USER MANUAL 1.60

B-Nimis SC-1000

Modular safety PLC for the B-Nimis I/O system (formerly E-I/O Safety PLC)

Original Operating Instructions

Product number S-01060101-0000

BERGHOF

Disclaimer of Liability
The contents of the publication have been checked for compliance with the hardware and software that are described. Deviations however cannot be entirely excluded, so we undertake no guarantee of complete compliance. The data in this publication are regularly checked and any necessary corrections are incorporated in subsequent issues.

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About this User Manual
This user manual is intended for qualified specialists and contains the information necessary for the correct use of the product.
For proper understanding and error-free application of technical descriptions, instructions for use and particularly of notes of danger and warning, extensive knowledge of automation technology and functional safety is compulsory.

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1. Legal Notice

1.1. Contact Details

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1.2. Version Details

1.2.1. Manual

Revision history		
Version	**Date**	**Comments / changes**
1.0	19.09.2017	First issue
1.10	11.08.2017	Safety ratings updated after review by TÜV Rheinland
1.20	16.11.2017	Declaration of Conformity and TÜV certification added
1.30	14.05.2018	Objects $210A_h$ "SW Build No.“ and 2212_h “Post Result Flag” added. User instructions for Safety Task time settings added. Note on the Safety ERRATA sheet inserted
1.40	05.02.2020	Chap. 8.4.20 Read MC 3 Error 2210h updated. For details see ERRATA Sheet.
1.50	14.06.2022	Changed Module Description - B-Nimis SC-1000 Changed Partnumber - S-01060101-0000
1.60	30.04.2024	A note has been added to chap. Cycle time setting of the safety application Chap Software Installation has been expanded to include the approved CODESYS versions with the appropriate safety packages. Chap. 7 Safety function blocks has been added Chap. - Safety Ratings of the safety function blocks has been added.

1.2.2. B-Nimis SC-1000 Safety PLC

The table below describes the relationship between the module releases (module versions) and the corresponding manual version.

Module release			
Version	**Manual**	**Date**	**Comments / changes**
V 1.00	V 1.20	From 16.11.2017	Initial release / valid for module release V 1.00
V 1.04	V 1.40	From 14.05.2018	Manual updated
V 1.04	V 1.50	From 14.06.2022	Changes of module name and Partnumber (in function and design identical to 204909000)
V 1.05	V 1.60	From 30.04.2024	Valid for module release from V 1.05

1.2.3. Terms used

Term	Explanation
Safety PLC	The Safety PLC described in this document
Standard PLC	The main PLC of the system, which provides the EtherCAT Master.
CODESYS	The programming environment for the main PLC
Safety Package	CODESYS Safety extension
PLCopen Safety	Certified library of safety function blocks
B-Nimis I/O System	B-Nimis I/O module family
B-Nimis PLC	PLC for the B-Nimis I/O System
Head module	General designation for bus couplers or small PLCs in the B-Nimis I/O System
CODESYS Safety extension	Certified safety programming environment
Logical exchange variables	These serve to exchange information between the safety PLC and the standard PLC (see CODESYS Safety user guide)

2. Preface

2.1. About this User Manual

This document is the user manual for the safety PLC module with the product number S-01060101-0000 (in function and design identical to 204909000).
When working with the module, always refer to the CODESYS Safety user guide, in the corresponding version certified for use with CODESYS Safety Runtime 1.2.0 (4.1.2.0), published by 3S-Smart Software Solutions GmbH.
This document is intended for the target group described in section 2.2.2 Target groups of this User . It does not contain any information about deliveries. We reserve the right to make changes and correct errors and omissions. Illustrations are similar.

Refer to the Safety ERRATA document for the current relevant safety warnings.
The current version con be found on our home page
https://www.berghof-automation.com
Under Products → Safety PLCs → General Information

2.1.1. Limitation of Liability

Specifications are only for product description and are not to be understood as guaranteed product properties in a legal sense. Exact properties and characteristics shall be agreed in the specific contract. Claims for damages against us - on whatever grounds - are excluded, except in instances of deliberate intent or gross negligence on our part.

2.1.2. Conditions of delivery

The general conditions of sales and service of Berghof Automation GmbH shall apply.

2.1.3. Copyright

2.1.4. Warranty

Warranty is subject to the provisions of the conditions of sale of Berghof Automation GmbH or any contractual agreements between the parties.
The warranty will be voided by:

→ improper assembly and use,
→ repairs or inadmissible servicing,
→ opening the module housing,
→ modifying, defacing or removing the serial number.

2.1.5. Symbols and means of portrayal

The following symbols and means of portrayal are used in this User Manual:

Symbol	Explanation
→ …	List entry
▶ …	Individual operational instructions or list with operational instructions, which can be displayed in any sequence.
1. … 2. …	List with operational instructions, which can be displayed in any sequence.
	Further information on the product

2.2. Reliability, Safety

2.2.1. Area of application

This user manual contains all the information you need to use the product described as intended.

2.2.2. Target groups of this User Manual

The user manual is written for design, project planning, servicing and commissioning experts. For proper understanding and error-free application of technical descriptions, instructions for use and particularly of notes of danger and warning, extensive knowledge of automation technology and functional safety is compulsory.

2.2.3. Hazards and Other Warnings

Despite the actions described in section 2.2.5 Safety, the occurrence of faults or errors in electronic control units - however improbable - must be taken into consideration.
Please pay particular attention to the additional notices which we have marked by symbols throughout this user manual. While some of these notices make you aware of possible dangers, others are intended as a means of orientation. They are described below in descending order of importance.

Every alert and hazard warning is made up as follows:

⚠ WARNING

Optional:	**Type and source of risk**
Other symbols	Brief description and potential consequences of non-observance
	▶ Preventive measures

The signal terms described below are used for warning instructions which you must comply with for your personal safety and for avoiding damage to property.

⚠ DANGER

A DANGER warning makes you aware of an immediately hazardous situation which WILL cause a serious or fatal accident if not observed.

⚠ WARNING

A WARNING makes you aware of a potentially hazardous situation which MAY cause a serious or fatal accident or damage to this or other devices if not observed.

⚠ CAUTION

A CAUTION alert makes you aware of a potentially hazardous situation which MAY cause an accident or damage to this or other devices if not observed.

2.2.4. Other Notices

Note, Information

This symbol draws your attention to additional information concerning the use of the described product. This may include cross references to information found elsewhere (e.g. in other manuals).

2.2.5. Safety

Our products normally become part of larger systems or installations. The information below is intended to help you integrate the product into its environment without dangers to people or materials/equipment.

⚠ DANGER

Non-compliance with the user manual

Measures for the prevention of dangerous faults or errors may be rendered ineffective or new hazard sources created.

- Read the user manual carefully.
- Take particular heed of the hazard warnings.

To achieve a high degree of conceptual safety in planning and installing an electronic control unit, it is essential to exactly follow the instructions given in the user manual because wrong handling could lead to rendering measures against dangers ineffective or to creating additional dangers.

2.2.6. Project Planning and Installation

- → Safety and precautions regulations for qualified applications must be complied with.
- → Please pay particular attention to the notices of warning which, at relevant places, will make you aware of possible sources of dangerous mistakes or faults.
- → Relevant standards and VDE regulations must be complied with in every case.
- → Control elements are to be installed in such a way as to exclude unintended operation.

2.2.7. Maintenance and Servicing

- → Accident prevention regulations (in Germany: BGV A3 - VBG 4.0) must be observed when measuring or checking a control unit after power-up, in particular §8 (permissible deviations when working on parts).
- → The B-Nimis SC1000 Safety PLC Module is maintenance-free, there are no spare parts available
- → Repair work on the B-Nimis SC-1000 Safety PLC Module is not permitted. In the event of a defect, return the module to Berghof Automation GmbH, with a description of the fault.
- → Installation, and changes to the connections, may be performed only in the de-energised state. Otherwise damage the modules may be seriously damaged or their functionality impaired. In addition, unexpected hazardous situations may arise, which can lead to accidents.

2.2.8. General Instructions on Installation

As component parts of machines, facilities and systems, electronic control systems must comply with valid rules and regulations, depending on their field of application.
General requirements concerning the electrical equipment of machines and aiming at the safety of these machines are contained in Part 1 of European Standard EN 60204 (corresponds to VDE 0113).

For safe installation of the B-Nimis SC-1000 Safety-PLC module, the instructions described in section 6 Installation and Operation must be complied with.

Emission of interference
Emission of electromagnetic field interference, HF to EN 55011, limit value class A, Group 1

If the control unit is used in residential areas, high-frequency emissions must comply with limit value class B as described in EN 55011.

A shielding compliant to the above standard can for instance be achieved by fitting the control unit into earthed metal cabinets and installing filters in the supply lines.

The design and immunity to interference of programmable logic controllers are internationally governed by standard IEC 61131-2:2007 which, in Europe, has been the basis for European Standard EN 61131-2:2007.

Refer to IEC 61131-4, User's Guideline, for general installation instructions to be complied with to ensure that hardware interface factors and the ensuing interference voltages are limited to tolerable levels.

Protection against the effects of external electrical interference

- ▶ To eliminate electromagnetic interference, connect the control system to the protective earth conductor.

Cable routing and wiring

- ▶ Route power circuits separately from control circuits:
  DC voltages 60…400 V
  AC voltages 25…400 V
- ▶ Route only the following control circuits together:
  Shielded data signals
  Shielded analogue signals
  Shielded Digital I/O cables
  Unshielded DC voltages < 60 V
  Unshielded AC voltages < 25 V

Location of installation

- ▶ Ensure that temperatures, contaminations, impact, vibration or electromagnetic interference are no impediment to the installation.

Temperature

- ▶ Take heat sources into account: general heating of rooms, sunlight, heat accumulation in assembly rooms or control cabinets.

Contamination

- ▶ Use suitable enclosures to avoid possible negative influences due to humidity, corrosive gas, liquid or conducting dust (such as installation in a suitable control cabinet).

Impact and vibration

- ▶ Consider possible influences caused by motors, compressors, transfer lines, presses, ramming machines and vehicles.

Electromagnetic interference

- ▶ Consider electromagnetic interference from various local sources: motors, switching devices, switching thyristors, radio-controlled devices, welding equipment, arcing, switched-mode power supplies, converters / inverters.

3. System Description

The purpose of the Safety PLC is to integrate functional safety functions into control systems. There is no need for separate cables for the safety circuits. The Safety PLC has the duty of executing the safety application program and exchanging safety-related control information with the safe slave modules assigned to it.

Fig. 1: Safety PLC

A pre-requirement for the use of the Safety PLC is the use of a supervisory PLC based on CODESYS, referred to below as the main PLC, together with EtherCAT as a field bus for data exchange.

3.1. Control system – functional overview

The diagram below depicts an example of a control system with a Safety PLC.

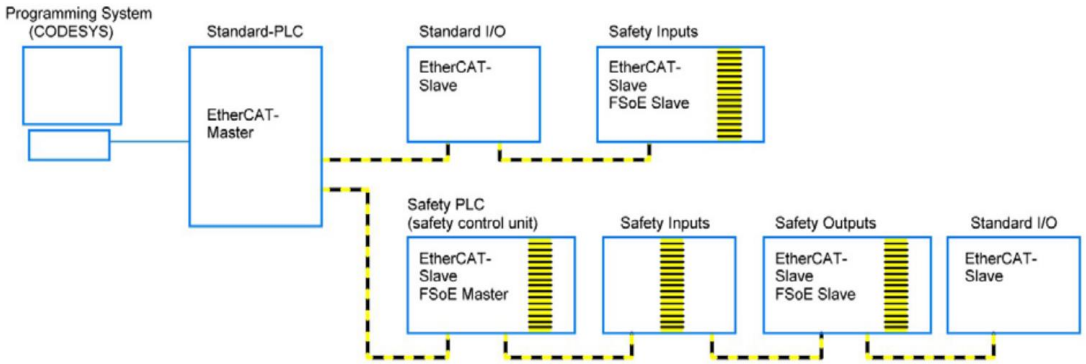


Fig. 2: System overview

The programming PC with the programming system programs the standard PLC via the Ethernet connection. One or more Safety PLCs can then be programmed by the standard PLC via the EtherCAT field bus.
When the system is in operation, process data are exchanged between the standard PLC and the standard actuators and sensors.
At the same time the Safety PLC uses the EtherCAT field bus and the FSoE protocol to exchange safety-relevant signals with safe I/O modules or drives.

3.2. EtherCAT® – Ethernet Control

EtherCAT is an Ethernet-based field bus system. Its speed, flexible topology and ease of configuration make it suitable for use as a quick drive and I/O bus for control units (industrial PCs or PLCs).
Its interconnections between the controller at one end and both the I/O modules and drives at the other are as fast as those of a backplane bus. EtherCAT control units thus act virtually as centralised control systems.

3.3. B-Nimis I/O System

The Safety PLC is a module within the B-Nimis I/O system. The B-Nimis I/O system is a collection of I/O modules which can be stacked in a row for incorporation into an EtherCAT network for transmission of process signals.
The B-Nimis I/O bus coupler acts as the head module which converts the transmission from twisted pair into LVDS (E-bus) and generates the system voltages required by the LVDS modules. The standard 100 Base Tx lines are connected to the one side. a succession of B-Nimis I/O modules are arranged in a row for the process signals connect to the other side. This is how the EtherCAT protocol is retained right through to the last I/O module.
Instead of the bus coupler a B-Nimis PLC can also be used as the head module. This then takes over the function of bus master from the standard PLC.

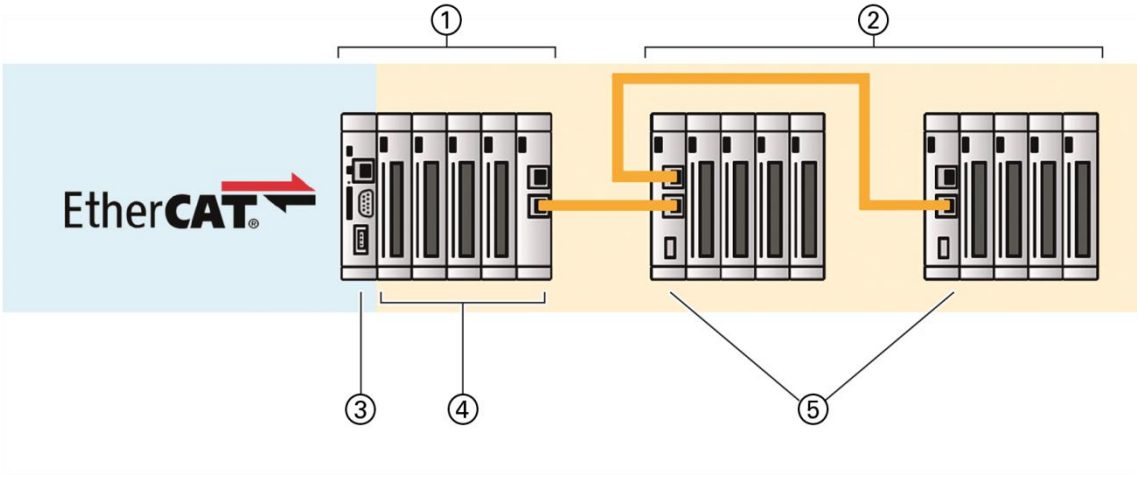


Fig. 3: B-Nimis I/O system

Item	Designation	Item	Designation
1	PLC with B-Nimis I/O expansion modules	4	Expansion Modules
2	Bus coupler with B-Nimis I/O expansion modules	5	Bus coupler
3	B-Nimis PLC		

3.4. B-Nimis-I/O Safety System

The B-Nimis-I/O safety system extends the B-Nimis I/O system by means of the Safety PLC and modules with safe inputs and outputs described here. There is no need to provide separately cabled safety circuits. The EtherCAT protocol is used to transfer both safe and standard signals to the Safety PLC. This integrated transfer process is based on the certified FSoE safety protocol.

3.4.1. Safety over EtherCAT (FSoE)

Along with EtherCAT, a safety protocol was developed and made available for EtherCAT as "Safety over EtherCAT" (FSoE = Fail Safe over EtherCAT). It is the backbone of providing functional safety over EtherCAT. Both the protocol and its implementation are certified to comply with Safety Integrity Level 3 (SIL 3) to IEC 61508. Since 2010, Safety over EtherCAT has been defined in an international standard, IEC 61784-3-12.
Since EtherCAT is used as the medium of communication, Safety over EtherCAT does not impose any constraints regarding the transfer rate and cycle time. The transport medium is considered a "black channel" which is disregarded in the safety assessment.

Fig. 4: FSoE Logo

3.4.2. Safety PLC

The Safety PLC links the inputs and outputs of the B-Nimis-I/O safety system and the safety-relevant signals of other FSoE devices within the system.
It operates at all time in conjunction with a supervisory CODESYS-based PLC, here referred to as the standard PLC.

The Safety PLC has a two channel architecture. It communicates to the programming system via the standard PLC and the logical exchange variables (see CODESYS Safety user guide - “Logical I/Os“) and to the standard PLC using non-safe variables, input and outputs.

3.4.3. CODESYS Safety

The Safety PLC is based on a certified plug-in that is fully integrated in the CODESYS Development System.
The Safety PLC is programmed as an EtherCAT slave node under the standard PLC and provides an application, task, lists of global variables, POUs and logical I/Os. It fulfils all the functions described in version 1.2.0 of the CODESYS® Safety user manual. The only restriction: The integration operates only in conjunction with EtherCAT as a communications medium to the Safety PLC.
The integrated function diagram (FD) safety editor (to IEC 61131-3, certified for use with IEC 61508 SIL3 applications) is used for basic or extended-level programming by means of certified function blocks (IEC 61131-3 or PLCopen Safety) as specified in the CODESYS Safety user manual.

At the basic level, certified function blocks (PLCopen-Safety) are graphically "wired up" to establish the system's safety programme. In case that a project demands more than the technology of the certified blocks can provide, the extra instructions available at the extended level can be used to expand the safety programme.
The software offers further functions for safeguarding the safety functions by change tracking, safe flow of signals, safe version control (pinning), separating safe operation, debugging mode, etc.

Fig. 5: CODESYS-Logo

3.4.4. PLCopen Safety Library in CODESYS

The PLCopen components have been defined and certified by the PLCopen organisation, its members and external organisations specialising in all safety-related aspects. The components interlink by logical operations which behave like logical wiring and therefore so that a safety application using these components can be programmed reliably.

Of itself the use of certified safe blocks is not sufficient to ensure that the user program is error-free. Each program must be developed for the relevant safety functions and exhaustively tested.

4. Product Description

4.1. Product Description Safety PLC

The Safety PLC allows the integration of safety functions into a control system. The core of the Safety PLC consists of two microprocessors which implement the safety functions and communicate with each other to exchange process data and to mutually monitor each other. A third microprocessor manages the external communications.
Modules can be installed in a row for incorporation in an B-Nimis I/O system. The module is designed for installation on a DIN rail within a control cabinet.

Overview

Fig. 6: External features of the Safety PLC Module

Item	Designation	Item	Designation
1	Grip	5	Screen connection to housing
2	Labelling clip	6	DIN rail attachment and effective earth
3	Unlock button	7	Module lock, E-bus
4	Status LEDs	8	Ventilation slots

The housing mount consists of an aluminium profile with an integrated clamping fixture used to attach the module to a 35 mm DIN rail. The housing trough including the optical fibres for the status indicators, the side faces and the front are made of plastic and contain the module.

4.2. Application

4.2.1. Intended Use

The B-Nimis I/O system is a system of I/O modules for interconnecting the process signals in an EtherCAT network. It consists of the bus coupler and a range of I/O modules. The B-Nimis I/O Safety System with B-Nimis SC-1000 Safety PLC and the B-Nimis I/O Safety Modules extend the B-Nimis I/O System by adding functions which permit use in the field of the functional safety of machines.

The intended applications of the B-Nimis safety system include safety functions of machines or systems and all industrial automation tasks immediately associated with them. Thus the system may only be used for applications providing a defined fail-safe state. The defined fail-safe state of the system is the de-energised state. Running any of the safety-related control components is subject to the safety precautions applicable to industrial control units (guarded by emergency stop and similar safety equipment) as specified by the relevant national and/or international regulations. The same applies to connected equipment such as drives or light grids.

