EUCHNER

Operating Instructions

Transponder-coded Electronic-Key-System

Electronic-Key-System EKS2

EN

Contents

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1. About this document

1.1. Scope

These operating instructions apply to the Electronic-Key-System EKS2. These operating instructions, the supplementary documents and any enclosed data sheets form the complete user information for your system.

They apply to:

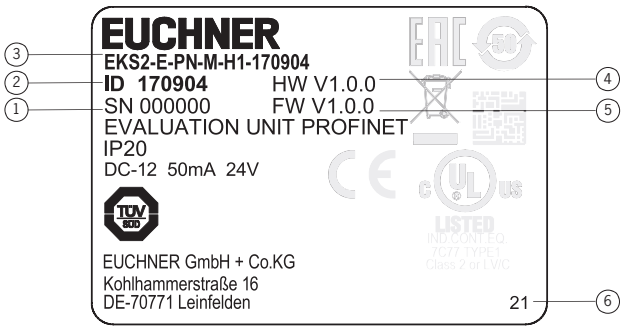
Electronic-Key-System EKS2 component		Product version (hardware version)	Firmware version
Evaluation unit	EKS2-E-PN-...	V1.0.X	V1.0.X
Read unit with holding clip	EKS2-R-I1A.-...	V1.0.X	V1.0.X
Read unit without holding clip	EKS2-R-I1B.-...	V1.0.X	V1.0.X

Important!

- Make sure to use the operating instructions valid for your product version. The version numbers can be found on the type label of the respective component.
- A firmware update might have been performed on your device. Make sure that the device documentation corresponding to the update is available and is observed. The current firmware version number can be accessed in the integrated web server, see chapter *14. Integrated web server on page 25*.
- Please contact the EUCHNER support team if you have any questions.

1.1.1. Evaluation unit type label

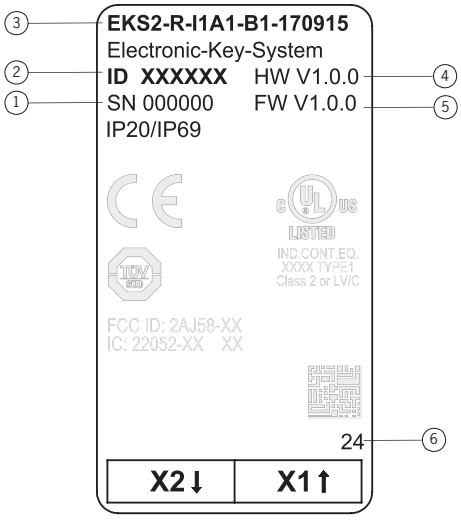
(example illustration)



Key	
1	Serial number
2	Order number
3	Item designation
4	Product version (hardware version)
5	Firmware version
6	Year of manufacture

1.1.2. Read unit type label

(example illustration)



Key	
1	Serial number
2	Order number
3	Item designation
4	Product version (hardware version)
5	Firmware version
6	Year of manufacture

1.2. Target group

Design engineers and installation planners for safety devices on machines as well as setup and servicing staff possessing the following expertise:

- specialist knowledge in handling safety components
- expertise in the installation, setup, programming and diagnostics of programmable logic controllers (PLC) and bus systems
- knowledge about the applicable EMC regulations
- knowledge about the applicable regulations on operational safety and accident prevention

1.3. Key to symbols

Symbol/depiction	Meaning
 **DANGER WARNING CAUTION**	Safety precautions **Danger** of death or severe injuries **Warning** about possible injuries **Caution** slight injuries possible
 **NOTICE Important!**	**Notice** about possible device damage **Important** information
Tip	Useful information

1.4. Supplementary documents

The overall documentation for this product consists of the following documents:

Document title (document number)	Contents
Safety information (2525460)	Basic safety information
Operating instructions (MAN20001715)	(this document)
Operating instructions (MAN20001744)	Operating instructions, EKS2 programming station
Software manual	Software manual for various EKS2 software applications, see www.euchner.com
Declaration of conformity	Declaration of conformity
Release notes	Release notes for firmware update
Possibly available data sheet	Item-specific information about deviations or additions

Important!

Always read all documents to gain a complete overview of safe installation, setup and use of the product. The documents can be downloaded from www.euchner.com. For this purpose enter the doc. no. in the search box.

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2. Correct use

The Electronic-Key-System EKS2 can be used in combination with a touch panel as part of a higher-level overall system for selection of safe operating mode. It can also be used to read and evaluate or forward data, e.g. to check authorizations.

The Electronic-Key-System is operated as an IO device in PROFINET.

The system consists of the following components:
- Read unit
- Evaluation unit
- Electronic-Key
- Connecting cable for connecting the read unit to the evaluation unit
- Programming station for reading and writing Electronic-Keys
- Various software applications for reading and writing Electronic-Keys

Before the system is used, a risk assessment must be performed on the machine, e.g. in accordance with the following standards:
- EN ISO 13849-1
- EN ISO 12100
- IEC 62061

Correct use includes observing the relevant requirements for installation and operation, particularly based on the following standards:
- EN ISO 13849-1
- EN 60204-1

The system is only allowed to be operated using Electronic-Keys and connection components that meet the EUCHNER guidelines. If unsuitable Electronic-Keys or connection components are used, EUCHNER provides no warranty for safe function.

The user is responsible for the safe overall function, especially for safe integration into the PROFINET environment.

Important!

- The user is responsible for the proper integration of the system into a safe overall system. For this purpose, the overall system must be validated, e.g. in accordance with EN ISO 13849-2.
- Use only components that are permissible according to *Table 1: Electronic-Key-System EKS2 system components on page 6* or that meet EUCHNER guidelines.

Table 1: Electronic-Key-System EKS2 system components

Component	Item	Description
Read unit	EKS2-R-I1A.-...	Read unit with holding clip
	EKS2-R-I1B.-...	Read unit without holding clip
Evaluation unit	EKS2-E-PN-M-H1-170904	Evaluation unit with PROFINET interface and 1-of-n safety outputs
Electronic-Key	EKS2-K-K-B-D2-...	Available in different colors
Connecting cable	C-RJ9-4X015PU...	For the connection of the read unit to the evaluation unit
Programming station	EKS2-P-USB-N-I1B0-C1-172018	Programming station for reading and writing Electronic-Keys
Various software applications for EKS2	SW ...	Various software applications for reading and writing Electronic-Keys

2.1. Notes on cybersecurity

EUCHNER components and systems must not be integrated into public networks. EUCHNER components are approved only for use in private networks. Use a VPN for remote access.

3. Description of the safety function

The Electronic-Key-System EKS2-… has the following safety function:

Safe switching and monitoring of the selected operating mode
(subsystem of the safety function *selection of safe operating mode* according to EN ISO 13849-1)

- Safety function:
  - Safe selection of an operating mode using a touch panel
  - Safe detection of a change of operating mode
- Safety characteristics: category, Performance Level, PFHD (see chapter *18. Technical data on page 36*).

Selection of safe operating mode

As a subsystem, the system fulfills the subfunctions of an operating mode selector that controls the machine's safety functions required for the selected operating mode. A failure or malfunction of selection of safe operating mode can lead to the safety functions of the selected operating mode not being activated in the machine.

A system for selection of safe operating mode can be subdivided into the following subfunctions according to EN ISO 16090-1, for example:

- Access system
- Selection system
- Activation system

Incorrect behavior or an error in the *selection system* subfunction can lead to the safety function of the overall *selection of safe operating mode* system failing.

The system fulfills the *access system* subfunction and, in combination with a touch panel, the *selection system* subfunction. The safety function is ensured by a two-stage interaction between the Electronic-Key-System EKS2 and the touch panel. This involves prompting for confirmation of the selection in a new, additional dialog.

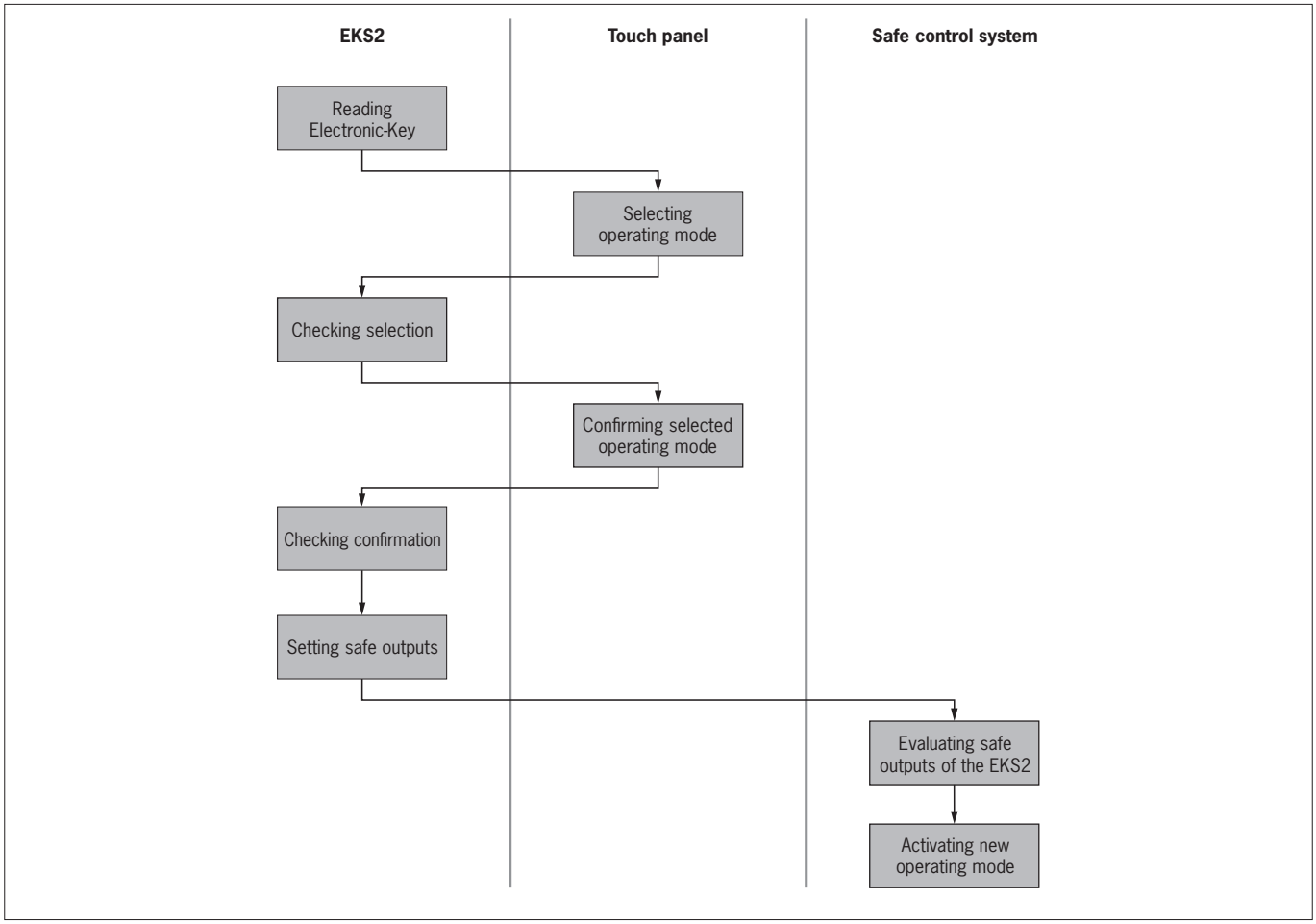

Fig. 1: Two-stage interaction between EKS2 and touch panel

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The data structure of selection of safe operating mode is hierarchically structured for the individual access rights, and it changes values accordingly in the individual polling levels.

