connected to the extension device in exactly the same way as on the safety contoller (see "Connecting the signal lines" on page 3-16).

4.5 Technical data MSI-EM200-8I4IO

Logic input data	
Nominal input voltage U_N	24 V DC (A1/A2)
Permissible range	0.85 ... 1.1 x U_N
Typical current consumption at U_N	100 mA
Maximum response time	< 30 ms
Buffering of voltage dips	20 ms
Recovery time	< 10 s
Diagnostic indicator	2 LEDs (green, red)

Inputs (IN)	
Number of safe inputs	12 (up to SIL 3/IEC 62061) of which 4 can be configured as input or output
Nominal voltage U_N	24 V DC
Typical current consumption at U_N	4 mA
Signal level at "0"	< 5 V
Signal level at "1"	> 11 V
Status indicator	1 LED (green) per input

Output data	
Number of safe outputs	4 (Cat. 4/EN 13849-1/EN 954) if the 4 inputs/outputs are configured as outputs
Nominal voltage	24 V DC
Limiting continuous current	4 x 0.5 A (see Derating)
Maximum capacitive load [1]	1 µF
Test pulses	< 1 ms
Status indicator	1 LED (green) per output

[1] When using electromechanical components (e.g., contactors), the capacitive load can be disregarded.

Clock and alarm outputs	
Number	2, can be used as clock outputs or alarm outputs dependent upon the configuration
Nominal voltage	24 V DC
Limiting continuous current	50 mA
Test pulses	1 ms, approx.

General data	
Permissible ambient temperature	
Operation	-5 °C ... +45 °C
Storage	-20 °C ... +70 °C
Nominal operating mode	100% operating factor
Degree of protection according to VDE 0470-1	
Housing	IP20
Connection terminal blocks	IP20
Installation location	IP54, minimum

General data	
Air and creepage distances between the circuits	According to EN 50178:1998-04 1
Rated surge voltage	0.8 kV/basic insulation
Pollution degree	2
Surge voltage category	III
Dimensions (W/H/D)	
MSI-EM201-8I4IO	(22.5/114.5/99) mm
MSI-EM202-8I4IO	(22.5/114.5/112) mm
Conductor cross-section	
Screw connection	0.2 ... 2.5 mm^2 (24 - 12 AWG)
Spring-cage connection	0.2 ... 1.5 mm^2 (24 - 16 AWG)
Housing material	Polyamide PA, non-reinforced

Safety characteristic data [1]	
Category according to EN 954-1	4
Performance level according to ISO 13849-1	e
SILCL according to EN 62061	3
Safety Integrity Level (SIL) according to IEC 61508	3

[1] Data only applies if the safety function is demanded at least once a year.

5 Configuration software MSIsafesoft

5.1 Installing MSIsafesoft

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 contoller.

To ensure that the configuration software detects the safety contoller 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 **commissioning set MSI-SWC1**, insert the supplied CD 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 "MSIsafesoft" 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 MSIsafesoft 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 instructions on the screen.
4. Once MSIsafesoft is installed, you will be prompted to install the drivers for the safety contoller.
   Follow the instructions on the screen.
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 contoller have been fully installed.

5.2 Overview of functions and features

The MSIsafesoft safe configuration software is used to configure the MSI 200 safety contoller and the extension modules used. The software supports the user in all operating phases, from planning the application, through configuration to starting up the MSI 200 safety contoller, and compiling system documentation.

The MSIsafesoft functions support:

Adding/Removing extension devices

– Up to ten extension modules can be added from the "Hardware" compartment of the toolbox by using drag & drop to move them to the hardware editor. Devices added previously can be removed by selecting the corresponding command from the context menu in the hardware editor.

Creating the safety logic
– Creation of the safety logic with the help of a graphical connection editor. The circuit which the safety contoller runs on is created by graphically linking safe functional 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 with safety logic
– The inputs and outputs of the safety contoller are linked to the safety logic using drag & drop.

Parameterizing inputs/outputs
– The inputs and outputs of the safety contoller and of the extension devices (e.g., MSI-EM200-8I4IO) are parameterized using a safe parameterization editor.

Downloading/Uploading the configuration
– You can download the configuration project, including all device parameters, to the safety contoller in a few steps. It is also possible to upload the project saved on the safety contoller 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 contoller 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 functional block in the safety logic. The hardware editor in online mode maps the LEDs on the safety contoller.

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. 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.

MSISIMsoft simulation
– Simulation of the safety contoller, for example, for preliminary testing of the developed safety logic even if no safety contoller is available.

Online help

You will find a description of the comprehensive functions of MSIsafesoft 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 functional blocks, general information about the objects can be accessed in this way.
- There is also specific functional block information, which can be called via the "Help" context menu command for the relevant functional block or function.

5.3 Description of the user interface

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

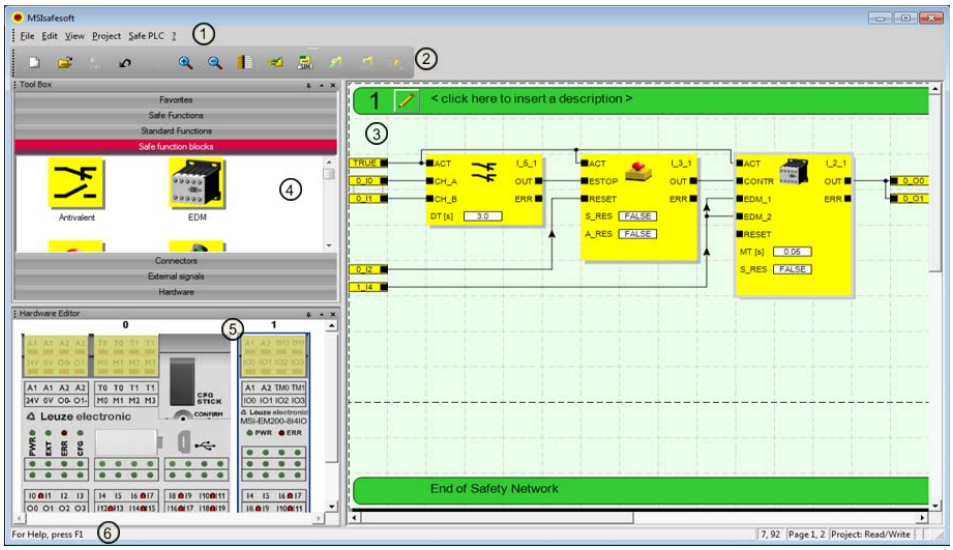


Figure 5-1 User interface MSIsafesoft

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**
   Frequently used functions can be accessed quickly via the icons in the toolbar.
3. **Connection editor**
   The connection editor is used to develop the safety logic by dragging graphical functional 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 functional blocks, safe functions, and connectors in the corresponding compartments. These elements can easily be dragged from the toolbox into the connection editor. The "Hardware" compartment contains extension devices (if there are any) as soon as the MSI 200 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 contoller 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 MSIsafesoft.
   The toolbox also contains a "Favorites" compartment, where you can insert frequently used functions and functional blocks as required.

5. **Hardware editor**
   The hardware editor contains a graphical representation of the MSI 200 safety contoller. 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 5-1).
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 contoller, and transmission progress when downloading or uploading the configuration from or to the safety contoller.

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

– **Message window**
  The message window can be used to track the progress of the project checking function. When the check is started, the message window opens automatically. If the system detects an error when checking the project, the relevant error location can be accessed directly by double-clicking with the left mouse button 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 MSI 200 safety contoller 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).

5.4 Safe functional blocks and functions

The MSI 200 safety contoller is configured in the MSIsafesoft configuration software by graphically connecting prepared safe functions and safe functional blocks.

