

CP 313

S-DIAS CPU Module

Instruction Manual

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Translation of the Original Instructions

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S-DIAS CPU Module

CP 313

with 1 Ethernet

1 EtherCAT Drive Controller

1 VARAN Out

1 USB Device

1 microSD

1 USB Host

1 CAN



The S-DIAS CP 313 CPU module 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 the I/O modules are powered by the integrated power 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 Ether-CAT drive is already supported.

Contents

- 1 Introduction 6**
 - 1.1 Target Group/Purpose of this Operating Manual 6**
 - 1.2 Important Reference Documentation 6**
 - 1.3 Contents of Delivery 6**
- 2 Basic Safety Directives 7**
 - 2.1 Symbols Used 7**
 - 2.2 Disclaimer 9**
 - 2.3 General Safety Directives 10**
 - 2.4 Software/Training 11**
- 3 Standards and Directives 12**
 - 3.1 Directives 12**
 - 3.1.1 EU Conformity Declaration 12**
- 4 Type Plate 13**
- 5 Technical Data 14**
 - 5.1 Performance Data 14**
 - 5.2 Standard Configuration 15**
 - 5.3 Electrical Requirements 16**
 - 5.3.1 Module Supply (Input) 16**
 - 5.3.2 S-DIAS Bus Supply (Output) 16**
 - 5.4 Miscellaneous 18**
 - 5.5 Environmental Conditions 18**

6	Mechanical Dimensions.....	19
7	Connector Layout.....	20
7.1	Status LEDs Interface Part.....	21
7.2	Status LEDs Supply Part.....	22
7.3	Connectors	23
7.4	Applicable Connector Cables.....	26
7.5	Applicable Connectors.....	27
7.6	Label Field	28
8	CAN Bus Setup.....	29
8.1	CAN Bus Station Number	29
8.2	Number of CAN Bus Participants.....	29
8.3	CAN Bus Data Transfer Rate	29
8.4	CAN Bus Termination.....	30
9	Buffer Battery	31
10	Wiring	33
10.1	Wiring Example	33
10.2	Note	34
10.3	Shielding.....	35
10.4	ESD Protection.....	35
11	Process Diagram.....	36
12	Status and Error Messages	37

13 EtherCAT Feature Overview45

14 Application Exceptions48

 14.1 The File System does not Support Safe Writing through SRAM 48

 14.2 Data Breakpoint 48

15 Strain Relief49

16 Recommended Shielding50

 16.1 Wiring from the Control Cabinet to an External Component . 51

 16.2 Wiring Outside of the Control Cabinet 52

 16.3 Interference SourcesShielding for Wiring Within the Control Cabinet..... 53

 16.4 Connecting Noise Generating Components 54

 16.5 Shielding Between Two Control Cabinets 55

17 Working with and on the CP 31356

18 Assembly/Installation57

 18.1 Check Contents of Delivery 57

 18.2 Mounting..... 58

19 Transport/Storage.....60

20 Storage60

21 Maintenance61

 21.1 Service 61

21.2	Repair.....	61
22	Disposal	61

1 Introduction

1.1 Target Group/Purpose of this Operating Manual

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

This operating manual is intended for:

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

General knowledge of automation technology is required.

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

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

1.2 Important Reference Documentation

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

1.3 Contents of Delivery

1x CP 313

2 Basic Safety Directives

2.1 Symbols Used

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

DANGER



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

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

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

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

WARNING



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

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

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

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

CAUTION



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

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

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

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

INFORMATION**Information**

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

2.2 Disclaimer

INFORMATION



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

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

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

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

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

2.3 General Safety Directives

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



INFORMATION

According to EU Directives, the operating manual is a component of a product.

This operating manual must therefore be accessible in the vicinity of the machine since it contains important instructions.

This operating manual should be included in the sale, rental or transfer of the product, or its online availability indicated.

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

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

CAUTION

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

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

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

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

The module complies with EN 61131-2.

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

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

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

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

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

2.4 Software/Training

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

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

3 Standards and Directives

3.1 Directives

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

3.1.1 EU Conformity Declaration



EU Declaration of Conformity

The product CP 313 conforms to the following European directives:

- **2014/35/EU** Low-voltage Directive
- **2014/30/EU** Electromagnetic Compatibility (EMC Directive)
- **2011/65/EU** "Restricted use of certain hazardous substances in electrical and electronic equipment" (RoHS Directive)

The EU Conformity Declarations are provided on the SIGMATEK website. See Products/Downloads or use the search function and the keyword "EU Declaration of Conformity".

4 Type Plate

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

Exemplary nameplate (symbol image)

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

HW: Hardware version

SW: Software version

5 Technical Data

5.1 Performance Data

Processor	EDGE2-Technology Dual Core
Processor cores	2 ¹⁾
Internal cache	32-kbyte L1 Instruction Cache 32-kbyte L1 Data Cache 512-Kbyte L2 Cache
Addressable I/O/P module	VARAN Bus: 65.280 CAN participants: > 110 S-DIAS bus: 64
Internal I/O	no
Internal program and data memory (DDR3 RAM)	256-Mbyte
Internal remnant data memory	256-kByte SRAM (battery buffered)
Internal storage device	4 GB microSD Karte (3D-TLC pSLC Technologie) ²⁾
Interfaces	1x Ethernet 1x EtherCAT Drive Controller 1x VARAN Out (Manager) (maximum cable length: 100 m) 1x CAN 1x USB host 2.0 (high speed 480 Mbit/s) 1x USB-OTG (host/device), type Mini B 1x S-DIAS (with manager)
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 4 GByte microSD card is formatted to 1 GByte in order to achieve the lifetime of a standard SLC card. A format change to the full 4 GByte is not allowed and will result in a massive reduction of the microSD card's lifetime.

5.2 Standard Configuration

Ethernet 1	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 ¹⁾
Current consumption of +24 V supply voltage	maximum 2.75 A ²⁾

¹⁾ Limited Voltage/Limited Current

²⁾ The current consumption is dependent on the connected load

INFORMATION



For loading the internal capacitors, power consumption may be increased for a short time (in the microsecond range).

This value is dependent of the input voltage and impedance of the power source.

