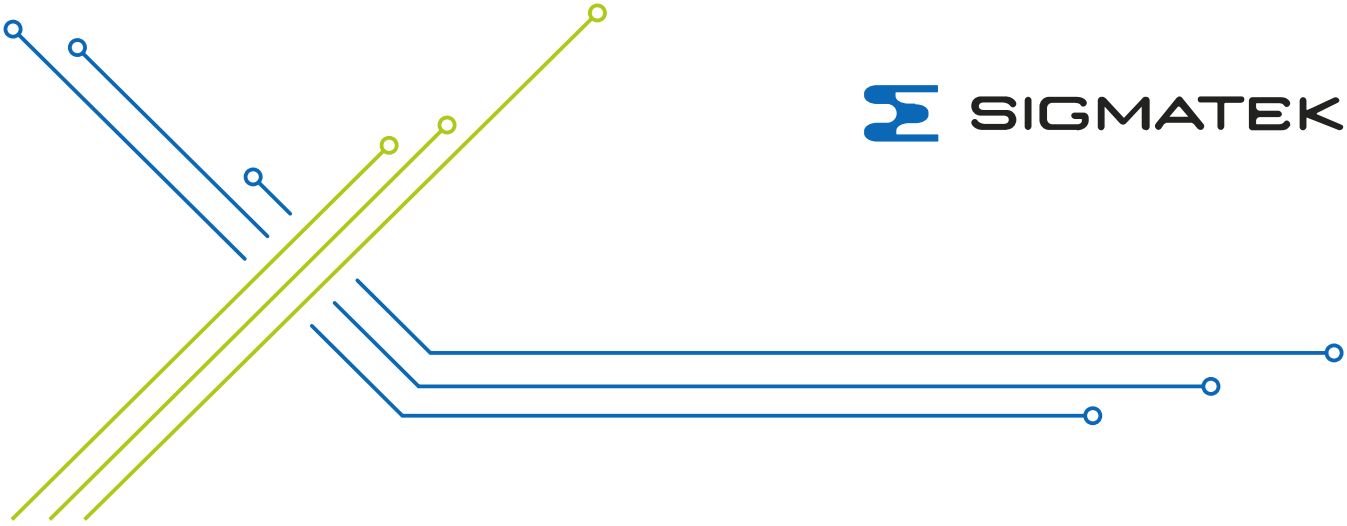


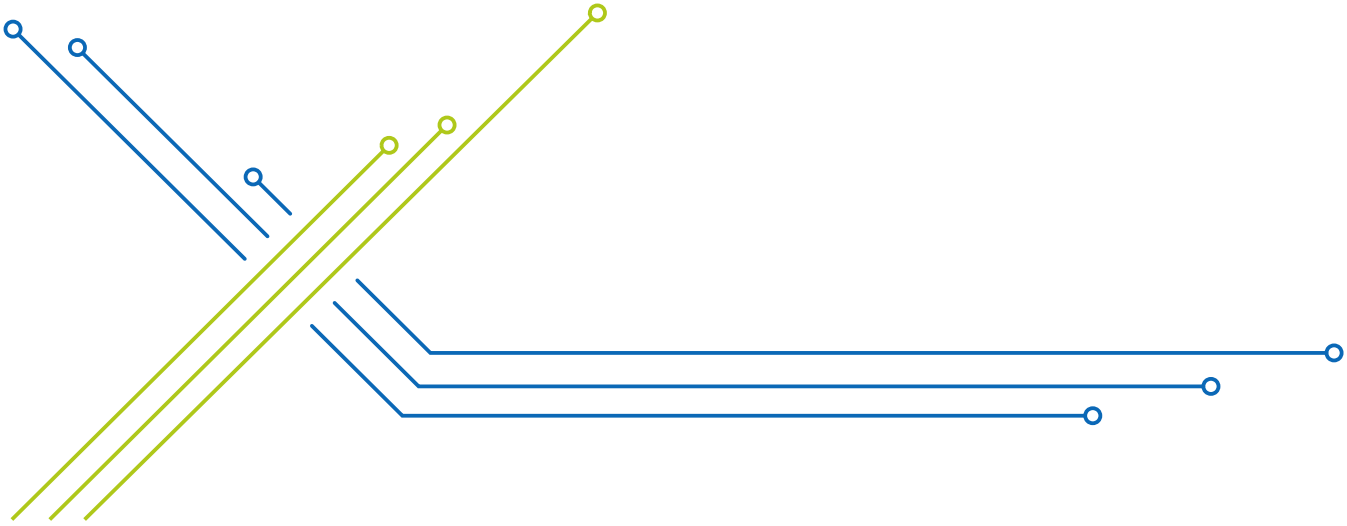
SIGMATEK

DC 104

S-DIAS Drive Module

INSTRUCTION MANUAL

Article number:	20-014-104-E
Date of creation:	09.01.2025
Version date:	23.10.2026



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Translation of the Original Instructions

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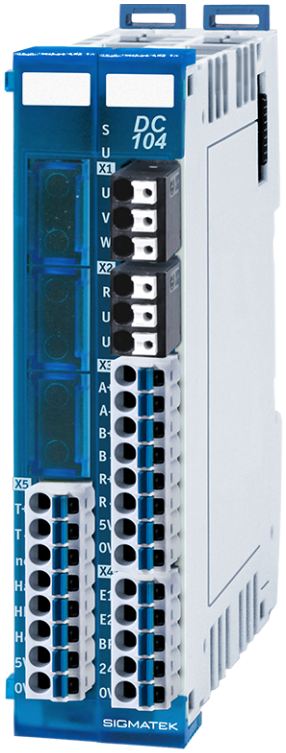
S-DIAS Drive Module DC 104



1 motor output stage 10 A

1 brake chopper

1 universal encoder feedback

2 enable inputs for STO

1 holding brake

1 motor temperature sensor input

The S-DIAS Drive Module DC 104 is used to control a synchronous servo motor/DC motor with +48 Vsupply voltage and a phase current of up to 10 A. There is also a brake chopper output for connecting an external brake resistor. A universal encoder feedback (Sanyo Denki, BiSS-C P2P, Tamagawa, EnDat, SSI, incremental encoder with additional Hall sensor interface for commutation search) is available for position feedback.

STO (Safe Torque Off) can be achieved for synchronous servo motors with 2 enable inputs, according to SIL3 in accordance with EN IEC 62061 or EN IEC 61508 and PL e, Cat.4 in accordance with EN ISO 13849.

A +24 V output is available for connecting a holding brake. There is also a motor temperature sensor input, which switches off the output stage if a maximum threshold value is exceeded.

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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 or assist you in case of any issues.
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 DC 104

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.

DANGER

Electrical voltage

Tension électrique

WARNING

Hot Surfaces

Surfaces chaudes

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

EU Declaration of Conformity

The product DC 104 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)

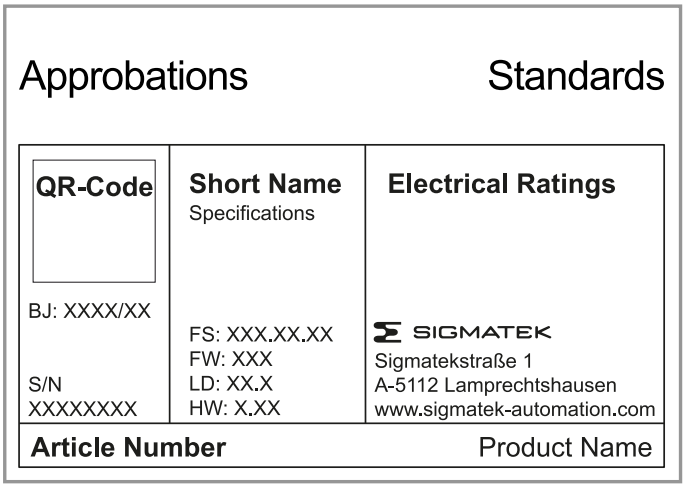
The EU Conformity Declarations are provided on the SIGMATEK website. They can be found in the download area of the respective product.

4.4 Safety-Relevant Parameters

DC 104	Safety parameters SIL 3, PL e / Cat. 4
Safety Function STO (the safety function STO is supported by the module ONLY for operation as a servo motor output stage)	PFH = 1,37E-09
	SFF = 99,86 %
	$MTTF_D$ = 2959 years
	DC = 96.16 %

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 Motor Output Stage Specifications

Type	Servo motor output stage	DC motor output stage
Operation modes	Current regulation	PWM control
	Speed regulation via universal encoder interface	Current regulation
	Position regulation via universal encoder interface	Speed regulation via IxR compensation
		Speed regulation via incremental encoder
		Position regulation via incremental encoder
Operation voltage	+18-55 V	
Regulator frequency	16 kHz	
PWM frequency	16 kHz	
Maximum PWM duty cycle	95 % (limited by hardware)	
Maximum continuous current	10 A	
Maximum peak current (10 s)	20 A	
Output current over the environmental temperature[1)]	maximum 10 A continuous current at 45 °C	
	maximum 7.5 A continuous current at 50 °C	
	maximum 5 A continuous current at 55 °C	
DC-link capacitance	5 µF	
Motor current measurement	0-20 A	
Voltage measurement	0-65 V	
Safety functions	Short circuit cut-off	
	Temperature cut-off	
	I^2t monitor	
	Overvoltage and under voltage monitoring	
	Motor temperature monitoring via resistance sensor in the motor	

1) Derating is dependent on temperature and does not happen automatically. It must be ensured that the output cur-rent, depending on the temperature, does not exceed the maximum values. Il faut s'assurer que le courant de sortie, en fonction de la température, ne dépasse pas les valeurs maximales.

