

SI 021

S-DIAS SSI Interface Module

Instruction Manual

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Translation of the Original Instructions

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S-DIAS SSI Interface Module

SI 021

with 2 SSI absolute value encoders

The S-DIAS SSI Interface Module SI 021 can evaluate two absolute value encoders via the S-DIAS interface.

The SSI interface is designed for SSI encoders (e.g. absolute angle encoded length measurement rods...). Non-coded and Gray coded (Gray code is internally converted to binary) sensors are supported.



Contents

- 1 Introduction 5**
 - 1.1 Target Group/Purpose of this Operating Manual 5**
 - 1.2 Important Reference Documentation 5**
 - 1.3 Contents of Delivery 5**
- 2 Basic Safety Directives 6**
 - 2.1 Symbols Used 6**
 - 2.2 Disclaimer 8**
 - 2.3 General Safety Directives 9**
 - 2.4 Software/Training 10**
- 3 Standards and Directives 11**
 - 3.1 Directives 11**
 - 3.1.1 EU Conformity Declaration 11**
- 4 Type Plate 12**
- 5 Technical Data 13**
 - 5.1 SSI Absolute Value Encoder Specifications 13**
 - 5.2 Electrical Requirements 13**
 - 5.3 Miscellaneous 15**
 - 5.4 Environmental Conditions 15**
- 6 Mechanical Dimensions 16**
- 7 Connector Layout 17**

7.1	Status LEDs.....	18
7.2	Applicable Connectors.....	18
7.3	Label Field	19
8	Wiring	20
8.1	Wiring Example	20
8.2	Note	21
8.3	RS422 Interface	21
9	Function	22
9.1	SSI Absolute Value Encoder Coding	22
9.1.1	Binary Mode.....	22
9.1.2	Gray Code Decoder Mode	22
10	Assembly/Installation	23
10.1	Check Contents of Delivery	23
10.2	Mounting	24
11	Addressing.....	26
12	Supported Cycle Times	28
12.1	Cycle Times below 1 ms (in μ s).....	28
12.2	Cycle Times equal to or higher than 1 ms (in ms).....	28
13	Hardware Class SI021	29
13.1	General Information.....	30
13.2	Channel 1, 2.....	31

14 Transport/Storage.....32

15 Storage32

16 Maintenance33

 16.1 Service 33

 16.2 Repair..... 33

17 Disposal.....33

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.sigmathek-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

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

1.3 Contents of Delivery

1x SI 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.

INFORMATION**Information**

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

2.2 Disclaimer

INFORMATION



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.



INFORMATION

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.

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!

The module complies with EN 61131-2.

In combination with a facility, the system integrator must comply with EN 60204-1 standards.

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

Le module est conforme à la norme EN 61131-2.

En combinaison avec une équipement, l'intégrateur de système doit respecter la norme EN 60204-1.

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

2.4 Software/Training

The application is created with the software LASAL CLASS 2 and LASAL SCREEN Editor.

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 Standards and Directives

3.1 Directives

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

3.1.1 EU Conformity Declaration



EU Declaration of Conformity

The product SI 021 conforms to the following European directives:

- **2014/35/EU** Low-voltage 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. See Products/Downloads or use the search function and the keyword “EU Declaration of Conformity”.

4 Type Plate

	HW: X.XX SW: XX.XX.XXX Safety Version: SXX.XX.XX
Serial No.	SIGMATEK GMBH & CO KG Sigmatekstrasse 1 A-5112 LAMPRECHTSHAUSEN
Article Number	Product Name Short Name

Exemplary nameplate (symbol image)

	HW: 1.00 SW: 01.00.000 Safety Version: S01.00.00
12345678	SIGMATEK GMBH & CO KG Sigmatekstrasse 1 A-5112 LAMPRECHTSHAUSEN
12-246-133-3	Handbediengerät Wireless HGW 1033-3

HW: Hardware version

SW: Software version

5 Technical Data

5.1 SSI Absolute Value Encoder Specifications

Number	2
Encoder	absolute value encoder with RS422 interface
SSI signal level	RS422 inputs: 330 Ω bus termination, per 1.2 k Ω resistor spread against to 5 volts and mass outputs: 330 Ω bus termination, without spread
Data transfer speed	125 kHz, 250 kHz, 500 kHz, 1 MHz (configurable)
Encoder resolution	maximum 32 bits
Coding	binary/gray
Status LED	yes