¹⁾ For USA and Canada:

The supply must be limited to:

a) max. 5 A at voltages from 0-20 V DC, or

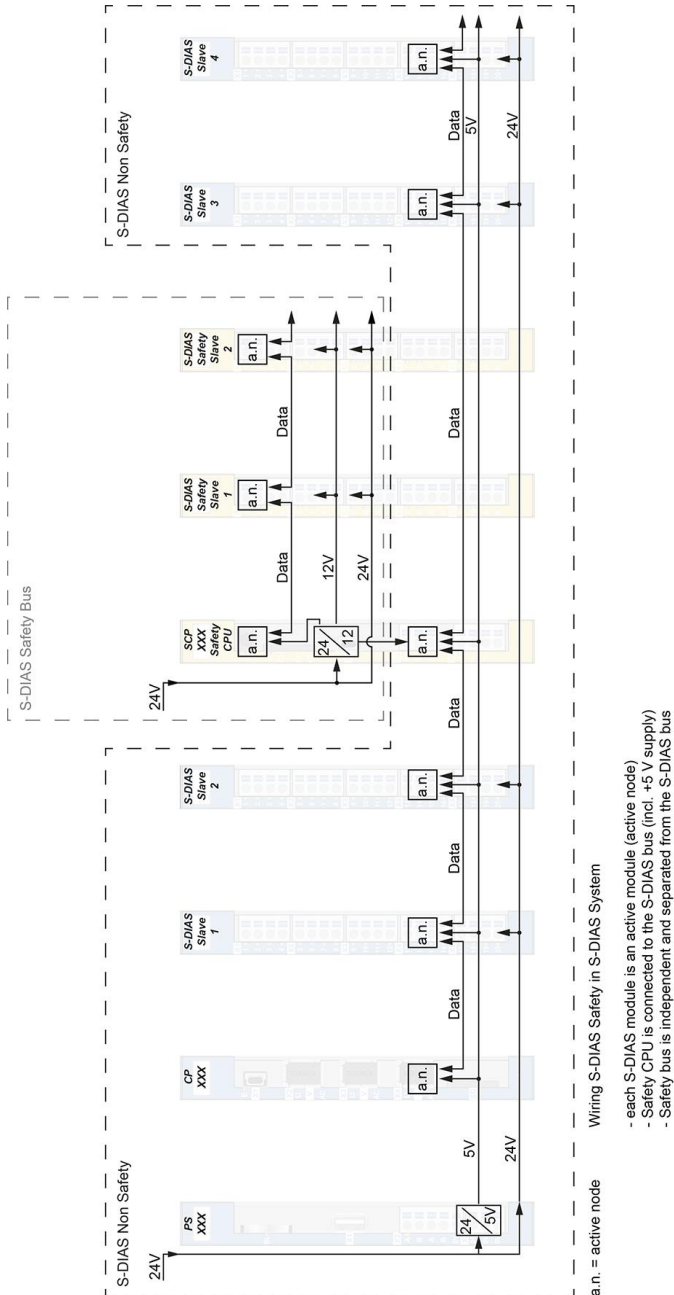
b) 100 W at voltages from 20-60 V DC

The limiting component (e.g. transformer, power supply or fuse) must be certified by an NRTL (Nationally Recognized Testing Laboratory).

5.3.2 S-DIAS Bus Supply (Output)

Voltage supply from S-DIAS bus	+5 V
Current consumption on the S-DIAS bus (+5 V supply)	maximum 1.1 ¹⁾
Voltage 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



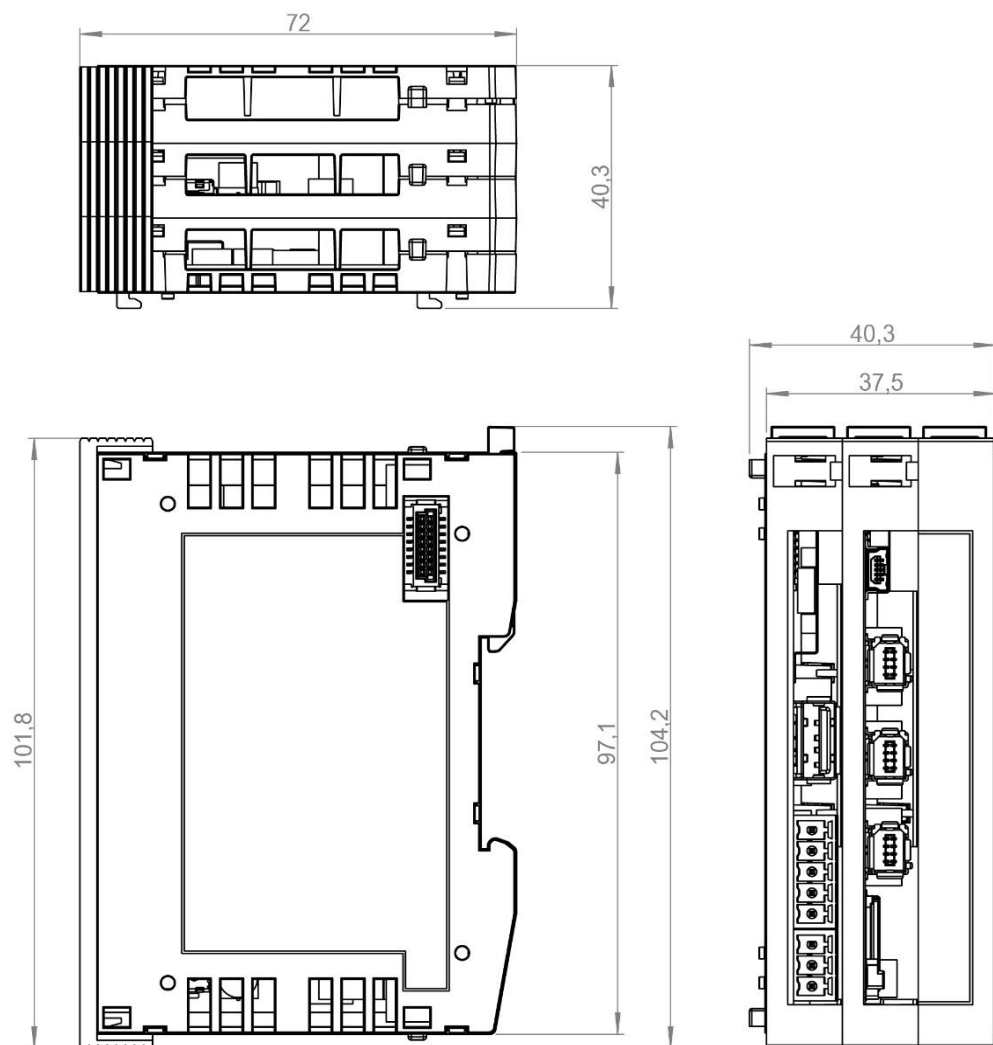
5.4 Miscellaneous

Article number	20-004-313
Operating system	Salamander
Project backup	internally on the microSD card
Standard	UL 508 (E247993)
Approbations	UL, cUL, CE, UKCA

