

EC 121

S-DIAS Control Module EtherCAT

Operating Manual

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S-DIAS Control Module EtherCAT

EC 121

With

- 1 EtherCAT IN**
- 1 EtherCAT Out**
- 1 S-DIAS-Bus OUT**
- 1 USB-Device (not used)**

The S-DIAS EtherCAT control module EC 121 is an interface module between an S-DIAS control system and EtherCAT bus. The module provides the voltage supply for up to 32 S-DIAS modules. With an additional power boost module (PSB 001), up to 64 modules can be connected via the EtherCAT control module.

The EC 121 detects the connected S-DIAS modules automatically. It provides the EtherCAT slave configuration for the EtherCAT master and exchanges data between the EtherCAT and S-DIAS bus during operation.



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1 Introduction

1.1 Target Group/Purpose of this Manual

This operating manual contains all information required to operate this 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 Contents of Delivery

1x EC 121

1x opposing connector

2 Basic Safety Guidelines

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 the 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 the 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 the 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

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

Fournit des recommandations importantes sur le produit, la manipulation ou sections pertinentes de la documentation, qui nécessitent prêter une attention particulière.

2.2 Disclaimer



The contents of this document were prepared with the greatest care. However, deviations cannot be ruled out. This document 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 document can be found on our website. If necessary, contact our support.

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

Please thoroughly read the corresponding data sheets, operating instructions and this system handbook 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 Guidelines



According to EU Guidelines, the operating instructions are 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.

Maintain this operating manual in readable condition and keep it accessible for reference.

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

Before commissioning this product, check that conformance with the provisions of the 2006/42/EG guidelines is correct. As long as the machine with which the with the device should be used does not comply with the guideline, operating this product is prohibited.

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, otherwise it could be damaged!

The module complies with EN 61131-2.

In combination with a machine, the machine builder must comply with EN 60204-1 standards.

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

The control cabinet must be connected to ground correctly.

To perform maintenance or repairs, disconnect the system from the power supply.

3 Norms and Guidelines

3.1 Guidelines

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

3.2 EU Declaration of Conformity



EU Declaration of Conformity

The EC 121 product conforms with the following European guidelines:

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

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

4 Technical Data

4.1 Performance Data

Interfaces	1x EtherCAT In (RJ45) 1x EtherCAT Out (RJ45) 1x S-DIAS bus 1x USB-Device (not used)
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4.2 EtherCAT Specifications

Configuration		2x shielded RJ45 port	
Cable length		maximum 100 m between stations	
Propagation delay		approximately 1 μ s	
Potential separation		500 V (EtherCAT - S-DIAS-Bus)	
FMMU		3	
Sync manager		4	
Process data RAM		8-kbyte	
Synchronization		64-bit distributed clock	
Process image		modular device profile	
Asynchronous data exchange	Protocol	Supported functions	Description
	CoE	Complete Access Support SDO-Info Support PDO Assign	CANopen over EtherCAT is required for transmitting parameters
	FoE	X	File over EtherCAT for transferring files (only in BOOTSTRAP mode)
	FSoE	X	UL in preparation
Max. number of S-DIAS modules		up to 32 (64 with PSB 001) S-DIAS modules	

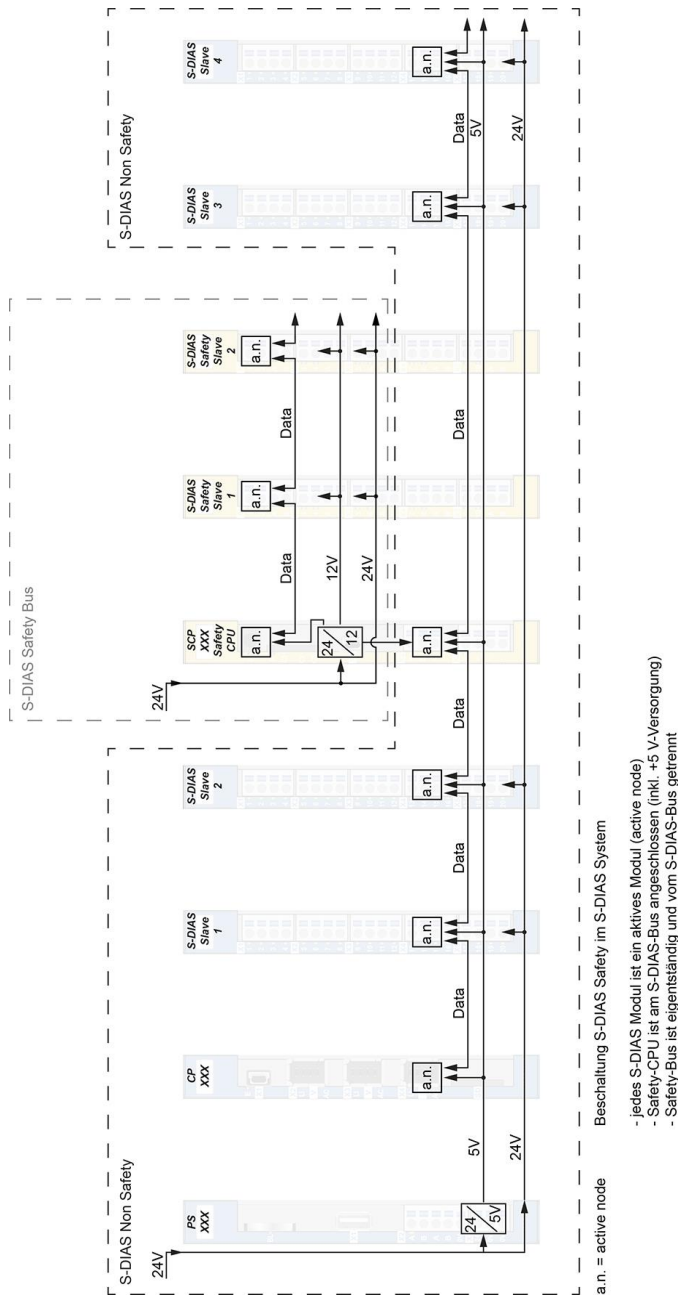
4.3 Electrical Requirements

Power supply +24 V	+24 V DC ±20 % UL: Class 2 or LVLC ⁽¹⁾	
Current consumption of +24 V power supply	the current consumption depends on the connected loads (max. 2.75 A)	
Power supply on the S-DIAS bus	via the EC 121	
Current capacity on the S-DIAS bus (power supply for the modules).	+5 V	+24 V
	maximum 1.6 A	maximum 1.6 A

⁽¹⁾Limited Voltage/Limited Current



The device must be connected to a secondary galvanically separated supply with a rated voltage of 24 V DC. In compliance with UL 249, max 4 A, the fuse must be connected in the area between the supply source and the end device.



