

Safety CPU module XS-102-C00-000



Powering Business Worldwide

Company information

All brand and product names are trademarks or registered trademarks of their respective owners.

Service

For service and support, please contact your local sales team.

Contact info. [Eaton.com/contact](https://www.eaton.com/contact)

Service page: [Eaton.com/aftersales](https://www.eaton.com/aftersales)

Original Operating Instructions

is the German-language edition of this document

Publication date

06/25 MN050019 1th edition

Copyright

© 2025 Eaton Industries GmbH, 53105 Bonn

All rights, including those of translation, reserved.

No part of this manual may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, whether electronic, mechanical, photocopying, micro-filming, recording, or otherwise, without the prior written permission of Eaton.

Subject to alteration.



DANGER!

Hazardous electrical voltage!

Before starting with the installation

- Installation requires qualified electrician
 - Disconnect the power supply of the device.
 - Secure against retriggering
 - Verify isolation from the supply
 - Ground and short-circuit
 - Cover or enclose any neighboring live parts.
 - Follow the engineering instructions (IL) of the device concerned.
 - Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 part 100) may work on this device/system.
 - Before installation and before touching the device ensure that you are free of electrostatic charge.
 - The functional earth (FE) must be connected to the protective earth (PE) or to the equipotential bonding. The system installer is responsible for implementing this connection.
 - Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automation functions.
 - Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
 - Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
 - Deviations of the mains voltage from the nominal value must not exceed the tolerance limits given in the specifications, otherwise this may result in malfunction and hazardous states.
 - Emergency-Stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency switching off devices must not result in an automatic restart.
 - Built-in devices for enclosures or cabinets must only be run and operated in an installed state;
- desktop devices and portable devices only when the housing is closed.
- Measures should be taken to ensure the proper restarting of programs interrupted after a voltage dip or outage. This should not result in dangerous operating states even for a short time. If necessary, emergency switching off devices should be implemented.
 - Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks, etc.).

Table of Contents

	Safety CPU module XS-102-C00-000	1
	Company information	2
	Before starting with the installation	3
	Table of Contents	4
0.1	About this manual	7
0.1.1	List of revisions	7
0.1.2	Target group	8
0.1.3	Legal disclaimer	9
0.1.4	Short designations	10
0.1.5	Writing conventions	11
0.1.5.1	Warning labels	11
0.1.5.2	Additional information for use	12
1.	Description Safety CPU module XS-102-C00-000	13
2.	Basic safety instructions	14
2.1	General safety instructions	14
2.2	Use as intended	15
2.3	Software	16
3.	IT security	17
4.	Directives and standards	18
4.1	Residual risks	18
4.2	Machine or system safety	18
4.3	Directives	18
4.3.1	Functional safety standards	18
4.3.2	EC Declaration of Conformity	19
5.	Safety-relevant characteristics	20
5.1	Horizontal mounting position, ambient temperature of 0–55 °C	20
5.2	Horizontal mounting position, ambient temperature of 55–60 °C	20
5.3	Compatibility	20
6.	Nameplate	21

7.	Technical specifications	22
7.1	Rating data	22
7.2	Electrical requirements	23
7.2.1	Power supply module (input)	23
7.2.2	Power delivered to the backplane bus / Safety (output)	24
7.3	Additional information	26
7.4	Ambient conditions	27
8.	Mechanical dimensions	28
8.1	Pin assignment	29
8.2	Status LEDs	30
8.3	Plug connectors that should be used	31
8.4	Labeling area	32
9.	Validation button	33
9.1	How the individual sequences work	34
9.1.1	Start sequence	34
9.1.2	Command selection sequence	34
9.1.3	End sequence	34
9.1.4	Error sequence	35
9.2	Command overview	35
9.3	Module state and command overview	36
9.4	Using a microSD card	37
9.5	Configuring a Safety CPU with a microSD card	38
10.	Behavior during a fault Scenario	39
10.1	Error when restarting	40
10.2	Configuration distribution failure	41
10.3	Troubleshooting	41
10.4	Troubleshooting with XN Safety designer	41
10.5	What to do if there is a wiring problem	41
10.6	Notes on the application	41
10.7	Screen earth kit	42
10.8	ESD protection	42
11.	Mounting/Installation	43

11.1	Checking the included equipment	43
11.2	Mounting	43
12.	Supported cycle times	45
12.1	Cycle times shorter than 1 ms (in μ s)	45
12.2	Cycle times greater than or equal to 1 ms (in ms)	45
13.	Transport/storage	46
13.1	Storage	46
14.	Maintenance	47
14.1	Maintenance	47
14.2	Repairs	47
15.	Disposal	48
	Appendix	49
A.1	Further usage information	50
A.2	Data sheets	51
	Alphabetical index	53

0.1 About this manual

This operating manual contains all the information you will need in order to use the XN Safety modular safety PLC safely and correctly.

This Manual is considered an integral part of the XN Safety module and must always be readily available in the device's close proximity so that users have access to it. The XN Safety Designer programming software program is an integrated part of the XN Safety modular safety PLC system. This software is used to program the corresponding Safety projects.

This hardware manual describes all of XN Safety CPU modules lifecycle stages: transportation, installation, commissioning, operation, maintenance, storage, and disposal.

It assumes you have electrical engineering knowledge and skills.

Make sure to always use the latest documentation for your device.



Manual Safety CPU module

MN050019EN

The latest version of this documentation, as well as additional references, is available for download on the Internet.



Eaton.com/documentation

Please send any comments, recommendations, or suggestions regarding this document to: DocumentationEGBonn@eaton.com

0.1.1 List of revisions

The following significant amendments have been introduced since previous issues:

Publication date	Page(s)	Keyword	New	Modification	Deleted
2025-06-01	ff	Product launch edition	✓		

0.1 About this manual

0.1.2 Target group

This operating manual contains all the information you will need in order to operate the Safety modules.

This operating manual is intended for electricians and electrical engineers, as well as for the people who will be in charge of performing the electrical installation and people who will be using the Safety CPU module:

- Project planners, automation technicians, and automation engineers
- Installers, commissioning technicians
- Machine operators
- Maintenance personnel / testing technicians

This manual assumes that the reader has extensive knowledge of automation and the specifics behind it.

For additional help, information, and compatible accessories, please visit our website: Eaton.com.

If you have any questions, our Support Team will of course be happy to assist you. For our emergency phone number and office hours, please visit our website.



CAUTION

Installation requires qualified electrician

XN Safety module must be installed and connected exclusively by electricians and people who are familiar with electrical installation work.



Follow the safety instructions for the XN Safety module!

The section on safety instructions must be read and understood by everyone who will be working with the XN Safety CPU module before the actual work is performed Safety modules.

0.1.3 Legal disclaimer

All the information in this manual has been prepared to the best of our knowledge and in conformity with the state of the art. However, this does not exclude the possibility of there being errors or inaccuracies. Accordingly, this manual is subject to change without notice, with potential changes including technical changes intended to improve devices.

We hereby disclaim any and all liability for the correctness and completeness of this information. Please note that this operating manual purely provides a product description. In particular, the information in it does not guarantee any specific properties in terms of warranty laws and similar regulations.

The machine manufacturer will be responsible for proper installation and product configuration. Meanwhile, the machine operator will be responsible for the product's safe use and proper operation.