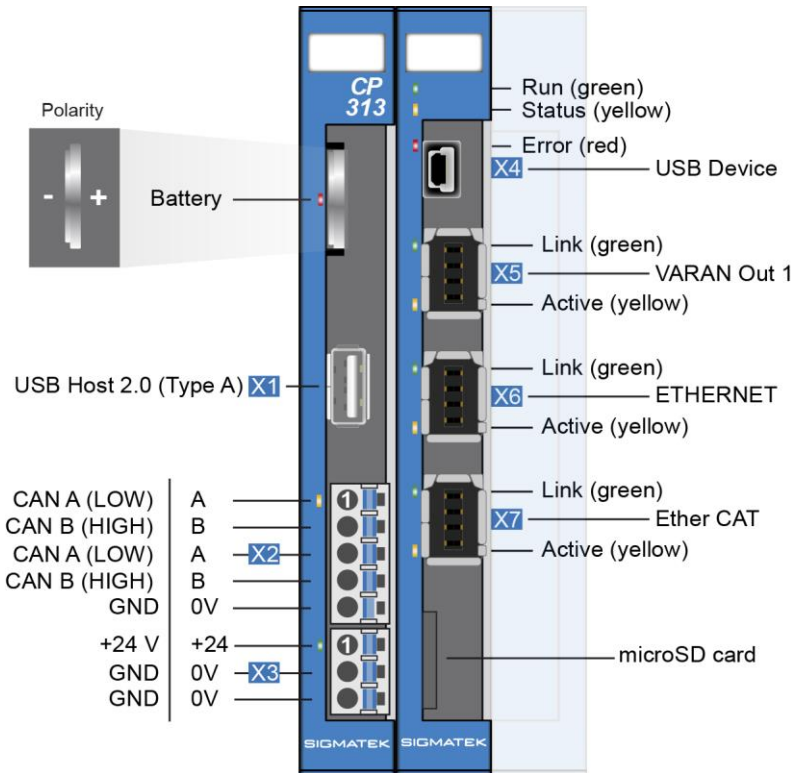
5.5 Environmental Conditions

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 with derating of the maximum environmental temperature by 0.5 °C per 100 m	
Operating conditions	pollution degree 2	
EMC resistance	in accordance with EN 61000-6-2 (industrial area)	
EMC noise generation	in accordance with EN 61000-6-4 (industrial area)	
Vibration resistance	EN 60068-2-6	3.5 mm from 5-8.4 Hz 1 g from 8.4-150 Hz
Shock resistance	EN 60068-2-27	15 g
Protection type	EN 60529	IP20

6 Mechanical Dimensions



7 Connector Layout



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 Interface Part

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 error occurs reset-state Permanent from power on: microSD card error ¹⁾
	can be set from the application (ON, BLINKING, OFF)		
Status	yellow	OFF	during start process during RUN status (application running) when error occurs or reset 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

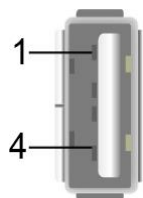
¹⁾ If the microSD card is not properly inserted or if data (operating system, application) is faulty, the RUN, STATUS and Error LEDs do not light up after switching on the power supply. The DC OK LED lights up permanently.

7.2 **Status LEDs Supply Part**

Module Status	red	ON	CPU is in RESET status
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

X1: USB Host 2.0 (Type A)



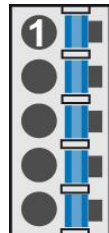
Pin	Function
1	+5 V
2	D
3	D+
4	GND

INFORMATION



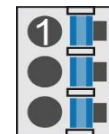
It should be noted that many of the USB devices on the market do not comply with USB specifications; this can lead to device malfunctions. It is also possible that these devices will not be detected at the USB port or function correctly. It is therefore recommended that the respective USB stick be tested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

X2: CAN Bus



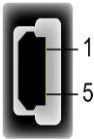
Pin	Function
1	CAN A (LOW)
2	CAN B (HIGH)
3	CAN A (LOW)
4	CAN B (HIGH)
5	GND

X3: Power Supply



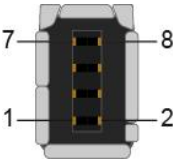
Pin	Function
1	+24 V supply
2	GND
3	GND

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



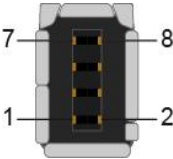
Pin	Function
1	+5 V
2	D
3	D+
4	ID
5	GND

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



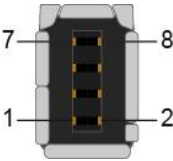
Pin	Function
1	TX/RX+
2	Tx/Rx-
3	Rx/Tx+
4-5	n.c.
6	Rx/Tx-
7-8	n.c.

X6: Ethernet (Industrial Mini I/O)



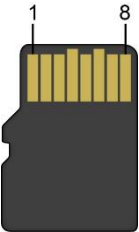
Pin	Function
1	Tx+
2	Tx-
3	Rx+
4-5	n.c.
6	Rx-
7-8	n.c.

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.

microSD Card



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

Size	Order number
4 Gbyte	12-630-105

INFORMATION



It is recommended that only storage media provided by SIGMATEK be used.

The number of read and write actions have 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 purposed only.

