SCU SERIES

Machine, Drive and Plant Safety

Easy and comfortable integration into the EtherCAT-environment

Safety over EtherCAT®

PROFIsafe

CIP Safety™

SAFETY @ ITS BEST!

Safety technology made easy

Safety applications have the claim to have a safe machine or plant condition ensure all operating conditions. Safety controls and components meet this condition with regard to correct program processing and hardware function. The correct creation of the application program is, however, the basic foundation for ensuring safety in all states of the application.

Safety @ its best! Means not only safety controls and components at the highest level of safety, but also optimal support in the creation, validation and maintenance of the application. Especially in the fieldbus environment, the highest level of transparency and secure connectivity is required. With the safe profile detection and central parameterization of slave devices, BBH SCU series offer an ideal solution for safety tasks in the fieldbus environment. But also the extensive libraries for tested IO and drive monitoring functions optimally support the implementation of the security application. Safety tasks from simple Safe IO processing to complex Safe Drive Monitoring of kinematic movements of several drive groups can be easily and safely implemented with the functionality of BBH SCU series even in networked and complex environments.

SCU MASTER | SAFE CONTROL UNITS | SCU-O-EC/x , SCU 1-EC/x , SCU 2-EC/x | SAFE FSoE MASTER

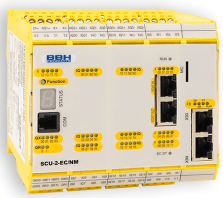

SCU-0-EC


SCU-0-EC/NM


SCU-1-EC


SCU-1-EC/NM


SCU-2-EC


SCU-2-EC/NM

- Suitable up to PL e (EN ISO 13849-1) / SIL3 (IEC 61508)
- Programming and parameterization via SafePLC^2
- Central or decentralized drive monitoring
- Fast-Channel Task = guaranteed reaction time of 4 ms
- Optional: SARC kinematic module for 6/12 axes for spatial speed / position monitoring
- Adaptable to inverter types / manufacturers Profiles for process data exchange
- up to 32 FSoE-Slave devices

SCU - SAFETY CONTROLLER

The ideal solution for any safety task

BBH SCU series offer safe master and slave devices for FSoE communication in EtherCAT environment. With their built-in capabilities, they provide an ideal basis for solving any security task in the EtherCAT environment.

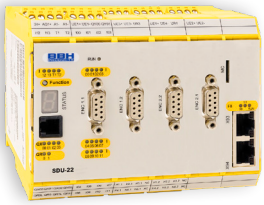
In addition to the standard functions for input, output and logic processing, special functions for time and functionally demanding applications are integrated. Deterministic program runs ensure defined response times. With optionally usable fast-channel processing, very fast reactions are also possible, e.g. to a light curtain. Synchronous sampling, fieldbus communication and processing enable monitoring of sizes from kinematic modules of a drive group such as TCP monitoring, etc. SCU slaves with the option of safe multiple synchronous position detection or a combination of distance encoders and motor feedback transmitted in the standard channel to generate a safe position ideally complement the series for any Safe Drive monitoring task.

SCU SLAVES | SAFE CONTROL UNITS | SDU 11 / 12 / 21 / 22 , SIO-1 /-2 , SSB-x* | SAFE FSoE SLAVES


SDU-11**


SDU-12


SDU-21*


SDU-22*


SIO-1


SIO-2


SSB-x**

- **Logic processing up to PL e (EN ISO 13849-1) and SIL3 (IEC 61508)**
- **Safe detection of speed and position for up to 6 axes**
- **Central or decentralized evaluation of safe speed and position**
- **I/O-Slaves for the decentralized expansion of an FSoE master assembly**

* Available as analog variant

** Different variants, depending on the encoder interface

SafePLC² comfortable programming
SafePMT application-oriented parametrization

The SafePLC² programming interface meets the requirements of a modern programming interface and combines all series of our safety controls. The view can be used to meet the needs of the requirements of the user. A very extensive library of sensors and actuators is available to the user. These can be adapted and extended to the customer‘s requirements.

