COMBICONTROL **C6**

INSTRUCTIONS FOR USE | **SAFETY PLC**

Preface

The hardware and software described in this document are products of KEB. The information contained in this document is valid at the time of publishing. KEB reserves the right to update this document in response to misprints, mistakes or technical changes.

Signal words and symbols

Certain procedures within this document can cause safety hazards during the installation or operation of the device. Refer to the safety warnings in this document when performing these procedures. Safety signs are also located on the device where applicable. A safety warning is marked by one of the following warning signs:

⚠ DANGER	Dangerous situation, which will cause death or serious injury iif this safety warning is ignored.

⚠ WARNING	Dangerous situation, which may cause death or serious injury if this safety warning is ignored.

⚠ CAUTION	Dangerous situation, which may cause minor injury if this safety warning is ignored.

NOTICE	Situation, which can cause damage to property if this safety warning is ignored.

RESTRICTION

Used when the following statements depend on certain conditions or are only valid for certain ranges of values.

ℹ	Used for informational messages or recommended procedures.

More symbols

►   This arrow starts an action step.

• / -   Enumerations are marked with dots or indents.

=>   Cross reference to another chapter or another page.

Note to further documentation.
https://www.keb-automation.com/search

Laws and guidelines

KEB Automation KG confirms with the EC declaration of conformity and the CE mark on the device nameplate that it complies with the essential safety requirements.

The EC declaration of conformity can be downloaded on demand via our website.

Warranty and liability

The warranty and liability on design, material or workmanship for the acquired device is given in the general sales conditions.

Here you will find our general sales conditions.
https://www.keb-automation.com/terms-conditions

Further agreements or specifications require a written confirmation.

Support

Although multiple applications are referenced, not every case has been taking into account. If you require further information or if problems occur which are not referenced in the documentation, you can request the necessary information via the local KEB agency.

The use of our units in the target products is outside of our control and therefore lies exclusively in the area of responsibility of the customer.

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the intended use. However, they are regarded as being only informal and changes are expressly reserved, in particular due to technical changes. This also applies to any violation of industrial property rights of a third-party. Selection of our units in view of their suitability for the intended use must be done generally by the user.

Tests can only be done within the intended end use of the product (application) by the customer. They must be repeated, even if only parts of hardware, software or the unit adjustment are modified.

Copyright

The customer may use the instructions for use as well as further documents or parts from it for internal purposes. Copyrights are with KEB and remain valid in its entirety.

This KEB product or parts thereof may contain third-party software, including free and/ or open source software. If applicable, the license terms of this software are contained in the instructions for use. The instructions for use are already available to you, can be downloaded free of charge from the KEB website or can be requested from the respective KEB contact person.

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Glossary

0	Earth potential-free earth point
1ph	1-phase mains
3ph	3-phase mains
AC	Alternating current or voltage
Application	The application is the intended use of the KEB product.
ASCL	Encoderless control of asynchronous motors
AWG	American coding for cable cross-sections
B2B	Business-to-business
CAN	Fieldbus system
CODESYS	Operating system of the standard control and programming environment
CODESYS Safety-PS	Safety programming system
COMBIVERT	KEB drive converter
COMBIVIS	KEB start-up and parameterisation software
DC	DC current or voltage
DIN	German Institute for Standardization
EMC	Electromagnetic compatibility
EN	European standard
End customer	The end customer is the user of the customer product.
EtherCAT	Real-time Ethernet bus system of the company Beckhoff
Ethernet	Real-time bus system - defines protocols, connectors, cable types
FE	Functional earth
FSoE	Functional safety via Ethernet
GND	Reference potential, ground
Manufacturer	The manufacturer is KEB, unless otherwise specified (e.g. as machine, motor, vehicle or adhesive manufacturer).
HMI	Visual user interface (touch screen)
IEC	International standard
IP xx	Degree of protection (xx for level)
KEB-I/O EtherCAT SPS	Small control from the KEB I/O system
KEB-I/O EtherCAT System	I/O module family

KEB product	The KEB product is the product which is the subject of this manual.
Head module	Name for bus coupler or small control in the KEB-I/O EtherCAT system
Customer	The customer has purchased a KEB product from KEB and integrates the KEB product into his product (customer product) or resells the KEB product (reseller).
MCM	American unit for large cable cross-sections
MTTF	Mean lifetime until failure
NN	above sea level
Emergency switching off	Switching off the voltage supply in emergency case
Emergency stop	Shutdown of a drive in emergency case (not de-energized)
PE	Protective earth
PELV	Safe protective low voltage, earthed
PFD	Term used in the safety technology (EN 61508-1...7) for the size of error probability
PFH	Term used in the safety technology (EN 61508-1...7) for the size of error probability per hour
POU	Program Organization Unit
RJ45	Modular connector with 8 lines
Safety Package	Plug-in for COMBIVIS studio 6 with safety functionality
Safety PLC	Safety PLC
Safety PLCopen	Library of certified Basic Level Safety modules
SELV	Safe protective low voltage, un-earthed (<60V)
SIL	The safety integrity level is a measuring unit to quantify risk reduction. Term used in the safety technology (EN 61508 -1...7)
PLC	Programmable control
USB	Universal serial bus

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1 Basic Safety Instructions

The COMBICONTROL is designed and constructed in accordance with state-of-the-art technology and the recognised safety rules and regulations. However, the use of such devices may cause functional hazards for life and limb of the user or third parties, or damages to the system and other material property.

The following safety instructions have been created by the manufacturer for the area of electric drive technology. They can be supplemented by local, country- or application-specific safety instructions. This list is not exhaustive. Non-observance of the safety instructions by the customer, user or other third party leads to the loss of all resulting claims against the manufacturer.

NOTICE	**Hazards and risks through ignorance.**
	► Read the instructions for use !
	► Observe the safety and warning instructions !
	► If anything is unclear, please contact KEB Automation KG !

1.1 Target Group

This manual is written for design, project planning, servicing and commissioning experts. Qualified personnel for the purpose of this instruction manual must have the following qualifications:

- Knowledge and understanding of the safety instructions.
- Knowledge of automation technology.
- Knowledge of functional safety.
- Skills for installation and assembly of electrical equipment.
- Detection of hazards and risks of the electrical drive technology.
- Understanding of the function in the used machine.
- Knowledge of the operation of the Windows operating system.
- Knowledge of *DIN IEC 60364-5-54*.
- Knowledge of *EN 60204-1*
- Knowledge of national safety regulations (e.g. *DGUV regulation 3*).

1.2 Transport, storage and proper use

The transport is carried out by qualified persons in accordance with the environmental conditions specified in this manual. The devices shall be protected against excessive strains.

Electronic devices contain electrostatic sensitive components.

► Avoid contact.

► Wear ESD-protective clothing.

Do not store the devices

• in the environment of aggressive and/or conductive liquids or gases.

• with direct sunlight.

• outside the specified environmental conditions.

1.3 Installation

⚠ DANGER

Do not operate in an explosive environment!

► The device is not intended for the use in potentially explosive environment.

To prevent damages to the device:

• Make sure that no components are bent and/or isolation distances are changed.

• The device must not be put into operation in case of mechanical defects. Non-compliance with the applicable standards.

• Do not allow moisture or mist to penetrate the unit.

• Avoid dust permeating the device. Allow for sufficient heat dissipation if installed in a dust-proof housing.

• Note installation position and minimum distances to surrounding elements. Do not cover the ventilation openings.

• Mounting according to the specified degree of protection.

• Make sure that no small parts fall into the device during assembly and wiring (drilling chips, screws etc.). This also applies to mechanical components, which can lose small parts during operation.

• Check the reliable fit of the device connections in order to avoid contact resistances and sparking.

• The safety instructions are to be kept!

1.4 Electrical connection

ATTENTION	**In order to prevent malfunctions or unpredictable conditions, observe the following instructions:**

► For any work on the device switch off the supply voltage.

► Never bridge upstream protective devices (also not for test purposes).

► Install all required covers and protective devices for operation.

► The electrical installation shall be carried out in accordance with the relevant requirements.

► Cable cross-sections and fuses must be dimensioned according to the design of the machine manufacturer. Specified minimum / maximum values may not be fallen below /exceeded.

► With existing or newly wired circuits the person installing the units or machines must ensure the EN requirements are met.

► When using components without isolated inputs/outputs, it is necessary that equipotential bonding exists between the components to be connected (e.g. by the equipotential line). Disregard can cause destruction of the components by equalizing currents.

1.5 Start-up and operation

When the device is installed in machines, start-up (i.e. commencement of the intended operation) is prohibited until it is determined that the machine complies with the machine directive; Account is to be taken of *EN 60204-1*.

• During operation, all covers and doors shall be kept closed.
• Use only approved accessories for this device.
• Never touch terminals, busbars or cable ends.

1.6 Maintenance

The following maintenance work has to be carried out when required, but at least once per year by authorized and trained personnel.Check unit for loose screws and plugs and tighten if necessary.

► Check unit for loose screws and plugs and tighten if necessary.

► Clean the device from dirt and dust deposits. Depending on the device, pay particular attention to ventilation slots or cooling fins.

► Examine and clean extracted air filter and cooling air filter of the control cabinet.

1.7 Repair

In case of malfunction, unusual noises or smells inform a person in charge!

⚠ DANGER	**Unauthorized exchange, repair and modifications!**
	Unpredictable malfunctions!

► The function of electronic devices can be influenced by the setting and parameterization. Never replace without knowledge of the application.

► Modification or repair is permitted only by KEB Automation KG authorized personnel.

► Only use original manufacturer parts.

► Infringement will annul the liability for resulting consequences.

1.8 Disposal

Electronic devices of the KEB Automation KG are exclusively professional devices for further industrial processing (so-called B2B devices).

Manufacturers of B2B devices are obliged to take back and recycle devices manufactured after 14.08.2018. These devices may not be disposed at the collection centres of public sector disposal organisations.
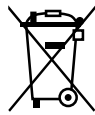
If no deviating agreement has been made between the customer and KEB or no deviating mandatory legal regulation exists, KEB products marked in this way can be returned. Company and keyword to the return point can be taken from the list below. Shipping costs are paid by the customer. Thereupon the devices will be professionally recycled and disposed.

The entry numbers are listed country-specific in the following table. The corresponding KEB return addresses can be found on our website.

Withdrawal by	WEEE-Reg.-No.		Keyword
Austria			
KEB Automation GmbH	ERA:	51976	Stichwort „Rücknahme WEEE"
France			
RÉCYLUM - Recycle point	ADEME:	FR021806	Mots clés „KEB DEEE"
Germany			
KEB Automation KG	EAR:	DE12653519	Stichwort „Rücknahme WEEE"
Italy			
COBAT	AEE: (IT)	19030000011216	Parola chiave „Ritiro RAEE"
Spain			
KEB Automation KG	RII-AEE	7427	Palabra clave „Retirada RAEE"
Česko			
KEB Automation KG	RETELA	09281/20 ECZ	Klíčové slovo: Zpětný odběr OEEZ
Slowakei			
KEB Automation KG	ASEKOL:	RV22EEZ0000421	Klíčové slovo: "Spätný odber OEEZ"

The packaging must be feed to paper and cardboard recycling.

2 System description

The Safety PLC is used to integrate functional safety into the control system. This avoids separate wiring of safety circuits. The Safety PLC has the task of executing the safety application program and exchanging the safety-relevant control information with the assigned safe slave modules.

Figure 1:	Safety PLC

A precondition for the use of our Safety PLC is the use of a superior control based on COMBIVIS studio 6, hereinafter called standard control, as well as EtherCAT as fieldbus for the data exchange.

2.1 Control system - functional overview

The following figure shows an example of a control system with Safety PLC.
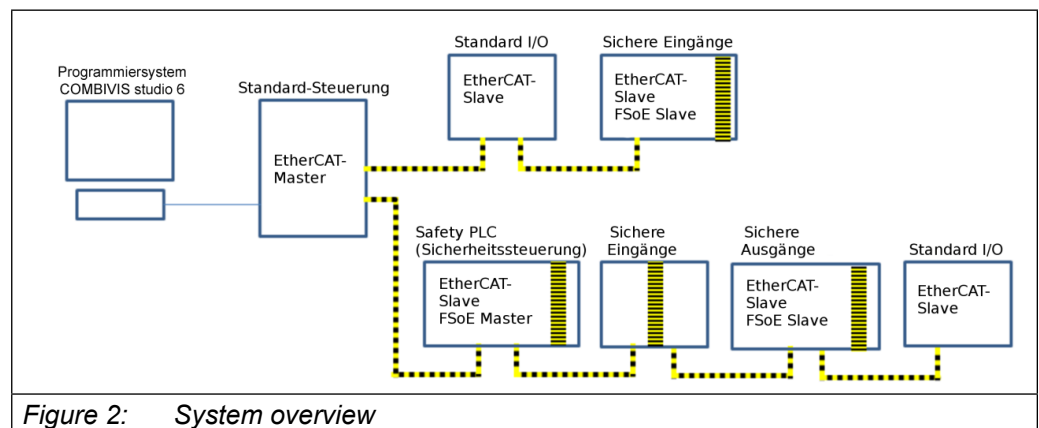
Figure 2:	System overview

The programming PC with the programming system is connected via Ethernet to the standard control in order to program it. Then one or more safety PLC(s) can be programmed via the connected EtherCAT fieldbus by the standard control.

During operation, the process data are exchanged via EtherCAT between the standard control and the standard actuators and sensors.

Simultaneously, the Safety PLC uses the EtherCAT fieldbus to exchange the safety-related signals with safe I/O modules or drives by using the protocol FSoE.

2.2 EtherCAT® - Ethernet Control

EtherCAT is an Ethernet-based fieldbus system and is suitable due to its speed as fast drive and I/O bus at controls (industrial PC or PLC). EtherCAT reaches e.g. upto 1000 I/Os in 30 µs.

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 controllers thus nearly act like centralised control systems, Bus runtimes as they occur in conventional fieldbus systems do not need to be considered.

2.3 KEB-I/O EtherCAT System

The Safety PLC is a module from the KEB-I/O EtherCAT system.The KEB-I/O EtherCAT system is a collection of side by side mountable modules for the integration into an Eth-erCAT network for the transmission of the process signals.

The transmission of Twisted Pair to LVDS (E bus) is converted in the KEB-I/O EtherCAT bus coupler as head module and the system voltages for the LVDS modules are gen-erated. The standard 100 Base TX lines are connected to the one side. The KEB-I/O EtherCAT modules for the process signals are connected to the other. This is how the EtherCAT protocol is retained right through to the last I/O module.

A KEB-I/O EtherCAT PLC can also be used as head module (instead bus coupler) which takes over then the function of the standard control with bus master.

1	PLC with KEB-I/O EtherCAT extension modules
2	I/O with KEB-I/O EtherCAT extension modules
3	KEB-I/O EtherCAT PLC or bus coupler
4	Extension modules
5	Bus coupler
Figure 3:	*KEB-I/O EtherCAT System*
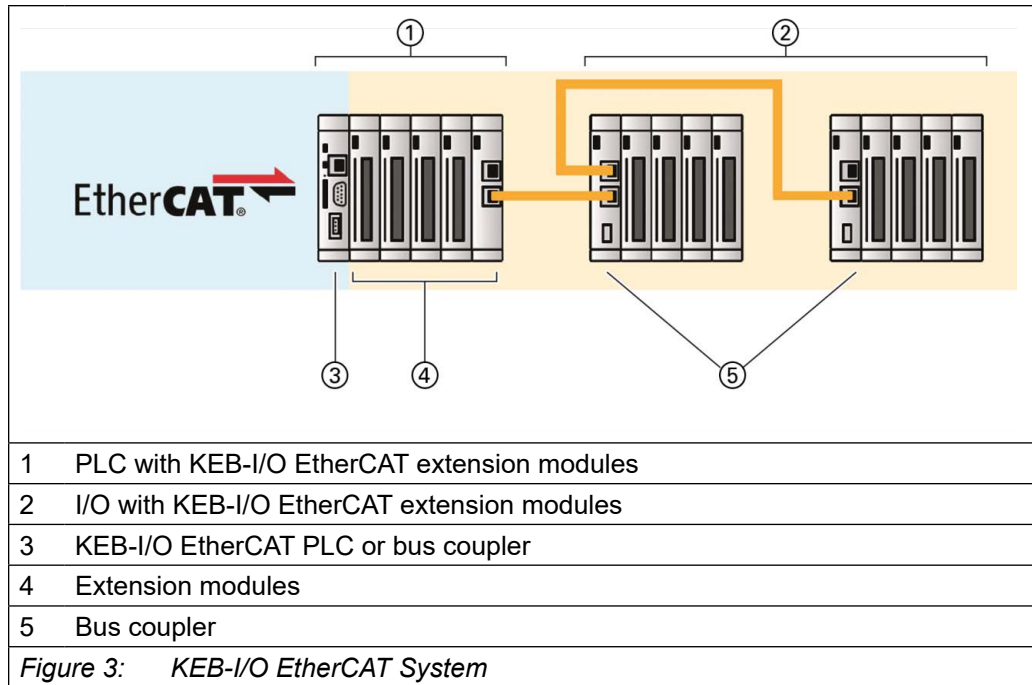
2.4 KEB-I/O EtherCAT Safety System

The KEB-I/O EtherCAT Safety system extends the KEB-I/O EtherCAT module system with the described Safety PLC and modules with safe inputs and outputs. The separate wiring of safety circuits is not necessary. The safe signals are transmitted to the Safety PLC together with the standard signals in the EtherCAT protocol. Basis for this integration is the certified safety protocol FSoE.

2.4.1 Safety over EtherCAT (FSoE)

Along with EtherCAT, a safety protocol was developed and made available for Ether-CAT as "Safety over EtherCAT" (FSoE = Fail Safe over EtherCAT). It is the backbone of providing functional safety over EtherCAT. Protocol and implementation are certified by TÜV and fulfil Safety Integrity Level 3 according to IEC 61508. IEC 61784-3-12 was published as the international reference standard for Safety over EtherCAT.

Since EtherCAT is used as single-channel 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 left out of the safety assessment.

2.4.2 Safety PLC

The Safety PLC links the inputs and outputs of the KEB-I/O EtherCAT Safety system and safety-related signals from other FSoE devices in the system.

It basically works in conjunction with a superimposed PLC based on COMBIVIS studio 6, here called standard control. The Safety PLC has a dual-channel design and communicates via the standard control with the programming system as well as via the logical exchange variables (see COMBIVIS studio 6 Safety user manual "Logical I/Os") with the non-safe variables and inputs and outputs of the standard control.

2.4.3 COMBIVIS studio 6 Safety

A certified and fully integrated plug-in (safety package) of the COMBIVIS studio 6 Development System is used to program the safety PLC.

The Safety PLC is shown under the standard PLC as an Ether-CAT slave node with its own application, a task, lists of global variables, POUs and logical I/Os. It provides all functions described in the COMBIVIS studio 6 Safety Manual for version 1.2.0. Only restriction: the only restriction beeing that the only way of integrating it is using EtherCAT as the medium of communicating with the Safety PLC.