7.4 Applicable Connector Cables

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

Connectors:

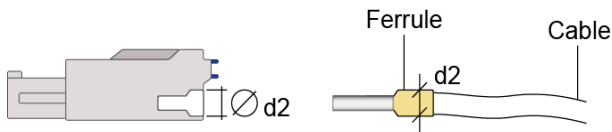
- X1: USB 2.0 (Type A) (not included in delivery)
- X2, X3: Connectors with spring terminals (included in delivery)

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

- X4 USB Type Mini-B (not included in delivery)
- X5, X6, X7: Industrial Mini I/O Plug Type 1 Lock Extend Version (not included in delivery)

Connections:

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



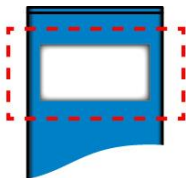
d2 = max. 2.8 mm

INFORMATION



The module **cannot** be connected or disconnected while voltage is applied!

7.6 Label Field



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

8 CAN Bus Setup

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

8.1 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!

8.2 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 110 participants are possible.

8.3 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.

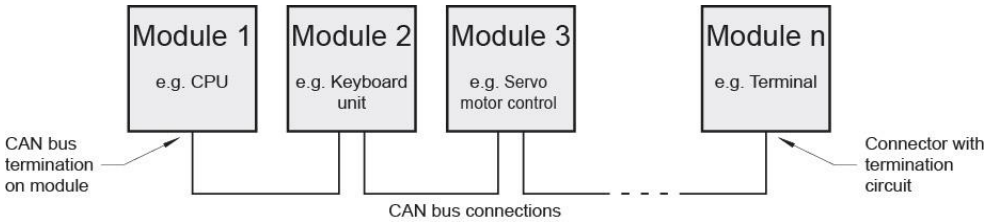
Value	Baud rate	maximum length
00	615 kbits/s	60 m
01	500 Kbits/s	80 m
02	250 Kbits/s	160 m
03	125 kbits/s	320 m
04	100 Kbits/s	400 m
05	50 Kbits/s,	800 m
06	20 Kbits/s,	1200 m
07	1 Mbit/s	30 m

These values are valid for the following cable: 120 Ω , Twisted Pair.

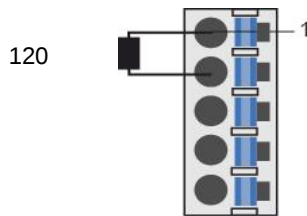
Note: For the CAN bus protocol: 1 kbits/s = 1 kBaud

8.4 CAN Bus Termination

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



It can be terminated by placing a $120\ \Omega$ resistor between CAN A (LOW) and CAN B (HIGH).



9 Buffer Battery

The exchangeable buffer battery ensures that programs and data in the expanded memory (SRAM) as well the clock time (RTC) of the CPU module (e.g. CP 313) 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 up to 3 years.

We recommend however, that the battery be replaced annually to ensure optimal performance.

INFORMATION



Battery order number: 01-690-028

	COMPANY	DATA
Lithium battery	RENATA (CR2032)	3.0 V/225 mAh

INFORMATION



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

WARNING



Fire and explosion hazard!

Minor to severe injuries may occur due to incorrect use of the battery.

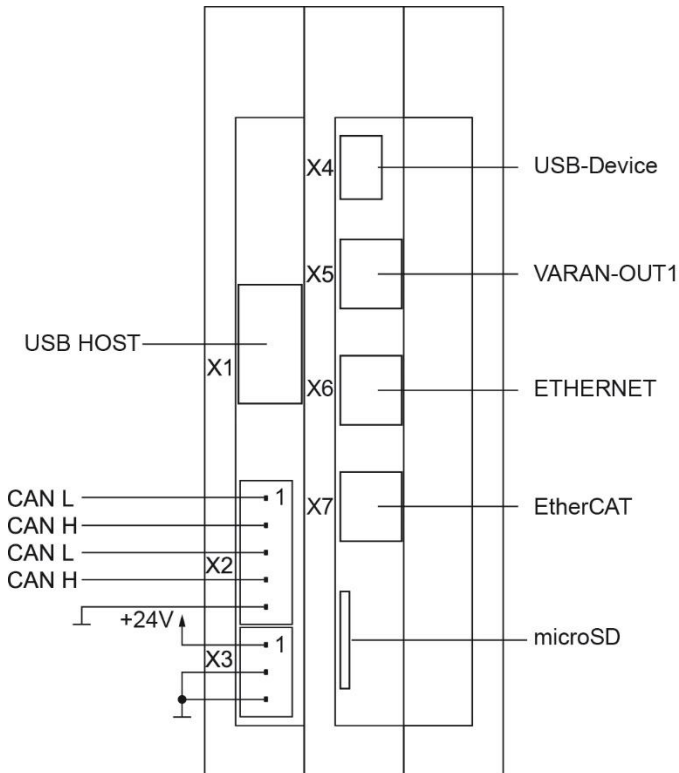
Do not recharge, disassemble or dispose of battery in fire!

The battery monitoring is designed so that a weak battery is first detected by the CPU module and displayed in the control software. If the battery voltage continues to decrease, the red LED "Battery Low" will light up. The battery should now be replaced quickly to prevent data loss in the event of a power failure.

If the battery voltage is located between both thresholds of the monitoring switch, the battery can be detected as good during operation, but as low after turning off and on. If this is the case, it is recommended that the battery be replaced.

10 Wiring

10.1 Wiring Example



10.2 Note

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

The following 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



Connect the ground bus to the control cabinet.

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

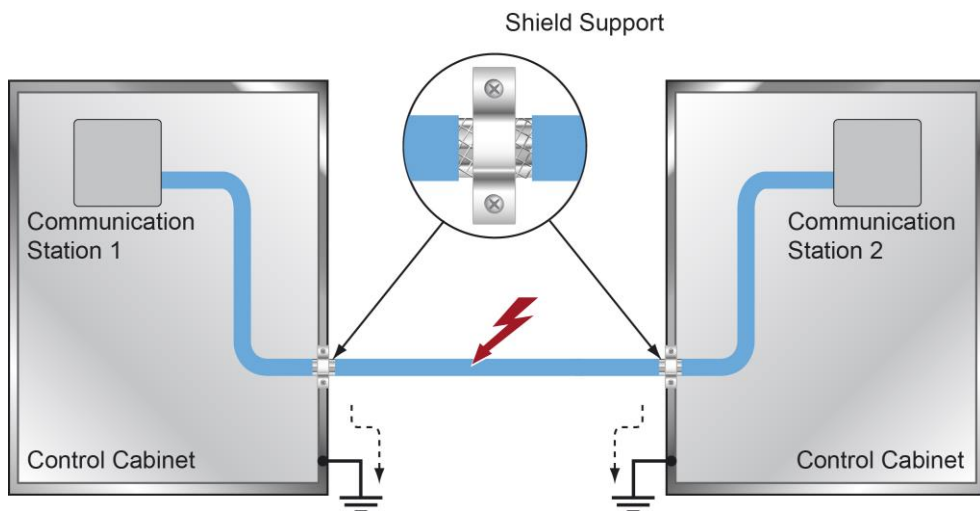
10.3 Shielding

The wiring for the CAN, VARAN and Ethernet must be shielded.