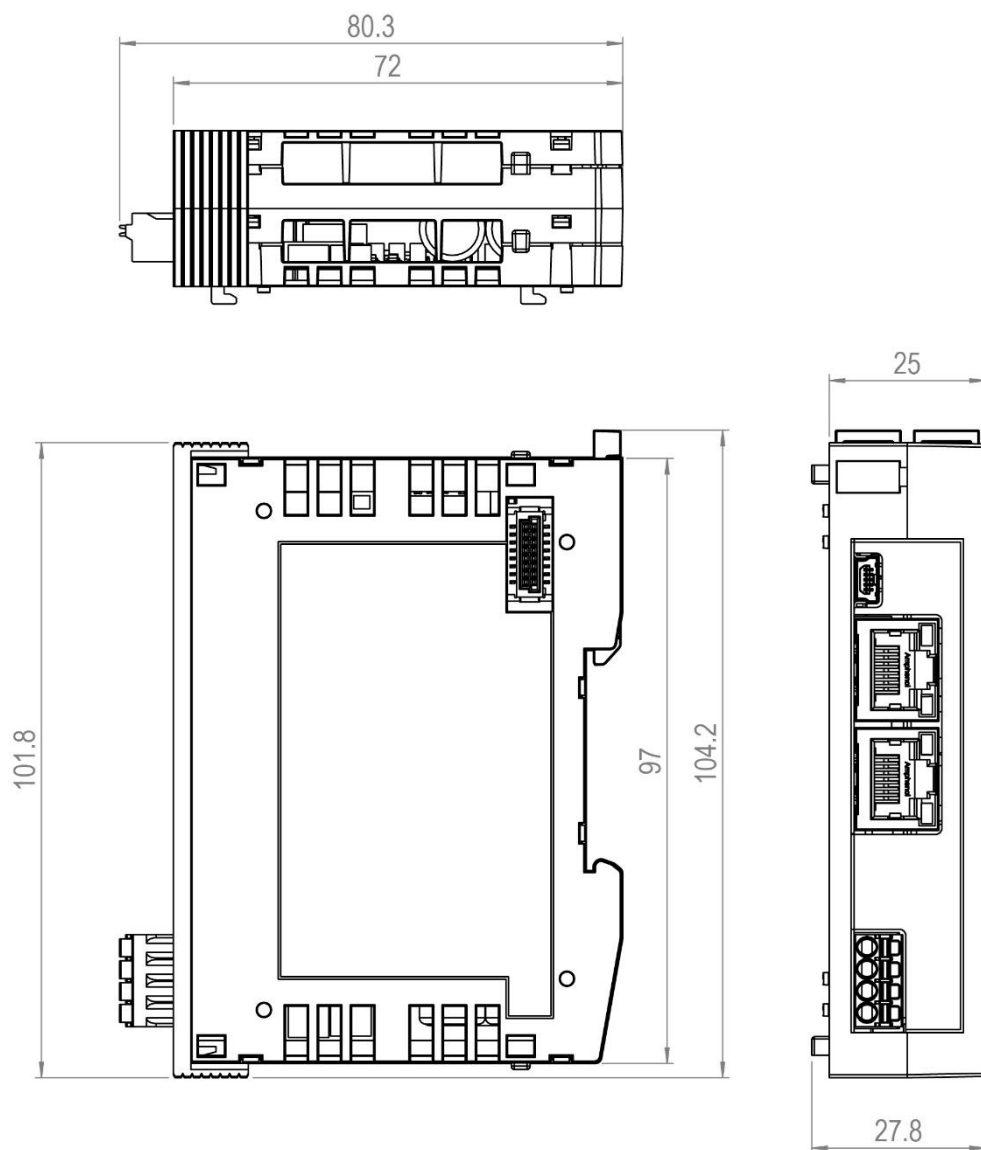
4.4 Environmental Conditions

Storage temperature	-40 ... +85°C	
Environmental temperature	-25 ... +60°C	
Humidity	0-95 %, non-condensing	
Installation altitude above sea level	0-2000 m without derating > 2000 m up to a maximum of 5000 m with derating of the maximum environmental temperature by 0.5 °C per 100 m	
Operating conditions	pollution degree 2	
EMC resistance	in accordance with EN 61000-6-2 (industrial area)	
EMC noise generation	in accordance with EN 61000-6-4 (industrial area)	
Vibration resistance	EN 60068-2-6	5-150 Hz: amplitude 3.5 mm transition frequency: 8.42454 Hz acceleration: 1 g duration: 10 cycles cycle: 1 octave/minute
Shock resistance	EN 60068-2-27	15 g (147.15 m/s ²),
Protection type	EN 60529	IP20

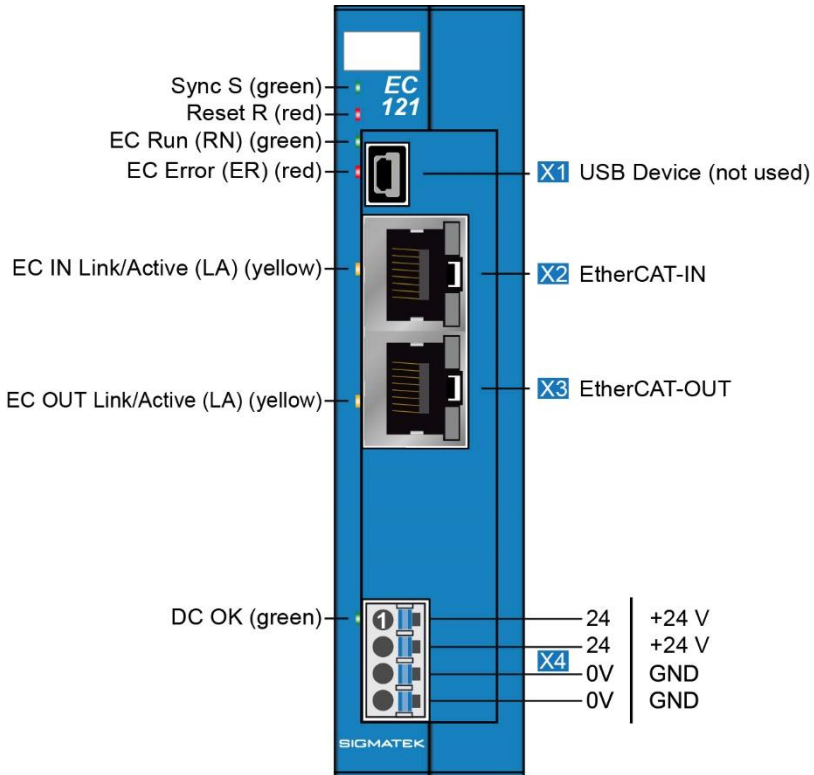
4.5 Miscellaneous

Article number	20-003-121
Hardware version	1.x
Approvals	CE, UL 508 (E247993)

5 Mechanical Dimensions



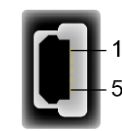
6 Connector Layout



The connections of the +24 V supply (X4: pin 1 and pin 2) or the GND supply (X4: pin 3 and pin 4) are internally bridged. To supply the module, only one connection to a +24 V pin (pin 1 or pin 2) and a GND pin (pin 3 or pin 4) is required. The bridged connections may be used for further looping of the +24 V supply and the GND supply. However, it must be ensured that through looping, a total current of 6 A per connection is not exceeded!