6.2 Brake Chopper Specifications

Type	Brake chopper for external power resistor
Output	GND switching
Maximum current	10 A[1)]
Lowest possible resistance	6 Ω[2)]
Short-circuit protection	yes
Regen resistor switching threshold on/off	60 V/55 V[3)]

WARNING

Hot surface warning!
A burn hazard exists with physical contact!
During operation, the surface of the brake resistor can become very hot and remain hot sometime after operation.
Avoid physical contact with the surface of the brake resistor, and for a significant time after operation as well.

Avertissement de surface chaude!
Il existe un risque de brûlure par contact physique!
Pendant le fonctionnement, la surface de la résistance de freinage peut devenir très chaude et rester chaude quelque temps après le fonctionnement.
Eviter tout contact physique avec la surface de la résistance de freinage, ainsi que pendant une longue période après le fonctionnement.

1) Regen braking must be dimensioned according to the application. For most applications, a 10 Ω/50 W resistor is sufficient. If multiple S-DIAS Drive Module are driven with one intermediate circuit supply, it is possible to equip only one module with regen braking. The recommended regen resistor (15 Ω/100 W) is available at SIGMATEK under the article number 20-014-061-Z1.

2) The resistance must be dimensioned based on its maximum power dissipation corresponding to the braking power generated in the application. However, the permissible short-term power generated must be at least P=U2/R, meaning 602/R.

3) The switch-off threshold must be at least +3 V below the switch-on threshold of the ballast resistor.

6.3 Universal Encoder Feedback Specifications

Number	1		
Encoder system	Sanyo Denki	BiSS-C (Point to Point)	Tamagawa
Signals	RS422 (A=ES+, /A=ES-) RS422 level (120 Ω termination, integrated in module)	RS422 (A=MA+, /A=MA-, B=SL+, /B=SL-) RS422 level (120 Ω termination, integrated in module)	RS422 (A=Data+, /A=Data-) RS422 level (120 Ω termination, integrated in module)
Hall sensors for commutation search	-	-	-
Input frequency	-	-	-
Counter frequency	-	-	-
Signal analysis	-	-	-
Data transfer speed	2.5 MHz	2.5 MHz	2.5 MHz
Encoder resolution	29-bit	maximum 64-bit	ID 0x11: 33-bit ID 0x17: 39-bit
Coding	-	-	-
Encoder power supply	+5 V/0,2 A short-circuit proof		

Number	1			
Encoder system	EnDat2.1/2.2[1)]	SSI	Incremental encoder with additional Hall sensor interface for commutation search	
Signals	RS422 (A=Data+, /A=Data-, B=Clk+, /B=Clk-) RS422 level (120 Ω termination, integrated in module)	RS422 (A=Data+, /A=Data-, B=Clk+, /B=Clk-) RS422 level (120 Ω termination, integrated in module)	TTL (A, B, R) TTL level (1200 Ω pull-up, termination, integrated in module)	RS422 (A, /A, B, /B, R, /R) RS422 level (120 Ω termination, integrated in module)
Hall sensors for commutation search	-	-	TTL (Ha, Hb, Hc) TTL level (1200 Ω pull-up, integrated in module)	
Input frequency	-	-	maximum 125 kHz	maximum 250 kHz
Counter frequency	-	-	maximum 500 kHz	maximum 1 MHz
Signal analysis	-	-	4x	
Data transfer speed	2 MHz	2.5 MHz	-	-
Encoder resolution	maximum 48-bit	30-bit	maximum 16-bit	
Coding	-	binary	-	-
Encoder power supply	+5 V/0.2 A short-circuit proof			

[1)] EnDat 2.2 supports only the features that are already included in EnDat 2.1. ATTENTION: When using SIGMATEK AKM motors with EnDat encoders, an M-ROFF of 180° is required.

6.3.1 Commutation Search

The DC 104 with an incremental encoder without Hall sensors performs a commutation search during the enable process, which can take several seconds. If the motor has a brake, this can cause problems if the brake does not allow sufficient play for the increment change required during the commutation search. Depending on the type and configuration of the drive, the maximum axis movement varies during the commutation search.

When using an incremental encoder with a Hall sensor interface, an offset calibration is performed. This process takes only a few hundred milliseconds, but significant axis movement is possible during this process. Commutation angle detection without Hall sensors has the smallest angular deviation during execution, while commutation angle detection with Hall sensors is the fastest in terms of execution time.

6.3.1.1 Commutation Angle Detection for Incremental Encoders without Additional Hall Sensors

The **rotation angle range** varies during the commutation angle search depending on the setting of

- the amplitude of the commutation signal
- the frequency of the sinusoidal current
- the pole pairs in the motor
- the load on the shaft
- the position of the shaft before commutation

The **commutation duration** varies during commutation angle search depending on the setting of

- the amplitude of the commutation signal
- the frequency of the sinusoidal current
- the number of commutation cycles (at least 3 successful cycles are required; if there are more than 7, an error message is displayed)

6.3.1.2 Commutation Angle Detection for Incremental Encoders with Additional Hall Sensors

The **rotation angle range** varies during the commutation angle search depending on the setting of

- the pole pairs in the motor
- axial load
- axial position before commutation
- controller parameters

For the **commutation duration** , there are no significant dependencies.

6.3.1.3 Test Results for Commutation Angle Detection in Incremental Encoders with/without Additional Hall Sensors

The tests were conducted using Nanotec DB42S03 (8 poles / 4 pole pairs) + WEDL / WEDS5541 (1000 CPR) + Hall sensors integrated into the motor with the motor under no mechanical load:

	Commutation Angle Detection for Incremental Encoders Without Additional Hall Sensors	Commutation Angle Detection for Incremental Encoders with Additional Hall Sensors
Angular Deflection	• minimum: 7.5° • average: 18.6° • maximum: 34.5°	• minimum: 2.3° • average: 31.9° • maximum: 78.9°
Commutation duration	• minimum (4 runs): 6.5 s • maximum (6 runs): 10.5 s	• minimum (4 runs): 205 ms • maximum (6 runs): 375 ms

6.4 Enable Inputs Specifications

Number	2	
Input voltage	+24 V	
Input voltage range	+18-30 V	
Signal level	low: ≤ +5 V	high: ≥ +15 V
Switching threshold	typically +11 V	
Input current	3 mA at +24 V	
Input delay	typically 0.5 ms	
Output test signal control	maximum 1.5 ms	

6.5 Holding Brake Specifications

Number	1
Output voltage	+24 V (corresponds to supply feed via X4)
Maximum continuous current	1.8 A
Short-circuit protection	yes
Maximum cut-off energy (inductive load)	0.65 J

6.6 Motor Temperature Sensor Input Specifications

Number	1	
Resistance measurement range	100-2,500 Ω	
Measurement value	100-2,500	
Input resistance	> 10 kΩ	
Typical input current	< 0.33 mA	
Input filter hardware	typically 10 Hz	low-pass 1st order

6.7 Electrical Requirements

Supply voltage (X4)voltage holding brake + universal encoder (X4)	+18-30 V, Class 2[1)]	
Current consumption of the supply voltage holding brake + universal encoder (X4)	maximum 1.9 A (load-dependent holding brake + universal encoder supply)	
Supply voltage motor (X2)	+18-55 V[2)]	
Current consumption supply voltage Motor (X2)	load-dependent (motor)	
Voltage supply from S-DIAS bus	+5 V	
Current consumption on the S-DIAS bus (+5 V supply)	-	-
Supply from S-DIAS bus	+24 V	
Current consumption on the S-DIAS bus (+24 V supply)	typically 35 mA	maximum 45 mA

INFORMATION

1) For USA and Canada:

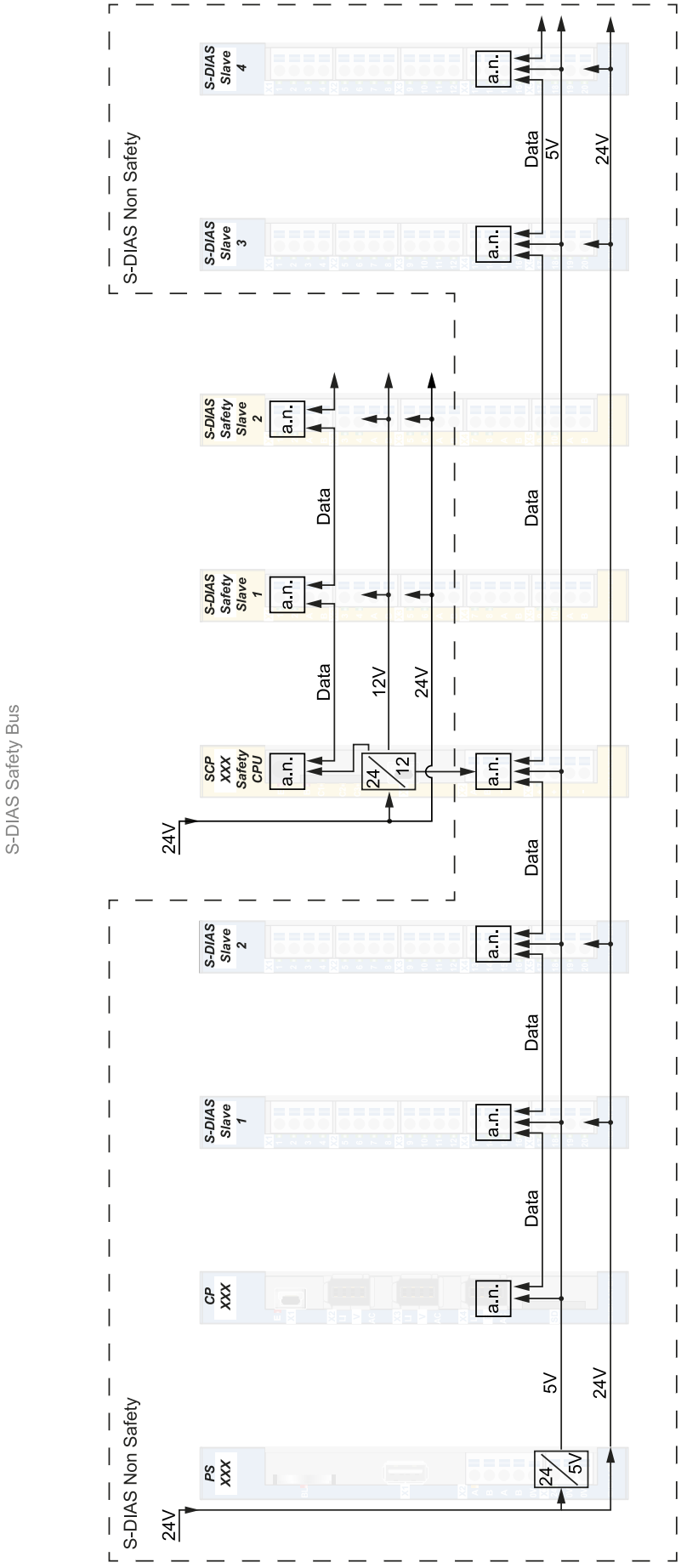
Only suitable for connection to secondary isolated power supply rated 24 V DC, class 2 or fuse rated max. 4 A in accordance with UL 248 shall be connected in the field between the supply source and device terminals.

2) The motor supply (X2) must be connected with an intermediate circuit capacitance appropriate for the application (at least 2000 µF/100 V).
Attention must be paid to short cables and appropriate cable cross-sections.(maximum 15 cm between module and capacitor / 1.5 mm²)

Braking a DC motor:
When braking a DC motor, a generative process can occur whereby the kinetic energy of the motor is converted into electrical energy. The energy of the motor is thereby fed back into the supply of the DC motor output stage; this then increases the supply voltage. It should be noted that the feedback voltage supply voltage of 65 V cannot be exceeded! The external capacity of the motor supply is may be needed. If the capacitors in the power supply are insufficient, a regen resistor, which converts the excess energy into heat must be connected to the DC motor output stage. When selecting the power supply, it is important to ensure that it is appropriately feedback-resistant up to the maximum regenerative voltage that occurs.

Use only conductors, which are rated for at least 75 °C!

Incorrectly set parameter or incorrect wiring can lead to destruction of the motor. In particular, motor currents and the I^2T settings (A-I2TT, A-I2TERR) must be monitored, which can be parameterized in the DIAS-Drive Editor via the LASAL CLASS 2 tool.
Only motors in a star configuration can be used.


S-DIAS Safety Bus
S-DIAS Non Safety
S-DIAS Non Safety
PS XXX
CP XXX
S-DIAS Slave 1
S-DIAS Slave 2
SCP XXX Safety CPU
S-DIAS Safety Slave 1
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

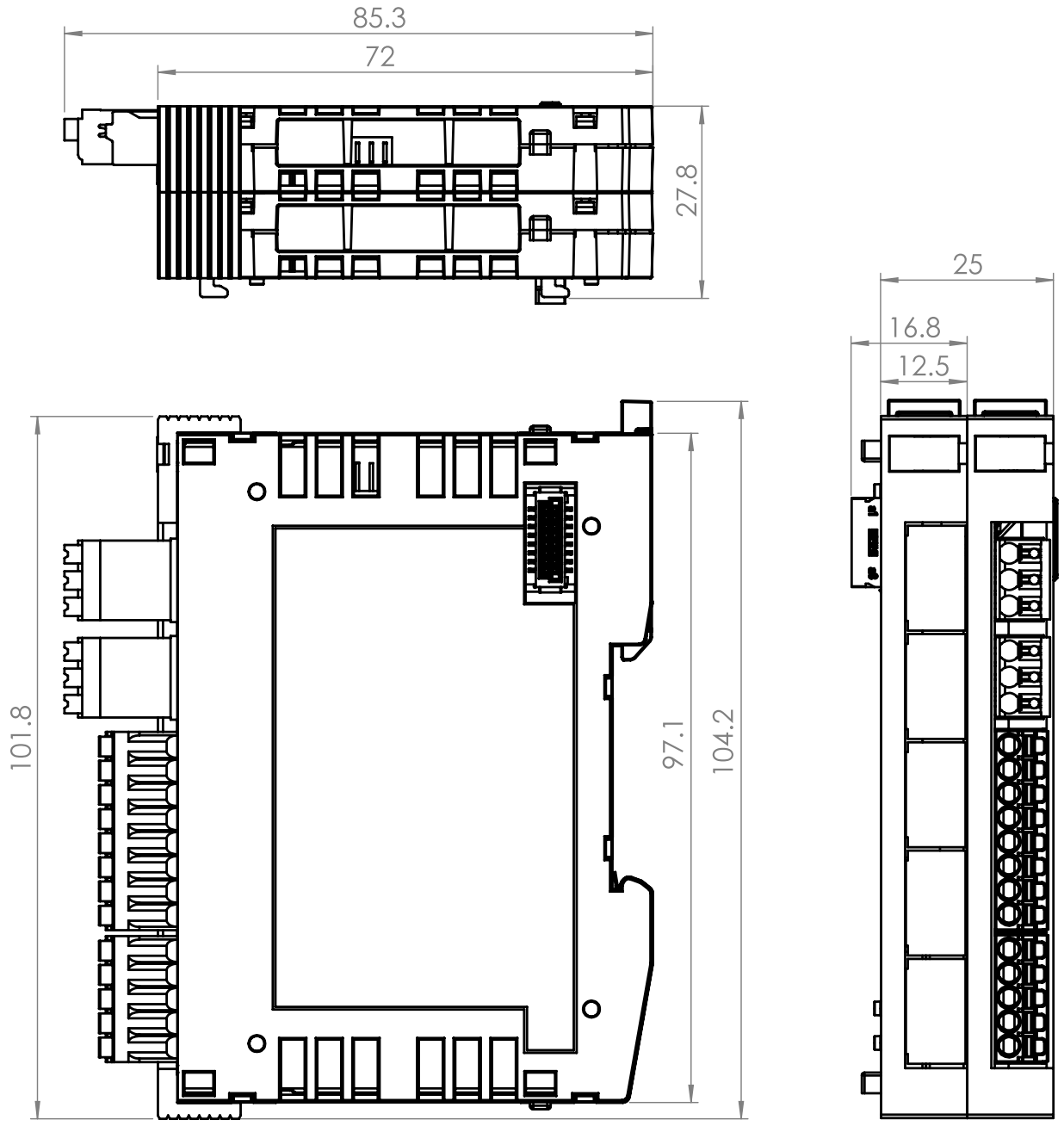
6.8 Miscellaneous

Article number	20-014-104	
Printed circuit board coating	no	
Approvals	CE	yes
	UL	designed according to UL
	Functional Safety	yes, EG-type-examined
	UKCA	no
Mission time	20 years	