Do not use the XN Safety before reading and understanding this manual.

It is assumed that the user of this manual is thoroughly familiar with the information found in the manuals for incorporating the safety controller into automation processes.

Hazards posed by the safety PLC cannot be ruled out if the safety instructions are not observed – especially if the safety PLC is installed and commissioned by inadequately qualified personnel or if it is used improperly. Eaton hereby disclaims any and all liability for damages arising from failure to observe these instructions or comply with all applicable standards and regulations.

The use of sample programs and of the program part screenshots used in the documentation are subject to the following safety instructions and operating guidelines:

1. The program examples provided were created to the best of our knowledge and belief and in accordance with the current state-of-the-art. The program examples provided were created to the best of our knowledge and belief and in accordance with the current state-of-the-art. However, errors cannot be totally excluded, and the example programs do not cover all function blocks and applications that are available for the safety controller.
2. Electrical engineering skills and know-how are required in order to be able to program and commission the safety controller. An incorrectly wired or incorrectly configured safety controller will pose a property damage risk and an injury hazard when active components such as motors and pressure cylinders are being driven.
3. When using the provided sample programs and generating a program with XN Safety Designer Configuration tool, the user has the sole responsibility to observe the following:
 - All relevant rules and practices for preparing circuit diagrams for the safety controller as specified in the latest documents for these XN Safety.

0.1 About this manual

- All occupational health and safety and accident prevention directives, standards, and regulations applicable to the commissioning, circuit diagram creation for, and use of the safety controller for your planned application, in particular those imposed by employers' liability insurance associations (Berufsgenossenschaften).
 - Acknowledged rule of technology and state of science.
 - All other general due diligence regarding the prevention of damages to life and physical condition of persons as well as material damage.
4. The manufacturer cannot accept any liability for any damages that are caused by customers not using the program examples provided in accordance with the conditions of use specified here under points 1 to 3.



The latest version of this manual can be found on our Download Center by using the following search term: MN050019.



Eaton.com/documentation

0.1.4 Short designations

The following general terms are used throughout this manual:

Short designation	Explanation
XN Safety	Entire series, used to refer to all the modules in the product family
Safety CPU	XN Safety CPU module XS-102-C00-000
XN Safety module	Extension of XN Safety CPU module
XN Safety designer	XN Safety Designer Configuration tool



For the exact designation for your Safety CPU module, please refer to the inscription on the XS-102-C00-000.

0.1.5 Writing conventions

0.1.5.1 Warning labels

Risk of personal injury warning.



DANGER

"Danger" means that death or serious injury will occur if the specified measures are not taken.

- Follow all instructions in order to prevent death and serious injury.



WARNING

"Warning" means that death or serious injury may occur if the specified measures are not taken.

- Follow all instructions in order to prevent death and serious injury.



CAUTION

"Caution" means that moderate or minor injury may occur if the specified measures are not taken.

- Follow all instructions in order to prevent moderate to minor injury.

Property damage warning



ATTENTION

Warns about the possibility of material damage.

Prohibited use



Prohibited uses, actions, etc.

Prohibition signs interdict actions or the use of certain objects

Bids



Bid

Mandatory signs require a certain behavior

0.1 About this manual

Notes



Additional information, information worth knowing, useful additional information

- Provides important information regarding the product, handling, use, or relevant parts of the documentation that require special attention.



► Indicates instructions to be followed

0.1.5.2 Additional information for use

Documents (such as manuals) are listed after the  icon together with the corresponding name and Eaton number.



Publication title

For identifying the Eaton publication code

Links to external Internet addresses are shown after the  symbol.



Destination address without http(s)://www.

Links to external content are shown in [blue](#).

1. Description Safety CPU module XS-102-C00-000

The XS-102-C00-000 XN Safety CPU module supports up to 16 Safety I/O modules. In addition, the Safety CPU module is able to handle hand-held terminals with emergency stop or enable buttons.

The Safety CPU module is characterized by safety integrity level SIL3 (EN IEC 62061) and performance level e (PL e) (EN ISO 13849).

The Safety CPU module for safety-related applications is suitable for use in systems with optional modules and interface tags as set forth in XN Safety system manual, → Section "Further usage information", page 50

The Safety CPU module alone already represents a minimum system for a safety controller.



XS-102-C00-000

In addition, the Safety CPU module uses secure bus frames to control communications with remote safety modules while ensuring the correct timing is used. Its tasks include:

- Processing the safety application

and

Distributing the configuration data to remote safety modules

Equipment supplied

1x XS-102-C00-000

One (1) PLUG-FMC-3S (1,5/3-ST-3,5) plug connector

One (1) PLUG-FMC-4S (1,5/4-ST-3,5) plug connector

2. Basic safety instructions

2.1 General safety instructions

2. Basic safety instructions

2.1 General safety instructions

Follow the safety instructions in all of this manual's sections without fail. These instructions will be highlighted visually with appropriate symbols.

Pursuant to EU Directives, this operating manual is an integral part of a product. Accordingly, make sure to always keep this manual in the machine's vicinity, as it contains important instructions.

If you sell, transfer, or rent out the product, make sure to pass this documentation on and point out that it is available online.

In regard to all occupational health and safety requirements associated with the machine's use, the manufacturer must conduct a risk assessment in accordance with Machinery Directive 2006/42/EC before a machine is placed on the market.

Operate the XN Safety CPU module product exclusively with devices and accessories approved by Eaton for this purpose.

CAUTION



Handle the device carefully and do not drop it.

Do not, under any circumstance, let any foreign objects or liquids get into the module.

Do not open the XN Safety CPU module!

If the XN Safety CPU module is not working as intended or if it sustains any damage that could result in a hazard being posed, replace it without fail!

The XN Safety CPU module conforms to EN 61131-2.

When used in combination with a system, the system integrator must meet the requirements in standard EN 60204-1.

Make sure to observe all environmental conditions for your own safety and the safety of others.

2.2 Use as intended

The safety functions implemented with the Safety CPU module are intended for use in safety applications within the context of a PLC and meet all necessary requirements for safe operation in conformity with SIL 3 as defined in EN IEC 62061 and PL e / Cat. 4 as defined in EN ISO 13849-1.

CAUTION



Always observe the instructions and information in this operation manual. Properly transporting and storing the device are essential for proper operation.

The device must be installed, mounted, programmed, commissioned, operated, maintained, and removed from service exclusively by trained qualified personnel.

Within this context, "trained qualified personnel" refers to individuals who have received the required vocational training as skilled workers or who have been trained by a skilled worker and accordingly are authorized to operate and take care of safety devices and systems in compliance with all applicable safety (functional safety) guidelines, standards, and Directives.

For your safety and the safety of others, make sure to only use the Safety CPU module as intended.

This intended use also includes installing the device properly in terms of EMC.

Within this context, the following are instances of unintended use:

- Any alterations of any type made to the device, as well as the use of damaged devices.
- Using the device outside of the technical limits and scope described in this operating manual or outside of the specified technical data.

2. Basic safety instructions

2.3 Software

2.3 Software

The XN Safety Designer Configuration tool is used to program the Safety project. The application compiled from this project can then be transferred to the XN Safety CPU module.

For basic information regarding functional safety, please refer to the XN Safety system manual.