6.1 Connectors

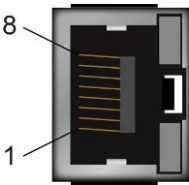
6.1.1 X1: USB-Device 2.0 (not used)



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

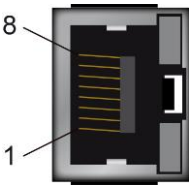
n.c. = do not use

6.1.2 X2: EtherCAT IN (RJ45)



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

6.1.3 X3: EtherCAT OUT (RJ45)



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

6.2 Status LEDs

Sync	green	ON	S-DIAS bus operating synchronously
Reset	red	ON	S-DIAS bus in reset
EC Run	green	ON	Status Operational
		BLINKS FAST	initialization or bootstrap status
		SINGLE FLASH	Status Safe Operational
		FAST BLINKING:	Pre-operational status
		OFF	Init status
EC Error	red	ON	PDI watchdog timeout
		BLINKS FAST	boot error
		DOUBLE FLASH	watchdog process
		SINGLE FLASH	general runtime error
		BLINKS	configuration error
		OFF	No errors
EC IN Link/Active	yellow	ON	connection to the upstream EtherCAT module established without data communication
		BLINKS	connection to the upstream EtherCAT module established with data communication
		OFF	no connection to the upstream EtherCAT module
EC OUT Link/Active	yellow	ON	connection to the downstream EtherCAT module established without data communication
		BLINKS	Connection to the downstream EtherCAT module established with data communication
		OFF	no connection to the downstream EtherCAT module
DC Ok	green	ON	+24 V supply ok
		OFF	+24 V missing or voltage too low

6.3 Applicable Connectors

X1: USB Type Mini-B (not included in delivery)

X2, X3: RJ45 (not included in delivery)

X4 Connectors with spring terminals (included in delivery)

The spring terminals are suitable for the connection of ultrasonically compressed (ultrasonically welded) strands.

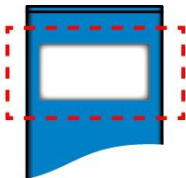
Phoenix connection capacity:

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)



The S-DIAS module CANNOT be connected or disconnected while voltage is applied! Le module S-Dias NE PEUT PAS être inséré ou retiré sous tension.

6.4 Label Field



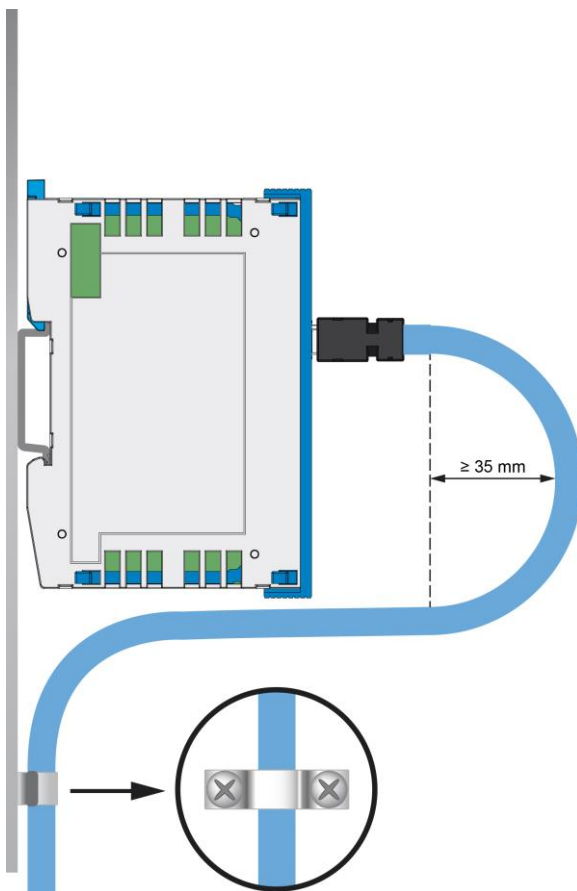
Manufacturer	Weidmüller
Type	MF 10/5 CABUR MC NE WS
Article number Weidmüller	1854510000
Compatible printer	Weidmüller
Type	Printjet Advanced 230V
Article number Weidmüller	1324380000

7 Wiring Instructions



Recommended Shielding Wiring the EtherCAT cables according to EtherCAT Technology Group (ETG).

7.1 Strain Relief



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

No mechanical stress can be applied to the connection!

7.2 Supported S-DIAS Modules

The S-DIAS EtherCAT control module supports the following S-DIAS modules starting from the listed serial numbers.

Module name	Serial number
AI 022	5939502
AI 043	6060705
AI 075	6064879
AI 084	6056902
AI 088	6095866
AI 088-1	5963592
AM 221	6039568
AM 222	6019430
AM 441	6070032
AM 442	6044310
AO 081	6096202
NC 100	6060801
SR 020	6095746
SR 022	6058839
DI 080	5903091
DI 160	6093972
DI 200	6093772
DI 202	6071963
DI 203	6036131
DI 205	5695936
DM 081	5794579
DM 161	6096698
DM 162	6078257
RO 041	5914846
TO 081	6096778
TO 127	6079257
TO 161	6103003

ICA 011	6082482
ICA 012	6096378
SI 021	5898508

8 System Description

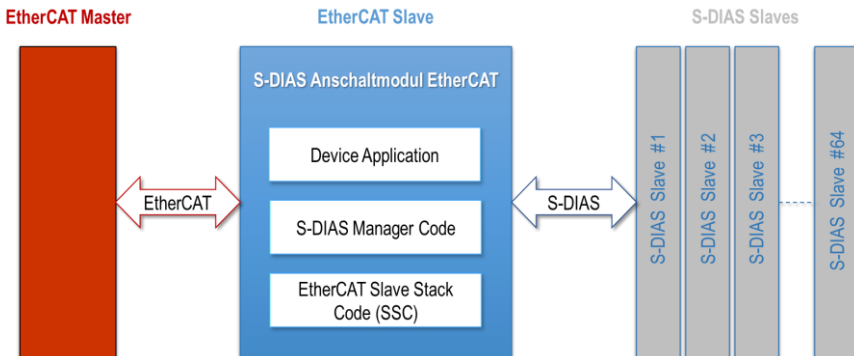
8.1 Architecture

The S-DIAS EtherCAT Control Module functions as an EtherCAT slave and enables communication between an EtherCAT master and selected modules of the S-DIAS control and I/O system. Communication with up to 64 selected S-DIAS participants can be thereby implemented.



The S-DIAS EtherCAT control module supports only S-DIAS modules with a specific FPGA version. S-DIAS modules with an older version are not compatible with the S-DIAS EtherCAT control module. A list of supported modules can be found in chapter 7.2; Supported S-DIAS modules.

The following graphic illustrates the connection of the S-DIAS EtherCAT control module to its corresponding components. The module is designed so that with each EtherCAT master that meets the specifications is compatible and can communicate.



8.2 Initialization

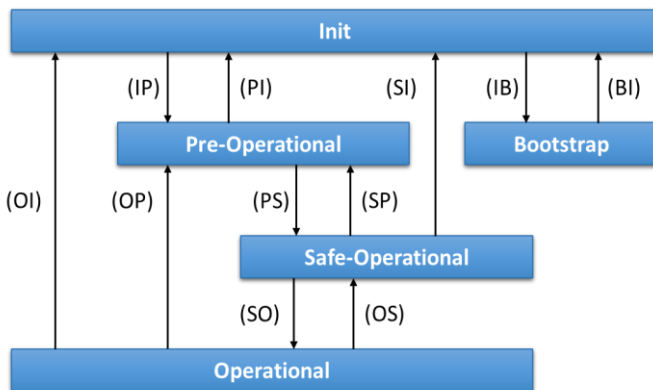
In the EtherCAT protocol different states and state transitions are defined during operation. The S-DIAS control module mirrors these EtherCAT states on the S-DIAS bus or in the S-DIAS slaves.