Before installing and putting the system into operation, the safety instructions, connection specifications (nameplate and documentation) and the limiting values listed in this user guide's Technical Data section must be read carefully and complied with in every respect. The system is not designed for applications causing potentially fatal risks or dangers to the life and health of many persons or disastrous ecological hazards unless exceptionally strict safety precautions are taken. In particular, the system is unsuitable for applications such as the monitoring of nuclear reactions in nuclear power stations as well as the control of flight or air traffic control systems, means of mass transit, medical life support systems and weapon systems and its use is not allowed.

In particular, its use is approved only in the context of the relevant Machinery Directive (Directive 2006/42/EU).

⚠ WARNING

Impairment of safety due to the use of unsuitable EtherCAT modules!

- The B-Nimis SC-1000 Safety-PLC module may be operated only in conjunction with bus modules which conform to ETG.

⚠ WARNING

Impairment of safety due to the use of unsuitable FSoE slave modules!

- The B-Nimis SC-1000 Safety-PLC module may be operated only in conjunction with certified FSoE slaves which conform to FSoE.

4.2.2. Qualified Persons

The safety-related products may be used only by the following persons:

→ Qualified persons who know the applicable concepts of functional safety as well as the relevant standards and regulations.

→ Qualified persons who plan, design, install and put machine and system safety equipment into operation.

Qualified persons in the sense of this User Manual are persons whose training, experience, instructions and knowledge of the applicable standards, codes, accident prevention regulations and operating conditions authorise them to perform the required work and enable them to recognise and avoid potential hazards associated with that work. Language skills sufficient to understand this Guide are therefore part of this qualification.

⚠ WARNING

Incorrect operation by unqualified personnel!

▶ Only qualified persons are allowed to install and program the B-Nimis SC-1000 Safety-PLC module.

4.2.3. Disclaimer of Liability

The operator is responsible for self-reliantly running the safety-related control components in conformity with the requirements set by the competent authority.
The manufacturer shall neither be held liable nor accept any warranty for damages caused by:

→ inappropriate use,

→ non-compliance with standard and directives,

→ unauthorised modifications of devices, connections or settings,

→ use of unapproved or unsuitable equipment or equipment groups,

→ non-observance of the safety instructions contained in this manual.

4.3. Safe State

There are two different types of "safe states”:

→ The first one is functional and depends on the machine's application, operation and software. This is the desired functional safe state. The system is operating free of defects.

→ The second one is the fail-safe state and is adopted whenever a fault or error occurs in any of the monitored components.

4.3.1. Safe Functional State

The Safe Functional State is the state of defect-free working operation.
This state also includes situation where modules associated with the Safety PLC are reporting a fault. In general these do not lead to exiting the functional safe state, instead they are dealt with in relation to the safety application (e.g. loss of communication to a safe I/O module).

4.3.2. Fail-Safe State

Internal Fault
The Fail-Safe State of the Safety PLC is the state in which no valid FSoE telegrams are being sent to the participating FSoE slaves. If valid FSoE telegrams are outstanding the FSoE slaves adopt the safe state (de-energised outputs).
Internal faults which pose a safety hazard lead to the stoppage of FSoE communication, and thus trigger a switch into the fail-safe state. FSoE communication is then stopped. Insofar as this is possible, EtherCAT communication remains active and permits diagnostic activities.

External Fault
The module monitors its supply voltage (overvoltage and undervoltage) and also the permissible operating temperature. It any of these strays outside the permissible range the Safety PLC switches to the fail-safe state and no more FSoE telegrams are sent out.

Exiting the fail-safe state
The fail-safe state can be exited only by switching off the power supply to the head module (bus coupler or PLC). When the system is switched on again it performs a complete self-test as part of the initialisation phase.
In accordance with the FSoE specification, when no correct FSoE telegram is received within the watchdog expiry time the FSoE slaves that are connected switch into the safe state.

4.3.3. Traceability

Traceability means that the time and entity that produced, processed, stored, transported, consumed or disposed of a product or trading good can be traced back at any time

Whereas Berghof Automation GmbH is able to meet this requirement with regard to the production, processing, storage and transport, the purchaser is responsible for all further whereabouts of the product.

The serial number provides the means of uniquely identifying and tracing the product. You can find the serial number printed on the front of the module and also as a sticker on the underside of the module. It can also be read by software. To ensure proper traceability, the purchaser is obliged to note down this number together with the name, place of installation and end customer of the machine.

The purchaser must ensure the traceability of the units by means of this serial number.

4.4. Useful Life

B-Nimis SC-1000 Safety-PLC Modules have a design life of max. 20 years from their date of manufacture (see section 5.1 Labelling and Identification). The module must be taken out of use no later than one week before expiry of these 20 years (see section 6.10.3 Decommissioning).

The date of manufacture is printed on the housing as part of the serial number, and in addition is stored in the memory of the Safety PLC (see section 5.1.2 Serial number).

4.5. Technical Data

4.5.1. General specifications

Designation	Value
Device data	
Product name	B-Nimis SC-1000
Field bus	EtherCAT 100 Mbit/s
E-bus port	10-pin system plug in side wall
Memory for CODESYS application and configuration data	A total of 512 kByte are available: • 400 kByte for the CODESYS application • 112 kByte for the configuration data
Electrical insulation	All modules electrically insulated from each another and from the bus
Diagnostics	LEDs (see section 5.3 Status LEDs)
E-bus load	max. 240 mA (system power supply)
Terminating module	Module bus cover necessary at the last module
System Power Supply	
Supply voltage	5 V DC via E-bus connection provided by the head module (bus coupler or PLC in compliance with EN 61131-2, power supply 24 V DC, min. -15% / +20% SELV/PELV)
Overvoltage category	Category II to IEC 60664-1, in compliance with EN 61131-2
Reverse polarity safeguard	yes
Immunity to interference	Installation in Zone B to 61000-6-2, in compliance with EN 61131-2, installation on an earthed DIN rail in an earthed control cabinet. Lay the earth according to the operating conditions. (see section 6.2.1 Earth)
Storage and transport conditions	
Ambient temperature	-25…+70 °C
Rel. humidity	5…95 % non-condensing
Atmospheric pressure	70…108 kPa
Vibration	5…8.4 Hz: ±3.5 mm amplitude, 8.4…150 Hz: 10 m/s² (1g), to IEC 60068-2-6, Fc test
Shock	150 m/s² (15g), 11 ms semi-sinusoidal wave to IEC 60068-2-27

Operating conditions	
Installation position	horizontal, stackable
Degree of contamination	Degree of contamination II to IEC 60664-3

Permissible operating environment	Operation is restricted to environments complying with IP54 or at least IEC 60529 (e. g. in a suitable control cabinet)
Operating temperature	0…+55 °C
Relative humidity	5…95 % non-condensing
Atmospheric pressure	80…108 kPa
Installation altitude	Maximum 2000 above mean sea level
Vibration	5…8.4 Hz: ±3.5 mm amplitude, 8.4…150 Hz: 10 m/s² (1g), to IEC 60068-2-6, test Fc
Shock	150 m/s² (15g), 11 ms semi-sinusoidal wave to IEC 60068-2-27
Mechanical properties	
Mounting	35 mm DIN rail (top-hat rail)
Dimensions (W x H x D)	25 mm x 120 mm x 90 mm
Ingress Protection	IP20
Housing mount	Aluminium
Screen connection	connects straight to module housing

4.5.2. Size of the FSoE data frame

The FSoE protocol defined a maximum frame size of 1322 bytes. This is the maximum size of the data that can be exchanged between a Safety PLC and an FSoE slave.
The maximum number of FSoE slaves to a Safety PLC is calculated by the addition of the respective safe I/O data plus protocol overheads (these together yield the size of the frame). The size data can be found in the product description of the respective FSoE slave.

Typical values for the size of the FSoE frame of a FSoE slave is dependent on the safe I/O usable data:

Payload data (bytes)	Size required by the slave in the FSoE frame (bytes)
1	6
2	7
4	11
8	19
16	35
32	67

In general:
Size of the FSoE frame = 2 × safe I/O data + 3 byte descriptive data (CMD + connection ID)
Subject to the minimum size of the frame: 6 bytes

If during the configuration of a safety application the maximum size of the FSoE data frame stated above is exceeded, the respective safety application will not start.

4.5.3. Setting the cycle time for the safety application

The cycle time for the safety application is set in the programming system. It can be set to a value from 4 ms to a maximum of 600 ms in millisecond steps.

Values outside the range cannot be set.
When such a safety application is loaded, the Safety PLC will return an error message.

For new safety projects it is recommended that the safety task time is set to a high value (e.g. 50 ms). When the project is running, the safety task time actually required can be read in the object. (SDO Object 2220 Subindex 4) This value can be accepted with a buffer (e.g. +20%).

It is advisable to determine the maximum value by polling the object between the start of the ECM and the start of the FSoE.

4.5.4. Response Time

In a safety system consisting of the Safety PLC, safe I/O modules connected via FSoE and associated sensors and actuators, the overall response time is made up of the signal processing times of the individual components (see diagram). For the operating Safety PLC the response time is the task cycle time set in the safety application.

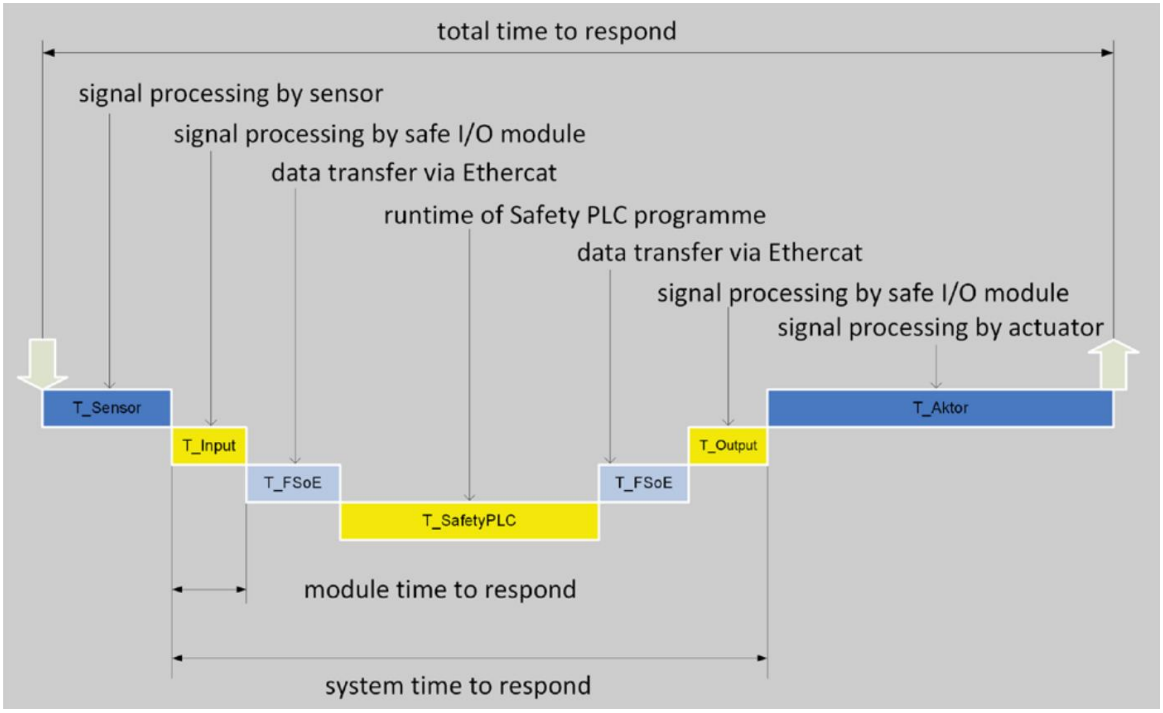


Fig. 7: Response time in multi-module operation (example)

Definition	Description
T_Sensor	Processing time of the sensor until the signal is available at the interface. Typically this is declared by the sensor manufacturer.
T_Input	Processing time of the safe input, e.g. SI4/SO2 module. This time can be found in the technical data of the input module.
T_FSoE	Processing time of the communication. This is max. 3x the EtherCAT cycle time, since new data are can always be sent only via a new Safety-over-EtherCAT telegram and the data must then be copied from the supervisory standard PLC. The processing time of the communication therefore depends directly on the cycle time of the EtherCAT master.
T_SafetyPLC	Processing time of the Safety PLC. This is the set cycle time of the safety application. If due to excessively high complexity of the program this cannot be achieved, the Safety PLC will switch into the safe state.
T_Output	Processing time of the safe output, e.g. SI4/SO2 module. This time can be found in the technical data of the output module.
T_Actuator	Processing time of the actuator. This information is typically provided by the actuator manufacturer.

⚠ CAUTION

To calculate the safe response time, take account of the fieldbus runtimes and the Safety PLC's cycle time.

- The field bus runtimes and the Safety PLC cycle time must be taken account of to calculate the safe response time.
- For the runtime of the field bus, a worst case of 3x the EtherCAT cycle time per directional signal must be assumed.

Since a fault may occur during the Safety PLC cycle, the maximum system response time must be assumed for the design response time. This can be set by means of the watchdog time of the FSoE slaves.

4.5.5. Size

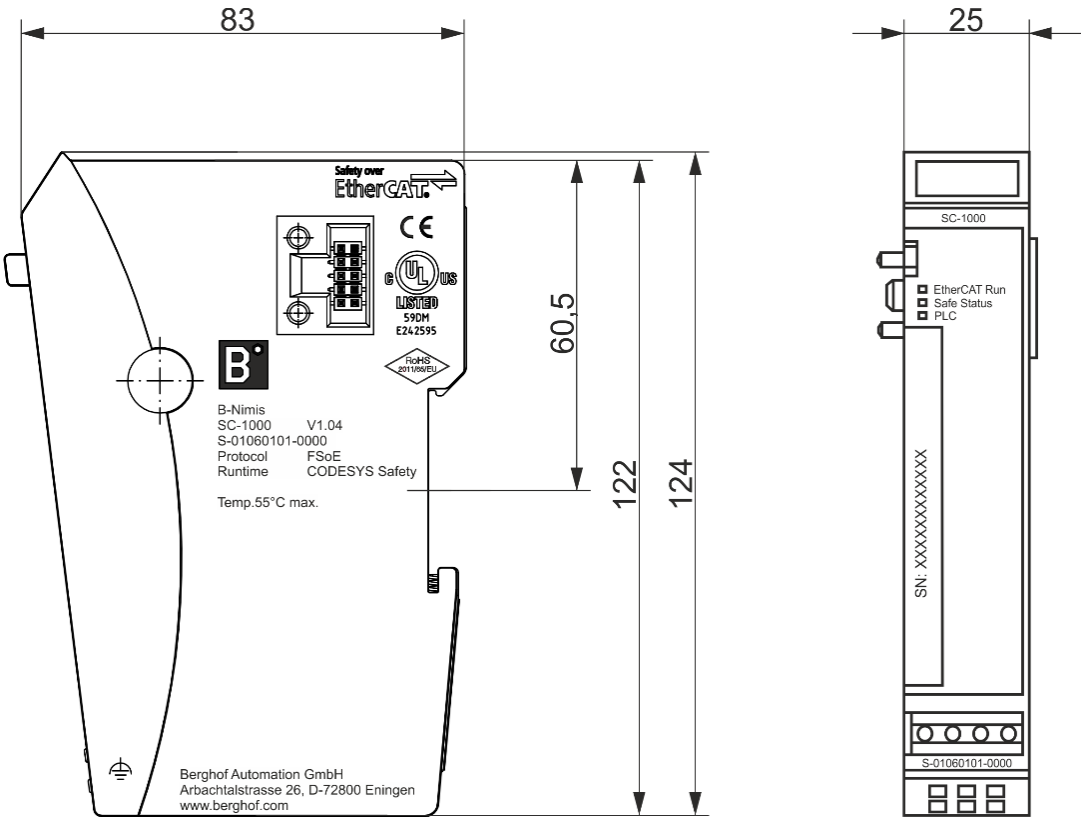


Fig. 8: Dimensions in mm

4.6. Transport and Storage

At times of transport and storage, protect the B-Nimis SC-1000 Safety-PLC module against inadmissible exposure to conditions such as mechanical stress, temperature, humidity and/or aggressive atmospheres.

- ▶ Transport and store the B-Nimis SC-1000 Safety-PLC module in its original packaging.
- ▶ When stock picking or unpacking, take care not to contaminate or damage the contacts.
- ▶ Comply with the ESD instructions - store and transport the B-Nimis SC-1000 Safety-PLC module in suitable containers/packaging.

Some parts of the units are sensitive to ESD and may be damaged if handled inappropriately.

- ▶ When commissioning and performing maintenance of the B-Nimis SC-1000 Safety-PLC module take the appropriate precautions against electrostatic discharge (ESD).

⚠ CAUTION

Electrostatic discharge

Destruction of or damage to the unit.

- ▶ Transport and store the B-Nimis SC-1000 Safety-PLC module in its original packaging.
- ▶ Ensure that the ambient conditions are as specified at all times during transport and storage.
- ▶ Handle the B-Nimis SC-1000 Safety-PLC modules in a well-earthed environment (persons, place of work, packaging).
- ▶ Do not touch electrically conductive parts such as data contacts. Some of the electronic components may be destroyed if exposed to electrostatic discharge.

5. Construction and Functionality

5.1. Labelling and Identification

5.1.1. Imprinted Texts and Symbols

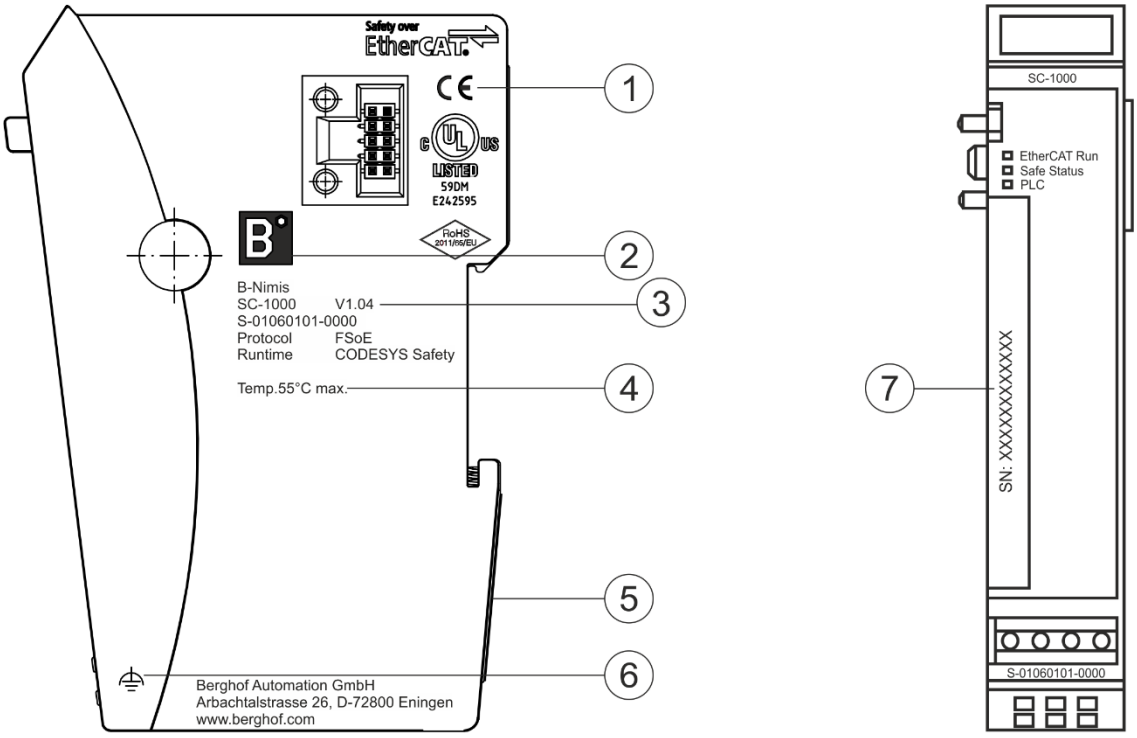


Fig. 9: Imprinted Texts and Symbols

Item	Designation	Item	Designation
1	Operating conditions	5	Serial number on the underside
2	Manufacturer's label	6	Operative earth
3	Module Version acc. to chapter 1.2.2	7	Serial number on front face
4	Wiring diagram		

5.1.2. Serial number

The serial number is printed vertically on the front face. It can also be found on the rear face of the module. The numerical code incorporates the production date and a serial number. The numerical code permits Berghof Automation GmbH to perform unique identification of the model, software and hardware release date.