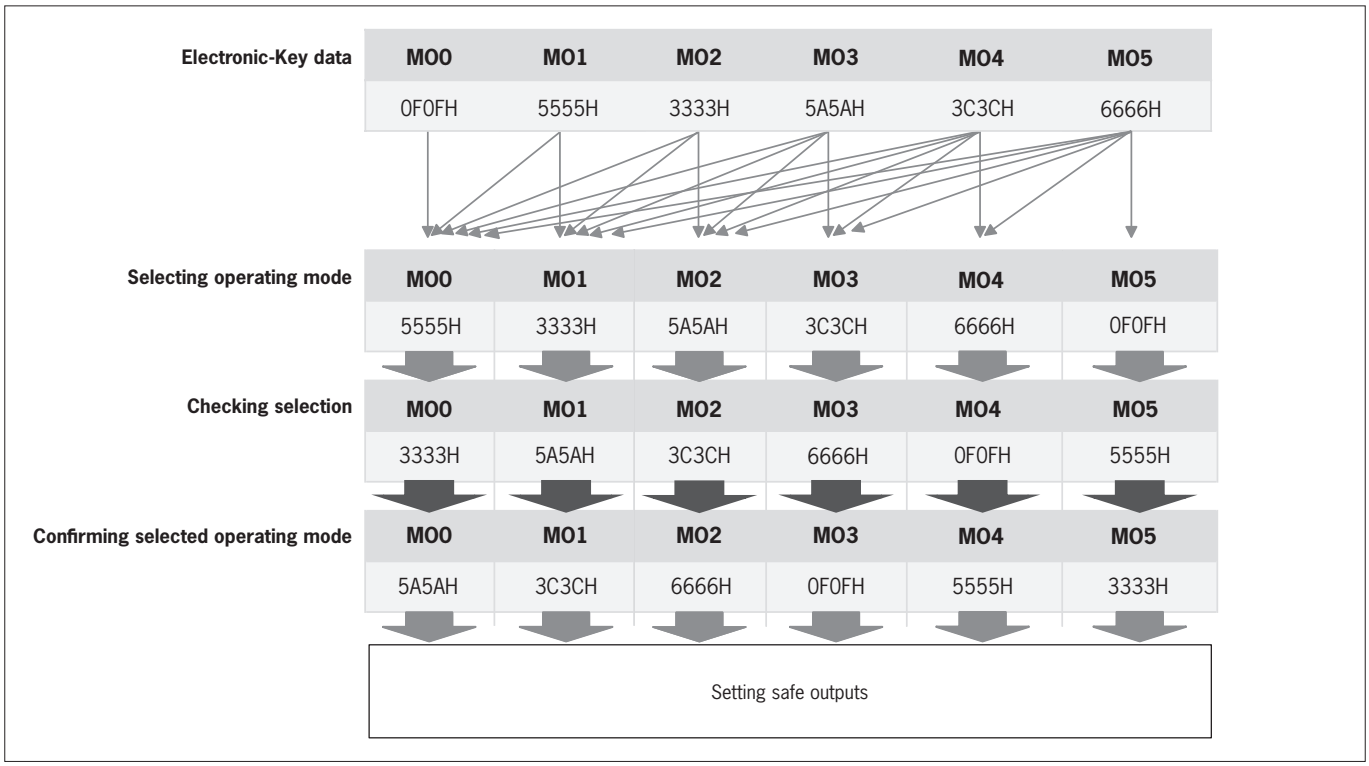
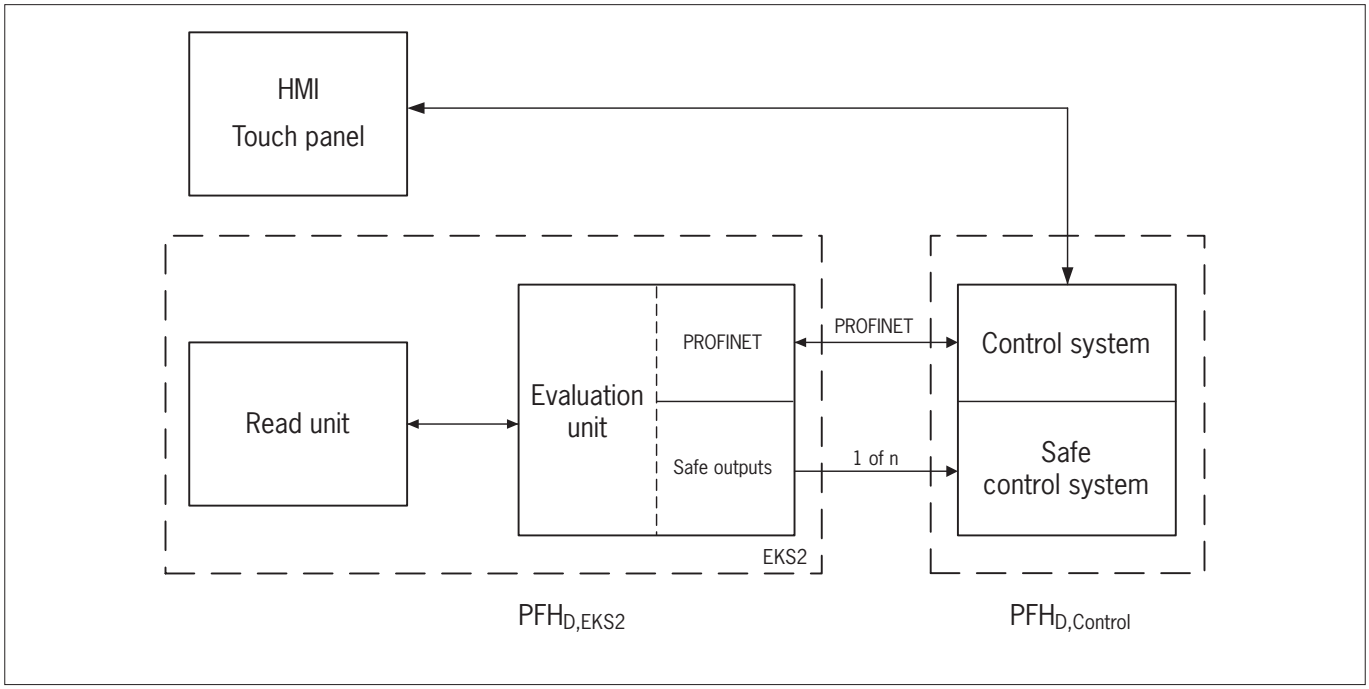


Fig. 2: Data structure of selection of safe operating mode

To fulfill the safety function of the overall *selection of safe operating mode* system, a suitable activation system must be connected to the safe outputs of the evaluation unit. A suitable activation system is a safe control system that can process 1-of-n signals, for example. Additionally, the safe function is ensured only if two adjacent safe outputs are connected and evaluated.

The failure probability of the overall system's safety function can therefore be calculated as follows:

$$PFH_{D,tot.} = PFH_{D,EKS2} + PFH_{D,Control}$$



4. Security

It is advisable to create and implement a comprehensive industrial security plan to protect instrumentation and control systems.

Additionally note the following points:

- Protect the standard PC for setting up the configuration software and for writing data to the Electronic-Keys using a firewall and an up-to-date virus scanner.
- Always use the latest software and firmware versions.
- Assign a specific password for each device.
- Assign different access rights to different user groups.
- Regularly check the assignment of rights and, if necessary, control using an expiry date.

5. Exclusion of liability and warranty

Liability or warranty is ruled out in case of:

- Incorrect use
- Failure to comply with the operating instructions and the safety regulations therein
- Failure to perform the required check for correct function
- Changes to the product

6. General safety precautions

Operating mode selectors fulfill personnel protection functions. Incorrect installation of the subsystem or tampering can lead to fatal injuries to personnel.

Observe the following safety regulations to prevent failure of the personnel protection function:

- Visually inspect all components for damage prior to mounting and connection. Do not use damaged components; file a complaint with the manufacturer instead.
- Do not modify plugs or cables.
- Check the safe function of the system as a subsystem, particularly:
  - each time after initial setup
  - each time after replacing the system or a system component
  - after extended periods without use
  - each time after correcting an error
  - after every factory reset
  - after every firmware update
  - in accordance with the machine's maintenance schedule

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7. Function

The Electronic-Key-System EKS2 can be used as part of a higher-level overall system for selection of safe operating mode on safe control systems. It can also be used to read and evaluate or forward data, e.g. to check authorizations.

The Electronic-Key-System EKS2 consists of the following components:

1	Read unit
2	Evaluation unit
3	EKS2 programming station
4	Connecting cable for connecting the read unit to the evaluation unit
5	EKS2 Electronic-Key
Not shown	Various software applications for reading and writing Electronic-Keys

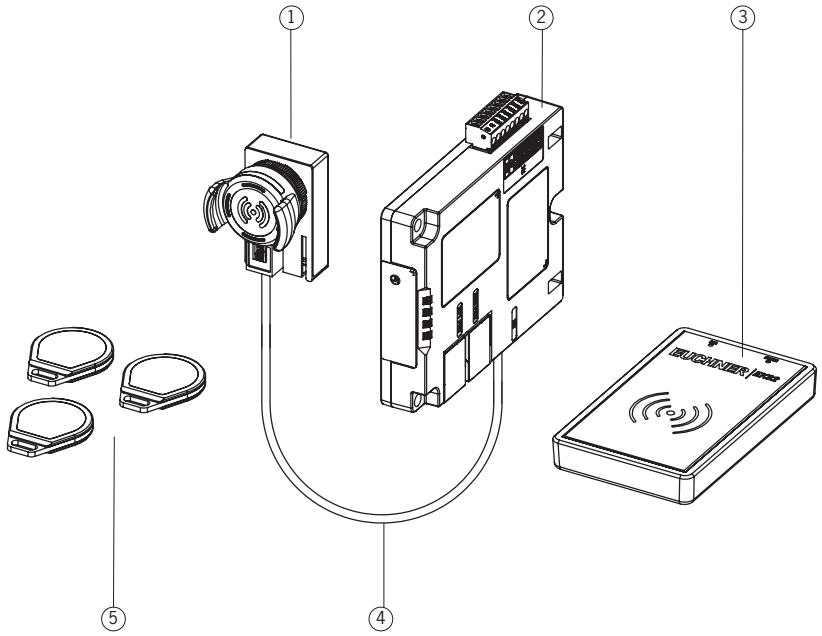

Fig. 3: Overview of Electronic-Key-System EKS2 components

The Electronic-Key data are read by the read unit and checked in the evaluation unit for validity based on specific parameters. If the Electronic-Key is recognized as valid, the operating modes available for selection can be displayed on the machine's touch panel.

The selected operating mode is transmitted via the evaluation unit's safety outputs FO1A to FO1F to the safe control system of the machine acting as the activation system. The safety outputs must be evaluated via 1-of-n evaluation in the safe control system.

During a change from one operating mode to another, first the output currently in use is set to LOW. Then all outputs are in the LOW state for 2 to 60 ms. This is not a fault state and must be tolerated by the control system. Then the output for the new operating mode is set.

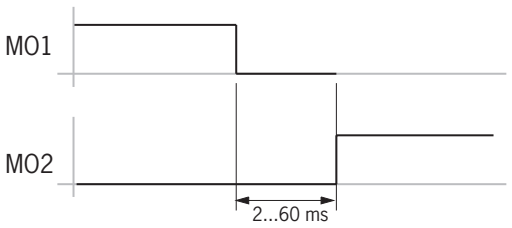

Fig. 4: Operating mode change

Each 1-of-n state maps an operating mode MO (**M**ode of **O**peration):

	FO1A	FO1B	FO1C	FO1D	FO1E	FO1F
MO0	1	0	0	0	0	0
MO1	0	1	0	0	0	0
MO2	0	0	1	0	0	0
MO3	0	0	0	1	0	0
MO4	0	0	0	0	1	0
MO5	0	0	0	0	0	1
Safe state [1) 2)]	0	0	0	0	0	0

1) Operating mode change: state duration from 2 to max. 60 ms; safe state: state duration longer than 60 ms.
2) The subsystem EKS2 is in the safe state. An error must be reported to the control system.

LEDs on the read unit and evaluation unit indicate status and error messages (see chapter *15. Status and error messages on page 29).*

The Electronic-Keys are written on the PC with the aid of the EKS2 programming station and corresponding application software. You will find further information in the corresponding instructions, see chapter *1.4. Supplementary documents on page 5.*

Detailed application examples can be found in the download area at www.euchner.com.

