



## DESCRIPTION

Free programmable and configurable Safety controller with encoder interface

- Interface for up to 6 safe scanner units
- 4 Encoder interfaces for up to 4 axes
- 16 safe digital inputs
- 8 safe digital Outputs
- 2 pulse outputs, 2 relay outputs
- Fast-Channel task for logic processing with a guaranteed response time of 2 ms
- Safety controller up to PL e acc. to EN ISO 13849-1 or SIL3 acc. to IEC 61508
- cULus approval

## CHARACTERISTIC OF THE MODULE

- » Safe logic processing of input, output, status and activation signals
- » Easy and transparent programming and parametrization via SafePLC<sup>2</sup>
- » Fast response time with integrated Fast Channel Task with guaranteed processing time of 2 ms
- » Scanner master functions, activation of monitoring areas and computing of monitoring result status
- » Complete set of Drive monitoring
- » Deterministic data communication and processing for safe position und speed functions via distributed sensor / multiple axes
- » Special AGV functions
- » Storage of safe parameters in the base module
- » Status LEDs for IO
- » Multifunction button (Quit, Start, Reset) front side
- » Integrated Communication interface :
  - field bus interface and PROFI-safe / FSoE-Slave stack for safe connectivity to higher levels of control

## SAFETY RELATED CHARACTERISTIC DATA

Performance Level	PL e (EN ISO 13849-1)
PFH / architecture	PFH = tbd.
Safety Integrity Level	one channel mode: Cat. 3 (EN 13849-1) / SIL2 (IEC61508) two channel mode: Cat. 4 (EN 13849-1) / SIL3 (IEC 61508)
Proof test interval	20 years = max. operation period

## GENERAL DATA

Max. no. of expansion modules	2x Axis or 4x IO
Interface for expansion modules	2x RJ-45 (Ethernet)
Number of safe digital inputs	16
Number of safe digital outputs	
	pp-switching * 8 + 4
	pn-switching * 2
Number of relay outputs	2
Number of safe analog inputs	2
Number of pulse outputs (clock outputs)	2
Number of scanner connections (data interface)	6
Number of encoder interface	4 (8x 6 pins)**
Type of connection	Plug-in terminals with spring connection

\* pn/pp are configurable via SafePLC<sup>2</sup>

\*\* see encoder specifications

## ELECTRICAL DATA

Supply voltage (tolerance)	24 VDC; 2A (-37,5%, +30%)
Fuse (should be provided)	Voltage supply device +24 VDC min. 32 VDC; max. 2A
	Voltage supply I/O +24 VDC min. 32 VDC; max. 10A
Max. Power consumption (logic)	
	SSCU/1/AX 4,7 W
Rated data digital inputs	24 VDC; 20 mA Typ 2 acc. to IEC 61131-2
Rated data digital outputs	24 VDC; 0,5A
	pn-switching 24 VDC; 2A
	pp-switching 24 VDC; 2A
	pulse outputs (clock outputs) 24 VDC; 250mA
Rated data relay outputs	240 VAC; 24 VDC; 2A
Rated data analog inputs	-10..+10 V, 4..20 mA