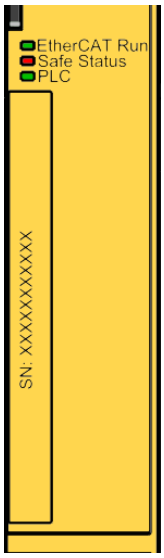


Fig. 10: Front view with serial number

Structure of the serial number:
YY MM DD NNNNN
Y = Year (production date)
M = Month (production date)
D = Day (production date)
N = sequential number

The serial number is also stored in object 1018h sub-index 4 (see section 8.3.7 Identity Object 1018h) and can be read by EtherCAT SDO access.

5.2. Scope of delivery

→ B-Nimis SC-1000 Safety-PLC module
→ Module bus cover

5.3. Status LEDs

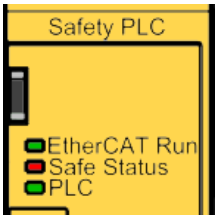


Fig. 11: Status LEDs

Displays:

→ "EtherCAT Run" LED Status of the EtherCAT communication
→ LED "Safe Status" (Duo-LED): Status of the module regarding its safety function
→ "PLC" LED: Status of the module

LED	State	Explanation
"EtherCAT Run" LED		
Off	Init	Initialising, no data exchange
Off/green, 1:1	Pre-Op	Pre-operational, no data exchange
Off/green, 5:1	Safe-Op	Safe operation, inputs readable
Green continuous	Op	Operational, unrestricted data exchange
LED "Safe Status"		
Green continuous	OK	Module is in the functional safe state
Red, continuous	Error	The module is in the fail-safe state
"PLC" LED		
Off	–	Safety application not loaded
Off/yellow, 1:1	–	Safety application is being loaded
Yellow, continuous	–	Safety application is loaded
Green continuous	–	Safety application is running
Red, continuous	–	Safety application is stopped
Off/red, 1:1	–	Safety application was aborted
Off/green, 1:1	–	The safety application is in Debug mode

The status LEDs are not a safety-related display. Thus the displays of the status LEDs must not be relied on as a reliable indication of the operating status of the module etc.

5.4. Operating Software

The Safety PLC is part of a decentralised CODESYS-based control system. The programming of the Safety PLC is performed using a CODESYS-based programming system extended by the use of a certified plug-in (CODESYS Safety Extension) that provides the safety functionality.

⚠ WARNING

Incorrect programming and parameter setting

- Perform programming and parameter setting only via the CODESYS Safety Extension approved for use in conjunction with the CODESYS Safety runtime system version 1.2.0.
- Perform programming and parameter setting in accordance with the relevant CODESYS Safety user guide.

6. Installation and Operation

- Before installation, verify that the Safety Module has been transported and stored under the ambient conditions specified in section "4.6 Transport and Storage" and section "4.5 Technical Data".
- Module operation is subject to the service conditions specified in section 4.5 Technical Data.

⚠ CAUTION

Incorrect operation

Safety PLC module malfunctions.

- Only persons qualified for dealing with safety matters are allowed to add, replace and put Safety PLC Modules into operation.
- Before installing, servicing or putting Safety PLC Module into service, please also read the safety information in this document.
- Before putting the unit into service, verify that all safety functions work as specified (validation of the safety function).

6.1. Mechanical Installation

No tools are required for installation and deinstallation of the Safety PLC. See sec. 6.1.3 to sec. 6.1.6

Instructions for the installation environment

The device must be protected against impermissible contamination (degree of contamination II of IEC 60664-3 must be complied with).
A housing to index of protection IP54, such as a suitable control cabinet will afford the necessary protection. Operation under conditions of condensing humidity is not permitted.

⚠ WARNING

Potentially hazardous failures due to contamination

Contaminations more severe than those described for degree of contamination II of IEC 60664-3 may cause potentially hazardous failures.

- Do ensure that the operating environment complies with at least IP 54, e. g. by installing the unit in a suitable control cabinet.

6.1.1. Installation position

The device is intended for installation on a rail (to DIN EN 50022, 35 x 7.5 mm). Mount the device on a horizontal rail with the status LEDs of the module facing forwards.
To ensure that enough air enters through the ventilation slots on the module, leave at least 20 mm to the top and 35 mm to the bottom of the module and any adjacent devices or cabinet surfaces. Leave at least 20 mm of lateral distance to third-party units and cabinet surfaces.

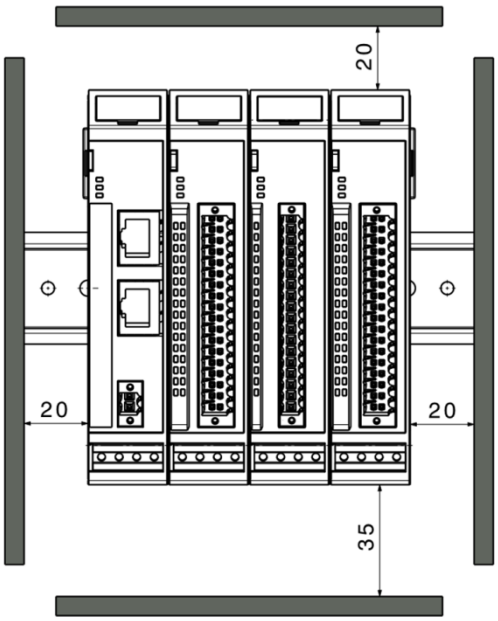


Fig. 12: Installation position and minimum clearances in mm

6.1.2. E-bus Plug Connector and Module Lock

The system plug connectors and the module lock are located on the sides of the B-Nimis SC-1000 Safety-PLC module. These plug connectors interconnect the modules. They supply power to the module electronic circuitry and transfer the EtherCAT signals. The module bus connector together with an end cap to protect the terminal unit against dirt is attached to the last module at the right-hand side. The integrated module lock prevents the modules from coming apart under mechanical load or vibration.

6.1.3. Snapping on a Single Module

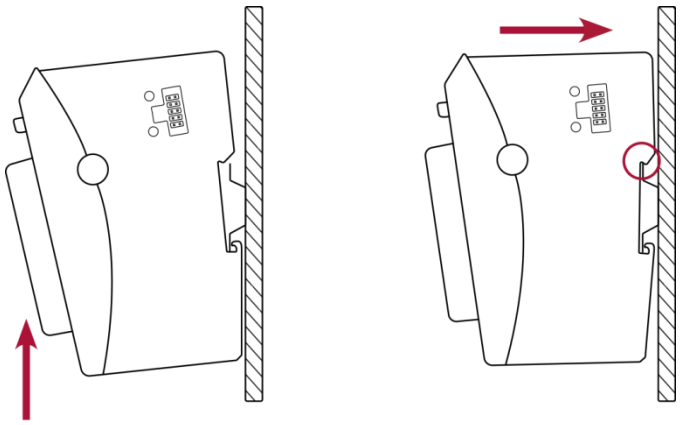


Fig. 13: Installing a module

1st Push the module up against the mounting rail from below, allowing the metal spring to snap in between mounting rail and mounting area as illustrated.
2nd Push the module upwards against the mounting wall until it snaps in.

6.1.4. Interconnecting two modules

1st After snapping on the first module to the rail, snap on the second module to the right of the first module at a distance of about 1 cm.
2nd Push the second module leftwards along the rail towards the first module until you hear the locking device snap in.
3rd To prevent inadmissible contamination, fit the cover of the module bus connector on to the rightmost module of the B-Nimis I/O system.

⚠ CAUTION

Risk of injury due to short circuit fault of module bus contacts

A short circuit of the module bus contacts may cause the communication with the safe module to fail.

- ▶ Make sure that the bus end cap is attached to the last modules of a row of modules.

6.1.5. Disconnecting two modules

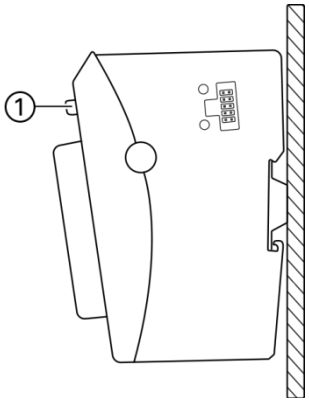


Fig. 14: Disconnecting modules

1st Press the locking device (1) of the module to be disconnected.
2nd Push the two modules away from one another until they are about 1 cm apart.

6.1.6. Removing a single module

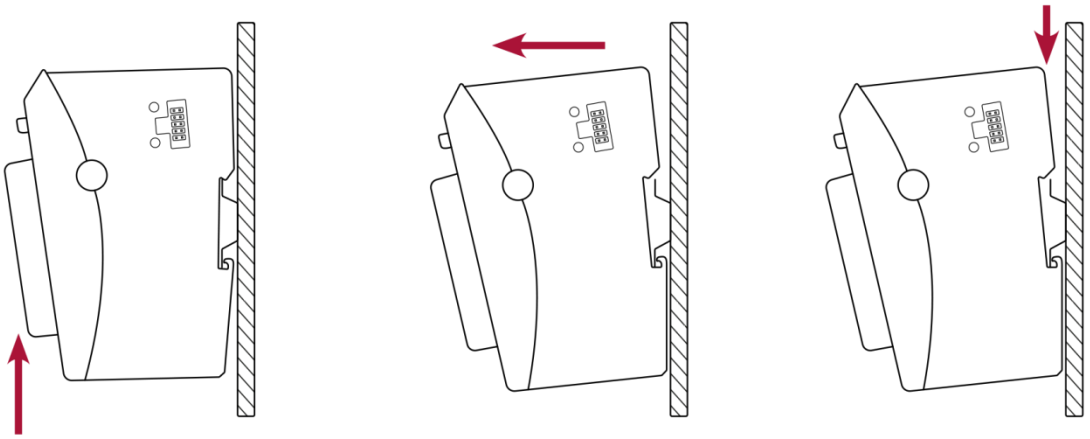


Fig. 15: Removing a module

1st Push the module upwards against the metal spring located on the underside of the rail guide.
2nd Tip the module forwards away from the rail as shown in the illustration.
3rd Pull the module downwards and off the mounting rail.

6.2. Electrical Installation

6.2.1. Earth

The modules must be earthed, for which purpose the inner metal housing must be connected to an effective earth conductor. Since the effective earth dissipates HF currents and is of the utmost importance for the interference immunity of the module.
HF interference is dissipated from the electronics board to the metal housing. The metal housing therefore needs to be suitably connected to an effective earth.
Normally, earthing of the module housing is provided by a good connection achieved by clicking on to the DIN rail. This is turn has a good earth connection to the control cabinet, which is itself well earthed. If necessary the earth can be connected directly to the front of the module (see illustration, item 1).

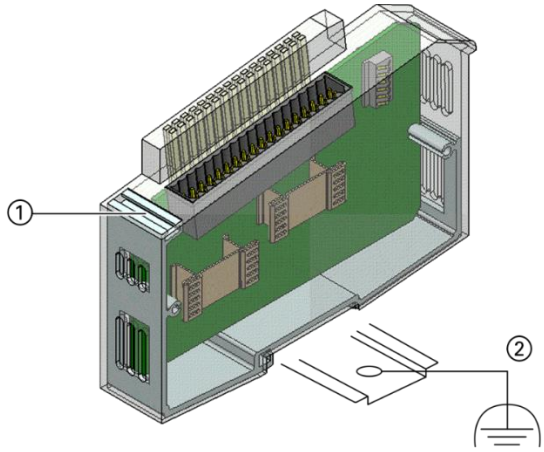


Fig. 16: Earthing (for example an I/O module)

Item	Designation	Item	Designation
1	Earth/cable screen attached using a M3x5 screw	2	DIN rail connected to an effective earth

Earth conductors should be short and have a large area (copper mesh).

When installing systems, measure the earthing of the DIN rail as specified in the applicable guidelines (earth test to VDE 0100). Measuring the earthing must show that every protective earthing and operational earthing are within the limits set by the applicable standards.

- Perform repeat testing at intervals determined by the risk assessment.

6.2.2. Interconnection between modules

The modules make electrical connections by being completely pushed together. This automatically connects the modules to both the EtherCAT bus and the system power supply. Refer to section 6.1 Mechanical Installation for details about how to interconnect two modules.

6.2.3. System Power Supply to the row of modules

Only modules may be used for the power supply to the Safety PLC (bus coupler, microcontrollers in compliance with EN 61131-2), which provide a reverse polarity safeguard for the 24V power supply.

The logical power supply to the individual modules is provided by the head module (microcontroller or bus coupler) via the backplane bus of the modules. The number of modules in a row is dependent on the output power of the head module. A typical output power of 3 A is sufficient to supply approx. 20 connected modules. To connect a larger number of modules these must be arranged in multiple blocks, each block with its own bus coupler.

- Please comply with the system power supply details provided in the operating instructions of the upstream bus couplers or compact PLCs as well as the additional system power supply instruction in this user manual.
- Please note that the maximum current supplied by the bus coupler limits the number of modules you may connect to a single block.

Depending on the number of modules in the row, the voltage conditions on the E-bus vary according to the module position.

- Place the B-Nimis SC-1000 Safety-PLC module as close as possible to the head module, in order to ensure the highest possible availability.

WARNING

Damage due to power supply with the wrong voltage

Supplying the wrong voltages may damage or destroy the unit.

Preventive measures:

- Only use PELV/SELV-ready power supply units to EN50178 or EN60950-1 to supply 24 V DC to bus couplers or compact PLCs to which any Safety PLC modules are connected.
- Only use the GND terminal to connect the power supply unit to earth (PELV system). Do not use earthing variants that connect earth to +24 V.
- To ensure that there is as little interference as possible, install a central power supply point and establish a star topology of as short wires as possible between the central point and the B-Nimis I/O module block.

6.3. Initial commissioning

The B-Nimis SC-1000 Safety-PLC module may be operated only with FSoE-compliant FSoE slaves. After any work has been performed on the safety system, the safety functions must be checked for correct operation.

6.3.1. Configuration

The Safety PLC is configured solely by means of the operating software. There are no configuration facilities on the module itself.

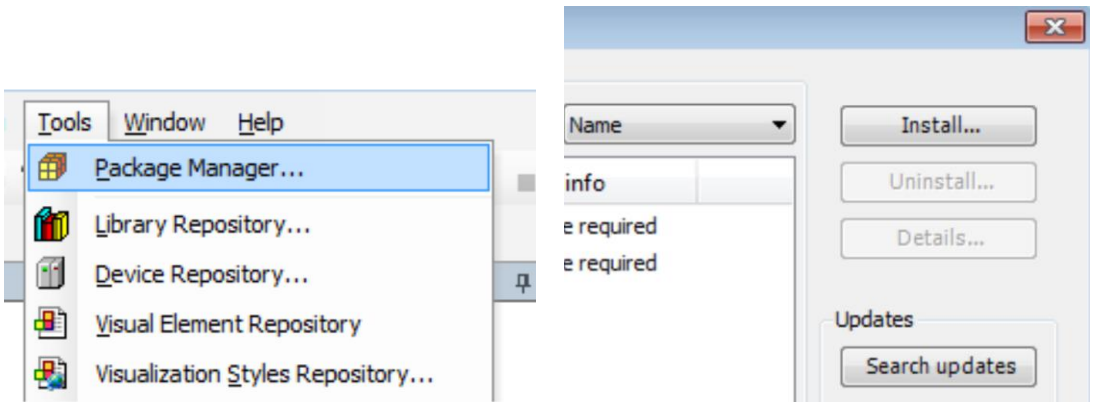
6.4. Software Installation

As a general rule, only the 32-bit version of CODESYS is currently permitted for the use of CODESY Safety.

CODESYS Version	Safety Package Version
32Bit CODESYS V3.5.8.30	Safety Package V1.2.0.0
32Bit CODESYS V3.5.14.40	Safety Package V1.5.0.0
32Bit CODESYS V3.5.16.40	Safety Package V1.6.1.0

6.4.1. Installing the Safety Extension

The Safety Extension required for the Safety PLC must be integrated manually into the programming system. After the CODESYS installation has been performed, double clicking on the CODESYS Safety Extension will install it in the installation file.
Alternatively the extension can be installed in the CODESYS itself under the "**Tools -> Package Manager… -> Install…**" tab.



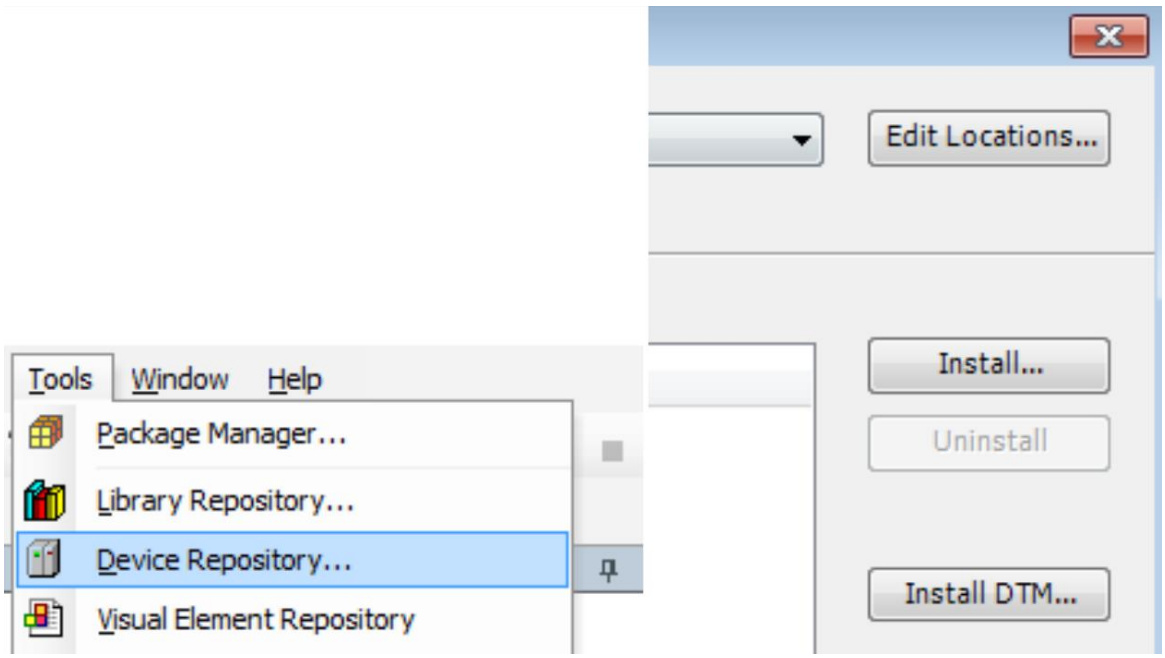
Important: In both cases the installation of the extension must be performed by a user with administrative rights.

▶ On completion of the installation, restart the CODESYS programming system.

6.4.2. Installing the Safety Device Description

It is a condition of use of EtherCAT modules that the associated device description is installed. This applies also to safety modules (Safety PLC and associated I/O modules).

Device descriptions (*.xml) can be installed in CODESYS under the "**Tools -> Device Repository**“ tab.

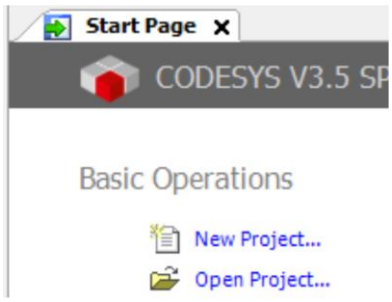


The device description for the Safety PLC and descriptions for all other devices must be installed in the device repository before they can be used in the project.

