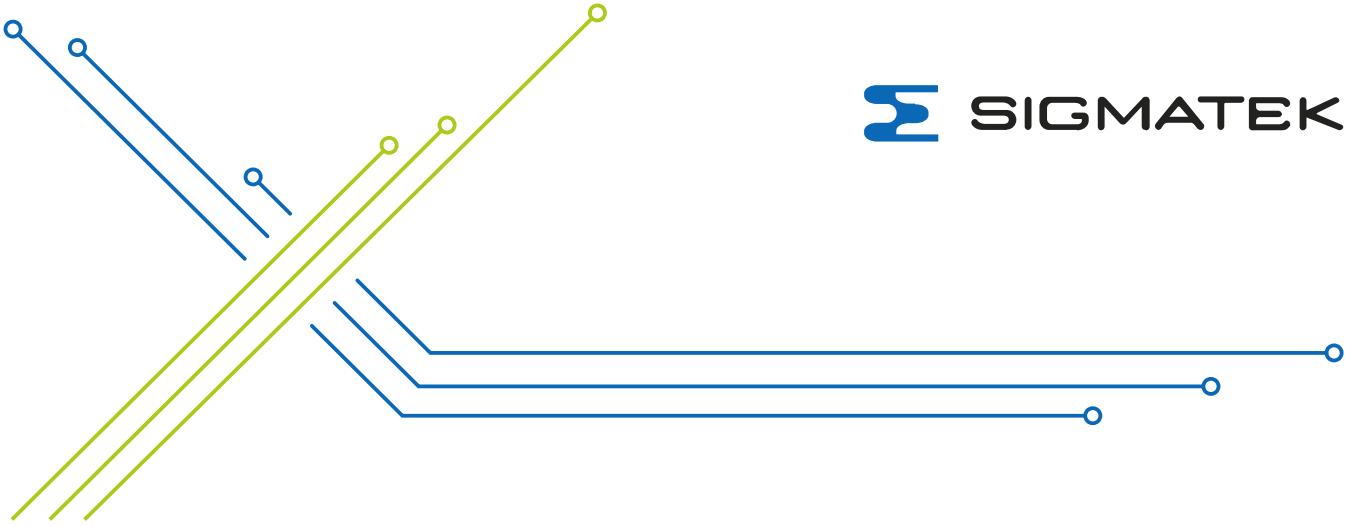

SIGMATEK

CP 313

S-DIAS CPU Module

INSTRUCTION MANUAL

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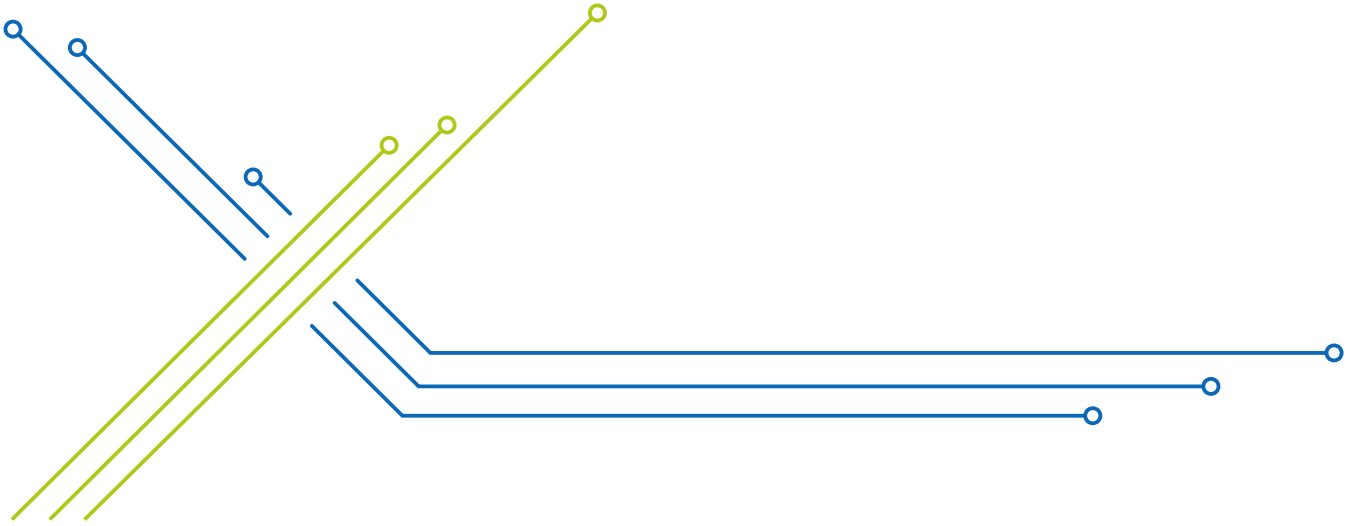

Publisher:
SIGMATEK GmbH & Co KG
Sigmatekstraße 1
A-5112 Lamprechtshausen
Tel.: +43/6274/4321
Fax: +43/6274/4321-18

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

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Translation of the Original Instructions

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S-DIAS CPU Module CP 313

1 Ethernet

1 EtherCAT Drive Controller

1 VARAN-Out

1 USB Device

1 microSD

1 USB Host

1 CAN

The S-DIAS CPU Module CP 313 is a high-performance processor unit for the S-DIAS I/O modules.

Through the various interfaces, such as Ethernet, EtherCAT, VARAN, CAN bus, USB and an exchangeable microSD card, this module can be used for a variety of applications. Additionally, a RealTimeClock and zero voltage proof RAM space with buffer battery are provided.

The CPU and I/O modules are supplied by the appropriate voltage supply module.

An ESI file is required for the use of a new EtherCAT Drive in the LASAL software. Please contact SIGMATEK support to clarify whether the used EtherCAT drive is already supported.

Table of 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 7

2.3 General Safety Directives 7

2.4 Software/Training 8

3 Standards and Directives 9

3.1 Directives 9

3.1.1 EU Declaration of Conformity 9

4 Type Plate 10

5 Technical Data 11

5.1 Performance Data 11

5.2 Standard Configuration 12

5.3 Electrical Requirements 12

5.3.1 Module Supply (Input) 12

5.3.2 S-DIAS Bus Supply (Output) 13

5.4 Miscellaneous 15

5.5 Environmental Conditions 15

6 Mechanical Dimensions 16

7 Connector Layout 17

7.1 Status LEDs 17

7.2 Status LEDs Supply Part 18

7.3 Connectors 18

7.3.1 X1: USB Host 2.0 (Type A) 18

7.3.2 X2: CAN Bus 19

7.3.3 X3: Power Supply 19

7.3.4 X4: USB 2.0 (Type Mini B) (can be used with OTG cable as USB host, otherwise USB device for service purposes) 19

7.3.5 X5: VARAN Out (Industrial Mini I/O) ... 19
7.3.6 X6: Ethernet (Industrial Mini I/O) ... 19
7.3.7 X7: EtherCAT Drive Controller (Industrial Mini I/O) ... 20
7.3.8 microSD Card ... 20
7.4 Applicable Connector Cables ... 21
7.4.1 VARAN/ Ethernet /EtherCAT ... 21
7.5 Applicable Connectors ... 22
7.6 Label Field ... 23
8 Storage Media ... 24
9 Buffer Battery ... 25
10 Wiring ... 26
10.1 Note ... 26
10.2 Wiring Example ... 26
10.3 Shielding ... 27
10.4 ESD Protection ... 27
10.5 CAN Bus ... 28
10.5.1 CAN Bus Station Number ... 28
10.5.2 Number of CAN Bus Participants ... 28
10.5.3 CAN Bus Data Transfer Rate ... 28
10.5.4 CAN Bus Termination ... 29
10.6 Recommended Shielding for VARAN ... 29
10.6.1 Wiring from the Control Cabinet to an External VARAN Component ... 30
10.6.2 Wiring Outside of the Control Cabinet ... 31
10.6.3 Shielding for Wiring Within the Control Cabinet ... 32
10.6.4 Connecting Noise Generating Components ... 32
10.6.5 Shielding Between Two Control Cabinets ... 33
11 Strain Relief ... 34
12 EtherCAT Feature Overview ... 35
13 Process Diagram ... 37
14 Status and Error Messages ... 38
15 Application Exceptions ... 46
15.1 The file system does not support safe writing through SRAM ... 46

15.2 Data Breakpoint 46
16 Assembly/Installation 47
16.1 Check Contents of Delivery 47
16.2 Mounting 47
17 Transport/Storage 49
18 Storage 50
19 Maintenance 51
19.1 Service 51
19.2 Repair 51
20 Disposal 52
21 Accessories 53
21.1 microSD Card 53
22 Application Notes 54
22.1 Storage Media 54
22.1.1 Create Boot Media (Make Bootdisk) 54
22.1.2 Lifetime Calculation (Flash Media Lifetime Calculation) 55

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

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

1.3 Contents of Delivery

1x CP 313

1x opposing connector

2 Basic Safety Directives

2.1 Symbols Used

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

DANGER

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

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

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

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

WARNING

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

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

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

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

CAUTION

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

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

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

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

CAUTION

Danger for ESD-sensitive components.

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

INFORMATION

INFORMATION

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

2.2 Disclaimer

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

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

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

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

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

2.3 General Safety Directives

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

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

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.

INFORMATION

Special hardware and software features (in particular application-specific information) can be found in the 22 Application Notes chapter.

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 Declaration of Conformity

CE

EU Declaration of Conformity

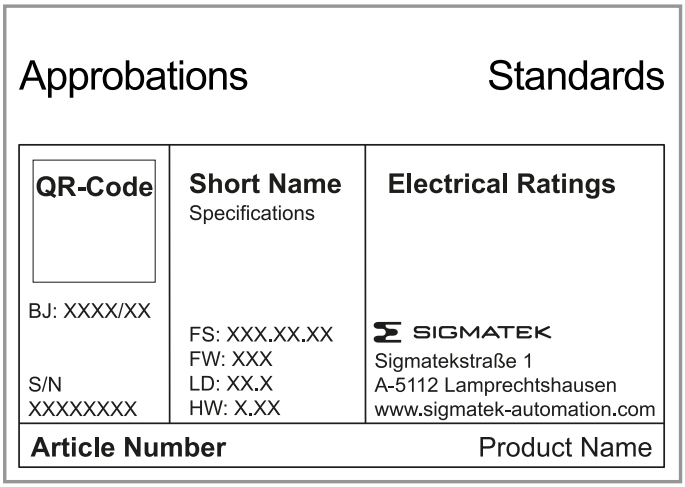
The product CP 313 conforms to the following European directives:

- → 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 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

5 Technical Data

5.1 Performance Data

Processor	EDGE2 Technology Dual Core
Processor cores	2[1)]
Addressable I/O/P modules	VARAN bus: 65,280 CAN participants: > 100 S-DIAS bus: 64
Internal I/O	no
Internal cache	32-Kbyte L1 instruction cache 32-Kbyte L1 data cache 512-Kbyte L2 cache
Internal program and data memory (DDR3 RAM)	256-Mbyte
Internal remnant data memory	256-Kbyte SRAM (battery buffered)
Internal storage device	1-Gbyte microSD (8-Gbyte 1:8 formatted ≥ 120k P/E cycles)[2)]
Interfaces	1x USB OTG (host/device), Typ Mini B 1x USB Host 2.0 (high speed 480 Mbit/s) 1x Ethernet 1x VARAN Out (Manager) (maximum cable length: 100 m) 1x CAN 1x S-DIAS (with manager) 1x EtherCAT drive controller
EtherCAT	Class A with distributed clock
Status display	no
Status LEDs	yes
Real-time clock	yes (battery buffered)
Cooling	passive (fanless)

1) Attention: When programming (with LASAL) on multicore CPUs, particular focus must be placed on thread security!

