

SNC 021

S-DIAS Safety Incremental Encoder

Operating Manual

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S-DIAS Safety SNC Incremental Encoder SNC 021

The S-DIAS Safety SNC incremental encoder module SNC 021 provides the values of two incremental encoders, 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 for **SIL 3** in accordance with EN / IEC 62061 and **PL e, Cat. 4** in accordance with EN ISO 13849-1/-2

as well as

- for **one**-channel application, the requirements for **SIL 3** in accordance with EN / IEC 62061 and **PL d, Cat. 2** in accordance with EN ISO 13849-1/-2.



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1 Basic Safety Guidelines

1.1 General Safety Information

Non-compliance with the Safety guidelines can result in danger to personnel, which could then lead to serious injury or in worst cases, death. In less serious cases, systems and equipment can be damaged.

The following symbols identify the individual risks as well as the degree of seriousness; their respective meanings are briefly explained below. You should therefore familiarize yourself with the Safety symbols and their meanings to prevent dangers and risks.

DANGER



DANGER

Identifies an immediate danger with high risk, which can lead to immediate death or serious injury if not avoided.

Indique un danger direct à haut risque d'un décès immédiat ou des blessures graves si les consignes de sécurité ne sont pas respectées.

WARNING



WARNING

Identifies a possible danger with a mid-level risk, which can lead to death or (serious) injury if not avoided.

Indique un danger possible d'un risque moyen de décès ou de (graves) blessures si les consignes de sécurité ne sont pas respectées.

CAUTION



CAUTION

Identifies a low risk danger, which can lead to injury or property damage if not avoided.

Indique un danger avec un niveau de risque faible des blessures légères ou des dommages matériels si les consignes de sécurité ne sont pas respectées.

1.2 Further Safety Guidelines



Warning, dangerous electrical voltage

Avertissement d'une tension électrique dangereuse



Hot surface warning

Avertissement d'une surface chaude



Danger for ESD-sensitive components



This symbol identifies important or additional information regarding the operation of the safety modules.

Ce symbole indique des informations importantes ou supplémentaires concernant le fonctionnement des modules de sécurité particuliers.

1.3 General Requirements

Technical Documentation



This technical documentation is a component of this product.

- This document must be accessible near the machine, since it contains important instructions.
- The technical documentation should be included in the sale, rental or transfer of the product.

Documentation technique

Cette documentation technique fait partie intégrale du produit.

- Gardez la toujours à portée de main et à la proximité de la machine, car elle contient des informations importantes.
 - Distribuez la documentation technique aux secteurs de la vente et/ou de la location du produit.
-

Acceptance of Safety Guidelines



Before handling the product to which this documentation belongs, the operating instructions and safety guidelines must be read. SIGMATEK GmbH & Co KG accepts no liability for damages resulting from non-compliance with the Safety guidelines or applicable regulations.

Acceptance of the Safety guidelines and the explanations in this document, as well as the Safety System Handbook (see homepage¹) are a basic requirement for proper use. Therefore, read this operating manual thoroughly and familiarize yourself with each of them in detail.

More information on standards and regulations etc. can be found in the system handbook.

Prendre connaissance de consignes de sécurité

Avant toute manipulation on doit impérativement prendre connaissance de consignes de sécurité et du mode d'emploi. SIGMATEK GmbH & Co KG n'assume aucune responsabilité pour les dommages causés par le non-respect des consignes de sécurité ou du mode d'emploi respectif.

La connaissance de consignes de sécurité et le contenu de cette documentation ainsi que le mode d'emploi du système de sécurité constitue une condition préalable à l'utilisation prévue. Lisez ce mode d'emploi et assurez-vous de le comprendre jusqu'aux détails.

Pour plus d'informations sur les normes et les lignes directrices, etc., reportez-vous au mode d'emploi

¹ Using the search function with the keyword "Safety System Handbook"

Qualified Personnel



Installation, assembly, programming and initial start-up, operation, maintenance and decommissioning of control and automation technology products in general, as well as safe products in particular, 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 equipment of functional safety, systems and facilities in compliance with the strict guidelines and standards of Safety technology.

Personnel qualifié

Installation, montage, programmation, mise en service, l'exploitation, l'entretien et mise hors service de produits de commande et d'automatisation en général, et de produits liés à la sécurité, en particulier, ne peut être effectuée que par le personnel qualifié.