6.9 Environmental Conditions

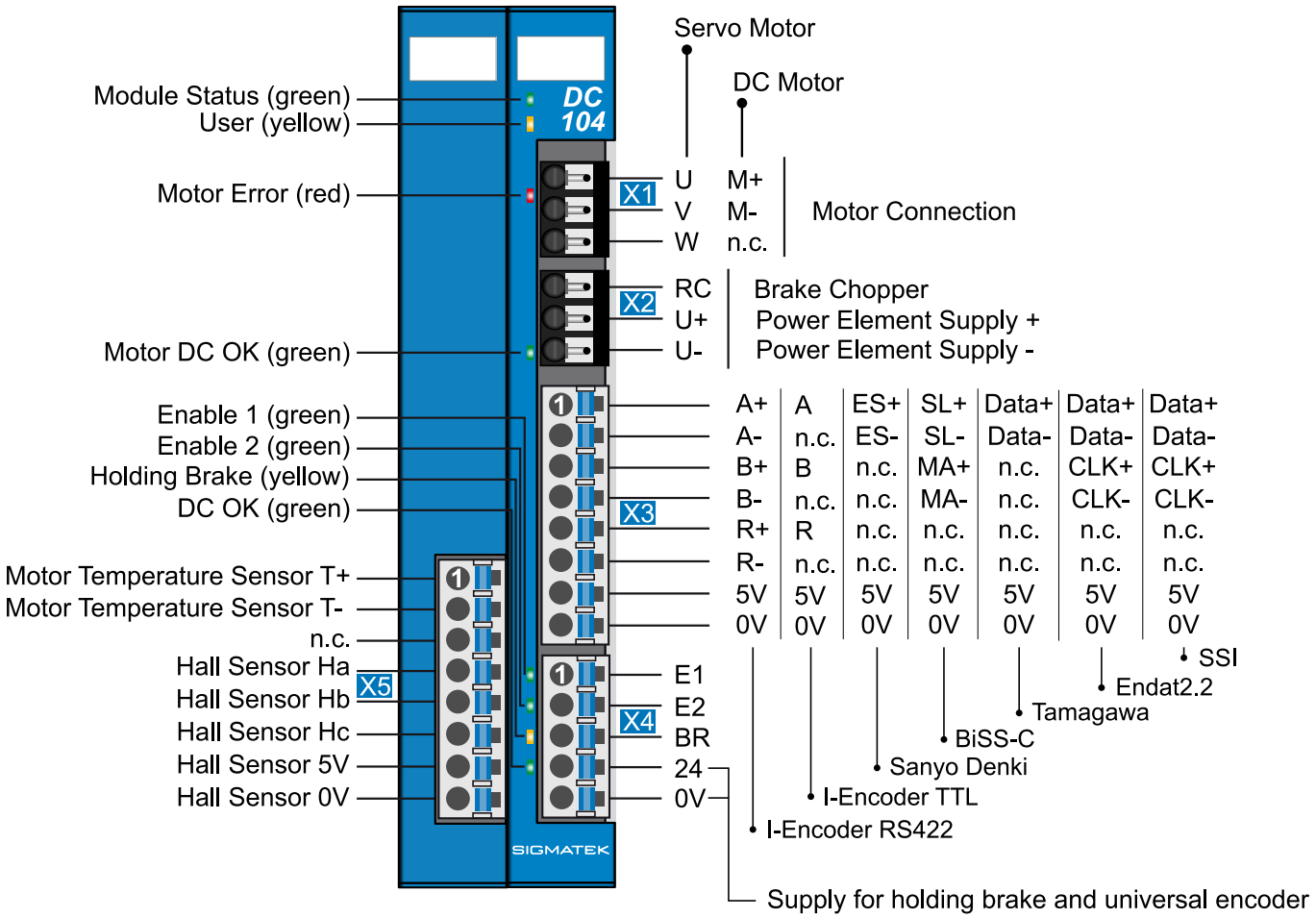
Storage temperature	-25 ... +85 °C	
Environmental temperature	0 ... +55 °C	
Humidity	0-95 %, non-condensing	
Installation altitude above sea level	0-2000 m without Derating > 2000 m up to a maximum of 5000 m with derating of the maximum environmental temperature by 0.5 °C per 100 m	
Operating conditions	pollution degree 2	
Noise emission	≤ 70 dB	
EMC resistance	EN 61000-6-2 (industrial area) EN 61000-6-7 (immunity industry functional safety) (increased requirements according to EN IEC 62061)	
	additionally tested in accordance with EN 61800-5-2 (safety requirements - functional safety)	
EMC noise generation	EN 61000-6-4 (industrial area)	
Vibration resistance	EN 60068-2-6	3.5 mm von 5-8.4 Hz 1 g von 8.4-150 Hz
Shock resistance	EN 60068-2-27	15 g (147.15 m/s²)
Protection type	EN 60529	IP20

7 Mechanical Dimensions



Measurements	25 x 104 x 72 mm (W x H x D)

8 Connector Layout



8.1 Status LEDs

Module status	green	ON	module active
		OFF	no supply available
		BLINKING (5 Hz)	no communication
User	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)	
Motor error	red	BLINKING	motor output stage error
		OFF	normal operation
Motor DC OK	green	ON	power applied and motor active
		OFF	no motor supply voltage
		BLINKING	power applied, but motor inactive
Enable 1	green	ON	enable 1 high
		OFF	enable 1 low
Enable 2	green	ON	enable 2 high
		OFF	enable 2 low
Holding brake	yellow	ON	output active (brake released)
		OFF	output inactive
DC OK	green	ON	+24 V supply for holding brake and encoder supply OK
		OFF	+24 V supply for holding brake and encoder supply too low
		BLINKS	+24 V supply for holding brake and encoder supply too high

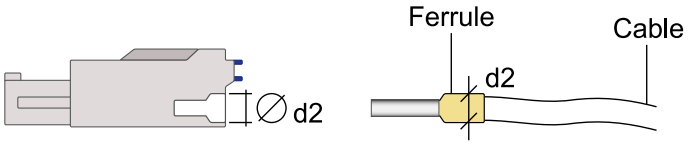
8.2 Applicable Connectors

X1, X2: Weidmüller socket connectors with spring terminals (included in delivery)
X3-X5: Phoenix connector plugs with spring terminals (included in delivery)

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

Connection capacity Phoenix connectors:

Stripping length/sleeve length	10 mm
Mating direction	parallel to conductor axis or to 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 reducing d2 of the ferrule)



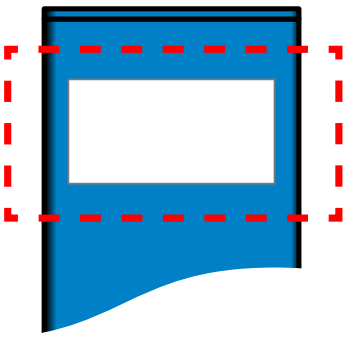
d2 = max. 2.8 mm

Weidmüller connector capacity:

Stripping length/sleeve length	9 mm
Mating direction	parallel to the conductor axis or circuit board
Conductor cross section rigid H05(07) V-U	0.14-1.5 mm^2
Conductor cross section flexible H05(07) V-K	0.14-1.5 mm^2
Conductor cross section, ultrasonically compacted	0.14-1.5 mm^2
Conductor cross section AWG/kcmil	26-16
Conductor cross section flexible with ferrule without plastic sleeve (DIN 46228-1)	0.25-1.5 mm^2
Conductor cross section flexible, with ferrule with plastic sleeve (DIN 46228-4)	0.25-1 mm^2 (reason for reduction d2 of the ferrule)

d2 = max. 3,5 mm

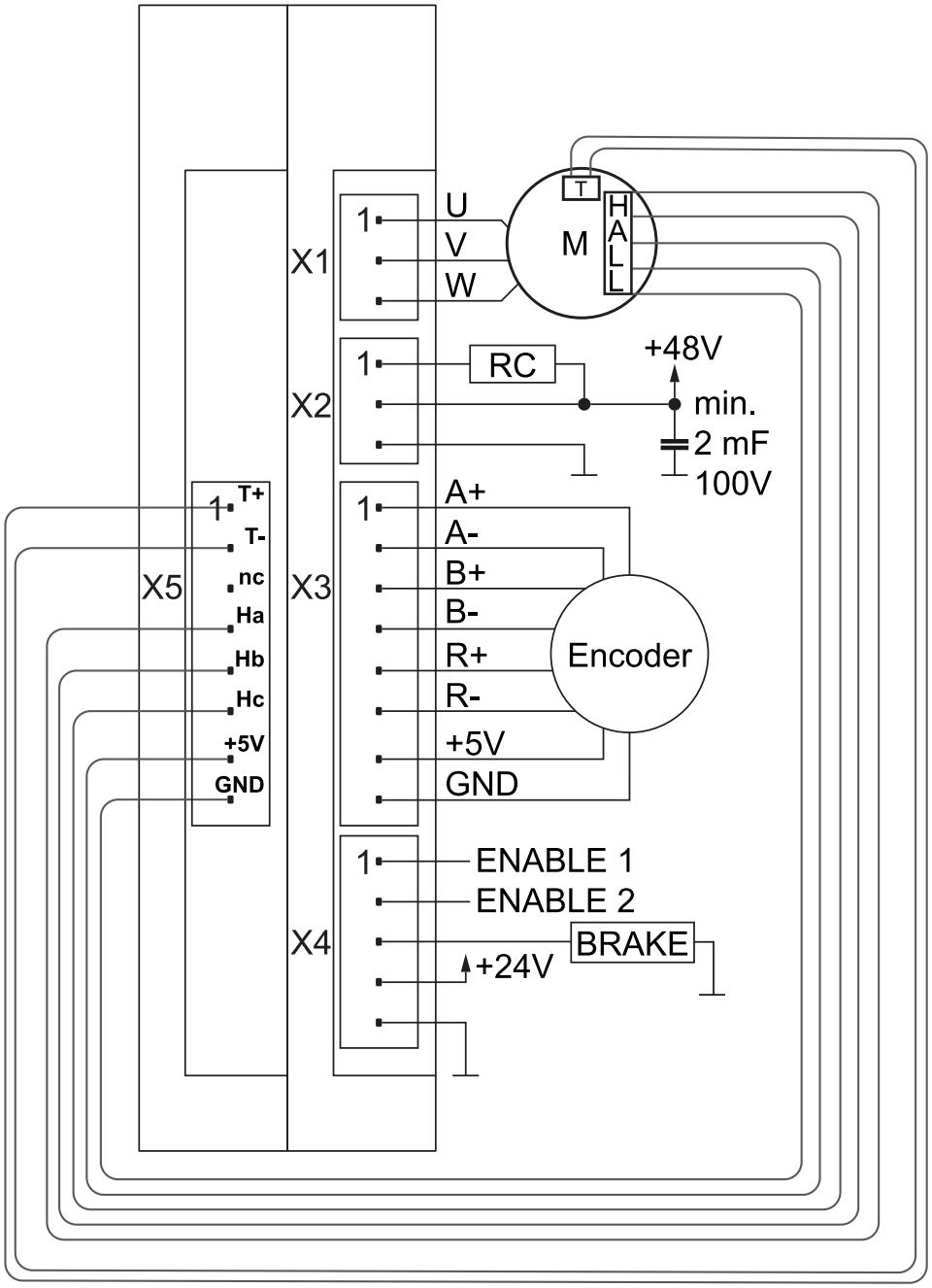
8.3 Label Field



The labeling field is printed directly on the module.