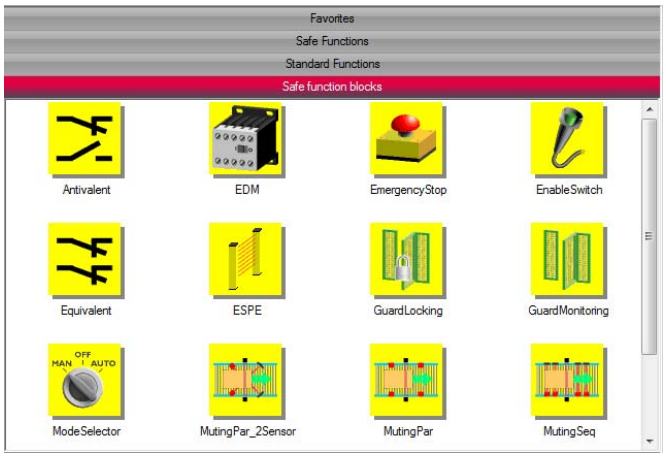


Figure 5-2 Safe functional blocks in the toolbox (excerpt)

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 MSIsafesoft 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 off delay)
- TON (timer for switch-on delay)
- TP (impulse encoder)
- XOR (Boolean EXORing)

Safe functional blocks

The safe functional blocks provide basic safety-related functions for implementing the required safety circuits. Table 5-1 lists the available functional blocks in alphabetical order.

Table 5-1 Safe functional blocks

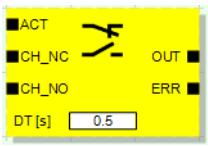
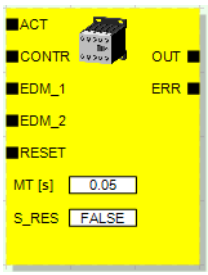
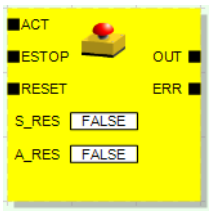
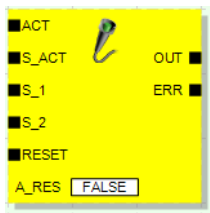
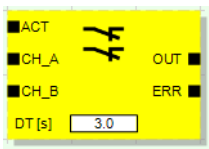
Name Icon in editor	Short description
Antivalent 	The Antivalent safe functional block monitors the signals of two safe input terminal blocks for different signal states. Typically, these signals come from two-channel sensors or switches, such as an emergency stop control device.
EDM 	The EDM (external device monitoring) safe functional block monitors the defined initial state and the switching behavior of contactors connected to the safety contoller.
EmergencyStop 	The EmergencyStop safe functional 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 EnableSwitch safe functional block evaluates the signals of a manually activated three-stage enable switch (in accordance with EN 60204) in order to identify its switching stage and 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 Equivalent safe functional 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 5-1 Safe functional blocks (continued)

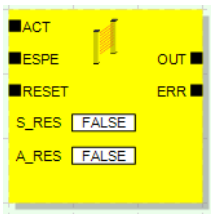
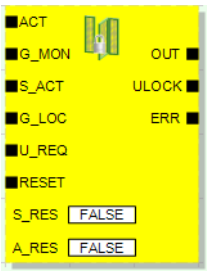
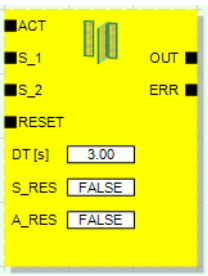
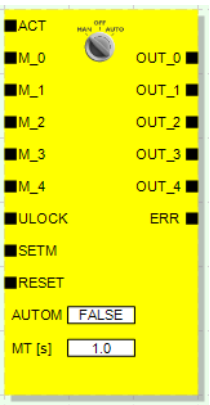
Name Icon in editor	Short description
ESPE 	The ESPE (electrosensitive protective equipment) safe functional block monitors the switching states of electrosensitive protective equipment (e.g., light grids). When the protective equipment is triggered, i.e., the light grid beam is interrupted, the enable signal at output OUT is set to FALSE.
GuardLocking 	The GuardLocking safe functional block supports the monitoring of a guard with guard locking (safety door monitoring with four-stage interlocking according to EN 1088).
GuardMonitoring 	The GuardMonitoring safe functional block monitors a guard (e.g., safety door) with two-stage interlocking according to EN 1088.
ModeSelector 	The ModeSelector functional 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 5-1 Safe functional blocks (continued)

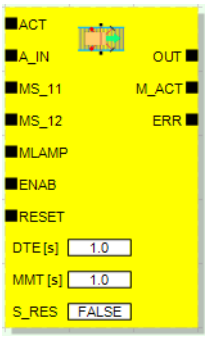
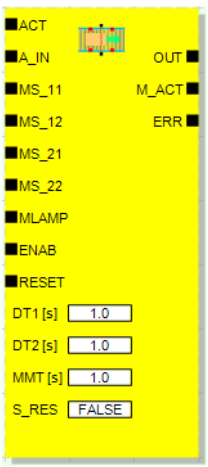
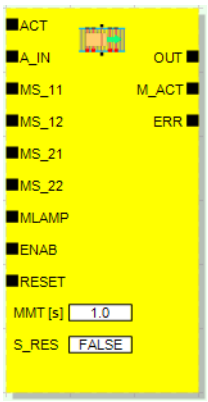
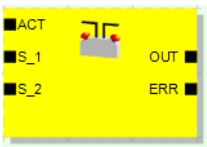
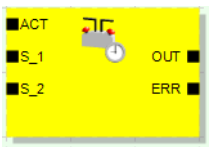
Name Icon in editor	Short description
MutingPar_2Sensor 	The MutingPar_2Sensor safe functional block evaluates the signals of two muting sensors and one optoelectronic protective device (e.g., light grid) in an application for parallel muting using two sensors and sets the enable signal at output OUT. This function can be used to temporarily deactivate (or "mute") protective 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 conveyor. 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 functional 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") protective 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 conveyor. 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 functional 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") protective 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 conveyor. 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 5-1 Safe functional blocks (continued)

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

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

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

5.5 Operating the MSIsafesoft configuration software

Intuitive operation

The MSIsafesoft configuration software follows the Windows standard for user activities. MSIsafesoft also supports additional functions. Examples include online diagnostic tools and simulation of the safety contoller.

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 6-1.

5.5.1 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 contoller 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 into 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.

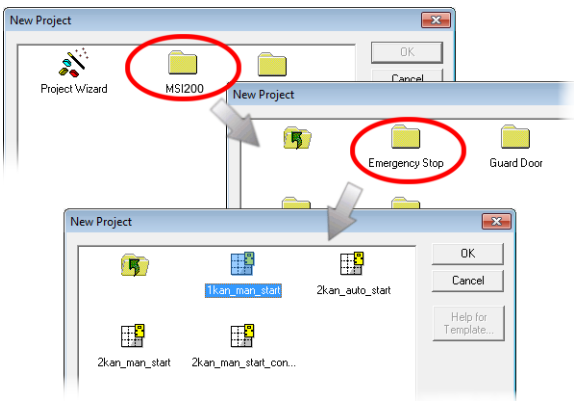


Figure 5-3 Project Wizard for creating a new configuration project

5.5.2 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 contoller used and available extension modules, as long as these are available for your safety contoller and are already in use in the project).

Inserting new devices into the hardware editor

To insert new devices into 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 5-7 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 contoller features extension devices.