5.2 Electrical Requirements

Voltage supply from the S-DIAS bus	+24 V	
Current consumption on the S-DIAS bus (+24 V power supply) without SSI encoders	typically 28 mA at +18 V	maximum 33 mA at +18 V
	typically 24 mA at +24 V	maximum 28 mA at +24 V
	typically 21 mA at +30 V	maximum 25 mA at +30 V
Current consumption on the S-DIAS bus (+24 V power supply) with two SSI encoders	typically 33 mA at +18 V	maximum 39 mA at +18 V
	typically 27 mA at +24 V	maximum 32 mA at +24 V
	typically 23 mA at +30 V	maximum 27 mA at +30 V

INFORMATION

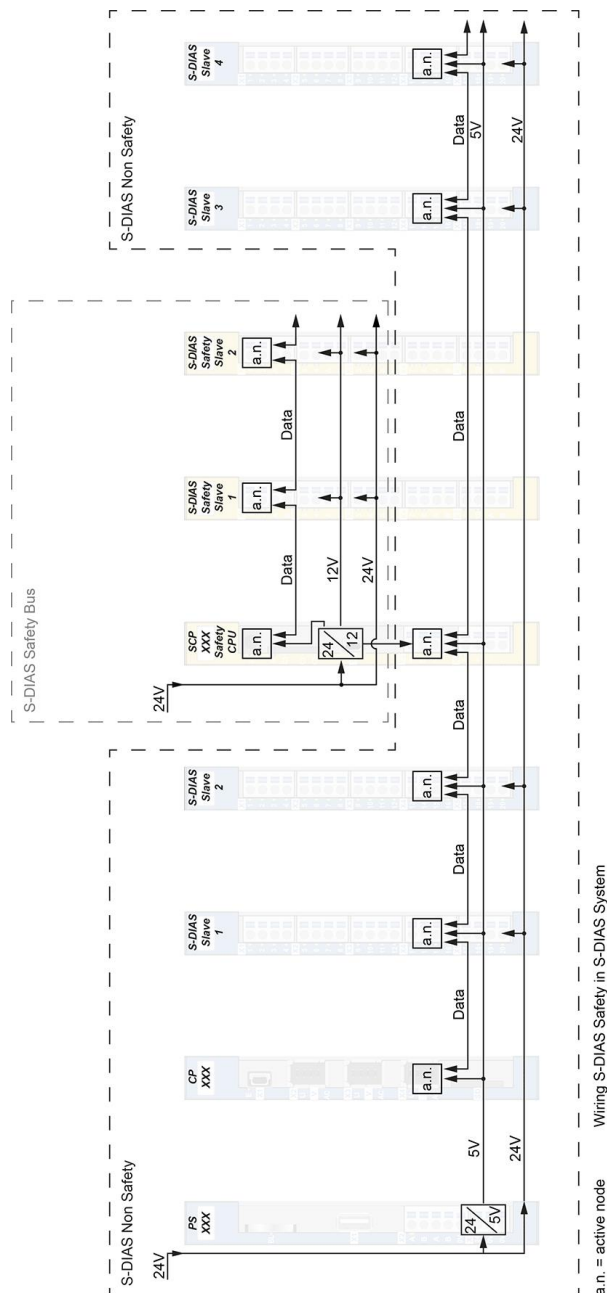


If this S-DIAS module is connected to an S-DIAS supply module with several S-DIAS modules, the total current of the modules used must be determined and checked.

The total current of the +24 V supply cannot exceed 1.6 A!

The total current of the +5 V supply cannot exceed 1.6 A!

The specification for the current can be found in the module-specific documentation under "Electrical Requirements".