9 Wiring

9.1 Wiring Example



9.2 Note

The following installation guidelines should be observed:

- The DIN rail must have an adequate mass connection.
- The shielding must be connected to a shielding bus.
- To wire the encoder, a shielded cable is required. The shield must be placed as close as possible before the module.
- For the motor wiring, a shielded cable is required. The shield must be placed as close as possible to the module.

INFORMATION

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

The maximum cable length for the encoder, motor, motor temperature and brake chopper cables is 30 meters.

CAUTION

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

CAUTION

The operator must ensure that no interference from ESD affects the product.

10 Additional Safety Information

The Safety function “STO” is an integrated part of the servo motor output stage. It meets all necessary requirements for safe operation in SIL 3 according to EN IEC 62061 or EN IEC 61508 and in compliance with PL e. Cat. 4 in accordance with EN ISO 13849-1.

CAUTION

The instructions contained in this document must be followed.

- The DC 104 can only be powered by supplies that meet the requirements for SELV or PELV in compliance with EN 60204.
  For error-free operation, proper transport and storage are essential. See chapter 13 Transport/Storage.
- 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 guidelines and standards of safety technology.

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

ATTENTION

Les instructions contenues dans ce document doivent être suivies.

- Pour un fonctionnement sans erreur, le transport et le stockage appropriés sont essentiels. Voir le chapitre 13 Transport/Storage pour plus d’informations.
- 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.

Pour votre propre sécurité et celle des autres, les modules de sécurité ne doivent être utilisés qu’à des fins prévues. Une installation CEM correcte est également incluse dans l’utilisation prevue.

CAUTION

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 manual or the speciation's defined in the technical data (see chapter 6 Technical Data).

The main power supply for the servo amplifier must be disconnected using the main switch for the following instances:

- Cleaning, maintenance or repairs
- Extended still-stand periods

CAUTION

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 (voir chapitre6 Technical Data).

L'alimentation principale du variateur doit être débranchée à l'aide de l'interrupteur principal dans les cas suivants:

- Nettoyage, entretien ou réparation
- périodes d'immobilisation prolongées

DANGER

Failure to follow the above safety measures can lead to severe injuries.

- Only trained personnel are authorized to install the "safe restart lock" STO (Safe Torque off) and set the parameters.
- All control devices (switches, relays, PLC, etc.) and the control cabinet must meet the requirements for EN ISO 13849.
  This includes:
  - Door switches, etc. with at least IP54 protection.
  - Control cabinet with at least IP54 protection.
- Appropriate cables must be used, and proper cable termination on the module side must be ensured (see the chapter “8.2 Applicable Connectors” => Connection capacity).
- All cables that affect safety (e.g. control cables for the ENABLE 1 and ENABLE 2 inputs) must be laid in a cable duct outside of the control cabinet: Short or crossed circuits in the signal lines must be avoided! See EN ISO 13849.

DANGER

Le non-respect des mesures de sécurité ci-dessus peut entraîner des blessures graves.

- Seul un personnel qualifié est autorisé à installer le "blocage de redémarrage sûr" STO (Safe Torque off) et à régler les parameters.
- Tous les appareils de commande (interrupteurs, relais, API, etc.) et l'armoire de commande doivent satisfaire aux exigences de la norme EN ISO 13849.
  Il s'agit des éléments suivants :
  - interrupteurs de porte, etc. avec une protection d'au moins IP54
  - armoire de commande avec une protection d'au moins IP54.
- Il convient d'utiliser des câbles adaptés et de veiller à ce que les extrémités des câbles soient correctement raccordées côté module (voir le chapitre 8.2 Applicable Connectors" => Connection capacity).
- Tous les câbles affectant la sécurité (par ex. les câbles de commande pour les entrées ENABLE 1 et ENABLE 2) doivent être posés dans un conduit de câbles de raccordement à l'extérieur de l'armoire électrique. Eviter les courts-circuits ou les courts-circuits croisés dans les lignes de signalisation! Voir EN ISO 13849.

DANGER

If external forces influence axes that are used with the STO safety function (e.g. hanging load), additional measures must be taken (such as an electromagnetic double-surface spring brake, instead of a permanent magnet brake).

Si des forces externes influencent les axes utilisés avec la fonction de sécurité STO (par ex. charge suspendue), des mesures supplémentaires doivent être prises (par ex. un frein à ressort électromagnétique à double surface au lieu d'un frein à aimant permanent).

WARNING

Hot surface warning!
Physical contact poses a burn hazard!
With unfavorable installation and operating conditions, the surface of the S-DIAS drive module can reach temperatures up to 73 °C and remain hot for some time after operation.

Avertissement de surface chaude !
Le contact physique présente un risque de brûlure !
En cas de conditions d'installation et de fonctionnement défavorables, la surface du module d'entraînement S-DIAS peut atteindre des tempé-ratures allant jusqu'à 73 °C et rester chaude pendant un certain temps après utilisation.

10.1 STO

The DC 104 supports the safety functions STO (Safe Torque Off) and meets the requirements for Category 4 Performance Level "e" according to EN ISO 13849-1 and SIL 3 according to EN IEC 62061 or EN IEC 61508 (for DC motors, the safety requirement is not met!).

For his purpose, the servo amplifier has two safe inputs ENABLE 1 and ENABLE 2.

The stop brake control is not a component of the safety function. If the holding brakes need to be switched off safely, the power supply for the holding brake and universal encoder must also be switched off externally.

10.2 Function

The safety functions in the DC 104 are controlled over two digital inputs.

The following table shows the status that the ENABLE 1 and ENABLE 2 inputs must assume to enable normal operation or trigger the safety function.

Input Status		Description
ENABLE 1	**ENABLE 2**	
Open	Open	**Safe status of the drive system**
Open	Low	
Low	Open	
Low	Low	
Low	High	
High	Low	
High	High	**Drive system ready**

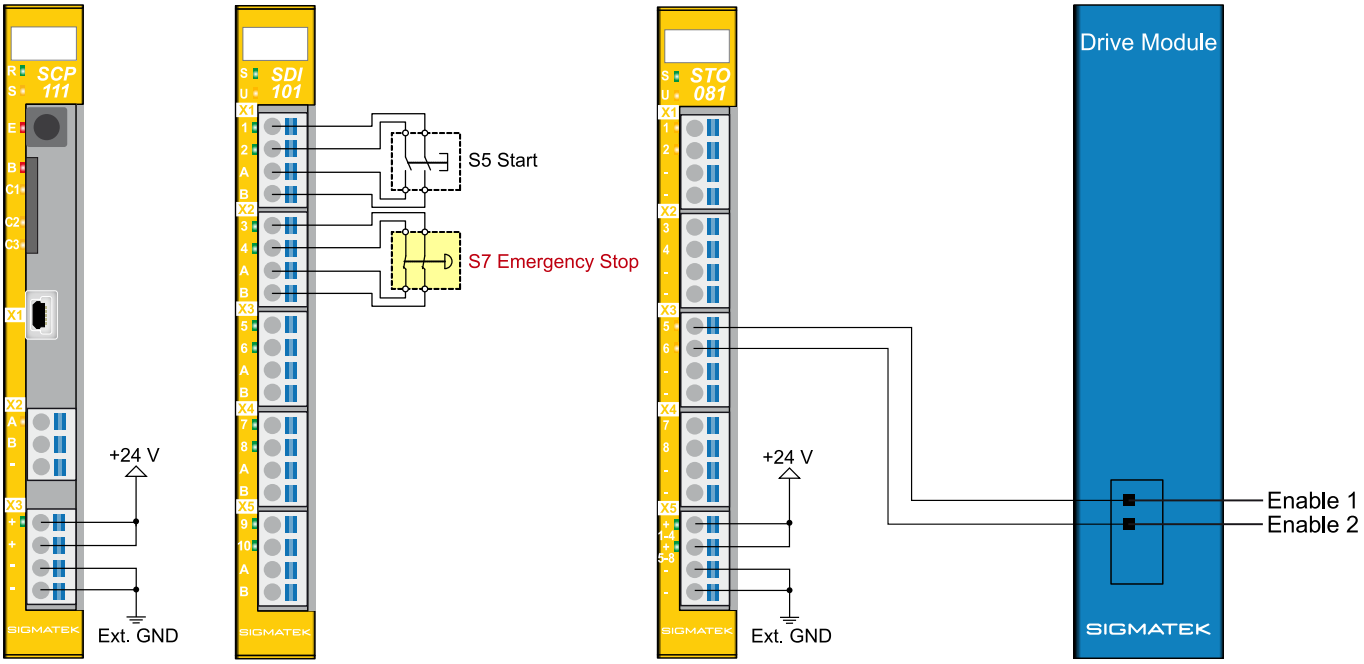
If the ENABLE 1 and ENABLE 2 are changed from any status to the "Drive Ready" status, the servo amplifier is not immediately enabled. In order to set the system to the status “Drive system ready”, a change from “Low-Low” to “High-High” has to be executed. The reason for this is that, for example, sticky contacts of switching devices are detected.