The integrated function diagram (FD) safety editor (according 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 standard or PLCopen Safety) as specified in the user manual.

At the basic level, certified function blocks (PLCopen-Safety) are graphically "wired up" to establish the system's safety program. In case a project demands more than the technology of the certified function blocks can provide, the extra instructions available at the extended level can be used to expand the safety programs.

Further software functions are available for safeguarding the safety functions by change tracking, safe flow of signals, safe version control (pinning), separating safe operation, debugging mode, etc.

2.4.4 SafetyPLCopen Library in COMBIVIS studio 6

The PLCopen components have been defined and certified by the PLCopen organisation, its members and external organisations specialising in all safety-related aspects.

Similar to a logical wiring, the modules can be inter-linked by logical operations to reliably program a safety application from these components.

3 Product description

3.1 General description

The Safety PLC is used to integrate safety functions into the control system. The core of the Safety PLC consists of two microprocessors, which transform the safety functions and communicate with each other in order to exchange process data and to monitor each other. A third microprocessor manages the external communication.

It is integrated into a KEB-I/O EtherCAT system as side-by-side mounted module. The module is designed for mounting on a DIN rail in a control cabinet.

1	Ventilation slots	5	Labeling clip
2	Module locking, E-Bus	6	Unlock button
3	DIN rail mount, functional earth	7	Status LEDs
4	Grip	8	Shield connection

Figure 4:   Safety PLC module
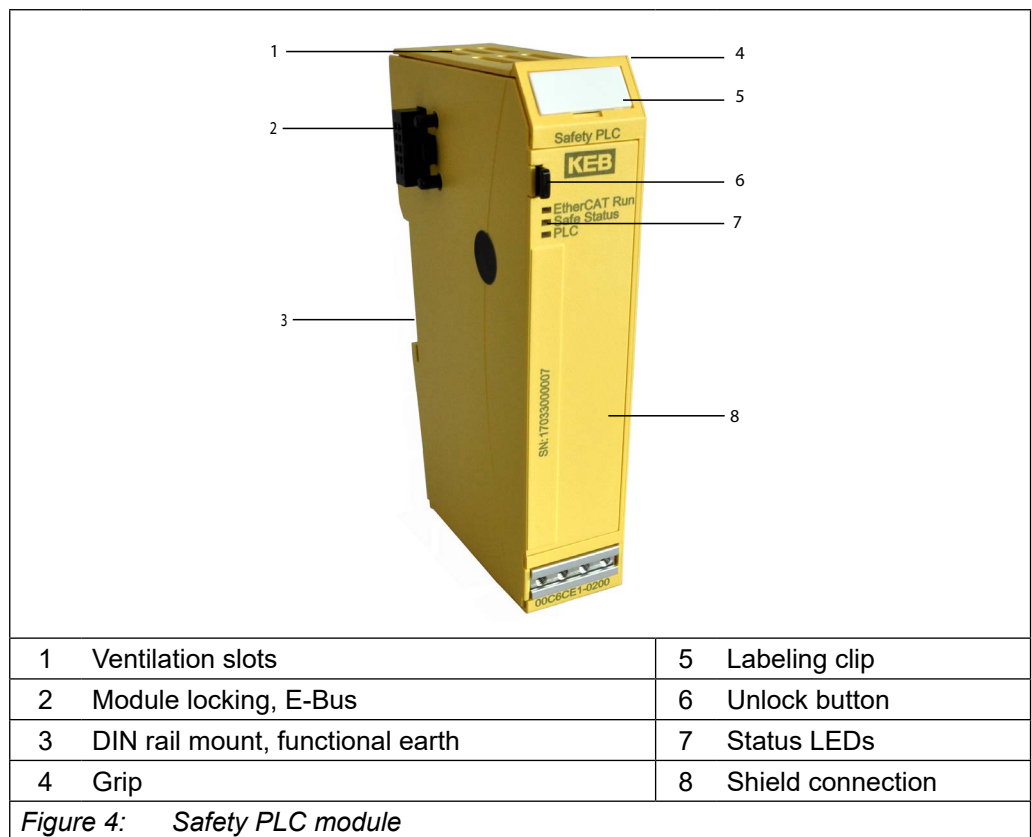
The housing mount consists of an aluminium profile with an integral clamping fixture used to attach the module to a 35mm DIN mounting rail. The housing trough including the optical fibres for the status indicators, the side faces and the front are made of plastic and contain the module.

3.2 Application

3.2.1 Specified application

The KEB-I/O EtherCAT is a system of I/O modules for interconnecting the process signals in an EtherCAT network. It consists of the bus coupler and different I/O modules. The KEB-I/O EtherCAT Safety system with Safety PLC and the KEB-I/O EtherCAT Safety module extend the KEB-I/O EtherCAT system with functions that allow the use in the field of functional safety of machines.

The intended applications include safety functions of machines 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 wattless.When using all safety-oriented control components, the safety measures applicable to the industrial controls (protection by means of protective devices such as emergency stop) in accordance with applicable national and/or international regulations must be observed. The same applies to connected equipment such as drives or light grids.

Before installing and putting the system into operation, the safety instructions with connection specifications (name plate and documentation) and the limiting values listed in the user guide's Technical Data must be read carefully and obeyed at any time. 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 exeptionally strict precautions are taken. In particular, the use in 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 is not permitted.

⚠ **WARNING**   **Impairment of safety when using unsuitable EtherCAT modules!**

► The Safety PLC may only be operated with ETG compliant modules on a bus.

3.2.2 Qualified staff

The use of the safety-related products is limited exclusively to the following persons:
- Qualified personnel familiar with the relevant safety concepts for functional safety as well as applicable standards and regulations.
- Qualified personnel, which is planning, developing, installing and commissioning safety devices for machines and plants.

Qualified personnel within the meaning of the safety instructions of this manual are persons who are authorized due to their training, experience and instruction and their knowledge of relevant standards, regulations, accident prevention regulations and operating conditions and can recognize and avoid possible dangers in the process. In this sense, sufficient language skills are also required for the understanding of this manual.

3.2.3 Suspension of liability

The user must coordinate and comply the safety-oriented control components on his own responsibility with the responsible authority for him.

The manufacturer will not assume any liability or warranty for damages caused by:

- Improper use
- Non-compliance of standards and directives
- Unauthorized changes to devices, connections and settings
- Use of non-approved or unsuitable devices or device groups
- Failure to observe the safety instructions given in this manual

3.3 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 of the machine. It is the aimed for **safe functional state**. The system works without problems.

The second one is the **Fail-Safe state** and applies whenever a fault or error occurs in any of the monitored components.

3.3.1 Safe functional state

The functional safe state is the state in error-free operation.

3.3.2 Fail-Safe state – external fault

The module monitors its supply voltage (overvoltage and undervoltage) and the permissible operating temperature. If the permissible range is left here, the Safety PLC turns into the Fail-Safe state and no FSoE telegrams are sent anymore.

In accordance with a diagnosis concept to be created an error evaluation is executed and reactions are defined.

3.3.3 Fail-Safe state – internal error

The state of the Safety PLC is considered "fail-safe" when valid FSoE frames are no longer sent to the associated safe FSoE slaves.

Safety-endangering internal faults cause that the FSoE communication is stopped and thus it is changed into the Fail-Safe state. This also stops the FSoE communication. The EtherCAT communication is still active and allows diagnostic possibilities (if possible).

3.3.4 To quit the Fail-Safe state

The only way of quitting the fail-safe state is to turn off the power supply to the head module (bus coupler or PLC).Initialising after powering up again includes a complete self-test.

In conformity with the FSoE specification, FSoE slaves linked into the system will change to the safe state if a correct FSoE frame fails to be received before the watchdog times out.

3.3.5 Traceability

Traceability means that a product or merchandise can be identified at any time, when and where and by whom the goods have been manufactured, processed, stored, transported, used or disposed.

Whereas KEB Automation KG 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 product is clearly identifiable by the serial number and therefore traceable. You can find the serial number printed on the module front and as label on the bottom side of the module. It is also readable by software. To ensure proper traceability, the purchaser is obliged to note down this number together with the machine's name, place of installation and end customer.

> The purchaser must ensure the devices retraceability by means of their serial number. In case of errors, it is essential to inform KEB Automation KG.

3.4 Useful Life

The Safety PLC modules have a design life of max. 20 years after the date of manufacture (see section „6.1.1 Mounting position"). The module must be removed from service not later than one week before the end of this 20-year period (see „6.10.3 Taking out of Service").

> The date of manufacture is part of the serial number printed on the housing and stored in the Safety PLC's memory. This can be read out by the standard PLC, e.g., to evaluate the date of manufacturer.

4 Technical Data

4.1 General specifications

4.1.1 General specifications

Product name	Safety PLC
Fieldbus	EtherCAT 100Mbit/s
E-bus port	10-pin system plug in side wall
Electrical insulation	all modules electrically insulated from one another and from the bus
Diagnosis	LEDs (see chapter „5.3 Status LEDs")
E-bus load	max. 240 mA (system power supply)
Terminating module	Cover for module bus on last module required
System power supply	
Supply voltage	5 V DC via E-bus connection is supplied by the head module (bus coupler or PLC in accordance with EN 61373, supply with 24 V DC, min. -15% / +20% SELV/PELV)
Overvoltage category	category II to EN 61373
Reverse polarity safeguard	Yes
Susceptibility to noise	Installation in zone B according 61000-6-2, in compliance with EN61131-2, installation on earthed mounting rail in the earthed control cabinet. Lay the earthing according to the operating conditions (see „6.2.1 Earthing").
Storage and transport conditions	
Surrounding temperature	-25°C … + 70°C
Rel. humidity	5% … 95%, non-condensing
Atmospheric pressure	70 kPa to 108 kPa
Vibration	5 to 8.4 Hz: +/- 3.5 mm amplitude, 8.4 to 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
Service conditions	
Mounting position	horizontal, stackable
Degree of contamination	II to IEC 60664-3
Admissible operating environment	operation restricted to environment complying with IP54 or better to IEC 60529 (e.g. suitable control cabinet)
Operating temperature	0°C ... + 55°C
Rel. humidity	5% … 95%, non-condensing
Atmospheric pressure	80 kPa to 108 kPa
Vibration	5 to 8.4 Hz: +/- 3.5 mm amplitude, 8.4 to 150 Hz: 10 m/ s2 (1g), to IEC 60068-2-6, Fc test
Shock	150 m/s^2 (15g), 11 ms semi-sinusoidal wave to IEC 60068-2-27
Mechanical properties	
Mounting	35 mm DIN rail (mounting rail)

Dimensions	25 mm x 120 mm x 90 mm (W x H x D)
Degree of protection	IP20
Housing mount	aluminium
Shield	connects straight to module housing
Table 1: *General specifications*	

4.1.2 Size of the FSoE data frame

The FSoE protocol defines a maximum frame size of 1322 bytes. This is the maximum size of the data that can be exchanged by a Safety PLC with FSoE slaves.

The maximum number of FSoE slaves at a Safety PLC is calculated by adding the respective safe I/O data plus protocol-overhead. The sizes can be found in the product description of the respective FSoE slave.

> **i** If the above mentioned maximum size of the FSoE data frame is exceeded with the configuration of a safety application, the relevant safety application does not start.

4.1.3 Cycle time setting of the safety application

The cycle time of the safety application is adjusted in the programming system. It can be adjusted from 4 ms to a maximum of 600 ms with a resolution of 1 ms.

> **i** Values outside the range cannot be adjusted. An error message is displayed when loading the safety application to the Safety PLC.

4.1.4 Response time

In a safety system, consisting of the safety control, via FSoE connected safe I/O modules and thus connected sensors and actuators, the entire response time is composed of the signal processing times of the single components (see figure).The response time corresponds to the task cycle time adjusted in the safety application for this present safety control.
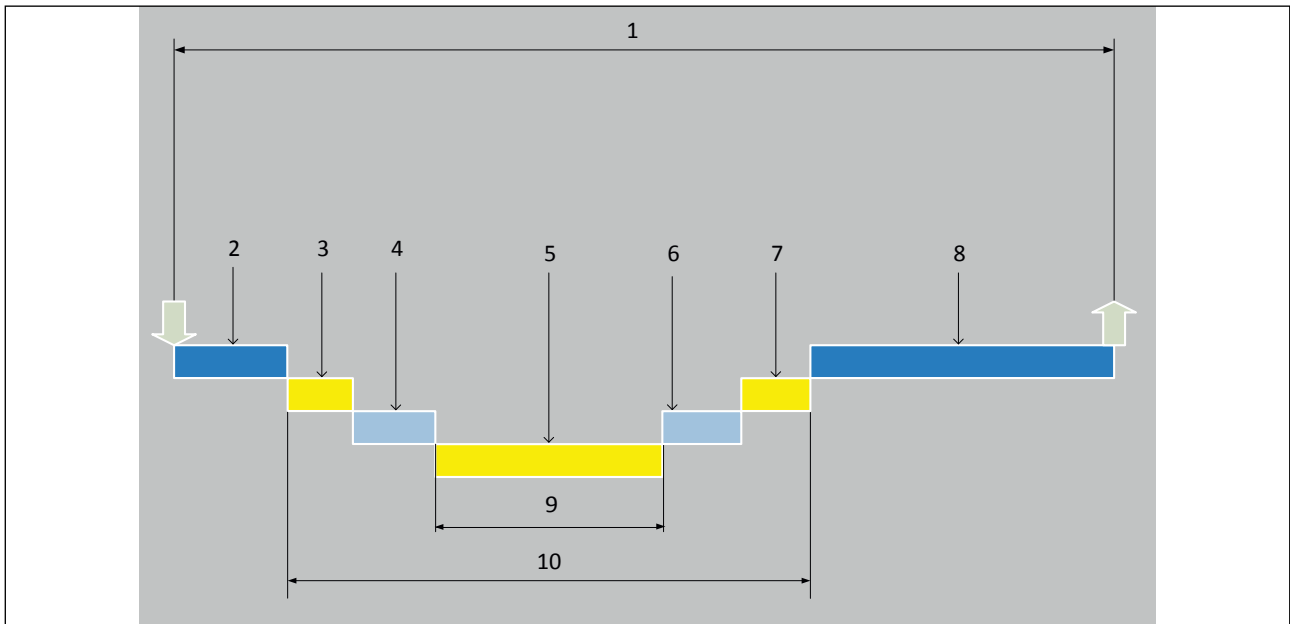
No.	Definition	Description
1	Total response time	
2	T_Sensor signal processing by sensor	Processing time of the sensor until the signal is provided at the interface. This time is given by the sensor manufacturer.
3	T_Input signal processing by safe I/O module	Processing time of the safe input, e.g. SI4/SO2 module. This time can be taken from the technical data of the input module.
4	T_FSoE transmission of the frames via EtherCAT	Processing time of the communication. This processing time is max. 3x the EtherCAT cycle time, since new data can only be sent in a new Safety-over-EtherCAT telegram and the data from the higher-level standard control are copied. The processing time of the communication therefore directly depends on the cycle time of the EtherCAT master.
5	T_Safety PLC program run time in the safe PLC	Processing time of the safety PLC. This is the adjusted cycle time of the safety application. The safety PLC will change to the safe state if this time is not achieved due to an excessive level of program complexity.
6	T_FSoE transmission of the frame via EtherCAT	Processing time of the communication. This processing time is max. 3x the EtherCAT cycle time, since new data can only be sent in a new Safety-over-EtherCAT telegram and the data from the higher-level standard control are copied. The processing time of the communication therefore directly depends on the cycle time of the EtherCAT master.
7	T_Output signal processing by safe I/O module	Processing time of the safe output, e.g. SI4/SO2 module. This time can be taken from the technical data of the output module.
8	T_Actor signal processing by actuator	Processing time of the actuator. This information is given by the actuator manufacturer.
9	Response time of the module	
10	Response time by system	
Figure 5: Response times by systems (example)		

| ⚠ **CAUTION** | **To calculate the safe response time, take account of the fieldbus runtimes and the Safety PLC's cycle time!** |

Avoid personal injury and damage to property!

► The fieldbus runtimes and the Safety PLC's cycle time must be taken account of to rate and calculate the safe response time.

► In the worst case, the fieldbus runtime must be assumed to amount to 3x the EtherCAT cycle time per direction of data transfer.

> ℹ Since an error can occur during the Safety PLC cycle, the maximum system reaction time must always be assumed for the reaction time. This is adjustable by the watchdog time of the FSoE slaves.

4.2 Dimensions
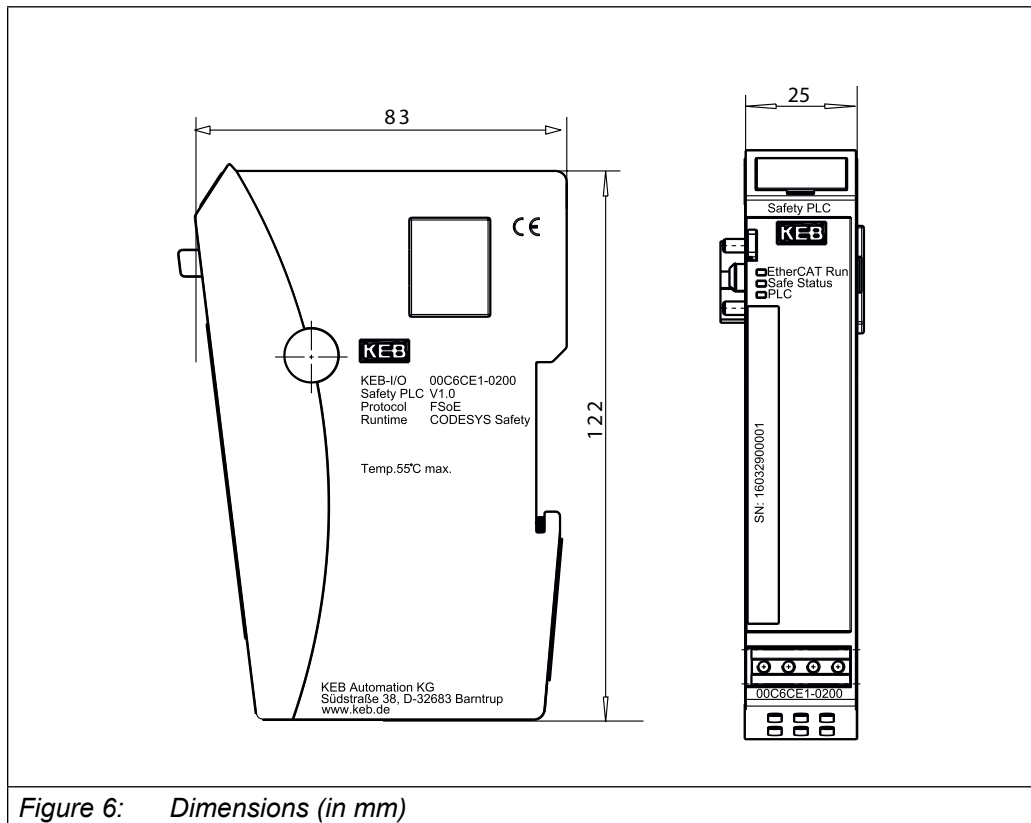
Figure 6:   Dimensions (in mm)

4.3 Transport and storage

At times of transport and storage, protect the Safety PLC against inadmissible exposure such as mechanical stress, temperature, humidity and/or aggressive atmospheres.