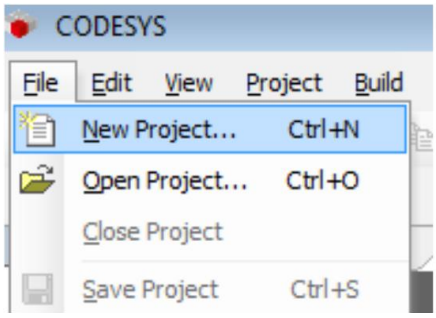
The installation of CODESYS Package files and device descriptions should always be performed by a user with administrative rights.

6.4.3. Creating a safety project

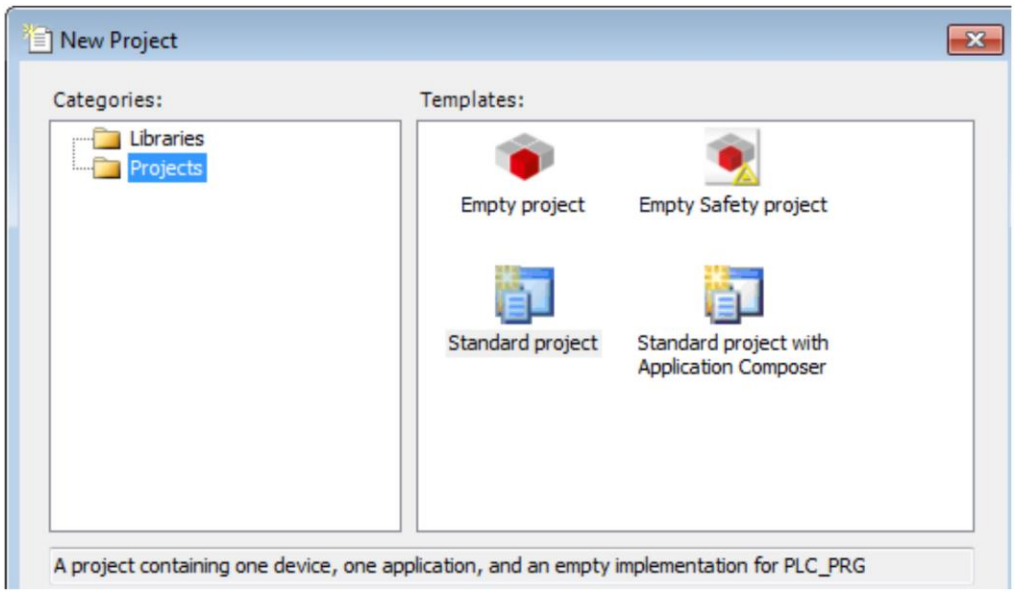
1st Open CODESYS V3.
2nd On the Standard CODESYS home page, under “**Basic operations**“ click on “**New project…**“.



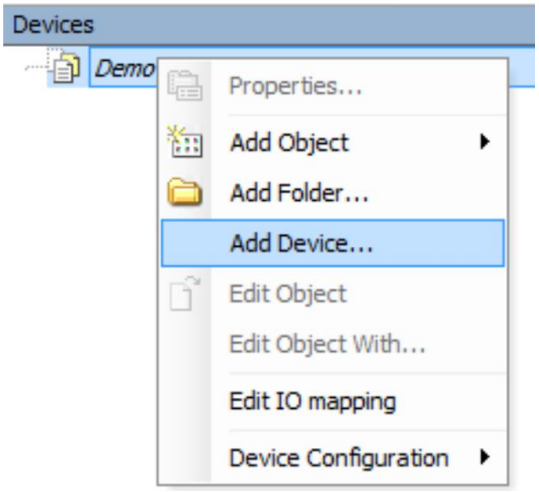
Alternatively you can create a new project under “**File -> New project…**“.



3rd Select the template “Empty safety project“.
4th Select "Name“ and the memory location of the project, and press "OK“ to create the project.

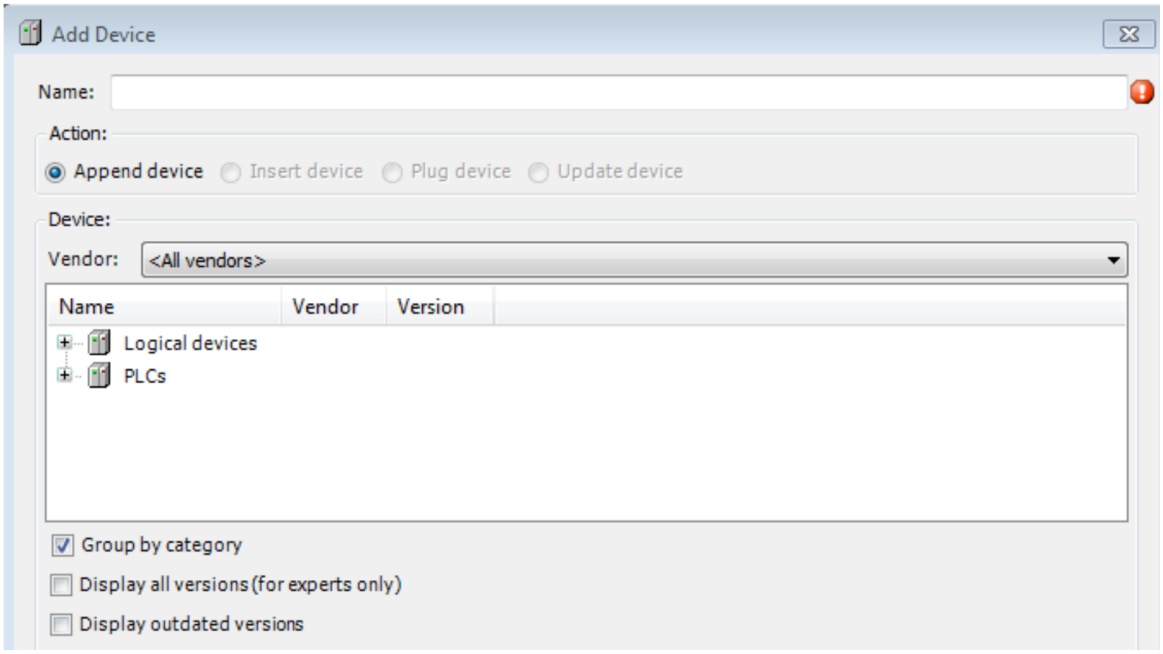


5th For an empty project, attach a standard PLC by right clicking on "**[project name] -> Attach device**“.



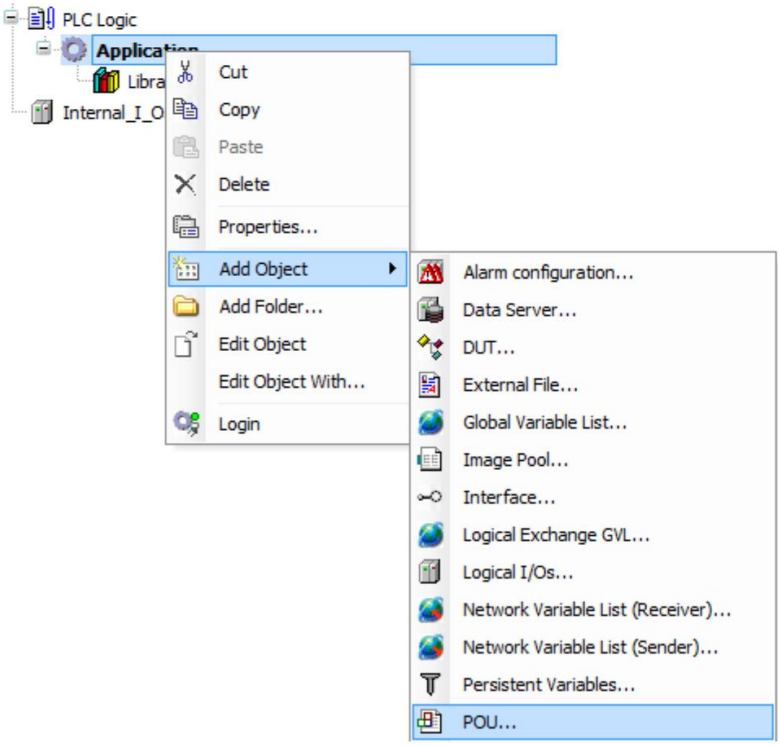
.

6th Select the device type of the desired standard PLC.

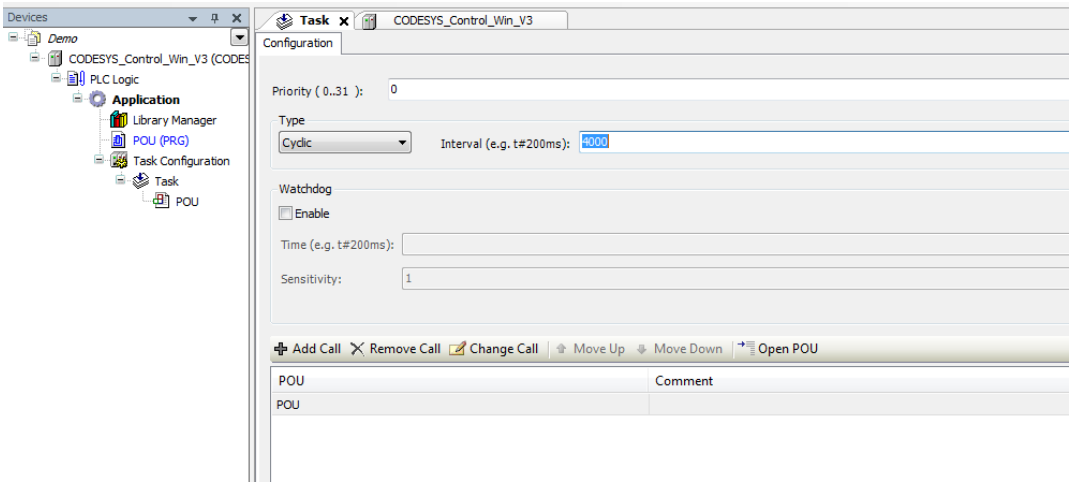


7th In order to insert objects into the application, right click on "Application -> Add Object“ to execute it.

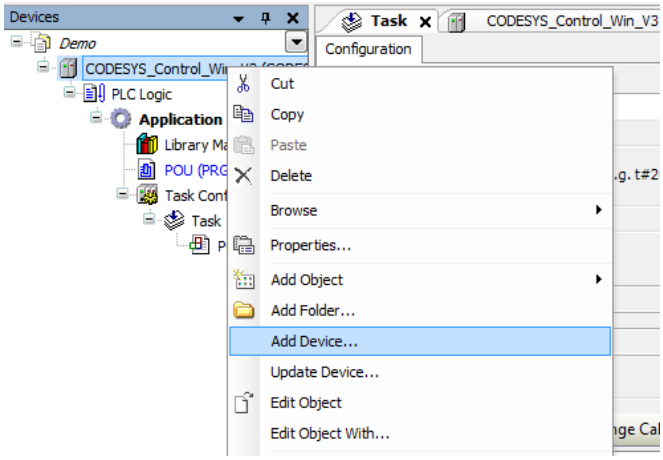
A list opens, in which all objects available to be added are shown.
Clicking on the respective object adds it to the application.



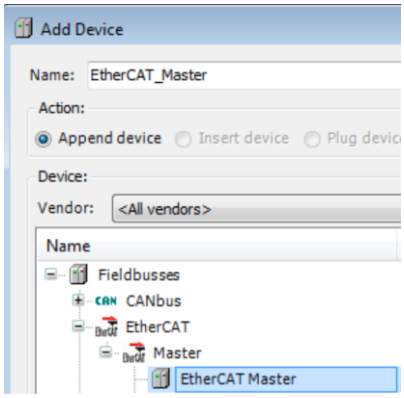
8th Inserting a POU (program).
9th Inserting a task configuration.
10th Use the task configuration to call up POU:
Click on “Add call up“ and select POU in the list.



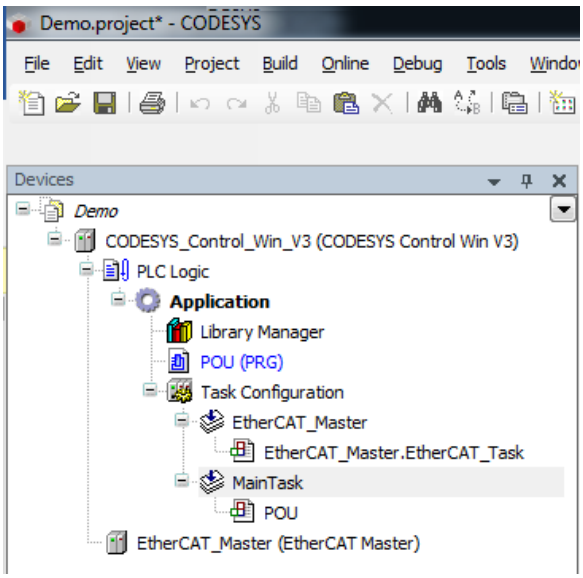
Since the Safety PLC is an EtherCAT-based module, an EtherCAT master must also be attached:
11th Right click on the standard PLC already selected.
12th Select "Attach device…“ in the selection window.



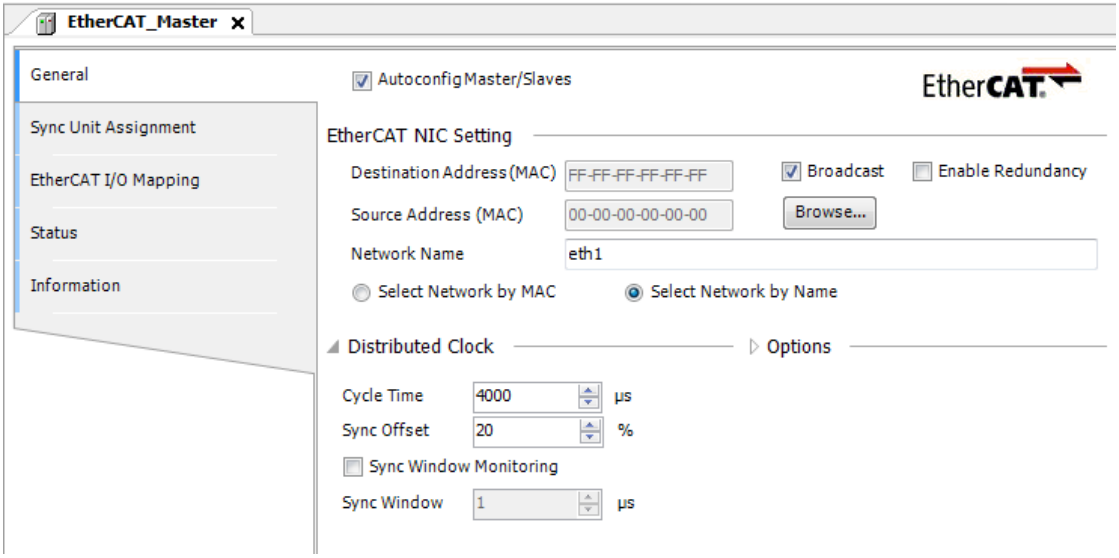
13th In the next window select “Field buses -> EtherCAT -> Master -> EtherCAT Master“.
14th Click on “Attach device“ to insert the EtherCAT master into the project.



The EtherCAT master is now listed in the device window and has been successfully incorporated into the project. The associated task configuration for the EtherCAT master is also created automatically.



15th In the settings for the EtherCAT master, select or declare the associated Ethernet interface. (EtherCAT NIC settings → Select the network by name, network name)

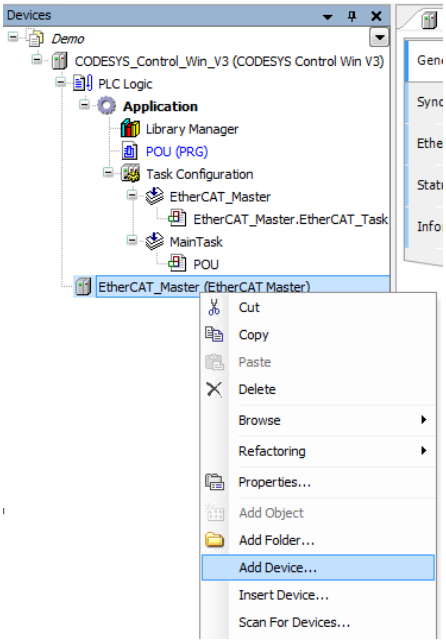


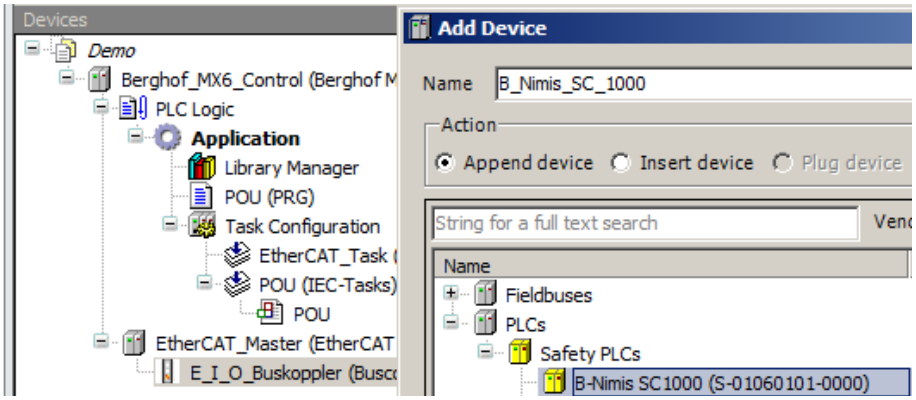
16th Inserting EtherCAT devices manually or by EtherCAT search.

Installing EtherCAT devices manually

The bus coupler, Safety PLC, safety modules and other EtherCAT modules can now be inserted from the point of view of the standard PLC:

1st Right click on "EtherCAT_Master -> Attach device…".
2nd Select devices.

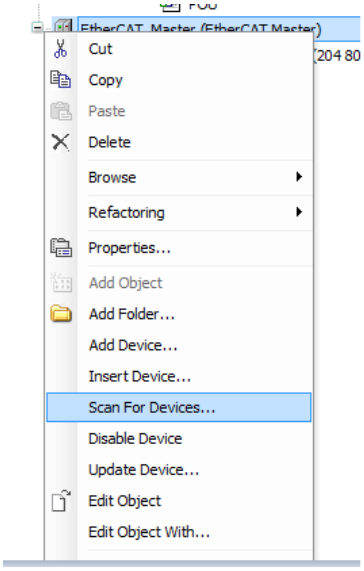




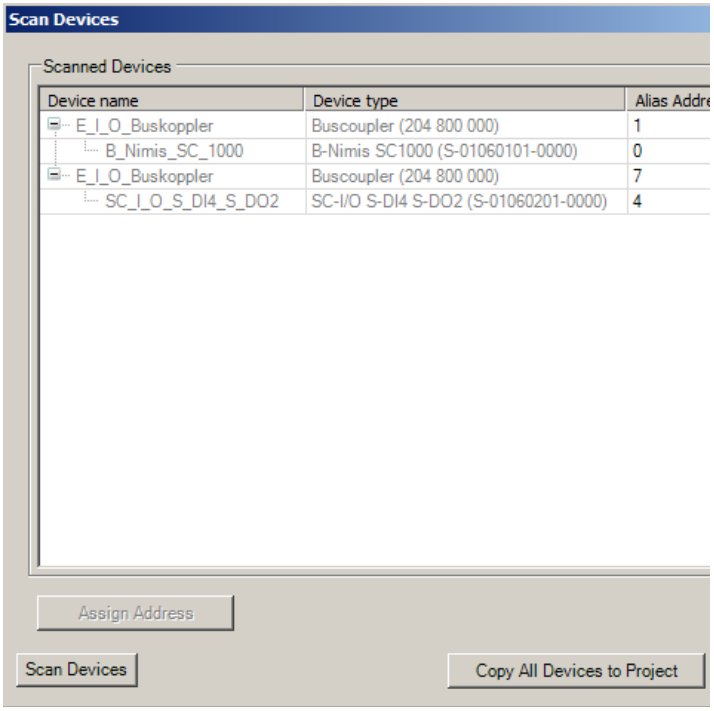
Insert devices by EtherCAT search

As an alternative to manual insertion, there is also an easy way to link modules into the project. Available EtherCAT devices can be sought automatically and inserted into the project. For this purpose an executable and compilable application must exist with the EtherCAT master on the standard PLC. In addition all desired additional modules must be connected.