The low-ohm shielding is either connected 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.

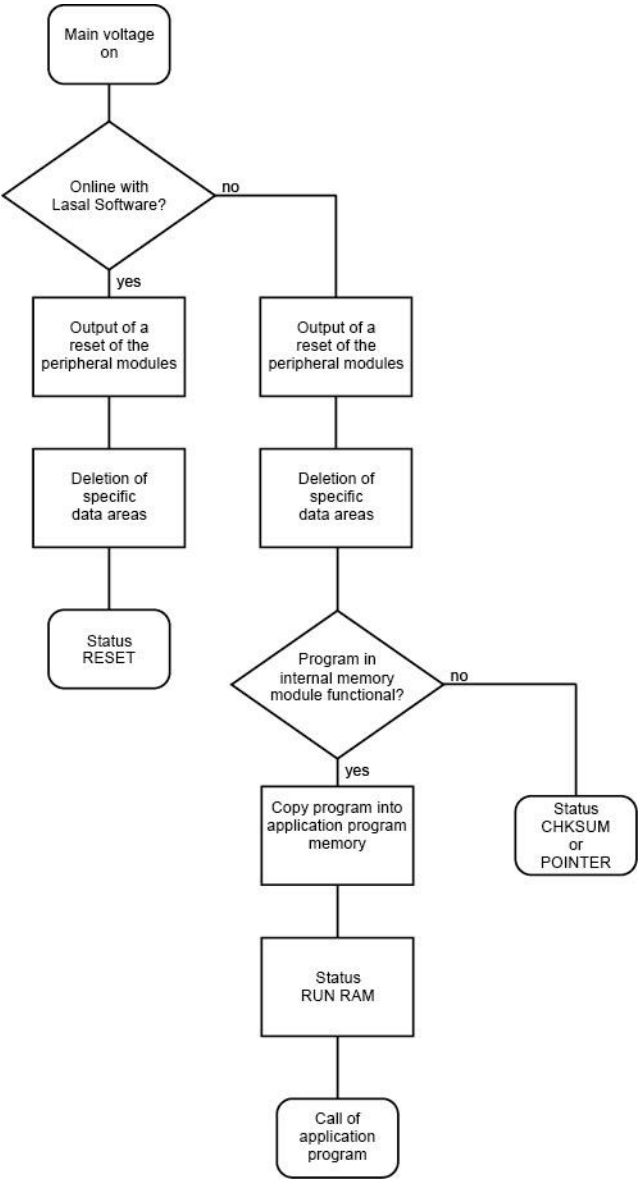
To avoid compensating currents from the PE, which flow over the shielding the conductors, it is recommended that the system components have low Ohm and low impedance connections to one another.



10.4 ESD Protection

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.

11 Process Diagram



12 Status and Error Messages

Status and error messages are displayed in the LASAL CLASS software status test.

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

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 over 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...
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...
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

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	PRIVILEGED 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: Remaining time -SWBTRuntime: Preset value for runtime counter	Solution: - Optimize the application's background task (background) - Use higher capacity CPU - Set SWBTRuntime correctly

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
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.	

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.	
242	LSL SAVE		
243	LSL LOAD		
252	CONTINUE		

253	PRERUN	The application is started.	
254	PRERESET	The application is ended.	
255	CONNECTION BREAK		

13 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	•
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	•
EtherCAT State Machine	Support of ESM special behaviour	104	•
Error Handling	Checking of network or slave errors, e.g. Working Counter	105	•
VLAN	Support VLAN Tagging	106	-
EtherCAT Frame Types	Support EtherCAT Frames	107	•
UDP Frame Types	Support UDP Frames	108	-
Process Data Exchange			
Cyclic PDO	Cyclic process data exchange	201	•
Multiple Tasks	Different cycle tasks Multiple update rates for PDO	202	•
Frame repetition	Send cyclic frames multiple times to increase immunity	203	-
Network Configuration			
Online scanning	Network configuration functionality included in EtherCAT Master	301	•
Reading ENI	Network Configuration taken from ENI file		

Compare Network configuration	Compare configured and existing network configuration during boot-up	302	•
Explicit Device Identification	Identification used for Hot Connect and prevention against cable swapping	303	•
Station Alias Addressing	Support configured station alias in slave, i.e. enable 2nd Address and use it	304	•
Access to EEPROM	Support routines to access EEPROM via ESC register	305	•
Mailbox Support			
Support Mailbox	Main functionality for mailbox transfer	401	•
Mailbox resilient Layer	Support underlying resilient layer	402	•
Multiple Mailbox channels		403	•
Mailbox polling	Polling Mailbox state in slaves	404	•
CAN application layer over EtherCAT (CoE)			
SDO Up/Download	Normal and expedited transfer	501	•
Segmented Transfer	Segmented transfer	502	•
Complete Access	Transfer the entire object (with all sub-indices) at once	503	•
SDO Info service	Services to read object dictionary	504	•
Emergency Message	Receive Emergency messages	505	-
PDO in CoE	PDO services transmitted via CoE	506	•
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	•
Continuous Propagation Delay compensation	Continuous Calculation of the propagation delay	1102	•
Sync window monitoring	Continuous monitoring of the Synchronization difference in the slaves	1103	•
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	-