- Transport and store the Safety PLC in its original packaging.
- Do not contaminate or damage the contacts during order picking or repackaging.
- Keep and transport the Safety PLC in a container/packaging ensuring electrostatic discharge (ESD) compliance.

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

- Take the necessary protective measures against electrostatic discharge (ESD) during commissioning and maintenance of the Safety PLC module.

⚠ CAUTION	**Electrostatic discharge!**

Destruction or damage to the unit!

► Transport and store the KEB-I/O EtherCAT Safety in its original packaging.

► Ensure that the ambient conditions are as specified at all times during transport and storage.

► Handle the Safety PLC modules in a well-earthed environment (persons, place of work and 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 Marking and identification

5.1.1 Imprinted texts and symbols

1 certification mark

2 manufacturer's label

3 operating condition

4 serial number

5 serial number on the front
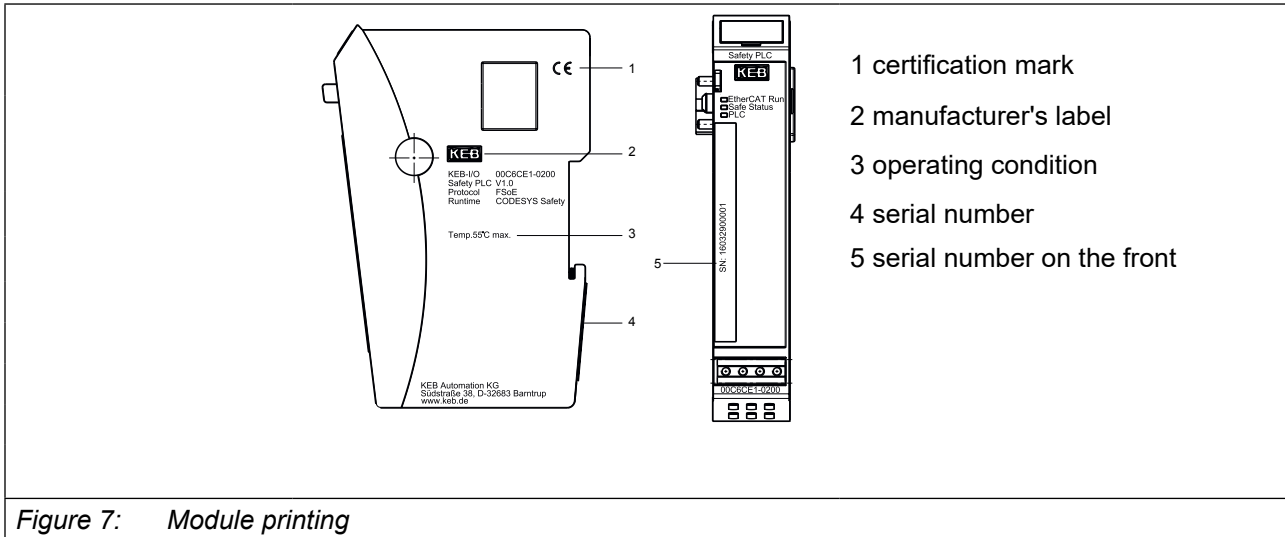
Figure 7:   Module printing

5.1.2 Serial number

The serial number is printed vertically on the front panel. It can also be found on the label on the back of the module.

The numerical code incorporates the production date and a serial number. Device history, device design, software and hardware version can be clearly identified with the number combination by KEB Automation KG.
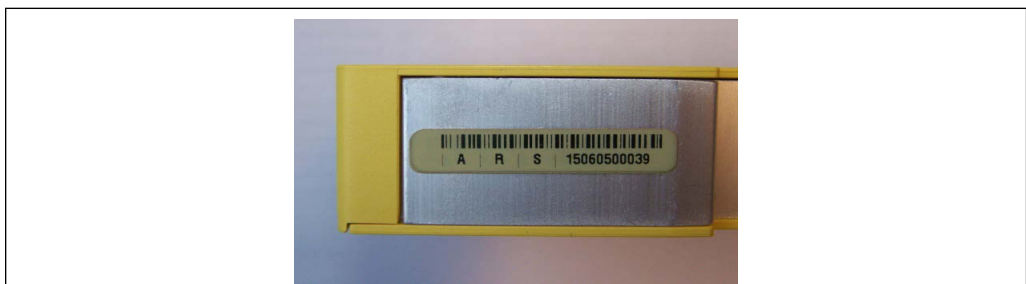
Figure 8:   Front view with serial number

Make-up of serial number: YY MM DD NNNNN

Example:

The device shown above was manufactured on 05th June 2015 and has the serial number 00039.

15 06 05 00039

Production date in the format: Year Month Day

The serial number is also stored in object 1018 sub-index 4 and can be retrieved by SDO Transfer.

> The serial number is also stored in object 1018_h in sub-Index 4 (see „8.3.6 Identity Object 1018h") and can be read out by EtherCAT SDO access.

5.2 Contents of package

- Safety PLC
- Module bus cover

5.3 Status LEDs

Figure 9:	Status LEDs

LED	State	Meaning
LED "EtherCAT Run"		
Off	Init	Initialising, no data exchange
Off/green, 1:1	Pre-Op	Pre-operational, no data exchange
Off/green, 5:1	Safe-Op	Safe operational, inputs readable
Green, on	Op	Operational, unrestricted data exchange
LED "Safe State"		
Green, on	OK	Module is in functional safe state
Red, on	Error	Module is in Fail-Safe state
LED "PLC"		
Off	−	Safety application not loaded
Off/yellow, 1:1	−	Safety application is loaded
Yellow, continuous light	−	Safety application is loaded
Green, on	−	Safety application is running
Red, on	−	Safety application is stopped
Off/red, 1:1	−	Safety application has been aborted
Off/green, 1:1	−	Safety application is in debug mode
Table 2:		Status LEDs

The status LEDs are not a safety-related display. That means, not only the status display of the LEDs should be a safe indicator for the operating condition of the module, etc.

5.4 Operating software

The Safety PLC is part of a distributed control system based on COMBIVIS studio 6. The Safety PLC is programmed using a programming system based on COMBIVIS studio 6 and extended by a certified plug-in (COMBIVIS studio 6 safety extension) which provides the safety functions.

⚠ **WARNING**	**Wrong programming and parameter setup!**
	► Verify that the COMBIVIS studio 6 safety extension used for programming and parameter setup is approved for use with COMBIVIS studio 6 Safety runtime system version 1.2.0.

6 Installation and operation

Before installing the KEB-I/O EtherCAT Safety Module, verify that it has been transported and stored at the ambient conditions specified in sections „Hier Text oder Variable eingeben" and „4 Technical Data".

Module operation is subject to the service conditions specified in section „4 Technical Data" and „6 Installation and operation".

⚠ CAUTION	**Inappropriate operation!„4 Technical Data"„4 Technical Data"„5 Construction and functionality"**
	Malfunction of the KEB-I/O EtherCAT Safety module!
	► Only persons qualified for dealing with safety matters are allowed to add, replace and put Safety I/O modules into operation!
	► Before installing, servicing or putting the Safety PLC Module into service, please read the safety information in the preface of this document.
	► Before putting the unit into service, verify that all safety functions work as specified!

6.1 Mechanical installation

ℹ	No tools are required for the installation and deinstallation of the Safety PLC, see chapter„6.1.6 To take down a single module".

Environment of installation

Protect the device against inadmissible contamination (comply with contamination degree II of IEC 60664-3).

A suitable means would be an IP 54 enclosure, e.g. a suitable control cabinet. Operation under condensing humidity is NOT allowed.

⚠ 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 IP54, e.g. by installing the unit in a suitable control cabinet.

6.1.1 Mounting position

The unit is intended for installation on a rail (according to DIN EN 50022, 35 x 7.5 mm). Mount the DIN rail horizontally and check that the moduled's status LEDs are at the front.

To ensure that enough air gets in through the ventilation slots, leave at least 20 mm to the top and 35 mm to the bottom of a module and any adjacent devices or cabinet surfaces. Leave at least 20 mm of lateral distance to third-party devices and control cabinet surfaces.
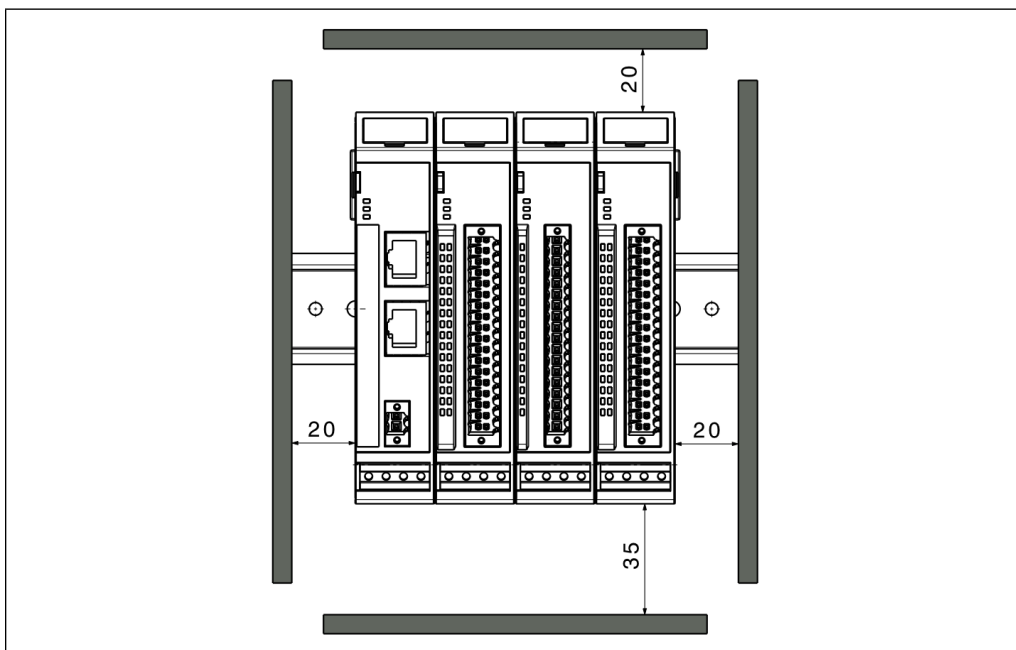
Figure 10:   Installation position and minimum distances in mm

6.1.2 E-bus connector and module lock

The system connectors and the module lock are located on the sides of the Safety PLC module. These contact pins interconnect the modules. They supply power to the module's electronic circuitry and transfer the EtherCAT signals. Leave the end cap from the package in place to protect the module bus connector of the last module to the right of the terminal unit against contamination.

The integrated module lock prevents the modules from coming apart under mechanical load or vibration.

6.1.3 To snap on a single module
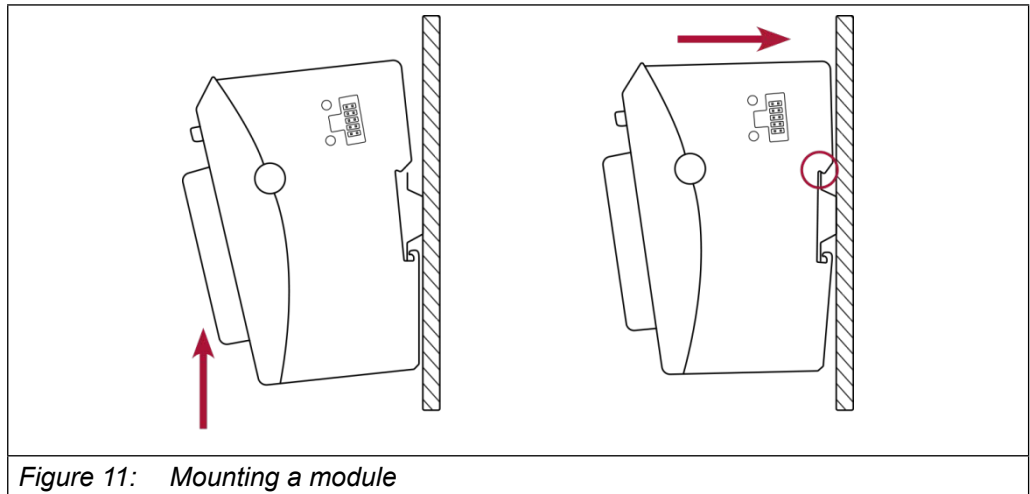
Figure 11:   Mounting a module

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

6.1.4 To interconnect two modules

1. If a module has previously been snapped on to the rail, place the next module about 1 cm away from it to the right and snap it on.
2. Then push the new module left towards the other module until the unlock button snaps out.
3. To prevent inadmissible contamination, mount the cover of the module bus connector on the rightmost module of the EtherCAT I/O system.

⚠ CAUTION	**Risk of injury by the module bus contacts shorting out!**
	A short circuit of the module bus contacts may cause the communication with the safe module to fail!
	► Verify that the end-of-bus cap is in place on the last module of a series of modules.

6.1.5 To disconnect two modules
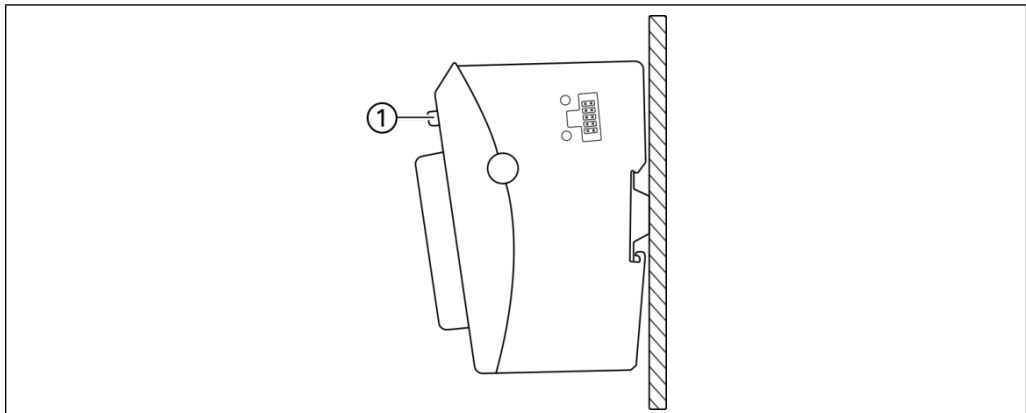
Figure 12:   Disconnecting modules

1. Push the unlock button (1) of the module you wish to remove.

2. Push both modules about 1 cm apart.

6.1.6 To take down a single module
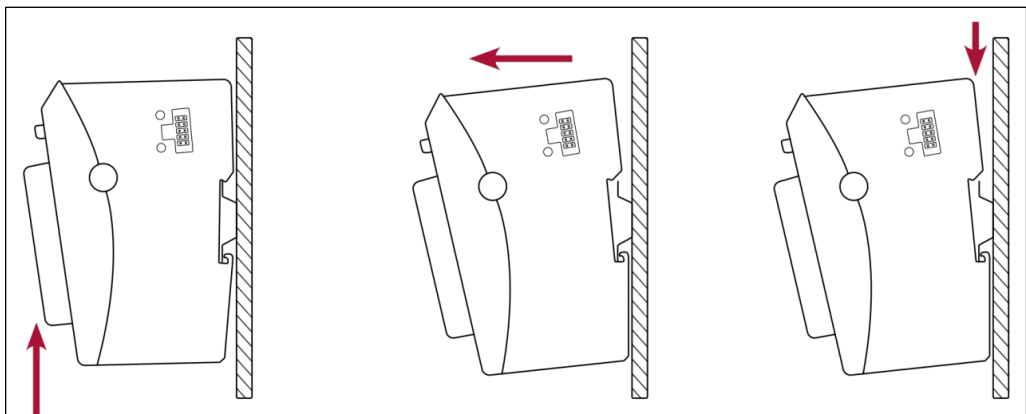
Figure 13:   Removing a module

1. Push the module up and against the metal spring located on the underside of the rail guide.
2. Tip the module forward and away from the rail as shown in the illustration.
3. Pull the module down and out of the mounting rail.

6.2 Electrical installation

6.2.1 Earthing

Every module needs to be earthed by connecting the internal metal housing to functional earth which dissipates HF currents and is of utmost importance to the module's immunity to noise.

HF interference is dissipated from the electronics board to the metal housing. The metal housing therefore needs to be suitably connected to a functional earth connector.

Snapping the module on to the rail normally provides a high-conductivity earth connection between the module housing and the rail. The rail has a high-conductivity connection to the control cabinet which is earthed well in itself.

If need be, the earth connection can be screwed to the front of the module (see figure, Pos. 1).

1.	Earthing/cable shield, connected by a M3x5 bolt
2.	DIN rail connected to functional earth
Figure 14:	*Earthing (example of an I/O module)*
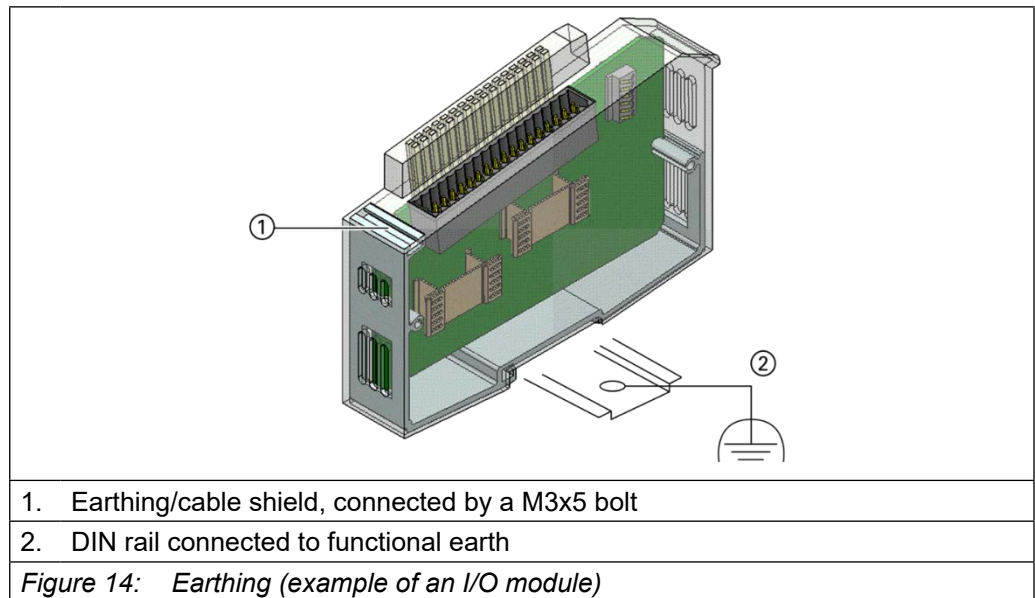
> Earth wires should be short and have a large surface (copper mesh). Refer to http://de.wikipedia.org/wiki/ground_(electronics)

> When installing production or other lines, measure the earth potential of the DIN rail as specified in the applicable guidelines (earth test to VDE 0100). Measuring the earth potential must show that every protective earthing and operational earthing is within the boundaries set by the applicable standards.
>
> Also consider the repeat testing frequency resulting from the hazard assessment.