COMMAND DEVICES, SENSORS AND CONTROL ARCHITECTURE

All common command devices and sensors in safety technology such as pushbuttons, emergency stop, door contacts, two-hand buttons, light curtain, operating mode selectors and limit switches are offered as pre-configured elements via icon. When inserted into the terminal plan, these elements are assigned to the module in the controller architecture rack to which it is physically connected.

ENCODER CONFIGURATION

Depending on the safety category, one or two sensors are required for the safe speed and/or position detection of the individual axes in the composite. For the configuration of the sensor type and the technical data, as well as for the axis-related resolution, a separate menu with various input and calculation aids is offered. The determination of the correct input data is thus possible even without special prior knowledge.

NETWORK PLAN

When using network-based security control, each network type is displayed and diagnosed.

WIRING PLAN

By configuring the safety controls and the sensors & actuators, a wiring plan is automatically created. This can be exported to EPLAN.

FUNCTION PLAN

Function plan-oriented programming with logic elements. The monitoring functions can be linked together by logical operators. Speeds, accelerations, and positions of multiple axes are monitored in relation to each other. The monitoring tasks to be implemented can be distributed and documented very clearly in different pages.

BLOCK FUNCTIONS

Function modules that have already been tested can be transferred from a library or own function modules can be defined, protected and stored for reuse.

MONITORING FUNCTIONS

Powerful functions for motion monitoring such as speed, standstill, area and direction monitoring, or emergency stop, destination and step measurement monitoring are offered for selection. After selection, the functions can be parameterized directly in a context-oriented manner.

SAFE ARITHMETIC FUNCTIONS

The mathematical functions are clearly displayed in the SARC calculation function library. With this, a safe kinematic calculation for multi-axis applications in the SCU safety controllers can be carried out. The Safe Arithmetic Calculation functions are dragged and dropped into the function chart. There they appear as blocks.

SafePMT

With the SafePMT software tool developed from practice, your security professionals can create a customized library of pre-validated security applications for your business. Use unique customizing and choose between parameterizing or free programming for your security solution.

With the SafePMT you can determine which parameters (limit values for standstill monitoring, safely reduced speed, protective grid, etc.) can be changed by commissioning, service personnel or maintenance personnel. For the respective machine type, therefore, only the selection of the safety application from your library has to be made and the changed parameters validated - you already have a standard-compliant safety solution.

Inadmissible manipulations are excluded as well as too high threshold values etc. There is no need to incorporate into programming or into a specific surface. Shortest service times are thus guaranteed and sources of error are eliminated.

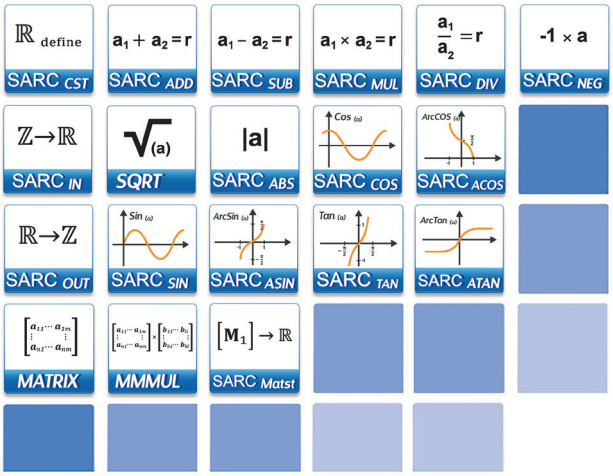


fig.: Safe Arithmetic Calculation Icons

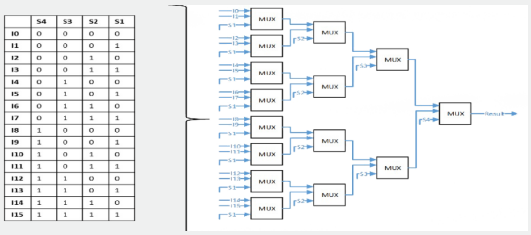
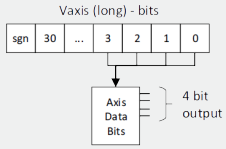
Safe ARithmetic Calculation (SARC)

Secure calculation functions

With the help of the SARC calculation function library, a secure kinematic calculation for multi-axis applications can be performed in the SCU safety control units. For this purpose, input values (safe position/ speed/ analog value, configurable constants etc.) are converted to a „single precision float“ value and normalized in order to be able to continue using them for the SARC. A variety of mathematical functions, in form of blocks, are available for further calculation, which can be linked individually. These links eventually result in a kinematic calculation instruction list that is loaded and executed on the safety controller. The result of the SARC calculation(s) can be converted into a virtual position or speed or a virtual analog value and linked to the existing safety functions. The SARC function library is available in BASIC and ADVANCED variants.