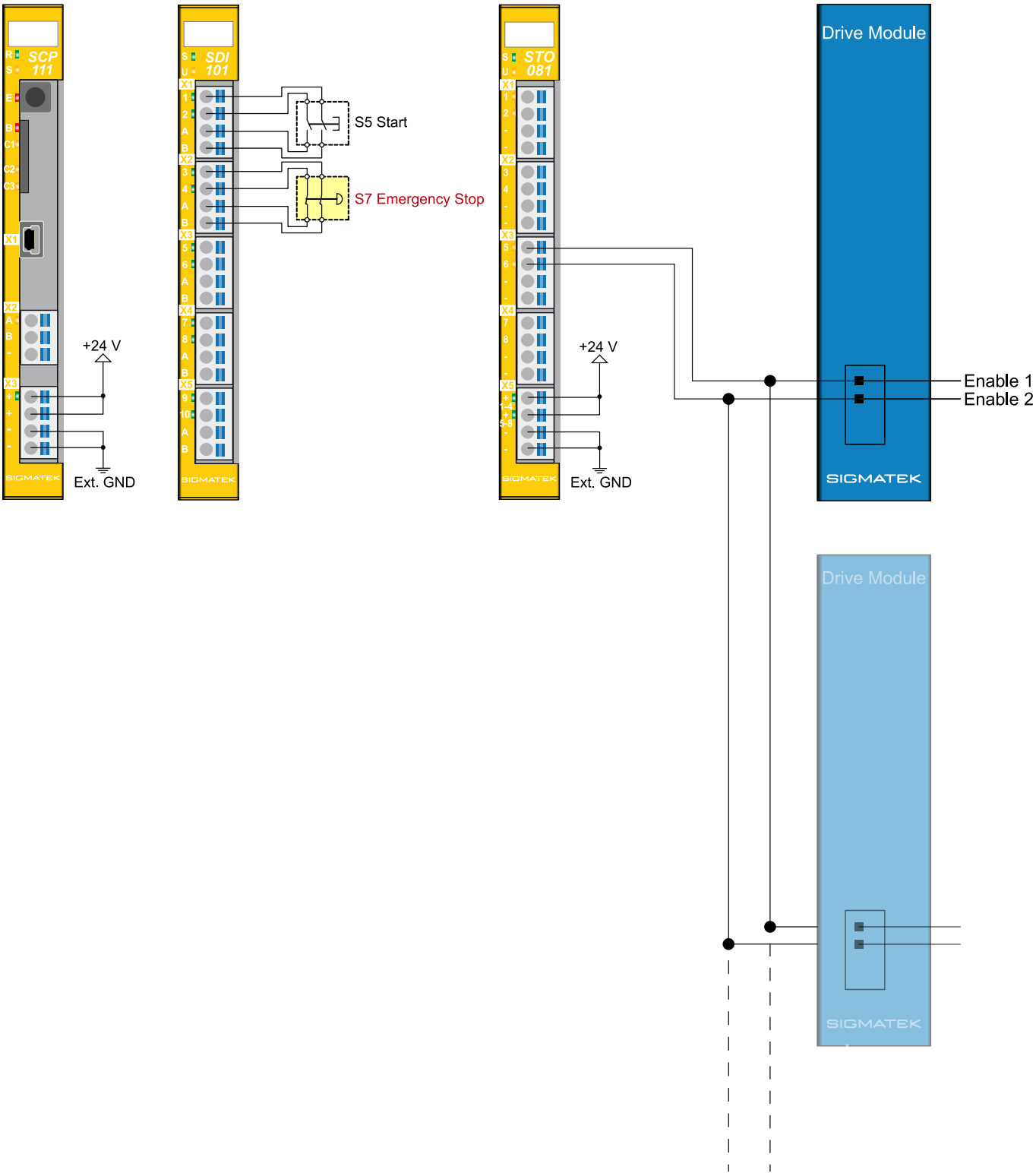
11 Wiring Examples

In the following sub chapters, wiring examples are provided. It must be ensured that all constructive measures etc. are complied with and applied in order to fulfill the requirements of the category used.

11.1 Performance Level e, Category 4 or SIL 3 - Safety PLC

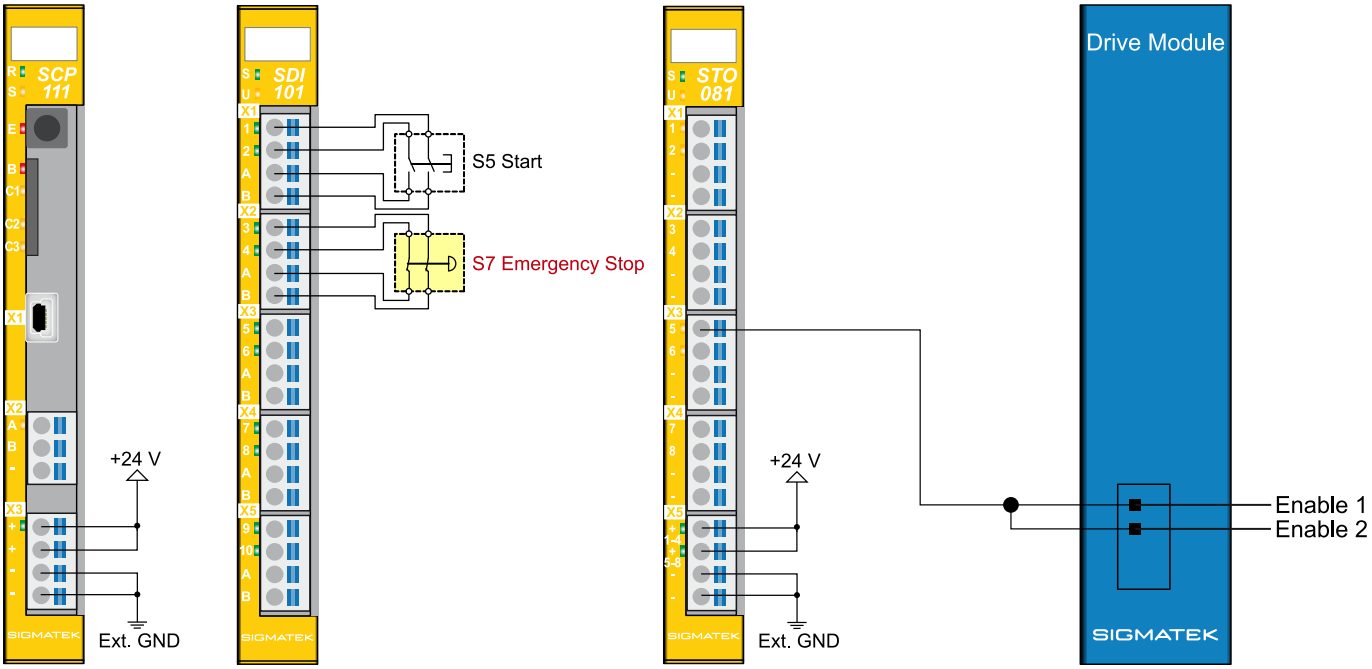
To meet the requirements of category 4, performance Level "e" for EN ISO 13849-1 and SIL 3 according to EN IEC 62061 or EN IEC 61508, two error-proof output of a Safety PLC must be used. Cross-circuit detection between the two lines via the output tests of the STO 081 is hereby possible.

