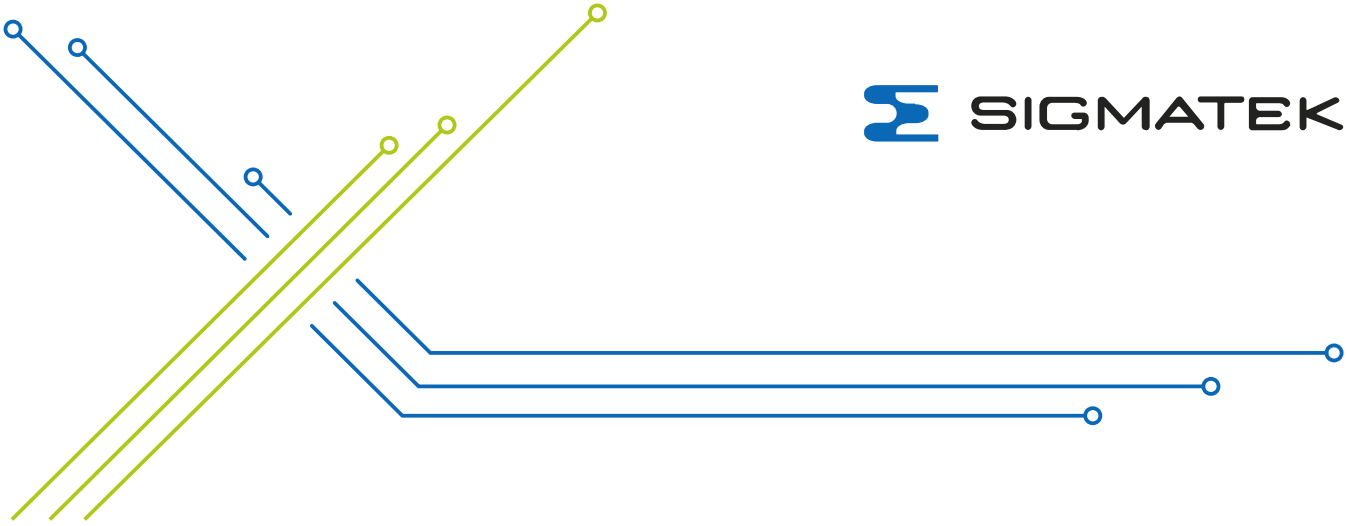


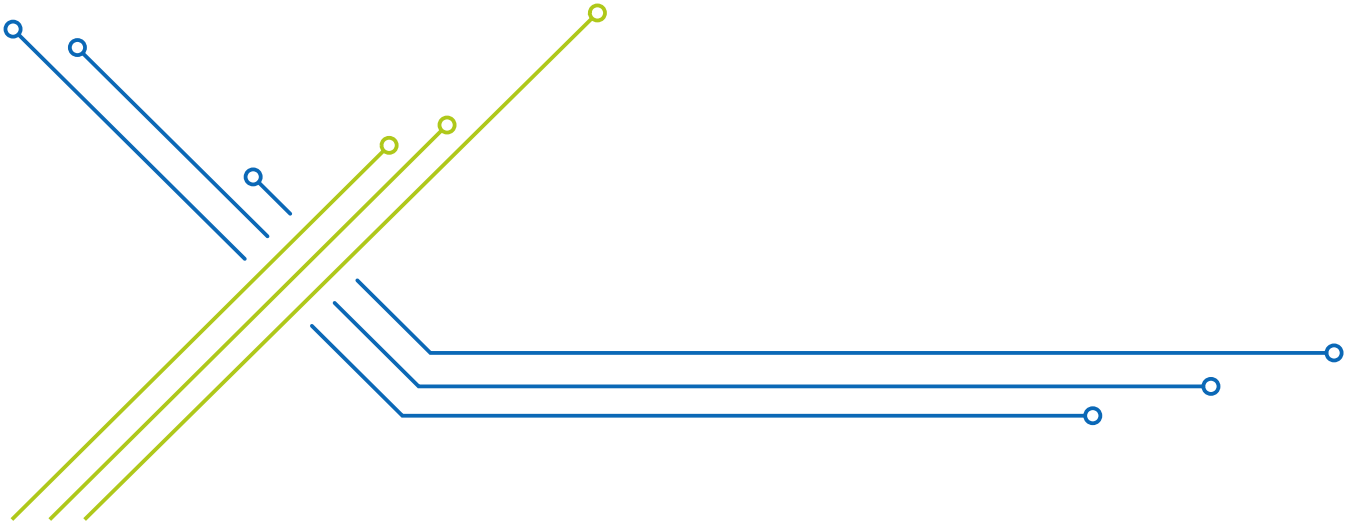
SIGMATEK

SNC 021

S-DIAS Safety SNC Incremental Encoder

INSTRUCTION MANUAL

Article number:	20-896-021-E
Date of creation:	14.11.2017
Version date:	09.02.2026



Publisher:
SIGMATEK GmbH & Co KG
A-5112 Lamprechtshausen
Tel.: +43/6274/4321
Fax: +43/6274/4321-18

Email: office@sigmatek.at
www.sigmatek-automation.com

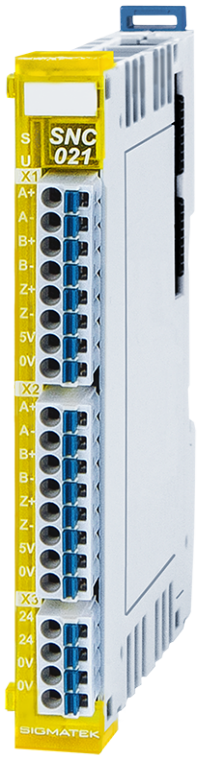
All rights reserved. No part of this work may be reproduced, edited using an electronic system, duplicated or distributed in any form (print, photocopy, microfilm or in any other process) without express permission.

We reserve the right to make changes in the content without notice. SIGMATEK GmbH & Co KG is not responsible for technical or printing errors in this handbook and assumes no responsibility for damages that occur through its use.

Translation of the Original Instructions

Copyright © 2017
SIGMATEK GmbH & Co KG

S-DIAS Safety SNC Incremental Encoder SNC 021



The S-DIAS Safety Incremental Encoder module SNC 021 provides the values of two incremental encoders to the Safety CPU as well as the non-Safe CPU (standard PLC).

The two-channel safety function "monitors" the increments in the incremental encoder interfaces and processes the so-called Safety core in two micro controllers with cross-communication.

The incremental encoder function is monitored through a 2-channel analysis of the encoder signals, with 2-channel error detection of each data line, as well as via the measurement of the encoder supply voltages and currents.

Speed, position, direction and acceleration are monitored via the Safe application in the Safety CPU.

The module detects various error types, such as a cable break, cross-circuit and inverted input signals.

The safety functions of the module meet

- **for two-channel application**
  the requirements according to SIL 3 in accordance with
  EN IEC 62061 and PL e, Cat. 4 in accordance with EN ISO 13849.

as well as

- **for one-channel application**
  the requirements according to SIL 3 in accordance with
  EN IEC 62061 and PL d, Cat. 2 in accordance with EN ISO 13849.

From safety version S05.05.04 and higher, the SNC 021 has a second operating mode that allows the configuration and use of encoders without Z pulses in LASAL SAFETYDesigner from release 01.01.078 and higher. The standard configuration continues to take the Z pulse into account. For more information on configuring and using the SNC 021 with encoders without Z pulses, refer to the LASAL SAFETYDesigner online help.