8.2.1 S-DIAS Manager

1. EC 121 Power-Up
2. The S-DIAS Manager integrated into the EC 121 searches the S-DIAS bus for available modules.
3. Create service and process data configuration for the EtherCAT protocol (for this purpose, info files are required which are stored in the S-DIAS slaves).
4. Generate object list using located S-DIAS modules.
5. S-DIAS initialization is “paused” until the EtherCAT bus changes from the Pre-Operational (PreOp) mode to Safe-Operational (Safe-Op) mode.
6. EtherCAT slave is available on the EtherCAT bus

8.2.2 EtherCAT

The following graphic shows the possible modes and mode transitions on the EtherCAT bus.



8.2.2.1 Init → PreOp

- EtherCAT master reads the ID from the EEPROM.
- Mailbox SyncManager (SM) is configured.
- Distributed Clock (DC) is configured.
- Module status LED on the S-DIAS slaves continue to blink.

8.2.2.2 PreOp → SafeOp

- Module list is read by the EtherCAT master.
- Process data (PDO) SyncManager (SM) are configured.
- Fieldbus Memory Management Units (FMMUs) are configured.
- Process data mapping is written via the master.
- The start-up data written via CoE for the configuration of the S-DIAS modules are accepted.
- S-DIAS bus starts with the process data for the module's inputs.
- EC 121 starts copying the S-DIAS input data with SafeOP status
- After the successful transition to the SafeOp status, the module status LED on the S-DIAS slave lights continuously.

8.2.2.3 SafeOp → Op

- S-DIAS bus starts with the process data for the module outputs.
- S-DIAS EtherCAT control module starts copying the S-DIAS output data with Op mode.
- Module status Led on the S-DIAS slave lights continually

9 Initial Startup

If the system has been configured according to the architecture description and all components have been correctly connected and linked, the S-DIAS EtherCAT interface module can be started with an EtherCAT master.

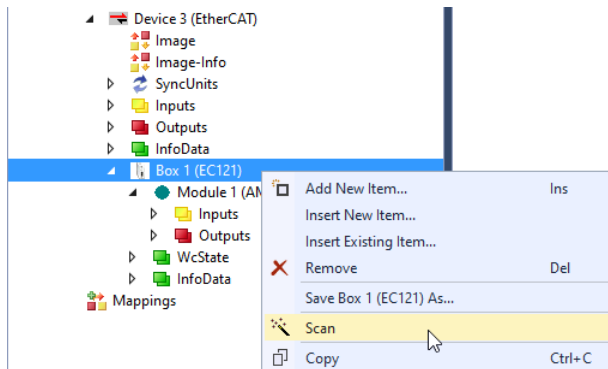


Turn off the voltage supply when you want exchange or replace S-DIAS modules. Otherwise the modules may be destroyed!

For the following example, TwinCAT was selected as the EtherCat bus to demonstrate commissioning the S-DIAS Control Module EtherCAT.

9.1 Automatic S-DIAS Module Configuration

If the assignment of the S-DIAS slave modules should be changed or modules added/removed, the option is available to automatically update the new configuration in the EtherCAT master. This is enabled with a right-click on the Box 1 (EC 121) and the selecting the option Scan. The S-DIAS EtherCAT control module detects the new configuration of the module automatically and lists it correctly.



9.2 Manual S-DIAS Configuration

Alternative to automatically loading the module configuration via the Scan instruction, the user has the option to manually define the module assignment. A double click on Box 1 (EC 121) opens the settings window for the current object. With the *Slots* menu, all 64 of the available module slots can be occupied. A selection of S-DIAS slaves can be found in the module list shown below.

[illegible]

With a restart command in the EtherCAT master, the selected module configuration is enabled. As can be seen in the graphic above, some S-DIAS slaves have special functions such as “Samplepoints” or “Timeoffsets”. For this reason, different variations available for several modules in the EtherCAT system. Whereby specific functions of the module can be used.



Automatic scanning of the S-DIAS slaves always adds the standard variant of the respective S-DIAS module. To use specific functions, the corresponding module must be replaced with the desired variant after an automatic scan.

Each module has a unique module identification number. If the number from the configuration does not match the number of the module in the system (incorrect slot, wrong module etc.) operation is not possible.

9.3 Operating Mode

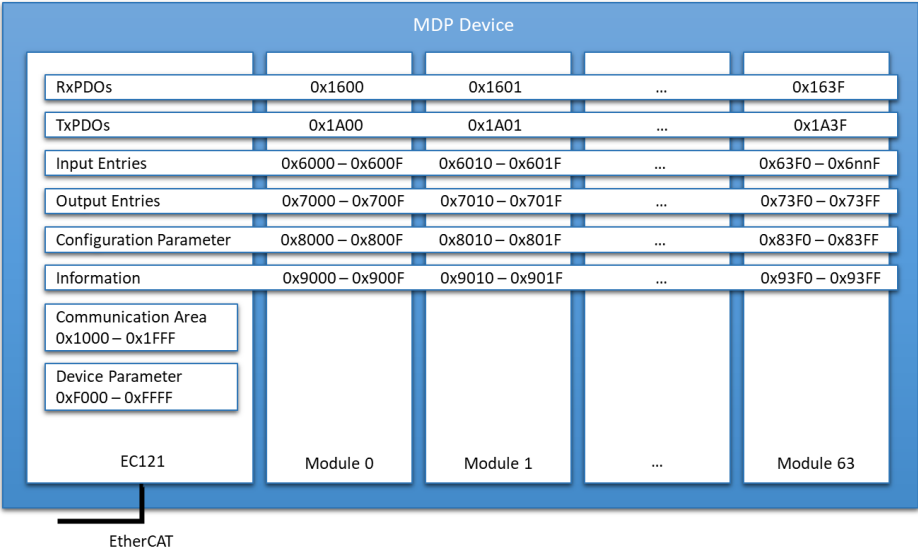
The EC 121 can be operated in either in **DC-Synchronous** or **FreeRun** mode. In FreeRun mode, the EC 121 is not synchronized with EtherCAT. In this case, the module operates with a preset cycle time of 4 ms by default. This cycle time can be set via the object 0xFB10. Further information can be found in section 10.4.20.

In DC-Synchronous mode, the EC 121 uses the distributed clock as a reference and operates with the specified cycle time. Possible cycle times are 250 μ s, 500 μ s and between 1 ms and 32 ms in millisecond intervals. Whether operation is possible with the cycle time setting depends on the cycle times supported by the connected S-DIAS Slaves. This information can be found in the product documentation of the corresponding S-DIAS slave. Otherwise the capacity of the system plays a role – depending on the number and configuration of S-DIAS slaves on the EC 121 – the possible cycle time for proper operation can vary.

10 Object Directory

10.1 Overview

The following graphic shows an overview of the objects in the S-DIAS EtherCAT control module.