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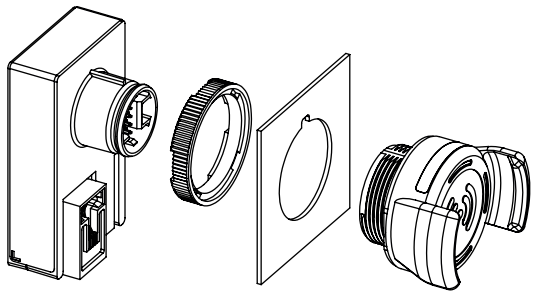
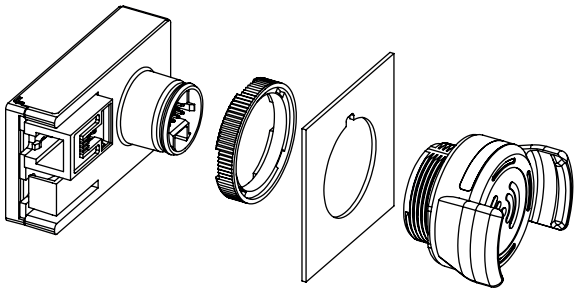
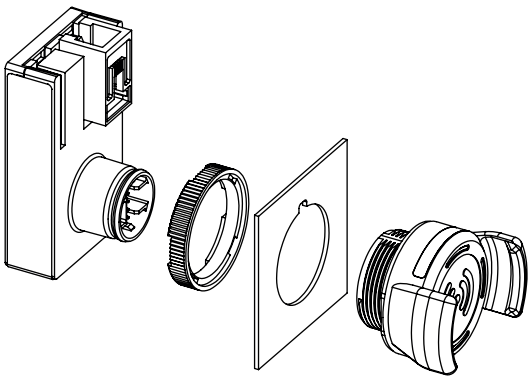
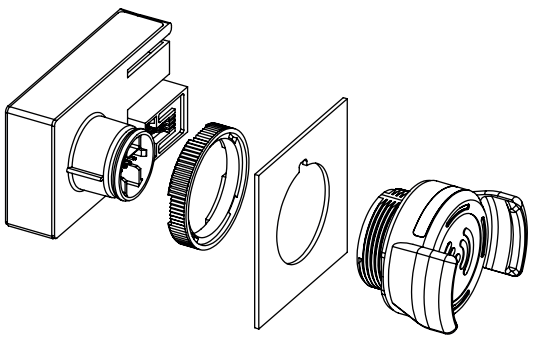
8. Mounting

8.1. Mounting the read unit

Depending on the installation situation on the panel, the following read unit variants are available:

Read unit	Installation situation in the panel
Read unit with holding clip	
EKS2-R-I1A1-B1-170915	
EKS2-R-I1A2-B1-173727	
EKS2-R-I1A3-B1-173728	
EKS2-R-I1A4-B1-173729	
Read unit without holding clip	
EKS2-R-I1B1-B1-170919	Any installation position

NOTICE

Risk of damage to equipment and malfunctions as a result of incorrect installation
- Install the read unit in a clean, flat front plate with a thickness of 1 to 3 mm.
- Provide a mounting cut-out D22 according to EN IEC 60947-5-1 with a diameter of 22.5 mm.
- During mounting, pay attention to the correct alignment of the individual components.
- Use only the threaded ring provided.
- Tighten the threaded ring to a tightening torque of 1.1 - 1.3 Nm using an appropriate tool.
- Provide strain relief for the connecting cables.
- Protect the read unit against rotation due to vibration or other external effects.

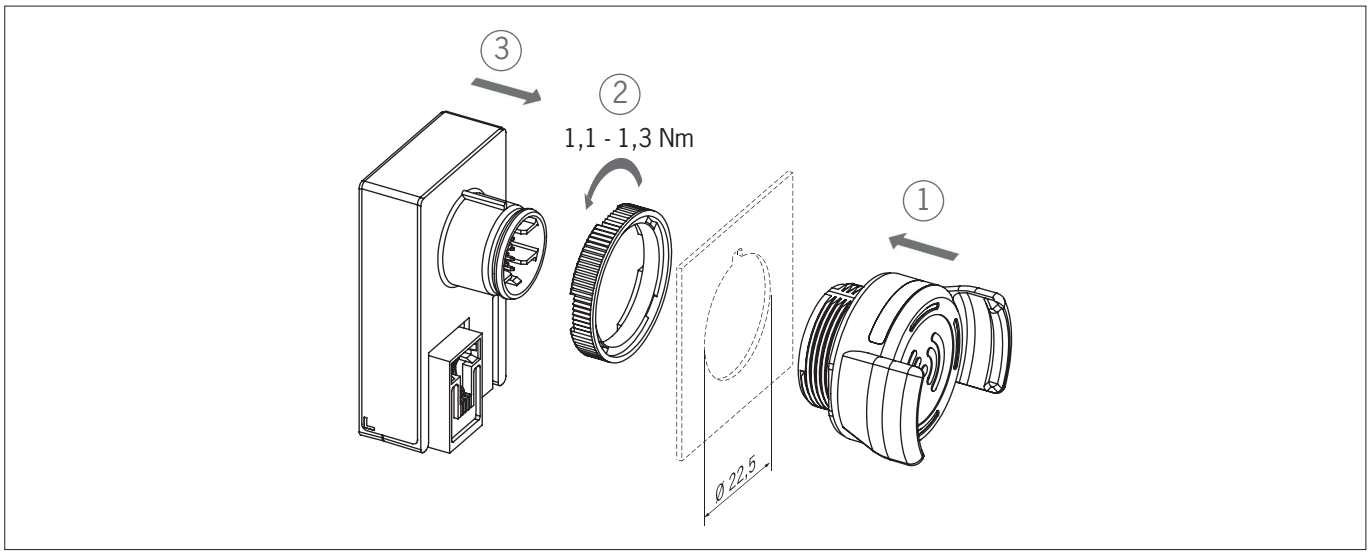


Fig. 5: Mounting the read unit

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8.2. Mounting the evaluation unit

NOTICE

Risk of damage to equipment and malfunctions as a result of incorrect installation

- Fasten evaluation unit using screws with a diameter of 4 mm.
- Tighten screws to a tightening torque of 1.1 - 1.3 Nm.
- Ensure adequate ventilation for the device to maintain the ambient temperature. Do not cover ventilation slots, see chapter *18.1.2. Dimension drawing for EKS2 evaluation unit on page 37*.

Important!

- The evaluation unit has a Reset pushbutton above the LEDs, see chapter *18.1.2. Dimension drawing for EKS2 evaluation unit on page 37*. While mounting, ensure that the Reset pushbutton is accessible.

8.2.1. Panel mounting

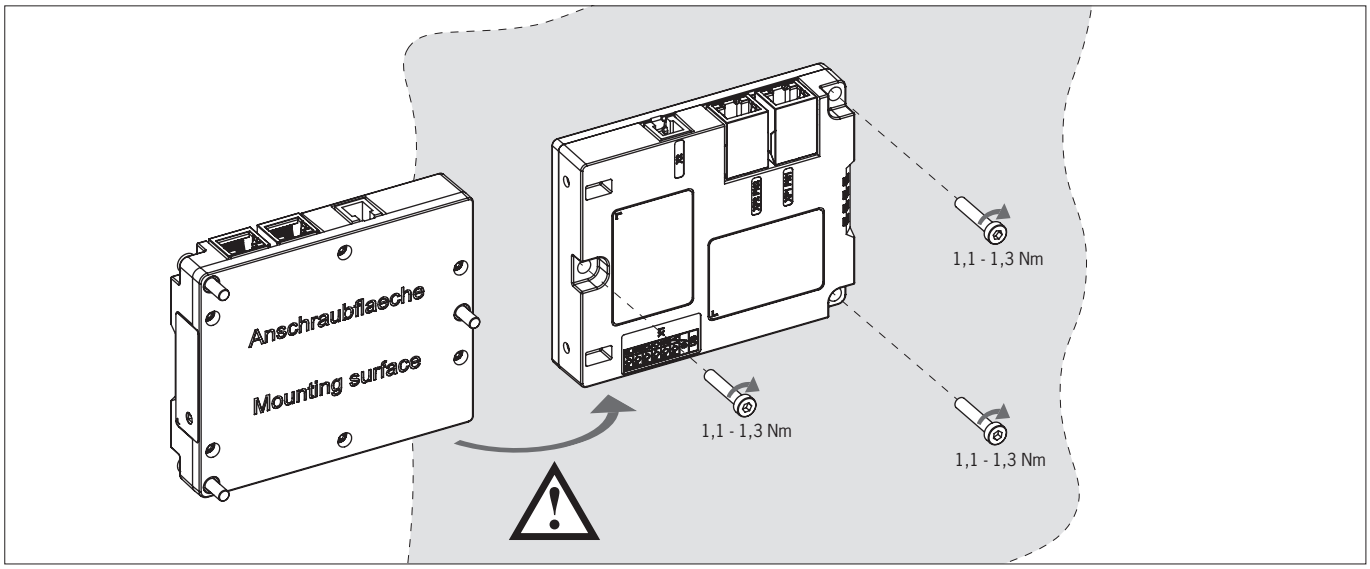

Fig. 6: Panel mounting

8.2.2. Control cabinet mounting

Important!

- Use the mounting rail adapter AM-SET-PS-169829 (order no. 169829) for mounting on a 35 mm mounting rail.
- Use only the screws provided during mounting.

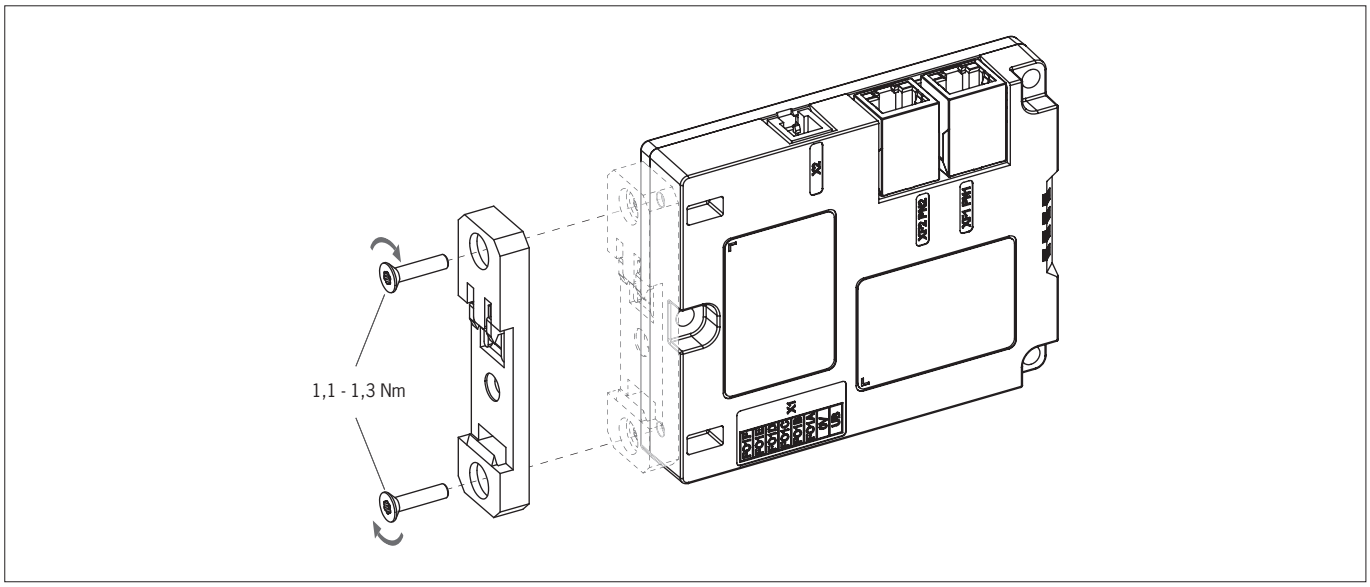

Fig. 7: Evaluation unit with mounting rail adapter for control cabinet mounting

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9. Electrical connection

9.1. General notes

WARNING

Loss of the safety function due to incorrect electrical connection.

- Ensure that the safety outputs FO1A to FO1F are evaluated via 1-of-n evaluation in the safe control system.
- Ensure that at least two adjacent outputs from the safety outputs FO1A to FO1F can be evaluated by a safe control system at all times.
- Lay the connecting cables with protection to prevent short circuits.
- Do not lay connecting cables in the immediate vicinity of sources of interference.

CAUTION

Risk of damage to equipment or malfunctions as a result of incorrect electrical connection.

- Ensure that all circuits connected to the device comply with the regulations for low voltages with safe electrical isolation (SELV/PELV).
- Ensure that power devices, which are a powerful source of interference, are installed in a separate location away from the input and output circuits for signal processing. The cables of the safety circuits must be installed as far away as possible from the cables of the power circuits.
- To avoid EMC interference, ensure that the physical environmental and operating conditions at the installation site of the device comply with the requirements according to the standard EN 60204-1 (EMC).
- All electrical outputs must have an adequate protective circuit for inductive loads. The outputs must be protected with a free-wheeling diode for this purpose. Varistors and RC interference suppression units must not be used.
- Pay attention to any interference fields from devices such as frequency converters or induction heating systems. Observe the EMC notes in the manuals from the respective manufacturer.
- As the PROFINET cable, use only a screened 100 BaseTX cable, twisted pair, Cat5 or higher, with a maximum cable length of 100 m.
- Use only cables with parallel conductors and straight-through wiring to connect the read unit to the evaluation unit.
- Provide strain relief for the connecting cables to prevent malfunctions or damage at the device connectors.
- Contact between the metal surfaces on the RJ45 sockets, the device's ground and the functional earth in the control cabinet must be prevented. The device itself does not have a functional earth.

9.2. Notes about UL

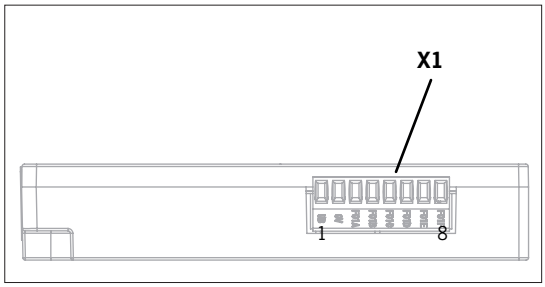
Important!