- 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

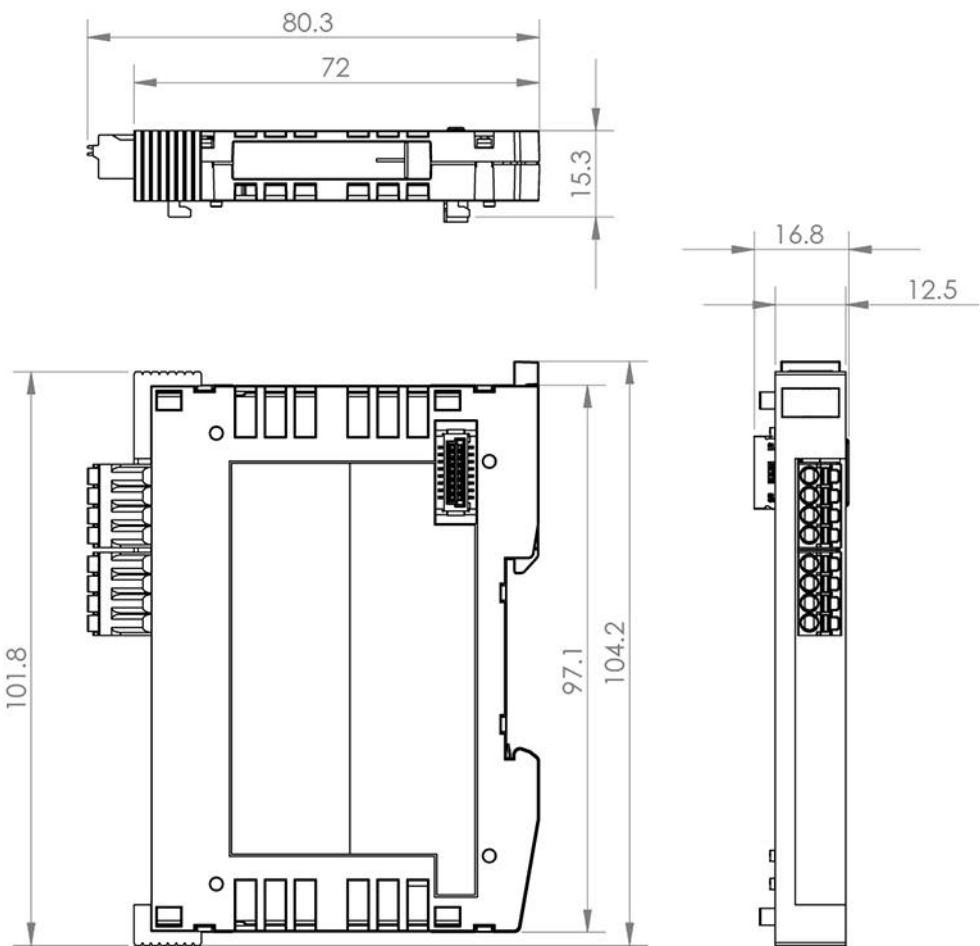
5.3 Miscellaneous

Article number	20-022-021
Standard	UL 508 (E247993)
Approbations	UL, cUL, CE, UKCA