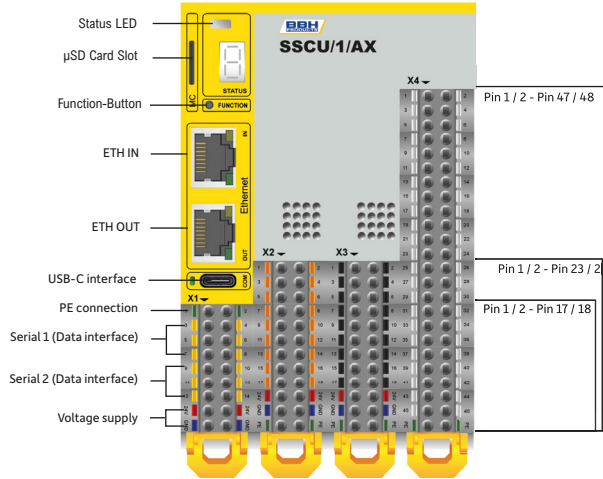
## ENVIRONMENTAL DATA

Temperature	-25°C ... +55°C operation
	-25°C ... +70°C storage and transport
Class of protection	IP 20, connectors IP00 EN 60529
Climatic category	3K24 acc. to DIN EN 60721-3-3
Pollution class	2, EN 60664-1
EMC	DIN EN 61800-3, DIN EN 61800-5-1, DIN EN 62061, DIN EN 62477-1, DIN EN 55011
Shocks	15g/11ms, 10G/16ms and 5G/11ms in all three axes
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27, IEC 60068-2-64
Max. appl. height	≤ 3000m

## MECHANICAL DATA

Dimension (HxDxW [mm])	SSCU/1/AX	124 x 95 x 76
Weight [g]	SSCU/1/AX	413
Mounting		to snap on top-hat rail
Min. terminal cross-section / AWG		0,2 mm <sup>2</sup> / 24
Max. terminal cross-section / AWG		1,5 mm <sup>2</sup> / 16

## DEVICE INTERFACES



Interface	Description of interface
X1 / Serial 1, Serial 2	Data Interface
X2 / I0.0-I0.15	Voltage supply and I/O interfaces
X3 / Q0.0-Q0.7, Q0.8-Q0.11, Q0.1x_Rx, P1-P2	I/O Interface
X4 / ENCx , AINx	Encoder interface
ETH OUT / ETH IN	Fieldbus interfaces
USB-C	Data interface
µSD Card Slot	Data interface

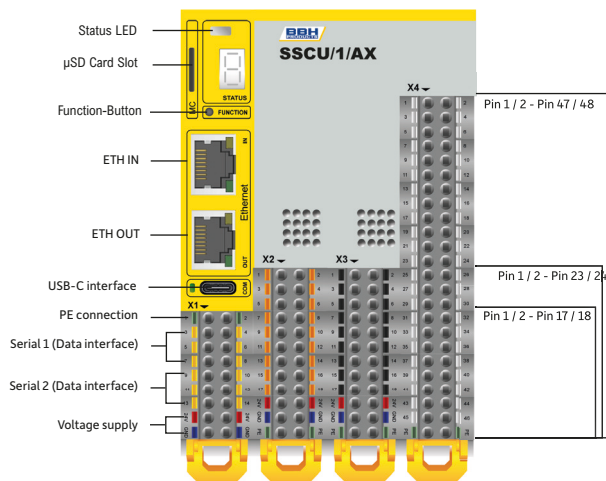
## DATA INTERFACE, VOLTAGE SUPPLY & I/O INTERFACE

### Pin assignment

X1			
Pin	1 – PE	2 – PE	Protective earth
	3 – UART_1+	4 – UART_1-	
	5 – UART_1+	6 – UART_1-	Serial interface 1
	7 – UART_1+	8 – UART_1-	
	9 – UART_2+	10 – UART_2-	Serial interface 2
	11 – UART_2+	12 – UART_2-	
	13 – UART_2+	14 – UART_2-	Voltage supply scanner
	15 – VCC_IN	16 – VCC_OUT	
17 – GND	18 – GND	Voltage supply 0 VDC	

X2				
Pin	1 – NC	2 – NC	Safe digital inputs	
	3 – I0.0	4 – I0.8		
	5 – I0.1	6 – I0.9		
	7 – I0.2	8 – I0.10		
	9 – I0.3	10 – I0.11		
	11 – I0.4	12 – I0.12		
	13 – I0.5	14 – I0.13		
	15 – I0.6	16 – I0.14		
	17 – I0.7	18 – I0.15		
	19 – VCC_IN	20 – VCC_IN		Voltage supply device +24 VDC
	21 – GND	22 – GND		Voltage supply device 0 VDC
	23 – PE	24 – PE		Protective earth