Table of Contents

1 Introduction 4
1.1 Target Group/Purpose of this Operating Manual 4
1.2 Important Reference Documentation 4
1.3 Contents of Delivery 4
2 Basic Safety Directives 5
2.1 Symbols Used 5
2.2 Disclaimer 6
2.3 General Safety Directives 6
2.4 Designated Use 8
2.5 Software/Training 9
3 IT Security 10
4 Standards and Directives 11
4.1 Residual Risks 11
4.2 Safety of the Machine or Equipment 11
4.3 Directives 11
4.3.1 Functional Safety Standards 12
4.3.2 EU Declaration of Conformity 12
4.4 Safety-Relevant Parameters 12
4.4.1 Mounting Position Horizontal 0-50 °C Ambient Temperature 12
4.5 Mounting Position Horizontal 0-60 °C Ambient Temperature 13
4.6 Compatibility 13
5 Type Plate 14
6 Technical Data 15
6.1 I-Encoder Specifications 15
6.2 Electrical Requirements 16
6.3 Miscellaneous 18
6.4 Environmental Conditions 18
7 Mechanical Dimensions 19
7.1 Connector Layout 20
7.2 Status LEDs 21
7.3 Applicable Connectors 21

7.4 Label Field 22
8 Wiring 23
8.1 Wiring Example 23
8.1.1 Incremental Encoder with Zero Position Mark 23
8.1.2 Incremental Encoder without Zero Position Track(starting with FS: S05.05.04, FW: 287, LD: L2.3, HW: 4.00) 24
8.2 Note 24
9 RS422 Interface 25
10 Encoder Configuration 25
11 Installing the Encoder 27
12 Important Notes for Two-channel Application 28
13 Assembly/Installation 29
13.1 Check Contents of Delivery 29
13.2 Mounting 29
14 Transport/Storage 31
15 Storage 32
16 Maintenance 33
16.1 Service 33
16.2 Repair 33
17 Disposal 34

1 Introduction

1.1 Target Group/Purpose of this Operating Manual

This operating manual contains all information required for the operation of the product.

This operating manual is intended for:

- Project planners
- Technicians
- Commissioning engineers
- Machine operators
- Maintenance/test technicians

General knowledge of automation technology is required.

Further help and training information, as well as the appropriate accessories can be found on our website www.sigmatek-automation.com.

Our support team is happily available to answer your questions.
Please see our website for our hotline number and business hours.

1.2 Important Reference Documentation

- Safety System Handbook

This and additional documents can be downloaded from our website or obtained through support.

1.3 Contents of Delivery

1x SNC 021

2 Basic Safety Directives

2.1 Symbols Used

The following symbols are used in the operator documentation for warning and danger messages, as well as informational notes.

DANGER

Danger indicates that death or serious injury **will occur**, if the specified measures are not taken.

→ To avoid death or serious injuries, observe all guidelines.

Danger indique une situation dangereuse qui, faute de prendre les mesures adéquates, **entraînera** des blessures graves, voire mortelles.

→ Respectez toutes les consignes pour éviter des blessures graves, voire mortelles.

WARNING

Warning indicates that death or serious injury **can** occur, if the specified measures are not taken.

→ To avoid death or serious injuries, observe all guidelines.

Avertissement d'une situation dangereuse qui, faute de prendre les mesures adéquates, **entraînera** des blessures graves, voire mortelles.

→ Respectez toutes les consignes pour éviter des blessures graves, voire mortelles.

CAUTION

Caution indicates that moderate to slight injury **can** occur, if the specified measures are not taken.

→ To avoid moderate to slight injuries, observe all guidelines.

Attention indique une situation dangereuse qui, faute de prendre les mesures adéquates, **peut** entraîner des blessures assez graves ou légères.

→ Respectez toutes les consignes pour éviter des blessures graves, voire mortelles.

CAUTION

Danger for ESD-sensitive components.

Les signes de danger pour les composants sensibles aux décharges électrostatiques.

INFORMATION

INFORMATION

→ Provides important information on the product, handling or relevant sections of the documentation, which require particular attention.

2.2 Disclaimer

The contents of this operating manual were prepared with the greatest care. However, deviations cannot be ruled out. This operating manual is regularly checked and required corrections are included in the subsequent versions. The machine manufacturer is responsible for the proper assembly, as well as device configuration. The machine operator is responsible for safe handling, as well as proper operation.

The current operating manual can be found on our website. If necessary, contact our support.

Subject to technical changes, which improve the performance of the devices. The following operating manual is purely a product description. It does not guarantee properties under the warranty.

Please thoroughly read the corresponding documents and this operating manual before handling a product.

SIGMATEK GmbH & Co KG is not liable for damages caused through, non-compliance with these instructions or applicable regulations.

2.3 General Safety Directives

The Safety Directives in the other sections of this operating manual must be observed. These instructions are visually emphasized by symbols.

According to EU Directives, the operating manual is a component of a product. This operating manual must therefore be accessible in the vicinity of the machine since it contains important instructions. This operating manual should be included in the sale, rental or transfer of the product, or its online availability indicated.

Regarding the requirements for Safety and health connected to the use of machines, the manufacturer must perform a risk assessment in accordance with machine directives 2006/42/EG before introducing a machine to the market.

INFORMATION

Operate the unit with devices and accessories approved by SIGMATEK only.

CAUTION

Handle the device with care and do not drop or let fall.
Prevent foreign bodies and fluids from entering the device.
The device must not be opened!

Manipulez l’appareil avec précaution et ne le laissez pas tomber.
Empêchez les corps étrangers et les liquides de pénétrer dans l’appareil.
L’appareil ne doit pas être ouvert!

If the device does not function as intended or has damage that could pose a danger, it must be replaced!

En cas de fonctionnement non conforme ou de dommages pouvant entraîner des risques, l'appareil doit être remplacé !

For your own safety and that of others, compliance with the environmental conditions is essential.

Pour votre propre sécurité et celle des autres, le respect des conditions environnementales est essential.

2.4 Designated Use

The Safety functions implemented in the product are designed for use with safety applications in a PLC control and meet the required conditions for safe operation.

CAUTION

The instructions contained in this operating manual must be followed. For error-free operation, proper transport and storage are essential.
Installation, mounting, programming, initial start-up, operation, maintenance and decommissioning can only be performed by qualified personnel.
Qualified personnel in this context are people, who have completed training or have trained under supervision of qualified personnel and have been authorized to operate and maintain safety-related equipment, systems and facilities in compliance with the strict directives and standards of safety technology (Functional Safety).

Les instructions contenues dans ce manuel technique doivent être suivies.
Pour un fonctionnement sans erreur, le transport et le stockage appropriés sont essentiels.
L'installation, le montage, la programmation, la mise en service initiale, l'exploitation, la maintenance et la mise hors service ne peuvent être effectués que par une personne qualifiée.
Dans ce contexte, on entend par personnel qualifié les personnes qui ont suivi une formation ou qui ont été formées sous la supervision d'un personnel qualifié et qui ont été autorisées à utiliser et à entretenir l'équipement, les systèmes et les installations de sécurité conformément aux directives et aux normes strictes de la technique de sécurité (Sécurité fonctionnelle).