- This device is intended to be used with a Class 2 power source in accordance with UL1310.
  As an alternative an LV/C (Limited Voltage/Current) power source with the following properties can be used:
  This device shall be used with a suitable isolating source in conjunction with a fuse in accordance with UL248. The fuse shall be rated max. 0.5 A and be installed in the max. 30 V DC power supply to the device in order to limit the available current to comply with the UL requirements. Please note possibly lower connection ratings for your device (refer to the technical data).
- For use and application as per the requirements of UL [1)] a connecting cable listed under the UL category code CYJV/7 must be used.

1) Note on the scope of the UL approval: The devices have been tested as per the requirements of UL508 and CSA/C22.2 no. 14 (protection against electric shock and fire).

9.3. Terminal assignment / connector assignment

9.3.1. Evaluation unit connection terminals



Pin	Designation	Description
X1.1	UB	Supply voltage 24 V DC
X1.2	0V	Supply voltage 0 V DC (GND)
X1.3	FO1A	Safety output MO0
X1.4	FO1B	Safety output MO1
X1.5	FO1C	Safety output MO2
X1.6	FO1D	Safety output MO3
X1.7	FO1E	Safety output MO4
X1.8	FO1F	Safety output MO5

Important!

- For the connection to the connection terminals on the evaluation unit, use only cables with a conductor cross-section of maximum 1.5 mm².
- For the screws in the terminal plug, pay attention to the tightening torque of 0.22 Nm.

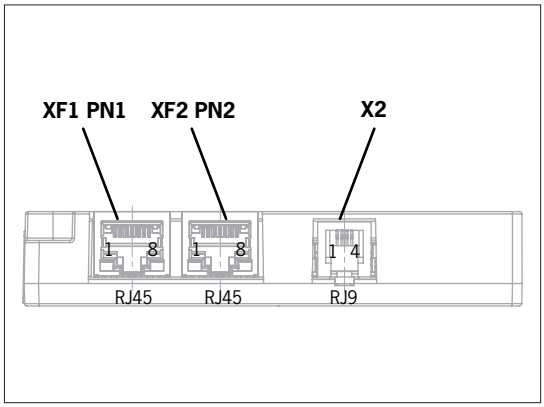
9.3.2. Evaluation unit terminal assignments

The evaluation unit has the following connections:

- Two RJ45 connections with integrated RT switch for the PROFINET interface
- One RJ9 connection for the read unit

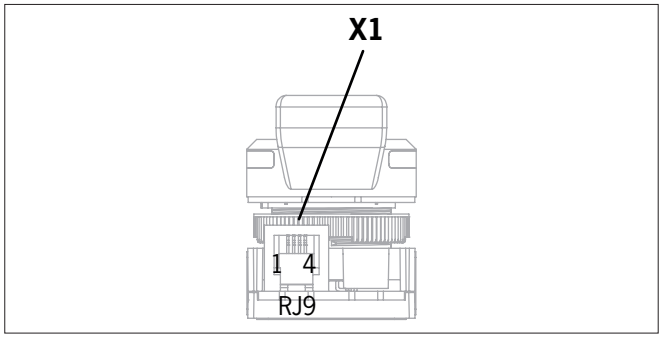
Pin	Description
XF1.1	Receive Data RD+
XF1.2	Receive Data RD-
XF1.3	Transmit Data TD+
XF1.4	n.c.
XF1.5	n.c.
XF1.6	Transmit Data TD-
XF1.7	n.c.
XF1.8	n.c.

Pin	Description
XF2.1	Receive Data RD+
XF2.2	Receive Data RD-
XF2.3	Transmit Data TD+
XF2.4	n.c.
XF2.5	n.c.
XF2.6	Transmit Data TD-
XF2.7	n.c.
XF2.8	n.c.



Pin	Description
X2.1	Supply voltage for read unit 24 V DC
X2.2	Read unit databus low (RS485-)
X2.3	Read unit databus high (RS485+)
X2.4	Supply voltage for read unit 0 V DC (GND)

9.3.3. Read unit terminal assignment



Pin	Description
X1.1	Supply voltage 24 V DC
X1.2	Databus low (RS485-)
X1.3	Databus high (RS485+)
X1.4	Supply voltage 0 V DC (GND)

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10. Setup

10.1. Programming in the control system

Important!

While programming the evaluation in the safe control system, ensure that, when the operating mode is selected, exactly one output is set at the safety outputs FO1A to FO1F for transmission to the safe control system and the output is monitored via 1-of-n evaluation.

This means:

- If more than one output or no output is set, there is an error in the device or in the cable installation. The safe control system must be capable of reacting to such errors in accordance with the machine's risk assessment.

10.2. PROFINET configuration

The Electronic-Key-System EKS2 is integrated into the PROFINET environment via individual data blocks with the related communication data. The corresponding data blocks are combined and parameters set in the configuration software of the control system with the aid of the GSDML file for the EKS2.

10.2.1. Installing GSDML file

1. Create a new TIA project.
2. Download GSDML file from the Download area at www.euchner.com.
3. In *Options*, select the *Manage general station description files* function.
3. Install the latest GSDML file.

10.2.2. Integrating EKS2 evaluation unit

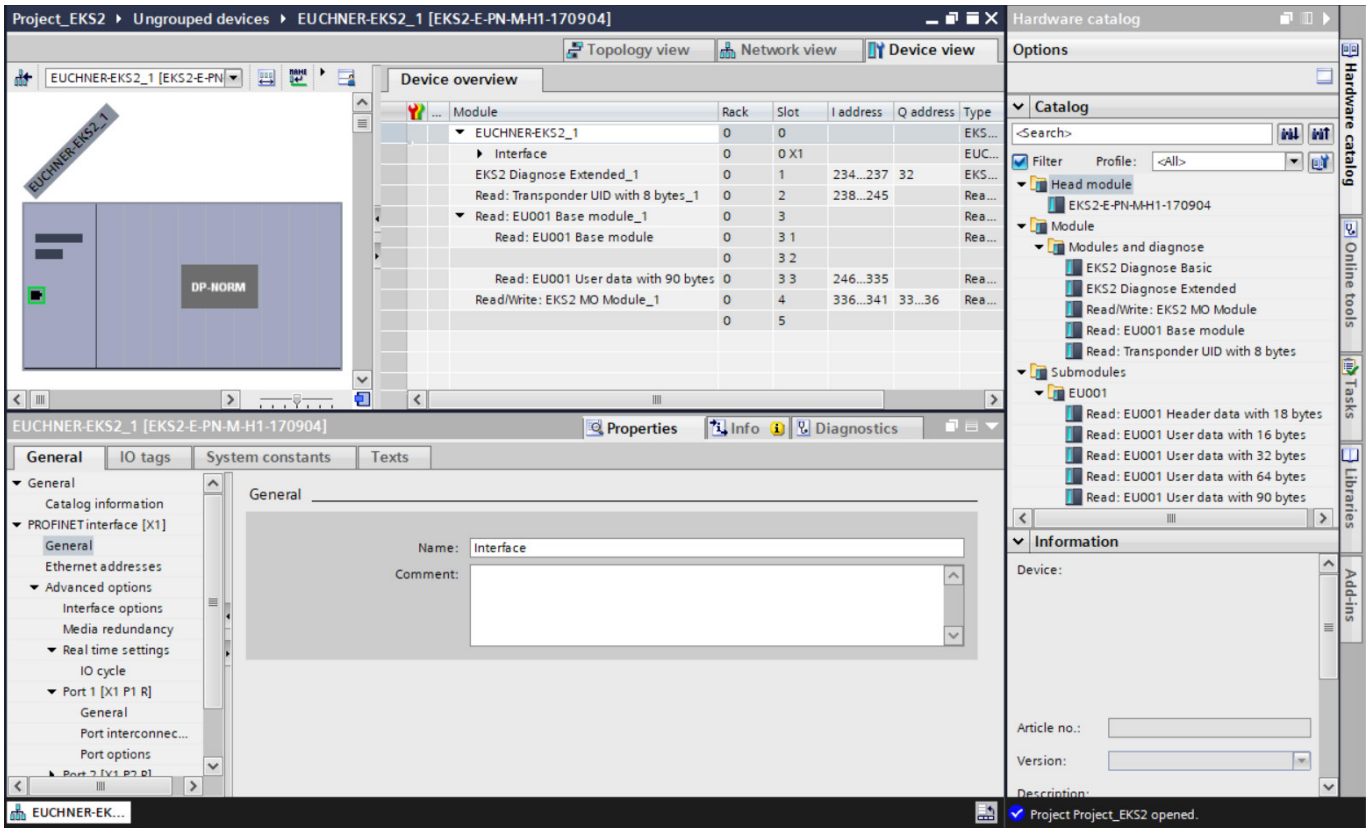
1. In the *Hardware catalog*, in *Other field devices*, select the EKS2 evaluation unit.
2. Using drag & drop, drag the evaluation unit to the network view and connect to the control system.
3. Select the evaluation unit by double-clicking it to configure the parameters.

➡ The *Device View* opens.

4. The following parameters can be specified:
   - Name of the device in *General*
   - IP address in *PROFINET interface/Ethernet addresses*

10.2.3. Selecting modules and submodules

1. The standard modules and other optional modules for the evaluation unit are displayed in the *Device View* in the *Hardware catalog*.



The following modules are available and are either already included in the GSDML for the evaluation unit as a standard configuration or, optionally, can be added:

Table 2: EKS2 modules (the standard modules are in bold)

Module	Parameter [default value]	Description	Slot	
EKS2 Diagnose Basic	Alarm setting: Activated/Deactivated [Deactivated]	Reading status messages	1	
EKS2 Diagnose Extended	Alarm setting: Activated/Deactivated [Deactivated]	Reading status and diagnostic messages	1	
Read: Transponder UID with 8 bytes		Reading the transponder's unique serial number (UID)	2	
Read: EU001 Base module	Automatic data evaluation: Yes/No [Yes]		3	3.1
	Company: [0] Plant: [0] Department: [0]	These fields are evaluated one after the other as a hierarchy		
	Cost center: 1 - 5 [0]	These fields are combined with an OR operator		
	Exception value: 1, 2 [0]	The values in these fields are superordinate to the other fields in the evaluation		
	Use expiry date: Yes/No [No]	The current date must be set in the control system and sent to the evaluation unit via an acyclical command		
	Automatic Electronic-Key management: Activated/Deactivated [Deactivated] For further information, see application in the Download area at www.euchner.com			
Read: EU001 Header data with 18 bytes		Additional reading of the header data in the control system		3.2
Read: EU001 User data with 16 bytes	Start address: [26] Number of bytes to be read: [dependent on the module]	Reading user data with 16 bytes 1)		3.3
Read: EU001 User data with 32 bytes		Reading user data with 32 bytes 1)		3.3
Read: EU001 User data with 64 bytes		Reading user data with 64 bytes 1)		3.3
Read: EU001 User data with 90 bytes		Reading user data with 90 bytes 1)		3.3
Read/Write: EKS2 MO Module	Machine group: 1-4 [1] Operating mode after system start: MO0-MO5 [MO0]	Configuring the parameters for selection of safe operating mode in the evaluation unit	4	

1) The first four bytes contain the Personnel number.

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10.3. Teaching-in access key

For the use of the Electronic-Key-System EKS2, it is necessary to teach-in an access key that encrypts the project and transponder data.

Proceed as follows:

1. Generate an access key in the EKS2 software for reading and writing Electronic-Keys. You will find further information in the corresponding instructions, see chapter *1.4. Supplementary documents on page 5*.
2. Place a transponder encrypted with the access key in the actuating range of the read unit ready for operation.

➡ The access key on the transponder is transferred to the system.

➡ The system can now decrypt the data from this transponder and other transponders with the same access key.

Important!

If the access key is changed, the system must be reset to the factory settings and taught-in again, see chapter *16. Factory reset on page 34*.

10.4. Functional check

WARNING

Loss of the safety function due to incorrect installation and erroneous functional check.
- Before carrying out the functional check, make sure that there are no persons in the danger area.
- Observe the valid accident prevention regulations.

After installation and after any fault, the safety function must be fully checked.

Proceed as follows:

1. Check for correct mounting and correct electrical connection of the individual components.
2. Apply operating voltage.
3. Connect PROFINET cable and establish connection.

➡ The STATE LED on the evaluation unit illuminates green. The LED on the read unit illuminates yellow.

➡ The system is ready for operation.

4. Place an Electronic-Key in the actuating range of the read unit.

➡ The LED on the read unit illuminates green with a valid Electronic-Key.

5. If selection of safe operating mode is used: check for the correct selection of the operating modes to check the safe outputs.

11. Operation

Important!

The operating mode to which the system switches automatically after system start is specified during the configuration of the parameters in the GSDML file, see *Table 2: EKS2 modules (the standard modules are in bold) on page 19*.

The operating mode MO0 (output FO1A) is the factory-set default.