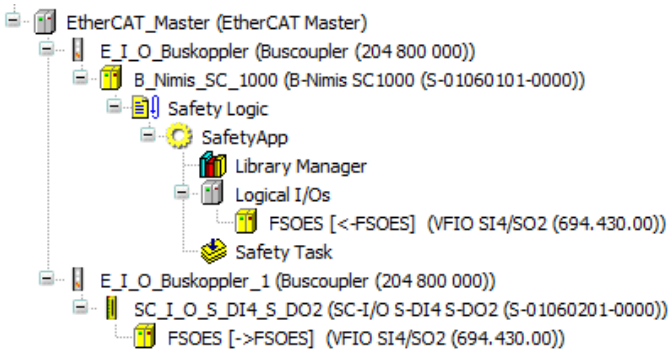
1st Right click on "Application-> Login“ to login to the standard PLC.
2nd Load the application to the PLC.
3rd Right click on "EtherCAT_Master -> Search for devices…“ to open a new window for the search.



After the search process, all devices found within the EtherCAT network are listed.



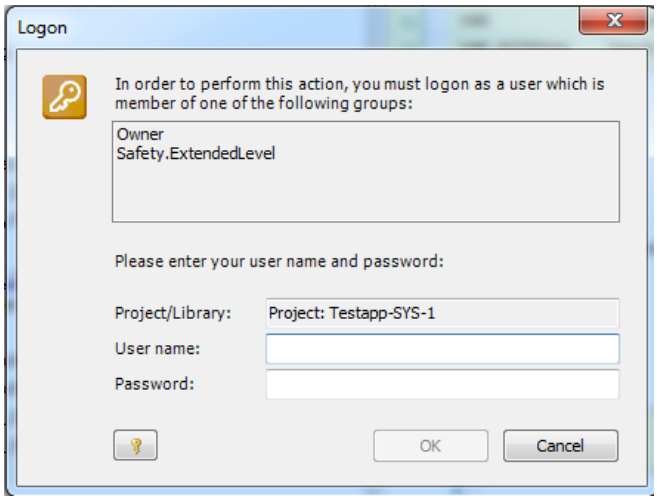
4th Click on “Copy all devices into project“ to automatically add all devices found under the EtherCAT master.



The safety application is located in the EtherCAT module of the Safety PLC. This is used within the programming system as a “normal“ standard PLC (set active application, login, logout).

For creation of the safety application see the CODESYS Safety Manual.

When an empty safety project is created, a user management is always incorporated automatically. By default this is the user as the “Owner“, with a blank password.
When changes are made to a safety application the user must be authenticated so that the change can be made.

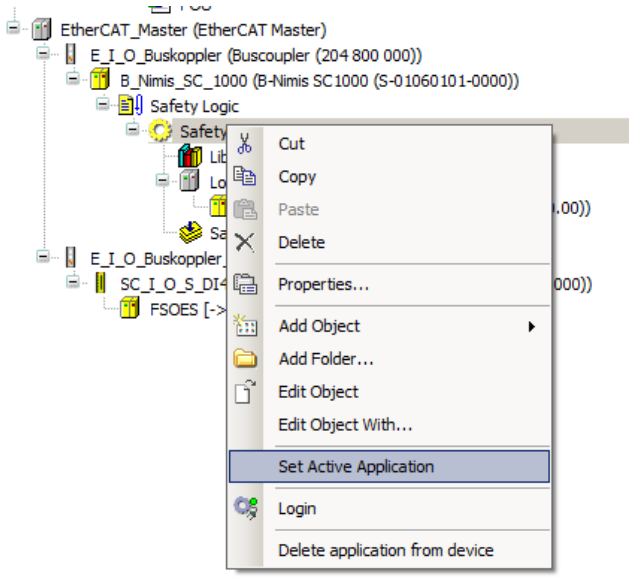


Safety devices and safety applications should generally be password-protected against unauthorised access

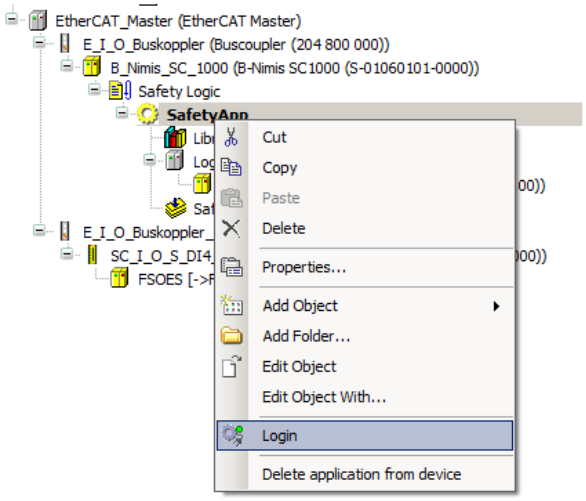
6.4.4. Safety PLC - logging in and downloading an application

In order to create a connection to the Safety PLC, an EtherCAT master with the correct EtherCAT configuration must be present and started on the standard PLC, so that the EtherCAT master is running.

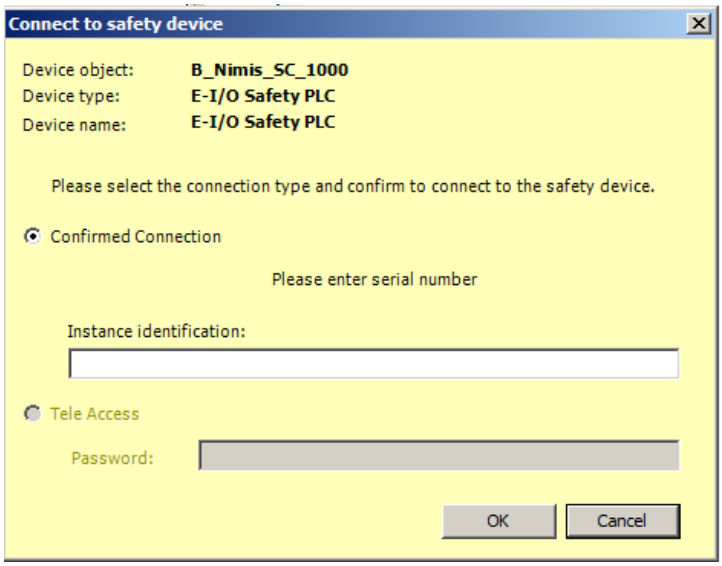
1st In the logged in state, right click on "Safety App“-> “Active application“ to switch the active application to the Safety PLC.



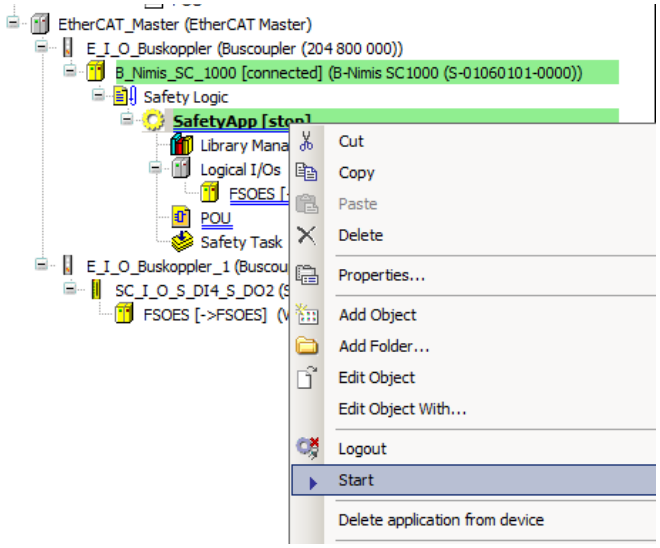
2nd Right click on "Safety App“->“Login“ to log in to the Safety PLC.
3rd Load the application to the PLC.



At logging in, a security question requests the serial number of the Safety PLC. The ensures that a Safety PLC and the application on it will not be changed inadvertently.



4th Right click on "Safety App“ -> Start to start the application.

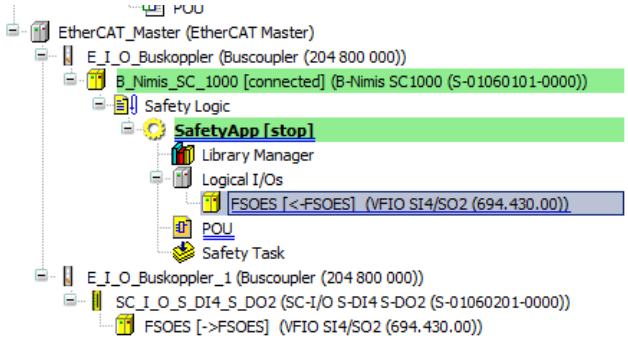


6.4.5. Safety PLC – FSoE (Safety over EtherCAT)

The Safety PLC communicated via FSoE (Safety over EtherCAT) with other safety modules. For this purpose the Safety PLC is the FSoE master and the safety modules are FSoE slaves. The FSoE slaves are addressed by the master via a unique ID. This FSoE slave ID must be unique within the EtherCAT network and configured both in the master and also in the slave module. (Refer to the User Guide for the respective module for the procedure for setting the FSoE ID in the slave module)

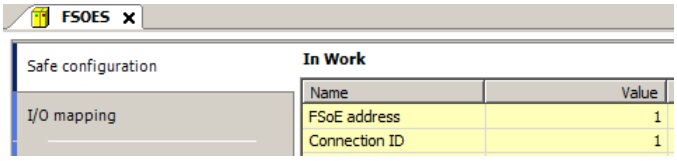
6.4.6. Configuration of the FSoE slave ID in the Safety PLC

The FSoE (Safety over EtherCAT) slave modules are configured in the Safety PLC using CODESYS Safety.



The FSoE configuration of the slave modules is performed in the Safety PLC under the "Safety App“ in the logical I/Os entry. Here the slave modules are inserted automatically and can be modified manually.

The configuration of the respective FSoE slave must be saved in the configuration window.
Each module must here be assigned a unique FSoE address and a unique connection ID.



6.5. Validation of the safety function

On completion of the installation and commissioning the safety application, this must be validated for correct operation within the overall system.

DANGER

Validation of the safety function

Safety applications must be validated for implementation and function within the overall system.

► Perform and document validation of the overall system as specified in the CODESYS Safety User Guide

6.6. Diagnostics

6.6.1. Selftest

When system voltage is applied to the Safety PLC, initially the module runs a complete system test. Only once the module has passed the self-test can the module be used. Only once this is done does the Safety PLC switch into the "Fail-Safe" safe state.
This is indicated by the "Safe Status" LED lighting up red.
The Safety PLC will remain in the fail-safe state until all internal tests have been passed.
Once the Safety PLC has passed the self-test the safety application saved on it is started.
This is the safe functional state is indicated by LED "Safe Status" lighting up green.
If the state is not achieved, for instance if it was not configured correctly in the application – the module still remains in the fail-safe state.
In service, the system test is repeated cyclically as a background process; any faults found the self-test also trigger the Fail-Safe state. This is recorded in the CODESYS log.

6.6.2. Faults within the Safety PLC module

Faults within the Safety PLC module will be discovered in good time by the cyclic system test in accordance with the requirements of the standards specified in the certificate, and will result in a switch to the Fail-Safe state.
The Fail-Safe state is indicated by the LED "Safe Status" lighting up red (see section 5.3 Status LEDs).

The status LEDs are not safety-related displays. Thus the displays of the status LEDs must not be relied on as a reliable indication of the operating status of the module etc.

DANGER

Use of devices in a fail-safe state

The following faults may provoke a hazard.

- On your own responsibility, ensure that after a fault occurs, all necessary measures are taken for clarification and rectification of the cause of the fault, and components are replaced as necessary.

In case of serious internal faults within the module of the Safety PLC, Berghof Automation GmbH must be informed.

6.6.3. Temperature Faults

The module is designed for ambient temperatures between 0 °C and max. 55 °C and to be installed in a control cabinet. The Safety PLC incorporates its own internal temperature sensor. If during operation the temperature strays outside the specified range, the Fail-Safe state will be adopted. If the ambient temperature is outside the specified temperature range, the module cannot be brought into operation.

⚠ CAUTION

It is prohibited to operate the B-Nimis SC-1000 Safety-PLC module outside the specified range

Faults due to undertemperature / overtemperature.

- The module may be operated only under the ambient conditions listed in the Technical Data.

⚠ CAUTION

It is impermissible to use the internal temperature sensors for safety applications!

Temperature sensor not available for safety-related applications.

- The internal temperature sensor may not be used for implementation of safety applications.

6.6.4. Error Handling and Logging

Depending on their type, faults detected are indicated by the diagnostic LEDs of the Safety PLC. In addition all error messages are displayed in the log-window of the respective Safety PLC in the programming system. Furthermore, the errors can be read by the standard PLC from special tabs of the Safety PLC by using COE objects (see the index of objects).

6.7. Resetting/acknowledging an error

The Safety PLC makes a distinction between errors in the Safety PLC and those in the communication with sensors and actuators and faults of the sensors and actuators.
Errors in the Safety PLC can be acknowledged only by restarting the system. This is achieved by performing a power cycle (switching the power off and on again) at the head module.
Loss of communications or faults in sensors and actuators lead to errors in the associated safety module. They are detected in the safety application and acknowledged by rest procedures at the modules (such as the FSoE master). In this case the Safety PLC remains in the functional safe state.

Power Cycle
After the cause of the fault has been rectified the Safety PLC can be reset by performing a power cycle (switching the power off and on again) at the head module.

⚠ WARNING

Resetting / acknowledging may cause a dangerous state

- Before acknowledging an error, verify that its cause has been removed professionally.
- Before acknowledging an error, verify that acknowledging it will not cause a dangerous machine state.
- At the machine or system planning stage, make sure that acknowledging an error must not be possible unless you have full view of the danger zone.

6.8. Maintenance / Servicing

6.8.1. General

Only qualified persons are allowed to work on the Safety PLC.

⚠ CAUTION

Unsafe and undefined machine state

Destruction or malfunction of the Safety PLC.

- The module housing may not be opened.
- The module may not be repaired.
- Do not plug, mount, unplug or touch the connectors during operation!
- Switch off all power sources before working on the modules. This also applies to any peripherals such as encoders or programming devices with external power sources, etc.
- Check that none of the ventilation slots is covered.

6.8.2. Servicing

The Safety PLC Module is maintenance-free for the specified service life, and requires no servicing. For this reason there are also no spare parts available.

Whilst in operation and storage the Safety PLC must be protected against contamination, apart from the degree of contamination usually expected in the defined ambient conditions of use. If the module if it has been exposed to inadmissible contamination, do not attempt to use it, clean it or continue to use it.

⚠ DANGER

Risk of injury due to safe and undefined machine state

- Operation of an impermissible contaminated module is prohibited.
- Cleaning the unit is prohibited.

6.9. Replacement of a Safety PLC

⚠ CAUTION

Risk of injury due to safe and undefined machine state

Risk of injury.

- Switch off the power supply to the Safety PLC and the connected modules before replacing a Safety PLC module.
- Once a Safety PLC module has been replaced, separately test the safety function before restarting the machine or system.

6.9.1. Replacement

Preparation

1st Ensure that the new module satisfies the following conditions:
   → Same type of device
   → The same or higher version, see section 5.1 Labelling and Identification.
2nd Bring the system or machine into a safe state.
3rd Switch off the power supply to the head module and the connected modules.

Remove the old module

4th If necessary, separate the row of B-Nimis I/O modules: Press the locking device of the adjoining module and push the two modules away from one another until they are about 1 cm apart (see the user guide for the other module).
5th Push the module upwards against the metal spring located on the underside of the rail guide. (see section 6.1.6 Removing a single module).
6th Tip the module forwards away from the rail.
7th Pull the module downwards and off the mounting rail.

Installing and programming the new module

8th Install the substitute module at the same place as the one that was removed (see section 6.1.3 Snapping on a Single Module).
9th Load the validated safety application.

6.9.2. Recommissioning

1st Ensure that the machine or system is in a safe state and that there is nothing and nobody in the danger zone.
2nd Switch the supply voltage on again.
3rd After the replacement safety module has been plugged in, proceed as for initial commissioning (see section 6.3 Initial commissioning).
4th After replacing a module, perform a check of all safety functions.

6.10. Working Life

Safety PLC modules have a design life of max. 20 years from their date of manufacture (see section 5.1 Labelling and Identification).

⚠ WARNING

Risk of injury if modules are used beyond their useful life!

- Take the module out of use no later than expiry of its useful life (see section 6.10.3 Decommissioning).

6.10.1. Repairs / Customer Service

It is prohibited to open or try to repair a B-Nimis SC-1000 Safety-PLC module. In such an event the function of the Safety PLC module can no longer be guaranteed.

If a module failure is potentially hazardous, return the module to the manufacturer where the fault will be identified.

For the manufacturer's address see section 9 Customer Service / Addresses.

6.10.2. Warranty

The statutory warranty is applicable. It lapses if the device/product is subjected to unauthorised attempts at repairs or other interventions.

6.10.3. Decommissioning

The manufacturer of the machine or system specifies the procedure for decommissioning the product.

- During decommissioning, ensure that the used modules are handled for further use as the the intended purpose.
- Comply with the transport and storage requirements specified in the Technical Data.

6.10.4. Disposal

- Dispose of the safety system in conformity with the applicable environmental regulations and make sure that it is not returned into circulation.
- Treat the packaging as recyclable paper and cardboard.

7. Safety function blocks

7.1. CODESYS safety libraries and their function blocks

The documentation for the CODESYS safety libraries and the blocks can be found in the installation directory after installing the safety package.
e.g. C:\Program Files (x86)\CODESYS 3.5.16.40\CODESYS\Documentation

7.2. Berghof Safety Library and its function blocks

The CODESYS programming system checks the validity of all FB names that are called up in the programme logic of the safety programme during the logon process that is used to log on to an S-PLC. If these are not reported as valid by the S-PLC, the login process is cancelled with an error message. A security-oriented program for an S-PLC can therefore only be executed on it or saved as a boot application if all the FBs called have been recognised as valid by the S-PLC beforehand.
It is therefore not possible to call an FB unknown to the S_PLC.

You can read out whether your SPLC supports the blocks via an object.