2) The internal storage medium is formatted in the specified ratio to increase its lifespan. Changing the format to the full storage medium size is not permitted and will result in a significant reduction in lifespan.

5.2 Standard Configuration

Ethernet	X6	IP: 10.10.150.1	Subnet mask: 255.0.0.0
CAN bus	X2	Station: 00	Baud rate: 01 = 500 kBaud

INFORMATION

Problems can arise if a control is connected to an IP network, which contains modules that are not running with a SIGMATEK operating system. With such devices, Ethernet packets could be sent to the control with such a high frequency (i.e. broadcasts), that the high interrupt load could cause a real-time runtime error or runtime error. By configuring the packet filter (Firewall or Router) accordingly however, it is possible to connect a network with SIGMATEK hardware to a third party network without triggering the error mentioned above.

5.3 Electrical Requirements

5.3.1 Module Supply (Input)

Supply voltage	+18-27 V DC (SELV/PELV), typically +24 V DC UL: Class 2 or LVLC	
Current consumption of +24 V supply voltage	-	maximum 2.75 A[1)]

INFORMATION

For loading the internal capacitors, power consumption may be increased for a short time (in the microsecond range).
This value is dependent on the input voltage and impedance of the power source.

INFORMATION

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.

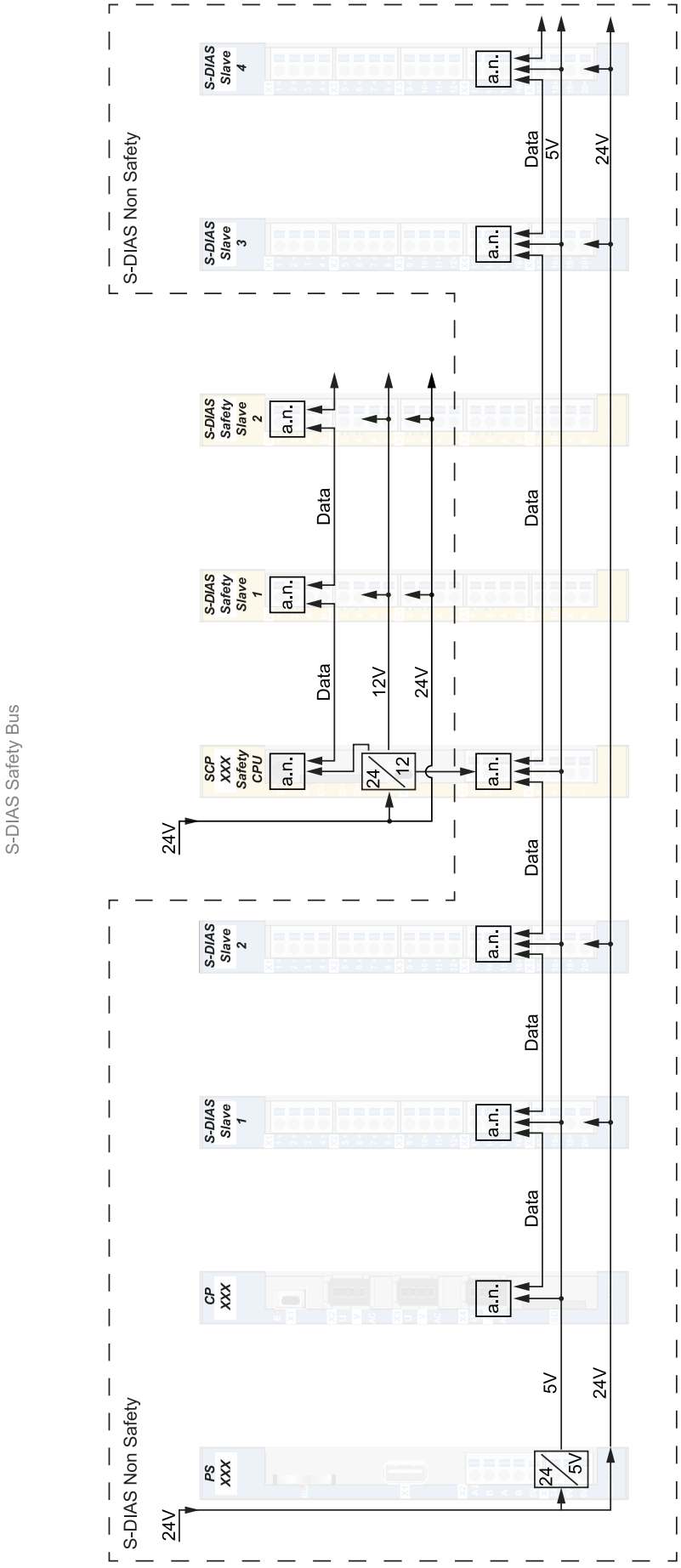
If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1) The current consumption is dependent on the connected load.

5.3.2 S-DIAS Bus Supply (Output)

Supply from S-DIAS bus	+5 V
Current consumption on the S-DIAS bus (+5 V supply)	maximum 1.1 A[1)]
Supply from S-DIAS bus	+24 V
Current consumption on the S-DIAS bus (+24 V supply)	maximum 1.6 A[1)]

1) The current consumption is dependent on the connected load.


S-DIAS Safety Bus
S-DIAS Non Safety
S-DIAS Non Safety
PS XXX
CP XXX
SCP XXX Safety CPU
S-DIAS Slave 1
S-DIAS Slave 2
S-DIAS Slave 3
S-DIAS Slave 4
S-DIAS Safety Slave 1
S-DIAS Safety Slave 2
a.n.
24V
5V
12V
Data
24/5
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

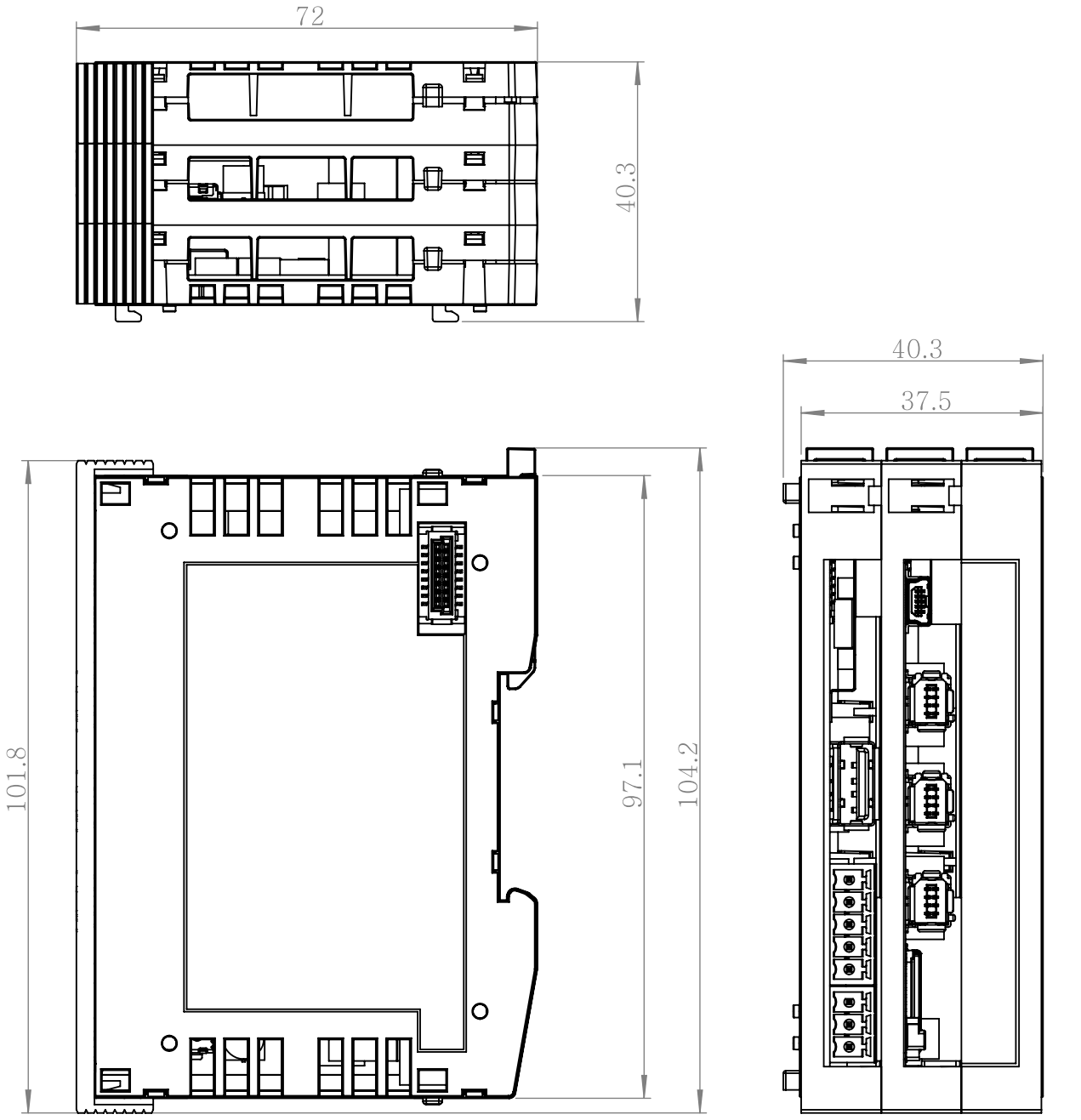
5.4 Miscellaneous

Article number	20-004-313	
Printed circuit board coating	no	
Operating system	Salamander	
Project backup	internally on the microSD card	
Approvals	CE	yes
	UL	cULus (E247993)
	Functional Safety	no
	UKCA	yes