SARC BASIC

	Name.	Function	Calculation rule
SARC CST	SARC-CST	Defintion of a constant	wissenschaftlich = a.b * 10^c > single precision floating point = r
SARC IN	SARC-IN (Load)	Conversion of input data to single precision floating point	Integer a > single precision floating point = r D = Factor of speed, position or analog input a/D=r
SARC OUT	SARC-OUT (ST)	Conversion of single precision floating point value to output data	Float a -> Integer r a * D =r
SARC ADD	SARC-ADD	Addition of two input values	$a_1 + a_2 = r$
SARC SUB	SARC-SUB	Subtraction of two input values	$a_1 - a_2 = r$
SARC MUL	SARC-MUL	Multiplication of two values	$a_1 * a_2 = r$
SARC DIV	SARC-DIV	Division of two values	$a_1 / a_2 = r$
SQRT	SARC-SQRT	Square root of input value	SQRT(a) = r
SARC NEG	SARC-NEG	Multiplication with -1	-1 * a
SARC ABS	SARC-ABS	Absolute value of input value	ABS(a) = r
SARC SIN	SARC-SIN	SIN value of input value (deg)	SIN(a) = r
SARC ASIN	SARC-ASIN	ARC SIN value of input value	ARC SIN(a) = r
SARC COS	SARC-COS	COS value of input value (deg)	COS(a) = r
SARC ACOS	SARC-ACOS	ARC COS value of input value	ARC COS(a) = r
SARC TAN	SARC-TAN	TAN value of input value (deg)	TAN(a) = r
SARC ATAN	SARC-ATAN	ARC TAN value of input value	ARC TAN(a) = r, where r ∈ [−90°,+90°]

SARC ATAN2	SARC-ATAN2	ARC TAN2 value of the input value	ARC TAN2 (y,x) = r, where r ∈ [−180°,+180°]
SARC MUX	SARC-MUX	SARC multiplexer Uses 2 to 16 input values and selects one according to the selector input; Up to 16 SARC values and up to 4 selector inputs (logic)	
SARC SGN	SARC-SGN	Determines the sign of a value; the sign of the input value is returned as +1 or -1	SGN(a)=r
if ... then SARC IF	SARC- IF	Comparison of two input values of virtual axes with „<“; returns a logical value as a result (binary value), is saved in the process image	IF (a < b) THEN k If a < b, then k = 1 If a ≥ b, then k = 0
Virtual Axis 1	Virtual Axis	Saving calculation results in „virtual“ axes	Emulation of standard axes with similar properties, Saving a position and a speed per axis or an analog value; use of up to 32 virtual axes
AxisDataBi...	AxisData-Bits	Use of the content of a virtual axis and provision as logic values (bits) for the PLC logic.	

SARC ADVANCED

MATRIX	MATRIX	Matrix calculation	Creation of a matrix Size up to 6x6
SARC Matst	SARC-MATST	Conversion of the matrix value to „single precision floating point“	Conversion of a matrix entry to individual float value
MMMUL	SARC-MMMUL	Matrix-matrix multiplication	$\begin{bmatrix} a11 & \cdots & a1m \\ \vdots & \ddots & \vdots \\ an1 & \cdots & anm \end{bmatrix} * \begin{bmatrix} b11 & \cdots & bil \\ \vdots & \ddots & \vdots \\ bk1 & \cdots & bkl \end{bmatrix} = \begin{bmatrix} r11 & \cdots & r1l \\ \vdots & \ddots & \vdots \\ rk1 & \cdots & rkl \end{bmatrix}$

APPLICATION EXAMPLES:

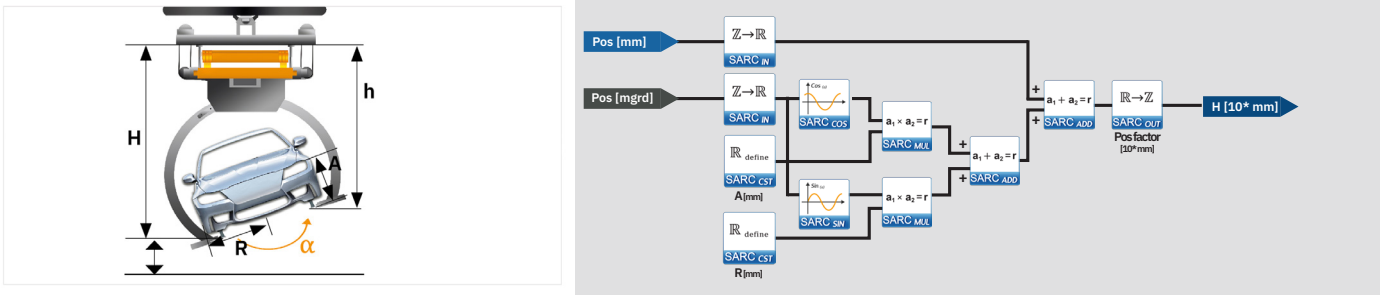


Fig. 1: Speed and position monitoring on 3-axis automatic conveyor systems (EMS)