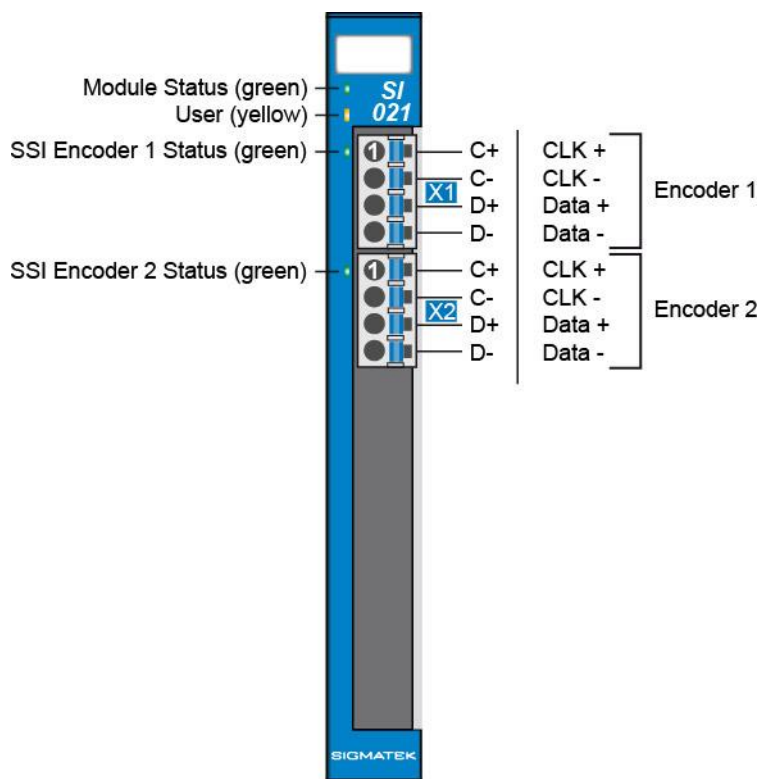
5.4 Environmental Conditions

Storage temperature	-20 ... +85 °C	
Environmental temperature	0 ... +60 °C	
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	
EMC resistance	in accordance with EN 61000-6-2 (industrial area)	
EMC noise generation	in accordance with 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
Protection type	EN 60529	IP20

6 Mechanical Dimensions



7 Connector Layout



7.1 Status LEDs

Module Status	green	ON	module active
		OFF	no supply available
		BLINKING (5 Hz)	no communication
User	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)	
SSI encoder status	green	ON	communication with encoder OK
		OFF	communication with encoder not OK

7.2 Applicable Connectors

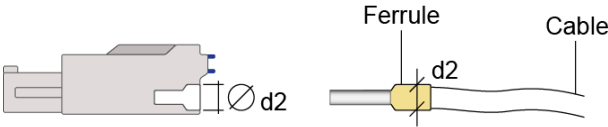
Connectors:

X1-X2: Connectors with spring terminals (included in delivery)

The spring terminals are suitable connecting ultrasonically compacted (ultrasonically welded) strands.

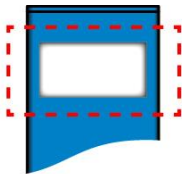
Connections:

Stripping length/Sleeve length:	10 mm
Plug-in direction:	parallel to conductor axis or to PCB
Conductor cross section, rigid:	0.2-1.5 mm ²
Conductor cross section, flexible:	0.2-1.5 mm ²
Conductor cross section, 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 (ground for reducing d2 of the ferrule)



d2 = max. 2.8 mm

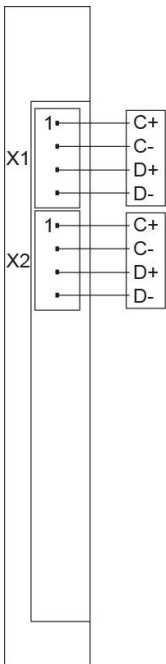
7.3 Label Field



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

8 Wiring

8.1 Wiring Example



8.2 Note

To ensure error-free operation, a careful wiring method must be followed.

- The 0 V connection (GND) of the supply voltage must be connected with the 0 V collection point over the shortest route possible.
- The lines connected to the SSI Absolute Value encoders must be as short as possible and parallel wiring to digital signal lines must be avoided.
- The signal lines must be 2, 3 or 4-pin shielded wires.

INFORMATION

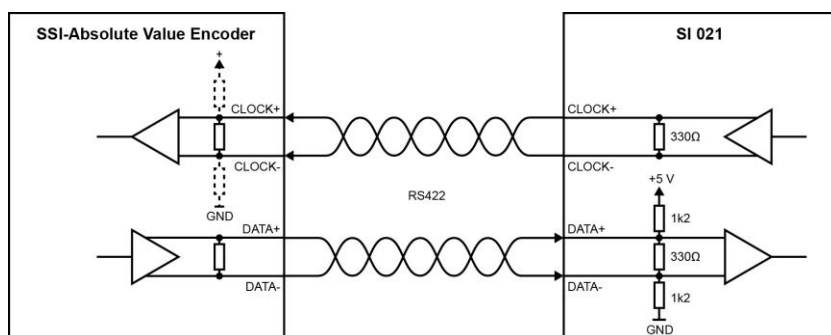


The ground bus should be connected to the control cabinet when possible!

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

8.3 RS422 Interface

The RS422 interface is internally connected in the SSI Interface Module.