3. IT security

XN Safety modules have been developed for integration into networks that are secure against third-party access.

The network being used could be exposed to the following risks, for example:

- Unauthorized access
- Data tampering
- And many other IT security risks

The integrator, or the company operating the device, is responsible for conducting a risk assessment for the connections between XN Safety and the corresponding integration into the general infrastructure. This assessment can result in a variety of measures, including, but not limited to (if necessary):

- IT/OT network segmentation (VLANs or physical)
- Firewalls
- Password-protected user accounts
- Data encryption
- and much more.

When it comes to functional safety, the various functions and their integrity are completely invulnerable to direct manipulation in this regard, since these functions cannot be affected through communication-based interfaces.

However, the availability of the overall system (as is the case with all safety functions) can be negatively affected as a result of third-party attacks, which is why the aforementioned measures are required.

4. Directives and standards

4.1 Residual risks

4. Directives and standards

4.1 Residual risks



CAUTION

The following residual risks for the Safety CPU module must be taken into account in the risk assessment conducted by the system integrator:

- Release of environmentally harmful substances, emissions, and unusual temperatures
- Dangerous touch voltages
- Effects of operational electric, magnetic, and electromagnetic fields
- Possible effects of IT devices

4.2 Machine or system safety



Observe all accident prevention and occupational health and safety standards and regulations that apply at the location of use.

4.3 Directives

The Safety CPU module has been designed in compliance with all applicable European Union Directives and tested for conformity accordingly.

4.3.1 Functional safety standards

EN IEC 62061	Safety of machinery - Functional safety of safety-related control systems
EN ISO 13849-1	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
EN ISO 13849-2	Safety of machinery - Safety-related parts of control systems - Part 2: Validation

4.3.2 EC Declaration of Conformity



EU Declaration of Conformity

The Safety CPU module XS-102-C00-000 conforms to all applicable European standards for programmable logic controllers and complies with the following European Directives:

- **2006/42/EG** Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (Machinery Safety Directive)
- **2014/30/EU** electromagnetic compatibility (EMC Directive)
- **2011/65/EU** Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive)

EU Declarations of Conformity are available on the EATON homepage. In addition, this one is included as a resource in the data sheet for the XS-102-C00-000.

5. Safety-relevant characteristics

5.1 Horizontal mounting position, ambient temperature of 0–55 °C

5. Safety-relevant characteristics

5.1 Horizontal mounting position, ambient temperature of 0–55 °C

Module	Safety characteristic values	Safety level
XS-102-C00-000	PFH = 1.80E-10 (1/h) SFF = 99 %	SIL 3 as per EN IEC 62061
	MTTF _D = 2242 years DC = 99 %	PL e / Cat. 4 as per EN ISO 13849

Configuration: Two-channel redundancy (diverse)

5.2 Horizontal mounting position, ambient temperature of 55–60 °C

Module	Safety characteristic values	Safety level
XS-102-C00-000	PFH = 2.30E-10 (1/h) SFF = 99 %	SIL 3 as per EN IEC 62061
	MTTF _D = 1862 years DC = 99 %	PL e / Cat. 4 as per EN ISO 13849

Configuration: Two-channel redundancy (diverse)

5.3 Compatibility

The safety XS-102-C00-000XN Safety CPU module is supported with
firmware version $\geq$ S02.18.02 and
Software version of the XN Safety Designer Configuration tool $\geq$ 11.01.076 and higher.



Compatibility

For more information on the compatibility of the XN Safety modules,
please refer to the "Compatibility of XN Safety modules" section in
the XN Safety system manual.

6. Nameplate

The nameplate can be found on the Safety CPU module.



7. Technical specifications

7.1 Rating data

CPU	ARM Cortex M μ Controller	
Addressable Safety I/O modules	XN Safety bus: 16	
Data memory	Type	SRAM
	Memory	24 kByte
Program memory	Type	Flash
	Memory	224 kByte
Retentive memory for parameter lists	-	
Retentive memory for tags	-	
Interfaces	One (1) microSD slot for microSD cards for loading an XN Safety project onto the Safety CPU 1x Safety interface, Phoenix MC1.5/3-G-3.5 One (1) mini B USB device (online & programming interface) 1x Safety bus IN/OUT 1x Safety bus OUT	
Field bus connection possible	Yes	
Status LEDs	Yes	

7. Technical specifications

7.2 Electrical requirements

7.2 Electrical requirements

7.2.1 Power supply module (input)

Supply voltage	+18-30 ⁵⁾ V DC, normally +24 V DC (SELV/PELV) UL: Class 2 or LVLC ¹⁾				
Current draw, power consumption	Normally 90 mA internal consumption				
	Maximum 1.4 A ^{2) 3)}				
Power consumption from the XN Safety bus		+5 V		+24 V	
	If +24 V is not connected (X3)	Normally 170 mA	Maximum 200 mA	0 A	0 A
	If +24 V is connected (X3)	0 A	0 A	0 A	0 A



The supply voltage must have an upstream fuse with appropriate voltage and current limiting characteristics!

7.2.2 Power delivered to the backplane bus / Safety (output)

Power supply	For the Backplane bus	+5 V	+24 V
		0 A	0 A
	For the XN Safety bus (power for I/O modules)	+12 V	+24 V
		max. 0.8 A ^{2) 4)}	max. 0.8 A ^{2) 4)}



¹⁾ For the United States and Canada:

The power must be limited to:

- a) Max. 5 A for voltages of 0 to 20 VDC or
- b) 100 W for voltages of 20 to 60 VDC

The limiting component (e.g., transformer, power supply unit, or fuse) must be certified by an NRTL (National Recognized Testing Laboratory such as UL).

²⁾ Depends on the number of modules connected to the XN Safety bus.