6.2.2 Module interconnection

The modules electrically connect by completely pushing the modules together. This automatically connects the modules to both the EtherCAT bus system and the system power supply. Refer to section 6.1 Mechanical Installation for details about how to interconnect two modules.

> Place the Safety PLC module as close as possible to the head module.

6.2.3 System power supply to the series of modules

Power to each module's logical circuitry is supplied by the head module (bus couplers or compact controller in compliance with EN 61131-2) via the module's backplane bus. The number of the stackable modules depends on the of the head module's power output. A typical power output of 3 A supports up to about 20 modules. To link in a larger number of modules, just make up blocks of modules and have a separate bus coupler supply power to each of the blocks.

> Take note of 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 instructions in this user guide.
>
> Note that the maximum current supplied by the head module limits the number of modules you may connect to a single block.

> The number of interconnected modules provokes varying voltage ratios on the E-bus with reference to the module position.
>
> In order to provide a maximum of availability, try to place the Safety PLC module as close to the head module as possible.

⚠ **WARNING**

Damage caused by wrong voltage supply!

Supplying the wrong voltages may damage or destroy the unit.

Preventive measures:

▶ Only use PELV/SELV-ready power supply units according to EN50178 or EN60950-1 to supply 24 VDC to bus couplers or compact PLCs that any Safety PLC modules are connected to.

▶ Only use the GND terminal to connect the voltage supply unit to earth (PELV system). Do not use earthing variants that connect earth to +24V.

▶ 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 block of KEB-I/O EtherCAT modules.

6.3 Putting into service

> The Safety PLC may only be operated with FSoE-compliant FSoE slaves.
>
> Whenever you work on the safety system, check that the safety functions are provided properly afterwards.
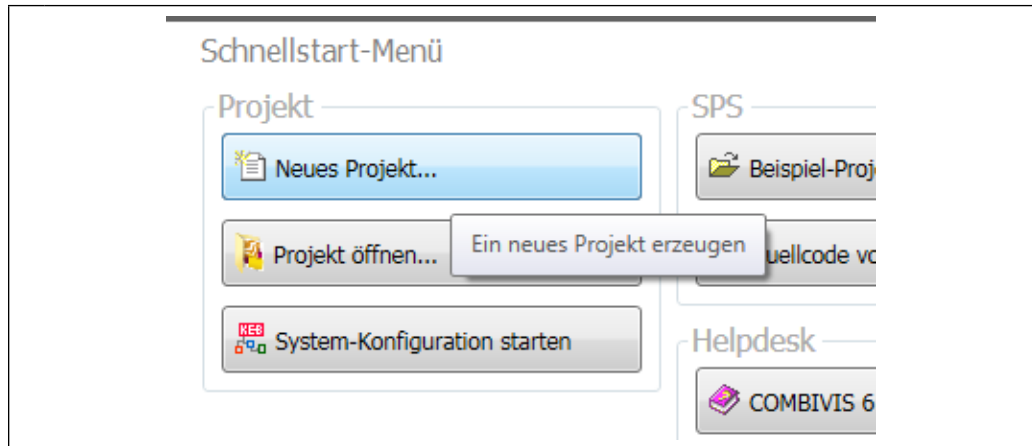
6.3.1 Configuration

Only the operating software is used to configure the Safety PLC. The module as such does not provide options to change any of the settings.
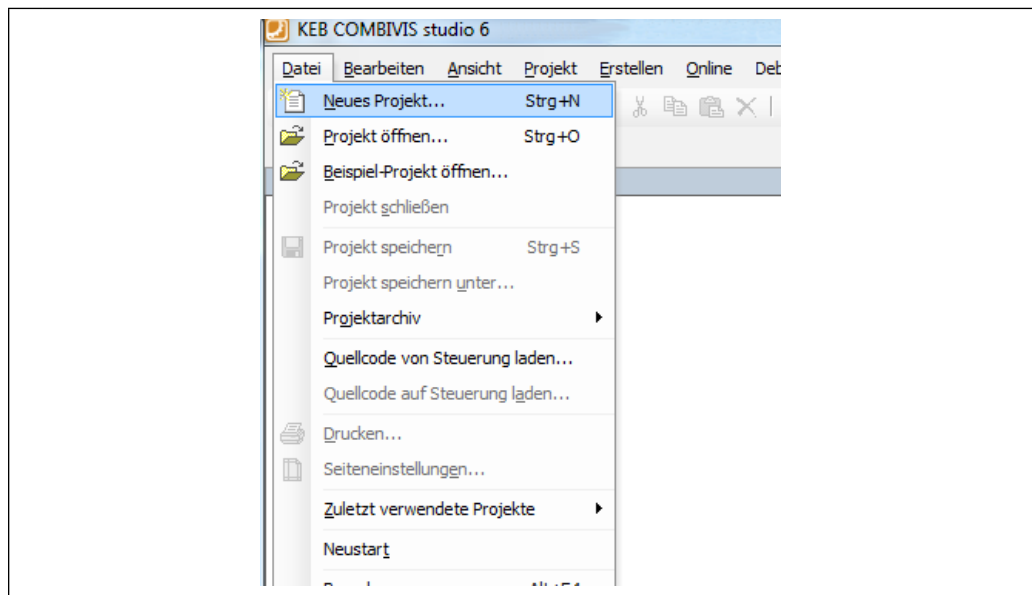
6.4 Software installation

6.4.1 Creating a safety project

- Start COMBIVIS studio 6

- On the standard COMBIVIS studio 6 homepage, go to "**Basisoperationen**" (Basic Operations) and click on "**Neues Projekt…**" (New Project).

Or choose "**Datei -> Neues Projekt…**" (File -> New project) to create a new project.
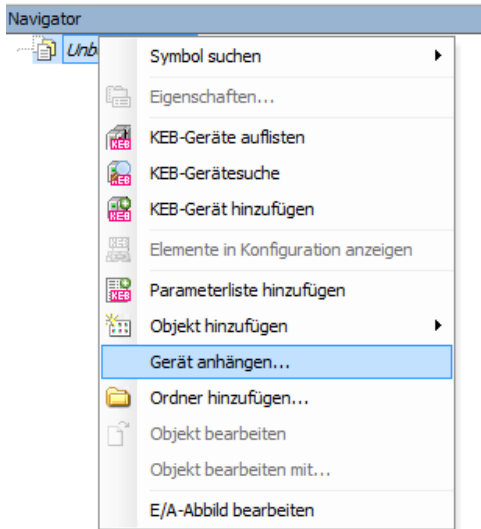
- Pick template "**Leeres Safety Projekt**" (Empty Safety Project).

- Assign a "**Name**" and choose a storage location, and click on "**OK**" to actually create the project.
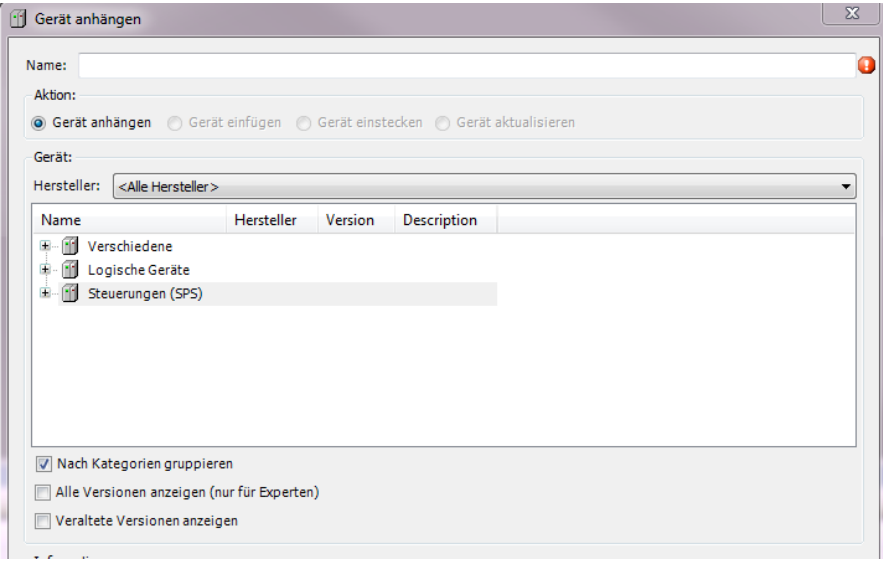
- Add a standard PLC to the empty project by right-clicking on "**[project name] -> Gerät anhängen**" (Add Device).

- Pick the correct type of your standard PLC.

- To add objects to your application, right-click on "**Application -> Add Object**" .
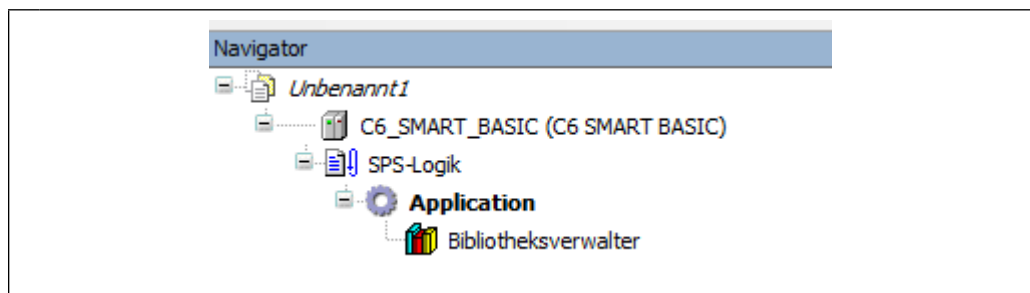
- A list of available objects appears. Click on any of the objects to add it to the application.
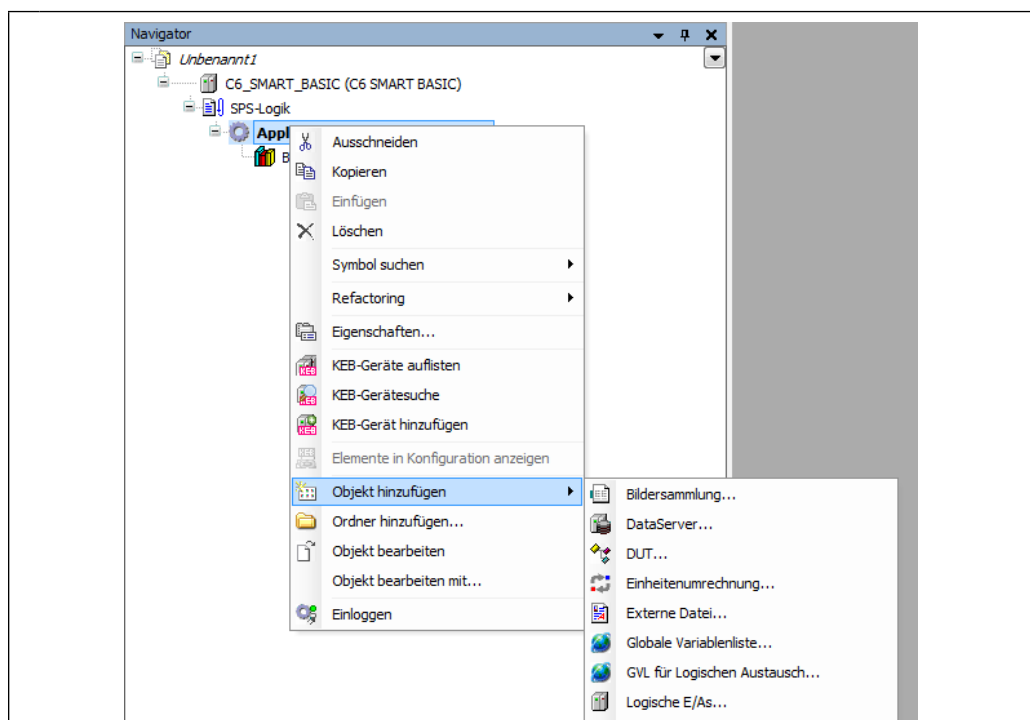
- Add a POU (program).
- Add a task configuration.
- To run the POU using the task configuration: Click on "**Aufruf hinzufügen**" (Add Call) and select the POU from the list.
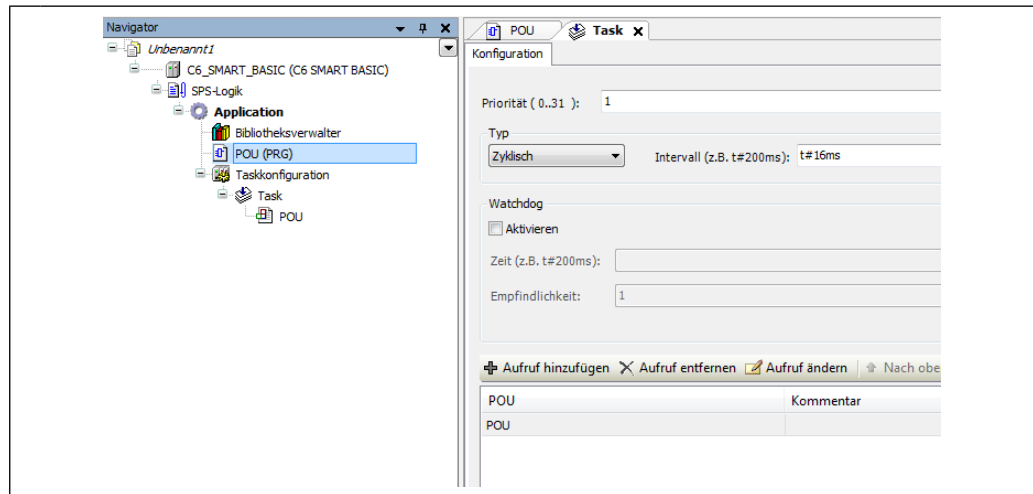
Since the Safety PLC is an EtherCAT based module, you will still need an EtherCAT master:
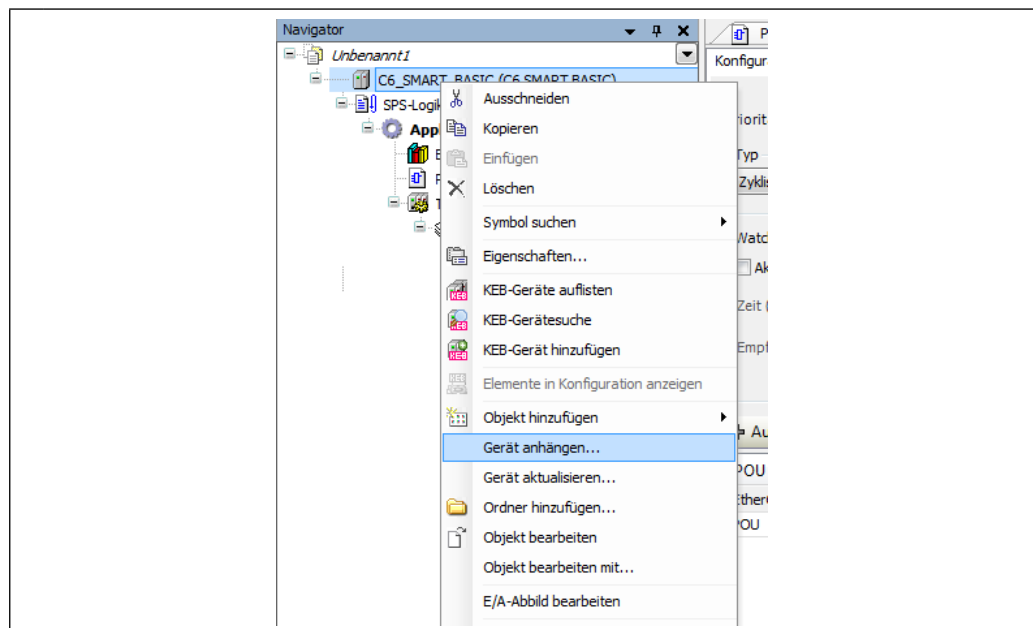
- Right-click on the standard PLC you added before.
- In the dialog, click on "**Add Device…**".
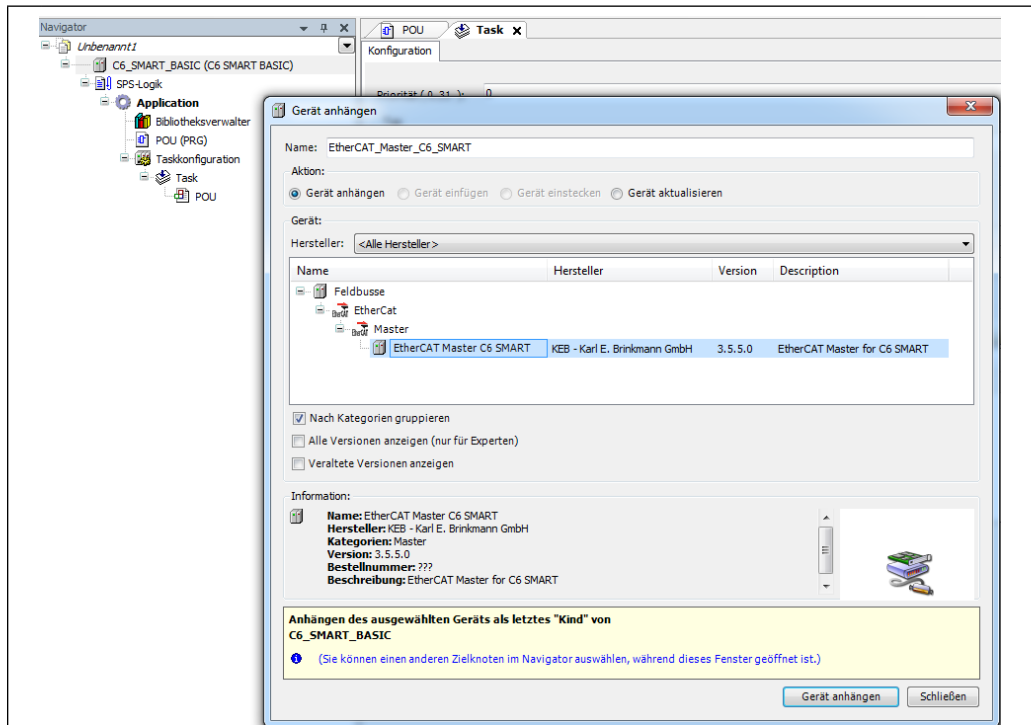
- In the next dialog, choose "Fieldbuses -> EtherCAT -> Master -> EtherCAT Master C6 Smart".
- Click on "Add Device" to add the EtherCAT master to your project.