## DEVICE INTERFACES



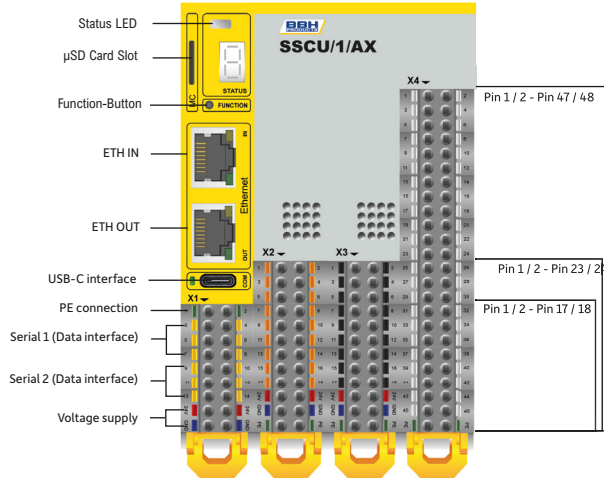
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X4 / ENCx, AINx	Encoder interface
ETH OUT / ETH IN	Fieldbus interfaces
USB-C	Data interface
µSD Card Slot	Data interface

## I/O INTERFACE AND VOLTAGE SUPPLY

### Pin assignment

X3				
Pin	1 – Q0.0	Safe digital outputs	2 – P1 / Q0.6	Non-safe pulse output / Safe digital output
	3 – Q0.1		4 – P2 / Q0.7	Non-safe pulse output / Safe digital output
	5 – Q0.2		6 – Q0.8_PP/Q0.8_P	Safe output pn- / pp switching 00
	7 – Q0.3	Safe digital outputs	8 – Q0.9_PP/Q0.9_N	Safe output, pn- / pp switching 01
	9 – Q0.4		10 – Q0.10_PP/Q0.10_P	Safe output, pn- / pp switching 02
	11 – Q0.5		12 – Q0.11_PP/Q0.11_N	Safe output, pn- / pp switching 03
	13 – Q0.12_R1.1	Relay output 1	14 – Q0.12_R1.2	Relay output 1
	15 – NC	No function	16 – NC	No function
	17 – Q0.14_R2.1	Relay output 2	18 – Q0.14_R2.2	Relay output 2
	19 – VCC_IN	Voltage supply I/O +24 VDC	20 – VCC_IN	Voltage supply I/O +24 VDC
	21 – GND	Voltage supply I/O 0 VDC	22 – GND	Voltage supply I/O 0 VDC
	23 – PE	Protective earth	24 – PE	Protective earth

## DEVICE INTERFACES



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ETH OUT / ETH IN	Fieldbus interfaces
USB-C	Data interface
µSD Card Slot	Data interface

## ENCODER INTERFACE

### Pin assignment X4

X4				
Encoder 1	Pin	1 – ENC1_Data +   NCA+	2 – ENC1_Data   NCA -	TTL/HTL, SinCos, Resolver, SSI
		3 – ENC1_CLK +   NCB+	4 – ENC1_CLK   NCB -	
		5 – ENC1_Z +	6 – ENC1_Z -	
		7 – ENC1_U_Out +	8 – ENC1_U_Out -	
		9 – ENC1_U_In +	10 – ENC1_U_In -	
		11 – NC	12 – NC	
Encoder 2	Pin	13 – ENC2_Data +	14 – ENC2_Data -	TTL/HTL, SinCos, Resolver, SSI/BISS, Analog
		15 – ENC2_CLK +	16 – ENC2_CLK -	
		17 – ENC2_Z +	18 – ENC2_Z -	
		19 – ENC2_U_Out +	20 – ENC2_U_Out -	
		21 – ENC2_U_In +	22 – ENC2_U_In -	
		23 – AIN1 +	24 – AIN1 -	
Encoder 3	Pin	25 – AIN2 +	26 – AIN2 -	TTL/HTL, SinCos, Resolver, SSI/BISS, HDSL, Analog
		27 – ENC3_Data +	28 – ENC3_Data -	
		29 – ENC3_CLK +	30 – ENC3_CLK -	
		31 – ENC3_Z +	32 – ENC3_Z -	
		33 – ENC3_U_Out +	34 – ENC3_U_Out -	
		35 – ENC3_U_In +   AIN3 +	36 – ENC3_U_In -   AIN3 -	
Encoder 4	Pin	37 – ENC4_Data +	38 – ENC4_Data -	TTL/HTL, SinCos, Resolver, SSI, HDSL, Analog
		39 – ENC4_CLK +	40 – ENC4_CLK -	
		41 – ENC4_Z +	42 – ENC4_Z -	
		43 – ENC4_U_Out +	44 – ENC4_U_Out -	
		45 – ENC4_U_In +   AIN4 +	46 – ENC4_U_In -   AIN4 +	
		47 – PE	48 – PE	