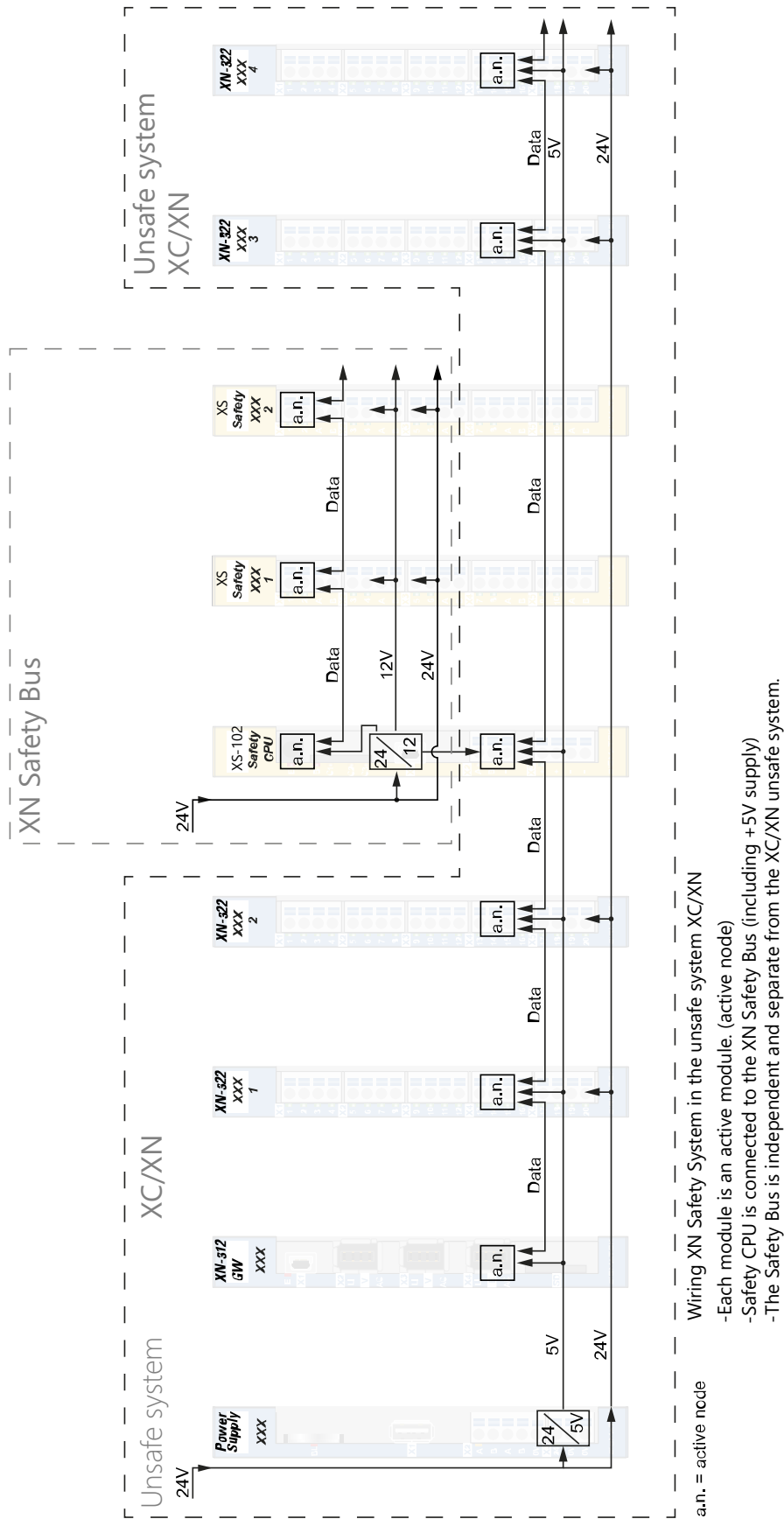
³⁾ In order to charge the internal capacitors, there can be an elevated current draw level for a very short time (in the microsecond range). This value will depend on the input voltage and the impedance of the power source.

⁴⁾ If you run the XN Safety CPU module with several modules, you will need to calculate the total currents for +24 V and +12 V based on the module documentation for the XN Safety modules used! The total current for the +24 V power supply must not exceed 800 mA. The total current for the +12 V power supply must not exceed 800 mA.

⁵⁾ If there is an elevated ambient temperature > 55 °C, the maximum permissible supply voltage decreases from +30 V to +28.8 V.

7. Technical specifications

7.2 Electrical requirements



7.3 Additional information

Article number	EP-401352
Circuit card coating	no
Standardization	Designed according to UL508 (E247993)
Approvals	cULus, CE, TÜV-Austria EC type-tested
Service life	20 years
Time of reaction	Please refer to the "Response time and shutdown time" section in the XN Safety system manual

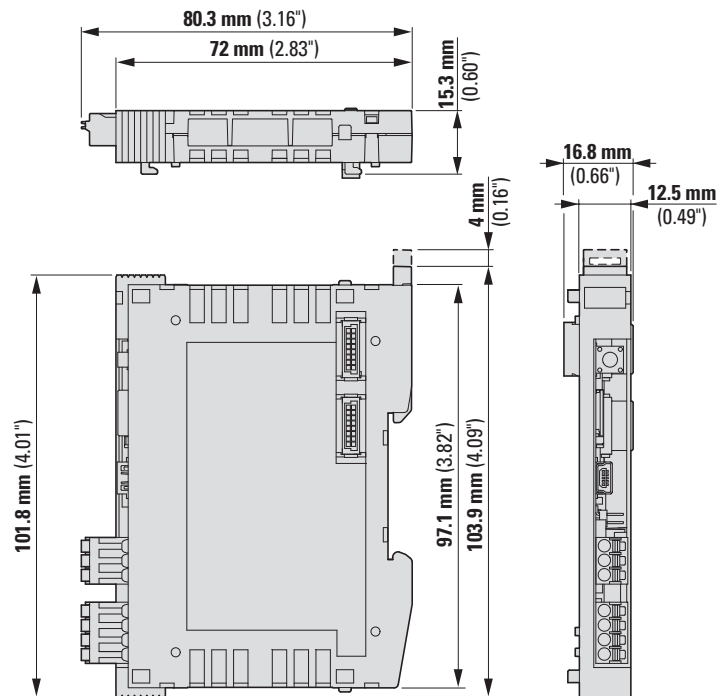
7. Technical specifications

7.4 Ambient conditions

7.4 Ambient conditions

Storage temperature	-20 – + 85 °C (-4 – +185 °F)	
Ambient temperature	± 0 – +55 °C (+32 – +131 °F) [UL] ± 0 – +60 °C (+32 – +140 °F) [CE]	
Humidity	0 - 95%, non-condensing	
Installation altitude	Max. 2000 m above sea level without derating > 2000 m to a maximum of 5000 m with the following maximum ambient temperature derating: 0.5 °C per 100 m	
Operating conditions	Pollution Degree 2	
Noise emissions	≤ 70 dB	
EMC interference immunity	EN 61000-6-2 (industrial environments) EN 61000-6-7 (interference immunity for functional safety in industrial applications) (stricter requirements in conformity with EN IEC 62061)	
EMC emitted interference	EN 61000-6-4 (industrial environment)	
Vibration resistance	EN 60068-2-6	3.5 mm of 5-8.4 Hz 1 g of 8.4-150 Hz
Mechanical shock resistance	EN 60068-2-27	15 g (147.15 m/s²)
Protection Style	EN 60529/NEMA 250	IP20/type1