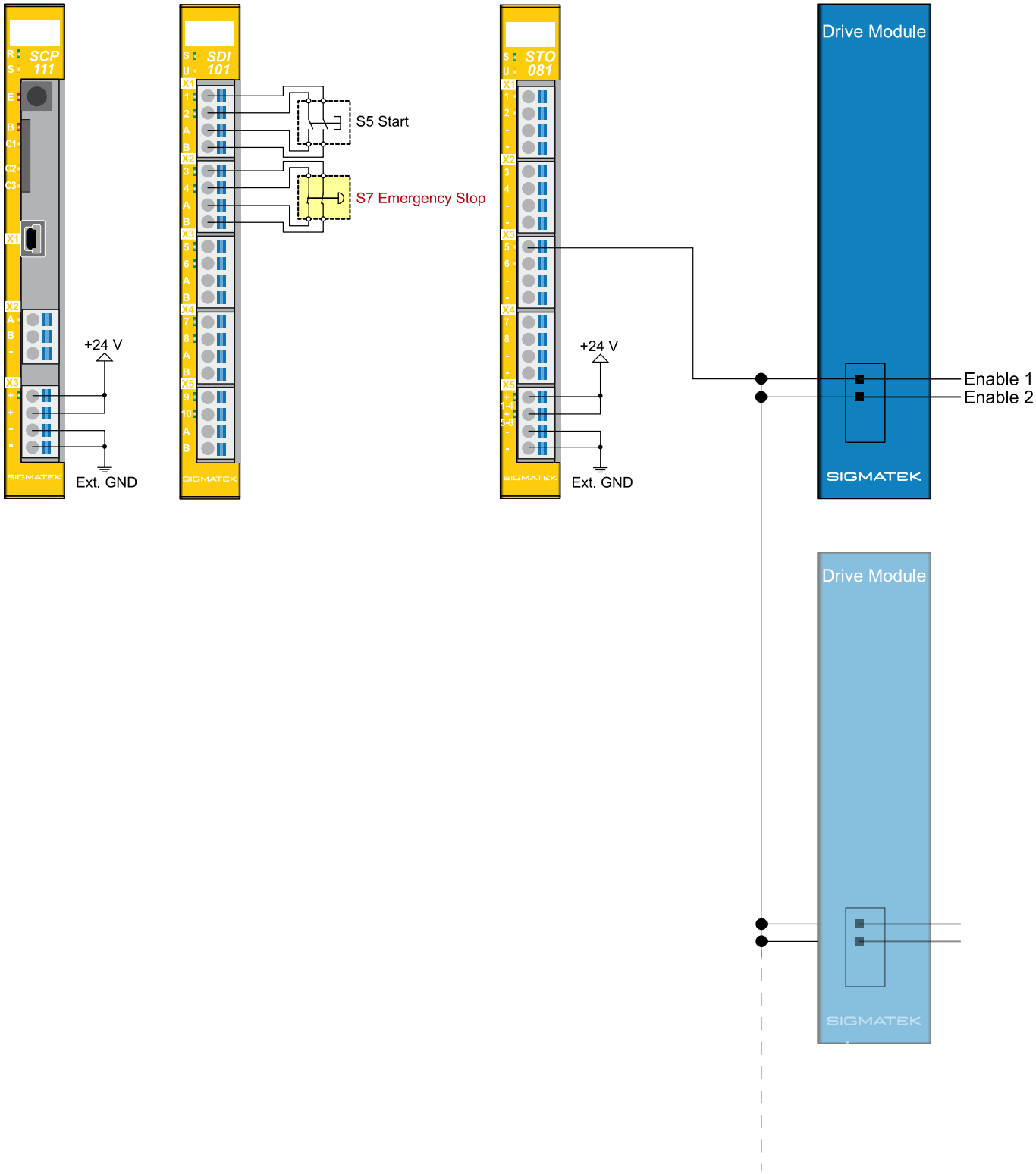



SCP 111
SDI 101
STO 081
S5 Start
S7 Emergency Stop
+24 V
Ext. GND
+24 V
Ext. GND
Drive Module
Enable 1
Enable 2
SIGMATEK
Drive Module
SIGMATEK

11.2 Performance Level e, Category 3 or SIL 3 - Safety PLC

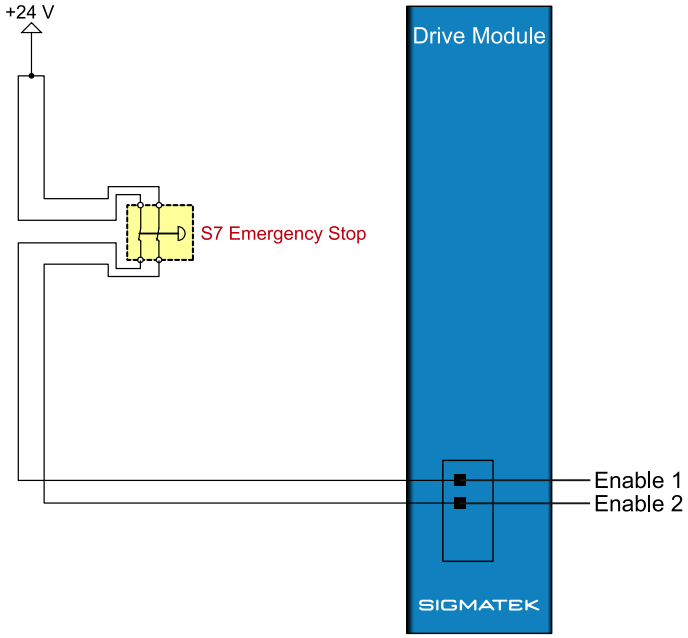
To meet the requirements of safety category 3, performance level "e" for EN ISO 13849-1 and SIL 3 according to EN IEC 62061 or EN IEC 61508, an error-proof output of a safety PLC must be used. The reason of category 3 here, is that cross-circuit detection between the two lines is not possible. To achieve the stated performance level, a fault exclusion for the wiring is also necessary for this connection. In addition, the wiring must be within the control cabinet.

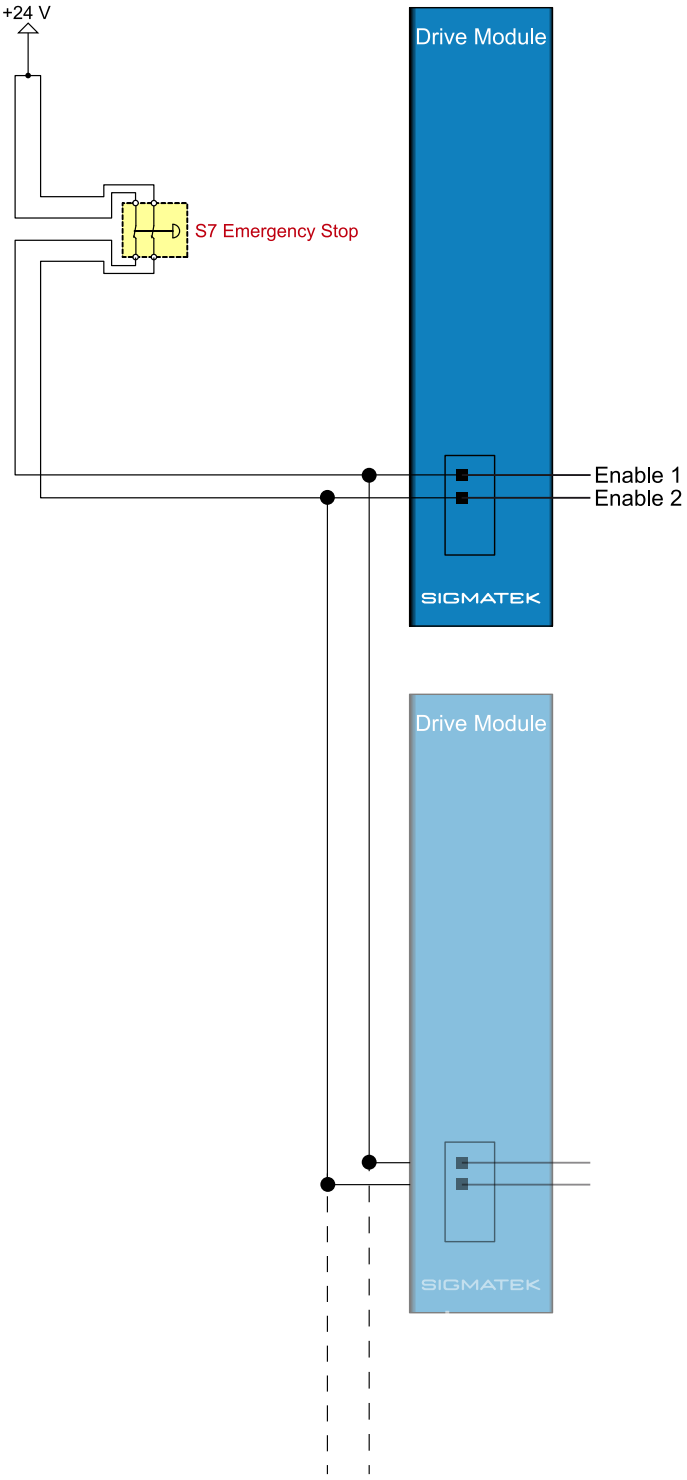



SCP 111
SDI 101
STO 081
S5 Start
S7 Emergency Stop
+24 V
Ext. GND
+24 V
Ext. GND
Drive Module
Enable 1
Enable 2
Drive Module
SIGMATEK

11.3 Performance Level e, Category 4 or SIL 3 - Conventional

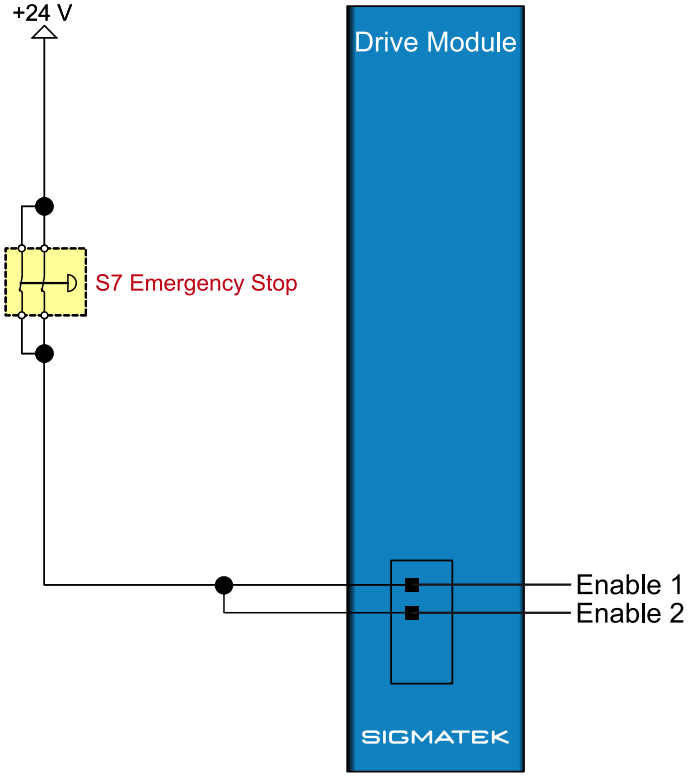
To meet the requirements of safety category 4, performance level "e" for EN ISO 13849-1 and SIL 3 according to EN IEC 62061 or EN IEC 61508, the placement of the lines must comply with EN ISO 13849-2, table D.4 (separate placement, prohibiting of error via short circuits between wires) as cross-circuit detection is not possible here.