The EtherCAT master has been added to the list of devices and, thus, to your project. The EtherCAT master's task configuration has been created automatically.
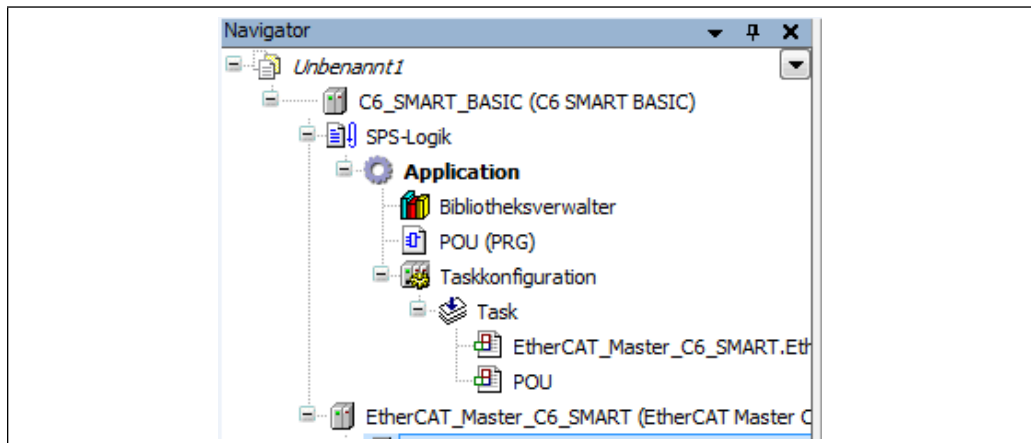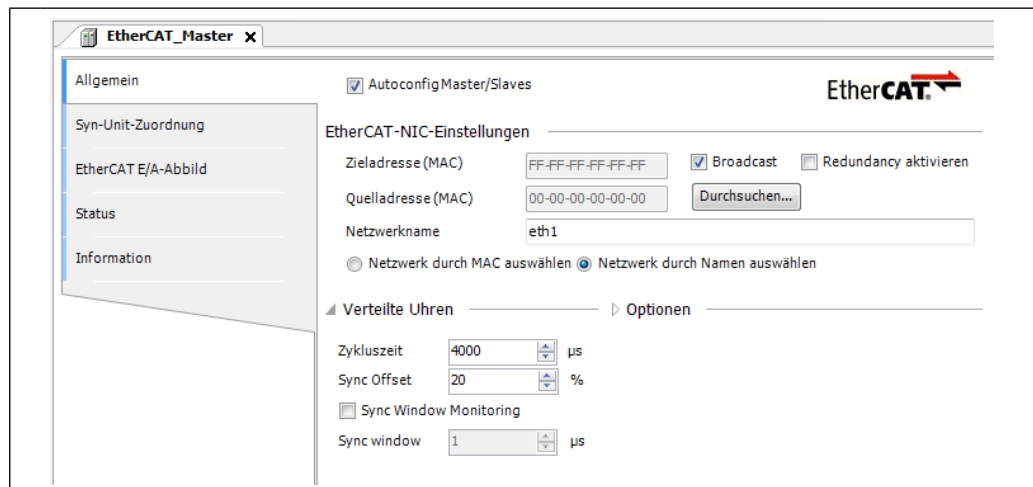
- Go to the settings of the EtherCAT_Master and choose or enter the correct Ethernet interface. (EtherCAT NIC settings → select network by name, name of network)

Add EtherCAT devices manually

You can now add bus coupler(s), the Safety PLC, safety modules and other EtherCAT modules as seen by the standard PLC:
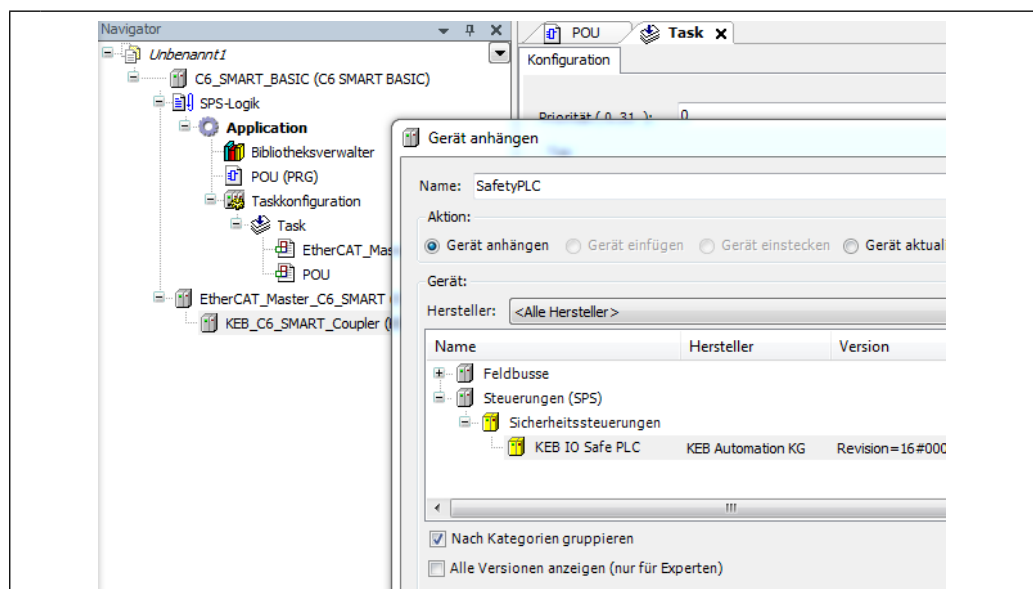
- Right-click on "**EtherCAT_Master -> Add Device…**".
- Choose the device

45
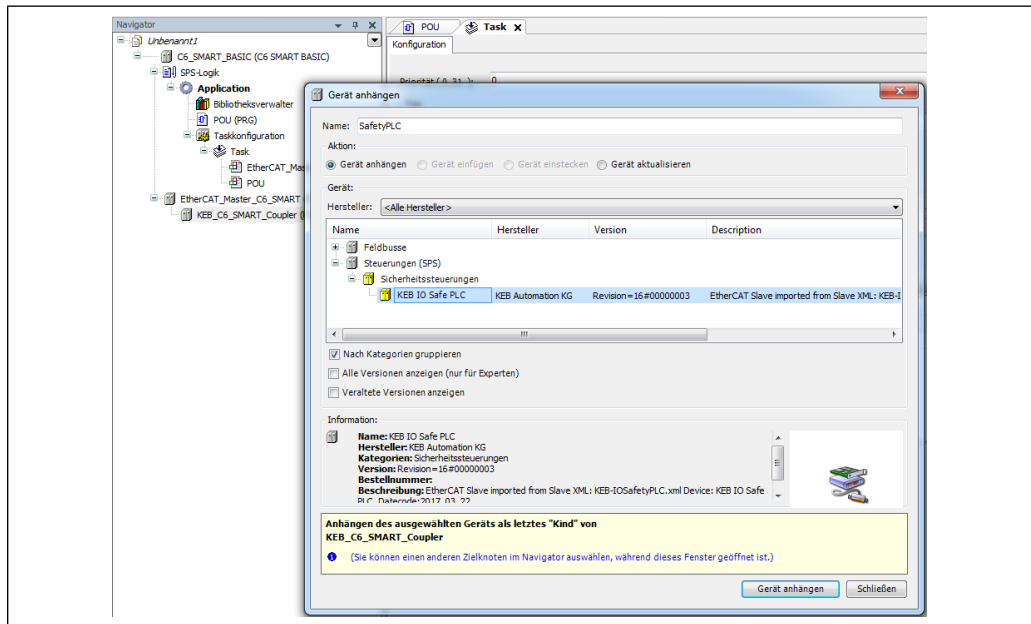
Add devices by searching EtherCAT

There is a more convenient way of adding modules than to pick them manually.

Available EtherCAT devices can be searched for automatically and added to the project. Before you can do so, check that the standard PLC hosts an executable and compilable application featuring an EtherCAT master. Also, all further modules you need have to be connected.
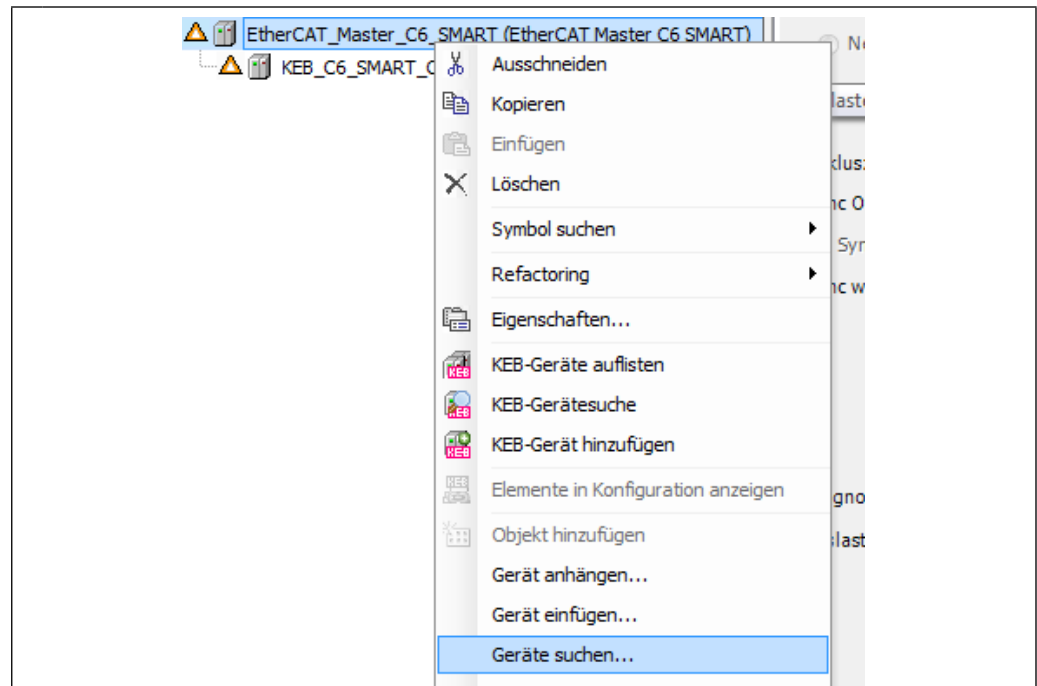
- Right-click on "**Application-> Log On**" to log on to the standard PLC.
- Load the application to the PLC.
- Right-click on "**EtherCAT_Master -> Find Devices…**" to display a search dialog.
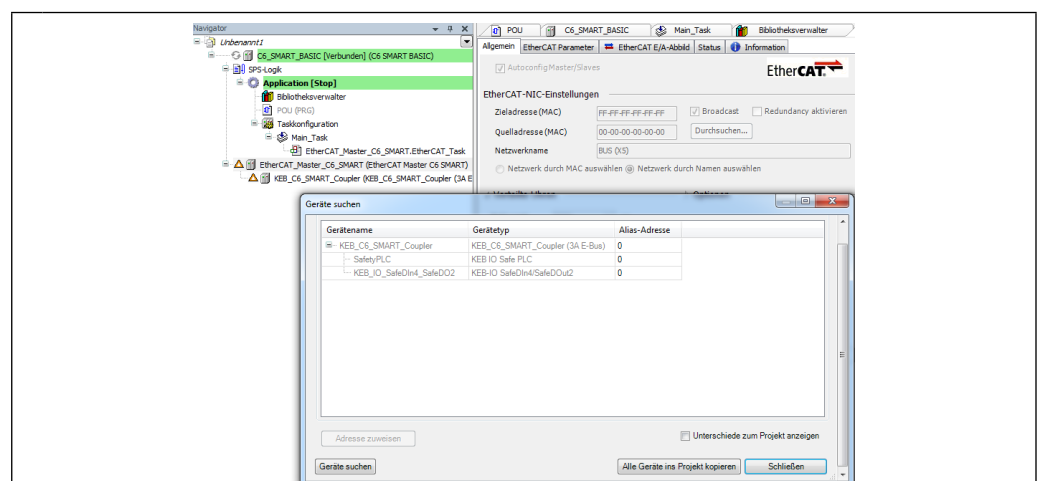
- After the search, the dialog lists all devices found on the EtherCAT network.

- Click on "**Copy All Devices to the Project** " to automatically append all devices below the EtherCAT master.

The safety application is in the EtherCAT module of the Safety PLC. The programming system treats the Safety PLC like a "normal" standard PLC (set active application, log on, log off).

> ℹ️ The COMBIVIS studio 6 Safety manual explains how to create the safety application.

By default, a newly created empty safety project will have an user administration. This will normally be a user called "Owner" with no password assigned.

A user must authenticate before changes made to a safety application become effective.

> ℹ️ Safety devices and safety applications should generally be protected by passwords against unauthorized access.

6.4.2 Safety PLC - Logging on and downloading an application

> ℹ️ A login is only possible if a Safe POU has been added below the Safety PLC.
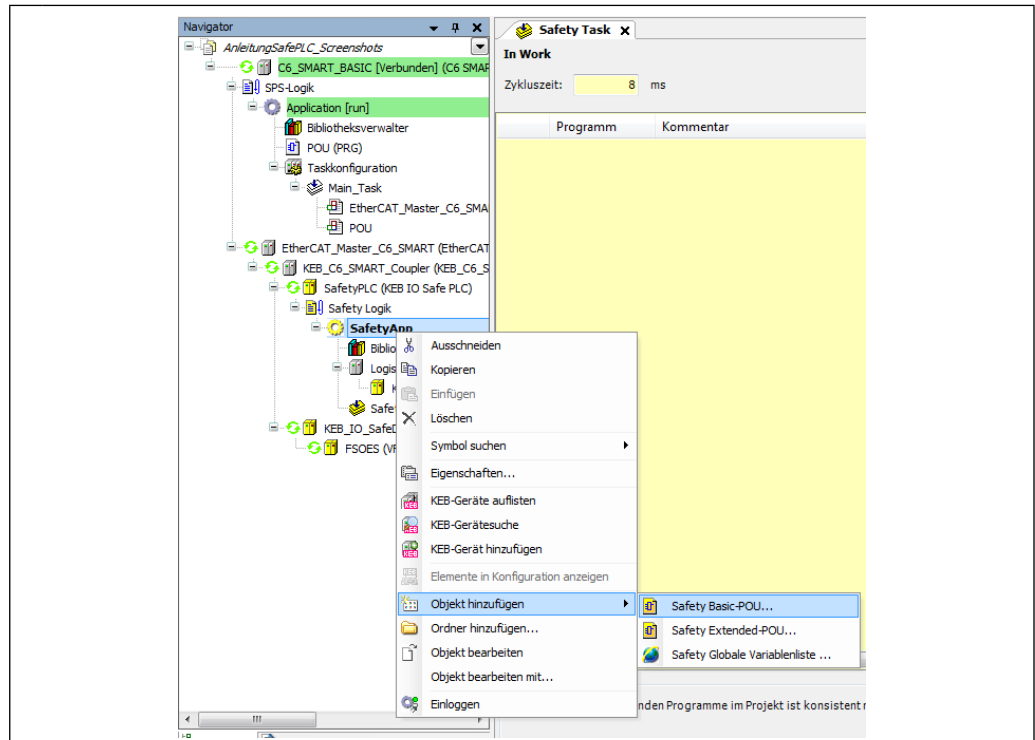
• Right-click on **"SafetyApp"-> "Add object" -> "Safety Basic POU**