## ENCODER INTERFACE

» Encoder types and their combinations, diagnostics characteristic data

Encoder combinations			
Type	Single Encoder	Dual Encoder	
Encoder Interface	1, 2	3	4
Safe data	Safe speed	Safe position, safe speed	
Encoder type	Resolver	SSI, INC/HTL	SSI
	TTL/HTL		TTL/HTL
	SinCos	SinCos	
	Analog	Analog	Analog

	Encoder type	Supply Voltage Monitoring	Plausibility Test Position Signal MPUA/MPUB	Plausibility Test Speed Signal MPUA/MPUB	Comparison of the Encoder Raw Values MPUA/MPUB	Encoder Diagnostic According to Corresponding Safety Manual	Difference Level Monitoring	Monitoring of the Permitted Quadrants	Monitoring of the Counter Signal Separated for Track A/B	SIN/COS Plausibility Monitoring	Input Signal Level Monitoring	Clk-Frequency Monitoring
		Interface X4	TTL/HTL	✓	✓	✓			✓		✓	
	SinCos	✓	✓	✓				✓		✓	✓	
	SSI	✓	✓	✓								✓
	Analog	✓	✓	✓	✓						✓	

Table: Encoder diagnoses

Encoder 1	Encoder 2	Safe direction	Safe Speed	Safe Absolute Position	Fault Exclusion: <i>Fault exclusion mech. Shaft fracture, form-locking encoder shaft connection required</i>	DC [%]		
						Single-Channel Subsystem	Dual-Channel Subsystem	dynamic Subsystem non-dynamic
NC	NC	-	-	-		-	-	-
Resolver	none	✓	✓			99	99	90-95
TTL/HTL		✓	✓			90	99	80-90
SinCos		✓	✓			99	99	90-95
Analog	Analog			✓		90-95	90-95	90-95
SSI	Resolver	✓	✓	✓		-	99	90-95
	TTL/HTL	✓	✓	✓		-	99	90-95
	SSI	✓	✓	✓		-	99	90-95
	SinCos	✓	✓	✓		-	99	90-95

Table: Diagnostics; encoder types and combinations (SIL 3 EN 61508 and PL e according to EN ISO 13849-1)