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

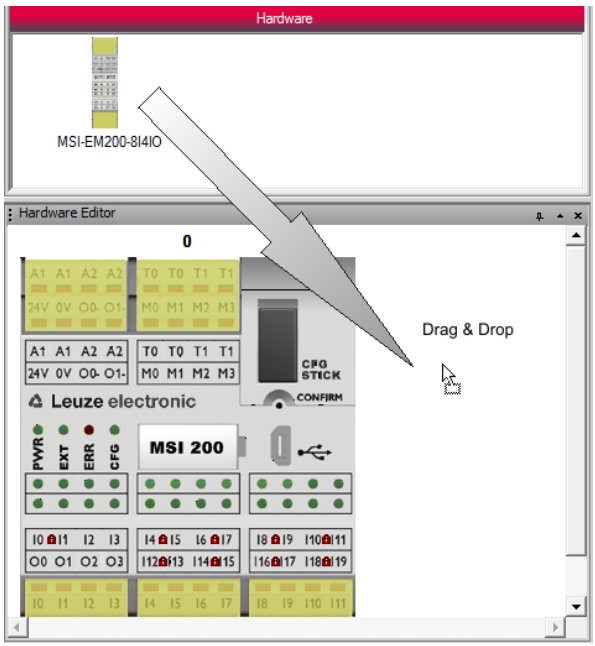


Figure 5-4 Inserting an extension device into the hardware editor

4. First of all, 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".

5. 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 checking the box 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.

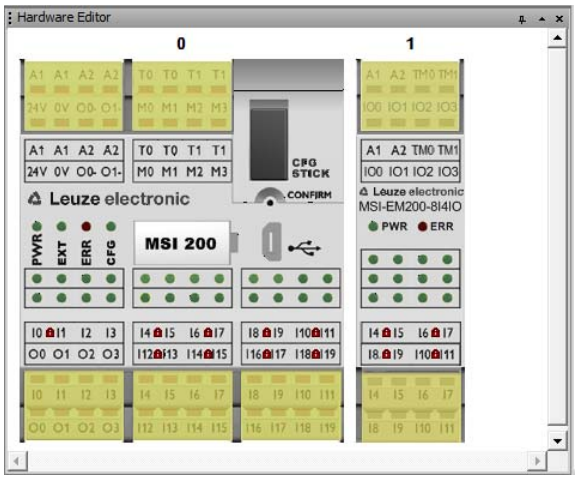


Figure 5-5 Hardware editor with master module and extension module inserted

6. Drag & drop the required input or output signals of the newly inserted module into the connection editor and connect them (see Figure 5-8 on page 5-15).

If there are signals available for data exchange between the safety contoller and a higher-level controller, these are not dragged from the hardware editor into 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:

1. 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).
2. Confirm the next dialog box that appears with "Yes".
3. 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".
4. The "Confirmation of Modified SDIO Devices" dialog box appears.
   If you want to delete the device in question, confirm the dialog box by checking the box in the list of deleted devices and then clicking "OK".
   The device is removed from the hardware editor and the ID is made available for any devices that are going to be inserted subsequently.

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

5.5.3 Inserting and connecting functions, functional blocks, and signals

The safety logic is created in the connection editor as a network of safe functions and functional blocks. These functions and functional 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 contoller, 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 into the connection editor from the hardware editor and linked to functional blocks in the connection editor if you have logged on with the correct project password ("Project, Log On" menu).

Functional blocks and functions in the toolbox

Safe functional blocks/functions and constants are always inserted into 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 5-7 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 into the connection editor from the toolbox compartment:
   - Left-click on the required object and hold the mouse button down.
   - 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 functional block connections, thus establishing the connection immediately on insertion.

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

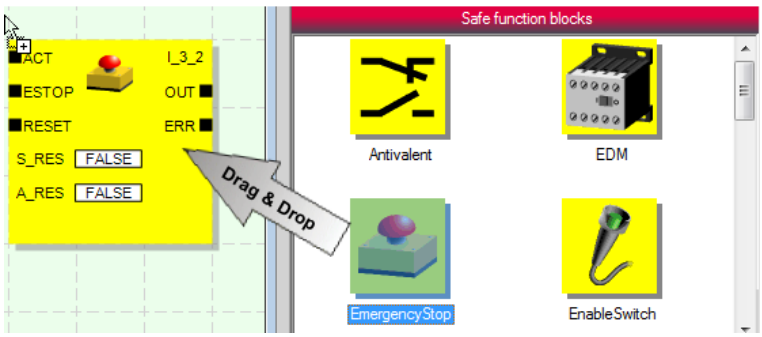


Figure 5-6 Inserting safe functional blocks and functions

Signal inputs and signal outputs in the hardware editor

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

If there are signals available for data exchange between the safety contoller 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 into 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.

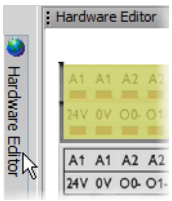


Figure 5-7 Opening the hardware editor with the auto-hide function enabled

Ensuring 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 contoller. This ensures that the safety contoller will perform redundant processing.

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

Please note: Dual signals are not connected to one another internally; they are simply grouped together.

2. Drag the required (dual) input or output signal from the hardware editor into the connection editor (see Figure 5-8 on page 5-15).
   - Left-click on the required (dual) signal and hold the mouse button down.
   - 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, 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 functional block connections manually (see "Connecting objects" on page 5-16).

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

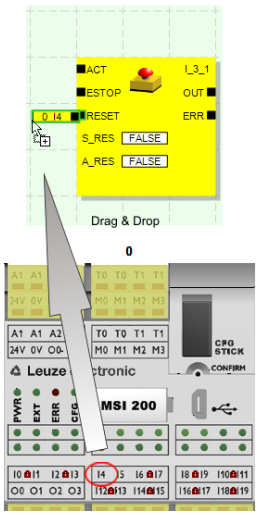


Figure 5-8 Inserting a signal in the connection editor

Standard alarm signals M0 to M3: As well as 20 safe inputs and four safe outputs, the safety contoller also provides four non-safety-related alarm outputs. These alarm outputs can be used, for example, to control a standard PLC or a simple detector unit (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 contoller cannot be moved to the connection editor using drag & drop. To implement cross-circuit detection using these two test pulses, the relevant safety contoller inputs must instead be parameterized accordingly.

Clock/alarm outputs TM0 and TM1 of the MSI-EM200-8I4IO safe extension device can be configured as either clock outputs or alarm signals.

If the I/Os (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 4-4 and "Clock/alarm outputs TM0 and TM1" on page 4-6).

External signals

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

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 MSIsafesoft.

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 graphic below).
2. Left-click, hold the mouse button down, 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).

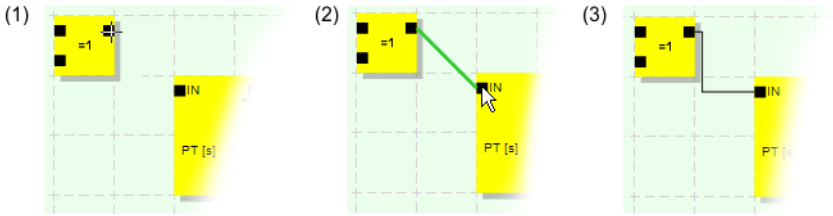


Figure 5-9 Connecting objects using a line

Connecting objects using drag & drop

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

1. Click on the (dual) signal or the constant to be connected and hold the mouse button down (see Figure 5-10).
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 5-10, (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 5-10 Connecting signals that are not connected to blocks or functions

5.5.4 Device parameterization in the safe parameterization editor

The inputs and outputs of the safety contoller 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 MSIsafesoft configuration software, this data is used to create a parameterization file, which is subsequently transmitted to the safety contoller automatically 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 a component 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 5-11 Opening the parameterization editor for all inputs/outputs of the MSI 200 safety contoller

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

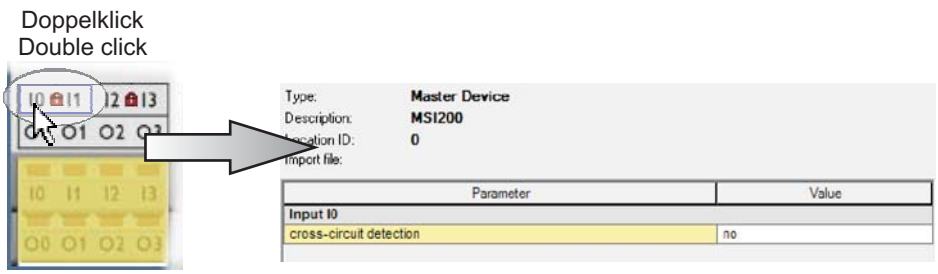


Figure 5-12 Opening the parameterization editor for one specific input/output

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 "Parameters" from the context menu.