Before connecting to the Safety PLC, verify that the standard PLC has an EtherCAT master with a correct EtherCAT configuration and that the configuration has been started to ensure that the EtherCAT master is running properly.
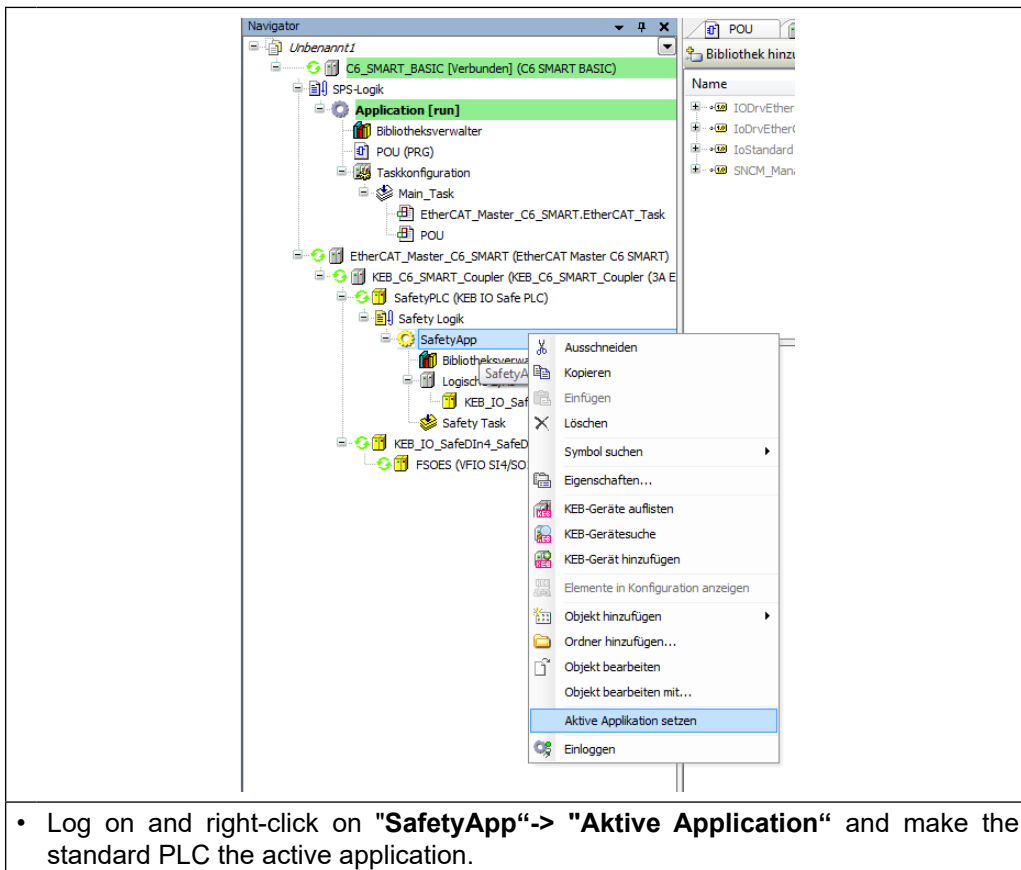
- Log on and right-click on **"SafetyApp"-> "Aktive Application"** and make the standard PLC the active application.
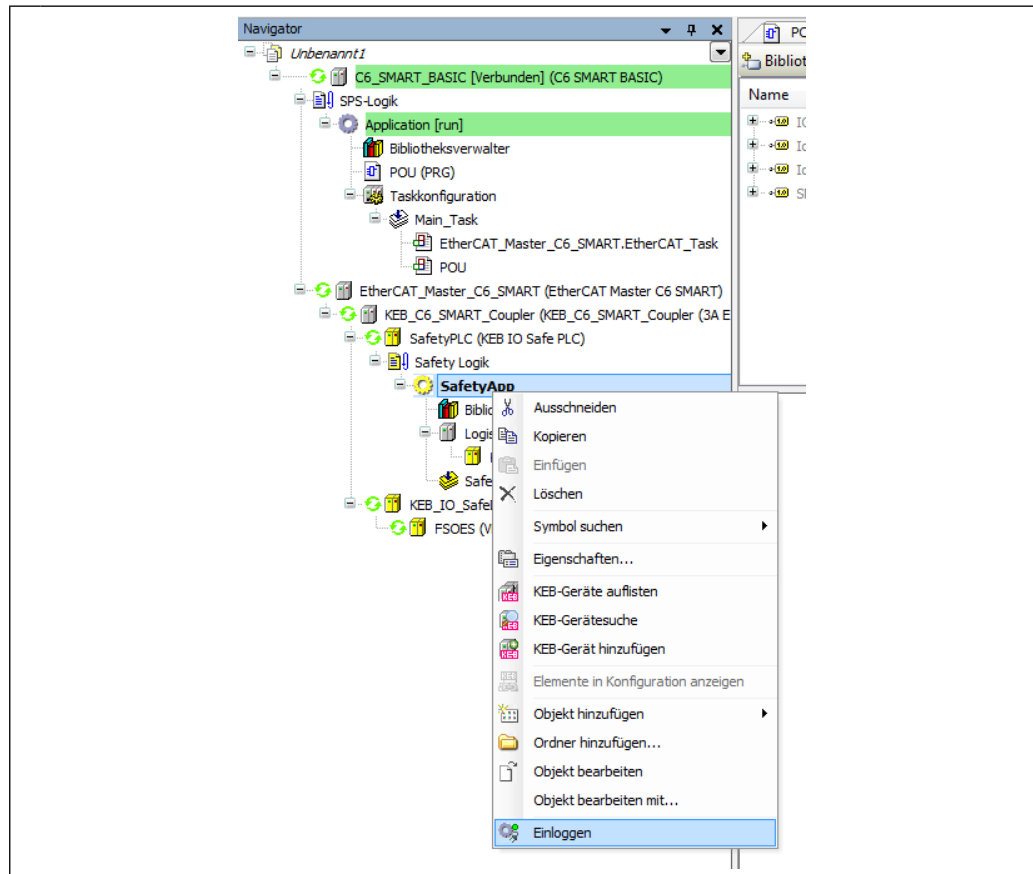
- Right-click on "**SafetyApp"->" Log On**" to log on to the Safety PLC.
- Load the application to the PLC.
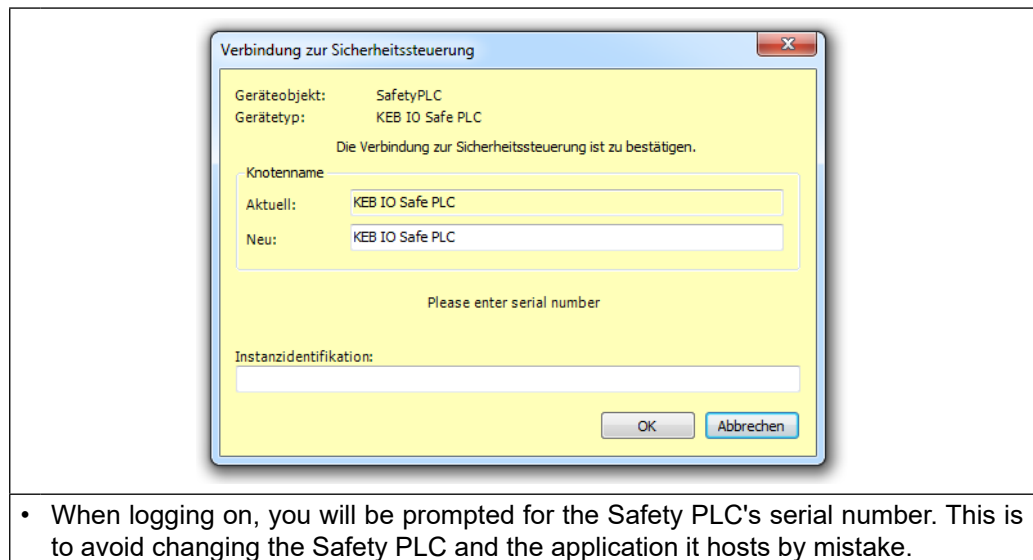
- When logging on, you will be prompted for the Safety PLC's serial number. This is to avoid changing the Safety PLC and the application it hosts by mistake.
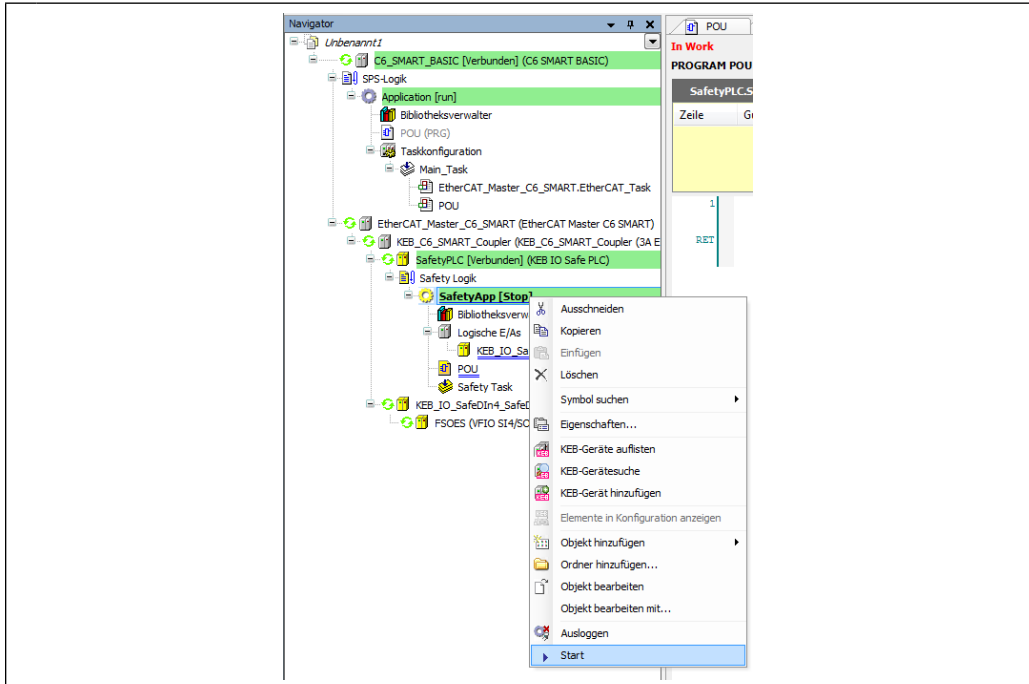
- Right-click on "**SafetyApp"** -> **Start** to start the application.

6.4.3 Safety PLC communication - FSoE (Safety over EtherCAT)

The Safety PLC uses FSoE (Safety over EtherCAT) to communicate with other safety modules. In this setup, the Safety PLC is the FSoE master, while the other safety modules are FSoE slaves. The master uses a unique ID to address the FSoE slaves. This will only work if the FSoE slave ID is unique within the EtherCAT network and has been added to both the master's and slave module's configuration. (Refer to the user guide of the slave module concerned to learn how to set the module's FSoE ID).

6.4.4 Setting the FSoE Slave IDs in the Safety PLC

Run COMBIVIS studio 6 Safety to configure the FSoE (Safety over EtherCAT) slave modules in the Safety PLC.
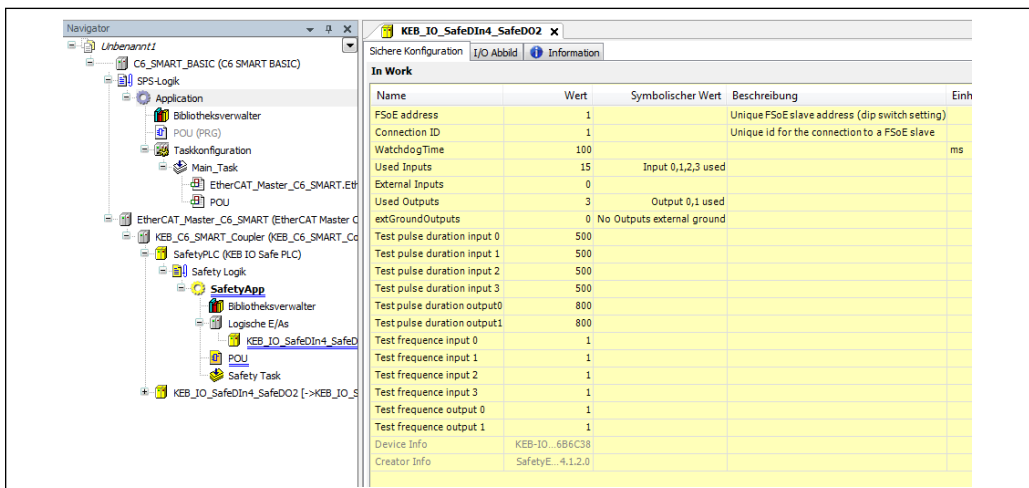
To configure the FSoE slave modules, go to the Safety PLC and find the "Logical I/Os" entry under "SafetyApp". This is where the system automatically adds the slave modules and where you can adapt them manually.

Enter the FSoE slave's configuration in the associated Configuration dialog by assigning a unique FSoE address and Connection ID to the module.

6.5 Validation of safety functions

After completing the installation and setting up the safety application, the latter must be checked for proper operation within the overall system.

⚠ DANGER	**Validation of the safety function!**
	The implementation and operation of safety applications within the overall system must be checked!
	► Validation of the complete system according to the COMBIVERT studio 6 safety user manual.

6.6 Diagnosis

6.6.1 Self-test

When system voltage is supplied to the Safety PLC, it initially runs a complete system test. Only if this system test is passed will the module be able to operate. First of all the Safety PLC changes to the "Fail-Safe" state. This state is indicated by LED "Safe Status" lighting up red.

The fail-safe state of the Safety PLC will be retained until the required internal tests have been passed. After the self-test, the Safety PLC will start the safety application from its memory. This defines as the safe functional state which is indicated by LED "Safe Status" lighting up green.

The module will retain its fail-safe state if it fails to qualify for the safe state, e.g. because of errors in the application's module setup.

In normal operation mode, the system test will be repeated as a cyclic background process. Any errors encountered will again provoke the fail-safe state and an entry in the COMBIVIS studio 6 log.

6.6.2 Safety PLC module errors

The cyclic self-tests performed in compliance with the standards listed in the certificate will discover all errors in due time and change the module state to "fail-safe".

This is indicated by LED "Safe Status" lighting up red (see „5.3 Status LEDs").

⚠ DANGER	**Use of devices in a fail-safe state!**
	The following faults may provoke a hazard!
	► When an error occurs, have the actions taken required to find and remove the root cause and initiate any replacements, as appropriate.

In the case of serious module-internal errors of the Safety PLC, KEB Automation KG must be informed.

6.6.3 Temperature faults

The module is designed for ambient temperatures between 0 °C and max. 55 °C and for being installed in a control cabinet. The Safety PLC features an extra internal temperature sensor. If the temperature is out of the specified range during operation, the state will change to "fail-safe". You cannot start the module if the temperature is out of the specified range.

⚠ CAUTION	Do not operate the Safety PLC module out of the specified range!
	High or low temperature fault.
	Operate the module under the ambient conditions listed in section Technical Data only.

⚠ CAUTION	Use of the internal temperature sensor for safety applications is not permitted!
	Non-safety-oriented temperature sensor.
	The internal temperature sensor must not be used for the realisation of safety applications.

6.6.4 Error handling and logging

The Safety PLC's diagnostic LEDs indicate faults and errors according to the type of fault detected. The log screen of the relevant Safety PLC in the programming system will also list all error messages. Furthermore, the standard PLC can use COE objects (see object dictionary) to retrieve errors from specific registers of the Safety PLC.

6.7 Resetting / acknowledging errors

Safety PLC errors are distinguished as errors of the Safety PLC as such and errors occurring when communicating with sensors and actuators or the errors provoked by sensors and actuators.

Safety PLC errors can be acknowledged by restarting the PLC only. To restart the PLC, perform a PowerCycle (supply off/on) at the head module.

A loss of communication or errors of sensors or actuators provoke an error of the associated safety module. They can be detected via the safety application and acknowledged by the associated reset inputs of the modules (e.g. the FSoE master). During that time, the Safety PLC will retain its safe functional state.

PowerCycle

After removing the cause of an error, reset the Safety PLC by performing a PowerCycle at the head module (power off/on).

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

6.8.2 Servicing

The Safety PLC module needs neither servicing nor any other actions. No spare parts are available.

During operation and storage, the Safety PLC must be protected against contamination, outside the usual contamination occurring in the defined ambient conditions. If the module has been exposed to unauthorized contamination, it must not be used, cleaned or further operated.

⚠ DANGER	**Unsafe and undefined machine state!**
	Risk of injury!
	► You are not allowed to operate an inadmissibly contaminated module.
	► Cleaning the unit is not allowed.

6.9 Replacing a Safety PLC

⚠ CAUTION	**Unsafe and undefined machine state!**
	Risk of injury!
	► Before replacing a Safety PLC module, turn off the power supply of the Safety PLC and the modules connected to it.
	► After replacing a Safety PLC module and before restarting the machine or system, verify that the associated safety function is provided properly.

6.9.1 Replacement procedure

Preparation

• Verify that the new module meets the following requirements.

  → Same device type

  → Same or higher version, see section „5.1 Marking and identification".

• Enable the safe system or machine state.

• Turn off the power supply to the head module and the modules connected to it.

Remove the old module

• Split up the line of KEB-I/O EtherCAT, as necessary: press the unlock button of the adjacent module and push the two modules about 1 cm apart (refer to the instructions of the other module).

• Push the module up and against the metal spring located on the underside of the rail guide (see „6.1.6 To take down a single module").

• Tip the module forward and away from the rail.

• Pull the module down and out of the mounting rail.

Install and program the new module

• Place the new module at the position in the line of module previously occupied by the old module (see section „6.1.3 To snap on a single module").

• Load the validated new safety application.

Restart

• Verify that the machine or system is in a safe state and that there is nothing and nobody in the danger zone.

• Switch the supply voltage on again.

• After replacing the safety module, repeat the initial startup procedure (see „6.3 Putting into service").

• Check all safety functions after replacing a module.

6.10 Lifetime

The Safety PLC modules have a design life of max. 20 years after the date of manufacture (see section „5.1 Marking and identification").

6.10.1 Repairs / Customer Service

You are not allowed to open a Safety PLC module or to attempt any other repairs. If you do, proper operation of the Safety PLC module is no longer warranted.

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

6.10.2 Warranty

The statutory period and conditions of warranty apply. Warranty expires if unauthorised attempts are made to repair the unit / product or any other intervention is performed.

6.10.3 Taking out of Service

The manufacturer of the machine or system specifies the procedure of taking the product out of service. The process must fully comply with the specified procedure.

- Verify that used modules taken out of service are provided for further use as intended.
- Comply with the storage and transport requirements specified in the Technical Data section.

6.10.4 Disposal

- Dispose of the safety system in conformity with the applicable environmental regulations and make sure that the modules are 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 of the CODESYS safety libraries and the blocks can be found in the installation directory after the installation of the Safety Package.

e.g. C:\Program Files (x86)\KEB\COMBIVIS_6\6.7.0.403\CODESYS\Documentation\en

7.2 Kendrion Kuhnke Safety Library and its function blocks

To log in to an S-PLC, the CODESYS programming system checks the validity of all FB names during the login process. The FB names are determined from the programming logic of the security programme. If these are not reported as valid by the S-PLC, the login process is aborted with an error message. A safety-related program for an S-PLC can therefore only be executed on the S-PLC or saved as a boot application if all called FBs have been recognised as valid by the S-PLC beforehand.

Calling an FB unknown to the S_PLC is therefore not possible.

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

7.2.1 Support of Additional Function Blocks – 210Bh

Name	Value
Name	Additional Function Blocks
Index	210Bh
No. of Elements	0
Access	Read only
PDO Mapping	No
Value	"1" FB's are supported, "0" FB's are not supported
Table 3: Support of Additional Function Blocks - 210Bh	

7.2.2 Library KICS_Safety-Libary

Name	Version	Safety CRC
SF01_ECM	1.0.0.0	16#0ECB_B7D4
SF01_Scale_Verify	1.0.0.0	16#823B_C19E
Table 4: Library KICS_Safety-Libary		

To be read in the project, example SF01_ECM:
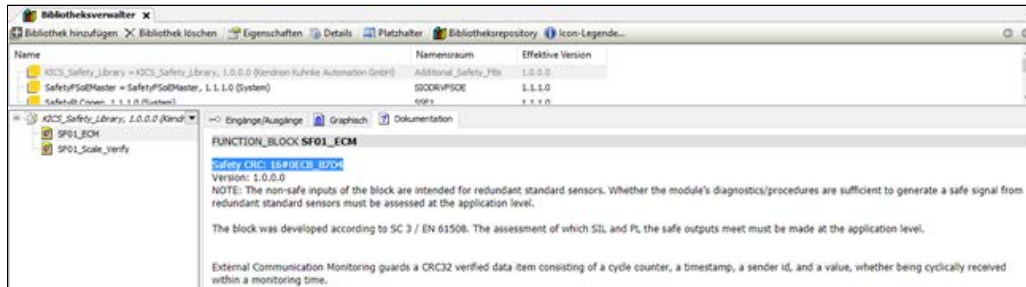
Figure 15:   To be read in the project, example SF01_ECM