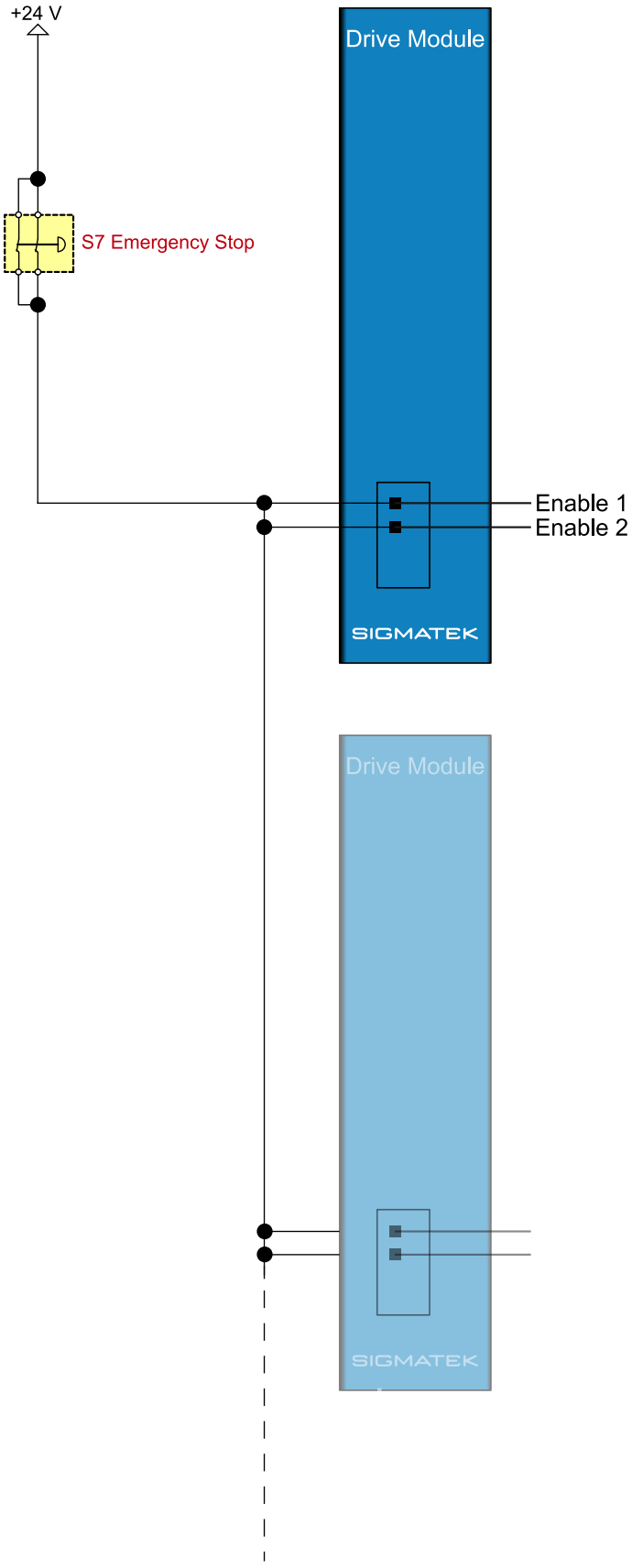



+24 V
S7 Emergency Stop
Drive Module
Enable 1
Enable 2
SIGMATEK
Drive Module
SIGMATEK

11.4 Performance Level e, Category 2 or SIL 2 - Conventional

This involves 1-channel wiring, whereby the Enable inputs are tested separately. Here, no cross-circuit detection is possible.




+24 V
S7 Emergency Stop
Drive Module
Enable 1
Enable 2
SIGMATEK
Drive Module
SIGMATEK

12 Assembly/Installation

12.1 Check Contents of Delivery

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

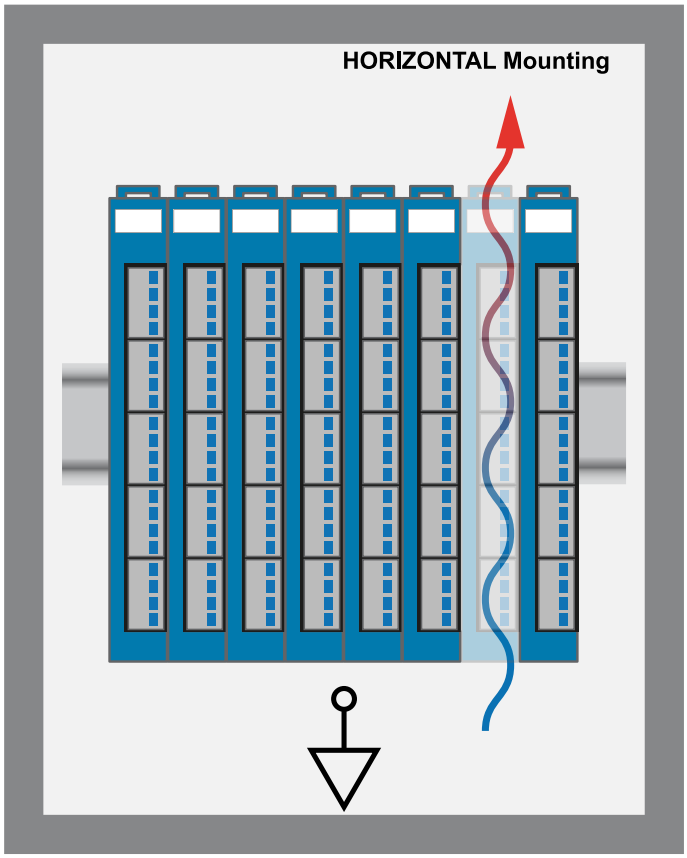
INFORMATION

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.

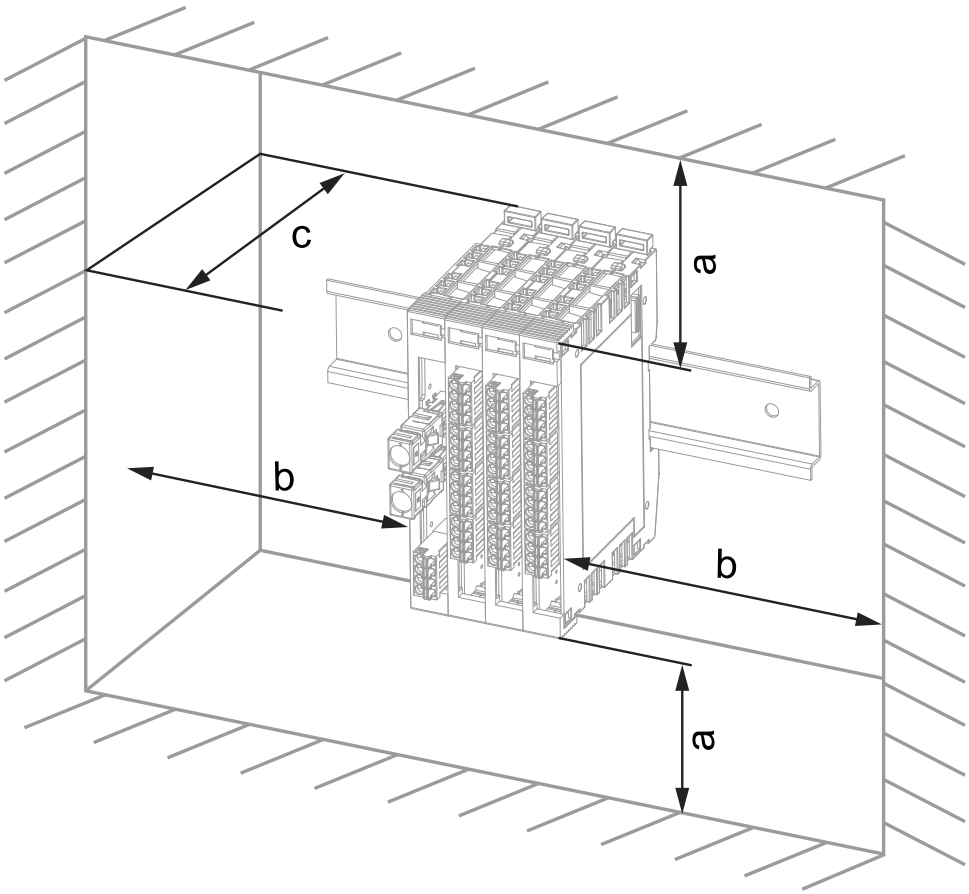
Damaged components can disrupt or damage the system.

12.2 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)

13 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.

14 Storage

When not in use, store the device according to the storage conditions. See chapter 13 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.

15 Maintenance

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

15.1 Service

This product was constructed for low-maintenance operation.

15.2 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 13 Transport/Storage.

16 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.

17 Supported Cycle Times

The DC 104 can be accessed via the S-DIAS bus with different bus cycle times.

17.1 Cycle Times below 1 ms (in µs)

50	100	125	200	250	500
					x

x = supported

17.2 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

Changes Chart

Change date	Affected page(s)	Chapter	Note
01.04.2025	22	6.8 Miscellaneous	yes, EG-type-examined
24.04.2025	24	8 Connector Layout	BiSS-C changed
08.08.2025	19	6.7 Electrical Requirements	Current consumption corrected
15.05.2026	30	10 Additional Safety Information	Info cable changed
22.07.2026	16	6.3 Universal Encoder Feedback Specifications	EnDat-footnote
	17	6.3.1 Commutation Search	Chapter expanded
23.10.2026	30	10 Additional Safety Information	Chapter Function Test deleted