For your own safety and that of others, the product should be used for their designated purpose only.
Correct EMC installation is also included under designated use.

Pour votre propre sécurité et celle des autres, le produit ne doivent être utilisés qu'à des fins prévues.
Une installation CEM correcte est également incluse dans l'utilisation prévue.

Non-designated use consists of:

- any changes made to the module or the use of damaged modules.
- use of the module inconsistent with the technical margins described in this operating manual or the specifications defined in the technical data.

L'utilisation non désignée consiste en:

- toute modification apportée au module ou l'utilisation des modules endommagés.
- utilisation du module non conforme aux marges techniques décrites dans ce manuel ou aux spécifications définies dans les données techniques.

2.5 Software/Training

The application is created with the software LASAL CLASS 2 and LASAL SCREEN Editor, the Safety application is created using the SAFETYDesigner. Basic information on Safety (Functional Safety) can be found in the Safety System Handbook.

Training for the LASAL development environment, with which the product can be configured, is provided. Information on our training schedule can be found on our website.

3 IT Security

S-DIAS safety modules were developed for integration into a network protected against unauthorized access.

For example, the following dangers can affect the network:

- Unauthorized access
- Data manipulation
- and many other IT security violations

It is the responsibility of the integrator or operator to carry out a risk analysis of the connections between S-DIAS modules and the integration into the overall infrastructure. The following measures, for example, may result from this (if necessary):

- Separation of IT/OT networks (VLANs or physical)
- Firewalls
- Password-protected user accounts
- Data encryption
- and much more

With regard to the functional safety objective, in this case the STO safety function, no direct effects on the function or its integrity are possible, since the function cannot be influenced via communication-based interfaces.

The availability of the overall system (as with all safety functions) can be compromised by external attacks, hence the above measures are necessary.

4 Standards and Directives

4.1 Residual Risks

CAUTION

The following residual risks for the product must be included in the system integrator's risk assessment:

- Release of non-environmentally safe substances, emissions and unusual temperatures
- Hazardous contact voltages
- Effects of operational electrical, magnetic and electromagnetic fields
- Possible effects of information technology devices

Les risques résiduels suivants pour le produit doivent être inclus dans l'évaluation des risques de l'intégrateur de système :

- Libération de substances non respectueuses de l'environnement, émissions et températures inhabituelles
- Tensions de contact dangereuses
- Effets des champs électriques, magnétiques et électromagnétiques opérationnels
- Effets possibles des dispositifs de technologie de l'information

4.2 Safety of the Machine or Equipment

Observe all on-site rules and regulations for accident prevention and occupational safety.

4.3 Directives

The product was constructed in compliance with the following European Union directives and tested for conformity.

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
EN IEC 61508-1	Functional safety - Part 1: General requirements
EN IEC 61508-2	Functional safety - Part 2: Requirements for electrical / electronic / programmable electronic safety-related systems
EN IEC 61508-3	Functional safety - Part 3: Software requirements

The issue status of the applied standards can be found in the EU declaration of conformity.

4.3.2 EU Declaration of Conformity

CE

EU Declaration of Conformity

The product SNC 021 conforms to the following European directives:

- → 2006/42/EG Machine Directive
- → 2014/30/EU Electromagnetic Compatibility (EMC Directive)
- → 2011/65/EU “Restricted use of certain hazardous substances in electrical and electronic equipment” (RoHS Directive)

The EU Conformity Declarations are provided on the SIGMATEK website. They can be found in the download area of the respective product.

4.4 Safety-Relevant Parameters

4.4.1 Mounting Position Horizontal 0-50 °C Ambient Temperature

CPU Module	Safety Parameters	Safety Levels
SNC 021 including CPU module **SCP 011/SCP 111**	**1-channel application:** PFH = 3.90E-09 (1/h) SFF = 99 % $MTTF_D$ = 704 years DC = 97 %	**1-channel application:** PL d / Cat. 2 SIL 2
	2-channel application: PFH = 4.00E-09 (1/h) SFF = 99 % $MTTF_D$ = 511 years DC = 99 %	**2-channel application:** PL e / Cat. 4 SIL 3

INFORMATION

The system integrator must perform a separate verification according to EN ISO 13849-1 for the overall system consisting of SNC 021 and encoder. The safety characteristics of the encoder are to be requested from the manufacturer. The specified safety data refer only to the product SNC 021.

4.5 Mounting Position Horizontal 0-60 °C Ambient Temperature

Input Module	Safety Parameters	Safety Levels
SNC 021 including CPU module **SCP 011/SCP 111**	**1-channel application:** PFH = 5.10E-09 (1/h) SFF = 99 % $MTTF_D$ = 545 years DC = 97 %	**1-channel application:** PL d / Cat. 2 SIL 2
	2-channel application: PFH = 5.10E-09 (1/h) SFF = 99 % $MTTF_D$ = 395 years DC = 99 %	**2-channel application:** PL e / Cat. 4 SIL 3
SNC 021 including CPU module **SCP 211/SCP 111-S)**	**1-channel application:** PFH = 6.00E-09 (1/h) SFF = 99 % $MTTF_D$ = 437 years DC = 97 %	**1-channel application:** PL d / Cat. 2 SIL 2
	2-channel application: PFH = 5.90E-09 (1/h) SFF = 99 % $MTTF_D$ = 347 years DC = 99 %	**2-channel application:** PL e / Cat. 4 SIL 3

INFORMATION

The system integrator must perform a separate verification according to EN ISO 13849-1 for the overall system consisting of SNC 021 and encoder. The safety characteristics of the encoder are to be requested from the manufacturer. The specified safety parameters refer only to the product SNC 021.

1- and 2-channel application

The application for a specific PL, category or SIL requires a correct installation. Please note any normative requirements of the end application (machine) for installation and selection of encoders The use of the specified parameters requires a risk analysis of the end application, by which whether 2 incremental encoders is sufficient must be determined. For two-channel application, both incremental encoders must be monitored in the application (SCP 011/111/211/111-S).

4.6 Compatibility

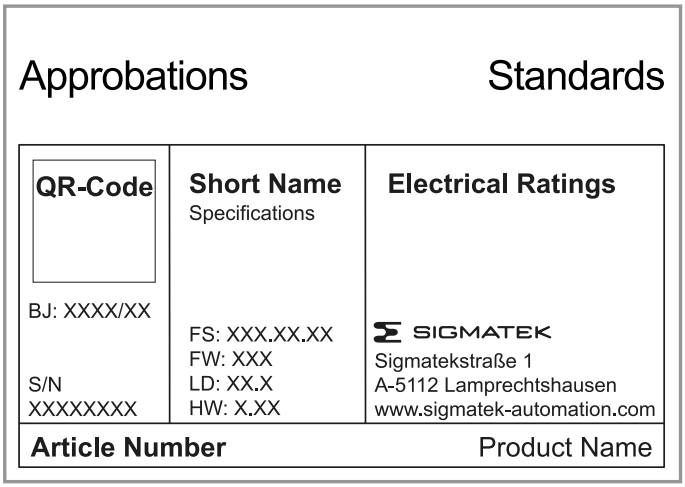
INFORMATION

Compatibility

For compatibility of the S-DIAS Safety modules, see section "Compatibility of S-DIAS Safety Modules" in the system handbook.

5 Type Plate

The type plate provides information about the product's features. The type plate shown here is only an example.