Or in the directly opened library, example SF01_Scale_Verify:
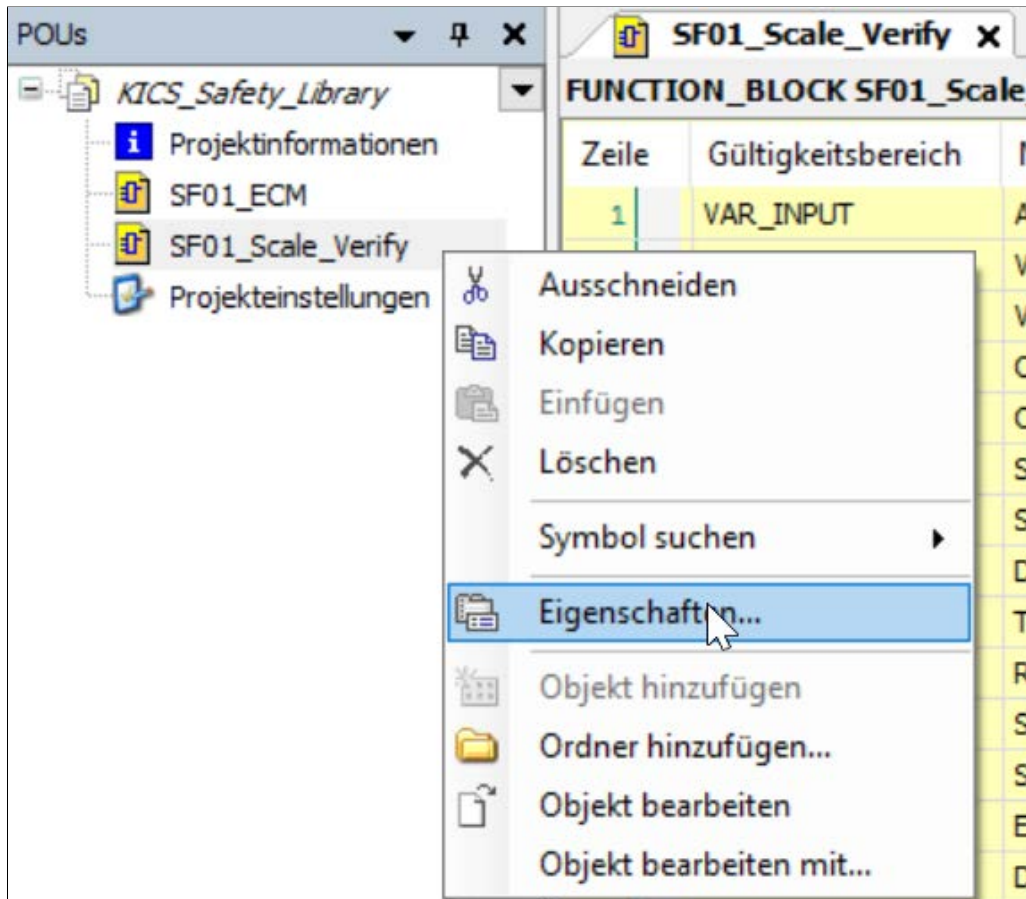
Figure 16:   Opened library, example SF01_Scale_Verify

Characteristics - SF01_Scale_Verify
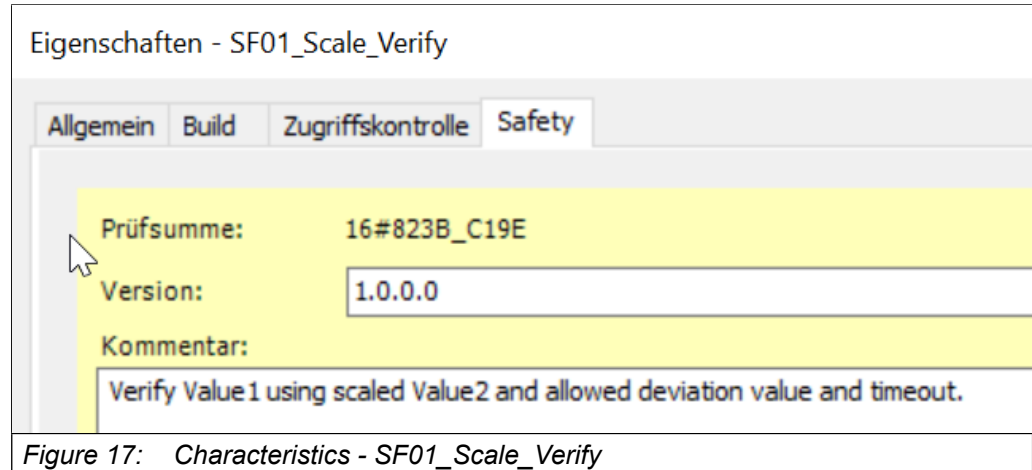
Figure 17:   Characteristics - SF01_Scale_Verify

7.3 SF01_ECM - External Communication Monitoring

This FB monitors the communication with another system (Profinet, Ethernet, RS485 etc.).

It can be checked whether communication is still taking place (timeout) or whether a communicated data value (DINT) is correct in terms of content.

Example 1 – Timeout

A communication between the PLC and a PROFINET master shall be safely monitored. If the telegram fails for a certain time or its content is no longer plausible, an emergency stop can be triggered.

Example 2 - Monitoring of a position

An external master sends a position (DINT) to the PLC via UDP.

This position shall be monitored safely and an STO shall be triggered when a value is exceeded.

The data structure contains the elements shown in the table.

No.,	Element of the data structure
1	Incremented telegram counter
2	Time stamp in milliseconds
3	ID for the data channel
4	PDO (data value) Type: DINT
5	CRC 32
Table 5:	*Elements of the data structure to be transferred*

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

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

> ℹ This is the same polynomial as in CRC.c in the SafetyManager and can be cal-culated using tables. This allows a quick generation of the CRC value.
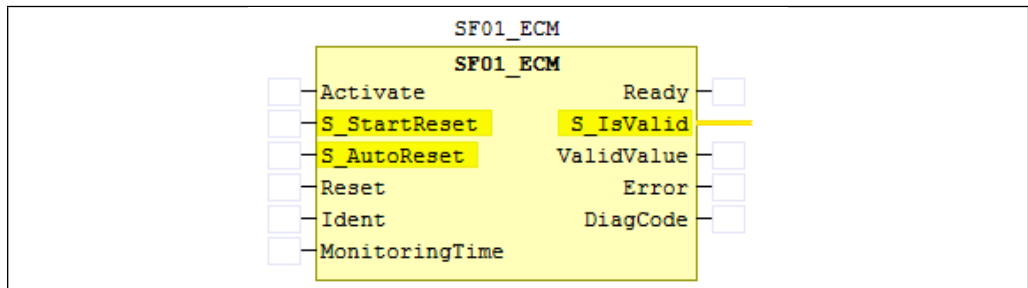
Figure 18: SF01_ECM

The SF01_ECM module receives the input data via an exchange device, which is direct-ly attached to the ECM (EtherCAT master).
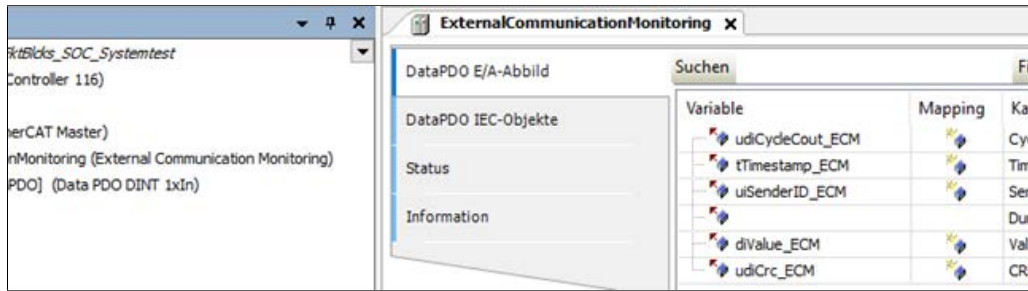
Figure 19: ECM device in CODESYSW environment

The data are made available via the Data PDO in the SPLC.
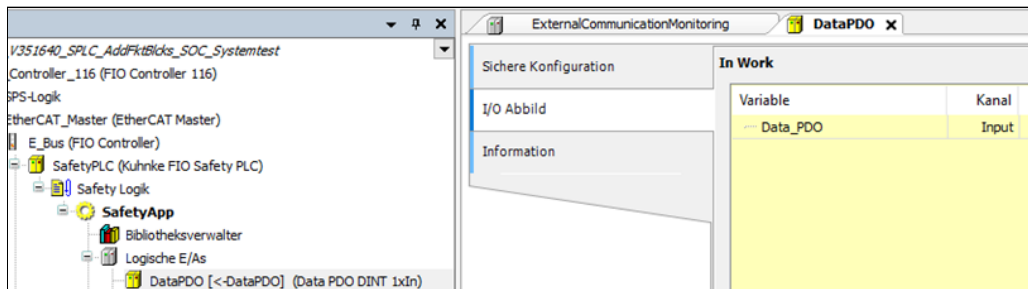
Figure 20: Logical I/O in SPLC linked with SF01_ECM

The data packets received by 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 non-safety area is monitored in the safe control.
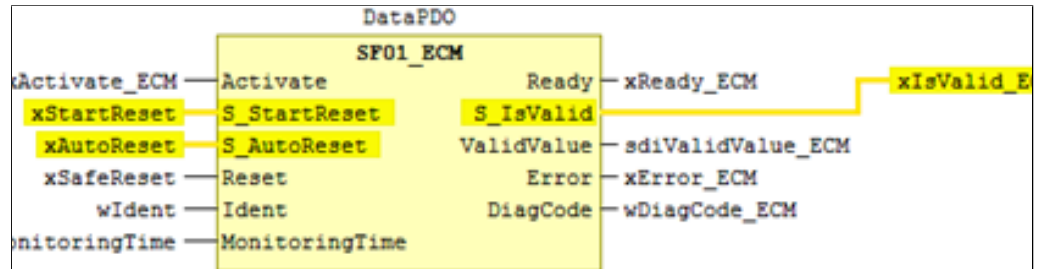
Figure 21: SF01_ECM FB in SPLC POU

7.3.1 VAR INPUT

Name	Data type	Initial value	Description
Activate	BOOL	FALSE	General activation of the module
S_StartReset	SAFEBOOL	TRUE	Automatic reset of the monitoring when starting the system.
S_AutoReset	SAFEBOOL	FALSE	Automatic reset of the monitoring in the running system.
Reset	BOOL	FALSE	Manual reset of the monitoring
Ident	DINT	0	Unique identification of the communication link
Monitoring Time	TIME	T#0ms	Timeout Time for monitoring
Table 6:	*Input parameter SF01_ECM*		

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

7.3.2 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
Table 7:	*Output parameter SF01_ECM*		

7.3.3 State diagram
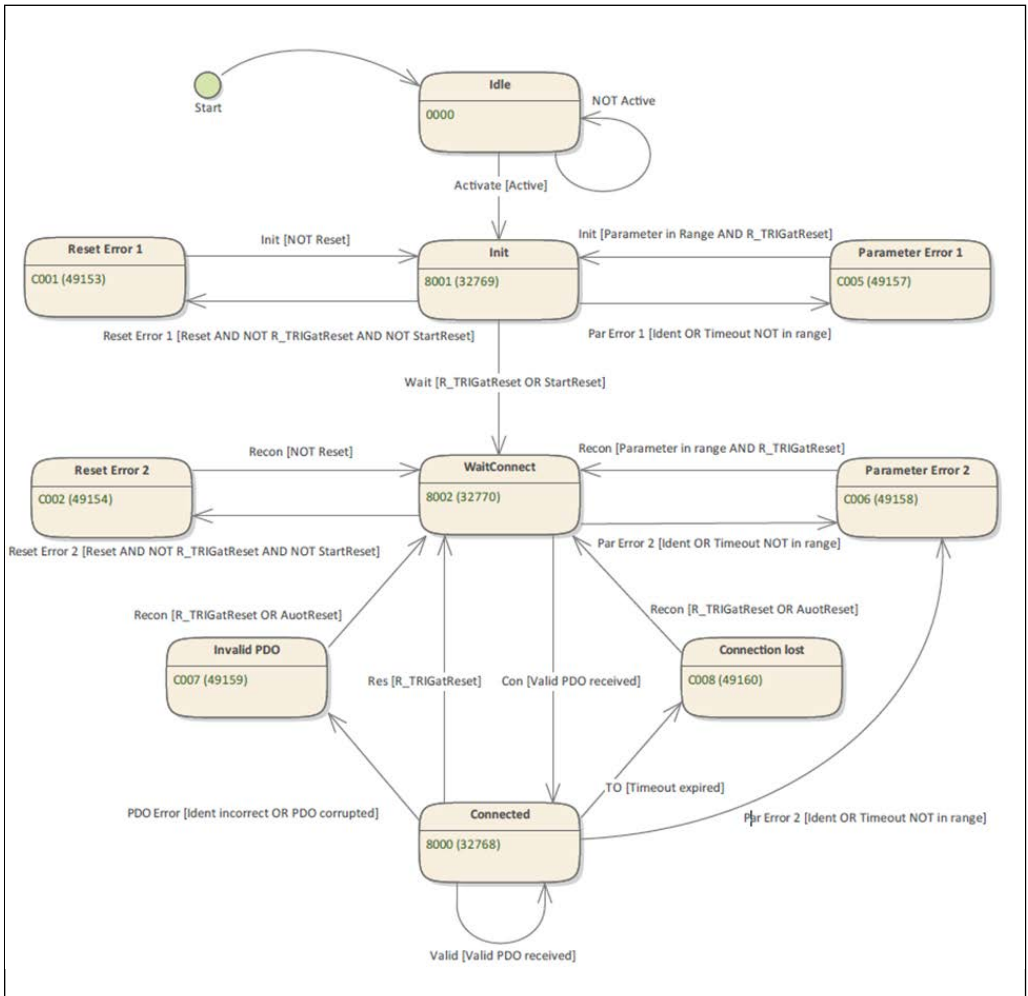
Figure 22: State diagram

> ℹ The state transition from any state to the Idle state due to the "NOT Active" condition is not shown for the sake of clarity.

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7.3.4 Diagnostic codes

DiagCode	Status name	Status description and setting of the output
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 lock is active. Activate := TRUE Ready := TRUE Error := FALSE S_IsValid := FALSE ValidValue := 0x0000
16#8002	WaitConnect	FB waits 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 state in the Init phase. Ready:= TRUE Error := TRUE IsValid := FALSE ValidValue := 0x0000
16#C002	Reset Error 2	Reset state 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
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
Table 8:	*Diagnostic codes*	

7.4 SF01_Scale_Verify

This FB verifies a grey measured value (DINT) by comparing it with a second grey measured value. For this, both measured values must be from 2 different signal sources and communicate by 2 different communication paths.

If both values outside the time in Timeout differ 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. This is shown in the table for the output parameters.
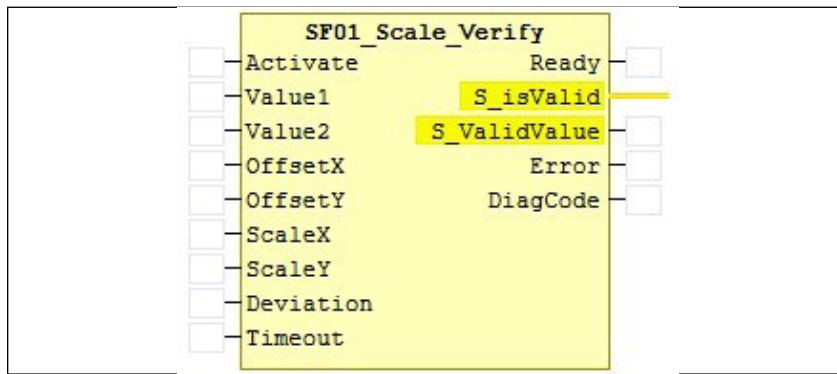
Figure 23: SF01_Scale_Verity

> The input values Value 1 and Value 2 are not SAFEDINT types, since these come from single-channel sources and the measured values are therefore not verified. The module ensures proper verification and provides a safe measured value of the type SAFEDINT at the output for further processing. The module itself is executed on a two-channel safety PLC.

7.4.1 VAR INPUT

Name	Data type	Initial value	Description
Activate	BOOL	FALSE	General activation of the module
Value 1	DINT	0	Measured value 1 to be verified
Value 2	DINT	0	Measured value 2 to be scaled and used for verification
Offset x	DINT	0	Counter of the offset for scaling
Offset y	DINT	1	Denominator of the offset for scaling
Scale x	DINT	1	Counter 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 values 1 and 2 may differ

Table 9:   Input parameter SF01_Scale_Verify

7.4.2 VAR OUTPUT

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

Table 10:   Output parameter SF01_Scale_Verify

7.4.3 State diagram
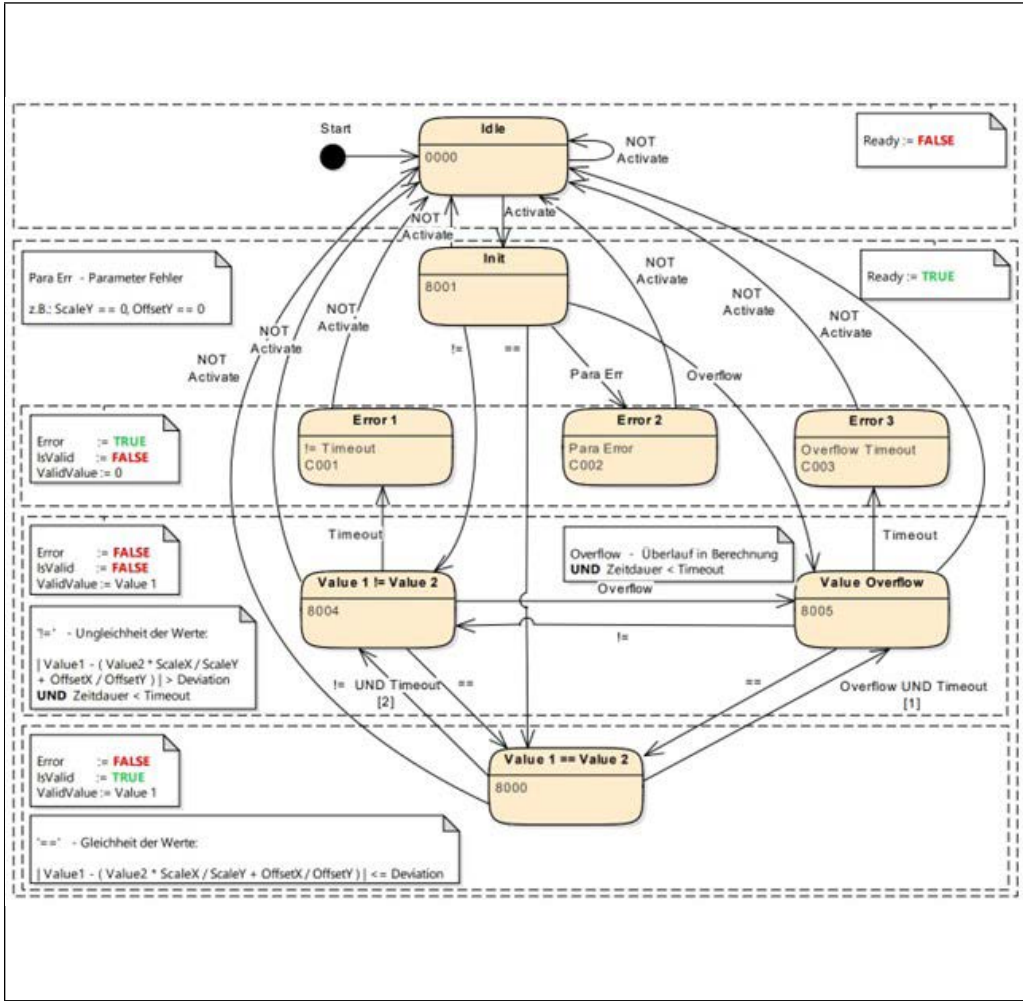
Figure 24:   State diagram

7.4.4 Diagnostic codes

DiagCode	Status name	Status description and setting of the output
16#0000	Idle	The module is not active (default state) Activate := FALSE Ready := FALSE
16#8001	Init	Module activation Start-up lock is active.Activate 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 difference (difference of measured value 1 and 2 <= deviation) within time monitoring (<Timeout) Error := FALSE IsValid := FALSE S_ValidValue := Value1
16#8005	Value Overflow	Value overflow Permissible overflow of measured value 2 within the time monitoring (<Timeout) Error := FALSE IsValid := FALSE S_ValidValue := Value1
16#C001	Error1 - Timeout	Time monitoring with 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 overflow of measured value 2 expired. Error := TRUE IsValid := FALSE S_ValidValue := 0
Table 11:	*Diagnostic codes*	

8 Annex

8.1 Safety-related ratings of the Safety PLC

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

Name	Value at 55°C ambient temperature
Highest safety integrity level to EN 62061:2010	SIL3
Highest safety integrity level to IEC 61508:2010	SIL3
Highest 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)
Probability of failure on demand PFDavg, proof test interval 20 years, (IEC 61508:2010)	$3{,}0 * 10^{-5}$ (3 % of entire PFDavg of 10^{-3} at SIL3)
Probability of failure on demand PFH, proof test interval 20 years, (IEC 61508:2010)	$3.6 * 10^{-10}$ 1/h (< 1 % of entire PFHd of 10^{-7} at SIL3)
DC (diagnostic coverage) to EN ISO 13849-1:2015	97,0 %
Safe failure fraction SFF	98,5 %
$MTTF_D$ to EN ISO 13849-1:2015	221[a]

Table 12:   Safety-related ratings of the Safety PLC

8.2 Safety-related ratings of the Safety function blocks

Name	Value
Maximum performance level according to EN ISO 13849-1:2015	PL d

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

The block was developed in accordance with SC 3 / EN 61508. The evaluation of SIL and PL fulfilled by the safety outputs must occur at the application level.