Support of Additional Function Blocks – 210Bh

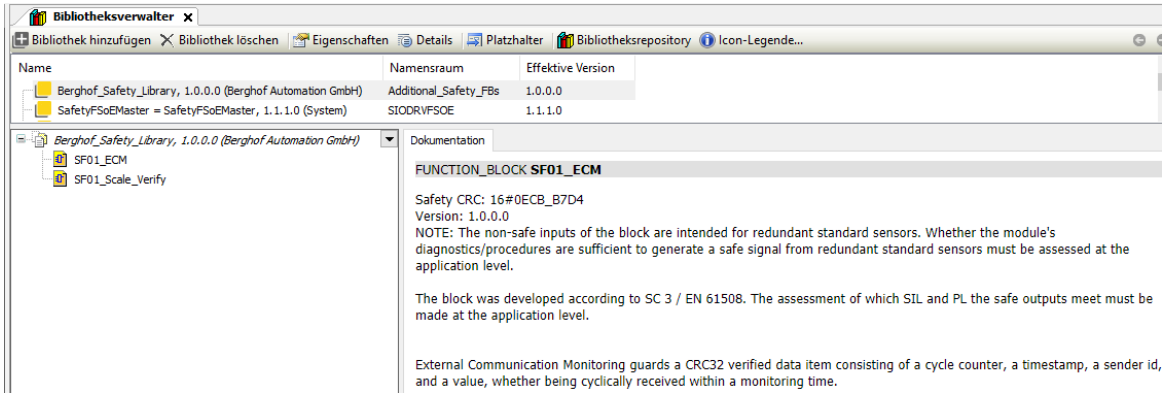
Description	Value
Name	Additional Function Blocks
Index	210Bh
No. of Elements	0
Access	Read only
PDO Mapping	No
Value	"1" FBs are supported, "0" FBs are not supported

Library Berghof_Safety_Library

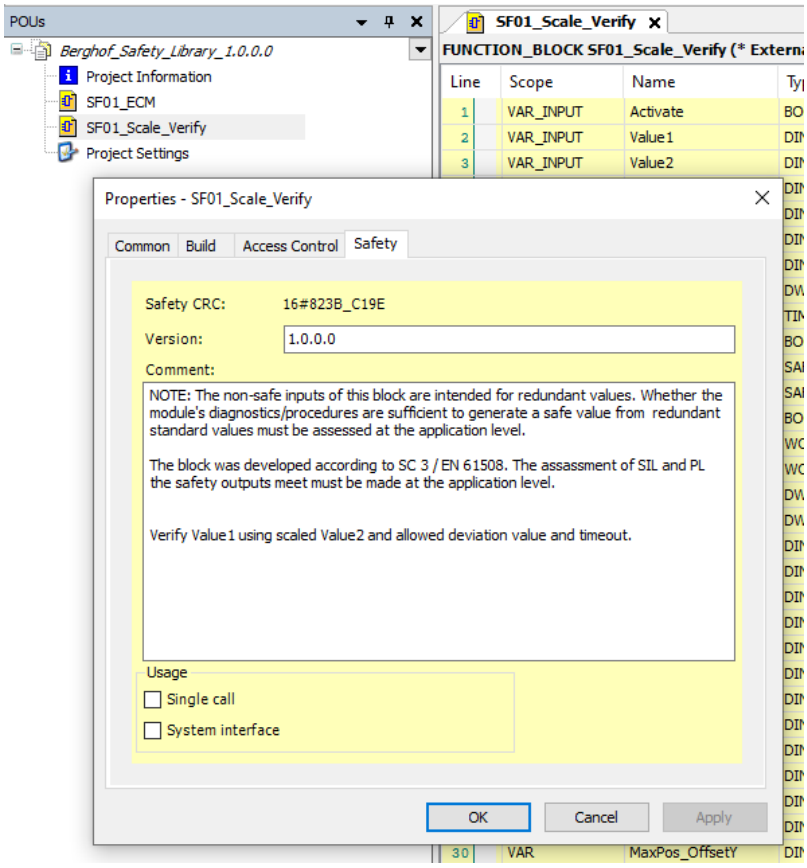
Identification of the components described here:

Name	Version	Safety CRC
SF01_ECM	1.0.0.0	16#0ECB_B7D4
SF01_Scale_Verify	1.0.0.0	16#823B_C19E

Can be read in the project, example SF01_ECM:



Or in the directly opened library, example SF01_Scale_Verify:



SF01_ECM - External Communication Monitoring

This FB monitors communication with another system (Profinet, Ethernet, RS485, etc.).
It can be checked whether communication is still taking place (timeout) or whether the content of a communicated data value (DINT) is correct.

Example 1 - Timeout
Communication between the PLC and a Profinet master should be monitored reliably. If the telegram fails for a certain time or its content is no longer plausible, an emergency stop can be triggered.

Example 2 - Monitoring a position
An external master sends a position (DINT) to the PLC via UDP.
This position should be monitored safely and an STO should be triggered if a value is exceeded.

The data structure contains the data shown in the table

No.	Element of the data structure
1	Incremented telegram counter
2	Timestamp in milliseconds
3	ID for the data channel
4	PDO (data value) Typ: DINT
5	CRC 32

This data structure is generated by the input module that outputs the data value and checked by this module in the safe control system. Each time the data value is generated, the input module increments the telegram counter and sets the time stamp to the current creation time. Each data source is assigned a unique ID to be parameterised, which must also be checked by the safe control system. The entire data structure is protected by means of a 32-bit CRC, which is defined by elements 1 - 4 from is calculated.
The CRC is formed with the following polynomial:

$$f(x)=x32 + x26 + x23 + x22 + x16 + x12 + x11 + x10 + x8 + x7 + x5 + x4 + x2 + x + 1$$

This is the same polynomial as in the SafetyManager and can be calculated using tables. This allows the CRC value to be generated quickly.

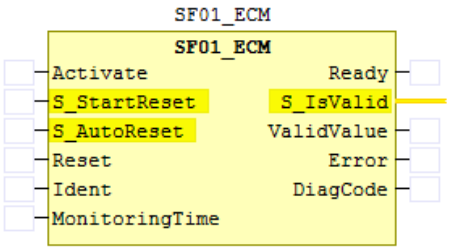


Fig. 17: SF01_ECM

The SF01_ECM module receives the input data via an exchange device, which is connected directly to the ECM (EtherCAT master).

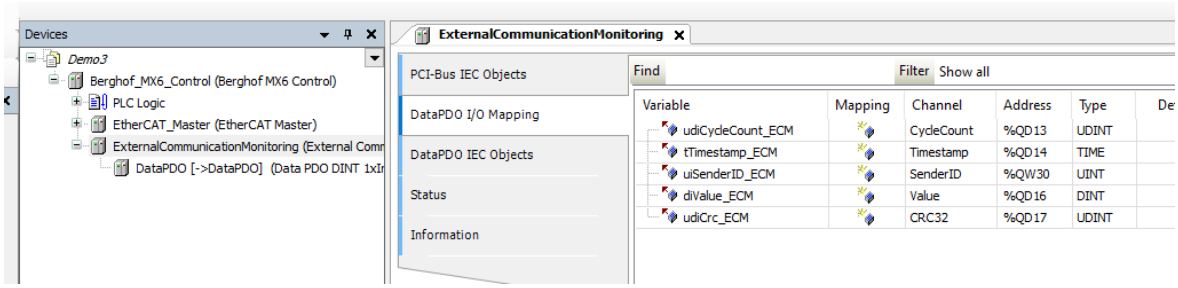


Fig. 18: ECM-Gerät in CODESYS-Umgebung

The data is made available via the Data-PDO in the Safety PLC.

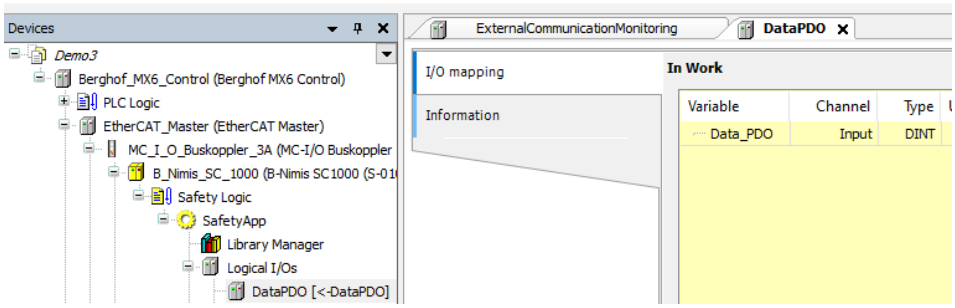


Fig. 19: Logische E/A in SPLC verknüpft mit SF01_ECM

The data packets received in this way are then checked in SF01_ECM and its outputs S_IsValid and ValidValue are set accordingly.

In this way, a cyclical data packet from the grey world is monitored in the safe control system.

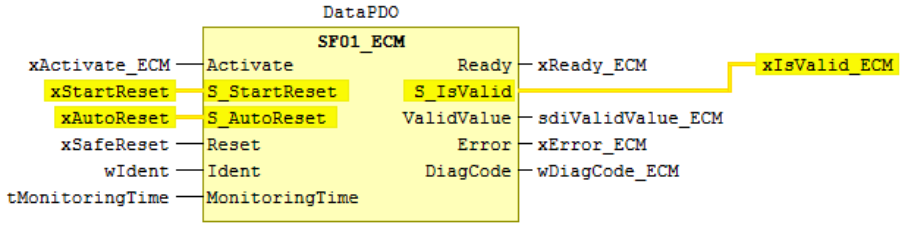


Fig. 20: SF01_ECM FB in SPLC POU

VAR INPUT

Name	Data type	Initial-value	Description
Activate	BOOL	FALSE	General activation of the module
S_StartReset	SAFE BOOL	TRUE	Automatic reset of the monitoring when the system is started.
S_AutoReset	SAFE BOOL	FALSE	Automatic reset of the monitoring system while the system is running.
Reset	BOOL	FALSE	Manual reset of the monitoring
Ident	DINT	0	Clear identification of the communication connection
MonitoringTime	TIME	T#0ms	Timeout time for monitoring

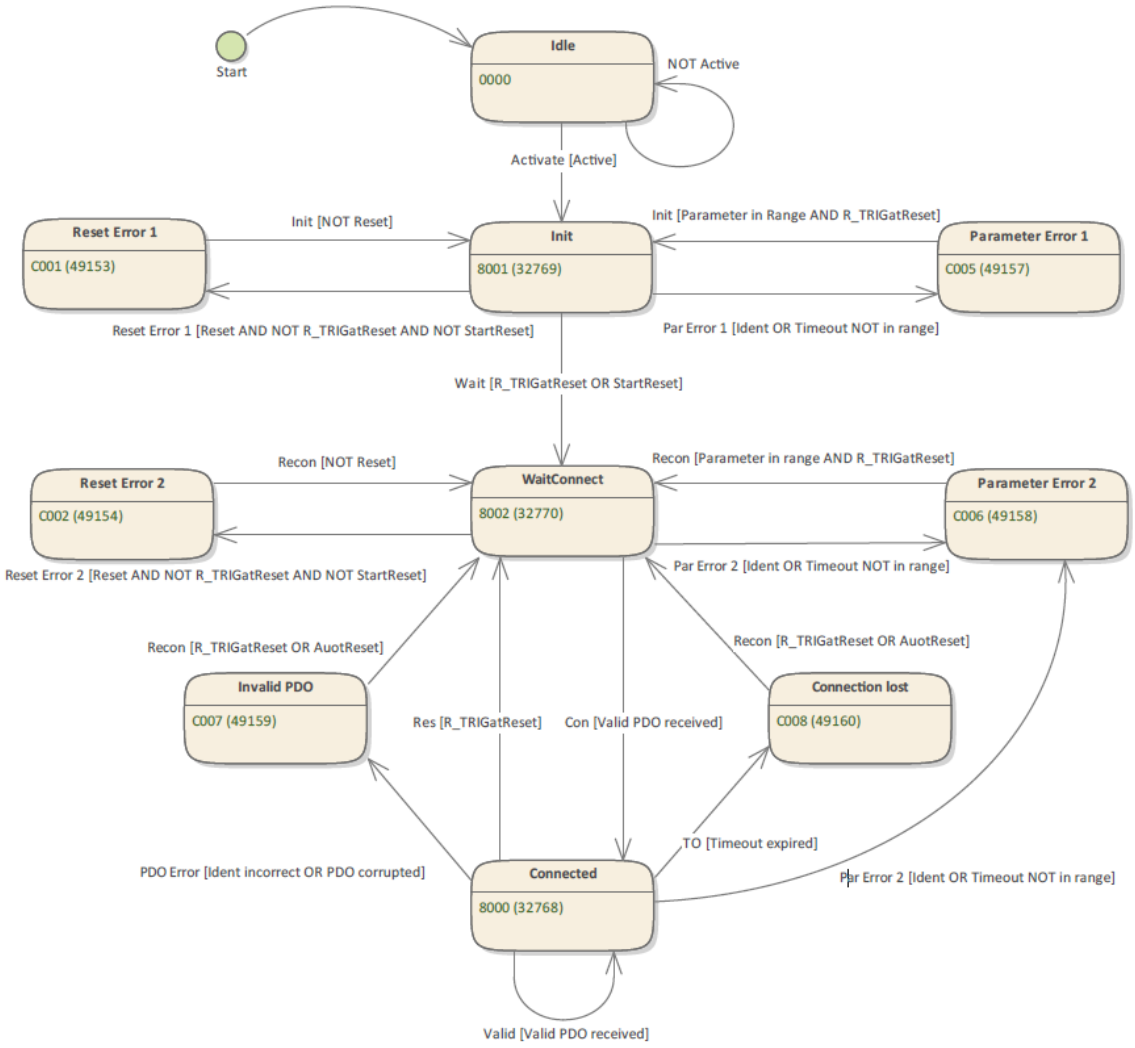
⚠ CAUTION

The inputs S_StartReset and S_Auto-Reset should only be activated if it is ensured that no hazardous situation can arise when the S-PLC starts.

VAR OUTPUT

Name	Data type	Initial-value	Description
Ready	BOOL	FALSE	Activation of the function block
S_IsValid	SAFEBOOL	FALSE	Flag to indicate the validity of the received data
ValidValue	DINT	0	Transmitted data value
Error	BOOL	FALSE	General error flag
DiagCode	WORD	0	Diagnostic code of the monitoring

State diagram



Note, Information

The state transition from any state to the Idle state due to the "NOT Active" condition is not shown for reasons of clarity

Diagnostic codes

DiagCode	Name	Description
16#0000	Idle	The module is not active (default state) Activate := FALSE Ready := FALSE Error := FALSE S_IsValid := FALSE ValidValue := 0x0000
16#8001	Init	Module activation, Start-up-block is active Activate := TRUE Ready := TRUE Error := FALSE S_IsValid := FALSE ValidValue := 0x0000
16#8002	WaitConnect	FB is waiting for valid data Ready := TRUE Error := FALSE S_IsValid := FALSE ValidValue := 0x0000
16#8000	Connected	Module active, final state without error Ready := TRUE Error := FALSE S_IsValid := TRUE ValidValue := <Act.Value>
16#C001	Reset Error 1	Reset status in the Init phase. Ready:= TRUE Error := TRUE IsValid := FALSE ValidValue := 0x0000
16#C002	Reset Error 2	Rest status in the Wait Connect phase Ready:= TRUE Error := TRUE IsValid := FALSE ValidValue := 0x0000
16#C005	Parameter Error 1	Parameter error in the Init phase Ready:= TRUE Error := TRUE IsValid := FALSE ValidValue := 0x0000
16#C006	Parameter Error 2	Parameter error in the WaitConnect or Connect Phase Ready:= TRUE Error := TRUE IsValid := FALSE ValidValue := 0x0000

DiagCode	Name	Description
16#C007	Invalid PDO	PDO error in the Connect Phase Ready:= TRUE Error := TRUE IsValid := FALSE ValidValue := 0x0000
16#C008	Connection Lost	Missing PDO Transmission Ready:= TRUE Error := TRUE IsValid := FALSE ValidValue := 0x0000

SF01_Scale_Verify

This FB verifies a grey measured value (DINT) by comparing it with a second grey measured value. To do this, both measured values must come from 2 different signal sources and from 2 different communication paths.
If both values differ outside the time in Timeout by the value in Deviation, then S_isValid = False. Otherwise, S_isValid = True and the measured value can be further processed in S_ValidValue as a safe value. There is also a diagnostic code (DiagCode) and an error flag (Error).
The Table explains the function of the input parameters. In Table this is shown for the output parameters.

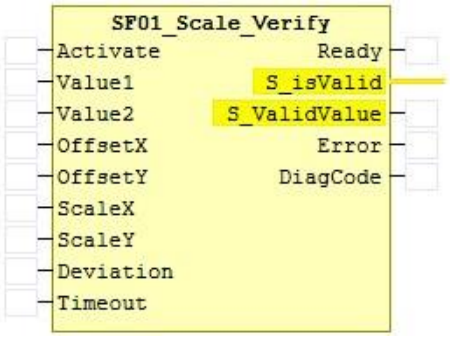


Fig. 21: SF01_Scale_Verify

Note, Information

The input values Value 1 and Value 2 are not of type SAFEDINT, as these originate from single-channel sources and the measured values are therefore not verified. The module ensures proper verification and supplies a safe measured value of type SAFEDINT at the output for further processing. The module itself is implemented on a dual-channel safety PLC.

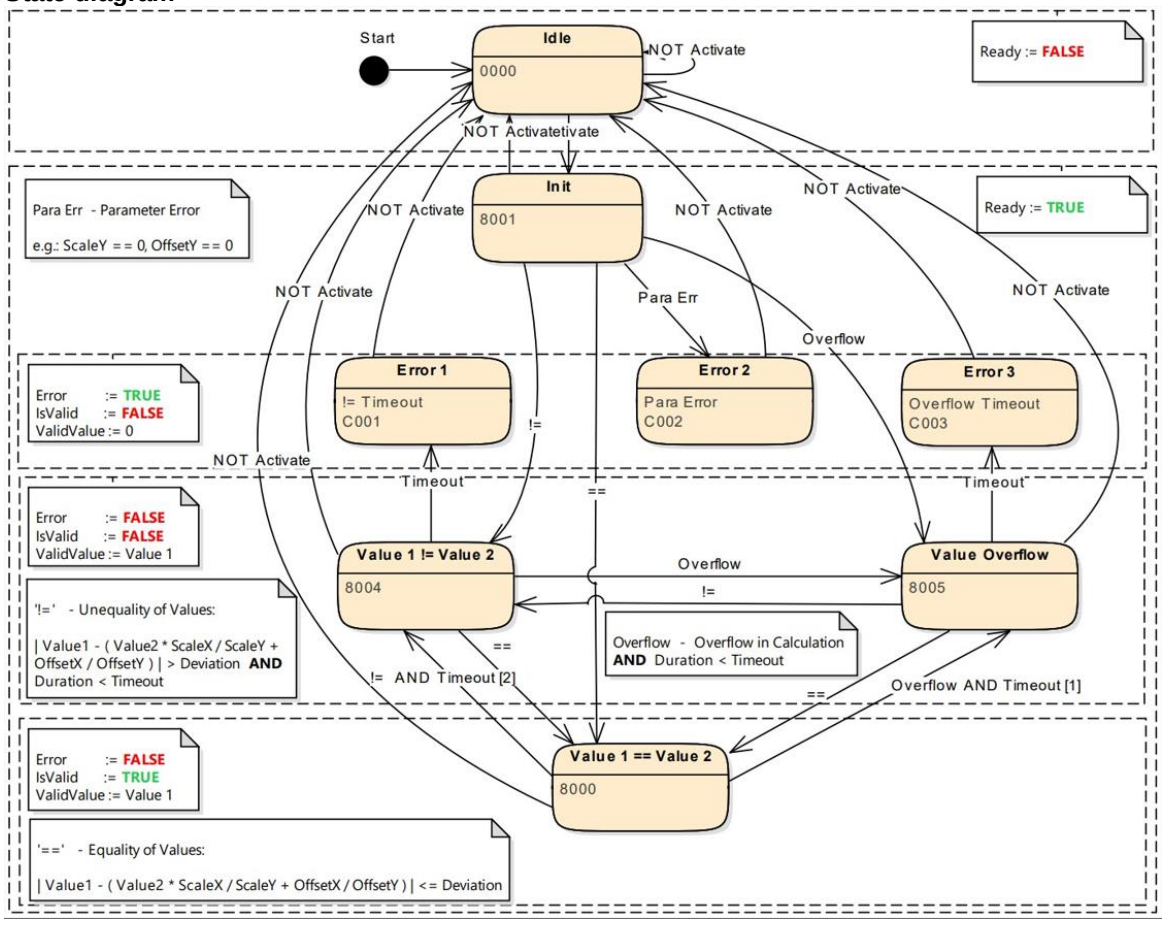
VAR INPUT

Name	Data type	Initial value	Description
Activate	BOOL	FALSE	General activation of the module
Value 1	DINT	0	Measured value to be verified 1
Value 2	DINT	0	Measured value to be scaled and used for verification 2
Offset x	DINT	0	Counter of the offset for scaling
Offset y	DINT	1	Denominator of the offset for scaling
Scale x	DINT	1	Numerator of the scaling factor
Scale y	DINT	1	Denominator of the scaling factor
Deviation	DWORD	0	Maximum permissible difference between measured value 1 (Value 1) and measured value 2 (Value 2)
Timeout	TIME	T#0ms	Maximum permissible time that measured value 1 and 2 may differ

VAR OUTPUT

Name	Data type	Initial value	Description
Ready	BOOL	FALSE	TRUE: Calculation and verification is complete
Error	BOOL	FALSE	General error flag
DiagCode	WORD	0	State code in the state machine
IsValid	SAFEBOOL	FALSE	Signal for validity of the measured output value (S_ValidValue)
S_ValidValue	SAFEDINT	0	Verified measured value 1

State diagram



Diagnostic/ State codes

Id	Name	Description
16#0000	Idle	The module is not active (basic status)) Activate := FALSE Ready := FALSE
16#8001	Init	Block activation Start-up block is active. Activation required. Activate := TRUE Ready := TRUE
16#8000	Value1 == Value2	Module active, final state without error Error := FALSE IsValid := TRUE S_ValidValue := Value1
16#8004	Value1 <> Value2 (!=)	Value1 <> Value2 Permissible inequality (difference between measured values 1 and 2 <= deviation) within the time monitoring (<timeout) Error := FALSE IsValid := FALSE S_ValidValue := Value1
16#8005	Value Overflow	Value overflow Permissible range exceedance of measured value 2 within the time monitoring (<Timeout) Error := FALSE IsValid := FALSE S_ValidValue := Value1
16#C001	Error1 - Timeout	Time monitoring with the value inequality expired. Error := TRUE IsValid := FALSE S_ValidValue := 0
16#C002	Error2 – Para Error	Parameter error Error := TRUE IsValid := FALSE S_ValidValue := 0
16#C003	Error3 – Overflow Timeout	Time monitoring with overrange of measured value 2 Error := TRUE IsValid := FALSE S_ValidValue := 0

8. Appendix

8.1. Safety-related Output Ratings of the Safety PLC

The following table contains the safety-related output ratings of the Safety PLC. All components involved in the safety function must be taken into account in order to assess whether the desired safety level is achieved.