On entend sous terme personnel qualifié les personnes ayant acquis une formation professionnelle dispensé par un spécialiste sur l'utilisation et surveillance des composants et des systèmes de sécurité, ceci conformément aux lignes directrices et les normes en vigueur.

Designated Use



The Safety modules are designed for use in applications with a requirement of functional safety and meet the required conditions for Safe operation with the parameters specified in section 2.

For your own safety and the safety of others, use Safety modules for their designated purpose only. Correct EMC installation as well as proper transport and storage are also included under designated use.

Non-designated use consists of:

- any change made to the Safety modules of any kind.
- the use of damaged Safety modules.
- the use of the Safety module inconsistent with the instructions described in this handbook.
- The use of the safety module inconsistent with the technical data described in this handbook.

Les modules de sécurité sont conçus pour une utilisation dans les applications sollicitant un niveau de sécurité et répondent à toutes les conditions nécessaires pour un fonctionnement sûr conformément au niveau de performance e (PL e) selon la norme EN ISO 13849-1/-2 et SIL 3 ou SIL CL 3 de la norme EN 62061.

Utilisation prévue

Utilisez le module de sécurité conformément à son mode d'emploi pour votre propre sécurité et celle d'autres personnes. L'utilisation conforme comprend également une installation conforme CEM ainsi que le transport et le stockage conforme.

L'utilisation abusive comprend entre autres:

- Les modifications quelconques apportées aux modules de sécurité.
 - Utilisation de modules de sécurité endommagés.
 - Utilisation de modules de sécurité en dehors du cadre décrit dans ce mode d'emploi.
 - Utilisation de modules de sécurité en dehors des spécifications décrites dans ce mode d'emploi.
-

Operator Due Diligence

The operator must ensure that

- the Safety modules are to be used for their designated purpose only.
- the Safety modules are to be operated in error-free, fully functional condition only.
- only sufficiently qualified and authorized personnel operate the Safety modules.

This documentation is complete and in readable condition and available at the site of operation.

Obligation de diligence

L'utilisateur doit s'assurer que

- les modules de sécurité ne sont utilisés que selon les spécifications.
- uniquement les modules de sécurité en parfait état de fonctionnement peuvent être utilisés.
- seulement le personnel qualifié et autorisé puisse manipuler les modules de sécurité.

la documentation dans son intégralité et dans un état lisible est mise à disposition à l'endroit où les modules de sécurité sont utilisés.

2 Conformity with EU Guidelines

2.1 Functional Safety Standards

- EN / IEC 62061:2005/A2:2015
- EN ISO 13849-1:2015
- EN ISO 13849-2:2012

2.2 EU Conformity Declaration



CE Declaration of Conformity

The SNC 021 complies with European norms for programmable logic controls.

- 2006/42/EG “Directive of the European Parliament and of the Council of 17 May 2006 on Machinery and Change to the Directive 95/16/EC” (machine guideline)
- 2014/30/EU “Electromagnetic Compatibility” (EMC guideline)
- 2011/65/EU Restricted use of certain hazardous substances in electrical and electronic equipment (RoHS Guideline)

The EU Conformity Declarations are provided on the SIGMATEK website. Using the search function with the keyword “EU Declaration of Conformity”.

2.3 Safety-Relevant Parameters

2.3.1 Mounting Position Horizontal 0-50 °C Ambient Temperature

Input Module	2-channel application Safety parameters for two connected incremental encoders, which monitor one another in the SNC 021	1-channel application Safety parameters for one connected incremental encoder, which is monitored in the SNC 021
SNC 021 including CPU modules SCP 011/SCP 111	$PFH_b = 3.5E-09$ (1/h) $MTTF_D = 581$ years DC = 99 % SFF = 99 %	$PFH_b = 3.4E-09$ (1/h) $MTTF_D = 806$ years DC = 97 % SFF = 99 %
	PL e / CAT 4 according to EN/ISO 13849 SIL 3 according to EN 62061	PL d / CAT 2 according to EN/ISO 13849 SIL 3 according to EN 62061
	The application for a specific PL, category or SIL requires a risk analysis of the end-use application to determine whether two incremental encoders are sufficient.	These safety parameters were calculated for the SNC 021 when used with a incremental encoder. The safety parameters of the entire machine must be determined in the end application.