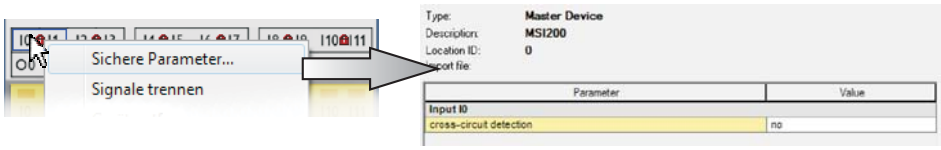


Figure 5-13 Opening the parameterization editor via the context menu

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 unambiguously 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 5-19).

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 variable value.

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 required value. This list is closed and the selected value is visible in the parameter field.

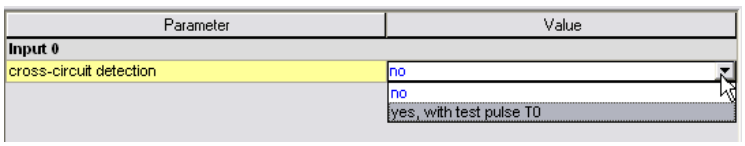


Figure 5-14 Modifying parameters in the parameterization editor

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 4-6).

Input parameters for the safety contoller: Cross-circuit detection

A "cross circuit" is an unintentional, incorrect connection between redundant circuits. The safety contoller 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 5-14 above).

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

For additional information about cross-circuit detection, please refer to "Signal inputs" on page 3-7 and "Error detection in I/O devices" on page 2-8. An application example is also provided there.

MSI-EM200-8I4IO: Cross-circuit detection

For the MSI-EM200-8I4IO safe extension module, clock/alarm outputs TM0 and TM1 must be configured as clock outputs (test clock) in order to facilitate parameterization for cross-circuit detection.

If the I/Os (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 4-4 and "Clock/alarm outputs TM0 and TM1" on page 4-6).

Output parameters for the safety contoller: Grounded switching output

The "additionally ground switching contact" parameter "no"/"yes, with O...-" is only available for outputs O0 and O1 of the MSI 200 safety contoller. Output O0 is connected to grounded switching output O0-, output O1 to grounded switching output O1-.

This parameter is used to specify whether the specified grounded switching output, which can assist in shutting down a single-channel application safely, should be switched in addition to the relevant safe module output.

The use of grounded switching outputs O0- and O1- increases cross-circuit protection, for example. For more detailed information about using grounded switching outputs O0- and O1- and a corresponding example application, please refer to "Grounded switching outputs O0- and O1-" on page 3-10.

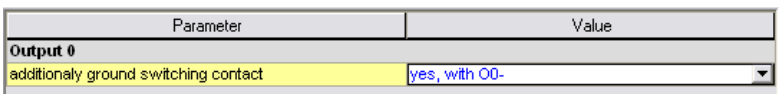


Figure 5-15 Setting the parameter for the use of grounded switching output O0-

Exporting and importing parameters

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

For information about exporting and importing parameters, please refer to the online help (see "Parameterizing the inputs/outputs of the safety contoller").

Printing parameters

The print dialog box ("File, Print Project" menu) contains a "Safe parameters" checkbox. If this checkbox is selected before printing a project, all the parameters of the safe device are printed too.

5.5.5 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 is done automatically prior to checking.

Check values (CRC): To ensure that any distortions to the configuration data during transmission to the safety contoller can be reliably detected, a check value (CRC) is calculated in the configuration software when the project is checked. The safety contoller also determines the check value for the downloaded data. If the check values on the safety contoller and in the configuration software are identical, all data has been saved on the safety contoller without distortion. If the check values differ, a corresponding error message is output.

The check value (CRC) will also differ if **subsequent modifications** have been made to the project in the configuration software, but have not yet been downloaded to the safety contoller. A change to the product 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, the project must be checked. 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:

   The progress of the checking function can be tracked in the message window, which opens automatically:
   If the configuration software detects an error, you can jump to the relevant location directly by double-clicking on the message in the message window with the left mouse button.
   In the example below, an input is not connected. Double-clicking on the error message highlights the affected object (in a green border) in the connection editor.

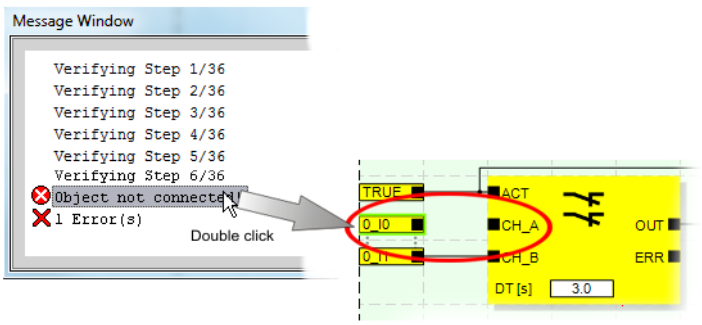


Figure 5-16 Jumping to an error location in the safety logic from the message window when checking the configuration project

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 contoller. For information about downloading a configuration project and the associated startup of the safety contoller, please refer to „Downloading the configuration from MSIsafesoft“ on page 6-9.

5.5.6 Documenting the signal assignment and the project

Documenting signal assignment

The system supports the maintenance of 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 to 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 tool tips.

1. Click on the following icon in the toolbar:

The "Assignment List" dialog box opens.

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

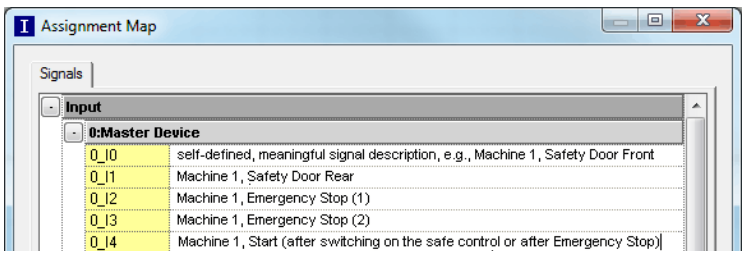


Figure 5-17 "Assignment List" dialog box

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

For further information about 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 about the current project, from project-specific data (description of the application, designation, name of the creator/editor, etc.) to manufacturer data, the operator, and installation location, through 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 contoller differs from the configuration project.

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

For further information about 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.

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

For further information about 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.

5.6 Simulation mode in MSIsafesoft

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

– If no safety contoller is available or
– If a simulated function test is recommended prior to the actual startup of the "real" safety contoller

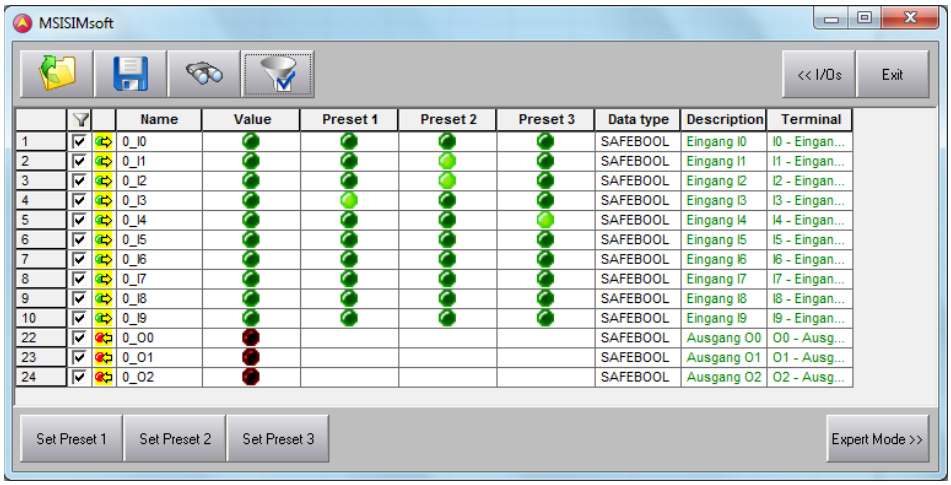


Figure 5-18 Simulation in MSIsafesoft

WARNING: A simulation does not replace a function test.
The simulation of the safety application must **not** replace the proper function test using the safety contoller 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.