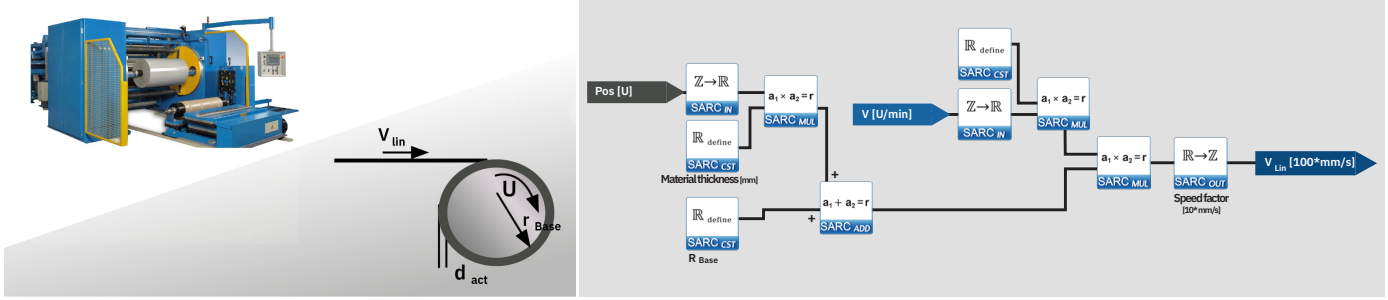


Fig. 2: Monitoring of winding machines

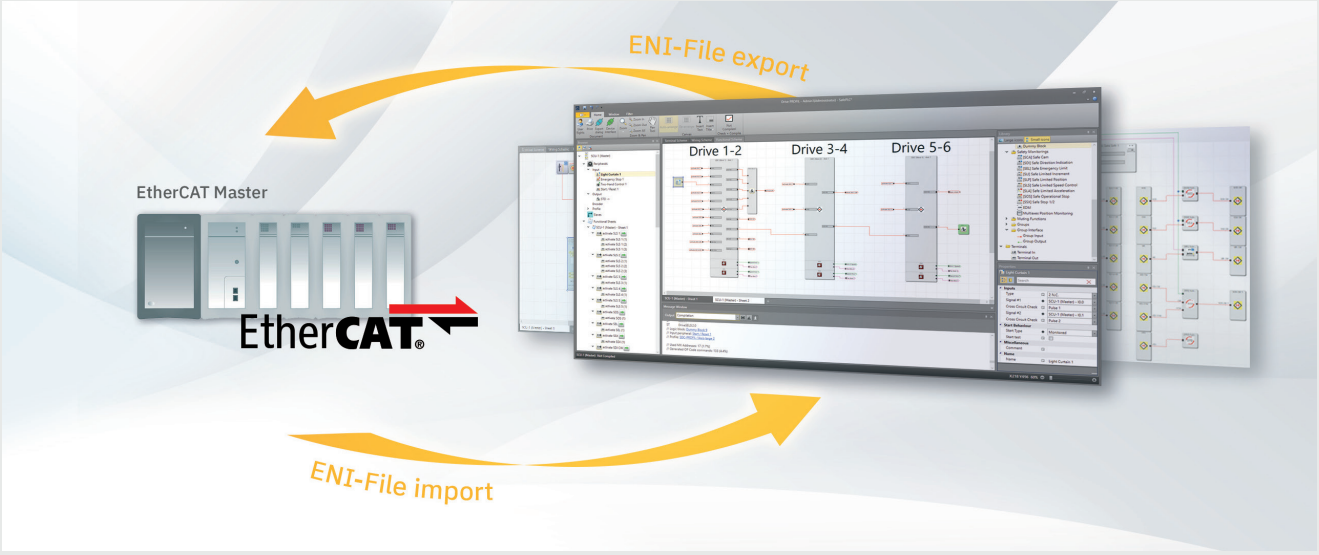
SafePLC² Safe Drive Profile

With the SafePLC² you can create a wide range of drive profiles. This allows the creation of a small (default) and large (complex) profile. A corresponding configuration of the profile allows the use of decentralized, central and cross-axis security functions. The profiles exported from The SafePLC² can be imported with the SafePLC² in the application of the SCU (FSoE-Master).

SafePLC² Export / Import ENI-File

With the exported ENI file, from the EtherCAT master, the SafePLC² can automatically create the necessary shortcuts and configurations in it.

The parameterization with SafePLC² is simple and clear.

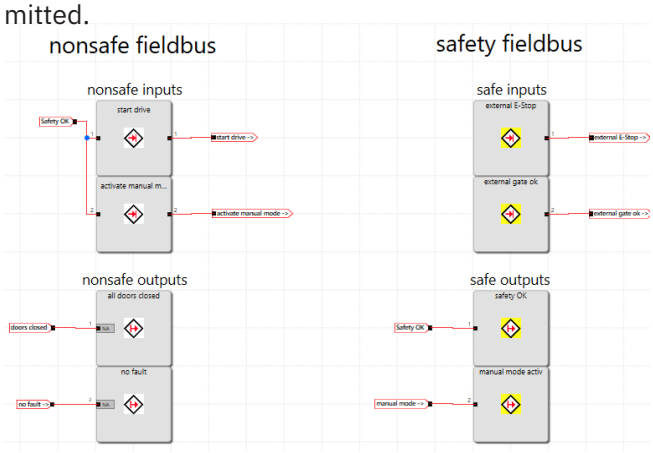


SCU FSoE-Master Communication

The SCU is designed as an FSoE master and has a variety of communication options. With the optional fieldbus interface, connection to a higher-level control system is possible. In addition, secure information can be exchanged between cells using **S**afe **M**aster **M**aster **C**ommunication (SMMC) via the EtherCAT Automation Protocol (EAP).

SAFE AND NO-SAFE FIELDBUS

The various fieldbus logs can be used to safe as well as unsafe inputs and outputs are received and transmitted.



CONFIGURATION

The configuration is simple and clear in the SafePLC². These inputs and outputs are configurable for the permanently integrated EtherCAT interface as well as the optional interface.