9 Function

9.1 SSI Absolute Value Encoder Coding

9.1.1 Binary Mode

For the binary mode, the Gray code decoding (default: off) must be enabled. This mode is also recommended if the sensor provides data but contains additional non-coded bits, which would lead to falsified data during automatic decoding. Decoding must be performed in the software. The de-serialized data stream is provided as a 32-bit value in the respective data register of the channel.

9.1.2 Gray Code Decoder Mode

For sensors that provide Gray encoded data. The result is decoded automatically (Gray code decoding on) and provided as a 32-bit value in the respective data register of the channel. In this mode, the additional bits in the sensor-data stream must be taken into consideration. With additional bits that are not encoded and transmitted in the serial data stream before the coded measurement data, the decoding leads to corruption of all data. With additional bits that are not encoded and transmitted in the serial data stream after the coded measurement data, the decoding leads to corruption of the additional bits.

10 Assembly/Installation

10.1 Check Contents of Delivery

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

INFORMATION

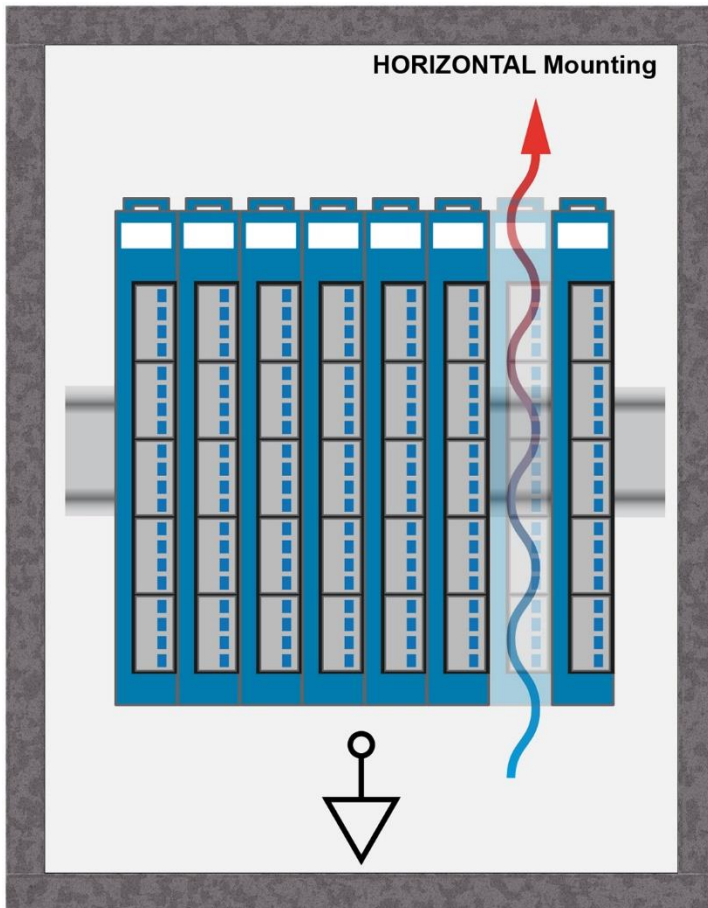


On receipt and before initial use, check the device for damage. If the device is damaged, contact our customer service and do not install the device in your system.

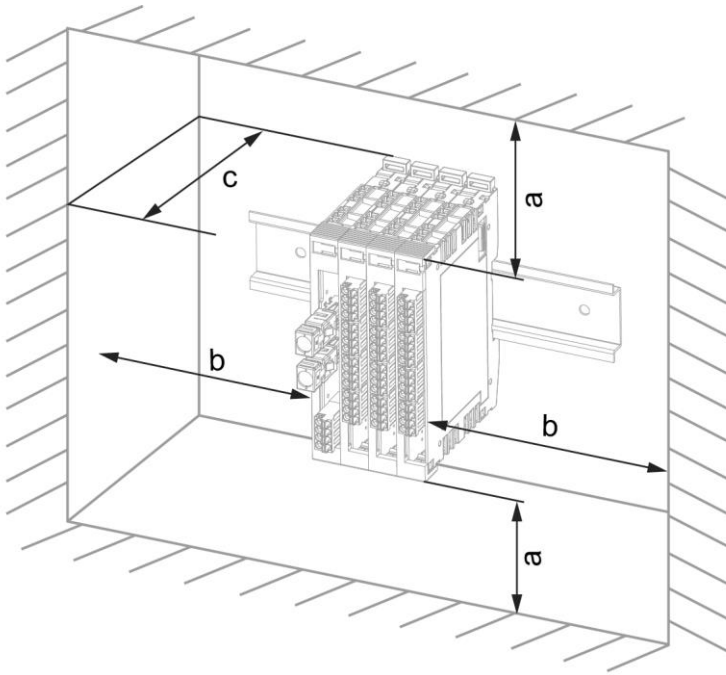
Damaged components can disrupt or damage the system.