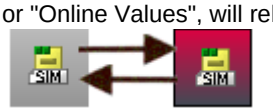
When working with the MSISIMsoft simulation instead of the safety contoller:

– If a safety contoller 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 MSIsafesoft configuration software as you would if you were working with the real safety contoller, but ensure that the "Simulate Safety Controller" icon in the toolbar is activated (see Figure 5-19 on page 5-24). 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, thus simulating the inputs and outputs of the actual hardware.
– The timing 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.



Icon	Not activated = MSI 200	Activated = Simulation

Figure 5-19 "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 contoller, 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 of the status bar: Simulation: Connected
   The MSISIMsoft application is displayed minimized in the Windows taskbar. MSISIMsoft

Exiting MSIsafesoft simulation mode

To switch from MSISIMsoft simulation to the real safety contoller, in the MSIsafesoft 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 contoller.

WARNING: Danger due to 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 MSISIMsoft simulation.

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

Exiting MSISIMsoft simulation

To exit MSISIMsoft simulation

If MSISIMsoft is exited while the "Simulate Safety Controller" button is activated in MSIsafesoft, MSISIMsoft restarts automatically after being exited.

First exit simulation mode in the configuration software (deselect the "Simulate Safety Controller" button).

5. Then select "Exit" in the MSISIMsoft context menu (in the Windows taskbar) or click "Exit" in the MSISIMsoft window.

Further information about operating MSISIMsoft

For further information about MSISIMsoft controller simulation, please refer to the "MSISIMsoft controller simulation" topic of the online help for the MSIsafesoft configuration software:

– Operating MSISIMsoft
– Simulating time sequences in MSISIMsoft expert mode
– Status of MSISIMsoft simulation

6 Configuration and startup

6.1 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 MSI 200 safety contoller. For detailed information, please refer to the sections cited and the MSIsafesoft online help.

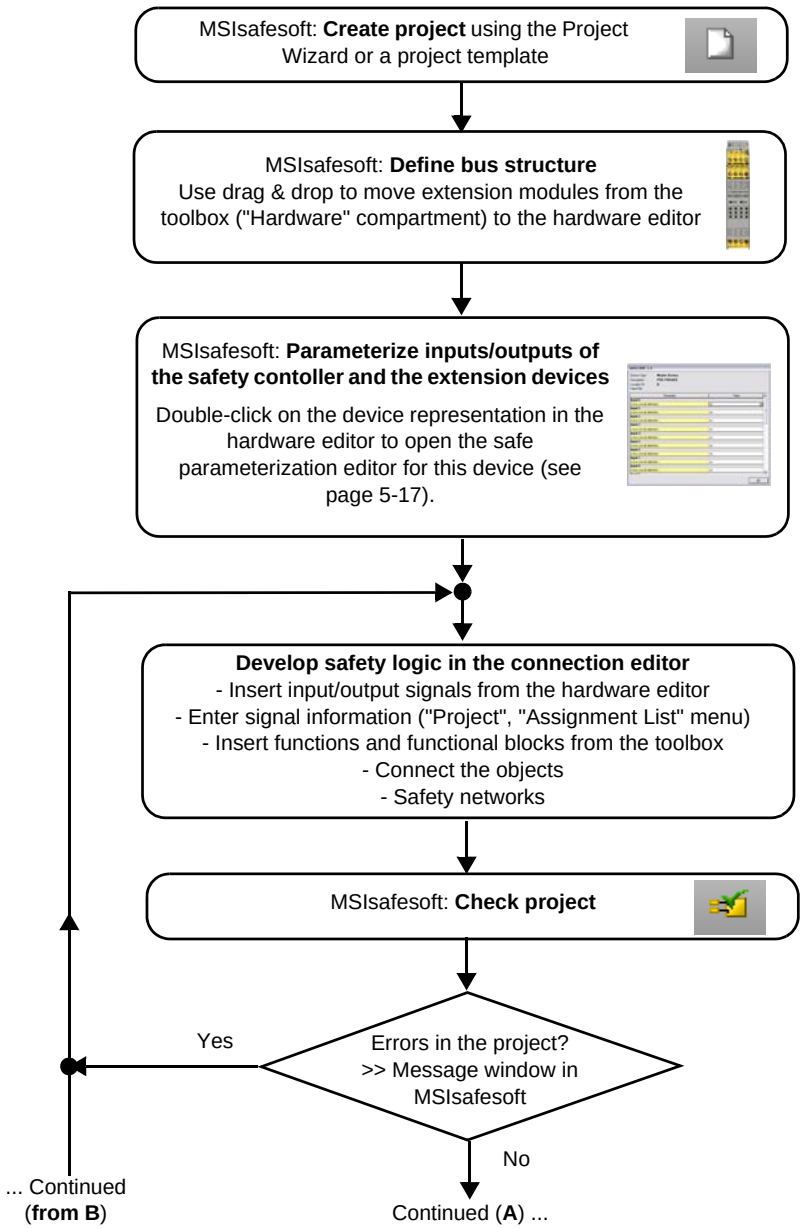


Figure 6-1 Flowchart: Configuration from A to Z (1 of 3)