2.3.2 Mounting Position Horizontal 0-60 °C Ambient Temperature

Input Module	2-channel application Safety parameters for two connected incremental encoders, which monitor one another in the SNC 021	1-channel application Safety parameters for one connected incremental encoder, which is monitored in the SNC 021
SNC 021 including CPU modules SCP 011/SCP 111	$PFH_D = 4.3E-09$ (1/h) $MTTF_D = 457$ years DC = 99 % SFF = 99 %	$PFH_D = 4.3E-09$ (1/h) $MTTF_D = 634$ years DC = 97 % SFF = 99 %
SNC 021 including CPU modules SCP 211/SCP 111-S	$PFH_D = 5.1E-09$ (1/h) $MTTF_D = 401$ years DC = 99 % SFF = 99 %	$PFH_D = 5.1E-09$ (1/h) $MTTF_D = 503$ years DC = 97 % SFF = 99 %
	PL e / CAT 4 according to EN/ISO 13849 SIL 3 according to EN 62061	PL d / CAT 2 according to EN/ISO 13849 SIL 3 according to EN 62061
	The application for a specific PL, category or SIL requires a risk analysis of the end-use application to determine whether two incremental encoders are sufficient.	These safety parameters were calculated for the SNC 021 when used with a incremental encoder. The safety parameters of the entire machine must be determined in the end application.

Reason for SIL 3 with single-channel use:

Because the high SFF value is greater than 99 %, SIL 3 can be accepted with a hardware tolerance (HFT) of 0 according to EN 62061.



1-channel 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).

2.4 Compatibility



Compatibility

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

3 Technical Data

3.1 I-encoder Specifications

Number of channels	2
Encoder	Incremental encoder with RS422 Interface with null position trace.
Input frequency	0.75 MHz
Counter frequency	3 MHz
Signal analysis	4x
Encoder resolution	12 bits (all versions up to FW V284, CPLD HW3.10 L1.9, S02.03.02) 28 bits (starting with version FW V286, CPLD HW3.20 L2.2, S03.04.03)
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 per encoder when installing the SNC 021 in ambient temperature up to 50 °C maximum 200 mA per encoder with 60 °C ambient temperature

3.2 Electrical Requirements

Supply voltage for the encoder supply	+18-30 V ⁽¹⁾	
Current consumption of 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

⁽¹⁾ 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 cannot exceed 800 mA.
The total current of the +12 V supply cannot exceed 800 mA.**

Si ce module de sécurité S-DIAS Safety est raccordé à un SCP avec plusieurs modules, le courant total des modules de sécurité S-DIAS utilisés doit être déterminé et vérifié.

**Le courant total de l'alimentation +24 V ne peut pas dépasser 800 mA.
Le courant total de l'alimentation +12 V ne peut pas dépasser 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.

Le module SNC 021 ne peut être utilisé qu'en combinaison avec un module SCP 011/SCP 111 lequel a été configuré comme processeur maître.

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**

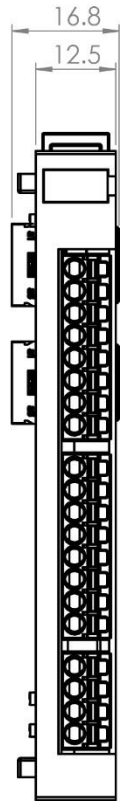
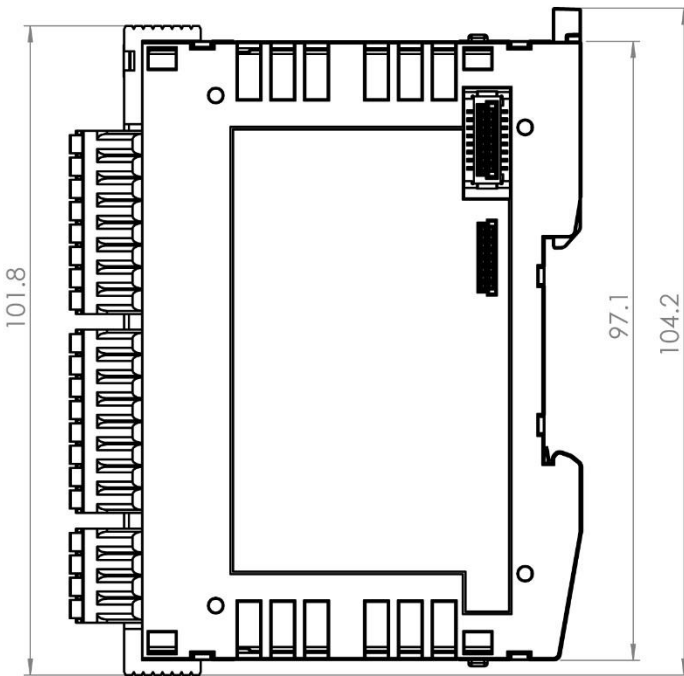
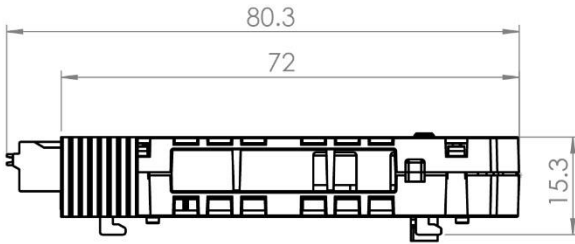
3.3 Miscellaneous