5.5 Environmental Conditions

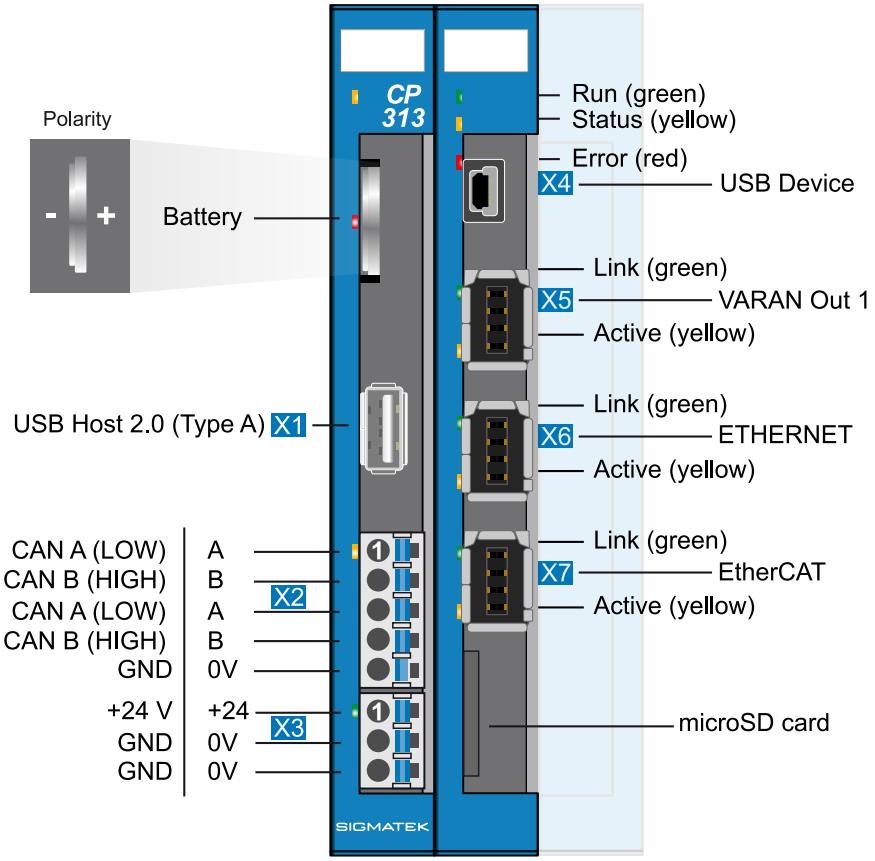
Storage temperature	-20 - +85 °C	
Environmental temperature	0 ... +55 °C	
Humidity	0-95 %, non-condensing	
Installation altitude above sea level	0-2000 m without derating > 2000 m up to a maximum of 5000 m with derating of the maximum environmental temperature by 0.5 °C per 100 m	
Operating conditions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

6 Mechanical Dimensions



Measurements	37.5 x 104 x 72 mm (W x H x D)

7 Connector Layout



INFORMATION

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

7.1 Status LEDs

Run	green	ON	from activation of the voltage supply until processing of the autoexec.lsl
			when the application is running (except when controlled differently via the application)
		BLINKS	in the CLI, while processing the autoexec.lsl until the application is running
			during installation of the operation system (starting from OS version 09.03.054)
		OFF	when an error or reset occurs
			permanent from power on: microSD card error[1)]

1) If the microSD card is not properly inserted or if data (operating system, application) is faulty, the RUN, STATUS and Error LEDs do not light up after switching on the power supply. The DC OK LED lights up permanently.

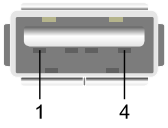
	can be set from the application (ON, BLINKING, OFF)		
Status	yellow	OFF	during start process
			during RUN status (application running)
			when an error or reset occurs
			permanent from power on: microSD card error[1)]
	can be set from the application (ON, BLINKING, OFF)		
Error	red	BLINKS	when an error or reset occurs
		OFF	during start process
			during RUN status (application running)
			permanent from power on: microSD card error[1)]
	can be set from the application (ON, BLINKING, OFF)		
VARAN Link	green	ON	connection between the two PHYs made
		BLINKS	VARAN In of the primary client has no link
VARAN Active	yellow	ON	data is exchanged over the VARAN bus
Ethernet Link	green	ON	connection between the two PHYs made
Ethernet Active	yellow	ON	data is exchanged over the Ethernet bus
EtherCAT Link	green	ON	connection between the two PHYs made
EtherCAT Active	yellow	ON	data is exchanged over the EtherCAT bus

7.2 Status LEDs Supply Part

Module Status	red	ON	CPU is in RESET state
Battery Low	red	ON	battery is empty
CAN active	yellow	BLINKS	data is being exchanged
DC OK	green	ON	module is supplied with a voltage > 18 V

7.3 Connectors

7.3.1 X1: USB Host 2.0 (Type A)

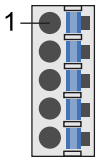


Pin	Function
1	+5 V
2	D-
3	D+
4	GND

INFORMATION

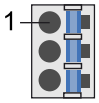
It should be noted that many of the USB devices on the market do not comply with USB specifications; this can lead to device malfunctions. This may cause the device to malfunction. It is also possible that these devices will not be detected at the USB port or function correctly. Therefore, it is recommended that every USB stick be tested before actual use.

7.3.2 X2: CAN Bus



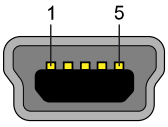
Pin	Function
1	CAN A (LOW)
2	CAN B (HIGH)
3	CAN A (LOW)
4	CAN B (HIGH)
5	GND

7.3.3 X3: Power Supply



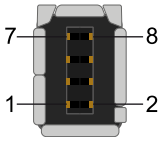
Pin	Function
1	+24 V supply
2	GND
3	GND

7.3.4 X4: USB 2.0 (Type Mini B) (can be used with OTG cable as USB host, otherwise USB device for service purposes)



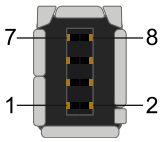
Pin	Function
1	+5 V
2	D-
3	D+
4	ID
5	GND

7.3.5 X5: VARAN Out (Industrial Mini I/O)



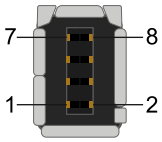
Pin	Function
1	Tx/Rx+
2	Tx/Rx-
3	Rx/Tx+
4-5	n.c.
6	Rx/Tx-
7-8	n.c.
n.c. = do not use	

7.3.6 X6: Ethernet (Industrial Mini I/O)



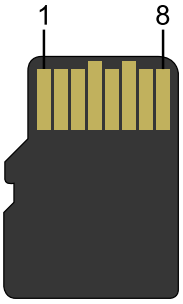
Pin	Function
1	Tx+
2	Tx-
3	Rx+
4-5	n.c.
6	Rx-
7-8	n.c.
n.c. = do not use	

7.3.7 X7: EtherCAT Drive Controller (Industrial Mini I/O)



Pin	Function
1	Tx+
2	Tx-
3	Rx+
4-5	n.c.
6	Rx-
7-8	n.c.
n.c. = do not use	

7.3.8 microSD Card



Pin	Function
1	DAT2
2	CD/DAT3
3	CMD
4	+3V3
5	CLK
6	GND
7	DAT0
8	DAT1

INFORMATION

Only storage media approved by SIGMATEK may be used.
If non-approved storage media are used, there is no entitlement to support or warranty coverage.

The number of read and write actions has a significant influence on the lifespan of the storage media.

The microSD card is not intended as an exchangeable medium and should therefore be removed from the card holder for maintenance purposes only.

7.4 Applicable Connector Cables

7.4.1 VARAN/ Ethernet /EtherCAT

Cable type	Length	Article number
RJ45 on industrial Mini I/O Type 1, drag chain capable	0.5 m	16-911-005
	1 m	16-911-010
	1.5 m	16-911-015
	2 m	16-911-020
	3 m	16-911-030
	5 m	16-911-050
	10 m	16-911-100
	20 m	16-911-200
	50 m	16-911-500
Industrial Mini I/O Type 1 on Industrial Mini I/O Type 1, drag chain capable	0.5 m	16-912-005
	1 m	16-912-010
	1.5 m	16-912-015
	2 m	16-912-020
	3 m	16-912-030
	5 m	16-912-050
	10 m	16-912-100
	20 m	16-912-200

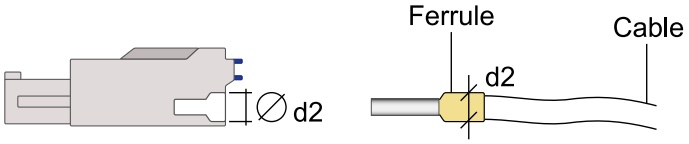
7.5 Applicable Connectors

X1: USB 2.0 (Type A) (not included in delivery)
X2, X3: Connectors with spring terminals (included in delivery)
X4: USB Type Mini B (not included in delivery)
X5-X7: Industrial Mini I/O Plug Type 1 Lock Extend Version (not included in delivery)

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

Connection capacity:

Stripping length/sleeve length	10 mm
Mating direction	parallel to 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)

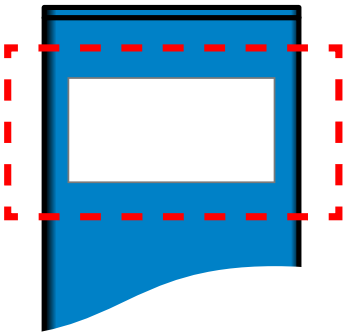


d2 = max. 2.8 mm

INFORMATION

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

7.6 Label Field



The labeling field is printed directly on the module.

8 Storage Media

INFORMATION

Only storage media approved by SIGMATEK may be used.
If non-approved storage media are used, there is no entitlement to support or warranty coverage.

The number of read and write actions has a significant influence on the lifespan of the storage media.

9 Buffer Battery

The exchangeable buffer battery ensures that programs and data in the expanded memory (SRAM) as well as the clock time (RTC) are preserved in the absence of a supply voltage.

A Lithium battery is installed at the manufacturer.

The battery has enough capacity to preserve data in the absence of a supply voltage for approximately 3 year(s). We recommend however, that the battery be replaced annually to ensure optimal performance.

	COMPANY	DATA
Lithium battery	RENATA	3.0 V/225 mAh

INFORMATION

Battery order number: 01-690-028

Use only batteries from RENATA of the type CR2032.

The battery can only be exchanged when power is supplied; otherwise data loss will occur!

WARNING

Fire and explosion hazard!

→ If not handled properly, the battery may explode. Do not recharge, disassemble or throw into fire.

→ Replace only with battery of the same cat. no. CR2032, manufactured by RENATA. Using another battery may present a risk of fire or explosion. You can find safety instructions in the instruction manual.

A weak battery is first detected by the supervisor circuit on the CPU module and displayed by the control software. When the battery voltage continues to fall eventually the supervisor circuit triggers and the red LED "Battery Low" is illuminated. The battery must be replaced soon to avoid data loss in case of power failure. When the battery voltage is in between the supervisor circuit thresholds, it may happen that the battery is detected "good" during operation, but "low" after a power cycle. If this happens, it is recommended to replace the battery.