- is supported
- is not supported

14 Application Exceptions

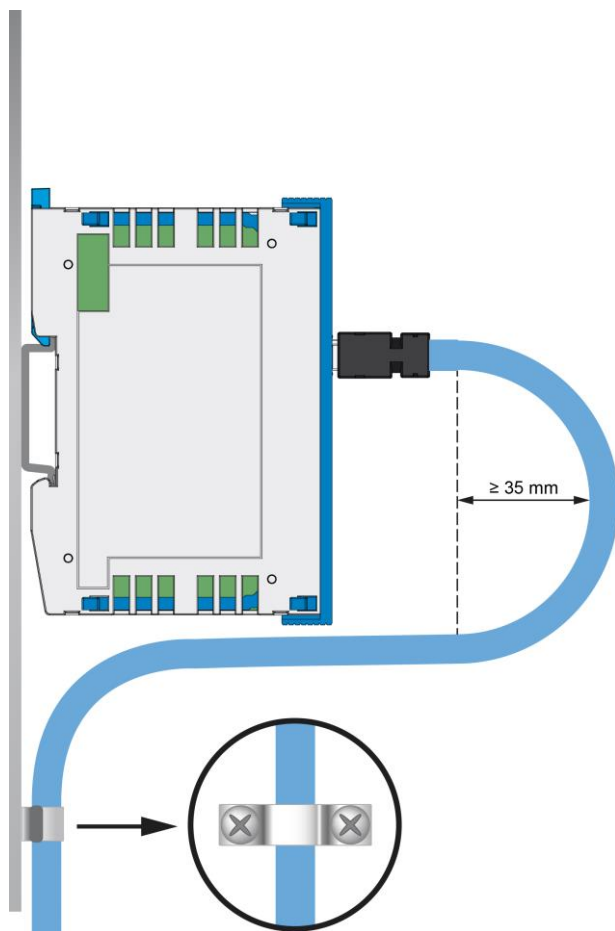
14.1 The File System does not Support Safe Writing through SRAM

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.

14.2 Data Breakpoint

This CPU does not support the data breakpoint feature.

15 Strain Relief



INFORMATION



The shielded data cable must be mounted close to the module (e.g. using a clamp)!

No mechanical stress can be applied to the connection!

16 Recommended Shielding

The VARAN real-time Ethernet bus system exhibits a very robust quality in harsh industrial environments. In the event of an error, the VARAN Manager resends messages to a bus participant immediately.

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.

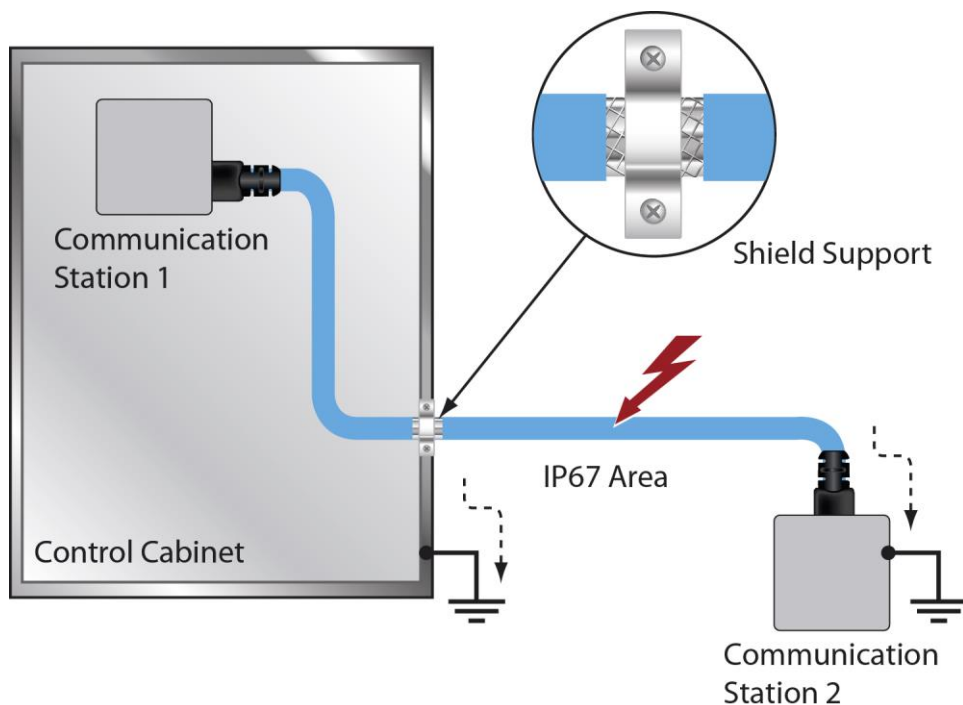
INFORMATION



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

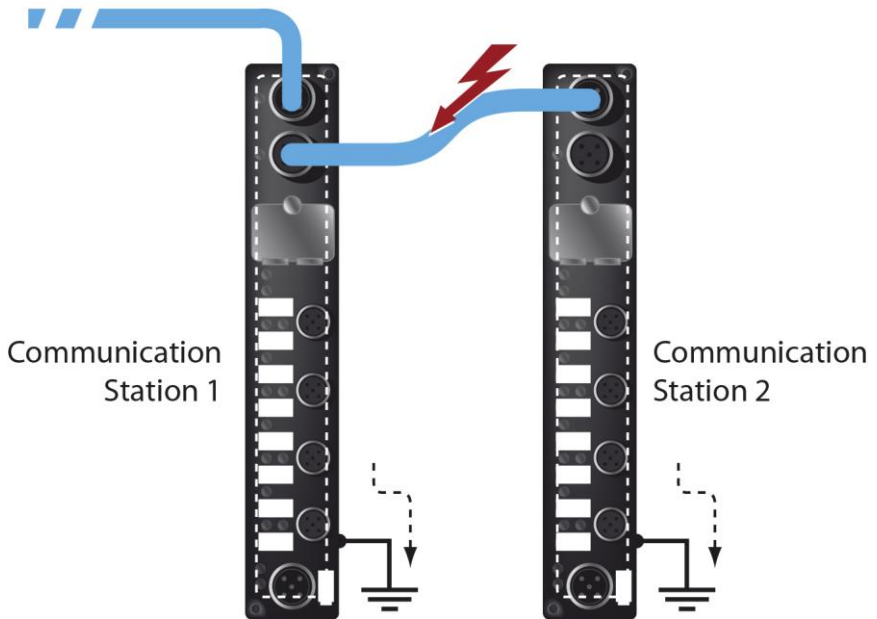
16.1 Wiring from the Control Cabinet to an External Component

If the Ethernet lines are connected from a component to a 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.