FSoE, EtherCAT & CIP Safety

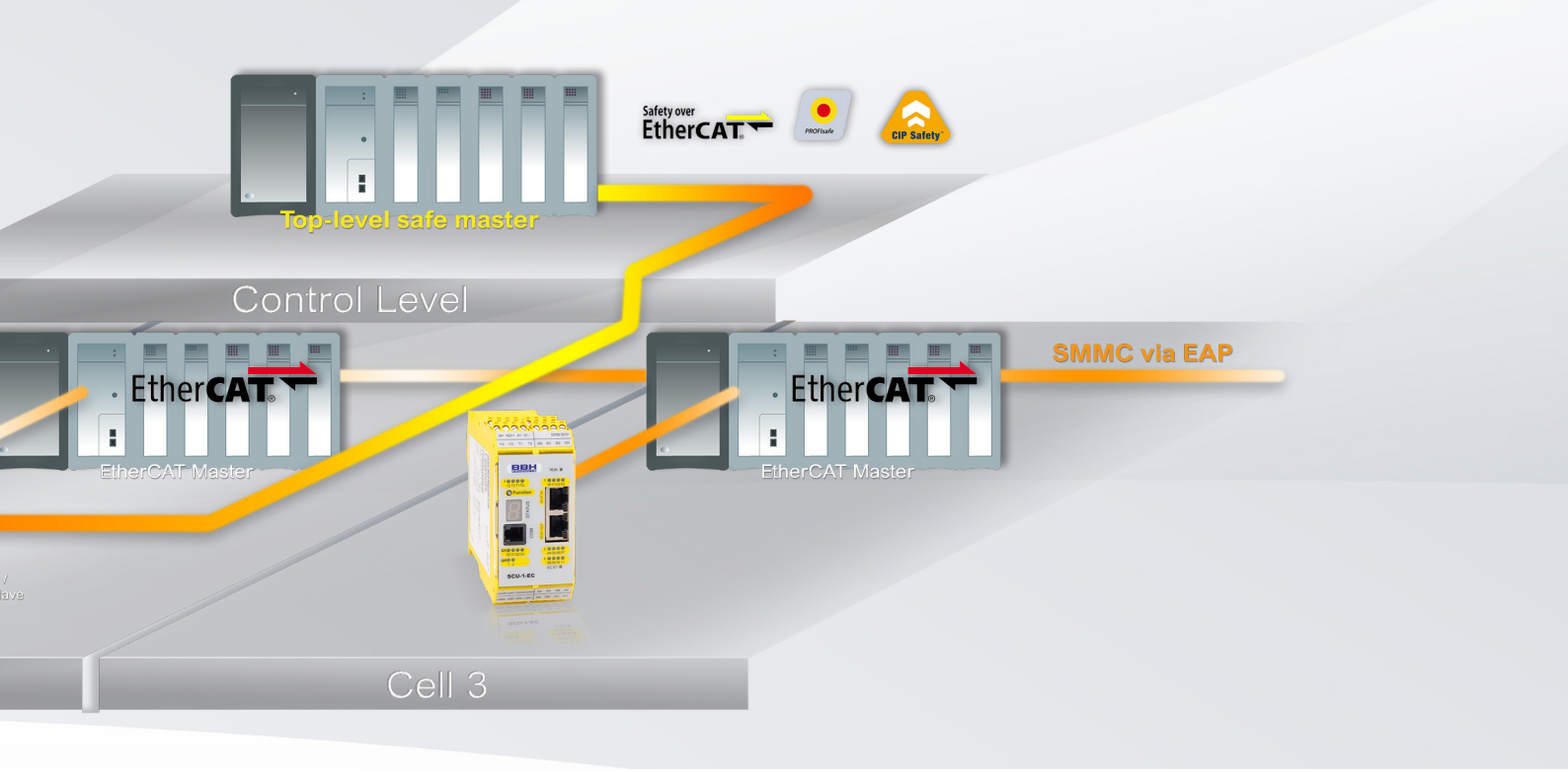
The SCU is designed as an FSoE master and starts the safe transmission via FSoE. In addition, as an EtherCAT slave, it is a participant in the insecure EtherCAT network.

A separate EtherCAT master starts the non-safe transmission via EtherCAT.

Optional safe slave with PROFIsafe, FSoE slave or CIP Safety stack for safe data transmission via EAP.

SMMC

SMMC communication enables the secure data exchange of 2 bytes between multiple SDDC masters. Communication takes place without a master for the coordination of the data. Thus, the exchange of data between available participants is always present. This principle allows an incomplete or disconnected network to operate in its sub-areas without changing the configuration.



SCU FSoE-Master - Fast Channel Processing

The SCU FSoE masters have a significant difference from other safety controls. This difference is particularly due to the deterministic cycle time.

GUARANTEED REACTION TIME

The deterministic cycle time of 16 ms enables guaranteed reaction times. To further underline this advantage, a Fast Channel task for logic processing has been implemented, which ensures a response time of 4 ms.

SCU-0-EC/x , SCU-1-EC/x , SCU-2-EC/x

Safe FSoE-Master in the SCU SERIES

The FSoE-Master modules SCU-0-EC (/NM), SCU-1-EC (/NM) and SCU-2-EC(/NM) are open programmable and configurable safety controller for the EtherCAT environment.