10 Wiring

10.1 Note

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

The following installation guidelines should be observed:

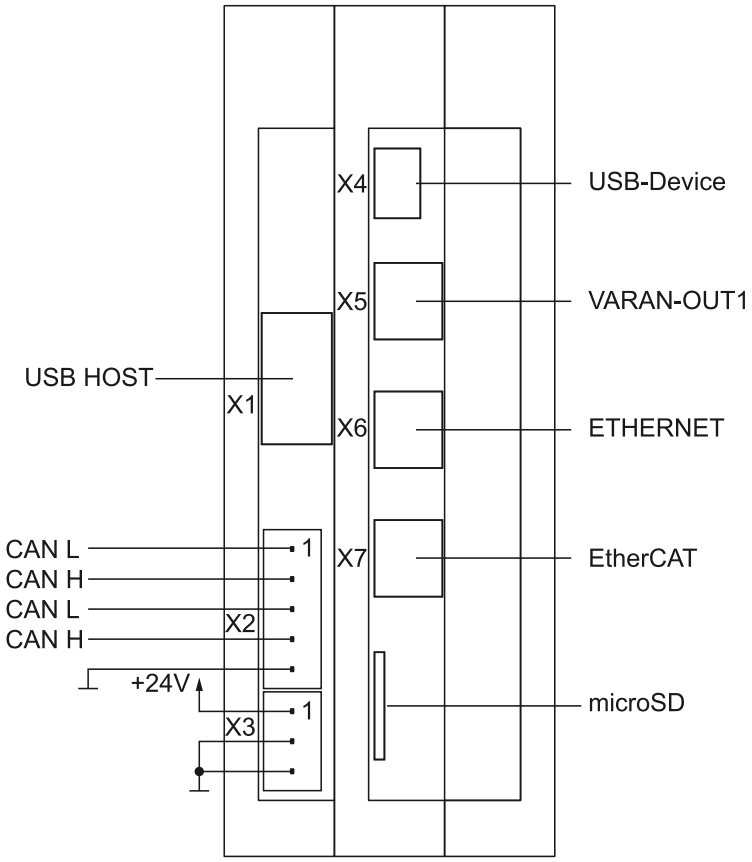
- Avoid parallel connections between input lines and load-bearing circuits.
- Protective circuits for all relays (RC networks or free-wheeling diodes)
- Correct wiring to ground

INFORMATION

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

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

10.2 Wiring Example



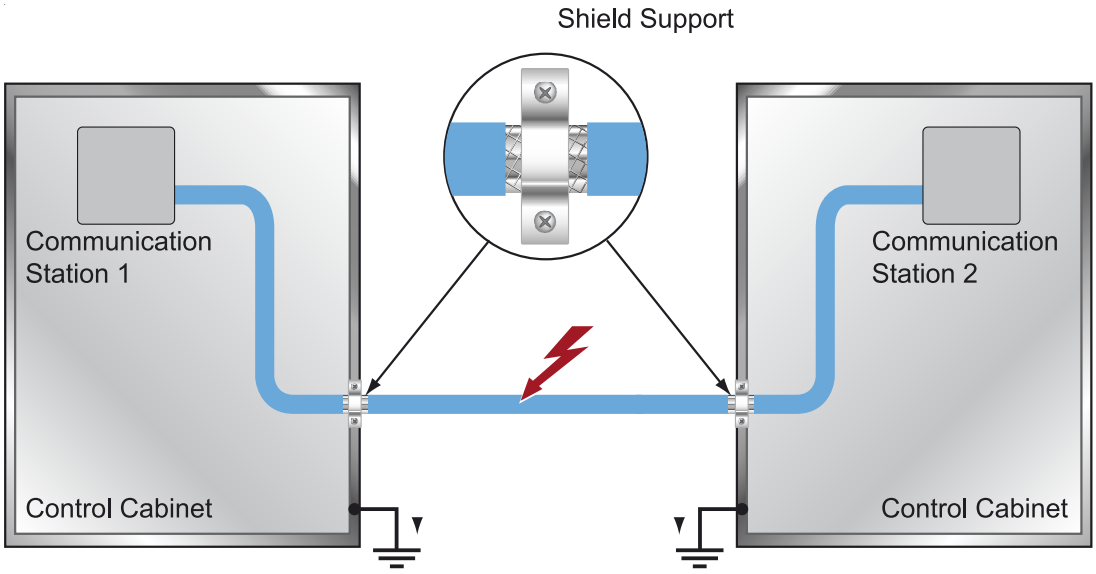
10.3 Shielding

The CAN and Ethernet wiring must be shielded.

The low-ohm shielding must be either connected either at the entry to the control cabinet or directly before the CP 313 over a large surface (cable grommets, grounding clamps)!

Noise signals can therefore be prohibited from reaching the electronics and affecting the function.

To avoid compensating currents from the PE, which flow over the shielding the conductors, it is recommended that the system components have low Ohm and low impedance connections to one another.



10.4 ESD Protection

CAUTION

Before any device is connected to or disconnected from the CP 313, the potential with ground must be equalized (by touching the control cabinet or ground terminal). Electrostatic loads (through clothing and shoes) can thereby be dissipated.

10.5 CAN Bus

This section explains how to correctly configure the CAN bus. The following parameters must first be set: Station number and data transfer rate.

10.5.1 CAN Bus Station Number

Each CAN bus station is assigned its own station number. With this station number, data can be exchanged with other stations connected to the bus. In a CAN bus system however, each station number can only be assigned once!

10.5.2 Number of CAN Bus Participants

The maximum number of participants on the CAN bus depends on the cable length, termination resistance, data transfer rate and the drivers used in the participants. With a termination resistance of 120 Ω, at least 100 participants are possible.

10.5.3 CAN Bus Data Transfer Rate

Various data transfer rates (baud rates) can be set on the CAN bus. The longer the bus line is, the lower the data transfer rate that must be selected.
These values apply to the following cable: 120 Ω Twisted Pair.

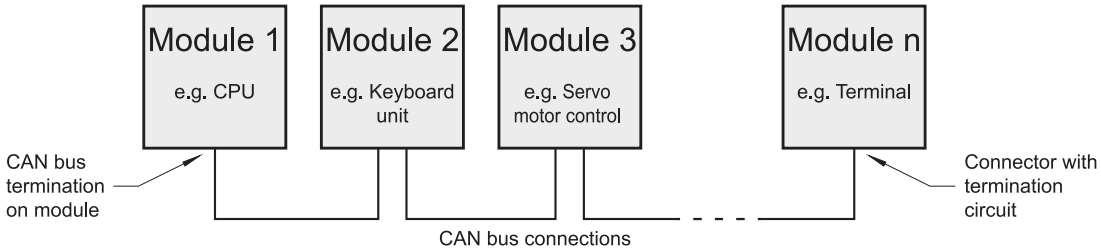
Value	Baud Rate	Maximum Length
0	615 kbit/s	60 m
1	500 kbit/s	80 m
2	250 kbit/s	160 m
3	125 kbit/s	320 m
4	100 kbit/s	400 m
5	50 kbit/s	800 m
6	20 kbit/s	1200 m
7	1 Mbit/s	30 m

INFORMATION

For the CAN bus protocol: 1 kbit/s = 1 kBaud

10.5.4 CAN Bus Termination

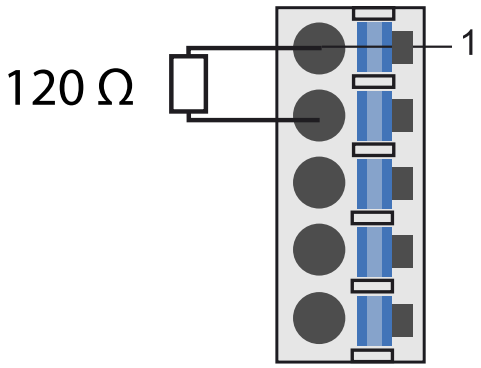
In a CAN bus system, both end modules must be terminated. This is necessary to avoid transmission errors caused by reflections in the line.



Example

INFORMATION

The termination is made by placing a 120 Ω resistor between CAN A (LOW) and CAN B (HIGH).



10.6 Recommended Shielding for VARAN

The VARAN real-time Ethernet bus system exhibits a very robust quality in harsh industrial environments. Through the use of IEEE 802.3 standard Ethernet physics, the potentials between an Ethernet line and sending/receiving components are separated. In the event of an error, the VARAN Manager resends messages to a bus participant immediately. The shielding described below is mainly recommended. For applications in which the bus is operated outside the control cabinet, the correct shielding is required. This is especially important, if due to physical requirements, the bus cables must be placed next to sources of strong electromagnetic noise. It is recommended to avoid placing VARAN bus lines parallel to power cables whenever possible.

SIGMATEK recommends the use of **CAT5e** industrial Ethernet bus cables. An **S-FTP cable** should be used for the shielding.

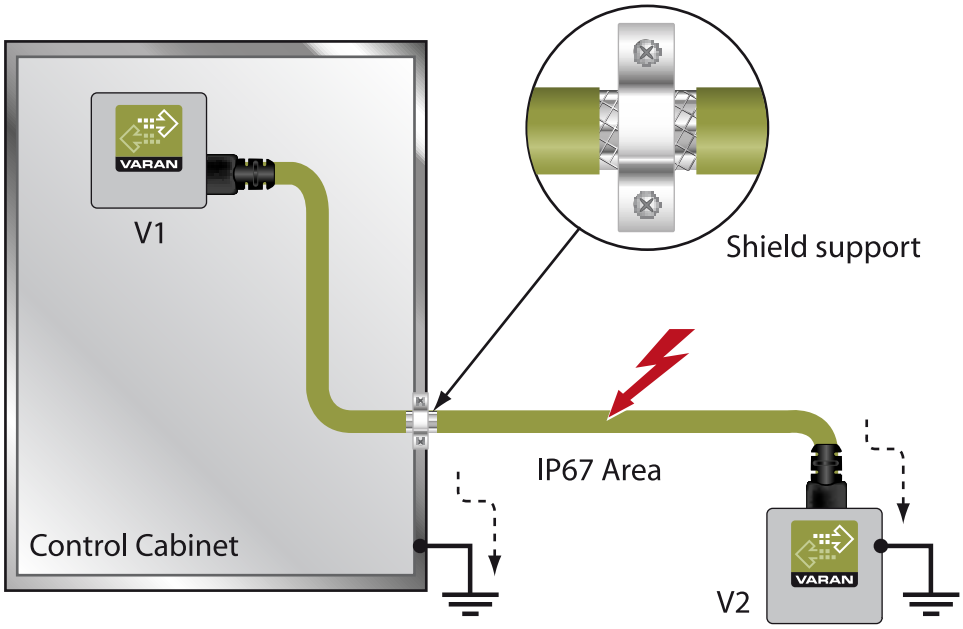
An S-FTP bus is a symmetric, multi-wire cable with unshielded pairs. For the entire shielding, a combination of foil and braiding is used. A non-laminated variant is recommended.

INFORMATION

The VARAN cable must be secured at a maximum distance of 20 cm from the connector to protect against vibration!