HW: Hardware version
FS: Safety version number
FW: Firmware version
LD: Logic device version
QR-Code: Serial number

6 Technical Data

6.1 I-Encoder Specifications

Number of channels	2
Encoder	incremental encoder with RS422 Interface with null position trace Incremental encoder with RS422 interface without zero position track (starting with FS: S05.05.04, FW: 287, LD: L2.3, HW: 4.00)
Input frequency	0.75 MHz
Counter frequency	3 MHz
Signal analysis	4x
Encoder resolution	12 bits (all versions up to S02.03.02, FW: 284, LD: L1.9, HW: 3.10)) 28 bits (starting with FS: S03.04.03, FW: 286, LD: L2.2, HW: 3.20)
Encoder power supply	+5 V supply, short-circuit proof with monitoring function and current measurement (+5 V is generated from +24 V at X3)
Status LED	yes
I-encoder current consumption	maximum 300 mA when installing the SNC 021 in ambient temperature up to 50 °C maximum 200 mA in ambient temperature up to 60 °C

6.2 Electrical Requirements

Supply voltage for encoder supply	+18-30 V[1] (+5 V is generated from +24 V at X3)	
Current consumption(supply voltage for the encoder supply)	typically 162 mA/24 V	maximum 200 mA/30 V
Voltage supply from Safety bus	+12 V	
Current consumption on the Safety bus (+12 V supply)	typically 75 mA	maximum 90 mA
Voltage supply from S-DIAS bus	+24 V	
Current consumption on the S-DIAS bus (+24 V supply)	typically 33 mA	maximum 40 mA

INFORMATION

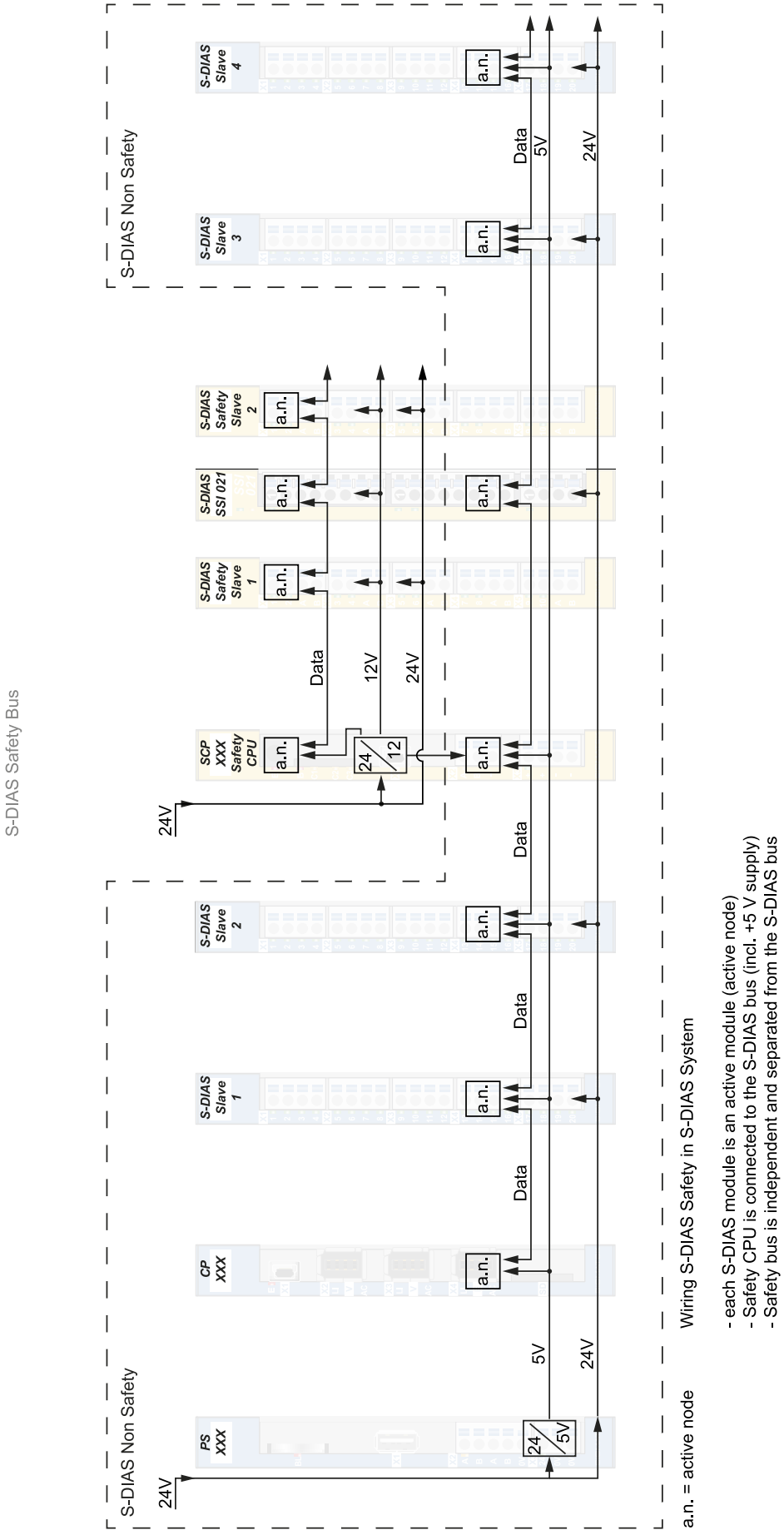
With horizontal mounting position and increased ambient temperature > 50 °C the maximum permissible supply voltage is reduced from +30 V to +28.8 V.

If this S-DIAS Safety module is connected to an SCP with several modules, the total current of the S-DIAS Safety modules used must be determined and checked.

The total current of the +24 V supply must not exceed 800 mA.
The total current of the +12 V supply must not exceed 800 mA.

The SNC 021 module can only be used in conjunction with an SCP 011/SCP 111 that has been configured as a master CPU.

The S-DIAS Safety module SNC 021 is supported from the following firmware versions of the S-DIAS Safety CPU modules:
S-DIAS Safety CPU module SCP 011: starting with FW version V370
S-DIAS Safety CPU module SCP 111: starting with FW version V447


S-DIAS Safety Bus
S-DIAS Non Safety
S-DIAS Non Safety
PS XXX
CP XXX
SCP XXX Safety CPU
S-DIAS Slave 1
S-DIAS Slave 2
S-DIAS Safety Slave 1
S-DIAS SSI 021
S-DIAS Safety Slave 2
S-DIAS Slave 3
S-DIAS Slave 4
a.n.
24V
5V
12V
Data
24/5V
24/12
a.n. = active node
Wiring S-DIAS Safety in S-DIAS System
- each S-DIAS module is an active module (active node)
- Safety CPU is connected to the S-DIAS bus (incl. +5 V supply)
- Safety bus is independent and separated from the S-DIAS bus