Article number	20-896-021
Hardware version	2.x-3.x
Standard	Two-channel application: EN 62061 SIL 3 EN ISO 13849-1 PL e/Cat. 4 One-channel application: EN 62061 SIL 3 EN ISO 13849-1 PL d/Cat. 2 UL 508 (E247993)
Approvals	CE, cUL _{US} , TÜV Austria EG type-tested

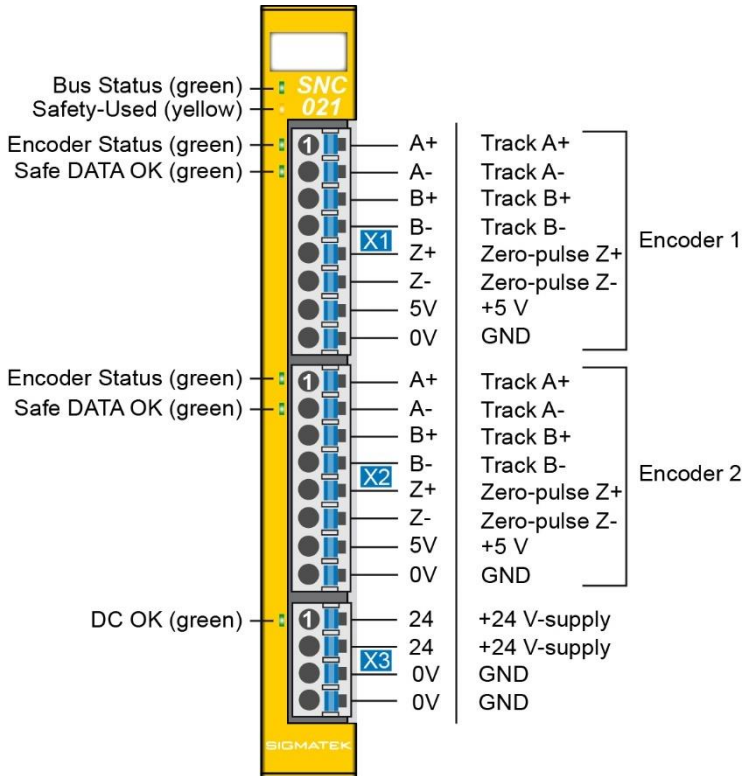
3.4 Environmental Conditions

Storage temperature	-20 ... +85 °C	
Environmental temperature	0 ... +50 °C (UL) 0 ... +60 °C (CE)	
Humidity	0-95 %, non-condensing	
Installation altitude above sea level	0-2000 m without derating > 2000 m with derating of the maximum environmental temperature by 0.5 °C per 100 m	
Operating conditions	Pollution degree 2	
EMC resistance	in accordance with 61000-6-7:2015 (Generic standards - Immunity requirements for equipment intended to perform functions in safety-related systems (functional safety) at industrial locations) in accordance with EN 61000-6-2:2007 (industrial area) (increased requirements in accordance with IEC 62061)	
EMC noise generation	in accordance with EN 61000-6-4:2007 (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
Protection type	EN 60529	IP20

4 Mechanical Dimensions



5 Connector Layout



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!

5.1 Status LEDs

Bus Status	green	ON	bus communication OK
		OFF	no supply available
		BLINKING (5 Hz)	no communication
Safety Used	yellow	ON	can be set from the application
		OFF	(e.g. the module LED can be set to blinking through the visualization so that the module is easily found in the control cabinet)
		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

5.2 Applicable Connectors

Connectors:

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

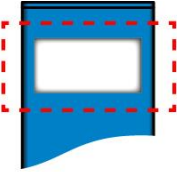
The spring terminals are suited for the connection of ultrasonically compacted (ultrasonically welded) wires.