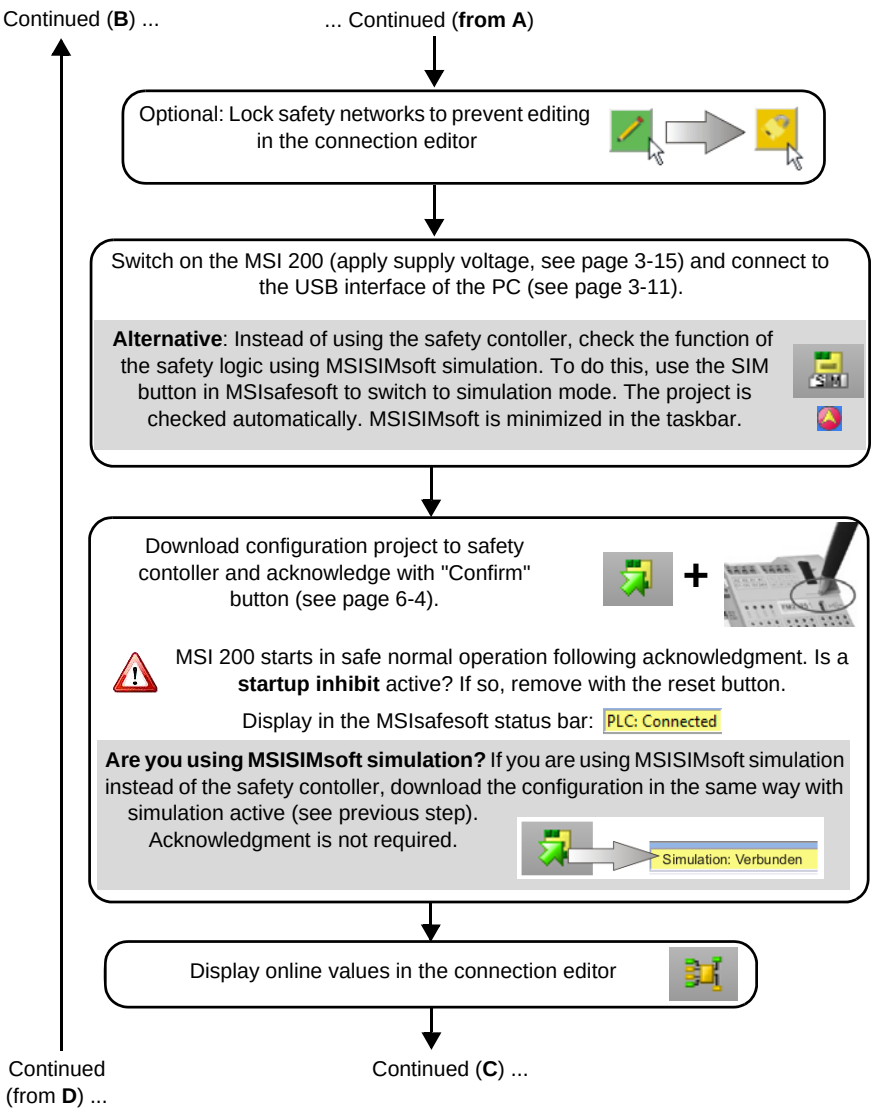


Figure 6-2 Flowchart: Configuration from A to Z (2 of 3)

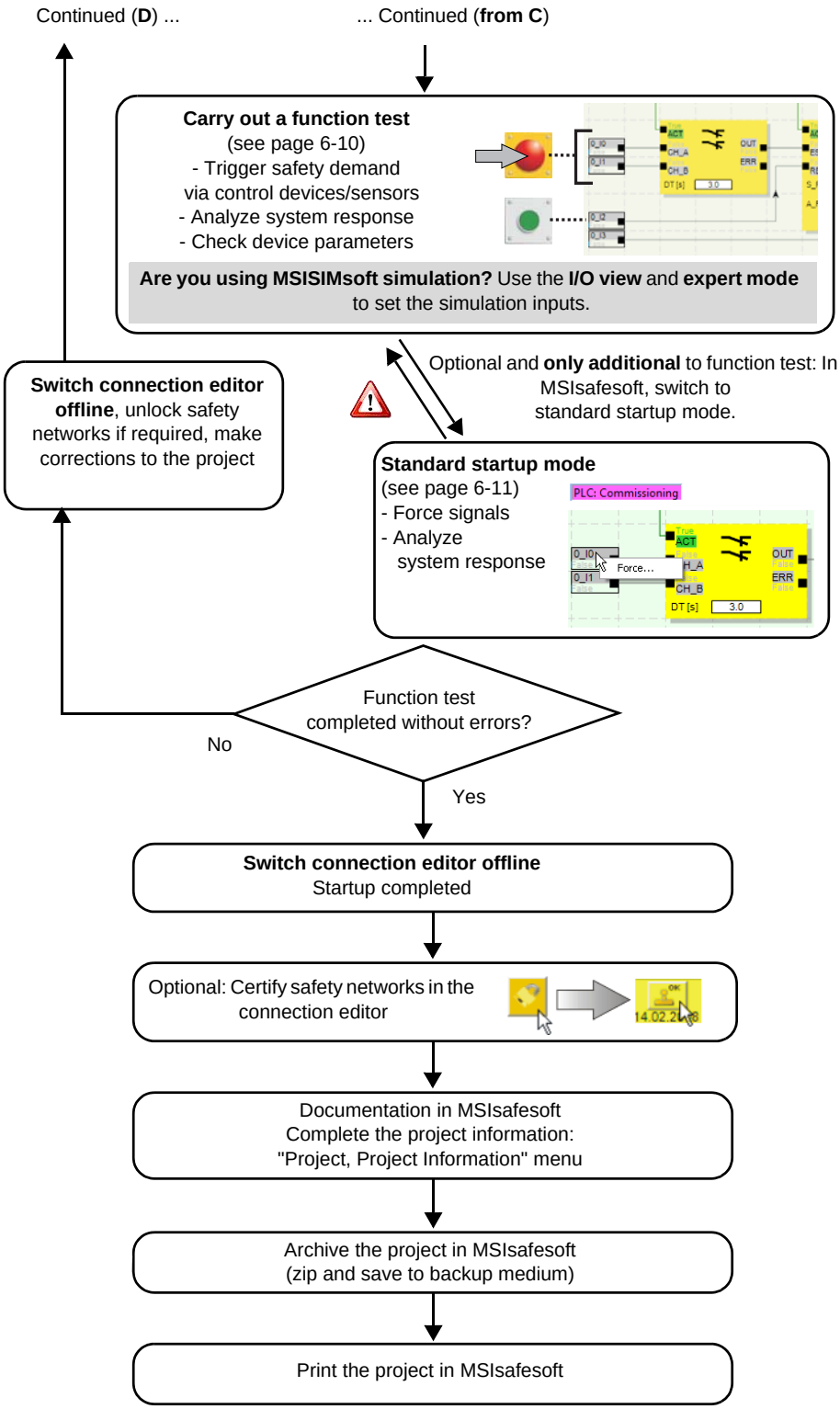


Figure 6-3 Flowchart: Configuration from A to Z (3 of 3)

6.2 Downloading the configuration from MSIsafesoft

WARNING: Danger of damage due to unintentional/incorrect operations
Prior to startup, ensure that, if the safety contoller functions in an unintended or incorrect way, this will not cause damage.

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

Alternatively, the configuration can also be downloaded by inserting an data memory module that contains the relevant data. For further information, please refer to "Downloading the configuration using the AC-MSI-CFG1" on page 6-7.

1. Ensure that:
   – The safety contoller is switched on
   – The MSIsafesoft configuration software is installed on the configuration computer (this installation also includes the required drivers)
   – The MSIsafesoft configuration software is started
   – An data memory module is inserted in the safety contoller (otherwise the configuration cannot be downloaded)
2. Connect the USB cable to the safety contoller (mini-USB connector, 5-pos., maximum cable length 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, take 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 correspondingly configured PC detects the safety contoller automatically and indicates the safety contoller status at the bottom right of the status bar (see Figure 5-1 on page 5-3).

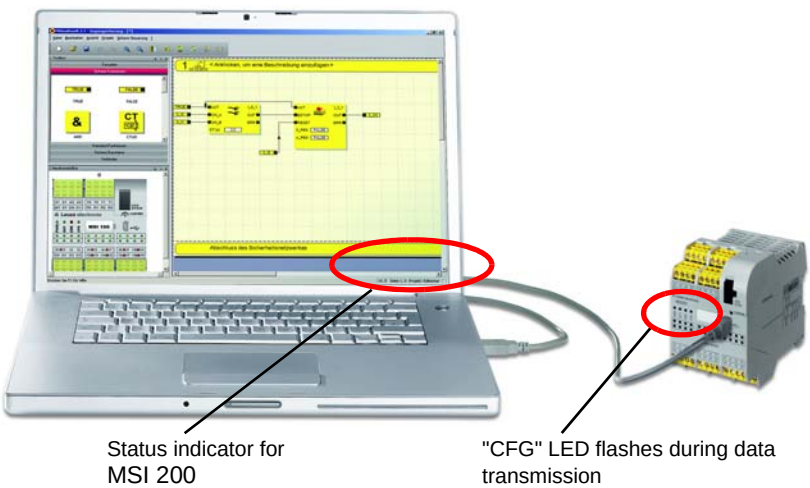


Figure 6-4 USB connection between PC and safety contoller

3. The project can only be downloaded to the safety contoller if you have logged on in MSIsafesoft 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 5-20 or the MSIsafesoft online help), the project loaded in MSIsafesoft can be downloaded to the safety contoller by clicking on the following icon in the toolbar:

   Is there already a project on the safety contoller?