10.2 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 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)

11 Addressing

Address (hex)	Size (bytes)	Access Type	Description	Reset value
SDO				
0000	1	r/w	Configuration register channel 1 Bit 0-5 SSI Shift Register size (max. 32 bits) Bit 6 read each value 2x Bit 7 HW configuration (read only) 0 = incremental encoder mode 1 = SSI encoder mode	20
0001	1	r/w	Control/status register channel 1 Bit 0-1 Shift register frequency 00 = 125 kHz 01 = 250 kHz 10 = 500 kHz 11 = 1 MHz Bit 2 Gray code encryption (1 = enable) Bit 3 SSI busy (1 = busy, read only) Bit 4 reserve Bit 5 Error reset (ro, write 1 = clear error) Bit 6 Start with Sync (1 = enable) Bit 7 Continuous read (1 = enable)	00
0002	1	r/w	Configuration register channel 2 Bit 0-5 SSI Shift Register size (max. 32 bits) Bit 6 read each value 2x Bit 7 HW configuration (read only) 0 = incremental encoder mode 1 = SSI encoder mode	20
0003	1	r/w	Control/status register channel 2 Bit 0-1 Shift register frequency 00 = 125 kHz 01 = 250 kHz 10 = 500 kHz 11 = 1 MHz Bit 2 Gray code encryption (1 = enable) Bit 3 SSI busy (1 = busy, read only) Bit 4 reserve Bit 5 Error reset (ro, write 1 = clear error) Bit 6 Start with Sync (1 = enable) Bit 7 Continuous read (1 = enable)	00
Write PDO				
0004	1	r/w	Start read cycle Bit 0 Start read for channel 1 Bit 1 Start read for channel 2	-
reserve				
0005	1	r/w	Reserved	00

Read PDO				
0006	1	r	Reserved	00
0007	1	r	Input status for channel 1 and 2 Bit 0 Channel 1 started Bit 1 Channel 1 busy Bit 2 Channel 1 toggle Bit 3 Channel 1 SSI error/Z-position invalid Bit 4 Channel 2 started Bit 5 Channel 2 busy Bit 6 Channel 2 toggle Bit 7 Channel 2 SSI error/Z-position invalid	00
0008	4	r32	Channel 1 input data Bit 0-31 SSI input data	00000000
3 m	4	r32	Channel 2 input data Bit 0-31 SSI input data	00000000

12 Supported Cycle Times

12.1 Cycle Times below 1 ms (in μs)

50	100	125	200	250	500
x	x	x	x	x	x

x= supported

12.2 Cycle Times equal to or higher than 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

x= supported

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 Hardware Class SI021

Hardware Class SI021 for the S-DIAS SSI encoder module SI 021

```
SDIAS:09, SI021 (SI0211)  
S Class State (ClassState) <-[]->  
S Device ID (DeviceID) <-[]->  
S FPGA Version (FPGAVersion) <-[]->  
S Hardware Version (HwVersion) <-[]->  
S Serial Number (SerialNo) <-[]->  
S Retry Counter (RetryCounter) <-[]->  
O LED Control (LEDControl) <-[]->  
I Data Channel 1 (Ch1_Data) <-[]->  
I Error Channel 1 (Ch1_Error) <-[]->  
I Data Channel 2 (Ch2_Data) <-[]->  
I Error Channel 2 (Ch2_Error) <-[]->  
ALARM:00, Empty
```

This hardware class is used to control the SSI 021 hardware module with 2 SSI encoder interfaces. More information on the hardware can be found in the module documentation.