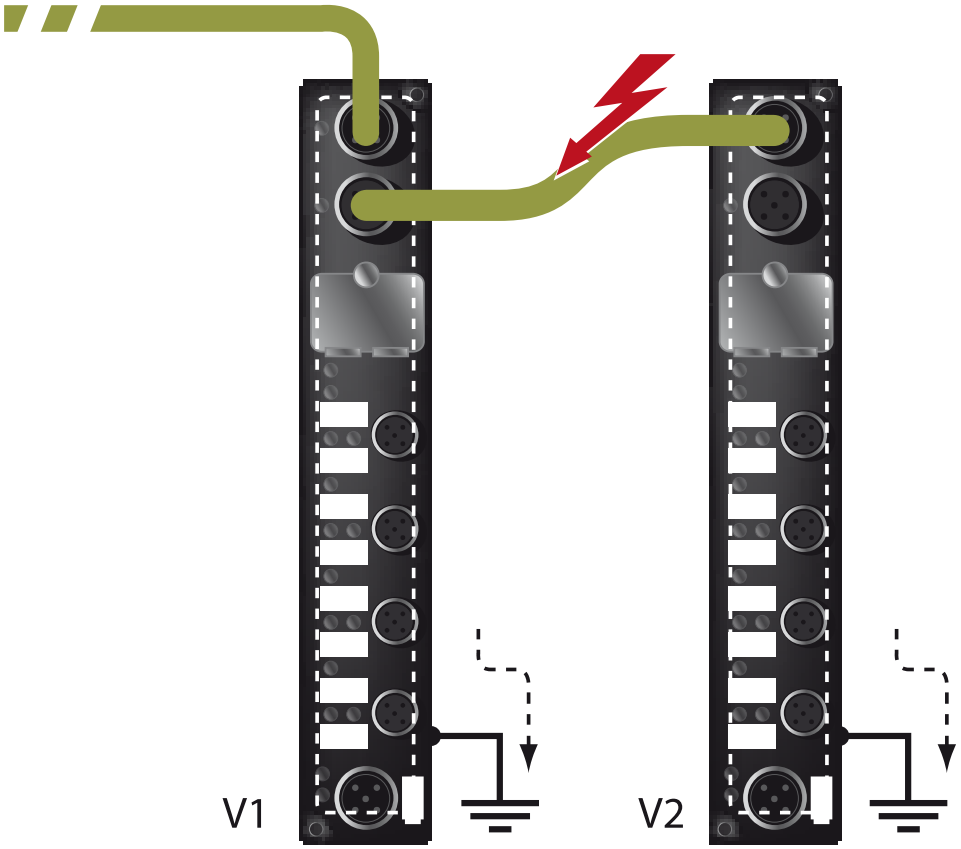
10.6.1 Wiring from the Control Cabinet to an External VARAN Component

If the Ethernet lines are connected from a VARAN component to a VARAN node located outside the control cabinet, the shielding should be placed at the entry point of the control cabinet housing. All noise can then be deflected from the electronic components before reaching the module.



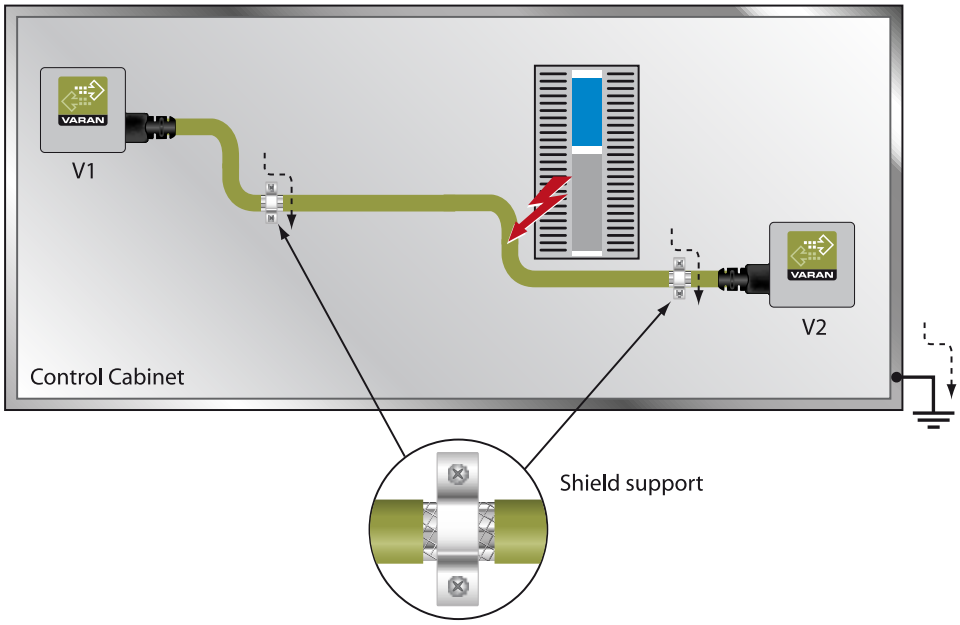
10.6.2 Wiring Outside of the Control Cabinet

If a VARAN bus line must be connected outside of the control cabinet only, no additional shield support is required. A requirement therefore, is that only IP67 modules and connectors can be used outside the control cabinet. These components are very robust and noise resistant. The shielding for all sockets in IP67 modules are electrically connected internally or over the housing, whereby voltage spikes are not dissipated through the electronics.



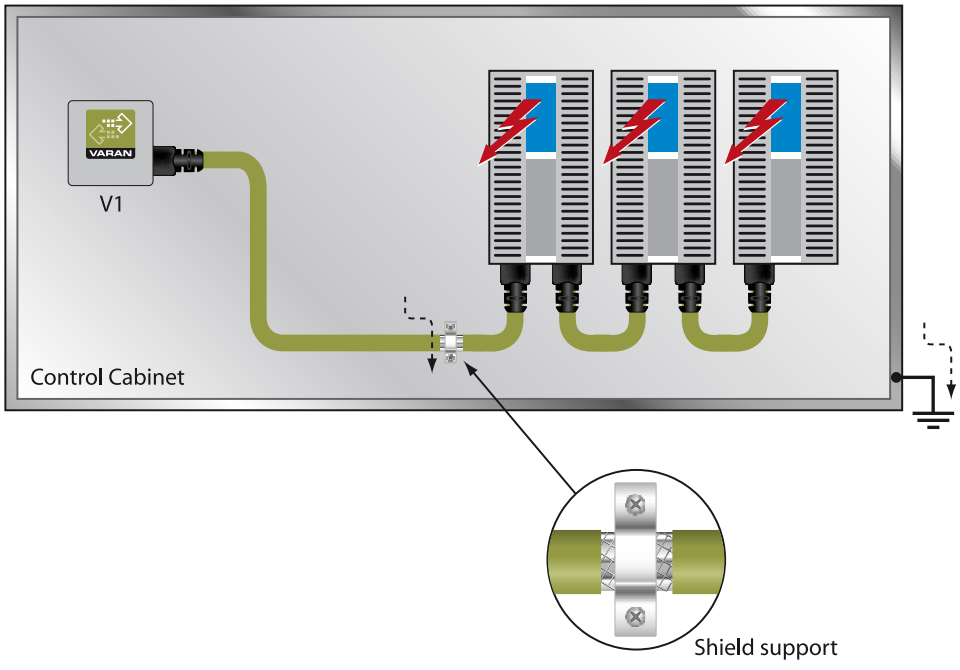
10.6.3 Shielding for Wiring Within the Control Cabinet

Sources of strong electromagnetic noise located within the control cabinet (drives, transformers, etc.) can induce interference in a VARAN bus line. Spike voltages are dissipated over the metallic housing of a RJ45 connector. Noise is conducted through the control cabinet housing without further action from the electronic components. To eliminate sources of noise during data exchange, it is recommended that the shielding for all electronic components be connected within the control cabinet.



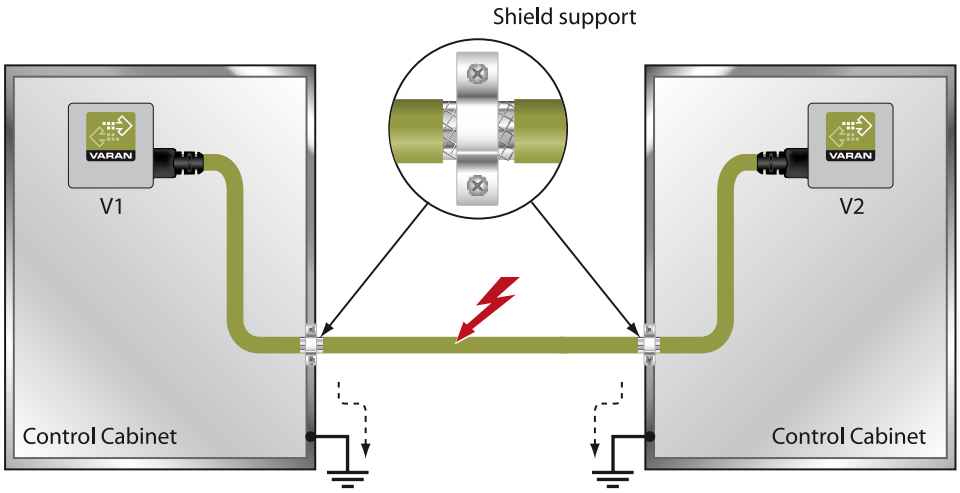
10.6.4 Connecting Noise Generating Components

With the connection of power components, which generate strong electromagnetic interference, it is also critical to ensure correct shielding. The shielding should be placed before a power element (or group of power elements).