- Suitable up to PL e (EN ISO 13849-1) and SIL3 (IEC 61508)
- Conveniently and transparent programming via SafePLC² in FUP
- Library for all common IO elements (emergency stop, door lock, light curtain, etc.)
- Complete set of drive monitoring for single axes and charged axes
- Optional safe kinematics module (SARC Basic, SARC Advanced)
- Easy integration of safe drives with adaptable Safe Drive Profiles
- Storage of safe parameters in the SCU
- Optional central or decentralized drive monitoring
- Optional FSoE-Slave, PROFIsafe- or CIP Safety-Stack for secure connection to higher-level control systems
- Fast-Channel Task allows a guaranteed response time of 4 ms
- Secure data exchange between multiple SCU-FSoE Masters via EAP
- Up to 32 FSoE-Slave assemblies

Safety over EtherCAT®

CIP Safety™

	SCU-0-EC*	SCU-1-EC*	SCU-2-EC*

Technical data

	FSoE Master	FSoE Master	FSoE Master
Safety Integrity Level	SIL3 / IEC 61508	SIL3 / IEC 61508	SIL3 / IEC 61508
Performance Level	PL e EN ISO 13849-1	PL e EN ISO 13849-1	PL e EN ISO 13849-1
Category	4	4	4
Cycle time PLC	16 ms	16 ms	16 ms
Fast Channel central / SCU	4 ms	4 ms	4 ms
Fast Channel decentralized SSB / standard Slaves	4 ms	4 ms	4 ms
Decentralized axes	32	32	32
Max. Slaves	32	32	32
Safe digital inputs	-	14	14
Safe digital outputs (pn- / pp-switching)	-	2/4	2/4
Safe digital I/O´s	-	-	20
Relays outputs	-	2	2
Outputs	-	-	4
Safe Master	FSoE	FSoE	FSoE
Optional safe Slave *	PROFIsafe / FSoE / CIP Safety	PROFIsafe / FSoE / CIP Safety	PROFIsafe / FSoE / CIP Safety
Non-safe Slave	EtherCAT	EtherCAT	EtherCAT
Dimension (width)	45 mm	45 mm	90 mm

* Optional: integrated communication interface (/NM)

SDU-11 /-12 /-21 /-22

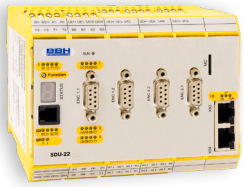
Safe FSoE-Slaves in the SCU SERIES

FSoE slave module for safe speed and position of up to 2 axes for further evaluation in an FSoE master assembly. Depending on the encoder type and combination, applications up to SIL 3 or PL e can be realized

- Logic processing up to PL e (EN ISO 13849-1) und SIL3 (IEC 61508)
- Safe detection of speed and position for up to 2 axes
- Functional plan-oriented programming
- Switchable safe outputs pn-, pp-switching for safety-relevant Functions
- Complete speed and position-related safety features for drive monitoring according to IEC 61800-5-2 integrated into firmware
- Parameter management for extension modules in the base unit
- Extensive diagnostic function integrated
- PXV variants for optoelectronic sensor ** (part of the incident light positioning system)





	SDU-11	SDU-11-PXV	SDU-11/NM	SDU-12	SDU-21 **	SDU-22

Technical data

	FSoE Slave	FSoE Slave	FSoE Slave	FSoE Slave	FSoE Slave	FSoE Slave
Safety Integrity Level	SIL3 / IEC 61508	SIL3 / IEC 61508	SIL3 / IEC 61508	SIL3 / IEC 61508	SIL3 / IEC 61508	SIL3 / IEC 61508
Performance Level	PL e EN ISO 13849-1	PL e EN ISO 13849-1	PL e EN ISO 13849-1	PL e EN ISO 13849-1	PL e EN ISO 13849-1	PL e EN ISO 13849-1
Category	4	4	4	4	4	4
Cycle time PLC	8 ms	8 ms	8 ms	8 ms	8 ms	8 ms
Fast Channel	2 ms	2 ms	2 ms	2 ms	2 ms	2 ms
Axis monitoring	1	1	1	1	2	2
Encoder interface	3 *	1	3*	4 *	5 *	8 *
Safe digital inputs	14	14	14	14	14	14
Safe digital outputs (pn-/pp-switching)	2/4	2/4	2/4	2/4	2/4	2/4
Safe digital I/O`s	-	-	-	-	-	-
Relay outputs	2	2	2	2	2	2
Pulse outputs	2	2	2	2	2	2
Safe Slave	FSoE	FSoE	FSoE/PROFIsafe	FSoE	FSoE	FSoE
Dimension (width)	67,5 mm	90 mm	67,5 mm	90 mm	90 mm	135 mm