13.1 General Information

Class State	State	Shows the actual status of the hardware class.
Device ID	State	Shows the Device ID of the hardware module.
FPGA Version	State	FPGA version of the module in 16#XY (e.g. 16#10 = version 1.0).
Hardware Version	State	Hardware version of the module in format 16#XXYY (e.g. 16#0120 = Version 1.20).
Serial Number	State	Shows the serial number of the hardware module.
Retry Counter	State	This server increments when a transfer fails.
LED Control	Output	With this output, the application LED of the S-DIAS module can be activated to find the module in the network more quickly. The following statuses are possible:
		0 LED off
		1 LED on
		2 blinks slowly
		3 blinks rapidly
Required	Property	This property is active by default, which means that the S-DIAS hardware module at this position is mandatory for the system and can under no circumstances be disconnected or return an error. Otherwise, the entire hardware deactivated. If the hardware module is missing or removed, an S-DIAS error is triggered. If his client is initialized with 0, the hardware module located in this position is not mandatory. This means that it can be inserted or removed at any time. However, which components identified as "not required" should be selected with regard to the safety of the system.
Sample Multiplier	Property	Multiplier for sampling the SSI data in relation to the bus (time = 1). If the SSI encoder requires more time to provide a new value than the bus time, it must be set in this property accordingly.

13.2 Channel 1, 2

Channel Data	Input	Shows the input value of the SSI encoder scaled over 32 bits. By setting the property Channel Raw Value, the raw value is displayed directly from the SSI encoder.
Channel Error	State	0 Values in Channel Data server are valid 1 Error while reading the SSI values
Channel SSI Bit Size	Property	With this property, the length of the SSI shift register is set as an initialization value (1 – 32 bits)
Channel SSI Double Read	Property	To protect the data transfer, this property can be set as an initialization value, so that each value is read twice and simultaneously checked for uniformity (1 = double-reading enabled).
Channel Frequency	Property	In this property, the frequency is set as an initialization value for the SSI transfer. 0 125 kHz 1 250 kHz 2 500 kHz 3 1 MHz
Channel Use Graycode	Property	This property can be set as an initialization value to select whether the SSI data is provided in "binary" or decoded using Gray code. 0 binary data 1 Gray code data
Channel Raw Value	Property	In this property, the mode for the output to Channel Data is set as an initialization value. 0 position is calculated 1 position is output directly

Communication Interfaces

ALARM	Downlink	With this downlink the corresponding alarm class can be placed via the hardware editor.
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14 Transport/Storage

INFORMATION



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

INFORMATION



When not in use, store the operating panel according to the storage conditions. See chapter 14.

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

INFORMATION



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

INFORMATION



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.



Documentation Changes

Change date	Affected page(s)	Chapter	Note
30.01.2015	9	4.2 Note	Added note concerning connecting the S-DIAS module while voltage is applied
26.03.2015	7	3.2 Applicable Connectors	Added connections
13.04.2015	3	1.1 SSI Absolute Value Encoder Specifications	Updated description of the SSI signal level in the table SSI Absolute Value Encoder Specifications
	9	4.3 RS422-Interface	New graphic
	13	7 Addressing	Changed description of the address 006
14.07.2015	3	1.2 Electrical Requirements	Changed Electrical Requirements
21.01.2016	4	1.3 Miscellaneous	Standard changed
26.01.2016	3	1.2 Electrical Requirements	Graphics added
28.04.2016	14	6 Mounting	Graphics distances
20.12.2016	10	4.1 Wiring example	Faulty graphic corrected
	11	4.3 RS422 Interface	Faulty graphic corrected
17.08.2017	6	1.4 Environmental Conditions	Pollution Degree
	9	3.2 Applicable Connectors	Sleeve length added Added info regarding ultrasonically welded strands
18.10.2017	10	3.3 Label Field	Added chapter
	15	6 Mounting	Graphic replaced
14.11.2019	19	8 Supported Cycle Times	Chapter added
28.02.2020	19	8 Supported Cycle Times	Text adapted
08.09.2020	20	9 Hardware Class SI021	Chapter added
04.11.2020	15	6 Mounting	Expansion functional ground connection
06.12.2022	7	1.3 Miscellaneous	UKCA conformity
26.07.2023		Document	General chapters added, design