Designation	Value	
Maximum safety integrity level to EN 62061:2010	SIL3	
Maximum safety integrity level to IEC 61508:2010	SIL3	
Maximum performance level to EN ISO 13849-1:2015	Cat. 4/PL e	
Hardware fault tolerance HFT (IEC 61508:2010/ EN ISO 13849-1:2015)	1 (a fault of the application need not cause the safeguard to fail)	
	Ambient temperature 25 °C	**Ambient temperature 55 °C**
Probability of failure on demand PFD_{avg} proof test interval: 20 years, (IEC 61508:2010)	$2.57 * 10^{-5}$ (2.57 % of the total PFD_{avg} of 10^{-3} at SIL3)	$2.99 * 10^{-5}$ (2.99 % of the total PFD_{avg} of 10^{-3} at SIL3)
Probability of failure on demand PFH_d, proof test interval: 20 years, (IEC 61508:2010)	$3.04 * 10^{-10}$ 1/h (0.3 % of the total PFD_{avg} of 10^{-7} at SIL3)	$3.55 * 10^{-10}$ 1/h (0.36 % of the total PFD_{avg} of 10^{-7} at SIL3)
DC (diagnostic coverage) to EN ISO 13849-1:2015	97.24 % (rounded up to 99% in accordance with EN ISO 13849-1:2015)	96.9 % (rounded up to 99% in accordance with EN ISO 13849-1:2015)
Safe failure fraction (SFF)	98.6 %	98.49 %
$MTTF_D$ to EN ISO 13849-1:2015	225 years	221 years

8.2. Safety Ratings of the safety function blocks

Bezeichnung	Wert
Maximaler Performance Level gem. EN ISO 13849-1:2015	PL d

The non-safe inputs of the function blocks are intended for (e.g. redundant) standard values. Whether the diagnostics of the function blocks are sufficient to generate safe values from the standard values must be assessed depending on the respective application

The module was developed in accordance with SC 3 / EN 61508. The evaluation of SIL and PL, which the safety outputs fulfill, must be carried out at the application level

8.3. Communications objects

8.3.1. Device Type 1000 h

Designation	Value
Name	Device Type
Index	1000_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read only
PDO Mapping	no
Value Range	Set
Default Value	89130000_h

8.3.2. Error Register 1001h

Designation	Value
Name	Error Register
Index	1001_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED8
Access	Read only
PDO Mapping	No, TX-PDO
Default Value	00_h

Bit evaluation to CANopen DS301:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x80	0x40	0x20	0x10	0x08	0x04	0x02	0x01
n.u.	n.u.	n.u.	n.u.	Temperature faults	Wrong supply voltage	n.u.	Other faults

8.3.3. Device Name 1008_h

Designation	Value
Name	Device Name
Index	1008_h
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING
Access	Read only
PDO Mapping	No
Value Range	Fix

Sub-index 0 of this object contains the string length. Sub-index 1 contains each of the characters. The character string has no terminating zero.

8.3.4. Hardware Version 1009_h

Designation	Value
Name	Manufacturer Hardware Version
Index	1009_h
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING
Access	Read only
PDO Mapping	No
Value Range	Fix
Default Value	$12E3030_h$ (1.00)

8.3.5. Software Version $100A_h$

Designation	Value
Name	Software Version
Index	$100A_h$
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING
Access	Read only
PDO Mapping	No
Value Range	Fix
Default Value	1.2.0

8.3.6. CANopen 'Restore default parameters obj. 1011_h

Designation	Value
Name	CANopen ‚Restore default parameters' obj.
Index	1011_h
Object Code	RECORD
No. of Elements	5

Designation	Value
Name	Number of entries
Subindex	00_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No
Default Value	No default

Designation	Value
Name	Restore all parameters (not used)
Subindex	01_h
Data type	UNSIGNED32
PDO Mapping	No

Designation	Value
Name	Restore communication parameters (not used)
Subindex	02_h
Data type	UNSIGNED32
PDO Mapping	No

Designation	Value
Name	Restore application parameters (not used)
Subindex	03_h
Data type	UNSIGNED32
PDO Mapping	No

Designation	Value
Name	Restore file system (write 0x64616F6C; comes into effect on next power cycle; request will be cleared after 1 min if no power cycle occurs)
Subindex	04_h
Data type	UNSIGNED32
Access	Read write
PDO Mapping	No

Designation	Value
Name	Delete Boot Application (write 0x64616F6C; comes into effect on next power cycle; request will be cleared after 1 min if no power cycle occurs)
Subindex	05_h
Data type	UNSIGNED32
Access	Read write
PDO Mapping	No

8.3.7. Identity Object 1018_h

Designation	Value
Name	Identity object
Index	1018_h
Object Code	RECORD
No. of Elements	4
Data Type	IDENTITY

Designation	Value
Name	Number of entries
Subindex	00_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No
Default Value	4

Designation	Value
Name	Vendor-ID
Subindex	01_h
Data type	UNSIGNED32
Access	Read only
PDO Mapping	No

Designation	Value
Name	Product Code
Subindex	02_h
Data type	UNSIGNED32
Access	Read only
PDO Mapping	No

Designation	Value
Name	Revision
Subindex	03_h
Data type	UNSIGNED32
Access	Read only
PDO Mapping	No

Designation	Value
Name	Serial number
Subindex	04_h
Data type	UNSIGNED32
Access	Read only
PDO Mapping	No
Units	yyyyyy mmmm ddddd nnnnnnnnnnnnnnnn 6-bit 4-bit 5-bit 17-bit Year 2014 is coded as '0'.
Value Range	14 01 01 00001 (0x00420001) … 77 12 31 99999 (0xFF3F869F)
Example	16052300001 ⇔ 0x096E0001

The object contains details of the manufacturer, the product code and the revision and serial number.

8.3.8. Error Settings (not used) $10F1_h$

Designation	Value
Name	Error Settings (not used)
Index	$10F1_h$
No. of Elements	0
Access	Read only
PDO Mapping	No, TX-PDO

8.3.9. Sync Manager Type (not used) $1C00_h$

Designation	Value
Name	Sync Manager Type (not used)
Index	$1C00_h$
No. of Elements	0
Data Type	UNSIGNED8
Access	Read only
PDO Mapping	No

8.3.10. SM out par (not used) $1C32_h$

Designation	Value
Name	SM out par (not used)
Index	$1C32_h$
No. of Elements	0
Data Type	UNSIGNED8
Access	Read only
PDO Mapping	No

8.3.11. SM in par (not used) $1C33_h$

Designation	Value
Name	SM in par (not used)
Index	$1C33_h$
No. of Elements	0
Data Type	UNSIGNED8
Access	Read only
PDO Mapping	No

8.4. Manufacturer-specific objects

8.4.1. MC 1: Reference Voltage [mV] 2000_h

Designation	Value
Name	MC 1: Reference Voltage [mV]
Index	2000_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	Read only
PDO Mapping	No
Units	mV
Value Range	0 … 65535
Default Value	No default value

8.4.2. MC 1: 5 V Supply Voltage [mV] 2002_h

Designation	Value
Name	MC 1: 5 V Supply Voltage [mV]
Index	2002_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	Read only
PDO Mapping	No
Units	mV
Value Range	0 … 65535
Default Value	No default value

8.4.3. MC 1: 3.3 V Supply Voltage [mV] 2003h

This is the supply voltage to MC 2 as measured by MC 1.

Designation	Value
Name	MC 1: 3,3 V Supply Voltage [mV]
Index	2003_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	Read only
PDO Mapping	No
Units	mV
Value Range	0 … 65535
Default Value	No default value

8.4.4. Temperature sensor [0.01°C] 2006_h

Designation	Value
Name	Temperature sensor [0,01°C]
Index	2006_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	Read
PDO Mapping	No
Units	0,01 °C
Value Range	0 … 8000
Default Value	No default Value

8.4.5. MC 1: Error code 2007h

Designation	Value
Name	MC 1: Error code
Index	2007_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No

The table below explains the entries in object 2007_h "error code".

Id	Hex	Explanation
0	0x0000	OK: No error No error
1	0x0001	HWT_PARAMETER_ERROR Hardware test parameter error
2	0x0002	HWT_INIT_ERROR Hardware test initialisation error
100	0x0064	HWT_MEM_MARCHC_ERROR Hardware test RAM check error
101	0x0065	HWT_MEM_GALPAT_ERROR Hardware test RAM check error
200	0x00C8	HWT_STACK_UNDERFLOW_ERROR Hardware test stack underflow
201	0x00C9	HWT_STACK_OVERFLOW_ERROR Hardware test stack overflow
300	0x012C	HWT_CPU_ERROR Hardware test CPU error
400	0x0190	WT_FW_ERROR Hardware test firmware error
500	0x01F4	HWT_FWINTERFACE_ERROR Hardware test firmware error
504	0x01F8	HWT_ADC_ERROR: Test handler: error in ADC value range checks Hardware test AD converter error
505	0x01F9	HWT_DMA_ERROR: Test Handler: error in DMA check Hardware test DMA checksum error
506	0x01FA	HWT_CRC_ERROR: Test Handler: error in CRC check

Id	Hex	Explanation
		Hardware test CCRC checksum error
507	0x01FB	HWT_TIMER_ERROR: Test handler: error in timer check Hardware test CPU timer error
508	0x01FC	HWT_CLOCK_ERROR: Test Handler: error in clock signal check Hardware test CPU clock error
512	0x0200	TIMEOUT_ERR: Timeout detected. Software timeout detected
513	0x0201	OUT_OF_RANGE_ERR: Parameter or value out of allowed range. Parameter range error
514	0x0202	OVERWRITE_ERR: Register buffer data overwrite occurred. Data overflow occurred
516	0x0204	PRG_CNTRL_ERR: Program sequence control detected error. Program execution error detected
517	0x0205	“Soft-Error” detected Software error detected
528	0x0210	INIT_ERROR: Initialisation error Initialisation error
592	0x0250	ASSERT_TRUE_ERR: Assertion for expression yields "true" failed. Assertion for "true" failed
593	0x0251	ASSERT_NOT_NULL_ERR: Assertion for unequal to NULL failed. Assertion for unequal to NULL failed
594	0x0252	ASSERT_GE_ERR: Assertion for ">=" comparison failed. Assertion for ">=" comparison failed
595	0x0253	ASSERT_GT_ERR: Assertion for ">" comparison failed. Assertion for ">" comparison failed
596	0x0254	ASSERT_LE_ERR: Assertion for "<=" comparison failed. Assertion for "<=” failed
597	0x0255	ASSERT_LT_ERR: Assertion for "<" comparison failed. Assertion for "<” failed
598	0x0256	ASSERT_NE_ERR: Assertion for "<>" comparison failed. Assertion for "<>" failed
599	0x0257	ASSERT_EQ_ERR: Assertion for "=" comparison failed. Assertion for "=" failed
600	0x0258	ASSERT_FALSE_ERR: Assertion for expression yields "false" failed. Assertion for "false" failed
672	0x02A0	MRAM is not initialized MRAM is not initialized
673	0x02A1	MRAM_READ_ERR: MRAM Read error. MRAM read error
676	0x02A4	MRAM_CORRUPT_PAGE_SIZE: MRAM invalid page size. MRAM page size error

Id	Hex	Explanation
677	0x02A5	MRAM_CRC_ERR: MRAM data CRC check failed. MRAM checksum error (CRC error)
688	0x02B0	LZS logging is not initialized yet.
689	0x02B1	LZS logging is initialized.
692	0x02B4	LZS world time timer has been initialized.
696	0x02B8	Request file system reset.
697	0x02B9	Request deleting boot app from file system.
698	0x02BA	Boot app deleted from file system.
699	0x02BB	Reset of file system activated.
700	0x02BC	System request cancelled due to timeout.
768	0x0300	RESET_LOW_POWER: Reset due to low power supply. Reset due to undervoltage
769	0x0301	RESET_WINDOW_WD: Reset due to window watchdog. Reset due to window watchdog
770	0x0302	RESET_INDEPENDENT_WD: Reset due to independent watchdog. Reset due to watchdog timer
771	0x0303	RESET_SW: Reset due to software reset. Reset due to software reset
772	0x0304	RESET_POWER_ON_DOWN: Reset due to power up or down. Reset due to switching on or switching off
773	0x0305	RESET_NMI: Reset due to non-maskable interrupt. Reset due to non-maskable interrupt
774	0x0306	RESET_BROWNOUT: Reset due to brown out detection. Reset due to CPU undervoltage
775	0x0307	RESET_NO_REASON: Reset due to unknown reason. Reset for no known reason
778	0x310	Reset due to invalid reason Reset due to invalid reason
1024	0x0400	ADC_REF_LOW: Reference voltage too low. AD converter reference voltage too low
1025	0x0401	ADC_REF_HIGH: Reference voltage too high. AD converter reference voltage too high
1028	0x0404	ADC_5V_LOW: 5 V supply voltage too low. (ErrReg: 4) 5V load power supply below the tolerance range
1029	0x0405	ADC_5V_HIGH: 5 V supply voltage too high. (ErrReg: 4) 5V load power supply above the tolerance range
1030	0x0406	ADC_3_3V_LOW: 3,3 V supply voltage too low. Internal 3.3V power supply below the tolerance range
1031	0x0407	ADC_3_3V_HIGH: 3,3 V supply voltage too high.

Id	Hex	Explanation
		Internal 3.3V power supply above the tolerance range
1032	0x0408	ADC_TEMP_LOW: On-chip temperature too low. (ErrReg: 8) Ambient temperature too low
1033	0x0409	ADC_TEMP_HIGH: On-chip temperature too high. (ErrReg: 8) Ambient temperature too high
1034	0x040A	ADC_CURR_HIGH: Total output current too high. (ErrReg: 2) Total output current too high
1036	0x040C	Temperature reached warning limit Temperature reached warning limit
1037	0x040D	Data value not yet available Data value not yet available
1280	0x0500	LINE_TIMEOUT: Invalid sync line level from base board Synchronisation wire level monitoring timed out
1282	0x0502	TIMEOUTTIMERERR: Timeout occurred Timeout timer error
1283	0x0503	HW_REVISION_ERROR: Invalid HW revision detected (the SW currently running is not designed for this HW revision) Incorrect hardware / PCB revision (the SW currently running is not designed for this HW revision)
1664	0x0680	MC1_NOTREADY: MC1 has not yet initiated communication to MC3 MC1 has not yet initiated communication to MC3
2048	0x0800	BCOM_NOTREADY: Communication to base board not ready / operational Base-board communication not ready / operational
2049	0x0801	BCOM_BUSY: Communication to base board is busy Base-board communication overloaded
2050	0x0802	BCOM_NONEWDATA: No new data received from base board Base-board communication – no new data received
2051	0x0803	BCOM_CRCERR: Communication to base board detected a CRC error Base-board communication – checksum error detected
2052	0x0804	BCOM_BITERR: Shifted bits detected Communication with base board – shifted bits detected
2304	0x0900	XCOM_NOTREADY: Communication with safety partner MC not ready / operational Communication with safety partner microcontroller not ready / operational
2305	0x0901	XCOM_BUSY: Communication with safety partner is busy Communication with safety partner microcontroller overloaded
2306	0x0902	XCOM_NONEWDATA: Communication with safety partner microcontroller – no new data received
2307	0x0903	XCOM_CRCERR: Communication with safety partner detected a CRC error Communication with safety partner microcontroller – checksum error detected
2336	0x0920	3S RTS background communication to safety partner MC not read operational

Id	Hex	Explanation
2337	0x0921	3S RTS background communication to safety partner is busy
2338	0x0922	3S RTS background communication has not yet received new data from safety partner MC
2339	0x0923	3S RTS background communication to safety partner detected a CRC error
2340	0x0924	BGCOM_QUEUEERR: 3S RTS background communication to safety partner detected a queue error
2352	0x0930	3S RTS VM communication to safety partner MC not read operational
2353	0x0931	3S RTS VM communication to safety partner is busy
2354	0x0932	3S RTS VM communication has not received new data from safety partner MC
2355	0x0933	3S RTS VM communication to safety partner detected a CRC error
2560	0x0A00	I2C_TIMEOUT: I2C communication timeout detected
2561	0x0A01	I2C_BUSY: I2C bus is busy
2976	0x0BA0	FSoE Master finished initialization
2977	0x0BA1	FSoE Master is shutting down
3329	0x0D01	MC1_ID_INVALID: Identification of MC 1 failed
3330	0x0D02	MC2_ID_INVALID: Identification of MC 2 failed
3331	0x0D03	MC3_ID_INVALID: Identification of MC 3 failed
3841	0x0F01	FLASH_TIMEOUT: FLASH operation timeout
3842	0x0F02	FLASH_LOCKED: FLASH operation failed because "LOCK" bit could not be reset
3851	0x0F0B	FLASH_BUSY: FLASH operation busy, sequence error in flash programming
3854	0x0F0E	FLASH_ERROR: FLASH operation error, programming of the flash memory failed

8.4.6. MC 1: Error line 2008_h

Designation	Value
Name	Err.line
Index	2008_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	Read
PDO Mapping	No

8.4.7. MC 1: Error module 2009_h

Designation	Value
Name	Error module
Index	2009_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED8
Access	Read
PDO Mapping	No

The table below explains the entries in object 2009_h "error code".