8.3 Communication objects

8.3.1 Device Type 1000h

Name	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

8.3.1.1 Error Register 1001h

Name	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 analysis to CANopen DS301:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x80	0x40	0x20	0x10	0x08	0x04	0x02	0x01
n.i.*	n.i.*	n.i.*	n.i.*	Temperature error	Voltage error	n.i.*	other errors
* not used							

8.3.2 Device Name 1008h

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

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

8.3.3 Hardware Version 1009h

Name	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	set
Default Value	$12E3030_h$ (1.00)

8.3.4 Software Version 100Ah

Name	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	set
Default Value	1.2.0

8.3.5 CANopen, Restore default parameters' obj. 1011h

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

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

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

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

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

Name	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

Name	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

8.3.6 Identity Object 1018h

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

Name	Value
Name	Number of entries
Subindex	00$_h$
Data type	UNSIGNED8

Name	Value
Access	Read only
PDO Mapping	No
Default Value	4

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

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

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

Name	Value
Name	Serial number
Subindex	04$_h$
Data type	UNSIGNED32
Access	Read only
PDO Mapping	No
Units	yyyyyy mmmm ddddd nnnnnnnnnnnnnnnnn 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.

8.3.7 Error Settings (not used) 10F1h

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

Sync Manager Type (not used) $1C00_h$

8.3.8 Sync Manager Type (not used) 1C00h

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

SM out par (not used) $1C32_h$

8.3.9 SM out par (not used) 1C32h

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

8.3.10 SM out par (not used) 1C33h

Name	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] 2000h

Name	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] 2002h

Name	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

Name	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] 2006h

Name	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

Name	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 following table shows the meaning of the entry in object 2007_h "Err.code":

ID	hex	Meaning
0	0x0000	OK: 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

ID	hex	Meaning
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 Hardware test 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 signal check 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 occured.
516	0x0204	PRG_CNTRL_ERR: Program sequence control detected error.
517	0x0205	"Soft-Error" detected Software error detected
528	0x0210	INIT_ERROR: Initialization error Initialization error
592	0x0250	ASSERT_TRUE_ERR: Assertion for expression yields "true" failed.
593	0x0251	ASSERT_NOT_NULL_ERR: Assertion for unequal to NULL failed.
594	0x0252	ASSERT_GE_ERR: Assertion for ">=" comparision failed.
595	0x0253	ASSERT_GT_ERR: Assertion for ">" comparision failed.
596	0x0254	ASSERT_LE_ERR: Assertion for "<=" comparision failed.
597	0x0255	ASSERT_LT_ERR: Assertion for "<" comparision failed.
598	0x0256	ASSERT_NE_ERR: Assertion for "<>" comparision failed.
599	0x0257	ASSERT_EQ_ERR: Assertion for "=" comparision failed.
600	0x0258	ASSERT_FALSE_ERR: Assertion for expression yields "false" failed.
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
672	0x02A0	MRAM is not initialized MRAM is not initialized
673	0x02A1	MRAM_READ_ERR: MRAM Read error.
676	0x02A4	MRAM_CORRUPT_PAGE_SIZE: MRAM page size invalid.
677	0x02A5	MRAM_CRC_ERR: MRAM data CRC check failed.
688	0x02B0	LZS logging is not initialized yet.
689	0x02B1	LZS logging is initialized now.

ID	hex	Meaning
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 canceled due to timeout.
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 on or down.
773	0x0305	RESET_NMI: Reset due to non maskable interrupt.
774	0x0306	RESET_BROWNOUT: Reset due to brown out detection.
775	0x0307	RESET_NO_REASON: Reset due to unkown reason. Reset due to unkown 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.
1026	0x0402	ADC_24V_LOW: 24 V supply voltage too low (< 24V - 10%). (ErrReg: 4) Lower limit of the 24V load supply has been fallen below
1027	0x0403	ADC_24V_HIGH: 24 V supply voltage too high (> 24V + 15%). (ErrReg: 4) Obere Grenze der 24V-Last-Versorgung wurde überschritten
1028	0x0404	ADC_5V_LOW: 5 V supply voltage too low. (ErrReg: 4) Lower limit of the internal 5V supply has been fallen below
1029	0x0405	ADC_5V_HIGH: 5 V supply voltage too high. (ErrReg: 4) Upper limit of the internal 5V supply has been exceeded
1030	0x0406	ADC_3_3V_LOW: 3,3 V supply voltage too low. Limit of the internal 3.3V supply has been fallen below
1031	0x0407	ADC_3_3V_HIGH: 3.3 V supply voltage too high. Upper limit of the internal 3.3V supply has been exceeded
1032	0x0408	ADC_TEMP_LOW: Onchip temperature too low. (ErrReg: 8) Onchip temperature too low
1033	0x0409	ADC_TEMP_HIGH: Onchip temperature too high. (ErrReg: 8)
1034	0x040A	ADC_CURR_HIGH: Total output current too high. (ErrReg: 2)

ID	hex	Meaning
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 Sync line level monitoring timeout from base board
1282	0x0502	TIMEOUTTIMERERR: Timeout occured
1283	0x0503	DIPSWITCHREADERR: DIP switch could not be read
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
2049	0x0801	BCOM_BUSY: Communication with base board is busy
2050	0x0802	BCOM_NONEWDATA: No new data received from base board Communication with base board - no new data received
2051	0x0803	BCOM_CRCERR: Communication to base board detected a CRC error
2052	0x0804	BCOM_BITERR: Shifted bits detected Communication with base board – shifted bits detected
2304	0x0900	XCOM_NOTREADY: Communication to safety partner MC not ready / operational
2305	0x0901	XCOM_BUSY: Communication to safety partner MC is busy
2306	0x0902	XCOM_NONEWDATA: Communication with safety partner MC – no new data received
2307	0x0903	XCOM_CRCERR: Communication to safety partner detected a CRC error
2336	0x0920	3S RTS background communication to safety partner MC not read operational 3S RTS background communication to safety partner MC not read operational
2337	0x0921	3S RTS background communication to safety partner is busy 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 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 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 3S RTS background communication to safety partner detected a queue error

ID	hex	Meaning
2352	0x0930	3S RTS VM communication to safety partner MC not read operational
		3S RTS VM communication to safety partner MC not read operational
2353	0x0931	3S RTS VM communication to safety partner is busy
		3S RTS VM communication to safety partner is busy
2354	0x0932	3S RTS VM communication has not received new data from safety partner MC
		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
		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
		FSoE Master finished initialization
2799	0x0BA1	FSoE Master is shutting down
		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 Timeout writing to FLASH
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 programmer the FLAH memory failed

8.4.6 MC 1: Error line 2008h

Name	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 line 2009h

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

The following table shows the meaning of the entry in object 2009h "Err.module":

ID	hex	Meaning
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 modul
30	0x1E	OBJ_BGCOM_ID Error from module: CBGCom modul
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
72	0x48	OBJ_DIAGNOSTIC_ID Error from module: CDiagnostic.cpp
74	0x50	OBJ_FSOEMASTER_ID Error from module: CHAL_FSoEMaster_Template.cpp

ID	hex	Meaning
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 200Ah

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

The following table shows the meaning of the entry in object 200Ah „Err.class":

ID	Meaning
0	No Error

ID	Meaning
1	Serious or synchronization error
2	Internal communication error
3	I/O error
4	Error in TestHandler

8.4.9 MC 1: System uptime [s] 200Ch

Name	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) 200Dh

Name	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

8.4.11 MC 3: 3.3 V Supply Voltage [mV] 2013Dh

Name	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 2016h

Name	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 or >55°C = 1
Default Value	No default Value

8.4.13 MC 1: LZS componentId 2017h

Name	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 fileId 2018h

Name	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

Name	Value
Name	MC 1: LZS line
Index	2019$_h$

Name	Value
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 201Ah

Name	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
Default Value	No default Value

8.4.17 MC 1: Read number of file system test cycles 201Bh

Name	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 201Ch

Name	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 210Ah

Name	Value
Name	SW Build No
Index	$210A_h$
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	Read
PDO Mapping	No
Default Value	No default Value

8.4.20 Read MC 3 error 2210h

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

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

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

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

Name	Value
Name	MC 3: Error module
Subindex	03_h
Data type	UNSIGNED8
Access	Read only
PDO Mapping	No

8.4.21 Read MC 1 runtimes 2220h

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

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

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

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

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

Name	Value
Name	Application runtime [µs] (name in the XML file: App RT)
Subindex	04$_h$
Data type	UNSIGNED16
Access	Read only

Name	Value
PDO Mapping	No

Name	Value
Name	Application CORA time [µs] (name in the XML file: CORA RT)
Subindex	06_h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Name	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 2221h

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

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

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

Name	Value
Name	Maximum of main loop runtime [µs] (name in the XML file: Max RT)
Subindex	02_h

Name	Value
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

8.4.23 Free disk space / app size information 2230h

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

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

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

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

Name	Value
Name	Actual application code size [Byte] (name in the XML file: App Code)
Subindex	03h
Data type	UNSIGNED16
Access	Read only
PDO Mapping	No

Name	Value
Name	Actual application data size [Byte] (name 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) 5001h

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

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

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

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

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

Name	Value
Name	Id bits 64...95 (name 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) 5003h

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

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

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

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

Name	Value
Name	Id bits 32...63
Subindex	03$_h$
Data type	UNSIGNED16
Access	Read only

Name	Value
PDO Mapping	No

Name	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 configuring.

Object	Explanation/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 für 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$_h$	Creates the ‚device stamp'

9 Guidelines and explanations

9.1 Mark of conformity

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.

EU KONFORMITÄTSERKLÄRUNG **KEB**

Dokument-Nr. / Monat.Jahr: ce_ca_rsafety-C6E-SafePLC-IO-c_de.docx / 10.2022

Hersteller: KEB Automation KG
Südstraße 38
32683 BARNTRUP

Produktbezeichnung: Steuerung Modellreihe   yyC6CEx – xxxx
Type   yy = 00
x = beliebige Ziffer oder Buchstabe
Spannungsklasse   24V dc

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinien überein:

Number: **Machine: 2006 / 42 / EU**
Text: Directive on machinery.
Nummer: **EMV : 2014 / 30 / EU**
Text: Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedsstaaten über die elektromagnetische Verträglichkeit.
Number: **Gefährliche Substanzen: 2011 / 65 / EU (inkl. 2015 / 863 / EU)**
Text: Richtlinie des Rates zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten.

Weitere Angaben zur Einhaltung dieser Richtlinien enthält der Anhang.

Anbringung der CE-Kennzeichnung: Ja

Aussteller: KEB Automation KG
Südstraße 38
32683 BARNTRUP

Ort, Datum   Barntrup, 12.10.2022
Rechtsverbindliche Unterschrift:

I. A. W. Hovestadt / Normenbeauftragter   W. Wiele / Technischer Leiter

Die Anhänge sind Bestandteil dieser Erklärung.
Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften.

Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

KEB Automation KG,   Südstr. 38,   D-32683 Barntrup   www.keb.de   E-Mail: info@keb.de   Tel.: +49 5263 401-0   Fax: -116   Seite 1 von 3

9.2 Mark of conformity

EU KONFORMITÄTSERKLÄRUNG   **KEB**

ANHANG 1

Dokument-Nr. / Monat.Jahr:	ce_ca_rsafety-C6E-SafePLC-IO-c_de.docx / 10.2022

Produktbezeichnung:	Steuerung Modellreihe Type	yyC6CEx – xxxx yy = 00 x = beliebige Ziffer oder Buchstabe
	Spannungsklasse	24V dc

Die Übereinstimmung des bezeichneten Produktes mit den Vorschriften der oben genannten Richtlinien wird nachgewiesen durch die vollständige Einhaltung der folgend Anforderungen und angegebenen Normen.

2005 / 42 / EG Maschinen-Richtlinie
Artikel 2,   Definition Begriffe: c) Sicherheitsbauteil
Anhang V Sicherheitsbauteile: 4. Logikeinheit zur Gewährleistung der Sicherheitsfunktionen

Berücksichtigte harmonisierte Europäische Normen:

EN - Norm	Text	Referenz	Ausgabe
EN 61131 – 2 Ausgabe 2007	Speicherprogrammierbare Steuerungen – Teil 2: Betriebsmittelanforderungen und Prüfungen	VDE 04110-500	04 / 2008
EN 61508-1 bis -7 Ausgabe 2010	Funktionale Sicherheit sicherheitsbezogener elektrischer, elektronischer und programmierbarer elektronischer Steuerungssysteme	VDE 0803 – 1 bis – 7	2011
EN ISO 13849-1 Ausgabe 2015	Sicherheit von Maschinen – Sicherheitsbezogene Teile von Steuerungen	DIN EN 13849-1	12 / 2015
EN 62061 Ausgabe 2005 + Berichtigungen	Sicherheit von Maschinen – Funktionale Sicherheit sicherheitsbezogener elektrischer, elektronischer und programmierbarer elektronischer Steuerungssysteme	VDE 0113 - 50	Verschiedene ab 2005

Die Konformität der gegenüber den Anforderungen der obigen Normen wurde bescheinigt durch:

Notifizierte Stelle: Anschrift :	TÜV – Rheinland Industrie Service GmbH Zertifizierungsstelle für Maschinen (NB Nr. 0035) Alboinstrasse 56 12103 Berlin

Safe PLC:
Nummer der EG Baumusterbescheinigung	01/205/5600.01/22
Ausstelldatum:	29.06.2022
Gültigkeit:	29.06.2027

Safe I/O:
Nummer der EG Baumusterbescheinigung	01/205/5604.01/21
Ausstelldatum:	26.07.2021
Gültigkeit:	26.07.2026

KEB Automation KG, Südstr. 38, D-32683 Barntrup www.keb.de E-Mail: info@keb.de Tel: +49 5263 401-0 Fax: -116 Seite 2 von 3

EU KONFORMITÄTSERKLÄRUNG   KEB

ANHANG 2

Dokument-Nr. / Monat.Jahr:	ce_ca_rsafety-C6E-SafePLC-IO-c_de.docx /	10.2022

Produktbezeichnung:	Steuerung Modellreihe	yyC6CEx – xxxx
	Type	yy = 00
		x = beliebige Ziffer oder Buchstabe
	Spannungsklasse	24V dc

Die Übereinstimmung des bezeichneten Produktes mit den Vorschriften der Richtlinie 2014/30/EU wird nachgewiesen durch die vollständige Einhaltung der nachfolgend angegebenen Normen.

Darin berücksichtigte harmonisierte Europäische Normen:

EN 61000 – 6 – 4 Ausgabe 2020	Fachgrundnorm Funkentstörung: Teil 2 Industriebereich	VDE 0839-6-4	09 / 2020
EN 61000 – 6 – 2 Ausgabe 2019	Fachgrundnorm Störfestigkeit: Teil 2 Industriebereich	VDE 0839-6-2	11 / 2019

Grundlage der Messungen ist die Definition eines typischen Aufbaus in einem Steuerungssystem

Die entsprechenden Aufbau - und Verdrahtungshinweise sind der Betriebsanleitung zu entnehmen!

Die Übereinstimmung des bezeichneten Produktes mit den Vorschriften der Richtlinie 2011/65/EG und der Änderung über 2015/863/EU wird nachgewiesen durch die Qualifikation von Bauteilen und Fertigungsverfahren im Rahmen der durch die ISO 9001 vorgegebene Qualitätssicherung. Die entsprechenden Informationen und Beschreibungen sind dokumentiert und abgelegt.

Das bezeichnete Produkt wurde unter einem umfassenden Qualitätsmanagementsystem entwickelt, hergestellt und geprüft.

Die Konformität des Qualitätsmanagementsystems nach DIN ISO 9001 wurde bescheinigt durch:

Notifizierte Stelle:	TÜV - CERT
Anschrift:	Zertifizierungsstelle des RWTÜV
	Steubenstrasse 53
	D - 45138 Essen

Nummer der Bescheinigung	041 004 500
Ausstelldatum:	20.10.94
Gültig durch Nachprüfung bis:	12.2024

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9.3 TÜV Certificate

EC Type-Examination Certificate

Reg.-Nr./No.: 01/205/5600.01/22

Prüfgegenstand Product tested	KEB I/O Safety PLC, FS-SPS System mit FSoE Master KEB I/O Safety PLC, FS-PLC System with FSoE Master	Zertifikats-Inhaber Certificate holder	KEB Automation KG Südstraße 38 32683 Bemtrup Germany
Typbezeichnung Type designation	00C8CE1-0200		
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 das 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

Notified Body for Machinery, NB 0035

Dipl.-Ing. Jelena Stenzel

www.fs-products.com
www.tuv.com

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Precisely Right.

10 Customer Service / Addresses

Repair work on the Safety PLC module is not allowed. In error case, send the module to the customer service of KEB Automation KG.

10.1 Customer service

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11 Revision history

Version	Date	Description
00	2017-06	Completion of pre-production
01	2017-11	Series version, update of the safety characteristics according to supplementary test 07.2017, certificate supplemented.
02	2023-10	Chapter Safety function blocks and chapter Safety-related characteristic values of the safety function blocks supplemented, certificates updated, various editorial changes.

Notice

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