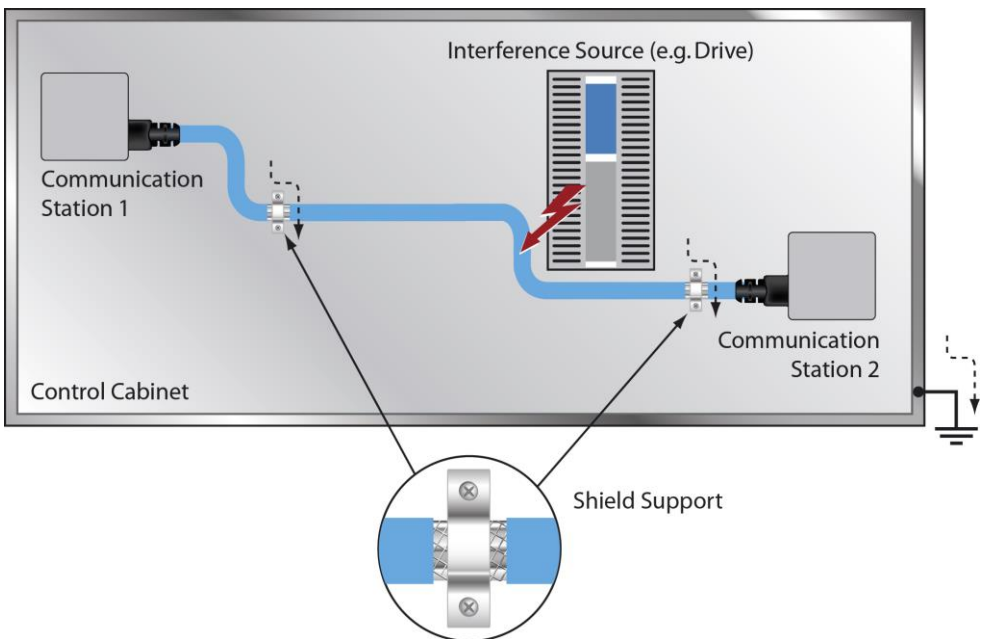
16.2 Wiring Outside of the Control Cabinet

If a 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.



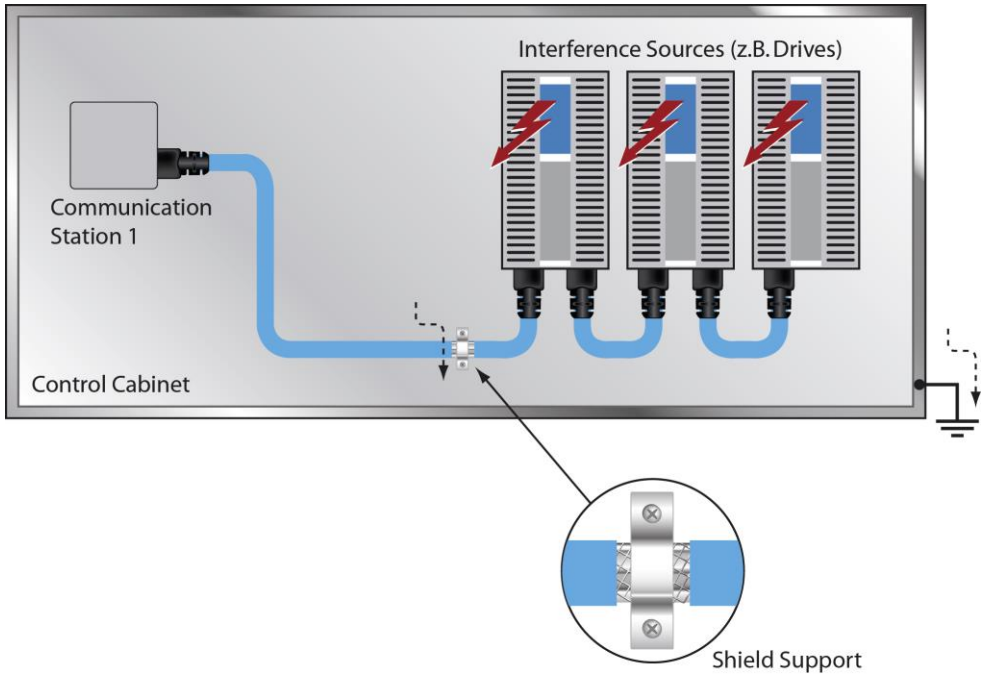
16.3 Interference SourcesShielding for Wiring Within the Control Cabinet

Sources of strong electromagnetic noise located within the control cabinet (drives, Transformers, etc.) can induce interference in a bus line. Spike voltages are deflected 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.



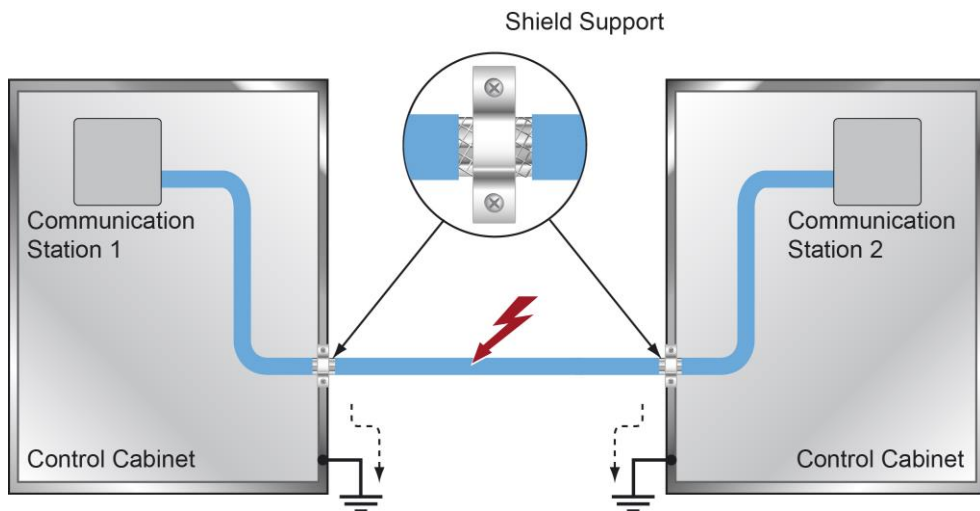
16.4 Connecting Noise Generating Components

With the connection of power components that 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).



16.5 Shielding Between Two Control Cabinets

If two control cabinets must be connected over a 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.