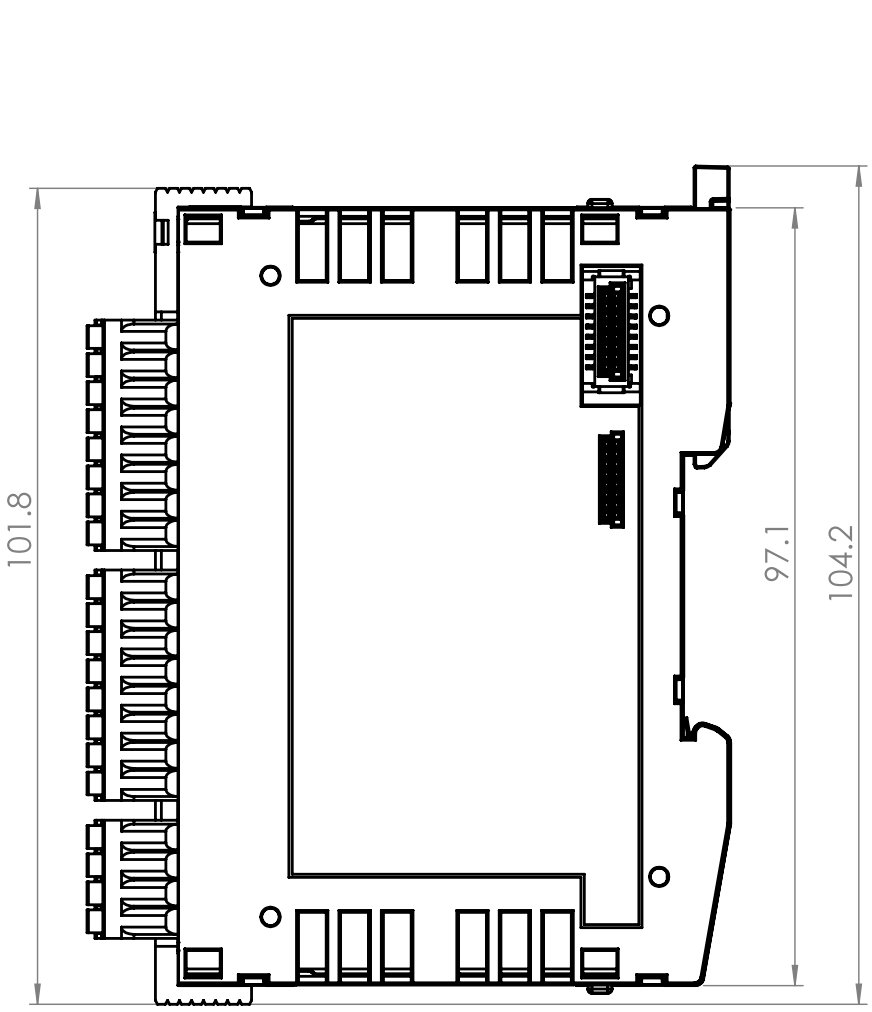
6.3 Miscellaneous

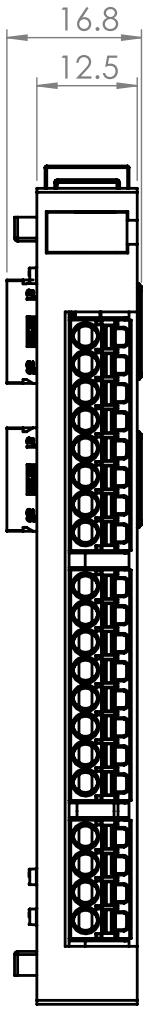
Article number	20-896-021	
Printed circuit board coating	no	
Approvals	CE	yes
	UL	cULus (E247993)
	Functional Safety	yes, EG-type-examined
	UKCA	no
Mission time	20 years	
Reaction time	see chapter "Reaction and Turn-off Time" in the Safety System Handbook	

6.4 Environmental Conditions

Storage temperature	-20 ... +85 °C	
Environmental temperature	0 ... +55 °C (UL) 0 … +60 °C (CE)	
Humidity	0-95 %, non-condensing	
Installation altitude above sea level	0-2000 m without derating > 2000 m up to a maximum of 5000 m with derating of the maximum environmental temperature by 0.5 °C per 100 m	
Operating conditions	pollution degree 2	
Noise emission	≤ 70 dB	
EMC resistance	EN 61000-6-2 (industrial area) EN 61000-6-7 (noise immunity industry functional safety) (increased requirements in accordance with EN IEC 62061)	
EMC noise generation	EN 61000-6-4 (industrial area)	
Vibration resistance	EN 60068-2-6	3.5 mm from 5-8.4 Hz 1 g from 8.4-150 Hz
Shock resistance	EN 60068-2-27	15 g (147.15 m/s²)
Protection type	EN 60529/NEMA 250	IP20/Type1 (not evaluated by UL)

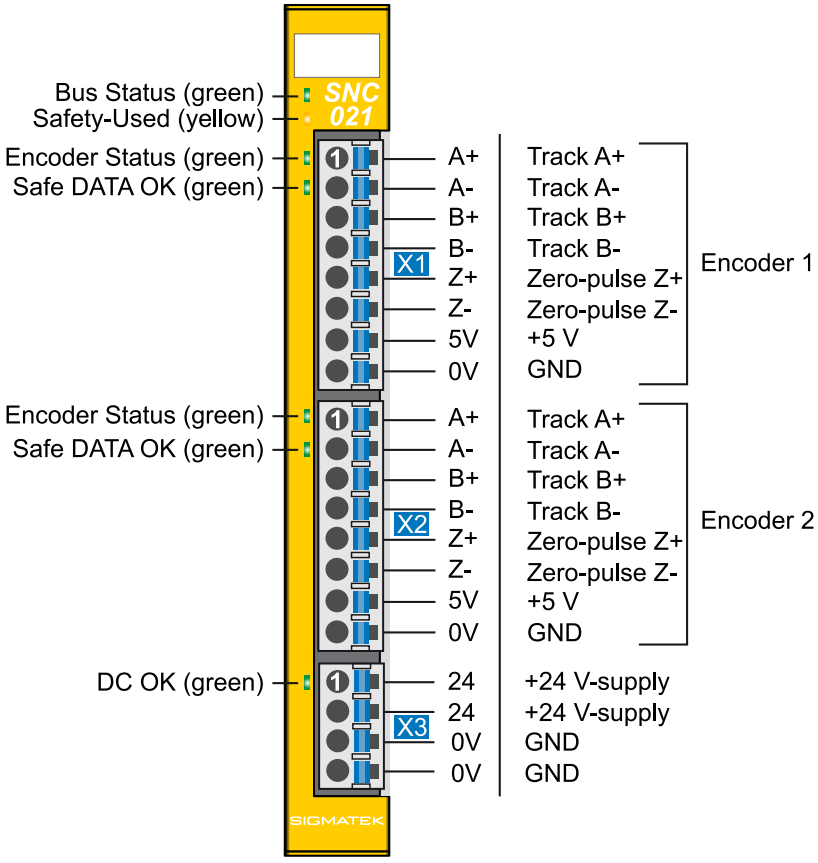
7 Mechanical Dimensions





Measurements	12.5 x 104 x 72 mm (W x H x D)

7.1 Connector Layout



INFORMATION

The connections of the +24 V supply (X3: pin 1 and pin 2) or the GND supply (X3: pin 3 and pin 4) are internally bridged. To supply the module, only one connection to a +24 V pin (pin 1 or pin 2) and a GND pin (pin 3 or pin 4) is required. The bridged connections may be used for further looping of the +24 V supply and the GND supply. However, it must be taken into account that a total current of 6 A per connection is not exceeded by the forward looping!