## Encoder specifications

<b>Incremental encoder - HTL</b>	
Signal level	24V / 0V
Physical Layer	PUSH/PULL
Measuring signal A/B	Track with 90 degree phase difference
Type of connection	Plug-in terminals with spring connection
Max. counting pulse frequency (X4/ ENC1 - ENC3)	200 kHz
Phase detection:	30° (Max. allowed deviation from the rated value)
<b>Incremental encoder - TTL</b>	
Signal level	5V / 0V
Physical Layer	RS-422 compatible
Measuring signal A/B	Track with 90 degree phase difference
Type of connection	Plug-in terminals with spring connection
Max. frequency of input cycles (X4/ ENC1, ENC2)	500 kHz
Phase detection:	30° (Max. allowed deviation from the rated value)
<b>Sin/Cos</b>	
Physical Layer	+/- 0,5 V <sub>SS</sub>
Signal level tolerance	0,7...1,4 V <sub>SS</sub>
Measuring signal A/B	Track with 90 degree phase difference
Type of connection	Plug-in terminals
<b>Standard Mode</b>	
Max. frequency of input clock pulses (X4)	500 kHz
<b>High Resolution Mode (optional)</b>	
Max. frequency of input clock pulses (X4)	15 kHz
<b>SSI/BISS encoder</b>	
Data interface	Serial Synchronous Interface (SSI) with variable data length of 12 – 28 Bit
Data format	Binary or Gray code
Physical Layer	RS-422 compatible
Type of connection	Plug-in terminals
<b>Master Operation Mode</b>	
Clock rate (X4/ ENC3, ENC4)	Variable: 125, 250, 500, 1000, 2000 kHz
<b>Resolver</b>	
<b>Mode</b>	<b>Master and slave</b>
Signal level	8.. 20 V <sub>SS</sub>
Source frequency master	8 kHz
Source frequency slave	4.. 12 kHz
Standard mode	yes
Maximum frequency / poles (X4/ ENC1, ENC2)	500 Hz /4
<b>Analog encoder (X4/ ENC2, ENC3, ENC4)</b>	
<b>Mode</b>	<b>Master</b>
Data interface	Analog input with data length of 9 Bit resolution
Data format	N.a
Physical Layer	-10..+10V, 4..20 mA



## FIELDBUS INTERFACES

### Pin assignment ETH IN / ETH OUT , ethernet-based interface

EtherCAT interface (RJ45)				
Pin	Name	Description	Colour	IN / OUT
1	TX+	Transmit Data +	white-orange	
2	TX-	Transmit Data -	orange	
3	RX+	Receive Data +	white-green	
4	NC	Not used	blue	
5	NC	Not used	white-blue	
6	RX-	Receive Data -	green	
7	NC	Not used	white-brown	
8	NC	Not used	brown	

## ETHERNET INTERFACE

» The Ethernet based one is for fieldbus communication whereby the SSCU/1/AX acts as a safe slave on the following fieldbus standards:

- EtherCAT with FSoE,
- PROFINET with PROFIsafe,
- EtherNet/IP with CIP-Safety

Description	Type	Description
Technology	Ethernet	Ethernet Port for Fieldbus communication, Selection by parameter
Protocol	EtherCAT PROFINET EtherNet/IP	EtherCAT Slave protocol with mandatory CoE, EoE PROFINET IO Slave Slave protocol
Safe protocol	FSoE PROFIsafe CIP Safety	EtherCAT safe slave data protocol, PROFINET safe slave data protocol Ethernet/IP safe slave protocol
Functional data	18 / 34 Byte	18 Byte functional inputs 34 Byte functional outputs
DC Mode	Free sync and DC sync	Synchronization with top-level control
Min. cycle time	4 ms	

## DATA INTERFACES

### Serial (Scanner) interface

The serial interface is exclusively reserved for communication with the Hokuyo-Type scanners by use of the proprietary Hokuyo protocol UAM-05LP. The SSCU/1/AX is master and can communicate with 3 slaves per interface. There are two serial interfaces on the SSCU/1/AX, the master is instantiated twice, therefore up to 6 scanners can be connected on one SSCU/1/AX.

Designation	Type	Description
Technology	Serial RS 485	Type and physical standard
Protocol	Hokuyo	Hokuyo protocol for master/slave communication, standard data if any
Safe Protocol	Hokuyo UAM-05LP	Hokuyo protocol for safe master/slave communication
Safe data	Master to Slave	8 Byte process data + 9 Byte Overhead
	Slave to Master	13 Byte process data + 9 Byte Overhead
Timing	As defined in UAM-05LP	Synchronization by master telegram with slots for return data of the slaves
Min. cycle Time	30 ms	

#### Serial interface

- Scanners 1...3 are connected to X1 (Serial Interface 1)
- Scanners 4...6 are connected to X1 (Serial Interface 2)

## USB-C interface

A USB-C connection is available to connect an engineering PC directly to the device for tooling purposes.