10.2 S-DIAS Slave Function Group Assignment

xx = module number 0 – 63 [module at slot 5 → xx = 5]

10.2.1 TxPDO

Index (TxPDO)	Function Group	Index (TxPDO)	Function Group
0x6xx0	Digital Input	0x6xxA	Status
0x6xx1	Analog Input	0x6xxB	Miscellaneous
0x6xx2	Analog Range	0x6xxC	
0x6xx3	Status word	0x6xxD	Error Bits
0x6xx4	Counter / Encoder	0x6xxE	Reference Voltage OK
0x6xx5	PWM Period	0x6xxF	Voltage OK
0x6xx6	Timestamp		
0x6xx7			
0x6xx8			
0x6xx9	Measurement Value		

10.2.2 RxPDO

Index (RxPDO)	Function Group	Index (RxPDO)	Function Group
0x7xx0	Digital Output	0x7xxA	Config
0x7xx1	Analog Output	0x7xxB	Miscellaneous
0x7xx2		0x7xxC	
0x7xx3	Control word	0x7xxD	
0x7xx4	PWM	0x7xxE	
0x7xx5	Time offset	0x7xxF	
0x7xx6			
0x7xx7			
0x7xx8	DriveCmd		
0x7xx9	Command		

10.2.3 CnfSDO

Index (CnfSDO)	Function Group	Index (CnfSDO)	Function Group
0x8xx0		0x8xxA	Config
0x8xx1	LED Control	0x8xxB	Miscellaneous
0x8xx2		0x8xxC	
0x8xx3		0x8xxD	
0x8xx4	PWM	0x8xxE	
0x8xx5	Time offset	0x8xxF	
0x8xx6			
0x8xx7			
0x8xx8	DriveCmd		
0x8xx9	Command		

10.3 EtherCAT Object-Specifications



Detailed information on the object directory for the basic structure of individual objects and the module device profile to use can be found in the corresponding EtherCAT specifications “**Part 1: General MDP Device Model**”, short: **ETG.5001.1 S**, and “**Part 3: MDP Fieldbus Gateway Profile Specifications**”, short: **ETG.5001.3 S**.

10.4 Information on the EC 121 Objects

10.4.1 Object 0x1000 Device Type

The object 0x1000 contains the type and function of the S-DIAS EtherCAT control module. The value 0x00001389 indicates a device with “Modular Device Profile”.

Description	Sub-Index	Description / Value
Name		Device Type
Object code		VAR
Data type	Sub-Index 0x00	UNSIGNED32
Access	Sub-Index 0x00	RO
Default value	Sub-Index 0x00	0x00001389

10.4.2 Object 0x1008 Device Name

The object 0x1008 contains the manufacturer-specific device names of the S-DIAS EtherCAT Control Module.

Description	Sub-Index	Description / Value
Name		Device Name
Object code		VAR
Data type	Sub-Index 0x00	Visible String
Access	Sub-Index 0x00	RO
Default value	Sub-Index 0x00	EC 121

10.4.3 Object 0x1009 Hardware Version

The object 0x1009 contains the hardware version of the EC 121.

Description	Sub-Index	Description / Value
Name		Hardware version
Object code		VAR
Data type	Sub-Index 0x00	Visible String
Access	Sub-Index 0x00	RO
Default value	Sub-Index 0x00	-

10.4.4 Object 0x100A Software Version

The object 0x100A contains the firmware version of the S-DIAS EtherCAT Control Module.

Description	Sub-Index	Description / Value
Name		Software Version
Object code		VAR
Data type	Sub-Index 0x00	Visible String
Access	Sub-Index 0x00	RO
Default value	Sub-Index 0x00	-

10.4.5 Object 0x1018 Identity Object

The 0x1008 contains manufacturer-specific information on the S-DIAS EtherCAT Control Module.

Description	Sub-Index	Description / Value
Name		Identity Object
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub-Index 0x01 to 0x04	UNSIGNED32
Access	Sub-Index 0x00	RO
	Sub-Index 0x01 to 0x04	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Manufacturer ID
	Sub-Index 0x02	Product Code
	Sub-Index 0x03	Revision
	Sub-Index 0x04	Serial number
Default value	Sub-Index 0x00	-
	Sub Index 0x01	0x000088FA
	Sub-Index 0x02	0x04000004
	Sub-Index 0x03	0
	Sub-Index 0x04	0

10.4.6 Object 0x10F1 Error Settings

The object 0x10F1 contains EtherCAT-specific error settings.

Description	Sub-Index	Description / Value
Name		Error Settings
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub Index 0x01	UNSIGNED32
	Sub-Index 0x02	UNSIGNED16
Access	Sub-Index 0x00	RO
	Sub Index 0x01	RW
	Sub-Index 0x02	RW
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Local error reaction
	Sub-Index 0x02	Counter limit for Sync error
Default value	Sub-Index 0x00	-
	Sub Index 0x01	0x00000001
	Sub-Index 0x02	0x0004

10.4.7 Object 0x16xx (RxPDO Mapping) / Object 0x1Axx (TxPDO Mapping)

The objects 0x16xx and 0x1Axx contain the corresponding process data mapping of the connected S-DIAS slaves. The content depends on the module configuration.

10.4.8 Object 0x1C00 Sync Manager Type

The object 0x1C00 contains the type for the individual EtherCAT Sync managers.

Description	Sub-Index	Description / Value
Name		Sync Manager Type
Object code		ARRAY
Data type	Sub-Index 0x00	UNSIGNED8
	Sub-Index 0x01 to 0x04	UNSIGNED8
Access	Sub-Index 0x00	RO
	Sub-Index 0x01 to 0x04	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Sub-Index 001
	Sub-Index 001	Sub index 002
	Sub-Index 0x03	Sub index 003
	Sub-Index 0x04	Sub index 004
Default value	Sub-Index 0x00	-
	Sub Index 0x01	0x02 (Mailbox In)
	Sub-Index 0x02	0x01 (Mailbox Out)
	Sub-Index 0x03	0x04 (Process Data In)
	Sub-Index 0x04	0x03 (Process Data Out)

10.4.9 Object 0x1C12 (RxPDO Assign) / Object 0x1C13 (TxPDO Assign)

The objects 0x1C12 and 0x1C13 contains the process data mapping assignment.

10.4.10 Object 0x1C32/0x1C33 SM Output/Input Parameter

These objects contain the Sync Manager Input or Output parameters.