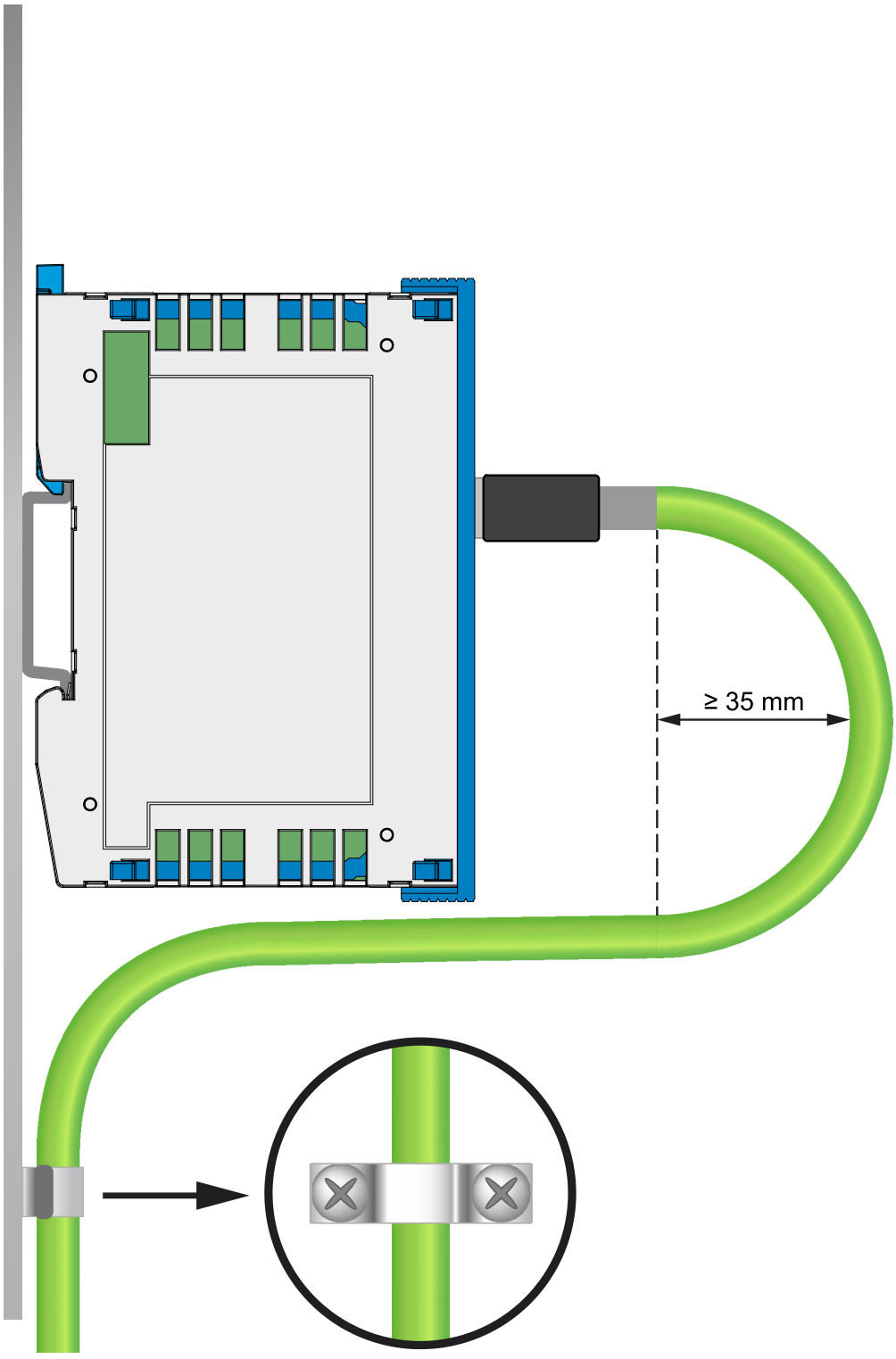


10.6.5 Shielding Between Two Control Cabinets

If two control cabinets must be connected over a VARAN bus, it is recommended that the shielding be located at the entry points of both cabinets. Noise can be thereby prevented from reaching the electronics within the control cabinet.



11 Strain Relief



INFORMATION

The VARAN cable must be mounted close to the module (e.g. using a clamp)!
No mechanical stress can be applied to the connection!

12 EtherCAT Feature Overview

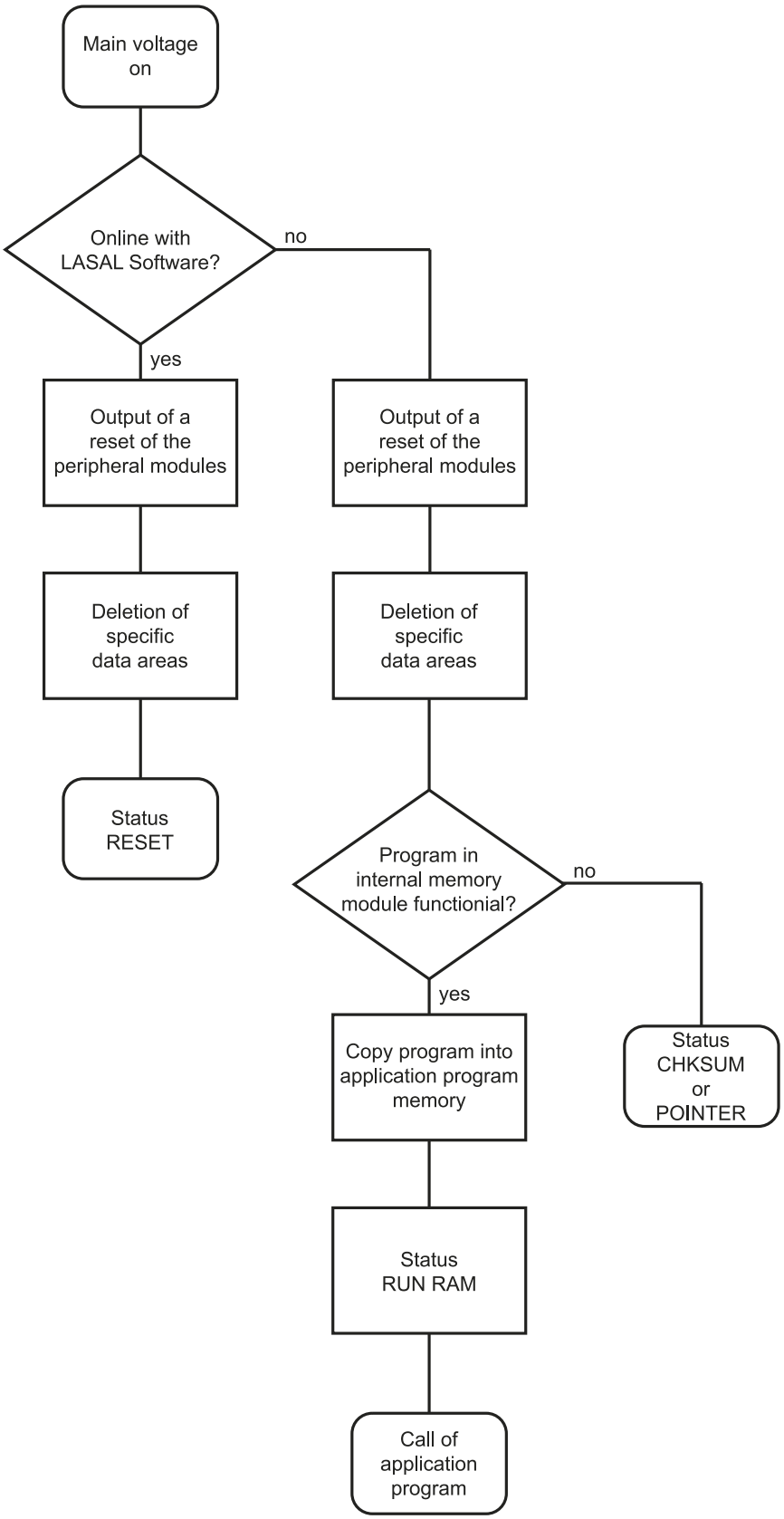
The EtherCAT master fulfills all necessary requirements for a class A master. In the following the overview of the EtherCAT master features defined according to ETG.1500.

Feature name	Short description	Feature ID	is supported
Basic Features			
Service Commands	Support of all commands	101	X
IRQ field in datagram	Use IRQ information from Slave in datagram header	102	-
Slaves with Device Emulation	Support Slaves with and without application controller	103	X
EtherCAT State Machine	Support of ESM special behaviour	104	X
Error Handling	Checking of network or slave errors, e.g. Working Counter	105	X
VLAN	Support VLAN Tagging	106	-
EtherCAT Frame Types	Support EtherCAT Frames	107	X
UDP Frame Types	Support UDP Frames	108	-
Process Data Exchange			
Cyclic PDO	Cyclic process data exchange	201	X
Multiple Tasks	Different cycle tasks Multiple update rates for PDO	202	X
Frame repetition	Send cyclic frames multiple times to increase immunity	203	-
Network Configuration			
Online scanning	Network configuration functionality included in EtherCAT Master	301	X
Reading ENI	Network Configuration taken from ENI file		
Compare Network configuration	Compare configured and existing network configuration during boot-up	302	X
Explicit Device Identification	Identification used for Hot Connect and prevention against cable swapping	303	X
Station Alias Addressing	Support configured station alias in slave, i.e. enable 2nd Address and use it	304	X
Access to EEPROM	Support routines to access EEPROM via ESC register	305	X
Mailbox Support			
Support Mailbox	Main functionality for mailbox transfer	401	X
Mailbox resilient Layer	Support underlying resilient layer	402	X
Multiple Mailbox channels		403	X
Mailbox polling	Polling Mailbox state in slaves	404	X
CAN application layer over EtherCAT (CoE)			
SDO Up/Download	Normal and expedited transfer	501	X
Segmented Transfer	Segmented transfer	502	X
Complete Access	Transfer the entire object (with all sub-indices) at once	503	X

Feature name	Short description	Feature ID	is supported
SDO Info service	Services to read object dictionary	504	X
Emergency Message	Receive Emergency messages	505	-
PDO in CoE	PDO services transmitted via CoE	506	X
Ethernet over EtherCAT (EoE)			
EoE protocol	Services for tunneling Ethernet frames. includes all specified EoE services	601	-
Virtual Switch	Virtual Switch functionality	602	-
EoE Endpoint to Operation Systems	Interface to the Operation System on top of the EoE layer	603	-
File access over EtherCAT (FoE)			
FoE Protocol	Support FoE Protocol	701	-
Firmware Up- /Download	Password, FileName should be given by the application	702	-
Boot State	Support Boot-State for Firmware Up/Download	703	-
Serverdrive-Profile over EtherCAT (SoE)			
SoE Services	Support SoE Services	801	-
ADS over EtherCAT (AoE)			
AoE Protocol	Support AoE Protocol	901	-
Vendor over EtherCAT (VoE)			
VoE Protocol	External Connectivity supported	1001	-
Synchronization with Distributed Clock (DC)			
DC support	Support of Distributed Clock	1101	X
Continuous Propagation Delay compensation	Continuous Calculation of the propagation delay	1102	X
Sync window monitoring	Continuous monitoring of the Synchronization difference in the slaves	1103	X
Slave-to-Slave Communication			
via Master	Information is given in ENI file or can be part of any other network configuration Copying of the data can be handled by master stack or master's application	1201	-
Master Information			
Master Object Dictionary	Support of Master Object Dictionary (ETG.5001 MDP sub profile 1100)	1301	-

An ESI file is required for the use of a new EtherCAT Drive in the LASAL software. Please contact SIGMATEK support to clarify whether the used EtherCAT drive is already supported.

13 Process Diagram



14 Status and Error Messages

Status and error messages are shown in the status test of the LASAL CLASS software. POINTER or CHKSUM messages can also be shown on the screen.