8. Mechanical dimensions

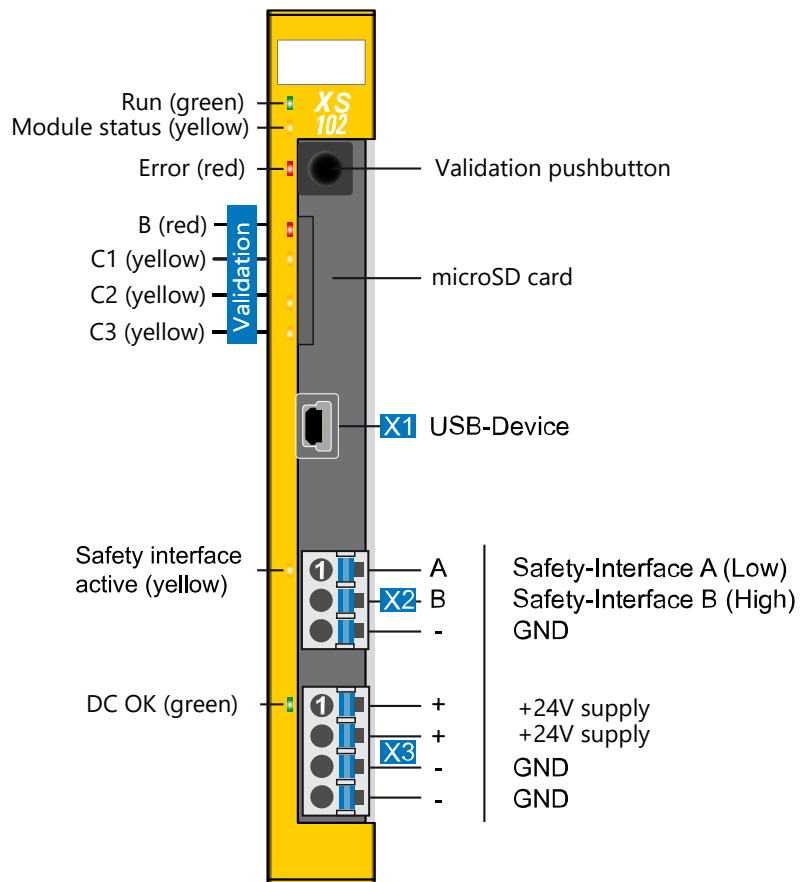


Dimensions (W x H x D)	16.8 mm x 104.2 mm x 80.3 mm (0.661" x 4.102" x 3.161") +/- 0.2 mm
Weight	55 gr

8. Mechanical dimensions

8.1 Pin assignment

8.1 Pin assignment



The terminals for +24 V power (X3: pin 1 and pin 2) and GND (X3: pin 3 and pin 4) are internally connected.

This means that only one +24 V pin (pin 1 or pin 2) and one GND pin (pin 3 or pin 4) needs to be connected in order to power the module. The internally connected terminals can be used to extend the +24 V and GND connections. However, it is necessary to make sure that this does not result in a total current of 6 A being exceeded per terminal!

8.2 Status LEDs

For inputs and outputs, a solid light on the corresponding LED indicates that the input/output is on.

Run	Green	Run	Indicates • Temporary ("S" LED on) Operational Mode • Standard (indefinite) ("S" LED off) Operational Mode
Module Status	Yellow	State	• Solid light: The module is in Service Mode • Slow flashing frequency: The module is in Idle or Check Configuration Mode (configuration distribution)
Error	red	Error	• Solid light: The module is in Error Mode • Slow flashing frequency: In the case of remote inputs, the maximum age has been exceeded (can be read with XN Safety designer) • Fast flashing frequency: Serious fault; it is no longer possible to communicate with the module (CANNOT be read with XN Safety designer)
B	red	Indicator Validation button S1	Description → Chapter "8 Validation button", page 33
C1	Yellow	Command 1	
C2	Yellow	Command 2	
C3	Yellow	Command 3	
DC OK	Green	DC OK +24 V	Indicates that the device is being powered

8. Mechanical dimensions

8.3 Plug connectors that should be used

8.3 Plug connectors that should be used

X1: Female connector for mini B USB (not included as standard)

X2, X3: Connector with push-in spring-cage terminal (included in the scope of supply)

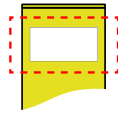
The spring-cage terminals can be used to connect ultrasonically spliced (ultrasonically welded) wires.

Connection specifications :

Stripping length / ferrule length	10 mm
Angle of plug	Parallel to conductor axis or circuit card
Conductor cross-section, rigid	0.2-1.5 mm ²
Conductor cross-section, flexible	0.2-1.5 mm ²
Conductor cross-section, ultrasonically spliced wires	0.2-1.5 mm ²
Conductor cross section, AWG/kcmil	24-16
Conductor cross-section, flexible with ferrule (uninsulated)	0.2-1.5 mm ²
Conductor cross-section, flexible with ferrule (insulated)	0.25-0.75 mm ² (reduction reason: d2 of ferrule)



8.4 Labeling area



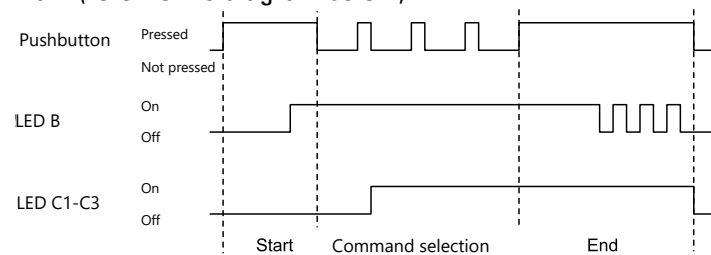
Manufacturer	Weidmüller
Type	MF 10/5 CABUR MC NE WS
Article number Weidmüller	1854510000
Compatible printers	Weidmüller
Type	Printjet Advanced 230V
Article number Weidmüller	1324380000

9. Validation button

You can use the S1 validation button to run several commands, as well as the validation routine itself:

- Resetting an error and exiting the device's error condition
- Deleting a configuration on the Safety CPU
- Validating the configured safety system

To enter a command with the validation button, you will need three sequences: the start sequence, the end sequence, and the sequence for selecting the command you want (refer to the diagram below).



9. Validation button

9.1 How the individual sequences work

9.1 How the individual sequences work

9.1.1 Start sequence

Press and hold down the button until LED B lights up (after approx. 3 seconds). If you hold down the button too long (longer than approx. 10 seconds), an error sequence will be output (please refer to "Error sequence"). The same will happen if you release the button too early (before LED B turns on) or you press the button again immediately after releasing it (less than approx. 200 ms between two button presses).

9.1.2 Command selection sequence

After entering the start sequence, you can select the command you want. To do this, press the button as follows: Press and hold down for at least 200 ms but no longer than approx. 3 seconds and then leave the button unpressed for at least 200 ms but no longer than 10 seconds before the next press. Every time after you press the button correctly (incl. the minimum pause of approx. 200 ms), the currently selected command will be indicated with LEDs C1, C2, C3. If you select an invalid command (please refer to "Valid commands"), the error sequence will be output. It will also be output if you fail to meet the timing requirements. LED B will show a solid light all throughout this sequence.

9.1.3 End sequence

This sequence is used to confirm the selected command. To do this, press and hold down the button until LED B starts flashing (after approx. 3 seconds; it will flash at a slow interval). The number of light pulses on LED B will depend on the command you selected previously (please refer to "Valid commands").

After the LED turns off, release the button. After a minimum pause of approx. 200 ms during which you should not press the button again, the device will switch to Service Mode and run the command. If you hold down the button longer than approx. 3 seconds after the flashing phase is done, the selected command will not be accepted and the error sequence will be shown. The same will happen if you release the button too early or press it during the minimum pause of approx. 200 ms. Once the command is run, the device will switch to the appropriate mode based on the command in question (please refer to "Valid commands").

If running the command results in an error (because, for instance, SET_VERIFIED is run even though there is no valid configuration data present on the Safety CPU), the error sequence will be output.

9.1.4 Error sequence

If you press the button in a way you are not supposed to (as described in the sequences above), the device will switch to the error sequence. This sequence will be indicated with fast LED B flashing. LED B will continue to flash for at least approx. 3 seconds.

If you are still holding down the button after the 3 seconds elapse, LED B will continue to flash until you release the button and do not press it again for at least approx. 200 ms. You will not be able to initiate the start sequence again until after LED B stops flashing.

Once the error sequence is done, the device will switch mode as shown in "Module state overview." If the C1, C2, or C3 LED is on, it will turn off after the error sequence is done.