12. Communication data

12.1. Cyclical communication data

Module	Data block	Size of user data	Data type
General			
Device	EKS2 Profinet		Name, IP address
Reading input data			
Status	Status	2 bytes	Status bytes and error codes
	Status and diagnostics	4 bytes	
UID	UID (Unique Identifier)	8 bytes	Serial number
EU001	EU001 header data	18 bytes	Company, plant, department, cost center, expiry date
	EU001 user data	16 bytes	Personnel number, other user data
		32 bytes	
		64 bytes	
		90 bytes	
Writing/reading input/output data			
MO	Read MO	6 bytes	Data words for the communication between EKS2 and touch panel, see *Table 2: EKS2 modules (the standard modules are in bold) on page 19*
	Write MO	4 bytes	

12.1.1. Input area (read process)

Table 3: Diagnose Basic module

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Cyclical job in progress	Ready for cyclical job	Cyclical job error	Device error	Ready for acyclical job	Acyclical job error	Electronic-Key detected	Device ready for operation
Byte 1	-	Electronic-Key valid	Electronic-Key invalid	-	-	-	Selection of safe operating mode error	No user area included

Table 4: Diagnose Extended module

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Cyclical job in progress	Ready for cyclical job	Cyclical job error	Device error	Ready for acyclical job	Acyclical job error	Electronic-Key detected	Device ready for operation
Byte 1	-	Electronic-Key valid	Electronic-Key invalid	-	-	-	Selection of safe operating mode error	No user area included
Byte 2	Diagnostics byte 1, see chapter *15.3. Error messages on page 31*							
Byte 3	Diagnostics byte 0, see chapter *15.3. Error messages on page 31*							

Bit	Description	Condition for setting	Condition for resetting
Cyclical job in progress	A cyclical job has been accepted and is in progress.	A new cyclical job is detected.	The cyclical job has been completed.
Ready for cyclical job	The last cyclical job has been completed and answered.	The device is ready for a new cyclical job.	A cyclical job is in progress.
Cyclical job error	The last cyclical job was erroneous.	The last cyclical job is invalid or contains incorrect parameters.	A new cyclical job is detected.
Device error	An error has occurred on a device.	▸ Connection to the read unit interrupted ▸ Output error during selection of safe operating mode	After error correction, see chapter *15.3. Error messages on page 31*.
Ready for acyclical job	The last acyclical job has been completed and answered.	The device is ready for a new acyclical job.	An acyclical job is in progress.
Acyclical job error	The acyclical job is erroneous.	The last acyclical job is invalid or contains incorrect parameters.	A new acyclical job is accepted.
Electronic-Key detected	An Electronic-Key is in the actuating range.	An Electronic-Key is located in the actuating range of the read unit and has been detected.	There is no Electronic-Key in the actuating range.

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Bit	Description	Condition for setting	Condition for resetting
Device ready for operation	The device is in operation.	The device has been restarted.	The device is restarted.
Electronic-Key valid	The Electronic-Key is readable and detected by the device as valid.	The Electronic-Key and the Electronic-Key data are valid.	There is no Electronic-Key in the actuating range.
Electronic-Key invalid	The Electronic-Key is invalid and not accepted by the device.	▸ The access key is invalid, see chapter *10.3. Teaching-in access key on page 20*. ▸ Header data are invalid.	There is no Electronic-Key in the actuating range.
Selection of safe operating mode error	An error occurred during selection of safe operating mode.	▸ Wrong sequence of selection of safe operating mode ▸ Output errors	After error correction, see chapter *15.3. Error messages on page 31*.
No user area included	No user area included on the Electronic-Key.	The Electronic-Key includes data but no user area.	There is no Electronic-Key in the actuating range.

Table 5: Data module EU001 header data

Byte no.	Designation
0 ... 3	Company
4 ... 7	Plant
8 ... 11	Department
12 ... 15	Cost center
16 ... 17	Expiry date

Table 6: Data module EU001 user data

Byte no.	Designation
0 ... 4	Personnel number
5 ... 16	Freely programmable user data with 16 bytes
5 ... 32	Freely programmable user data with 32 bytes
5 ... 64	Freely programmable user data with 64 bytes
5 ... 90	Freely programmable user data with 90 bytes

Table 7: MO module (reading)

Byte no.	Designation
0 ... 1	Max. MO
2 ... 3	Check MO
4	-
5	Current MO

12.1.2. Output area (write process)

Table 8: MO module (writing)

Byte no.	Designation
0 ... 1	Select MO
2 ... 3	Confirm MO

Table 9: Diagnostic module (writing)

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0 (command byte)	Acknowledge error messages or warnings	-	-	-	-	-	-	-

Command bit	Designation	Function
7	Acknowledgment bit	Resets resettable error messages and warnings via the control system. The acknowledgment bit must be set for min. 100 ms.

12.2. Acyclical data

12.2.1. Output area (write process)

The PROFINET index #1000 must be used for the write process.

Command	Designation	Function
0x02	Open special machine manufacturer area	Opens a special area on the Electronic-Key and reads the data contained there.
0x05	Set date and time	Sets a data and a time in the device, e.g. to evaluate the expiry date of an Electronic-Key internally.

PROFINET	Designation	Function	
Byte 0	Command = 0x05	Set date and time	
Byte 1	-	-	-
Byte 2	Date: year	Value from 0 (=1970) to 99 (=2069)	Value from 0x00 (=1970) to 0x63 (=2069)
Byte 3	Date: month	1 … 12	0x01 … 0x0C
Byte 4	Date: day	1 … 31	0x01 … 0x1F
Byte 5	Time: hour	0 … 23	0x00 … 0x17
Byte 6	Time: minute	0 … 59	0x00 … 0x3B
Byte 7	Time: second	0 … 59	0x00 … 0x3B
Byte 8	-	-	-
Byte 9	-	-	-

12.2.2. Special machine manufacturer area

The “Service” operating mode can be saved in the special machine manufacturer area, for example.

Command	Designation	Function
0x02	Open special machine manufacturer area	Opens a special area on the Electronic-Key and reads the data contained there.

PROFINET	Designation	Function
Byte 0	Command = 0x02	Open special machine manufacturer area
Byte 1	-	-
Bytes 2-17	Access key	Access key for the “Service” operating mode

You will find further information in the application in the Download area at www.euchner.com

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13. Electronic-Key data structure

13.1. Module EU001 data structure

Data area (116 bytes)	Designation	Category	Data type	Internal data evaluation
0 ... 3	Company	Header data	UInt	Yes
4 ... 7	Plant			
8 ... 11	Department			
12 ... 15	Cost center			
16 ... 17	Expiry date		Date	
18 ... 19	Machine group 1	Max. operating modes	Word	
20 ... 21	Machine group 2			
22 ... 23	Machine group 3			
24 ... 25	Machine group 4			
26 ... 29	Personnel number	User data	UInt	No
30 ... 115	Freely programmable user data		bytes	

13.2. Module EU002 data structure (only for machine manufacturers)

Data area (18 bytes)	Designation	Category	Data type	Internal data evaluation
0 ... 1	Expiry date	Header data	Date	Yes
2 ... 3	Operating modes	Max. operating modes	Word	
4 ... 7	Personnel number	User data	UInt	No
8 ... 17	Freely programmable user data		bytes	

14. Integrated web server

The Electronic-Key-System EKS2 has an integrated web server that can be used at any time during operation. The system parameters cannot be configured via the integrated web server.

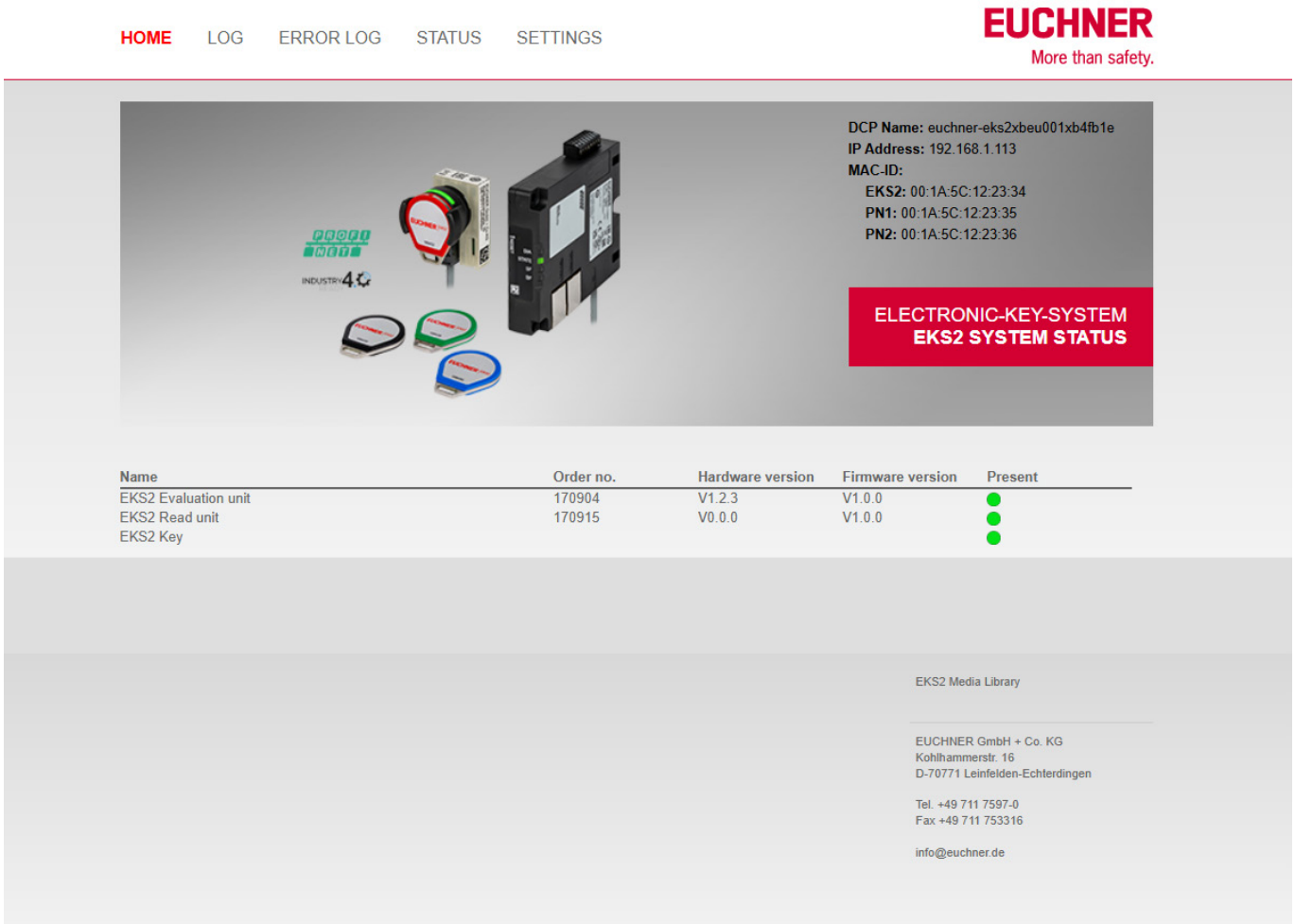
The following data can be read:

- Events in the network
- Errors in the Electronic-Key-System EKS2
- Device status of the individual EKS2 components

14.1. Using integrated web server

Proceed as follows to open the web server:

1. Connect the evaluation unit to a standard PC via the network cable.
2. Open browser and type the IP address of the device.
3. The web server is opened:



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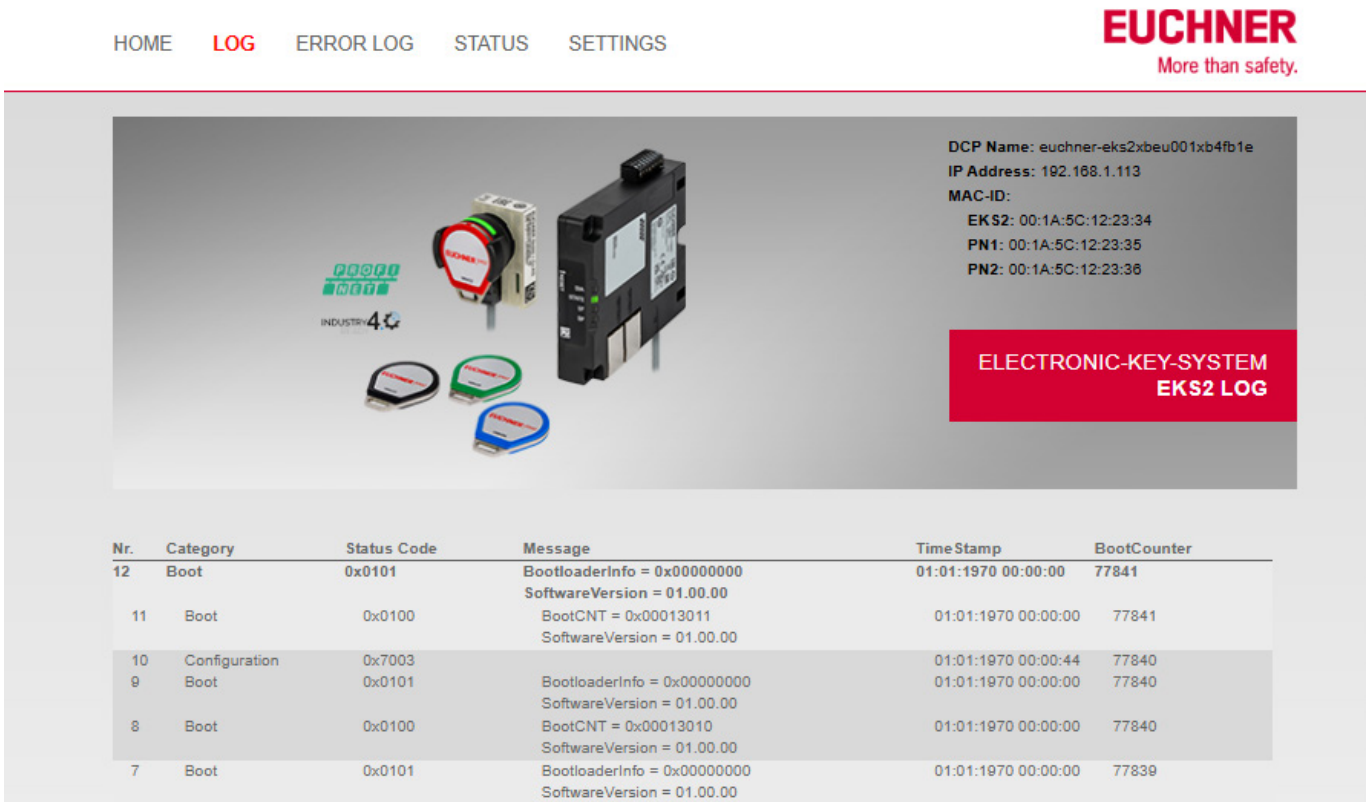
14.2. Reading event log

Events in the network can be viewed in the *Log* view:

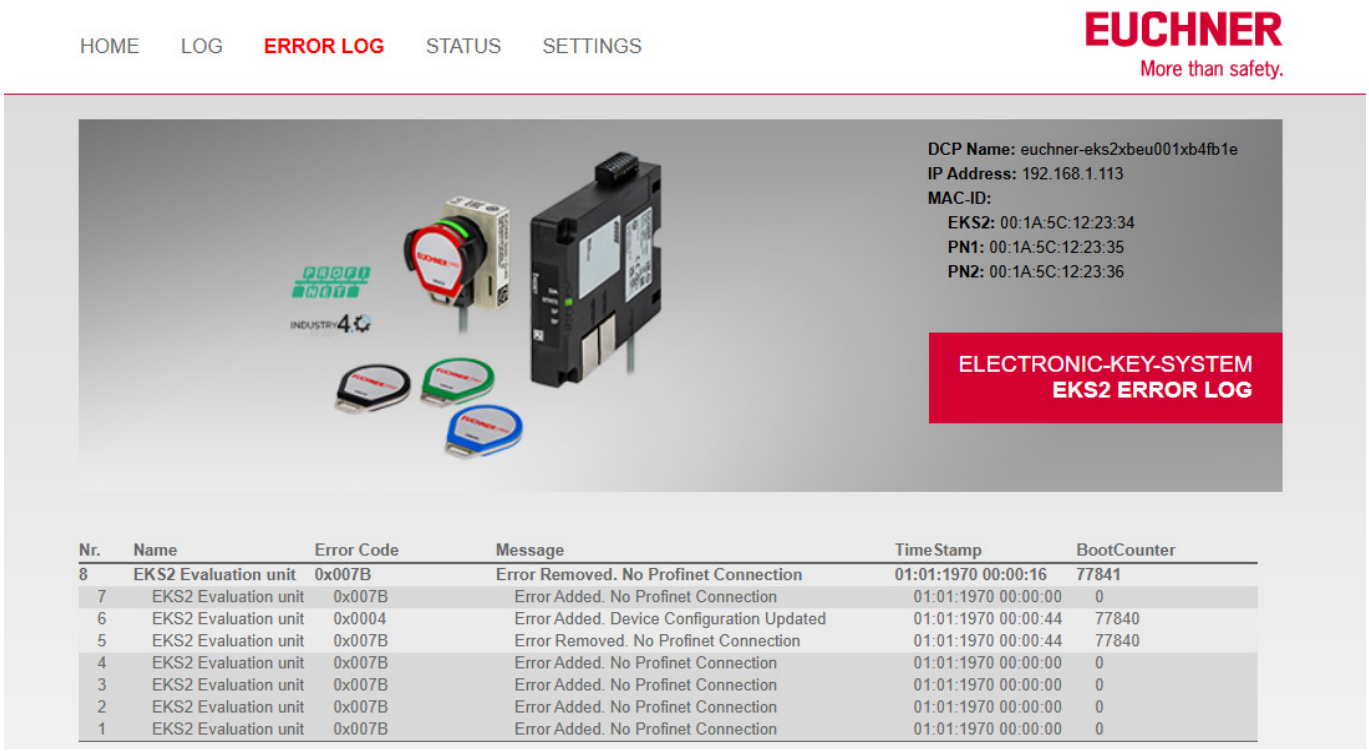


The following *status codes* are used:

Status code	Message	Description
0x0050	-	The memory for the event log is full. Older events will be deleted.
0x0100	*BootCNT*: number of restarts since the last firmware update *SoftwareVersion*: current firmware version of the evaluation unit	The system has been restarted.
0x0101	*BootloaderInfo*: status of the firmware update performed 0x46575553: firmware update successful 0x4E465755: firmware update not successful *SoftwareVersion*: current firmware version of the evaluation unit	The firmware has been updated.
0x0200	*SoftwareVersion*: current firmware version of the evaluation unit	A firmware update has been started.
0x0900	*KeyUID*: unique serial number (UID) of the transponder	A transponder has been placed.
0x0901	*KeyUID*: unique serial number (UID) of the transponder	A transponder has been removed.
0x0902	*KeyUID*: unique serial number (UID) of the transponder *ExpiryDate*: expiry date on the transponder	The placed transponder has expired and is not accepted.
0x0904	*KeyUID*: unique serial number (UID) of the transponder	The header data in the placed transponder have been changed via the control system.
0x0906	*KeyUID*: unique serial number (UID) of the transponder *SwitchAppType*: open data area	Change to a different data area.
0x1010	*MSOProcessStep*: status during the process to select the operating mode 0x00: selecting operating mode 0x01: checking selection 0x02: confirming selected operating mode	The selection process for selection of safe operating mode takes place.
0x7003	-	The system parameters have been changed.
0x7004	-	A factory reset has been performed successfully.
0x8000	*CurrentDate*: current time stamp	Date and time in the system have been updated.

14.3. Reading error log

Errors in the Electronic-Key-System EKS2 can be read in the *Error Log* view:

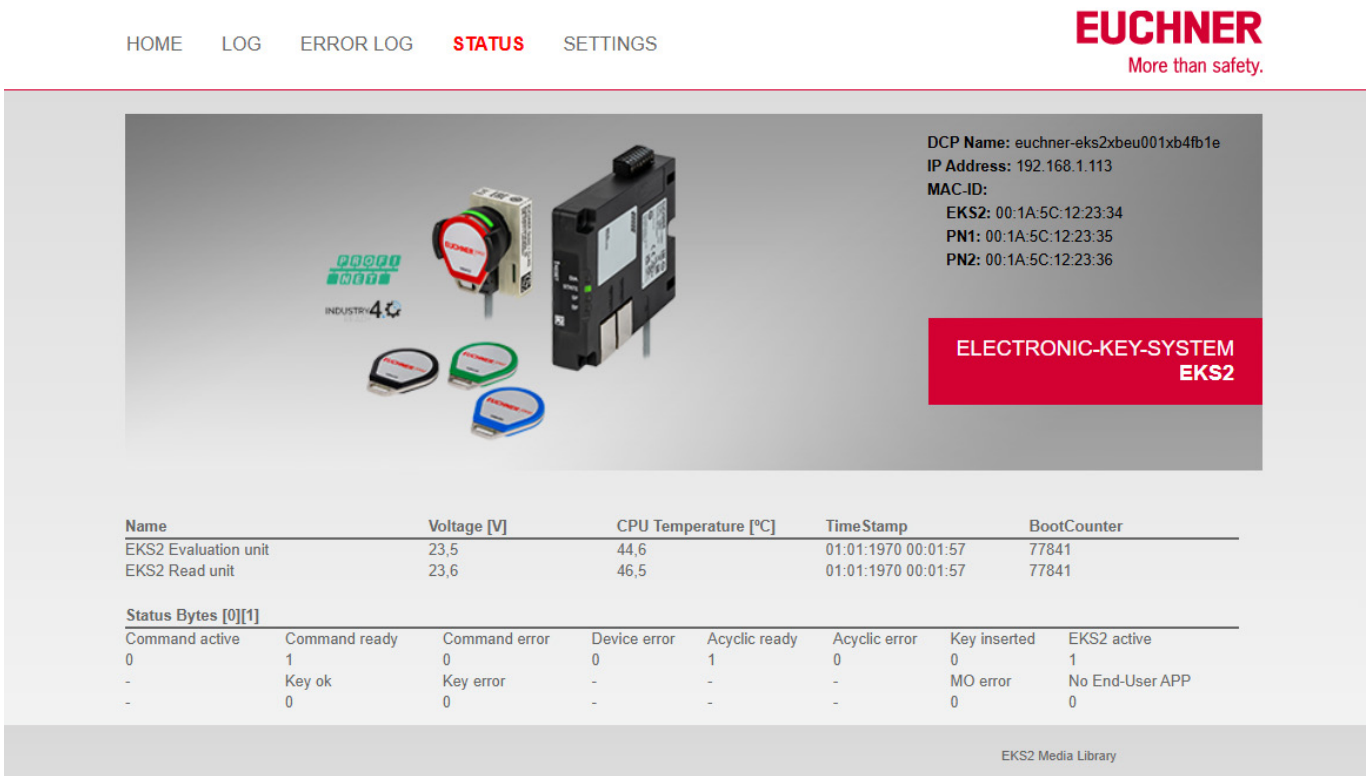


Nr.	Name	Error Code	Message	TimeStamp	BootCounter
8	EKS2 Evaluation unit	0x007B	Error Removed. No Profinet Connection	01:01:1970 00:00:16	77841
7	EKS2 Evaluation unit	0x007B	Error Added. No Profinet Connection	01:01:1970 00:00:00	0
6	EKS2 Evaluation unit	0x0004	Error Added. Device Configuration Updated	01:01:1970 00:00:44	77840
5	EKS2 Evaluation unit	0x007B	Error Removed. No Profinet Connection	01:01:1970 00:00:44	77840
4	EKS2 Evaluation unit	0x007B	Error Added. No Profinet Connection	01:01:1970 00:00:00	0
3	EKS2 Evaluation unit	0x007B	Error Added. No Profinet Connection	01:01:1970 00:00:00	0
2	EKS2 Evaluation unit	0x007B	Error Added. No Profinet Connection	01:01:1970 00:00:00	0
1	EKS2 Evaluation unit	0x007B	Error Added. No Profinet Connection	01:01:1970 00:00:00	0

You will find the error codes and their description in chapter *15.3. Error messages on page 31*.

14.4. Reading device status

The device status of the individual EKS2 components can be read in the *Status* view:



Name	Voltage [V]	CPU Temperature [°C]	TimeStamp	BootCounter
EKS2 Evaluation unit	23,5	44,6	01:01:1970 00:01:57	77841
EKS2 Read unit	23,6	46,5	01:01:1970 00:01:57	77841

Status Bytes [0][1]

Command active	Command ready	Command error	Device error	Acyclic ready	Acyclic error	Key inserted	EKS2 active
0	1	0	0	1	0	0	1
-	Key ok	Key error	-	-	-	MO error	No End-User APP
-	0	0	-	-	-	0	0

You will find further information about the status bytes in chapter *12.1.1. Input area (read process) on page 21*.