7.2 Status LEDs

Bus status	green	ON	bus communication OK
		OFF	no supply available
		BLINKING (5 Hz)	no communication
Safety-used	yellow	ON	adjustable by application (e.g. the module LED can be set to blinking through the visualization so that the module is easily found in the control cabinet)
		OFF	
		BLINKING (2 Hz)	
		BLINKING (4 Hz)	
Encoder status	green	ON	encoder signal OK
		OFF	encoder is not in use
		BLINKS	signal error was detected
Safe status	green	ON	Safety of the Safe CPU provides invalid encoder values
		OFF	encoder is not in use or Safety provides invalid encoder values
DC OK	green	ON	+24 V input voltage for encoder supply OK

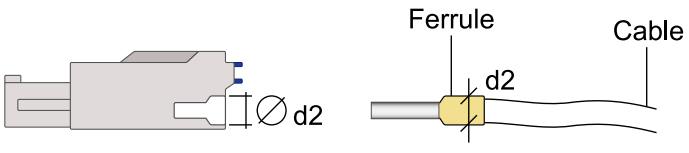
7.3 Applicable Connectors

X1-X3: Connectors with spring terminals (included in delivery)

The spring terminals are suited for the connection of ultrasonically compacted (ultrasonically welded) stranded wire.

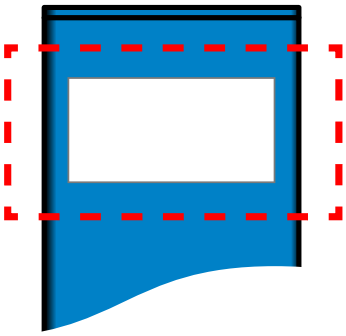
Connection capacity:

Stripping length/sleeve length	10 mm
Mating direction	parallel to the conductor axis or circuit board
Conductor cross section rigid	0.2-1.5 mm²
Conductor cross section flexible	0.2-1.5 mm²
Conductor cross section, ultrasonically compacted	0.2-1.5 mm²
Conductor cross section AWG/kcmil	24-16
Conductor cross section flexible with ferrule without plastic sleeve	0.25-1.5 mm²
Conductor cross section flexible with ferrule with plastic sleeve	0.25-0.75 mm² (reason for reduction d2 of the ferrule)



d2 = max. 2.8 mm

7.4 Label Field

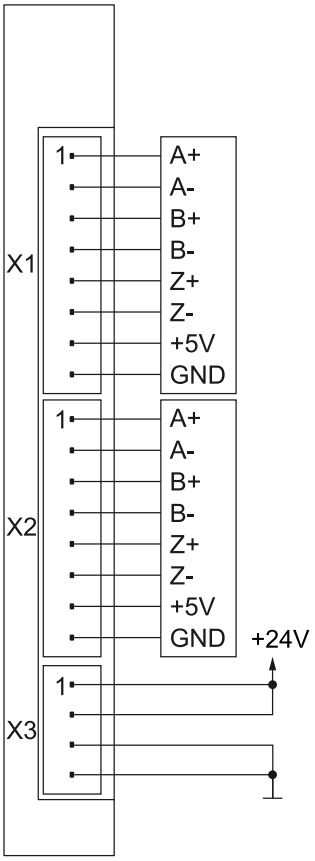


Manufacturer	Weidmüller
Type	MF 10/5 CABUR MC NE WS
Article number Weidmüller	1854510000
Compatible printer	Weidmüller
Type	Printjet Advanced 230V
Article number Weidmüller	1324380000

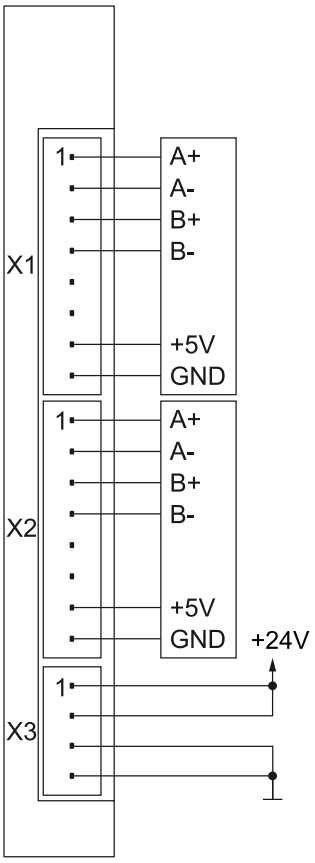
8 Wiring

8.1 Wiring Example

8.1.1 Incremental Encoder with Zero Position Mark



8.1.2 Incremental Encoder without Zero Position Track (starting with FS: S05.05.04, FW: 287, LD: L2.3, HW: 4.00)



8.2 Note

The input filters, which suppress noise signals, allow operation in harsh environmental conditions. A careful wiring method is also recommended to ensure error-free function.

The following installation guidelines should be observed:

- Avoid parallel connections between input lines and load-bearing circuits.
- Protective circuits for all relays (RC networks or free-wheeling diodes)
- Correct wiring to ground

INFORMATION

The ground bus should be connected to the control cabinet when possible!

The wiring and assembly must be performed when no voltage is applied!

The S-DIAS module CANNOT be connected/disconnected while voltage is applied!

9 RS422 Interface

The RS422 interface is internally connected in the component.

10 Encoder Configuration

The maximum encoder frequency is defined with 750 kHz (at 1x edge analysis). This corresponds to a maximum counter frequency or 1.5 MHz (at 4x edge analysis).

When selecting the encoder to install, this must be taken into consideration accordingly.

In the following table, the permissible speed in the rotary encoder for the respective resolution based on the maximum encoder frequency can be seen.

Encoder Resolution (Increments/Revolutions)	Speed Scaling	
	Revolutions/Second	Revolutions/Minute
60	12,500	750,000
80	9,375	562,500
100	7,500	450,000
128	5,859	351,563
150	5,000	300,000
200	3,750	225,000
256	2,930	175,781
512	1,465	87,891
1024	732	43,945
2048	366	21,973
4096	183	10,986

This is only a sample of possible encoder resolutions. With the following formulas, the highest permissible rotation speed (revolutions/min) can be determined for an encoder with a resolution that is not listed in the table above.

Revolutions/s: $n_{max} = \frac{f_{max}}{res}$

Revolutions/min: $n_{max} = \frac{f_{max} * 60}{res}$

Legend:

n_{max} … maximum permissible speed in revolutions/s or revolutions/min

f_{max} … maximum encoder frequency of 750 kHz

res … encoder resolution according to the manufacturer data sheet.

If linear encoders are used or for example, a translation ratio must be included, as well as the calculation for the maximum permissible speeds and the scaling parameters that must be defined in the Safety Designer for each encoder, taken into consideration.

The following formula is thereby generated:

$$v_{max} = (f_{max} * mul_{position} / div_{position}) * (mul_{speed} / div_{speed})$$

Legend:

v_{max}	…	maximum possible, scaled speed
f_{max}	…	maximum encoder frequency of 750 kHz
$mul_{position}$	…	factor for converting the position of length (units parameter)
$div_{position}$	…	divisor for converting the position of length (units parameter)
mul_{speed}	…	factor for converting the speed or time base (speed multiplier parameter)
div_{speed}	…	divisor for converting the speed or time base (speed divisor parameter)

Due to the 32-bit data width, a maximum value of 2,147,483,647 is generated for the upper speed limit (the highest bit is used as the sign).