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

   If another project or another version of the same project is already available on the safety contoller 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 contoller.

   During data transmission

   – A progress indicator is displayed in the MSIsafesoft status bar.
   – The "CFG" status indicator flashes quickly on the safety contoller (approximately 6 Hz).

If data transmission is interrupted during the download, "Problems and solutions" starting on page 8-1 describes how to solve this problem.

WARNING: Danger due to activated outputs

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

5. Once data transmission has been completed successfully, the "CFG" 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 contoller (see step 6.) ...

... before clicking "OK".

Figure 6-5 Dialog box following successful data transmission

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

WARNING: Danger due to activated outputs

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

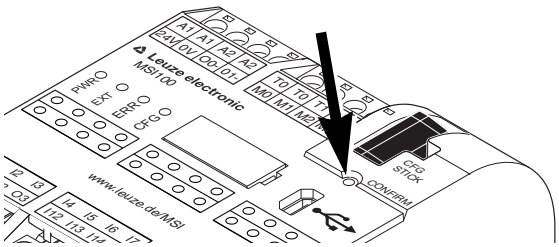


Figure 6-6 Confirming the configuration with the "Confirm" button

The safety contoller is then reinitialized (all diagnostic indicators are on briefly) and then switches to safe normal operation (only "PWR" LED on).

Startup inhibit active?

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

For further information, please refer to "System startup and restart behavior" on page 2-6.

If the safety contoller is not initialized correctly, proceed as described in "Problems and solutions" on page 8-1.

Next steps

Next, continue with the function test (see "Function test" on page 6-10).

Check values (CRC): To ensure that any distortions to the configuration data during transmission to the safety contoller can be reliably detected, a check value (CRC) is calculated in the configuration software when the project is checked. The safety contoller also determines the check value for the downloaded data. If the check values on the safety contoller and in the configuration software are identical, all data has been saved on the safety contoller without distortion. If the check values differ, a corresponding error message is output.

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

6.3 Downloading the configuration using the AC-MSI-CFG1

WARNING: Danger of damage due to unintentional/incorrect operations
Prior to startup, ensure that, if the safety contoller 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 data memory module. This means that the configuration of one device can be transferred to other safety contollers. This is useful if no configuration computer is available at an installation location or for transferring the configuration to a new device on device replacement.

To replace the data memory module, proceed as follows. This sequence ensures that the active configuration is not overwritten by accidental insertion of an data memory module.

Removing the data memory module

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

Inserting the new data memory module

WARNING: Danger due to activated outputs
When the data memory module is replaced, outputs may be activated. Once the configuration has been downloaded in this way, the safety contoller starts program execution. Provided that no startup inhibit, which must be cancelled manually, is active, outputs may be activated immediately.
Make sure that the safety contoller startup will not lead to any hazardous situations.

2. Insert the new data memory module in the safety contoller, which is switched off. The data memory module is mechanically keyed and cannot be inserted in the device incorrectly.
3. Switch the safety contoller on and wait until it has initialized (all four diagnostic indicators light up once during initialization).
   The safety contoller now detects the previously unknown data memory module and indicates this by making the "CFG" diagnostic indicator flash.
4. Remove the data memory module again.
5. Press the "Confirm" button on the device and **hold** it down.

6. Reinsert the data memory module **while** holding down the "Confirm" button.

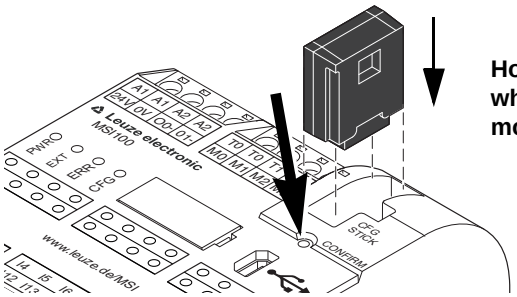


Figure 6-7 Inserting the data memory module

7. Release the "Confirm" button once the data memory module is inserted correctly. The safety contoller now initializes with the new configuration.

Startup inhibit active?

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

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

For further information, please refer to "System startup and restart behavior" on page 2-6.

If the safety contoller is not initialized correctly, proceed as described in "Problems and solutions" on page 8-1.

When the data memory module has been removed correctly, all of the safety contoller outputs are FALSE. While the data memory module is not inserted, the safety contoller has no function.

If the data memory module is not removed correctly, the safety contoller also displays an error message.

6.4 Uploading the configuration from the safety contoller

Projects downloaded to the safety contoller 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 contoller for diagnostic purposes.

It is possible to upload a project from the safety contoller 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 contoller.
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 contoller to the PC starts and a progress indicator is displayed in the MSIsafesoft 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 contoller, and start it up there as usual.

6.5 Function test

WARNING: Danger of injury or material damage due to unintentional system states or incorrect responses

Make sure that the act of triggering the safety demand will not pose a risk for people or materials.

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

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

Validation

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

Online mode in MSIsafesoft

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

Safety demand/Monitoring signals

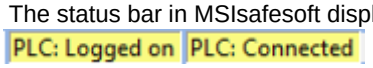
Once a safety demand has been triggered by activating the safe control devices, e.g., by pressing the emergency stop control device or opening the safety door, the behavior of the safety logic can be analyzed precisely in the configuration software, as in online mode the connection editor displays the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

To perform a function test, proceed as follows:

Connected/Logged on

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

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

The system can only display online values if the project in the safety contoller 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 send it to the safety contoller again before you can display online values.

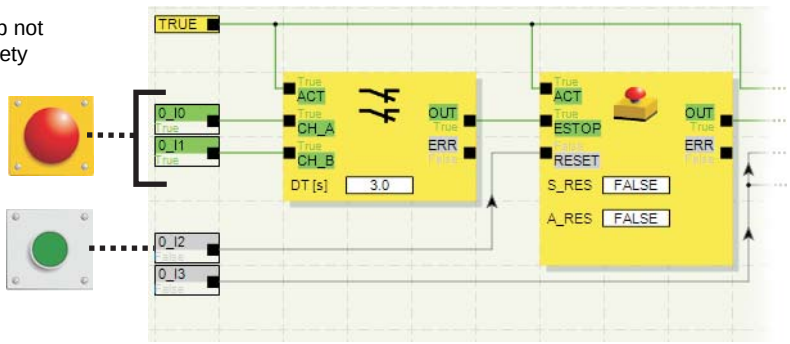
2. Switch MSIsafesoft to online mode by clicking on the "Display online values" icon in the toolbar:

   "Signal lines" and functional 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 through "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.

Example:

Emergency stop not pressed, no safety demand



Safety demand

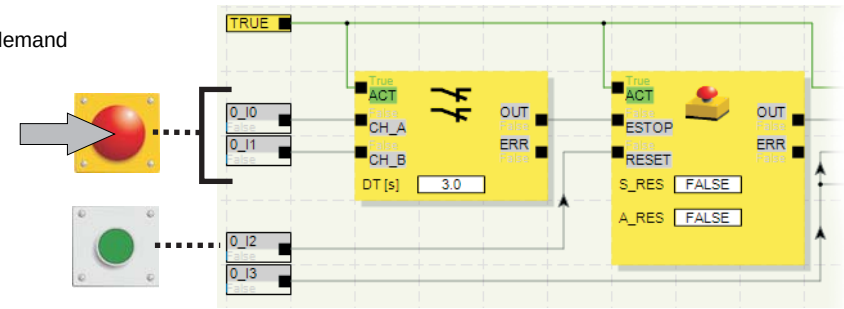


Figure 6-8 Example of a function test for the safety system using MSIsafesoft online mode

6.6 Startup mode

In addition to the mandatory function test using online mode (see "Function test" on page 6-10), startup mode can also be used.

For example, instead of pressing the emergency stop control device or opening the safety door, in startup mode you can force the signal corresponding to the safe control device in the connection editor.