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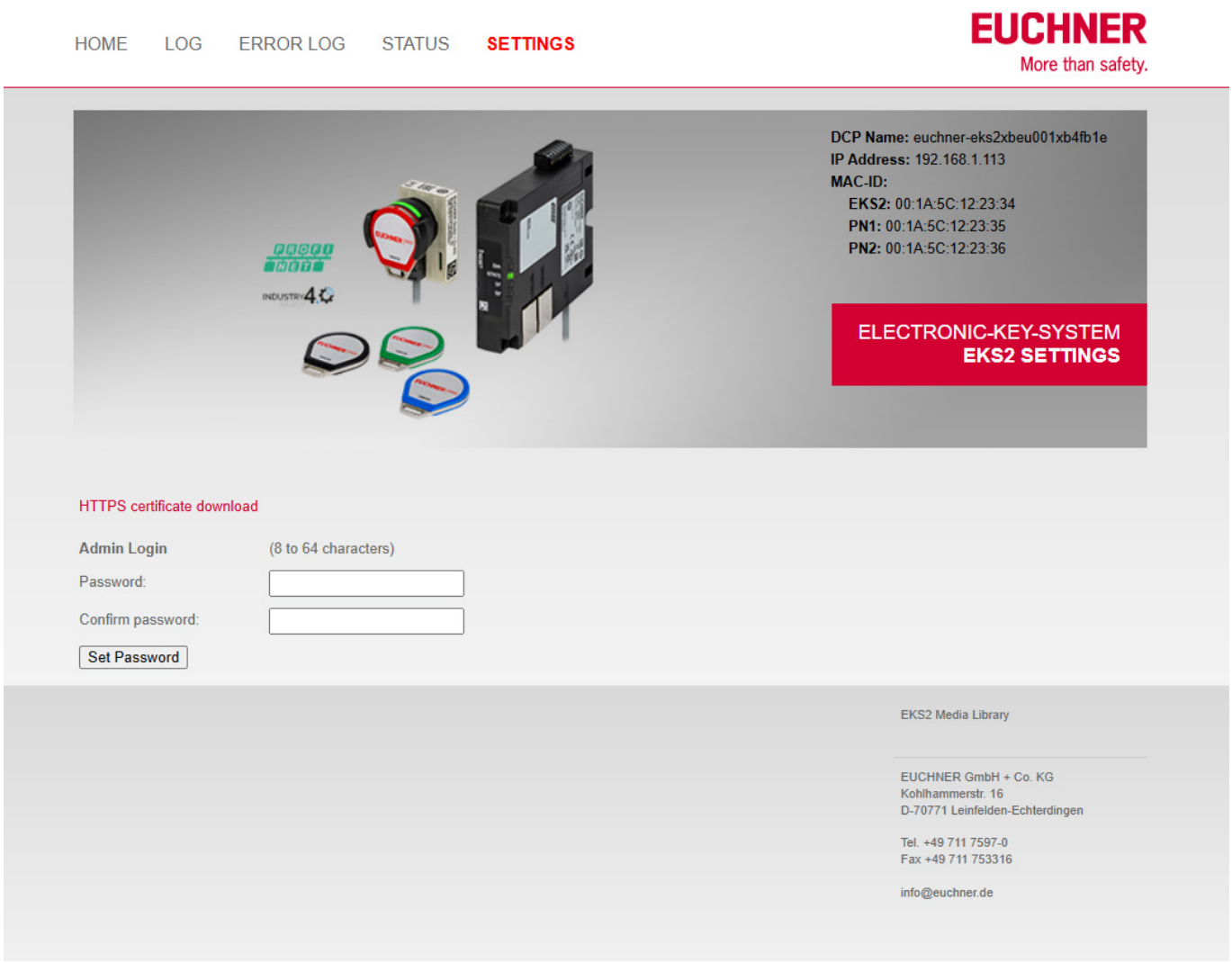
14.5. Managing settings

You can download the HTTPS certificate and manage the administrator area in the *Settings* view:



The administrator area is protected by a specific password that is assigned the first time the web server is used.

In the administrator area, it is possible to assign a further password for the firmware update process, see chapter *17. Updating firmware on page 35*.

Important!

- EUCHNER recommends assigning an individual password for each device.
- If a default password is used for different devices instead of individual passwords, it is essential to observe the following points:
  - The use of default passwords might facilitate unauthorized access to the network and the devices.
  - If a network error occurs during the firmware update process, devices not intended for a firmware update might be updated.

15. Status and error messages

15.1. LED displays

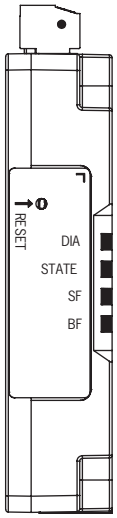
The LED displays on the read unit and the evaluation unit indicate the individual status and error messages. More detailed error messages can be read via the control system or the integrated web server.

Key to symbols	○		LED not illuminated
	☼		LED illuminated
	☼ 1x inverse		LED illuminated, briefly goes off 1x
	☼ 5 Hz		LED flashes at 5 Hz
	☼ 3 x		LED repeatedly flashes three times
	☼ ⬌ ☼		LEDs flash alternately
	X		Any state

15.1.1. Read unit LED indicator

The LED in the read unit indicates using the colors red, green and yellow.

15.1.2. Evaluation unit LED indicator



LED	Color
DIA	red, yellow
STATE	red, green, yellow
SF (System error)	red, yellow
BF (Bus error)	red, yellow

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15.2. Status messages

Operating mode	Evaluation unit LED indicator red/green/yellow				LED indicator Read unit	Status
	DIA	STATE	SF	BF	RGB	
Normal operation	○	green	○	○	yellow	Ready for operation
	○	green	○	○	green	Valid Electronic-Key
	red 1 Hz	green 1 Hz	○	○	red/green 1 Hz	Device detection after pressing the "Flash LED" option in the control system
Factory reset	red 2 Hz	green 2 Hz	○	○	red/green 2 Hz	Factory reset, see chapter *16. Factory reset on page 34*

15.3. Error messages

Error code	Evaluation unit LED indicator red/green/yellow				Read unit LED indicator	Error	Troubleshooting	Acknowledging errors	
	DIA	STATE	SF	BF	red/green/ yellow			Resettable	Non-resettable
Internal fault									
0x01	red	○	○	○	red on/green 1x briefly	▸ Internal device fault ▸ Error during factory reset	Restart system. On repeated occurrence, contact the EUCHNER support team.		●
-	yellow	2x yellow	○	○	red	Error on the read unit	Restart system. On repeated occurrence, contact the EUCHNER support team.		●
-	yellow	yellow	yellow	yellow	2x yellow	Error on the evaluation unit	Restart system. On repeated occurrence, contact the EUCHNER support team.		●
Configuration error									
0x03	red	green 3 x	○	○	red on/green 1x briefly	Invalid safe configuration of the parameters	Check the parameters for the MO settings in the GSDML file and correct if necessary. Then load the corrected parameters into the assembly and restart the system.		●
0x04	red	green 2 Hz	○	○	red / green 2 Hz	The safe configuration has been changed	Load new configuration into the assembly and restart the system.		●
	red 2 Hz					The non-safe configuration has been changed		●	
Compatibility error									
0x05	yellow	yellow 3 x	○	○	yellow 3 x	System components are incompatible	▸ Check device versions for compatibility. ▸ Update firmware.		●
Output errors									
0x54	red 1x inverse	green 4 x	○	○	red on/green 1x briefly	Invalid state of the safety outputs	Check wiring.	●	

Error code	Evaluation unit LED indicator red/green/yellow				Read unit LED indicator	Error	Troubleshooting	Acknowledging errors	
	DIA	STATE	SF	BF	red/green/yellow			Resettable	Non-resettable
Evaluation unit environment errors									
0x60	red 1x inverse	green 5 x	red	○	red on/green 1x briefly	Supply voltage at the evaluation unit too high	Observe the specified supply voltage, see chapter *18.1.1. Technical data for EKS2 evaluation unit on page 36*	●	
0x61	red 1x inverse					Supply voltage at the evaluation unit too low		●	
	red								●
0x62	red 1x inverse	green 5 x	red	○	red on/green 1x briefly	Device temperature at the evaluation unit too high	Observe the specified temperature range, see chapter *18.1.1. Technical data for EKS2 evaluation unit on page 36*	●	
0x63						Device temperature at the evaluation unit too low		●	
Read unit environment errors									
0x6C	yellow 1x inverse	red 5 x	red	○	red 5 x	Supply voltage at the read unit too high	Observe the specified supply voltage, see chapter *18.2.1. Technical data for EKS2 read unit on page 38*	●	
0x6D	yellow 1x inverse					Supply voltage at the read unit too low	▸ Observe the specified supply voltage, see chapter *18.2.1. Technical data for EKS2 read unit on page 38* ▸ Check wiring.	●	
	yellow								●
0x6E	yellow 1x inverse	red 5 x	red	○	red 5 x	Device temperature at the read unit too high	Observe the specified device temperature, see chapter *18.2.1. Technical data for EKS2 read unit on page 38*	●	
0x6F						Device temperature at the read unit too low			
Communication error									
0x7B	yellow 1x inverse	yellow 2 x	○	red 1 Hz	yellow on/green 2x briefly	No PROFINET connection	Check cables and plug connectors for the PROFINET connection for correct seating and damage.	●	
0x7C				○	yellow 2 x	Communication error between system components	Check cables and plug connectors between evaluation unit and read unit connection for correct seating and damage.		

Error code	Evaluation unit LED indicator red/green/yellow				Read unit LED indicator	Error	Troubleshooting	Acknowledging errors	
	DIA	STATE	SF	BF	red/green/yellow			Resettable	Non-resettable
Transponder/Electronic-Key errors									
0xC0	yellow 1x inverse	1x yellow	○	○	1x yellow	Erroneous Electronic-Key data	Check transponder, only EUCHNER transponders intended for the EKS2 system are permitted to be used.	●	
0xC1						Invalid Electronic-Key	Check header data for validity.		
0xC2						Expired Electronic-Key	Check transponder for validity.		
0xC3						Disabled Electronic-Key			
Application errors									
0xC4	yellow 1x inverse	1x yellow	○	○	1x yellow	Application error	Check data sent. The access key or the command may be incorrect.	●	
0xC5									
0xC6							Check contents of transponder. The transponder must contain the special machine manufacturer area if necessary.		
0x7D	yellow 1x inverse	yellow 2 x			yellow on/green 2x briefly	Invalid PROFINET request	Correct PROFINET command.		
0x11		yellow 1 x			1x yellow	Error during selection of safe operating mode	▸ Check data sent. ▸ Check data channel. ▸ Check configuration of the touch panel.		
Update error									
0xAF	yellow 1x inverse	4x yellow	○	○	4x yellow	Error during firmware update	▸ Run firmware update again. ▸ Check product and firmware versions and their compatibility. ▸ Wait until the update has finished and the device is restarted.	●	
	yellow								●

1) This error message will not result in system shutdown.

15.4. Acknowledging error messages

Resettable errors can be acknowledged as follows:

- Send the acknowledgment bit, see chapter *12.1.2. Output area (write process) on page 22*
- Selection of a valid operating mode
- For application errors: place a valid Electronic-Key

If the error is still indicated, disconnect the power supply for min. 3 s.

Non-resettable errors are also acknowledged by disconnecting the power supply (min. 3 s).

The system configuration is not deleted when the power supply is disconnected to acknowledge errors.

	**Important!** If the fault display is not cleared after a reset, contact the EUCHNER support team.

16. Factory reset

A factory reset deletes the system configuration and restores the factory settings.

1. Apply voltage to the system.

➡ The system is started.

2. Wait 30 s.

➡ The system has booted.

3. Within 70 s, actuate the Reset pushbutton on the evaluation unit for longer than 5 s.

➡ The DIA LED flashes red, and the STATE LED flashes green. The LED on the read unit alternately flashes red and green, see chapter *15.2. Status messages on page 30*.

➡ The system restarts automatically after completion of the factory reset.

17. Updating firmware

The evaluation unit's firmware can be updated using EUCHNER Device Update. You will find further information in the software manual for EUCHNER Device Update.

WARNING

Loss of the safety function

A firmware update can change or expand functions.

Observe the following points to ensure the safety function:

- Carefully observe the release notes for the respective firmware version prior to the update process. Ensure that the changes triggered by the firmware update continue to comply with the requirements of the overall system.
- Perform a risk assessment on the overall system before the update if necessary, because the update could change functions or processes in the EUCHNER device.
- Observe and follow the instructions in the software manual for EUCHNER Device Update when updating the firmware.

17.1. Running EUCHNER Device Update

NOTICE

Damage to the device

The device can be damaged when the firmware is updated.

- Make sure to use only one instance of the EUCHNER Device Update tool. Sending several broadcasts simultaneously from different instances to search for devices can damage the device.
- Ensure that a possible network connection loss does not result in the loss of data and damage to the device. While the network is being scanned, an overload might occur.
- Ensure a stable power supply for the device.
- Ensure that the automatic restart of the device after a successful update is not interrupted.

Important!

- After the update, check the update report to determine whether and on which devices the update process was successful.
- Ensure that the firmware update is recorded in the machine documentation using the automatically generated update report.
- Ensure that the device documentation corresponding to the update is available and is observed after the device update.

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18. Technical data

NOTICE

If a data sheet is available for the product, the information on the data sheet applies.