Description	Sub-Index	Description / Value
Name		SM output/input parameter
Object code		ARRAY
Data type	Sub-Index 0x00	UNSIGNED8
	Sub Index 0x01	UNSIGNED16
	Sub-Index 0x02	UNSIGNED32
	Sub-Index 0x04	UNSIGNED16
	Sub-Index 0x05	UNSIGNED32
	Sub Index 0x06	UNSIGNED32
	Sub-Index 0x08	UNSIGNED16
	Sub-Index 0x09	UNSIGNED32
	Sub-Index 0x0A	UNSIGNED32
	Sub-Index 0x0B	UNSIGNED16
	Sub Index 0x0C	UNSIGNED16
	Sub-Index 0x20	BOOL
Access	Sub-Index 0x00	RO
	Sub Index 0x01	RW
	Sub-Index 0x02	RO
	Sub-Index 0x04	RO
	Sub-Index 0x05	RO
	Sub Index 0x06	RO
	Sub-Index 0x08	RW
	Sub-Index 0x09	RO
	Sub-Index 0x0A	RO
	Sub-Index 0x0B	RO
	Sub Index 0x0C	RO
	Sub-Index 0x20	RO

Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Sync Mode
	Sub-Index 0x02	Cycle Time
	Sub-Index 0x04	Sync modes supported
	Sub-Index 0x05	Minimum cycle time
	Sub Index 0x06	Calc and copy time
	Sub-Index 0x08	Get cycle time
	Sub-Index 0x09	Delay time
	Sub-Index 0x0A	Sync0 cycle time
	Sub-Index 0x0B	Cycle time small
	Sub Index 0x0C	SM event missed counter
	Sub-Index 0x20	Sync error

10.4.11 Object 0xF000 Modular Device Profile

The object 0xF000 contains basic information on the modular device profile used.

Description	Sub-Index	Description / Value
Name		Modular Device Profile
Object code		ARRAY
Data type	Sub-Index 0x00	UNSIGNED8
	Sub Index 0x01	UNSIGNED16
	Sub-Index 0x02	UNSIGNED16
	Sub-Index 0x03	UNSIGNED32
	Sub-Index 0x04	UNSIGNED32
	Sub-Index 0x05	UNSIGNED16
Access	Sub-Index 0x00	RO
	Sub index 0x01 to 0x05	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Module Index Distance
	Sub-Index 0x02	Maximum number of modules
	Sub-Index 0x03	General configuration
	Sub-Index 0x04	General information
	Sub-Index 0x05	Module PDO device group
Default value	Sub-Index 0x00	0x05
	Sub Index 0x01	0x10
	Sub-Index 0x02	0x40
	Sub-Index 0x03	0x00000001
	Sub-Index 0x04	0x00000000
	Sub-Index 0x05	0x0000

10.4.12 Object 0xF030 Configured Module Ident List

The object 0xF030 contains a list of the configured S-DIAS modules with their corresponding module identification number. These are written by the EtherCAT Master when transitioning from INIT to PreOP.

Description	Sub-Index	Description / Value
Name		Configured Module Ident List
Object code		ARRAY
Data type	Sub-Index 0x00	UNSIGNED8
	Sub-Index 0x01 to 0x41	UNSIGNED32
Access	Sub-Index 0x00	RW
	Sub-Index 0x01 to 0x41	RW
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01 to 0x41	Bit 24-0 Module identification number 0 means no module or module not active. Bit 31-25 Operation mode of the corresponding module, usually 0. Values for these objects according to the field "ModuleIdent" from the module specific ESI file.

10.4.13 Object 0xF050 Detected Module Ident List

The object 0xF050 contains a list of detected S-DIAS modules with their corresponding module identification modules.

Description	Sub-Index	Description / Value
Name		Detected Module Ident List
Object code		ARRAY
Data type	Sub-Index 0x00	UNSIGNED8
	Sub Index 0x01 to 0x40	UNSIGNED32
Access	Sub-Index 0x00	RO
	Sub Index 0x01 to 0x40	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01 to 0x40	Module identification number 0xFFFF means, that either no module was detected or a serious error with this module occurred. More information can be found in the module specific status objects and the ErrorInfo object 0xF111.

10.4.14 Object 0xF100 S-DIAS Versions

The object 0xF100 contains information on the S-DIAS manager

Description	Sub-Index	Description / Value
Name		S-DIAS versions
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub-Index 0x01 to 0x02	UNSIGNED32
	Sub-Index 0x03	UNSIGNED8
Access	Sub-Index 0x00	RO
	Sub-Index 0x01 to 0x03	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	S-DIAS Manager Protocol Version
	Sub-Index 0x02	S-DIAS Manager Option Bits
	Sub-Index 0x03	S-DIAS Manager FPGA Version
Default value	Sub-Index 0x00	-
	Sub-Index 0x01 to 0x03	0

10.4.15 Object 0xF101 EC121 Info

The object 0xF101 contains the serial number of the EC 121.

Description	Sub-Index	Description / Value
Name		S-DIAS versions
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub Index 0x01	VISIBLESTRING
Access	Sub-Index 0x00	RO
	Sub Index 0x01	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Serial number
Default value	Sub Index 0x01	0

10.4.16 Object 0xF110 S-DIAS Diagnosis

The object 0xF110 Diagnostics information for the S-DIAS bus.

Description	Sub-Index	Description / Value
Name		S-DIAS Diagnosis
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub Index 0x01	UNSIGNED32
Access	Sub-Index 0x00	RO
	Sub Index 0x01	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Retry Counter
Default value	Sub-Index 0x00	-
	Sub Index 0x01	0

10.4.17 Object 0xF111 ErrorInfo

The object 0xF111 contains information on errors that occurred in the system.

Description	Sub-Index	Description / Value
Name		ErrorInfo
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub-Index 0x01 to 0x07	UNSIGNED32
Access	Sub-Index 0x00	RO
	Sub-Index 0x01 to 0x07	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	ErrorCounter
	Sub-Index 0x02	NewErrorCounter
	Sub-Index 0x03	Last Error
	Sub-Index 0x04	Second Last Error
	Sub-Index 0x05	Third Last Error
	Sub Index 0x06	Fourth Last Error
	Sub-Index 0x07	Fifth Last Error
Default value	Sub-Index 0x00	-
	Sub-Index 0x01 to 0x07	0x00000000

The error information is formed from the 32-bit value as follows.

Byte	Error information	Values:	
0 ... 1	Reason Code	0 ... 65535	
2	Error Code	0 ... 255	
3	Device	0x00 to 0x3F	S-DIAS Slave
		0xFF	EC 121

10.4.17.1 Error Codes

Error Code	Error information
1	The I/O mapping file stored in the FPGA of the slave could not be read
2	The I/O mapping file stored in the FPGA of the slave could not be parsed
3	The S_DIAS slave could not be detected
4	A standard data object could not be created.
5	The Mailbox handler could not be started
6	Error while determining the cycle time
7	Error while setting the cycle time
8	The Input handler could not be started
9	Error stopping the Input handler
10	The Output handler could not be started
11	Error stopping the Output handler
12	Error creating the PDO mapping
13	Copying the Input PDO failed
14	Copying the Output PDO failed
15	Error accessing the SDO in the S-DIAS slave
16	PDO data reading could not be started
17	PDO data reading had to be stopped
18	PDO data writing could not be started
19	PDO data writing had to be stopped
20	A function call during a state transition has failed
21	Parsing of an SDO in the stored I/O mapping file has failed
22	CAN handler must be restarted
23	Function failed
24	Error in task state ISO read
25	Error in task state ISO write
26	S-DIAS task in error
27	Error during Infofile Container setup
28	Error while writing the Infofile Container

29	Reading the type label failed
30	S-DIAS module from non-supported provider
31	Sync mode not supported
32	Invalid serial number

10.4.17.2 Reason Codes

ReasonCode	Error information
1	Cause unknown
2	Insufficient available memory
3	File is unusable
4	S-DIAS bus not ready
5	S-DIAS did not confirm the state transition
6	The S-DIAS module configuration could not be checked
7	State transition request has failed on the S-DIAS side.
8	The master tried to change the data objects of the PDO mapping
9	Configuration inconsistent
10	Error during Mutex request
11	Starting SDO communication failed
12	TimeOut
13	Entry not found
14	Module-specific function failed
15	Handshake from base task
16	PLL
17	Task status
18	SPI error
19	Slave function failed during state transition
20	Incorrect entry in the S-DIAS slave internal mapping file
21	No more copy entries available
22	The transition from ISO-Full to the Read-only task state in the S-DIAS failed.
23	File name too long
24	Invalid checksum
25	Unexpected response from S-DIAS base task

10.4.17.3 EtherCAT Error Codes

The following table shows device-specific EtherCAT Error codes.