Pin assignment USBC- interface					
Pin	Name	Pin	Name	Description	USB-C
A1	GND	B1	GND	Ground	
A2	TX1+	B2	TX2+	Not connected	
A3	TX1-	B3	TX2-	Not connected	
4A	V <sub>BUS</sub>	B4	V <sub>BUS</sub>	Voltage supply	
A5	CC1	B5	CC2	Not connected	
A6	D+	B6	D+	USB data +	
A7	D-	B7	D-	USB data -	
A8	NC	B8	NC	Not connected	
A9	V <sub>BUS</sub>	B9	V <sub>BUS</sub>	Voltage supply	
A10	RX2-	B10	RX1-	Not connected	
A11	RX2+	B11	RX1+	Not connected	
A12	GND	B12	GND	Ground	

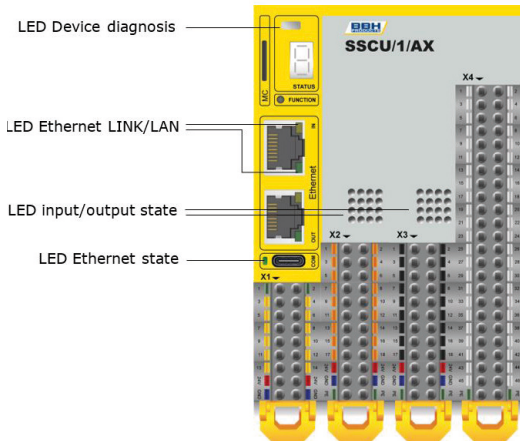
## µSD-Card Slot

The µSD card slot is used to exchange devices without a technical PC and enables the backup / recovery of software on the devices.

Designation	Type	Description
Tooling connection	micro SD card connector	Backup / recovery of FW, parameterization and PLC code (esp. for device exchange)

## HMI

The following table gives an overview of the LEDs:



Overview	Parameter	Description
LED Device diagnosis	Multicolor	Green / orange / red to show device status
LED Ethernet state	Green/red	1 LED
LED Ethernet LINK/LAN	Green & yellow	2 per Ethernet, following conventions
LED I/O state	Green	1 per I/O
LED voltage supply	Green/red	1 on 24V / GND supply
Function button	1 push button	Button for interaction with device on front panel
Display		1x 7-segment display

For further information see „Installation manual HSC Series

## LED assignment

Input		Output		LED display X2, X3
LED	Name	LED	Name	
1	I0.0	1	Q0.0	
2	I0.1	2	Q0.1	
3	I0.2	3	Q0.2	
4	I0.3	4	Q0.3	
5	I0.4	5	Q0.4	
6	I0.5	6	Q0.5	
7	I0.6	7	Q0.6	
8	I0.7	8	Q0.7	
9	I0.8	9	Q0.8_PP/P	
10	I0.9	10	Q0.9_PP/N	
11	I0.10	11	Q0.10_PP/P	
12	I0.11	12	Q0.11_PP/N	
13	I0.12	13	Q0.12_R1 (Relay1)	
14	I0.13	14	Q0.14_R2 (Relay 2)	
15	I0.14	15	-	
16	I0.15	16	Voltage supply I/O	

## ORDER INFORMATIONS

### BASIC MODULES

item	description	item no.
SSCU/1	Base module with 16 safe inputs, 8 safe outputs	on request
SSCU/1/AX	Base module with 16 safe inputs, 8 safe outputs, additional 4 encoder interfaces	on request

### EXTENSIONS

item	description	item no.
SSCU AX/1	Axis extension module	on request
SSCU IO/1	IO extension module (8 I + 8 IO)	on request

### ACCESSORIES

item	description	item no.
SXxxx-x	Terminal connector, screw terminals (set), encoded for cabling SSCU/1	on request
SXxxx-x	Terminal connector, spring terminals (set), encoded for cabling SSCU/1	on request

### SOFTWARE

item	description	item no.
SafePLC <sup>2</sup> 1st	Programming software, 1st License incl. Hardlock	1244
SafePLC <sup>2</sup> 2nd	Programming software, 2nd License incl. Hardlock	1646
SafePLC <sup>2</sup> 3rd	Programming software, 3rd License incl. Hardlock	1647