WARNING: The test in startup mode does not replace the proper function test

The test of the safety application using startup mode must not replace the proper function test using safe control devices. The test in startup mode may only be performed in addition to the standard function test, as a preliminary test, for example.

By forcing signals in the connection editor's online display, you can directly influence the safety contoller. This type of influence is commonly known as "forcing".

WARNING: Eliminate hazards

Before forcing any signals, ensure that doing so will not pose a risk for people or materials.

WARNING: Startup mode is a standard operating mode

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

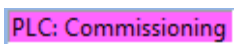
Once the supplementary function test has been performed in startup mode, exit startup mode again. This resets forced signals.

Starting startup mode

1. In MSIsafesoft, 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 change 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 contoller is running in standard mode:



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

Be extremely careful when forcing signals with the safety contoller 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 with the left mouse button.
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 set in the dialog box.
5. Click "Force" to force the corresponding signal to the set value.

WARNING: Eliminate hazards due to forcing

Before forcing any signals, ensure that doing so will not pose a risk for people or materials.

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, which will cause the safety contoller to run in a safe operating mode again.

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

7 Application examples

Functional block help: Application for each functional block

Application examples are available in the online help for the safe functional blocks.

The online help describes at least one typical application for each functional block and shows the safety logic configured in MSIsafesoft as well as the wiring of the MSI 200 safety contoller 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 functional block.

The following application examples are included in the online help for the functional 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

8 Problems and solutions

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

8.1 General

Table 8-1 Solutions for general problems

Problem	Solution
When the MSIsafesoft safe configuration software was launched, the installation check identified a faulty system file. A corresponding message window is displayed.	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 MSIsafesoft configuration software on an operating system that is not supported.	Install an operating system supported by MSIsafesoft (see "System requirements for the configuration software MSIsafesoft" on page 2-15) or consult the technical support team to find out whether a newer version of MSIsafesoft 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 MSIsafesoft 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.

8.2 Graphical connection editor

Table 8-2 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 is displayed.	The project concerned is damaged 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 damaged 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.

8.3 Parameterization editor

Table 8-3 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 is displayed.	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 department.
During editing, a message window appears where the parameterization editor reports damaged 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.

8.4 Online communication between MSIsafesoft and the safety contoller

Table 8-4 Solutions for communication problems between MSIsafesoft and MSI 200

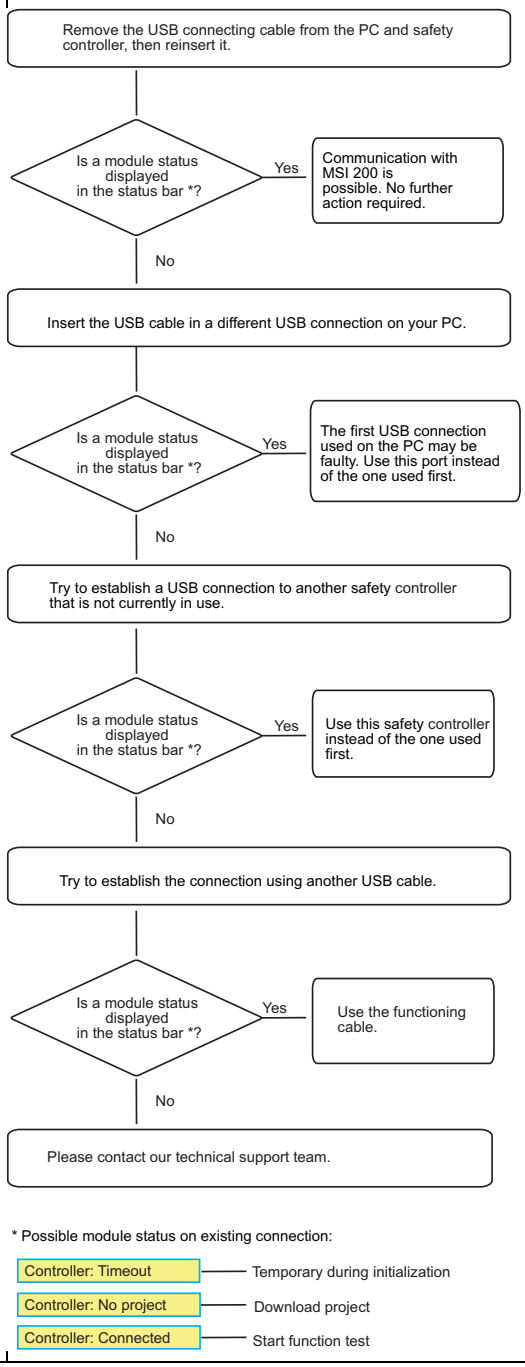
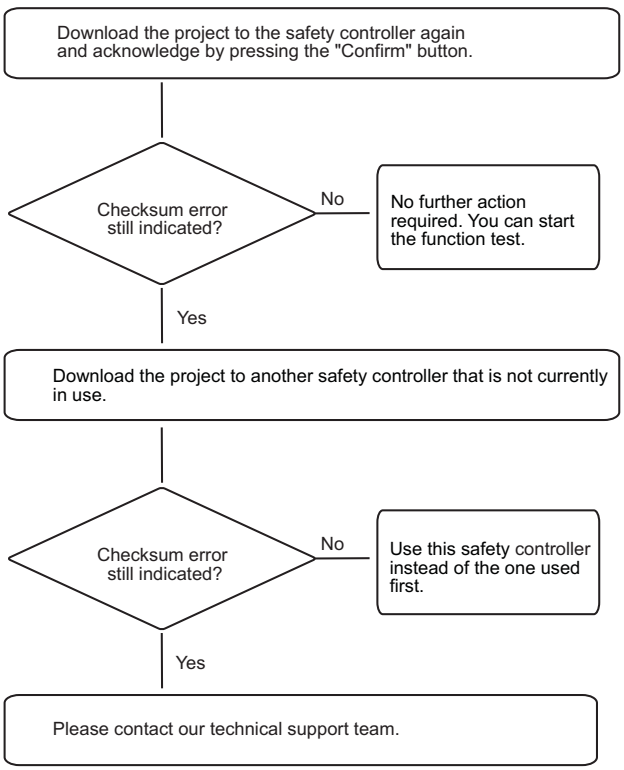
Problem	Solution
A connection cannot be established to the safety contoller. The status bar does not display a status for the safety contoller ("Timeout", "No project" or "Connected"; see information under the diagram below). The status bar looks like this, for example: 	Proceed as follows: 

Table 8-4 Solutions for communication problems between MSIsafesoft and MSI 200

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 contoller has been detected correctly (see display in the status bar), restart the download procedure.
Following successful project download, the MSIsafesoft safe configuration software identifies that the checksum of the project on the safety contoller does not match that of the project on the PC. A corresponding message window is displayed.	Proceed as follows: 

8.5 Communication between the safety contoller and the extension device

Table 8-5 Solutions for communication problems between MSI 200 and MSI-EM200-8I4IO

Problem	Solution
Communication between the safety contoller and the extension device via the DIN rail bus (TBUS) has been interrupted. The "Data" LED is off on the safety contoller.	Check that all MSI-EM200-8I4IO extension modules are connected to the MSI 200 correctly. A connection is correct if there is a TBUS male connector under each extension module and the plug-in connection has been made properly (the module must snap into place). Check whether the power supply at each extension module has been connected and switched on correctly.

8.6 Safety contoller messages

Table 8-6 Solutions for messages from the MSI 200 safety contoller

Problem	Solution
Following acknowledgment of the newly loaded configuration, the safety contoller is not initialized correctly ("Controller: Error" in the status bar and flashing "ERR" status indicator on the safety contoller).	1. Switch the safety contoller off and on again. 2. Download the project to the safety contoller 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 contoller reports an internal error.	Please contact our technical support team.

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