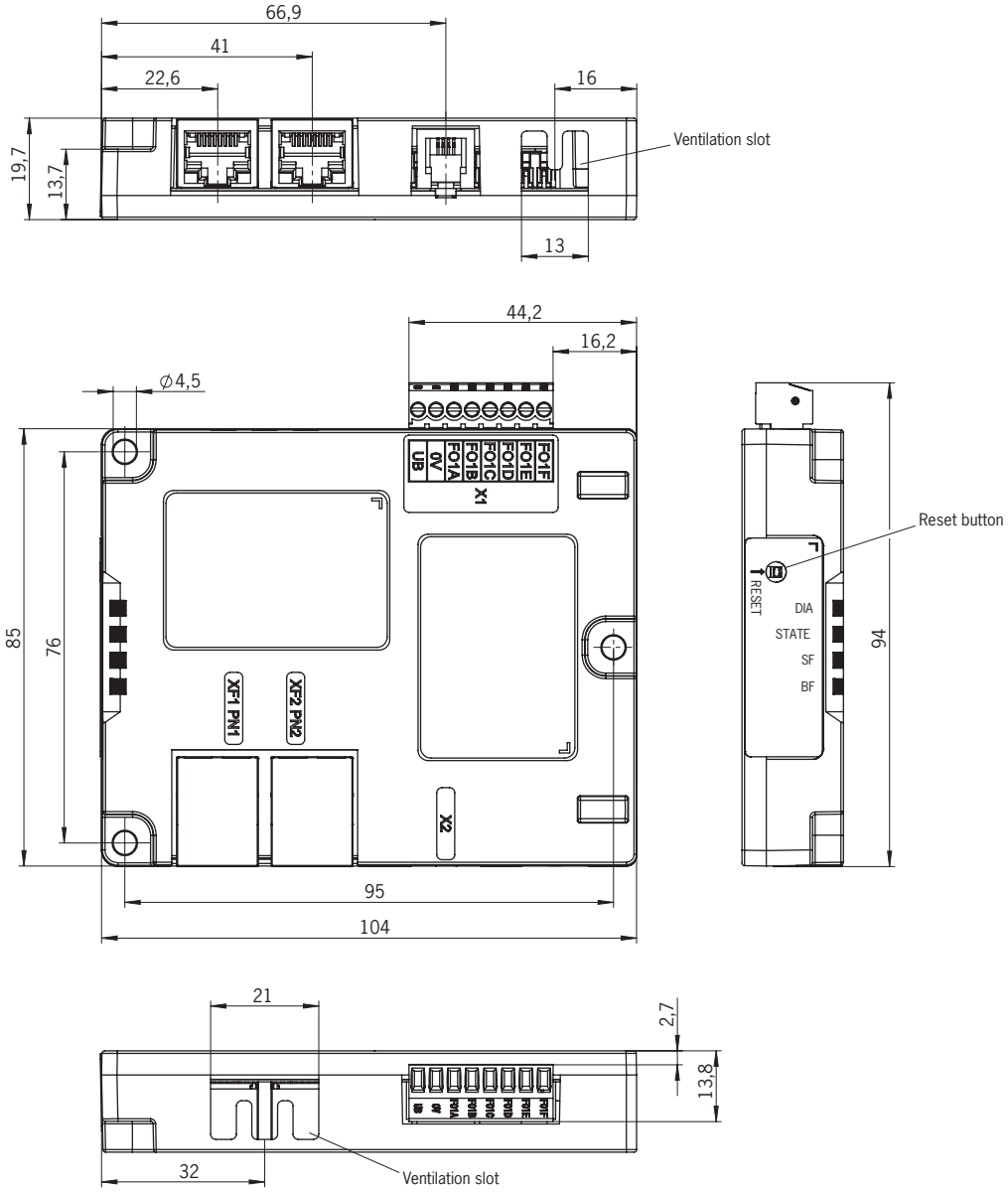
18.1. EKS2 evaluation unit

18.1.1. Technical data for EKS2 evaluation unit

Parameter	Value			Unit
	min.	typ.	max.	
General				
Material	Plastic (PA66 GF40, black)			
Degree of protection in the installed state	IP20			
Ambient temperature at UB = 24 V	-20	-	+55	°C
Storage temperature	-35	-	+85	°C
Power supply connection	Plug-in connection terminal, 8-pin, with screw terminal (tightening torque 0.2 … 0.25 Nm), conductor cross-section 0.05 … 1.5 mm²			
Interface, data transfer				
Interface to the control system	Industrial Ethernet (IEEE 802.3)			
Transfer protocol	PROFINET			
Data transfer rate (full duplex)	10/100			MB/s
Connection for Ethernet interface	2 x RJ45			
Data line	2 x 2 twisted-pair copper cables, screened; min. category 5			
Cable length			100	m
Read unit connection	1 x RJ9			
Operating voltage UB (reverse polarity protected, regulated, residual ripple <5%)	24 -15 … +20% (PELV)			V DC
Current consumption			150	mA
Switching current	1 … 50			mA
The following applies to the approval acc. to UL	Operation only with UL class 2 power supply or equivalent measures			
Switching load acc. to UL	DC 24 V, class 2			
External fuse (operating voltage UB)		0.5		A
EMC protection requirements	As per IEC 61000-6-2			
Safety outputs FO1A … FO1F	Semiconductor outputs, p-switching, short circuit-proof			
- Output voltage U_{FO1A}…U_{FO1X}				
HIGH U_{FO1A}…U_{FO1X}	UB - 1.5		UB	V DC
LOW U_{FO1A}…U_{FO1X}	0		1	
Switching current per safety output	1		50	mA
Utilization category acc. to EN 60947-5-2	DC-13 24 V 50 mA (Caution: outputs must be protected by a free-wheeling diode in the case of inductive loads.)			
Off-state current I_r 1)			0.25	mA
Characteristics acc. to EN ISO 13849-1 and EN IEC 62061				
Mission time	20			years
Category	3			
Performance Level (PL)	e			
PFH	6.44×10^{-9}			
Max. SIL	3			

1) Maximum current at an output in switched-off state.

18.1.2. Dimension drawing for EKS2 evaluation unit



EN

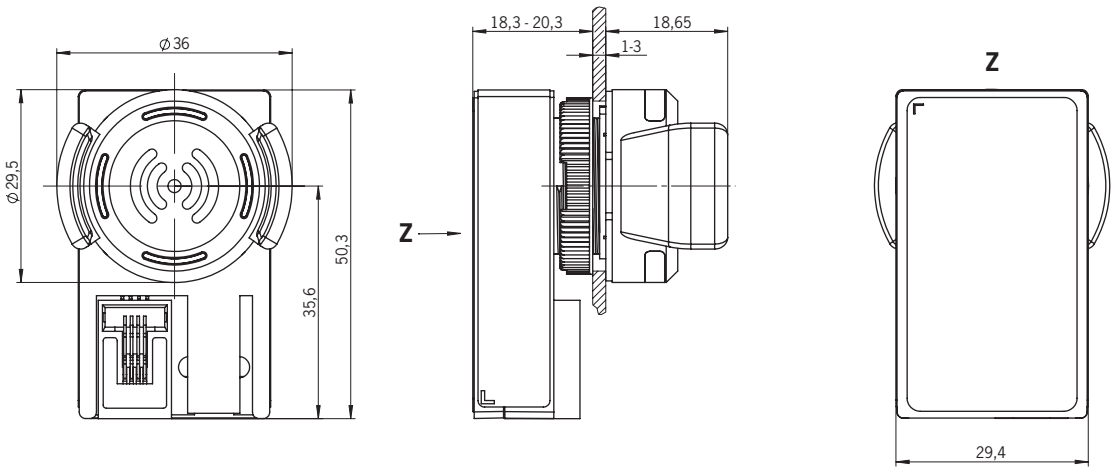
18.2. EKS2 read unit

18.2.1. Technical data for EKS2 read unit

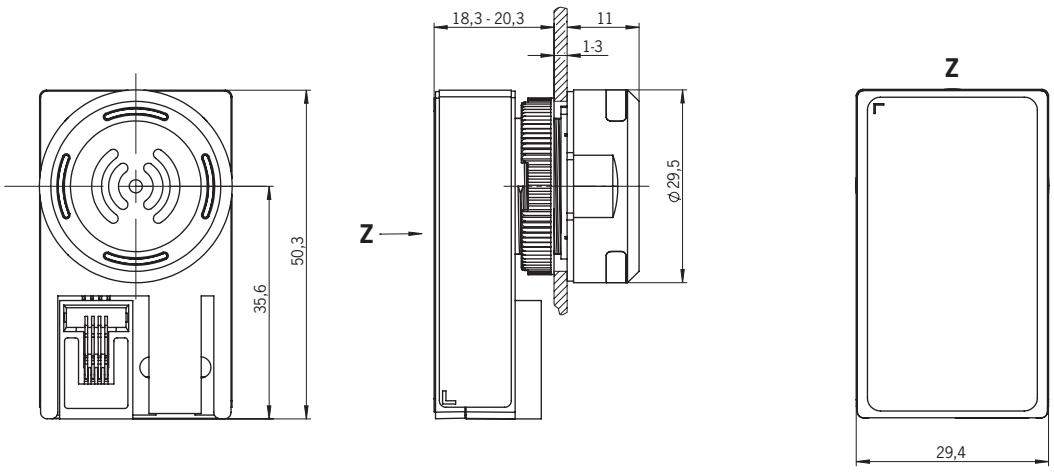
Parameter	Value			Unit
	min.	typ.	max.	
Material	Plastic (TPU, PBT)			
Mounting cut-out D22 acc. to EN IEC 60947-5-1	Ø 22.5			mm
Degree of protection in the installed state	IP65/IP67/IP69/IP69K at front, IP20 in panel			
Ambient temperature at UB = 24 V	-20	-	+55	°C
Storage temperature	-35	-	+85	°C
Connection	RJ9, 4-pin			
Cable length			50	m
Operating voltage UB (reverse polarity protected, regulated, residual ripple <5%)	24 -15 … +20% (PELV) Power supply via the evaluation unit			V DC

18.2.2. Dimension drawing for EKS2 read unit

Read unit with holding clip EKS2-R-I1A.-...



Read unit without holding clip EKS2-R-I1B.-...

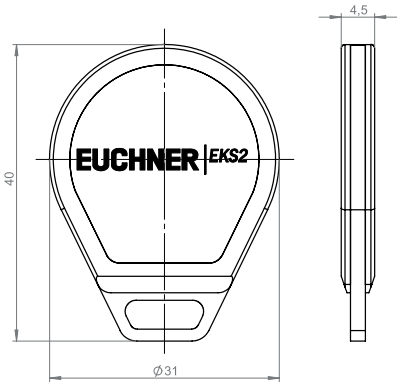


18.3. EKS2 Electronic-Key

18.3.1. Technical data for EKS2 Electronic-Key

Parameter	Value			Unit
	min.	typ.	max.	
Material	Stainless steel, plastic (ABS)			
Degree of protection	IP65/IP67			
Ambient temperature	-25	-	+60	°C
Storage temperature	-35	-	+85	°C
Power supply	Inductive via read unit			
Storage capacity	4,096			bytes
Data retention time			10 y at +22 °C	
Length of serial number (UID)	7 (read only)			bytes
Number of write cycles			500,000	

18.3.2. Dimension drawing for EKS2 Electronic-Key



EN

18.4. Radio frequency approvals

FCC ID: 2AJ58-21
IC: 22052-21

FCC/IC-Requirements

This device complies with part 15 of the FCC Rules and with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

1) This device may not cause harmful interference, and

2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority

to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Supplier's Declaration of Conformity
47 CFR § 2.1077 Compliance Information

Unique Identifier:
EKS2-R-I series

Responsible Party – U.S. Contact Information
EUCHNER USA Inc.
1860 Jarvis Avenue
Elk Grove Village, Illinois 60007

+1 315 701-0315
info(at)euchner-usa.com
http://www.euchner-usa.com

19. Inspection and service

Regular inspection of the following is necessary to ensure trouble-free long-term operation:

- Check the secure mounting of the devices and the connections
- Check for contamination

No servicing is required. Repairs to the device are only allowed to be made by the manufacturer.

20. Disposal

Observe the country-specific regulations when disposing of the device.

For further information, please refer to the *Company/Sustainability* area at www.euchner.com.

21. Service

If servicing is required, please contact:

EUCHNER GmbH + Co. KG
Kohlhammerstraße 16
70771 Leinfelden-Echterdingen
Germany

Service telephone:
+49 711 7597-500

E-mail:
support@euchner.de

Internet:
www.euchner.com

22. Declaration of conformity

The product complies with the following requirements:

- Machinery Directive 2006/42/EC (until January 19, 2027)
- Machinery Regulation (EU) 2023/1230 (from January 20, 2027)

The EU declaration of conformity can be found at www.euchner.com. Enter the order number of your device in the search box. The document is available under *Downloads*.

EN

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