The following conditions result:

$$n_{max} \leq 2.147.483.647 \text{ and } f \leq f_{max}$$
$$v_{max} \leq 2.147.483.647 \text{ and } f \leq f_{max}$$

Legend:

f	…	encoder frequency (with simple edge analysis)

Notes on position monitoring

If the encoder is set for position monitoring, (linear, rotation encoder), it must be taken into consideration that the minimum and maximum value of the position must be monitored in the application. The maximum value is dependent on the scaling parameters for calculating the parameters and limited to 32 bits.

11 Installing the Encoder

Line and encoder errors are diagnosed using, among other things, the measurement of the encoder currents.

For this purpose, the preset values for measuring current must be defined in the system. The current limits are defined in the automatic system automatically, so the user does not have to predefine or configure any additional parameters.

In the unverified status of the system, the encoder currents are measured while starting the system and used as temporary reference values. Based on the determined reference values, the current limits are temporarily defined with ±25 %. If a corresponding fluctuation in the encoder currents due to a wiring fault is detected during movement, the system switches to the Safe mode and the appropriate diagnostic codes are provided.

CAUTION!

Before the Safety system is labeled as verified, the wiring of the installed encoder must be checked manually to ensure that the system operates error-free (the encoder operates without fault).

During verification, which is run via the “Set Verified” button in the SafetyDesigner or the validation button on the Safe CPU, the actual current measurements are used to determine the permissible limit values for the encoder current and then stored in the Safe CPUs remnant data. These limit values are based on the measured value ±25 %.

After successful validation, the encoder currents are monitored using the current values stored in the Safe CPU. When in verified status, the upper or lower limits are exceeded, the system changes to safe mode and the appropriate diagnostic code for error analysis is again provided.

In the standard application, the actual and preset current values are provided via the hardware classes.

NOTE:

The SNC 021 detects when a sensor is disconnected by actively monitoring the current values. If the current falls below the specified limit, the SNC 021 recognizes this as an error.

The safe CPU receives this error and stops. The error code (ERRVAL) 10002 is output (for further measures, see the SafetyDesigner help). This error cannot be acknowledged. When the system restarts, the error remains.

CAUTION! Exchanging the encoder

Basically, the Safety system cannot detect an encoder exchange when no power is applied. The parameters of the new encoder could be different from the replaced encoders with regard to the currents, whereby it is no longer possible guarantee the appropriate monitoring of the newly installed encoder.

In such a case, the system **must** be reverified. This means reconfiguring the Safe CPU via the SafetyDesigner or µSD card and verifying (see Safety System manual).

12 Important Notes for Two-channel Application

When using the SNC 021 module in compliance with **SIL 3** according to EN IEC 62061 and **PL e, Cat. 4** according to EN ISO 13849-1, it must be taken into consideration that for 2-channel application, a part of the possible wiring errors can only be detected by comparing the measurement results of both encoders in the Safety application of the Safe CPU.

The inversion of signal lines A+ with A- as well as B+ with B- are one of these errors. Mechanical errors, such as a detached coupling can also be detected only in the Safety application of the Safe CPU.

To meet the requirements of the diagnostic coverage ratio, both encoders **must** be synchronously monitored in the Safety application of the Safe CPU.

For synchronous monitoring, the functional Safety block SF_SkewMonitor (see chapter “Numerical Function Blocks” in the SafetyDesigner tool help) must be placed in the Safety project and used according to the documentation.

The inputs S_ChnValue1 and S_ChnValue2 of the functional Safety blocks must be wired with the input information _Chn1Value and S_Chn2Value (synchronous monitoring of the position) or alternatively, with S_Chn1Speed and S_Chn2Speed (synchronous monitoring of the speed) of the SNC 021 module.

The required tolerance must be defined by the user. During synchronous monitoring via the position, it must be taken into consideration that if there is the possibility of a position overflow, the scaling parameter can cause position jumps. In such a case, the scaling parameter for calculating the position should be left at the default settings (factor and divisor are 1), or synchronous monitoring performed using the speed.

INFORMATION

If the system is not in Safe mode, synchronous monitoring must be performed according to the previously mentioned criteria!

If all mechanical error sources can be excluded due to the coupling type and the type of encoder used (e.g. defective encoder mechanics), monitoring the direction of both encoders is then sufficient.

This can be run in the Safety application using the functional Safety block SF_DirectionMonitor (see chapter “Numeric Function Blocks” in the SafetyDesigner tools help) and in this case, performed for both encoders.

INFORMATION

If synchronous monitoring is not performed in the Safety application as described here, the machine manufacturer must then prove that the requirements of SIL 3 according to EN IEC 62061 and PL e, Cat. 4 according to EN ISO 13849 are met if required for the machine.

13 Assembly/Installation

13.1 Check Contents of Delivery

Ensure that the contents of the delivery are complete and intact. See chapter 1.3 Contents of Delivery.

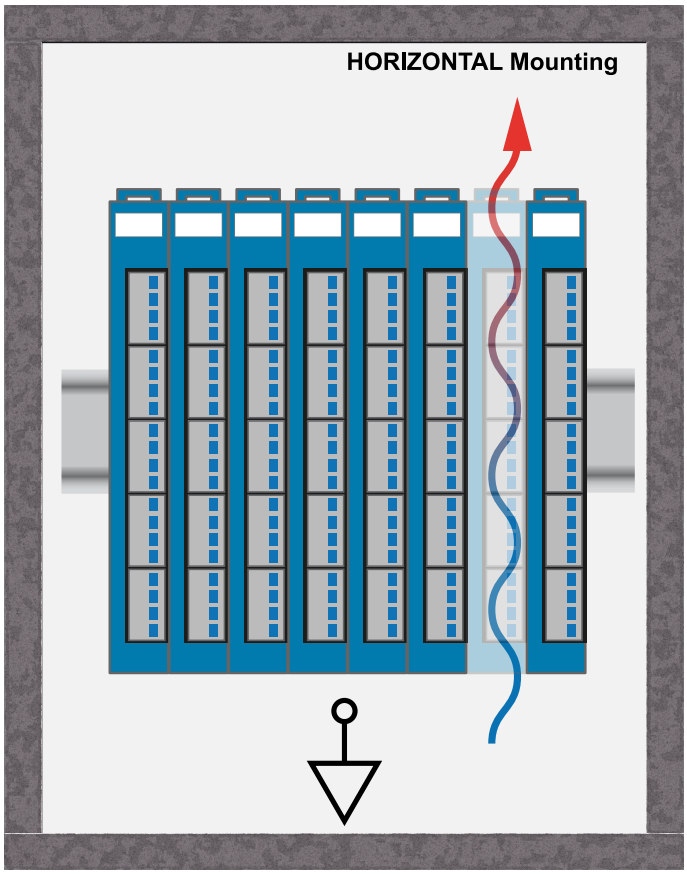
INFORMATION

On receipt and before initial use, check the device for damage. If the device is damaged, contact our customer service and do not install the device in your system.