Connections:

Stripping length/sleeve length:	10 mm
Mating direction:	parallel to the conductor axis or circuit board
Conductor cross section rigid:	0.2-1.5 mm ²
Conductor cross section flexible:	0.2-1.5 mm ²
conductor cross section strands ultrasonically compacted:	0.2-1.5 mm ²
Conductor cross section AWG/kcmil:	24-16
Conductor cross section flexible with ferrule without plastic sleeve:	0.25-1.5 mm ²
Conductor cross section flexible with ferrule with plastic sleeve:	0.25-0.75 mm ² (reason for reduction d2 of the ferrule)



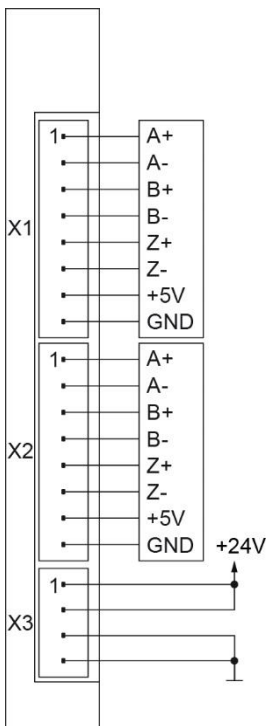
5.3 Label Field



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

6 Wiring

6.1 Wiring Example



6.2 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

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

Si possible la terre doit être connectée à l'armoire de commande!



Wiring and mounting must be performed with no voltage applied!

IMPORTANT:

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

Important!

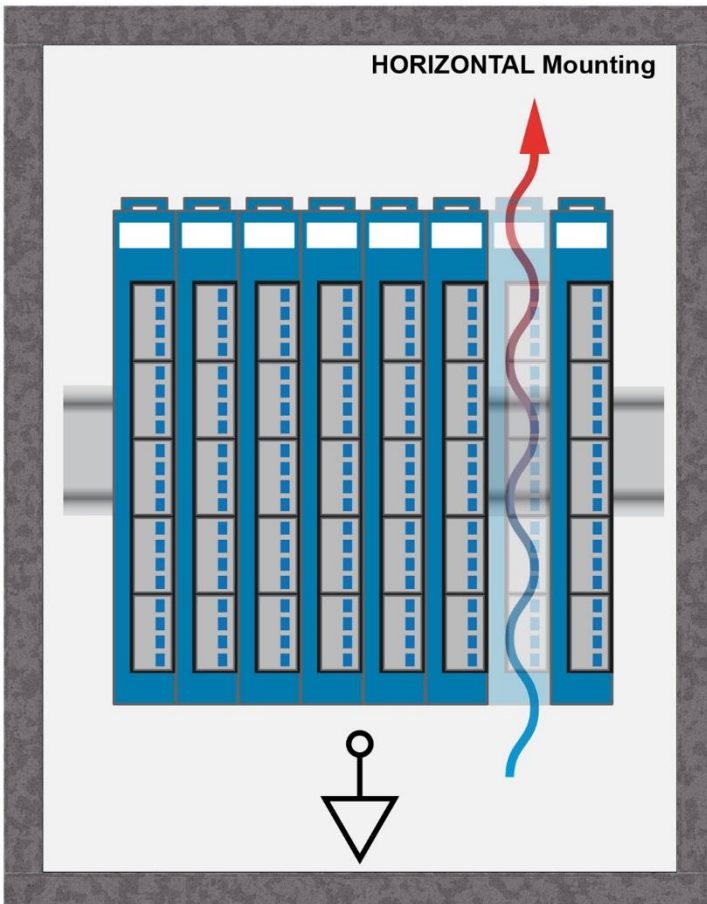
Le module S-DIAS ne peut pas être inséré ou retiré sous tension.