9.2 Command overview

The number of times you press the button will match the number of light pulses on LED B during the end sequence.

Commands	Number of times the button is pressed	LED C1	LED C2	LED C3
QUIT_ERROR	1	X		
CLR_CFG	2	X	X	
SET_VERIFIED	3	X	X	X

9. Validation button

9.3 Module state and command overview

9.3 Module state and command overview

The following tables show the states that the system can assume, as well as the commands that you can use in these states and how they will affect the module states.

	Command		
System state	QUIT_ERROR	CLR_CFG	SET_VERIFIED
Check configuration		X	
Temporary Operational Mode		X	X
Operational Mode		X	
Service Mode		X	
Error	X		

Command	What the command does	State after the command is run
QUIT_ERROR	If there is an error, it will be reset on the Safety CPU and all the safety modules required by the Safety CPU, and the corresponding error conditions will be exited.	SW-RESET ¹⁾
CLR_CFG	The configuration on the Safety CPU will be deleted. After the command is run, the Safety CPU will be in Service Mode.	Service Mode
SET_VERIFIED	The configuration state will be set to "verified".	Operational Mode
¹⁾ A SW reset will be carried out. If the error persists after that, the Safety CPU will remain in error mode; otherwise, the Safety CPU will start up correctly. General note: If you enter a command incorrectly, the Safety CPU will run the error sequence (see above). Once the error sequence is done, you can enter the command again.		



If the Safety CPU itself is in its error condition, the error will be reset on the Safety CPU when a "Quit Error" command is transmitted with the validation button.

If the configuration on the Safety CPU also features remote safety modules that are in their respective error conditions, these error conditions will not be canceled. To cancel them, you will need to run an additional "Quit Error" command.

9.4 Using a microSD card

You can only write to a microSD card with XN Safety designer.

If you have a Safety project that has been programmed with the XN Safety Designer Configuration tool, you can store it on a microSD card. You can then transfer the stored Safety project to another XS-102-C00-000 Safety CPU. Please note that in order to be able to do this, the flash memory on the latter Safety CPU module must have been cleared first.

If the configuration on the microSD card and the configuration in the Safety CPU's flash memory are different from each other, the system will switch to its error condition (error message 87). Do not insert the microSD card into the Safety CPU during normal operation (Operational Mode or Temporary Operational Mode). If you insert the microSD card during normal operation, the Safety CPU will switch to its error condition (error message 88). In contrast, you can remove a microSD card during normal operation without issue.

9. Validation button

9.5 Configuring a Safety CPU with a microSD card

9.5 Configuring a Safety CPU with a microSD card

To apply the configuration from a microSD card, follow the steps below:

- **Delete the configuration on the Safety CPU being programmed**

In order to be able to apply the configuration from the microSD card, you will first need to delete the configuration that is on the Safety CPU. You can either do this with XN Safety designer or

with the CLR_CFG command (which you can send with the validation button on the Safety CPU). Please note that once the configuration on the Safety CPU has been deleted, the Safety CPU will no longer be able to switch back to the runtime Operational Mode or Temporary Operational Mode. Instead, the Safety CPU will remain in Service Mode.

- **Insert the microSD card and shut down the system**

Next, you will need to insert the microSD card with the configuration you want into the Safety CPU and shut down the system.

- **Restart the system with the microSD card inside**

When you restart the system, the configuration will be transferred from the microSD card to the Safety CPU's flash memory. However, please note that this can only happen if the configuration on the microSD card is valid. If the microSD card is formatted incorrectly (error message 86) or the Safety CPU's flash memory has not been cleared (error message 87), the Safety CPU will detect this and switch to its error condition. If the configuration does not match the modules that are actually physically present, the configuration distribution operation will fail (error message 9) and the Safety CPU will switch to its safe state.

- If an error occurs when restarting, please consult the following section ("Error when restarting").



A 2 GB microSD card with article No. 191087, MEMORY-SDU-A1 is available from Eaton.

Make sure to only use microSD cards that support at least Version 2.0 of the SDA Physical Layer Specification (SDA = SD Card Association).

We recommend using microSD cards approved by Eaton exclusively.

Please note that the number of read and write operations carried out will significantly affect the data storage device's life.

10. Behavior during a fault Scenario

If any problems occur, please make sure to consult the → Section "Status LEDs", page 30, since the status and fault LEDs provide important information regarding the system's runtime state. However, since faults tend to be more complex in general, make sure not to diagnose them based exclusively on these LEDs. Instead, please refer to the Diagnostics section in the XN Safety system manual.

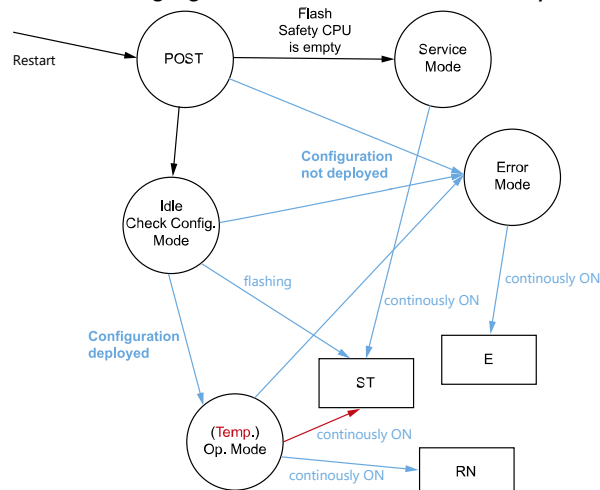
To analyze problems in more detail and with greater precision, you will need to use XN Safety designer without exception.

10. Behavior during a fault Scenario

10.1 Error when restarting

10.1 Error when restarting

The following figure shows how the XN Safety CPU module behaves when restarting.



1. When restarted, the Safety CPU first goes through its **POST** (power-on self-test) routine. During the POST, the system will already detect whether the Safety CPU is configured. If nothing has been written to the Safety CPU's flash memory (empty), the device will switch to **Service Mode** and the status LED (ST) will show a solid light.
2. If there is a configuration in the Safety CPU's flash memory, the device will switch to **Idle / Check Configuration Mode**. In this mode, the device will attempt to distribute the configuration, and the ST LED will flash during this process.
3. If the configuration is distributed successfully, the Safety CPU will either switch to **Operational Mode** or **Temporary Operational Mode** depending on whether the configuration has already been validated. If the system has already been validated, the ST LED will turn off and the RN LED will light up. If it has not been validated, both LEDs will light up at the same time.
4. However, if the attempt to distribute the configuration fails (regardless of the reason), the Safety CPU will switch to **Error Mode** and the E LED will turn on.
5. If the Safety CPU remains in **Idle / Check Configuration Mode** permanently (ST LED flashing) without switching to **Error Mode**, this indicates that bus communications have dropped out. In this case, the PLC is in its error condition and needs to be restarted.
6. The device can also switch to its error condition from **POST** and from **(Temp.) Op. Mode** if other (internal) faults are detected or if faults on remote modules take effect. Please note, however, that you will need to use XN Safety designer to analyze these faults.