17 Working with and on the CP 313

- During installation / initial start-up / maintenance of the product, appropriate ESD protection measures must be taken (For example: the employees must ground themselves before working with and on the product.)

18 Assembly/Installation

18.1 Check Contents of Delivery

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

INFORMATION

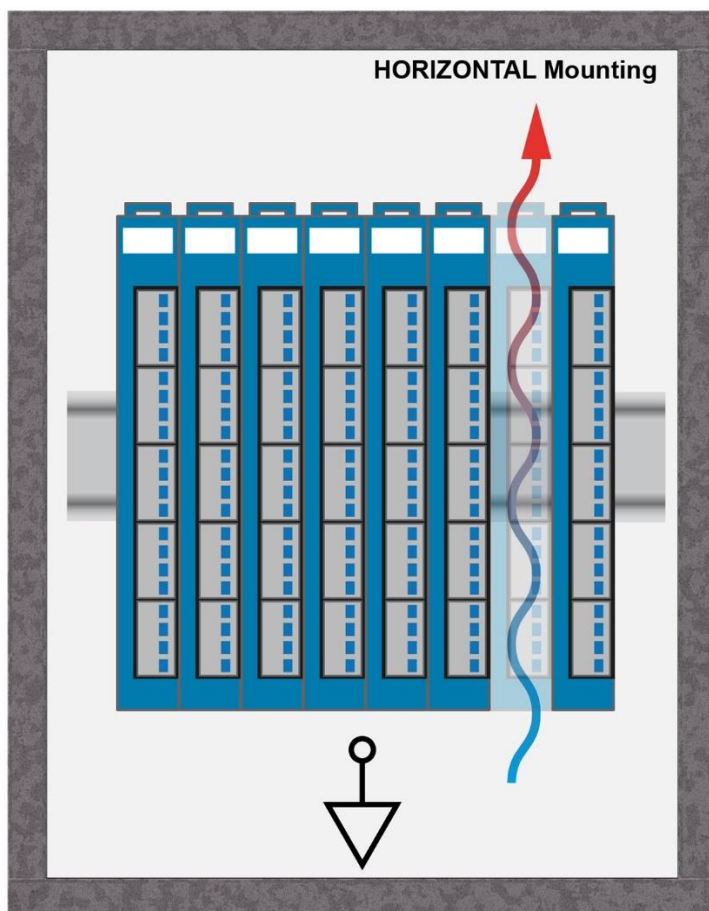


On receipt and before initial use, check the device for damage. If the device is damaged, contact our customer service and do not install the device in your system.

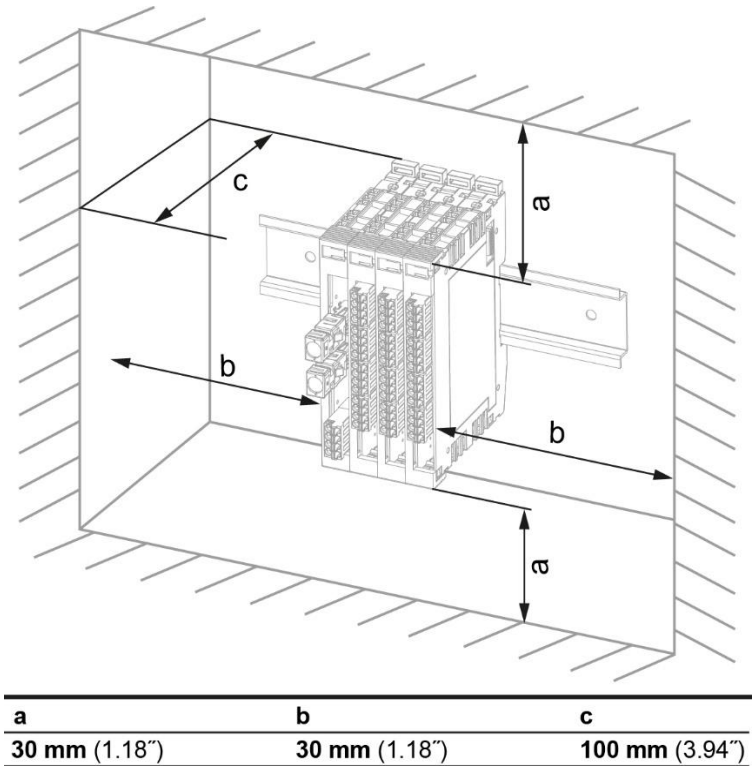
Damaged components can disrupt or damage the system.

18.2 Mounting

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



Recommended minimum distances of the S-DIAS modules to the surrounding components or control cabinet wall:



a, b, c ... distances in mm (inches)

19 Transport/Storage

INFORMATION



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

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

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

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

20 Storage

INFORMATION



When not in use, store the operating panel according to the storage conditions. See chapter 19.

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

21 Maintenance

INFORMATION



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

21.1 Service

This product was constructed for low-maintenance operation.

21.2 Repair

INFORMATION



In the event of a defect/repair, send the device with a detailed error description to the address listed at the beginning of this document.

For transport conditions, see chapter 19 Transport/Storage.

22 Disposal

INFORMATION



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

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



Documentation Changes

Change date	Affected page(s)	Chapter	Note
26.11.2019	12	4.3.2 S-DIAS Bus Supply (Output)	24 V added
05.12.2019		14 Recommended Shielding	General update
28.01.2020			TÜV conformity
09.03.2020		Documentation	EtherCAT Drive Controller
29.05.2020	17	6.1 Status LEDs Interface Part	Text + footnote added
24.06.2020	1		Added note about EtherCAT Drive
14.07.2020		12 EtherCAT Feature Overview	Chapter added
04.11.2020	52	18 Mounting	Expansion functional ground connection
17.11.2020	10	4.1 Performance Data	Footnote cores (programming) added
17.03.2022		4.3.1 Module Supply	Maximum Supply Voltage corrected
		4.5 Environmental Conditions	Maximum Environmental Temperature corrected
22.04.2022		4.5 Environmental Conditions	Environmental temperature from 50 to 55
20.04.2023	16	6 Connector Layout	Info box corrected
26.07.2023		Document	General chapters added, design
13.03.2024	14	5.1 Performance Data	microSD card updated
	20	7 Connector Layout	
03.09.2024	18	5.4 Miscellaneous	UL certification added