7 RS422 Interface

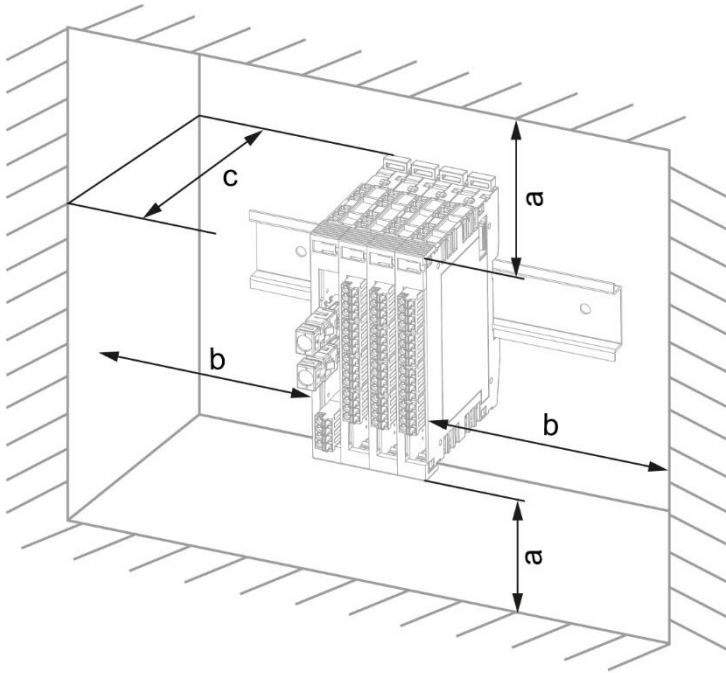
The RS422 interface is internally connected in the component.

8 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 rail is made via the grounding clamp 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, so that proper function up to the maximum operating temperature is ensured.



Recommended minimum distances of the S-DIAS modules to 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)

9 Disposal

For the disposal of the product, the respective guidelines, possibly country-specific, must be observed and followed.

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/Conversion)	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/sec:

$$n_{max} = \frac{f_{max}}{RES}$$

Revolutions/min:

$$n_{max} = \frac{f_{max} * 60}{RES}$$

Legend:

n_{max} ... highest permissible speed in revolutions/sec 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} ... maximal 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:

$$\begin{aligned}
 n_{max} &\leq 2,147,483,647 \text{ and } f \leq f_{max} \\
 v_{max} &\leq 2,147,483,647 \text{ and } f \leq f_{max}
 \end{aligned}$$

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 $\pm 25\%$. 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 $\pm 25\%$.

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.

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 to 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 μ SD 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 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.

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

Si le système n'est pas en mode Safe, une surveillance synchrone doit être effectuée selon les critères mentionnés précédemment.

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.

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 62061 and PL e, Cat. 4 according to EN ISO 13849-1/-2 are met if required for the machine.

Si la surveillance synchrone n'est pas effectuée par le logiciel de sécurité comme décrit dans la présente documentation, le constructeur de la machine doit alors prouver que les exigences des normes SIL 3 ou SIL CL 3 selon EN 62061 et PL e, Cat. 4 selon EN ISO 13849-1/-2 sont respectées si la machine le requiert.

Documentation Changes

Change date	Affected page(s)	Chapter	Note
20.09.2018		5 Connector Layout	Note added
15.11.2018	15	3.3 Miscellaneous	UL instead of UL in preparation
19.02.2019	28	11 Installing the Encoder	Tolerance changed from +25 % to ± 25 %
02.04.2019	12	2.3 Safety-Relevant Parameters	Correction of the safety-relevant parameters
	16 all	3.4 Environmental Conditions	Corrections environmental conditions Corrections due to CE
08.08.2019		Entire document	"safety-related" replaced
14.11.2019		13 Supported Cycle Times	Chapter added
02.12.2019		2.3 Safety-Relevant Parameters	Values updated
28.02.2020	31	13 Supported Cycle Times	Text adapted
22.04.2020	14	3.1 I-encoder Specifications	Encoder resolution changed to 12 bits
28.05.2020	31	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	2.3.1 Mounting Position Horizontal 0-50 °C Ambient Temperature	MTTF _D changed and text below corrected
	13	2.3.2 Mounting Position Horizontal 0-60 °C Ambient Temperature	MTTF _D changed and text below corrected
	17	3.3 Miscellaneous	Text adapted for Standard
	30	12 Important Notes for Two-channel Application	Text corrections

04.11.2020	25	8 Mounting	Expansion functional ground connection
05.03.2021		3.4 Environmental Conditions	Standards added
01.06.2021	16	3.2 Electrical Requirements	FW version SCPs added
07.02.2022	13	2.3.2 Mounting Position Horizontal 0-60 °C Ambient Temperature	Parameters SCP 211/SCP 111-S added