Number	Message	Definition	Cause/Solution
00	**RUN RAM**	The user program is currently running in RAM. The display is not affected.	Info
01	**RUN ROM**	The user program stored in the program memory module was loaded into the RAM and is currently running. The display is not affected.	Info
02	**RUNTIME**	The total time for all cyclic objects exceeds the maximum time; the time can be configured using 2 system variables: ■ Runtime: Remaining time ■ SWRuntime: Preset value for runtime counter	Solution: ■ Optimize the application's cyclic task. ■ Use higher capacity CPU. ■ Configure preset value
03	**POINTER**	Incorrect program pointers were detected before running the user program	Possible Causes: ■ The program memory module is missing, not programmed or defective. ■ The program in the user program memory (RAM) is not executable. ■ The buffer battery has failed. ■ The user program has overwritten a software error. Solution: ■ Reprogram the memory module, if the error reoccurs exchange the module. ■ Exchange the buffering battery ■ Correct programming error
04	**CHKSUM**	An invalid checksum was detected before running the user program.	Cause/Solution: s. POINTER

Number	Message	Definition	Cause/Solution
05	**WATCHDOG**	The program was interrupted via the watchdog logic.	Possible Causes: ■ User program interrupts blocked over a longer period of time (STI command forgotten). ■ Programming error in a hardware interrupt. ■ INB, OUTB, INW, OUTW instructions used incorrectly. ■ The processor is defective. Solution: ■ Correct programming error. ■ Exchange CPU
06	**GENERAL ERROR**	General error An error has occurred while stopping the application via the online interface.	This error occurs only during the development of the operating system.
07	**PROM DEFECT**	An error has occurred while programming the memory module.	Causes: ■ The program memory module is defective. ■ The user program is too large. ■ The program memory module is missing. Solution: ■ Exchange the program memory module
08	**RESET**	The CPU has received the reset signal and is waiting for further instructions. The user program is not processed.	Info
09	**WD DEFECT**	The hardware monitoring circuit (watchdog logic) is defective. After power-up, the CPU checks the watchdog logic function. If an error occurs during this test, the CPU deliberately enters an infinite loop from which no further instructions are accepted.	Solution: ■ Exchange CPU
10	**STOP**	The program was stopped by the programming system.	
11	**PROG BUSY**	Reserved	
12	**PROGRAM LENGTH**	Reserved	
13	**PROG END**	A memory module was successfully programmed.	Info
14	**PROG MEMO**	The CPU is currently programming the memory module.	Info

Number	Message	Definition	Cause/Solution
15	**STOP BRKPT**	The CPU was stopped by a breakpoint in the program.	Info
16	**CPU STOP**	The CPU was stopped by the programming software.	Info
17	**INT ERROR**	The CPU has triggered a false interrupt and stopped the user program or has encountered an unknown instruction while running the program.	Causes: ■ A nonexistent operating system was used. ■ Stack error (uneven number of PUSH and POP instructions). ■ The user program was interrupted by a software error. Solution: ■ Correct programming error.
18	**SINGLE STEP**	The CPU is in single step mode and is waiting for further instructions.	Info
19	**READY:**	A module or project has been sent to the CPU and it is ready to run the program.	Info
20	**LOAD**	The program is stopped and the CPU is currently receiving a new module or project.	Info
21	**INVALID MODULE**	The CPU has received a module that does not belong to the project.	Solution: ■ Recompile and download the entire project
22	**MEMORY FULL**	The operating system memory (heap) is too small. No memory could be reserved while calling an internal function or an interface function is called from the application.	Causes: ■ Memory is only allocated but not released. Solution: ■ Clear memory
23	**NOT LINKED**	When starting the CPU, a missing module or a module that does not belong to the project was detected.	Solution: ■ Recompile and download the entire project
24	**DIV BY 0**	A division error has occurred.	Possible Causes: ■ Division by 0. ■ The result of a division does not fit in the result register. Solution: ■ Correct programming error.
25	**DIAS ERROR**	While accessing a DIAS module, an error has occurred.	Hardware problem
26	**WAIT**	The CPU is busy.	Info

Number	Message	Definition	Cause/Solution
27	OP PROG	The operating system is currently being reprogrammed.	Info
28	OP INSTALLED	The operating system has been reinstalled.	Info
29	OS TOO LONG	The operating system cannot be loaded; too little memory.	Restart, report error to SIGMATEK.
30	NO OPERATING SYSTEM	Boot loader message, no operating system found in RAM.	Restart, report error to SIGMATEK.
31	SEARCH FOR OS	The boot loader is searching for the operating system in RAM.	Restart, report error to SIGMATEK.
32	NO DEVICE	Reserved	
33	UNUSED CODE	Reserved	
34	MEM ERROR	The operating system loaded does not match the hardware configuration.	Solution: ■ Use the correct operating system version
35	MAX IO	Reserved	
36	MODULE LOAD ERROR	The LASAL Module or project cannot be loaded.	Solution: ■ Recompile and download the entire project
37	BOOTIMAGE FAILURE	A general error has occurred while loading the operating system.	Contact SIGMATEK
38	APPLMEM ERROR	An error has occurred in the application memory (user heap).	Solution: ■ Correct allocated memory access error
39	OFFLINE	This error does not occur in the control.	This error code is used in the programming system to show that there is no connection to the control.
40	APPL LOAD	Reserved	
41	APPL SAVE	Reserved	
44	VARAN MANAGER ERROR	An error number was entered in the VARAN manager and stopped the program.	Solution: ■ Read LogFile
45	VARAN ERROR	A required VARAN client was disconnected or a communication error has occurred.	Solution: ■ Read LogFile ■ Error tree

Number	Message	Definition	Cause/Solution
46	**APPL-LOAD-ERROR**	An error has occurred while loading the application.	Cause: ■ Application was deleted. Solution: ■ Reload the application into the control.
47	**APPL-SAVE-ERROR**	An error has occurred while attempting to save the application.	
50	**ACCESS-EXCEPTION-ERROR**	Read or write access of a restricted memory area. (I.e. writing to the NULL pointer).	Solution: ■ Correct application errors
51	**BOUND EXCEEDED**	An exception error has occurred while accessing arrays. The memory area was overwritten by accessing an invalid element.	Solution: ■ Correct application errors
52	**PRIVILEDGED INSTRUCTION**	An unauthorized instruction for the current CPU level was given. For example, setting the segment register.	Cause: ■ The application has overwritten the application program code. Solution: ■ Correct application errors
53	**FLOATING POINT ERROR**	An error has occurred during a floating-point operation.	
60	**DIAS-RISC-ERROR**	Error from the Intelligent DIAS Master.	Restart, report error to SIGMATEK.
64	**INTERNAL ERROR**	An internal error has occurred, all applications are stopped.	Restart, report error to SIGMATEK.
65	**FILE ERROR**	An error has occurred during a file operation.	
66	**DEBUG ASSERTION FAILED**	Internal error	Restart, report error to SIGMATEK.
67	**REALTIME RUNTIME**	The total duration of all real-time objects exceeds the maximum time; the time cannot be configured. 2 ms for 386 CPUs 1 ms for all other CPUs	Solution: ■ Optimize the application's real-time task (RtWork). ■ Reduce the clock time for the real-time task of all objects. ■ Correct application errors ■ CPU is overloaded in real-time => use a higher capacity CPU.
68	**BACKGROUND RUNTIME**	The total time for all background objects exceeds the maximum time; the time can be configured using 2 system variables: -BTRuntime: -SWBTRuntime: pre-selected value for the runtime counter	Solution: ■ Optimize the application's background task (background) ■ Use higher capacity CPU ■ Set SWBTRuntime correctly

Number	Message	Definition	Cause/Solution
70	**C-DIAS ERROR**	A connection error with a C-DIAS module has occurred.	Cause: ■ The cause of the error is documented in the log file Solution: ■ This depends on the cause
72	**S-DIAS ERROR**	A connection error with an S-DIAS module has occurred.	Possible Causes: ■ Real network does not match the project ■ S-DIAS client is defective Solution: ■ Analyze log file
75	**SRAM ERROR**	An error occurred while initializing, reading or writing SRAM data.	Possible Causes: ■ SRAM configured incorrectly ■ Battery for powering the internal program memory is empty Solution: ■ Analyze log file (Event00.log, Event19.log) ■ Check configuration ■ Exchange battery for powering the internal program memory
95	**USER DEFINED 0**	User-definable code.	
96	**USER DEFINED 1**	User-definable code.	
97	**USER DEFINED 2**	User-definable code.	
98	**USER DEFINED 3**	User-definable code.	
99	**USER DEFINED 4**	User-definable code.	
100	**C_INIT**	Initialization start; the configuration is run.	
101	**C_RUNRAM**	The LASAL project was successfully started from RAM.	
102	**C_RUNROM**	The LASAL project was successfully started from ROM.	
103	**C_RUNTIME**		
104	**C_READY**	The CPU is ready for operation.	
105	**C_OK**	The CPU is ready for operation.	
106	**C_UNKNOWN_CID**	An unknown object from a stand-alone or embedded object, or an unknown base class was detected.	

Number	Message	Definition	Cause/Solution
107	C_UNKNOWN_CONSTR	The operating system class cannot be created; the operating system is probably wrong.	
108	C_UNKNOWN_OBJECT	Indicates an unknown object in an interpreter program; more the one DCC080 object.	
109	C_UNKNOWN_CHNL	The hardware module number is greater than 60.	
110	C_WRONG_CONNECT	No connection to the required channels.	
111	C_WRONG_ATTR	Wrong server attributes.	
112	C_SYNTAX_ERROR	Non-specific error. Recompile and download all project sections.	
113	C_NO_FILE_OPEN	An attempt was made to open an unknown table.	
114	C_OUTOF_NEAR	Memory allocation failed	
115	C_OUT OF_FAR	Memory allocation failed	
116	C_INCOMAPTIBLE	An object with the same name already exists but has a different class.	
117	C_COMPATIBLE	An object with the same name and class exists but must be updated.	
224	LINKING	The application is currently linking.	
225	LINKING ERROR	An error has occurred while linking.	
226	LINKING DONE	Linking is complete.	
230	OP BURN	The operating system is currently being burned into the Flash memory.	
231	OP BURN FAIL	An error has occurred while burning the operating system.	
232	OP INSTALL	The operating system is currently being installed.	
240	USV-WAIT	The power supply was disconnected; the UPS is active. The system is shutdown.	
241	REBOOT	The operating system is restarted.	

Number	Message	Definition	Cause/Solution
242	**LSL SAVE**		
243	**LSL LOAD**		
252	**CONTINUE**		
253	**PRERUN**	The application is started.	
254	**PRERESET**	The application is ended.	
255	**CONNECTION BREAK**		

15 Application Exceptions

15.1 The file system does not support safe writing through SRAM

If files are created, modified or written from the user program on the microSD card, these files must always be created with a fixed maximum size. Since changes in size and the simultaneous shutdown of the voltage supply can corrupt the file system, a later change in the file size is not allowed.

15.2 Data Breakpoint

This CPU does not support the data breakpoint feature.