AL Status Code	Error information
0x8000	An attempt was made to start the EtherCAT state machine when the S-DIAS bus was not initialized.
0x8001	Call for the slave-specific state transition function failed.
0x8002	The requested state transition was not confirmed by the S-DIAS bus in time.
0x8003	A state transition was active or another was activated during the wait time.
0x8004	Inconsistency between the configured/detected modules and mapping. Check settings or check the module status for fatal errors.
0x8005	Slave-specific function call in OP mode failed.
0x8006	Slave-specific function call in the SafeOP mode failed.
0x8007	Copy function between EtherCAT hardware and EtherCAT data object failed.
0x8008	Copy function between EtherCAT hardware and EtherCAT data object failed.
0x8009	State transition on the S-DIAS bus from Idle to Read-only (similar to SafeOP) failed.
0x800A	State transition on the S-DIAS bus from Read-only (similar to SafeOP) to ISO-Full (similar to OP) failed.
0x800B	SPI Access to the S-DIAS interface failed.
0x800C	Undefined error in the S-DIAS ISO-Full state (similar to OP)
0x800D	State transitions in S-DIAS from ISO-Full (similar to OP) to Read-Only (similar to SafeOP)
0x800E	The S-DIAS main task unexpectedly interrupted the handshake with the S-DIAS Iso task.
0x800F	Time-out while waiting for the PLL interrupt.
0x8010	PLL lost the "locked" status.
0x8011	Unexpected response from S-DIAS base task

10.4.18 Object 0xF120 S-DIAS Statistics

The object 0xF120 contains the statistics data for the S-DIAS bus

Description	Sub-Index	Description / Value
Name		S-DIAS Statistics
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub-Index 0x01 to 0x04	UNSIGNED32
Access	Sub-Index 0x00	RO
	Sub-Index 0x01 & 0x03	RO
	Sub-Index 0x02 & 0x04	RW
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	ISO Write task duration
	Sub-Index 0x02	Maximum ISO Write task duration
	Sub-Index 0x03	ISO Read task duration
	Sub-Index 0x04	Maximum ISO Read task duration
Default value	Sub-Index 0x00	-
	Sub-Index 0x01 to 0x04	0x00000000

10.4.19 Object 0xFB00 Device Control

The object 0xFB00 contains control options for the EC 121

Description	Sub-Index	Description / Value
Name		Device Control
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub Index 0x01	UNSIGNED32
Access	Sub-Index 0x00	RO
	Sub Index 0x01	RW
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Software Restart
Default value	Sub Index 0x01	0x00 (Force Restart = 0x01)

10.4.20 Object 0xFB10 S-DIAS Configuration

The object 0xFB10 contains the configuration options for the S-DIAS bus.

Description	Sub-Index	Description / Value
Name		SDIAS Configuration
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub Index 0x01	UNSIGNED16
	Sub-Index 0x02	UNSIGNED8
Access	Sub-Index 0x00	RO
	Sub Index 0x01	RW
	Sub-Index 0x02	RW
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	SDIAS cycle time in free-run mode
	Sub-Index 0x02	ISO start time from the S-DIAS bus in %
Default value	Sub Index 0x01	4000 µs
	Sub-Index 0x02	50 %

In free-run mode, the S-DIAS bus cycle time can be defined with this object via the sub index 0x01. The default value is 4 ms. So that the cycle time can be set, a start-up command must be set for the state transition *Init to PreOp* or *PreOp to SafeOp*. For the S-DIAS bus, Default cycle times are accepted.

Freerun cycle time [µs]
250
500
1000 ... 32000 (Values are valid in intervals of 1000 µs)

When an invalid cycle time is entered, it is ignored by the EC 121 and the default value of 4 ms is used.

The ISO start time can be defined within a range of **10-90%**.

10.4.21 Object 0x9xx0 [Module Name] Module Information

The object 0x9xx0 contains general information on the respective S-DIAS module.

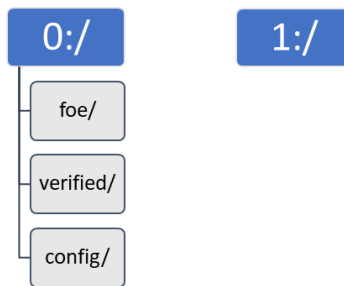
Description	Sub-Index	Description / Value
Name		[Module Name] Module information
Object code		RECORD
Data type	Sub-Index 0x00	UNSIGNED8
	Sub-Index 0x01 to 0x04 & 0x06	UNSIGNED32
	Sub-Index 0x05	Visible String
Access	Sub-Index 0x00	RO
	Sub Index 0x01 to 0x06	RO
Function	Sub-Index 0x00	Number of entries
	Sub Index 0x01	Module Status (0 = Module OK)
	Sub-Index 0x02	Device ID
	Sub-Index 0x03	FPGA version
	Sub-Index 0x04	HW version
	Sub-Index 0x05	Serial number
	Sub Index 0x06	Firmware version
Default value	Sub-Index 0x00	-
	Sub Index 0x01 to 0x06	0x00000000

11 File Handling (FoE)

The File Over EtherCAT (FoE) function is available in the S-DIAS EtherCAT Control Module in BOOTSTRAP mode only and is used to exchange files between the EtherCAT master and EC 121.

11.1 File system

The S-DIAS EtherCAT Control Module contains its own file system in which files are stored. The file system is structured as follows:



There are two drives. On drive 0:/ all files exchanged via FoE are processed. Drive 1:/ serves as the storage location for a “Golden Image” of the firmware. If a firmware update of the EC 121 fails, the golden image stored on drive 1:/ is loaded and displayed as such in the EtherCAT master. The following files can be exchanged between the EtherCAT and the EC 121:

Update files received via FoE are first stored in the foe/ folder. As soon as a file is verified, it is moved to the verified/ folder. Otherwise, it is deleted. After the system is restarted, the verified/ folder is searched and updates are performed. After an update, regardless of whether successful or failed, all files are deleted from the verified/ folder.

If the file received is an update configuration file, it is moved to the config/ folder and deleted after the update process is completed. With this configuration file, you have the option to include or exclude targeted S-DIAS slaves in defined slots during the update. Detailed information can be found in section 12.1.

The following table provides an overview of the drives and directories in the file system and which files are stored at the respective location.

Drive	Folder	File Type
0:/	Root directory	Storage location for the log file
	foe/	Storage location for received files
	verified/	Storage location for verified files
	config/	Storage location for update configuration files
1:/	Root directory	Golden image of the EC 121 firmware

The following table shows an overview of the files that can be exchanged between the EtherCAT master and the EC 121.