10.2 Configuration distribution failure

If the Safety CPU's attempt to distribute the configuration fails, this can be traced back to one or more of the following problems:

- The configuration and the actual physical topology do not match
- One or more modules are missing
- More than one module has been swapped
- Faulty communications with a remote module
- The module being configured is in an error condition

10.3 Troubleshooting

- Check all the modules in the system to make sure they are complete and conform to the corresponding type and model
- Check all modules to make sure they are working properly
- Check all connection cables
- Reset the error with the **QUIT_ERROR** command

If the Safety CPU continues to be in an error condition even after running the **QUIT_ERROR** command, run a new check with XN Safety designer.

10.4 Troubleshooting with XN Safety designer

Connecting XN Safety Designer Configuration tool

Debug the system with XN Safety designer

10.5 What to do if there is a wiring problem



If you identify a wiring problem, shut down the system in a controlled manner and de-energize it. Do not carry out any wiring or installation work without first de-energizing the system!

10.6 Notes on the application

The input filters that suppress noise pulses make it possible to use the device in harsh environmental conditions. In addition, it is recommended to exercise particular care during wiring in order to ensure proper operation.

Observe the following installation instructions:

10. Behavior during a fault Scenario

10.7 Screen earth kit

- Do not route the input cables parallel to load circuits.
- Suppressor circuit for all contactor coils (RC suppressors or flyback diodes)
- Correct grounding



If possible, connect the earth bus to the control panel earth bus!
De-energize the system before carrying out any wiring or installation work!

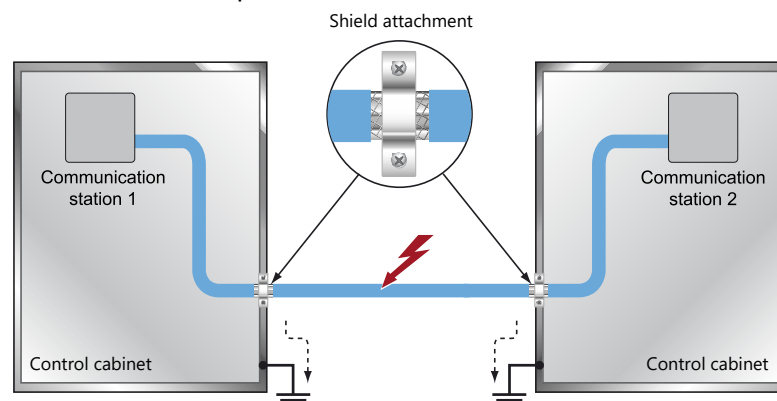
Do NOT, under any circumstance, connect or disconnect the XN Safety module while energized!

10.7 Screen earth kit

Terminate the shielding either at the entry point into the control cabinet or immediately before the XS-102-C00-000 across a large area and with a low impedance (cable glands, ground clamps)!

This will prevent interference signals from reaching the electronics and negatively affecting operation.

In order to prevent equipment grounding conductor stray currents flowing through the cable shielding, it is recommended to bond the system parts with a low-resistance and low-impedance connection.



10.8 ESD protection



CAUTION

The system integrator and the operator must make sure that no ESD interference affects the XN Safety CPU module.

11. Mounting/Installation

11.1 Checking the included equipment

Make sure to check the included equipment to make sure everything is included and in perfect condition,

→ Section "Equipment supplied", page 13.



Check the XN Safety CPU module for damage both when first receiving it and before using it for the first time. If the Safety CPU is damaged, please contact our Customer Service Team and do not install the XN Safety CPU module in your system.

Damaged components can disrupt or damage your system!

11.2 Mounting

XN Safety modules are intended for installation in control cabinets. An EN/IEC 60715 DIN-rail is required in order to mount the modules. The DIN-rail must establish a conductive connection to the control panel's back plate. The individual XN Safety modules need to be mounted side by side on the DIN-rail and then secured in place by closing the locking elements. The grounding tab at the back of the XN Safety modules is used to establishing the functional earth connection between the module and the DIN-rail.

The device must always, without exception, be installed in a horizontal mounting position (module designation on top) with sufficient clearance between the XN Safety module block's vents and surrounding components / the control cabinet wall. This is necessary in order to achieve optimal cooling and air circulation so that the device's proper functionality will be guaranteed all the way up to the maximum operating temperature.

11. Mounting/Installation

11.2 Mounting

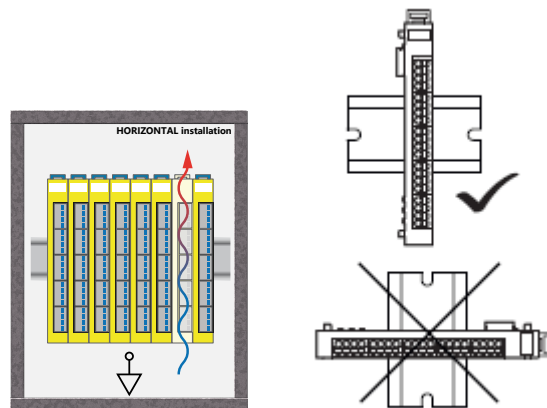
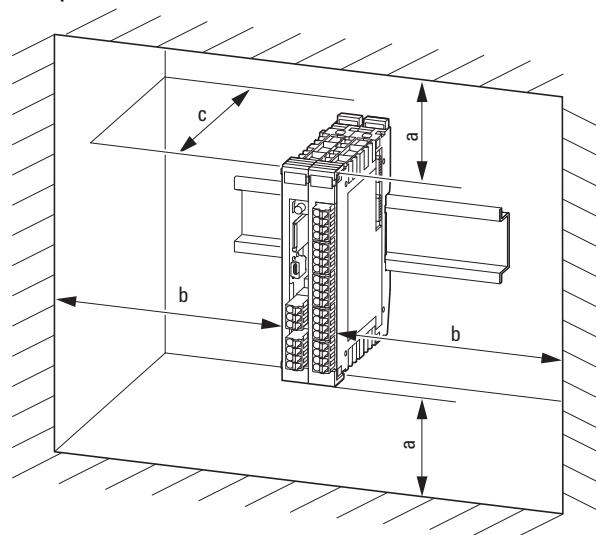


Fig. 1: Installation position - horizontal installation

Recommended minimum clearances between XN Safety modules and surrounding components / the control cabinet wall:



Clearances in mm (inch)

$a, b \geq 30 \text{ mm (1.18")}$, $c \geq 100 \text{ mm (3.94")}$

Operating temperature

$\theta: 0^\circ\text{C (32}^\circ\text{F)} \leq T \leq 55^\circ\text{C (131}^\circ\text{F)}$ [UL] or $\pm 0 - +60^\circ\text{C (+32 - +140}^\circ\text{F)}$ [CE]

12. Supported cycle times

12.1 Cycle times shorter than 1 ms (in µs)

12. Supported cycle times

The XS-102-C00-000 can be used with the XN Safety bus to carry out access operations with various bus cycle times.

12.1 Cycle times shorter than 1 ms (in µs)

50	100	125	200	250	500
X	X	X	X	X	X

x = supported

12.2 Cycle times greater than or equal to 1 ms (in ms)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

x = supported

13. Transport/storage

13.1 Storage

13. Transport/storage



This XN Safety module contains sensitive electronics. This means that you should make sure that it is not subjected to any large mechanical loads during transportation and storage.

The humidity, shock, and vibration conditions that apply during operation apply to storage and transportation as well!