16 Assembly/Installation

16.1 Check Contents of Delivery

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

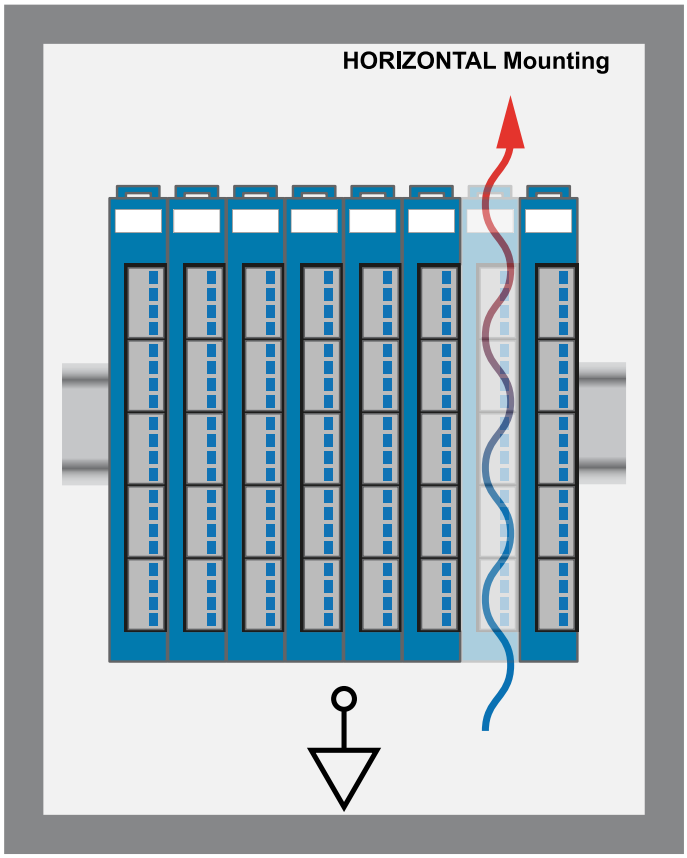
INFORMATION

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.

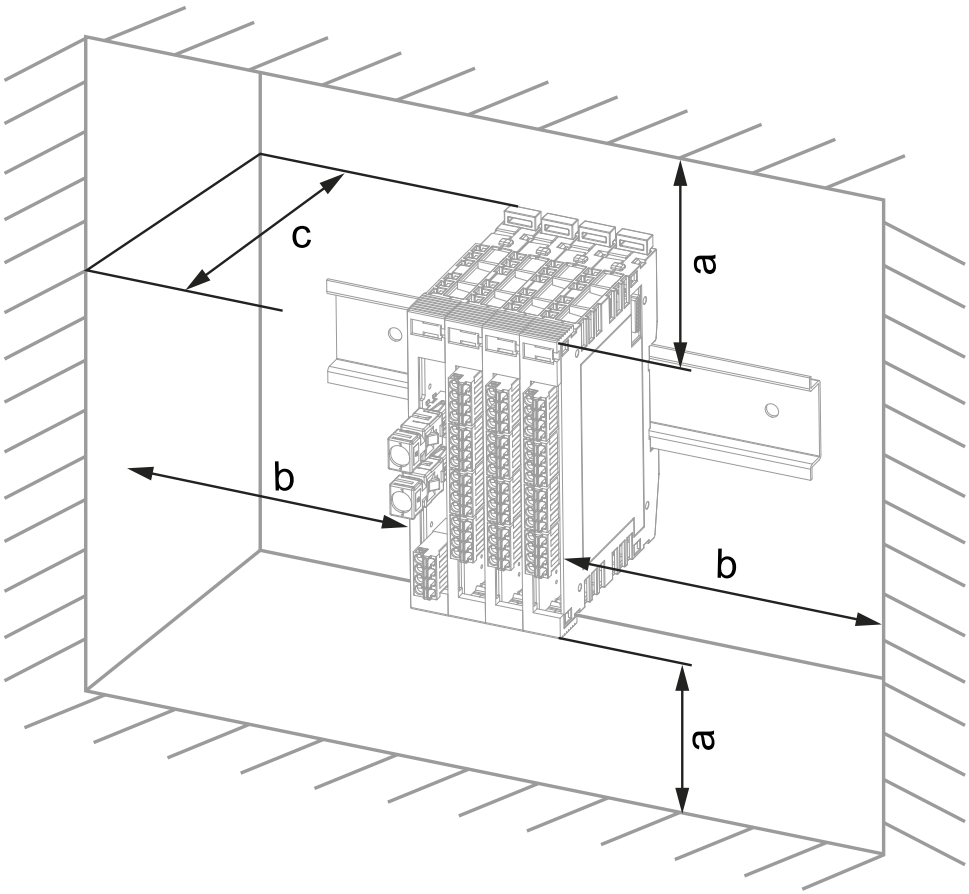
Damaged components can disrupt or damage the system.

16.2 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 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)

17 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.

18 Storage

When not in use, store the device according to the storage conditions. See chapter 17 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.

The existing battery in the device must be replaced after approx. 3 year/s. If the device is to be stored longer, the battery must be removed to prevent leakage.

19 Maintenance

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

19.1 Service

This product was constructed for low-maintenance operation.

19.2 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 17 Transport/Storage.

20 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.

21 Accessories

21.1 microSD Card

Description	Order Number
8 Gbyte	12-630-805

The microSD card is delivered empty and unformatted. For actual memory usage and formatting format, see performance data.

22 Application Notes

22.1 Storage Media

The operating system and customer application are stored on the internal storage device.

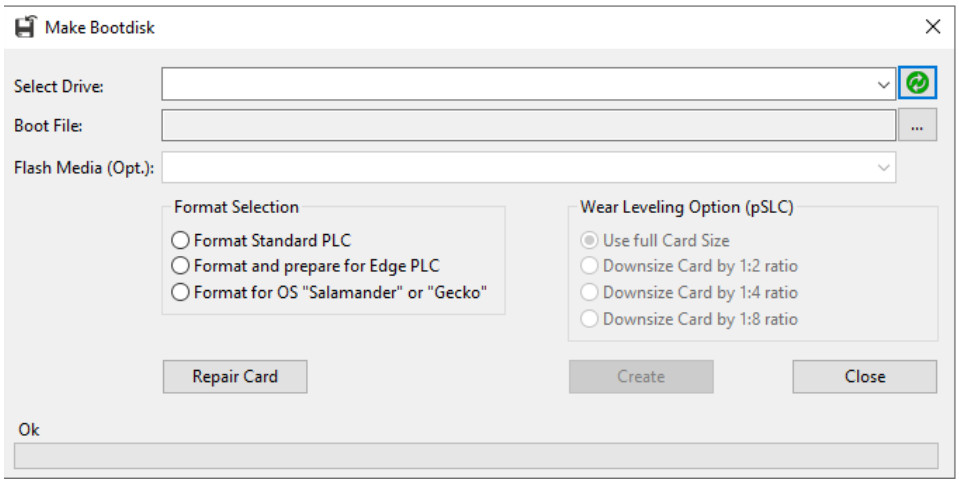
To ensure longevity of the memory, writing cyclic data to the internal storage medium should be avoided (lifespan drastically reduced). For cyclic writing, an external storage medium (e.g. microSD card or USB stick, depending on the respective device) from SIGMATEK must be used.

Errors resulting from the use of storage media from other manufacturers are excluded from support.

22.1.1 Create Boot Media (Make Bootdisk)

To create a boot medium with a SIGMATEK operating system, the PlcDiag function “Make Bootdisk” must be used. For the corresponding formatting of the storage medium, the storage medium identifier must be entered in addition to the operating system image.

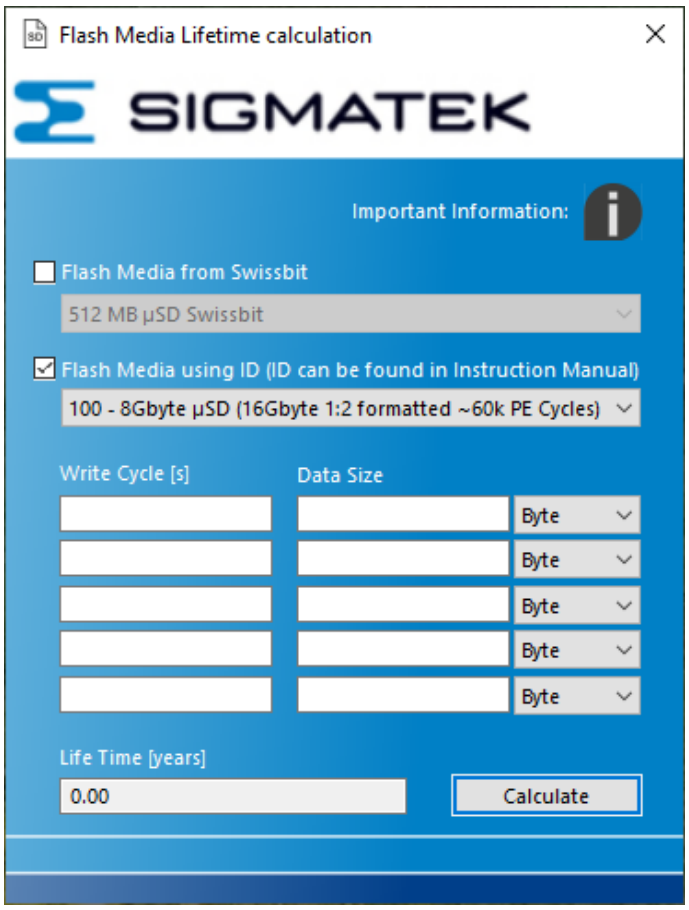
HW version	Storage media identification	Storage media designation
≥ 1.80	102 (microSD)	1-Gbyte microSD (8-Gbyte 1:8 formatted ≥ 120k P/E cycles)



Customer-specific data can then be copied to the storage medium.

22.1.2 Lifetime Calculation (Flash Media Lifetime Calculation)

The life span of the internally installed storage medium can be calculated using the Flash Media Lifetime Calculation Tool. This is a theoretical guideline value. The storage medium ID must be entered to ensure the correct selection. The current status of the storage medium can be read out via the hardware class “PLC_Info” using the “SDCardHealth” server.



INFORMATION

These extended functions of Make Bootdisk and Flash Media Lifetime Calculation are available from LASAL CLASS 2 version 02.02.244.

Starting with hardware version ≥ 1.80, operating system version Salamander 3 ≥ 09.04.140 is required for the correct reading of the microSD card parameters.
Hardware version < 1.80: Use "Flash Media from Swissbit".

Changes Chart

Change date	Affected page(s)	Chapter	Note
26.11.2019	13	5.3.2 S-DIAS Bus Supply (Output)	+24 V added
05.12.2019	29	10.6 Recommended Shielding for VARAN	General update
28.01.2020			TÜV conformity
09.03.2020		Documentation	EtherCAT Drive Controller
29.05.2020	17	7.1 Status LEDs	Text + footnote added
24.06.2020	1		Added note about EtherCAT Drive
14.07.2020	35	12 EtherCAT Feature Overview	Chapter added
04.11.2020	47	16 Assembly/Installation	Expansion functional ground connection
17.11.2020	11	5.1 Performance Data	Footnote cores (programming) added
17.03.2022	12	5.3.1 Module Supply (Input)	Maximum Supply Voltage corrected
	15	5.5 Environmental Conditions	Maximum Environmental Temperature corrected
22.04.2022	15	5.5 Environmental Conditions	Environmental temperature changed from 50 to 55 °C
20.04.2023	17	7 Connector Layout	Info box corrected
26.07.2023		Document	General chapters added, design
13.03.2024	11	5.1 Performance Data	microSD card updated
	17	7 Connector Layout	
03.09.2024	15	5.4 Miscellaneous	UL certification added
05.11.2026	11	5.1 Performance Data	microSD card updated
	53	21 Accessories	Chapter added
	54	22 Application Notes	
		Document	Revision