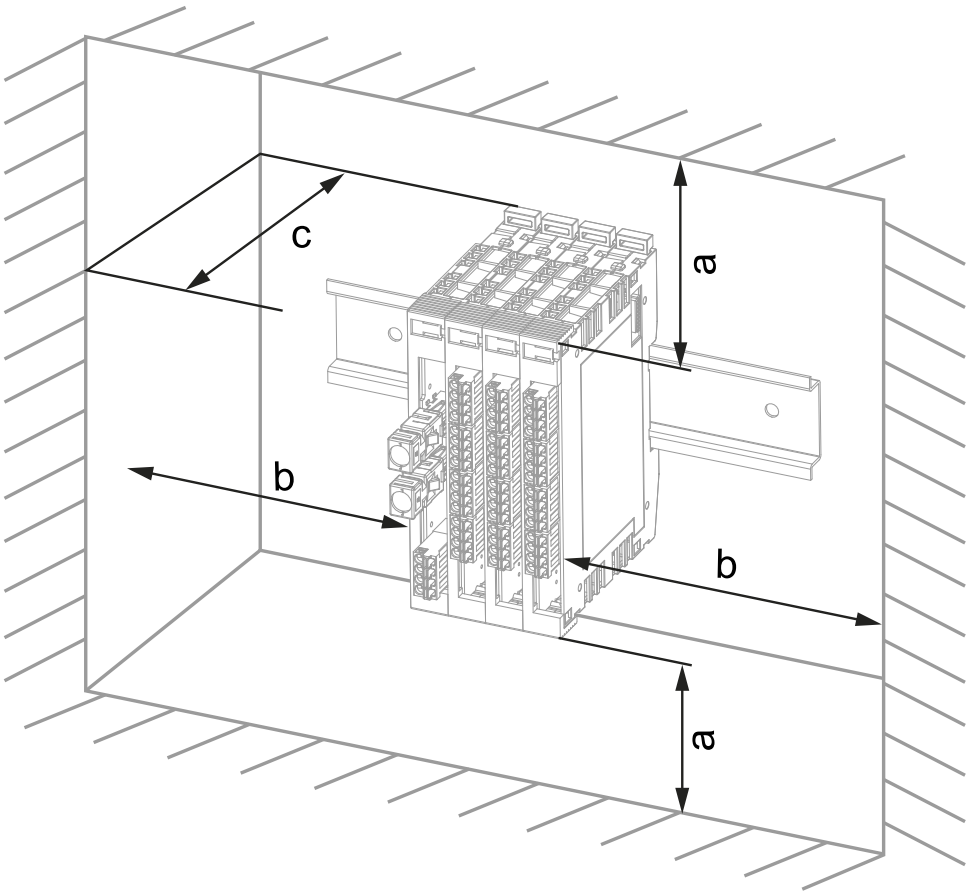
Damaged components can disrupt or damage the system.

13.2 Mounting

The S-DIAS modules are designed for installation into the control cabinet. To mount the modules, a DIN-rail is required. The DIN rail must establish a conductive connection with the back wall of the control cabinet. The individual S-DIAS modules are mounted on the DIN rail as a block and secured with latches. The functional ground connection from the module to the DIN rai is made via the grounding lug on the back of the S-DIAS modules. The modules must be mounted horizontally (module label up) with sufficient clearance between the ventilation slots of the S-DIAS module blocks and nearby components and/or the control cabinet wall. This is necessary for optimal cooling and air circulation to ensure proper function up to the maximum operating temperature.



Recommended minimum distances between the S-DIAS modules and the surrounding components or control cabinet wall:



a	b	c
30 mm (1.18″)	**30 mm** (1.18″)	**100 mm** (3.94″)

a, b, c … distances in mm (inches)

14 Transport/Storage

This device contains sensitive electronics. During transport and storage, high mechanical stress must therefore be avoided.

For storage and transport, the same values for humidity and vibration as for operation must be maintained!

Temperature and humidity fluctuations may occur during transport. Ensure that no moisture condenses in or on the device, by allowing the device to acclimate to the room temperature while turned off.

When sent, the device should be transported in the original packaging if possible. Otherwise, packaging should be selected that sufficiently protects the product from external mechanical influences. Such as cardboard filled with air cushioning.

15 Storage

When not in use, store the device according to the storage conditions. See chapter 14 Transport/Storage.

INFORMATION

During storage, ensure that all protective covers (if available) are placed correctly, so that no contamination, foreign bodies or fluids enter the device.

16 Maintenance

During maintenance as well as servicing, observe the safety instructions from chapter 2 Basic Safety Directives.

16.1 Service

This product was constructed for low-maintenance operation.

16.2 Repair

In the event of a defect/repair, send the device with a detailed error description to the address listed at the beginning of this document.
For transport conditions, see chapter 14 Transport/Storage.

17 Disposal

INFORMATION

Should you need to dispose of the device, the national regulations for disposal must be followed.

The device appliance must not be disposed of as household waste.

Changes Chart

Change date	Affected page(s)	Chapter	Note
20.09.2018	20	7.1 Connector Layout	Added note
15.11.2018	18	6.3 Miscellaneous	UL instead of UL in preparation
19.02.2019	27	11 Installing the Encoder	Tolerance changed from +25 % to ±25 %
02.04.2019	12	4.4 Safety-Relevant Parameters	Correction of the safety-relevant parameters Corrections
	18	6.4 Environmental Conditions	Corrections because of CE
08.08.2019		Entire document	“safety-related” replaced
14.11.2019	26	13 Supported Cycle Times	Chapter added
02.12.2019	12	4.4 Safety-Relevant Parameters	Values updated
28.02.2020	26	13 Supported Cycle Times	Text adapted
22.04.2020	15	6.1 I-Encoder Specifications	Encoder resolution changed to 12 bits
28.05.2020	26	13 Supported Cycle Times	Chapter removed
20.07.2020	all		Up to +60 °C ambient temperature, derating I encoder power consumption and correction encoder resolution
02.09.2020	1		Text correction
	12	4.4.1 Mounting Position Horizontal 0-50 °C Ambient Temperature	$MTTF_D$ changed and text below corrected
	13	4.5 Mounting Position Horizontal 0-60 °C Ambient Temperature	$MTTF_D$ changed and text below corrected
	18	6.3 Miscellaneous	Text for standards adjusted At Environmental temperature 0 ... +55 °C deleted
	28	12 Important Notes for Two-channel Application	Text correction
08.09.2020		13 Hardware Class SNC021	Chapter added
04.11.2020	29	13 Assembly/Installation	Expansion functional ground connection
05.03.2021	18	6.4 Environmental Conditions	Standards added
01.06.2021	16	6.2 Electrical Requirements	FW version SCPs added
07.02.2022	13	4.5 Mounting Position Horizontal 0-60 °C Ambient Temperature	Parameters SCP 211/SCP 111-S added
20.02.2023	16	6.2 Electrical Requirements	Info encoder supply added
15.06.2023	12	4.4 Safety-Relevant Parameters	Specifications clarified

Change date	Affected page(s)	Chapter	Note
05.12.2023	18	6.3 Miscellaneous	Mission time and Reaction time added
	18	6.4 Environmental Conditions	Noise emissions added
		13 Hardware Class SNC021	Chapter removed
01.02.2024	12	4.3.2 EU Declaration of Conformity	Note on download adjusted
	12	4.4 Safety-Relevant Parameters	The safety indicators (PFH, $MTTF_D$) were adjusted slightly with the recertification.
21.02.2024	10	3 IT Security	Chapter added
26.09.2024	27	11 Installing the Encoder	Note added
18.03.2025		Document	Layout corrected
04.09.2025	15	6.1 I-Encoder Specifications	RS422 interface without zero position track added
	23	8.1 Wiring Example	Wiring example without zero position track added
12.11.2025	1	Introduction	Introductory text extended 2. Operating mode
09.02.2026		Document	Layout