Temperature and humidity fluctuations may occur during transportation. Accordingly, make sure that no moisture condenses inside the XN Safety module by turning off the XN Safety module and letting it acclimate to room temperature first.

If possible, ship / transport the XN Safety module in its original packaging. Otherwise, select packaging that will adequately protect the XN Safety module from external mechanical factors (a cardboard box filled with air pillows, for instance).

13.1 Storage



If you are not using the XN Safety CPU module, store it in conformity with the corresponding storage conditions. For more information, please refer to → Section "Transport/storage", page 46.

Make sure that when the XN Safety CPU module is stored, all protective caps (if any) are in place so that the device will not become soiled and foreign objects and liquids will be unable to get into it.

14. Maintenance



Follow all safety instructions during servicing and maintenance →
Section "Basic safety instructions", page 14 .

14.1 Maintenance

The XN Safety CPU module has been specifically designed for low-maintenance operation.

14.2 Repairs



If the XN Safety CPU module is defective or needs repairs, please send it to Eaton together with a detailed description of the problem. Shipping conditions, → Chapter "14 Transport/storage", page 46.

15. Disposal

15. Disposal



If you want to dispose of the XN Safety CPU module, make sure to comply with all applicable national disposal regulations without fail.

Do not dispose of the XN Safety CPU module with household waste.



Appendix

A.1 Further usage information	50
A.2 Data sheets	51

Appendix

A.1 Further usage information

A.1 Further usage information

Hardware

For more information and information on additional XN Safety module, please refer to the following documentation:

	XN Safety system manual	MN050020
	Installation instructions XS-102-C00-000, XS-322-...	IL050036ZU
	ManualXN Safety CPU module XS-102-C00-000	MN050019
	ManualXN Safety module XS-322-10DI-PF	MN050021
	ManualXN Safety module XS-322-8DO-P20	MN050022
	ManualXN Safety module XS-322-8DIO-PF20	MN050023
	ManualXN Safety module XS-322-2INC	MN050024
	ManualXN Safety module XS-322-4AI-I2	MN050025
	ManualXN Safety module XS-322-2DO-RNOAC	MN050026
	ManualXN Safety module XS-322-2DO-RNODC	MN050027

Software

For information on XN Safety designer, open the XN Safety Designer Configuration tool software and then the user help ( MN050028).

Download Center, Eaton Online Catalog

Enter "xnsafety" into the search box and the catalog will take you directly to the corresponding product group in the Automation, Control and visualization section.

 [Eaton.com/documentation](https://eaton.com/documentation)

 [Eaton.com/ecat](https://eaton.com/ecat)

Product information

For up-to-date information, please consult the product page on the Internet.

 [Eaton.com/xnsafety](https://eaton.com/xnsafety)

A.2 Data sheets

For the latest information on available XN Safety modules, please refer to the data sheet for the module in the Eaton online catalog.

 Eaton.com/ecat

XN Safety CPU module

EP-401352 XS-102-C00-000	Safety CPU module, SIL3/PLe, Cat. 4
--	-------------------------------------

XS-Safety modules as expansions

with relay outputs	
EP-401359 XS-322-2DO-RNODC	Safety Digital, 30 VDC 2 outputs, relay ,NO, 6 A
EP-401360 XS-322-2DO-RNOAC	Safety Digital, 230 VAC 2 outputs, relay, NO, 6 A
With digital inputs	
EP-401353 XS-322-10DI-PF	Safety Digital, 10 inputs, 24 VDC, 0.5ms
with digital output	
EP-401354 XS-322-8DO-P20	Safety Digital, 8 outputs, 24 VDC, 2 A
With digital inputs/outputs	
EP-401355 XS-322-8DIO-PF20	Safety Digital, 6 inputs / 2 outputs, 24 VDC, 0.5 ms, 2 A
Rotary encoder	
EP-401357 XS-322-2INC	Safety rotary encoder, 2 inputs, incremental, 12-bit
with analog inputs	
EP-401356 XS-322-4AI-I2	Safety Analog current input, 4 inputs, 4-20 mA, 16-bit

Appendix

A.2 Data sheets

Accessory devices

Cat No. and type	Description
191080 XC-303-C32-002	XC modular PLC XC303, Small PLC, CODESYS 3 programmable, SD Slot, USB, 3x Ethernet, 2x CAN, RS485, four digital inputs/outputs
191081 XC-303-C32-001	XC modular PLC XC303, Small PLC, CODESYS 3 programmable, SD Slot, USB, 2x Ethernet, CAN, RS485
191082 XC-303-C32-000	XC modular PLC XC303, Small PLC, CODESYS 3 programmable, SD Slot, Ethernet, CAN
199973 XC-204-C10-000	Modular PLC XC204, Micro PLC, programmable CODESYS 3, USB, Ethernet
199975 XC-204-C21-001	Modular PLC XC204, Micro PLC, programmable CODESYS 3, USB, 2x Ethernet, CAN, 2DIO
199977 XC-204-C20-002	Modular PLC XC204, Micro PLC, programmable CODESYS 3, USB, 2x Ethernet, RS485, 2DIO
199971 XC-104-C10-000	Modular PLC XC104, Micro PLC, programmable CODESYS 3, USB, Ethernet
178782 XN-312-GW-CAN	XN-312 gateway to bus system CANopen
178785 XN-312-GW-EC	XN-322 digital input module, 20 digital inputs with 24 VDC each, pulse-switching, 5.0 ms
191087 MEMORY-SDU-A1	microSD card
206903 TS-CI-K3	DIN-rail that fit to 4RU
206904 TS-CI-K4	DIN-rail that fit to 6RU

Alphabetical index

A

After Sales Service	2
Ambient conditions	27
Approvals	26

B

Brand names	
Product names	2

C

Command selection sequence	34
Commands	36
Company information	2
Compatibility	20
Configuration failure	41
Copy-protected	2
Copyright	2
Current draw	23
Cycle times	45

D

Description	13
Directives	18
Download Center	50

E

ecat	50
End sequence	34
Error sequence	35

F

Fault Scenario	39
----------------------	----

Further reading	50
-----------------------	----

I

Installation instructions	41
Intended use	15
IT security	17

L

Labeling area	32
---------------------	----

M

Manuals	50
microSD card	37
Module states	36

O

Online Catalog	50
Original Operating Instructions	2

P

Pin assignment	29
Plug connectors	31
Power supply	24

R

Rating data	22
Residual risks	18
Restarting	40

S

Safety-relevant characteristics	20
Service life	26
Software	16
Standards	18
Start sequence	34

Status LEDs	30
Supply voltage	23

T

Troubleshooting	41
-----------------------	----

V

Validation button	33
-------------------------	----

Eaton is an intelligent power management company dedicated to improving the quality of life and protecting the environment for people everywhere. We are guided by our commitment to do business right, to operate sustainably and to help our customers manage power – today and well into the future. By capitalizing on the global growth trends of electrification and digitalization, we're accelerating the planet's transition to renewable energy, helping to solve the world's most urgent power management challenges, and doing what's best for our stakeholders and all of society.

For more information, visit eaton.com.



Powering Business Worldwide

Eaton Industries GmbH

Hein-Moeller-Str. 7–11
D-53115 Bonn

© 2025 Eaton Corporation
All rights reserved
06/2025 MN050019EN