* max. 2 encoder per axis
** Available as PXV variant for optical 2D reading head PXV100AS-F200-R4-V19-BBH
» SDU-21 / SDU-22 available with Analog Option

SSB-3-x / SSB-6-x

Safe FSoE-Slaves in the SCU SERIES

FSoE-Slave module for safe speed and position of up to 6 axes for further evaluation in an FSoE master assembly. Depending on the encoder type and combination, applications up to SIL3 or PL e can be realized. With an update time of up to 1 ms, applications with a high dynamic security requirement can also be implemented.

- Suitable for applications up to SIL3 (IEC 61508) / PL e (EN ISO 13849-1)
- Safe detection of speed and position for up to 6 axes
- Parametric interface for digital and analog-digital encoders
- Optional additional safe inputs and outputs
- Time resolution 1 ms for safe data of speed and position, 62,5 µs for non-safe Encoder values

SSB-3-AD-x

SSB-6-EnDAT-x

SSB-6-DSL-x

Technical data

	FSoE Slave	FSoE Slave	FSoE Slave
Safety Integrity Level	SIL3 / IEC 61508	SIL3 / IEC 61508	SIL3 / IEC 61508
Performance Level	PL e EN ISO 13849-1	PL e EN ISO 13849-1	PL e EN ISO 13849-1
Category	4	4	4
Cycle time safe data	1 ms	1 ms	1 ms
Cycle time non-safe data	-	62,5 µs	62,5 µs
Axis monitoring	3	6	6
Encoder interfaces	6	6	6
Encoder technology	Analog / Digital	EnDAT 2.2	Hyperface DSL
safe digital inputs	8 **	8 **	8 **
Safe digital outputs	10 **	10 **	10 **
Safe digital I/O`s	-	-	-
Relays outputs	-	-	-
Outputs	-	-	-
Safe Slave	FSoE	FSoE	FSoE
Dimension (HxDxW)	64x176x170 mm	64x176x170 mm	64x176x170 mm

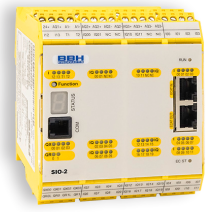
** Optional

SIO-1 / SIO-2

Safe FSoE-Slaves in the SCU SERIES

FSoE IO slave modules for decentralized expansion of an FSoE-Master module.

- Suitable up to PL e (EN ISO 13849-1) and SIL3 (IEC 61508)
- Pulse outputs for cross-wire detection of digital input signals
- External contact monitoring of connected devices (EMU)
- Switchable safe outputs pn-, pp-switching for safety-relevant functions
- Extensive diagnostic functions integrated
- Multifunction button (Quit, Start, Reset), on frontside
- Coded status display via 7-segment display on the front and status LEDs



SIO-1	SIO-2

Technical data

	FSoE IO-Slave	FSoE IO-Slave
Safety Integrity Level	SIL3 / IEC 61508	SIL3 / IEC 61508
Performance Level	PL e EN ISO 13849-1	PL e EN ISO 13849-1
Category	4	4
Cycle time PLC	8 ms	8 ms
Fast Channel	2 ms	2 ms
Axis monitoring	-	-
Encoder interfaces	-	-
Safe digital inputs	14	14
Safe digital outputs (pn-/pp-switching)	2/4	2/4
Safe digital I/O`s	-	20
Relay outputs	2	2
Clock outputs	2	2
Safe Slave	FSoE	FSoE
Dimension (width)	45 mm	90 mm

BBH PRODUCTS

SAFETY@ITS BEST!

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