Id	Hex	Explanation
0	0x00	OBJ_UNKNOWN_ID Error from module: unknown
4	0x04	OBJ_PRGCONTROLTASK_ID Error from module: CProgramControlTask.cpp
8	0x08	OBJ_SAFETYHAL_ID Error from module: CSafetyHal.cpp
12	0x0C	OBJ_MAINTASK_ID Error from module: CMainTask.cpp
16	0x10	OBJ_PRGCONTRLTASK_ID Error from module: CProgramControlTask.cpp
20	0x14	OBJ_SYNCSAFETYPARTNER_ID Error from module: CSyncSafetyPartner.cpp
24	0x18	OBJ_XCOM_ID Error from module: CXcom.cpp
28	0x1C	OBJ_BBCOM_ID Error from module: CBBCom.cpp
29	0x1D	OBJ_VMCOM_ID Error from module: CVMCom module
30	0x1E	OBJ_BGCOM_ID Error from module: CBGCom module
52	0x34	OBJ_HELPER_ID Error from module: CHelper.cpp
56	0x38	OBJ_SYNCLINE_ID Error from module: CSyncSafetyPartner.cpp - sync()
58	0x40	OBJ_TESTHANDLER_ID Error from module: CTestHandler.cpp

Id	Hex	Explanation
72	0x48	OBJ_DIAGNOSTIC_ID Error from module: CDiagnostic.cpp
74	0x50	OBJ_FSOEMASTER_ID Error from module: CHAL_FSoEMaster_Template.cpp
88	0x58	OBJ_INTHANDLER_ID Error from module: InterruptHandler.cpp
192	0xC0	OBJ_SPI_ID Error from module: CSpi.cpp
193	0xC1	OBJ_TIMER_ID Error from module: CTimer.cpp
194	0xC2	OBJ_BACKUPSRAM_ID Error from module: CBackupSRam.cpp
195	0xC3	OBJ_PWR_ID Error from module: CPwr.cpp
196	0xC4	OBJ_RCC_ID Error from module: CRcc.cpp
197	0xC5	OBJ_GPIO_ID Error from module: CGpio.cpp
198	0xC6	OBJ_DMASTREAM_ID Error from module: CDmaStream.cpp
199	0xC7	OBJ_ADC_ID Error from module: CAdc.cpp
200	0xC8	OBJ_WD_ID Error from module: CWatchdog.cpp
201	0xC9	OBJ_FLASH_ID Error from module: CFlash.cpp
202	0xCA	OBJ_CRC_ID Error from module: CCrc.cpp
203	0xCB	OBJ_I2C_ID Error from module: CI2c.cpp
208	0xD0	OBJ_APPIF_ID Error from module: CECatApplInterface.cpp

8.4.8. MC 1: Error class 200A$_h$

Designation	Value
Name	Err.class
Index	200A$_h$
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED8
Access	Read
PDO Mapping	No

The table below explains the meaning of the entries in object 200A$_h$ "Error Class".

Id	Explanation
0	No Error
1	Serious error or synchronisation error
2	Internal communication error Internal communication error
3	I/O Error I/O Error
4	Error in Test Handler Error in the Test Handler

8.4.9. MC 1: System Uptime [s] 200C$_h$

Designation	Value
Name	System uptime [s]
Index	200C$_h$
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No
Units	s
Default Value	No default Value

8.4.10. Read / write world time [s] (LOG Time) $200D_h$

Designation	Value
Name	Read / write world time [s] (GMT, UTC)
Index	$200D_h$
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read / Write
PDO Mapping	No
Units	s
Default Value	No default Value

8.4.11. MC 3: 3,3 V Supply Voltage [mV] 2013_h

Designation	Value
Name	MC 3: 3,3 V Supply Voltage [mV]
Index	2013_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No
Units	mV
Default Value	No default Value

8.4.12. Temperatur warning 2016_h

Designation	Value
Name	Temperature warning
Index	2016_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED8
Access	Read
PDO Mapping	No
Value	0°C – 55°C = 0; <0°C oder >55°C = 1
Default Value	No default Value

8.4.13. MC 1: LZS component ID 2017_h

Designation	Value
Name	MC 1: LZS componentId
Index	2017_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No
Default Value	No default Value

8.4.14. MC 1: LZS file ID 2018_h

Designation	Value
Name	MC 1: LZS fileId
Index	2018_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No
Default Value	No default Value

8.4.15. MC 1: LZS line 2019h

Designation	Value
Name	MC 1: LZS line
Index	2019_h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No
Default Value	No default Value

8.4.16. MC 1: Read number of CORA test cycles $201A_h$

Designation	Value
Name	MC 1: Read number of CORA test cycles
Index	$201A_h$
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No

Designation	Value
Default Value	No default Value

8.4.17. MC 1: Read number of file system test cycles $201B_h$

Designation	Value
Name	MC 1: Read number of file system test cycles
Index	$201B_h$
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No
Default Value	No default Value

8.4.18. MC 1: Read number of IAR test cycles $201C_h$

Designation	Value
Name	MC 1: Read number of IAR test cycles
Index	$201C_h$
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	Read
PDO Mapping	No
Default Value	No default Value

8.4.19. SW Build No $210A_h$

Designation	Value
Name	SW Build No
Index	$210A_h$
Object Code	VARIABLE
No. of Elements	0
Data type	UNSIGNED16
Access	Read

Designation	Value
PDO Mapping	No
Default Value	No default Value

8.4.20. Read MC 3 error 2210_h

Designation	Value
Name	Read MC 3 error
Index	2210_h
Object Code	RECORD
No. of Elements	3

Designation	Value
Name	Number of entries
Subindex	00_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No
Default Value	3

Designation	Value
Name	MC 3: Error number
Subindex	01_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	MC 3: Error line
Subindex	02_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	MC 3: Error module

Designation	Value
Subindex	03_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No

8.4.21. Read MC 1 runtimes 2220_h

Designation	Value
Name	RunTime MC 1
Index	2220_h
Object Code	RECORD
No. of Elements	6

Designation	Value
Name	Number of entries
Subindex	00_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No
Default Value	6

Designation	Value
Name	Runtime main loop [µs] (Designation in the XML file: Act RT)
Subindex	01_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Maximum of main loop runtime [µs] (Designation in the XML file: Max RT)
Subindex	02_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Application cycle time (Par. from PS) [µs] (Designation in the XML file: App Cycle)
Subindex	03_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Application runtime [µs] (Designation in the XML file: App RT)
Subindex	04_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Application CORA time [µs] (Designation in the XML file: CORA RT)
Subindex	05_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Reserved [µs]
Subindex	06_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

8.4.22. MC 3 main loop cycle time and max cycle time 2221_h

Designation	Value
Name	MC 3 main loop cycle time and max cycle time [µs] (Designation in the XML file: RunTime MC3)
Index	2221_h
Object Code	RECORD
No. of Elements	2

Designation	Value
Name	Number of entries
Subindex	00_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No
Default Value	2

Designation	Value
Name	Runtime main loop [µs] (Designation in the XML file: Act RT)
Subindex	01_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Maximum of main loop runtime [µs] (Designation in the XML file: Max RT)
Subindex	02_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

8.4.23. Free disk space / app size information 2230_h

Designation	Value
Name	Free disk space / app size information (Designation in the XML file: Free Disk Space)
Index	2230_h
Object Code	RECORD
No. of Elements	4

Designation	Value
Name	Number of entries
Subindex	00_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No
Default Value	4

Designation	Value
Name	Actual local free disk space [Byte] (Designation in the XML file: Local)
Subindex	01_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Actual global free disk space [Byte] (Designation in the XML file: Global)
Subindex	02_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Actual application code size [Byte]

Designation	Value
	(Designation in the XML file: App Code)
Subindex	03_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Actual application data size [Byte] (Designation in the XML file: App Data)
Subindex	04_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

8.4.24. ST CPU Chip Id MC 1 (96 bit serial number) 5001_h

Designation	Value
Name	ST CPU Chip Id MC 1 (96 bit serial number) (Designation in the XML file: Id MC1)
Index	5001_h
Object Code	RECORD
No. of Elements	4

Designation	Value
Name	Number of entries
Subindex	00_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No

Designation	Value
Name	MC 1 id received: 1 - OK, 0 - failed (Designation in the XML file: Id rx from MC1)
Subindex	01_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Id bits 0...31 (Designation in the XML file: Bits 0-31)
Subindex	02_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Id bits 32...63 (Designation in the XML file: Bits 32-63)
Subindex	03_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Id bits 64...95 (Designation in the XML file: Bits 64-95)
Subindex	04_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

8.4.25. ST CPU Chip Id MC 3 (96 bit serial number) 5003_h

Designation	Value
Name	ST CPU Chip Id MC 3 (96 bit serial number) (Designation in the XML file: Id MC3)
Index	5003_h
Object Code	RECORD
No. of Elements	4

Designation	Value
Name	Number of entries
Subindex	00_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No
Default Value	4

Designation	Value
Name	Identification state: 1 - OK, 0 - failed (Designation in the XML file: Id valid)
Subindex	01_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Id bits 0...31
Subindex	02_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Id bits 32...63
Subindex	03_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Designation	Value
Name	Id bits 64...95
Subindex	04_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

8.5. Objects - For Internal Use Only

The objects listed below are not intended for use by the end user. Some of them are used for configuration purposes.

Object	Meaning/Designation
0x10F1h	Error Settings
0x1C00h	Sync Manager Type
0x1C32h	SM Output Parameter
0x1C33h	SM Input Parameter
0x2000h	Ref Voltage for µC1
0x2002h	Supply 5 Voltage for µC1
0x2003h	Supply 3.3 Voltage for µC1
0x200Bh	Number of CORA Test Cycles for µC1
0x2020h	MaxAsicDataUnequalCounter
0x2212h	Post Result Flag
0x2220h	MC1 Main Loop Cycle Time
0x5001h	Id MC1
0x5003h	Id MC3
$0x5E5E_h$	Generation of the ‘Device stamp’

8.6. Standards Complied With

8.6.1. Product Standard Applied

→ EMC Directive 2014/30/EU
→ EN 61131-2:2007
Programmable logic controllers – Part 2: Equipment requirements and tests

8.6.2. Safety Standards and Directives

→ IEC 61508:2010 Parts 1-7
Functional safety of electrical/electronic/programmable electronic safety-related systems
→ EN ISO 13849-1:2015
Safety of machinery – Safety-related parts of control systems Part 1: General principles for design
→ EN 62061:2005 + AC:2010 + A1:2013 + A2:2015
Safety of machinery - Functional safety of electrical, electronic and programmable electronic safety-related control systems
→ EN 60204-1:2006 + A1:2009 + AC:2010 (excerpts)
Safety of machinery – Safety-related parts of control systems -Part 1: General principles for design

8.6.3. EMC Standards

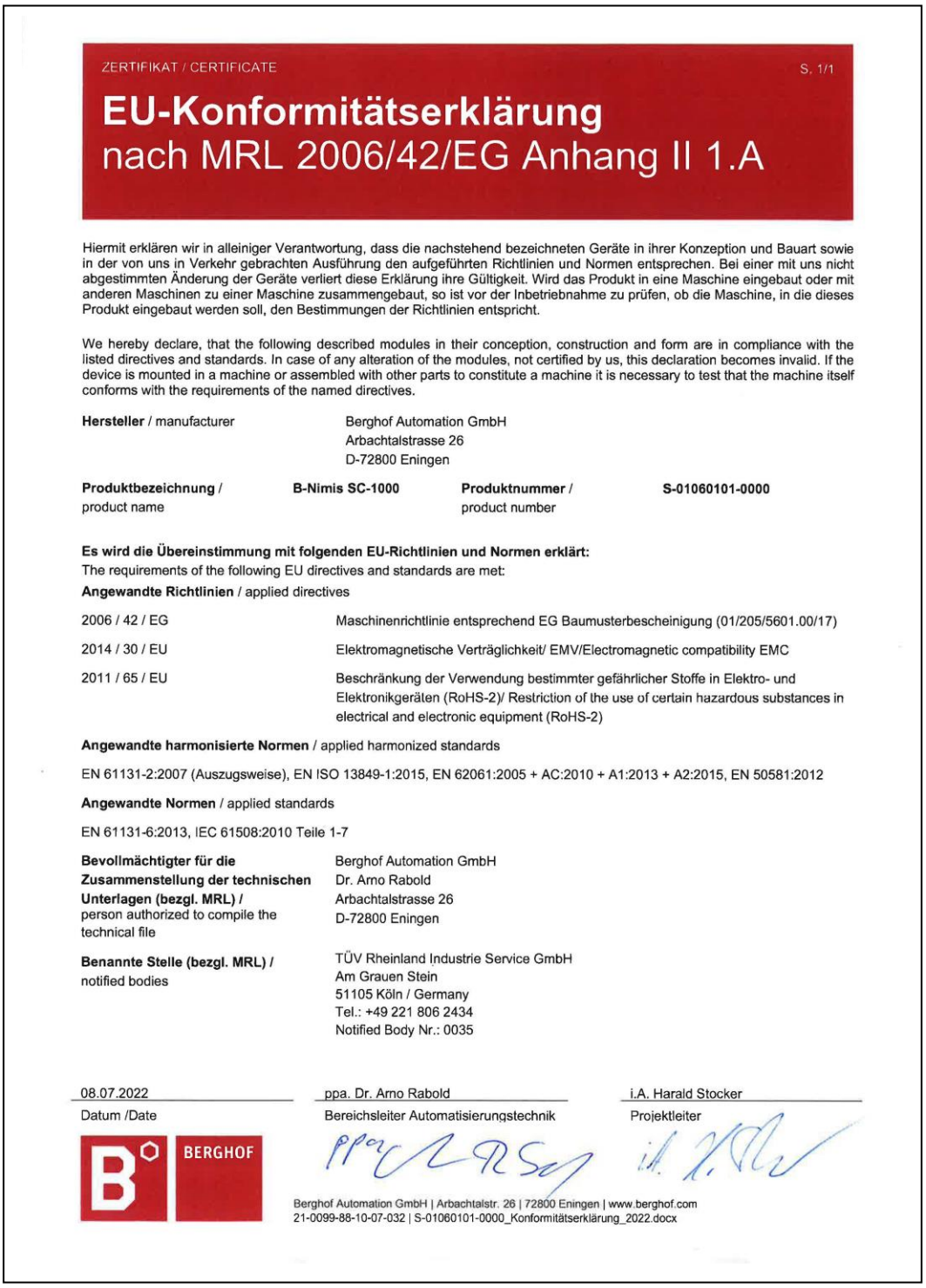
EMC Immunity from interference
→ Generic standard DIN EN 61000-6-2:2005
Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity for industrial environments
→ Product standard DIN EN 61131-2:2007
Programmable logic controllers – Part 2: Equipment requirements and tests

Enhanced interference immunity levels of safety-related applications
→ DIN EN 61131-6:2012
Programmable logic controllers – Part 6: Functional Safety

EMC Emission of interference
→ Generic standard EN 61000-6-4:2007 + A1:2011
Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
→ Product standard EN 61131-2:2007
Programmable logic controllers – Part 2: Equipment requirements and tests

8.7. Regulations and Declarations

8.7.1. Declaration ofConformity



ZERTIFIKAT / CERTIFICATE S. 1/1

EU-Konformitätserklärung
nach MRL 2006/42/EG Anhang II 1.A

Hiermit erklären wir in alleiniger Verantwortung, dass die nachstehend bezeichneten Geräte in ihrer Konzeption und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den aufgeführten Richtlinien und Normen entsprechen. Bei einer mit uns nicht abgestimmten Änderung der Geräte verliert diese Erklärung ihre Gültigkeit. Wird das Produkt in eine Maschine eingebaut oder mit anderen Maschinen zu einer Maschine zusammengebaut, so ist vor der Inbetriebnahme zu prüfen, ob die Maschine, in die dieses Produkt eingebaut werden soll, den Bestimmungen der Richtlinien entspricht.

We hereby declare, that the following described modules in their conception, construction and form are in compliance with the listed directives and standards. In case of any alteration of the modules, not certified by us, this declaration becomes invalid. If the device is mounted in a machine or assembled with other parts to constitute a machine it is necessary to test that the machine itself conforms with the requirements of the named directives.

Hersteller / manufacturer — Berghof Automation GmbH, Arbachtalstrasse 26, D-72800 Eningen

Produktbezeichnung / product name: **B-Nimis SC-1000** — **Produktnummer** / product number: **S-01060101-0000**

Es wird die Übereinstimmung mit folgenden EU-Richtlinien und Normen erklärt:
The requirements of the following EU directives and standards are met:

Angewandte Richtlinien / applied directives

2006 / 42 / EG	Maschinenrichtlinie entsprechend EG Baumusterbescheinigung (01/205/5601.00/17)
2014 / 30 / EU	Elektromagnetische Verträglichkeit/ EMV/Electromagnetic compatibility EMC
2011 / 65 / EU	Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten (RoHS-2)/ Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS-2)

Angewandte harmonisierte Normen / applied harmonized standards

EN 61131-2:2007 (Auszugsweise), EN ISO 13849-1:2015, EN 62061:2005 + AC:2010 + A1:2013 + A2:2015, EN 50581:2012

Angewandte Normen / applied standards

EN 61131-6:2013, IEC 61508:2010 Teile 1-7

Bevollmächtigter für die Zusammenstellung der technischen Unterlagen (bezgl. MRL) / person authorized to compile the technical file: Berghof Automation GmbH, Dr. Arno Rabold, Arbachtalstrasse 26, D-72800 Eningen

Benannte Stelle (bezgl. MRL) / notified bodies: TÜV Rheinland Industrie Service GmbH, Am Grauen Stein, 51105 Köln / Germany, Tel.: +49 221 806 2434, Notified Body Nr.: 0035

08.07.2022	ppa. Dr. Arno Rabold	i.A. Harald Stocker
Datum /Date	Bereichsleiter Automatisierungstechnik	Projektleiter

BERGHOF

Berghof Automation GmbH | Arbachtalstr. 26 | 72800 Eningen | www.berghof.com
21-0099-88-10-07-032 | S-01060101-0000_Konformitätserklärung_2022.docx

The original EC Declaration of Conformity and the associated documentation can be made available to the competent authorities. Please contact the Project Management, as necessary.

8.7.2. TÜV Certificate

EC Type-Examination Certificate

Reg.-Nr./No.: 01/205/5601.01/22

Prüfgegenstand **Product tested**	E-I/O Safety PLC, Safety Controller für E-I/O System über FSoE E-I/O Safety PLC, Safety Controller for E-I/O System via FSoE	**Zertifikats-inhaber** **Certificate holder**	Berghof Automation GmbH Arbachtalstrasse 26 72800 Eningen Germany

Typbezeichnung
Type designation
B-Nimis SC-1000 - S-01060101-0000 (E-I/O Safety PLC - 204909000)

Prüfgrundlagen
Codes and standards
EN ISO 13849-1:2015
EN 61508 Parts 1-7:2010
EN 61131-2:2007
EN 61326-3-1:2017

Bestimmungsgemäße Verwendung
Intended application
Die sichere speicherprogrammierbare Steuerung erfüllt die Anforderungen der Prüfgrundlagen (Kat. 4 / PL e nach EN ISO 13849-1, SIL 3 nach EN 61508). Die Steuerung kann im Anwendungsbereich der EN 60204-1:2018 und EN IEC 62061:2021 eingesetzt werden.
The safety programmable logic controller complies with the requirements of the relevant standards (Cat. 4 / PL e acc. to EN ISO 13849-1, SIL 3 acc. to EN 61508). The product can be used in the application area of EN 60204-1:2018 and EN IEC 62061:2021.

Besondere Bedingungen
Specific requirements
Die Hinweise in der zugehörigen Installations- und Betriebsanleitung sowie des Sicherheitshandbuchs sind zu beachten.
The instructions of the associated Installation, Operating and Safety Manual shall be considered.

Es wird bestätigt, dass der Prüfgegenstand mit den Anforderungen nach Anhang I der Richtlinie 2006/42/EG über Maschinen übereinstimmt.
It is confirmed, that the product tested complies with the requirements for machines defined in Annex I of the EC Directive 2006/42/EC.

Gültig bis / Valid until 2027-06-29

Der Ausstellung dieses Zertifikates liegt eine Prüfung zugrunde, deren Ergebnisse im Bericht Nr. 968/FSP 1413.03/22 vom 29.06.2022 dokumentiert sind.
Dieses Zertifikat ist nur gültig für Erzeugnisse, die mit dem Prüfgegenstand übereinstimmen.
The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/FSP 1413.03/22 dated 2022-06-29.
This certificate is valid only for products which are identical with the product tested.

Köln, 2022-06-29

0035 Notified Body

Notified Body for Machinery, NB 0035

Dipl.-Ing. Jelena Stenzel

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TÜVRheinland®
Precisely Right.

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8.8. List of figures

9. Customer Service / Addresses

Repair work on the Safety PLC Module is not permitted. In the event of a defect, return the module to Berghof Automation GmbH Customer Service.

9.1. Customer Service

Berghof Automation GmbH
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72800 Eningen
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