File Transfer Direction	File Type
EtherCAT Master → EC 121	Update file (EC 121 FW / FPGA, S-DIAS Slave FW / FPGA)
	Update configuration file (relevant only for S-DIAS slave updates)
EC 121 → EtherCAT Master	Logfile (Log for the update process)
	Listfile (List of files stored in the verified/ folder)

11.2 FoE Password

The file exchange between the EtherCAT master and S-DIAS ETHERCAT control module is password-protected. When down- as well as uploading a file, the correct password must be entered. The password is a 32-bit hexadecimal value defined for the EC 121 as follows:

FoE Password	0x5CD26BF1
--------------	------------

11.3 File Names

Files transferred to the S-DIAS EtherCAT control module via FoE are subject to a name check. Directory traversal characters ("I", "V", ":") are not allowed in the file name or are not accepted by the EC 121. The number of characters in the file name is limited to a **maximum of 20 characters**. The name of the files provided by SIGMATEK **cannot be changed** when downloading to the EC 121.

11.4 File Validation

The S-DIAS EtherCAT Control Module has a system for validating update files. Only update files created specifically for the EC 121 can be validated and stored in the verified folder for updates.



The update files for all update targets must be signed and provided by the manufacturer. The S-DIAS EtherCAT control module only accepts update files signed by the manufacturer.

Update configuration files must do not have to be signed by the manufacturer for the EC 121 to classify them as valid. To be accepted by the EC 121, the configuration file must have the file name "Config" and a specific format, which is described in the next chapter.

11.5 List Function

To retrieve a list of files in the verified folder, the file name "ls" (as with CLI) must be specified. The S-DIAS EtherCAT Control Module thereby recognizes that the user is requesting a list of the files stored in the verified folder. If no files are stored in the verified folder, this list is empty.

11.6 Logfile

The logfile in the S-DIAS EtherCAT Control Module is used to log information on the file exchange over FoE and the update process. Information on the write/delete processes, data validation, installation and update process is recorded.

The number of log entries is limited to 50. After the last entry, the log file is restarted from the beginning. Whereby after the newest entry, a space follows to quickly identify it.

Example for Log file entries

```
verified/AI_075_FW write
verified/AI_075_FW starting slave FW update for 3ef01
verified/AI_075_FW update successful 103ef01
verified/AI_075_FW delete
```

In this example, a firmware update file was transferred via FoE, verified and moved to the verified/ folder. After a power cycle, the update for the S-DIAS slave with the module ID 0x03EF at slot 1 was started and successfully run after one attempt. The update file was then deleted from the file system.

11.6.1 S-DIAS Slave ID Display

Possible display of the module ID: *BBBBCC* or *AABBBBCC*

Place holder	Description	Value range
AA	The number of update attempts	Maximum 3 tries
BBBB	Device ID	0x03E8 to 0x1F3F
CC	Module number	Slot of the S-DIAS slave

12 Update Process

The S-DIAS EtherCAT Control Module can update its own firmware, as well as its own FPGA. In addition, the EC 121 provides the option to update the firmware and FPGA of the connected S-DIAS modules.

To update a device, the update file for the target device must be transferred to the file system of the EC 121 via FoE. It is possible to store multiple update files in the file system. In this case, the EC 121 processes the updated sequentially.

After turning the voltage supply on and off, the content of the verified folder is searched for update files. If a file is found and the update target is available, the process is started. As long as the update is running, communication with the EtherCAT master is not possible. During this time, the EC IN LED is inactive. If the update process is completed, the connection to the EtherCAT master is made and the EC IN LED indicates a link.



The update process can, depending on the number of update files, take several minutes. During this time, do not turn of the voltage supply and try not to interrupt the process.

To retrieve information on the results of the update process, the option is available to compare the target device version before and after the update or output the corresponding log file via FoE.

The EC 121 is theoretically designed to resume operation after the update process. It is highly recommended however, to perform a power cycle after a successful update to ensure proper operation.

After updating the EC 121 FPGA, a power cycle **must** be performed. Otherwise communication with the EtherCAT master is affected.

Update files have a file header in which a module ID is entered that determines the update target. If the update target is an S-DIAS **slave** that occurs **several times in the configuration**, then each of the slaves is updated **based on this single update file**. With the existence of multiple identical modules, a configuration file can be used to select specific modules for the update.

12.1 Configuration File

The configuration file is used to update S-DIAS slaves in specified slots. If the EC 121 identifies the configuration file as such, it is moved to the config folder. So that the configuration file is used during the update process, it must be stored in the file system together with the desired update file via FoE before the power cycle. After the update process is completed, the configuration and update files are deleted.

The configuration file is a conventional text file in which the target devices to update can be defined. During the update, the availability of a configuration file is checked during the search for update files and whether it defines the modules to update. IF there are no explicit configuration files for the update file, or no configuration file exists, all modules that match the header of the update file are then updated.

The configuration file must have the file name “config” and the following format per entry or line to be verified by the EC 121 as a configuration file:

DeviceID-TargetDevice-Option-ModuleSelection

Parameters	Value	Description
DeviceID	1000 ... 7999	Manufacturer-specific identification number of the S-DIAS slave
TargetDevice	2	Configuration for the update file with the target FW
	3	Configuration for the update file with the target CPLD
	4	Configuration for the update file with the target FPGA
Option	INC	Include selection from ModuleSelection for update
	EXC	Exclude selection from ModuleSelection from the update.
ModuleSelection	0xffffffff FFFFFFFF	Possible S-DIAS slave slots displayed as 64-bit value (Bit 0 = Module Slot 1 Bit 63 = Module Slot 64)

The individual parameters are separated with a character (hyphen). The *DeviceID* parameter indicates to which S-DIAS slave the configuration should apply and via the *TargetDevice* parameter, for which update destination the configuration is valid. The parameter *Option* determines whether the selection made in the following parameter should be included or excluded from the update. *ModuleSelection* displays the maximum configurable order of the system in the form of a 64-bit hexadecimal value – each bit corresponds to a slave module.

Example for configuration file entries:

- 64 S-DIAS slaves are connected to the EC 121
- In module slots 1 -32, S-DIAS slaves with the DeviceID = 1026 are connected
- In module slots 33-64, S-DIAS slaves with the DeviceID = 1016 are connected
- A firmware update should be run for the first 4 (1, 2, 3, 4) and the last 4 (61, 62, 63, 64) module slots.

The configuration could then appear as follows:

```
1026-2-INC-0x000000000000000F  
1016-2-EXC-0x0FFFFFFFFFFFFFFF
```

The configurations are entered by line for the corresponding S-DIAS slave or target device. If the parameters from the configuration file do not match the specification, the module is not updated and a log entry is created. As soon as all updates are complete and there are no more update files in the verified folder, the configuration file is deleted.

12.2 Providing Update Files

As previously mentioned in section 11.4, the EC 121 does not accept default update images. The update images must contain a special header and a signature. The header and signature can only be added to the file by SIGMATEK.



For each update type (EC 121 Firmware, EC 121 FPGA, Slave Firmware, Slave CPLD/FPGA), the corresponding update image must be requested from and/or provided by SIGMATEK.

13 Transport/Storage



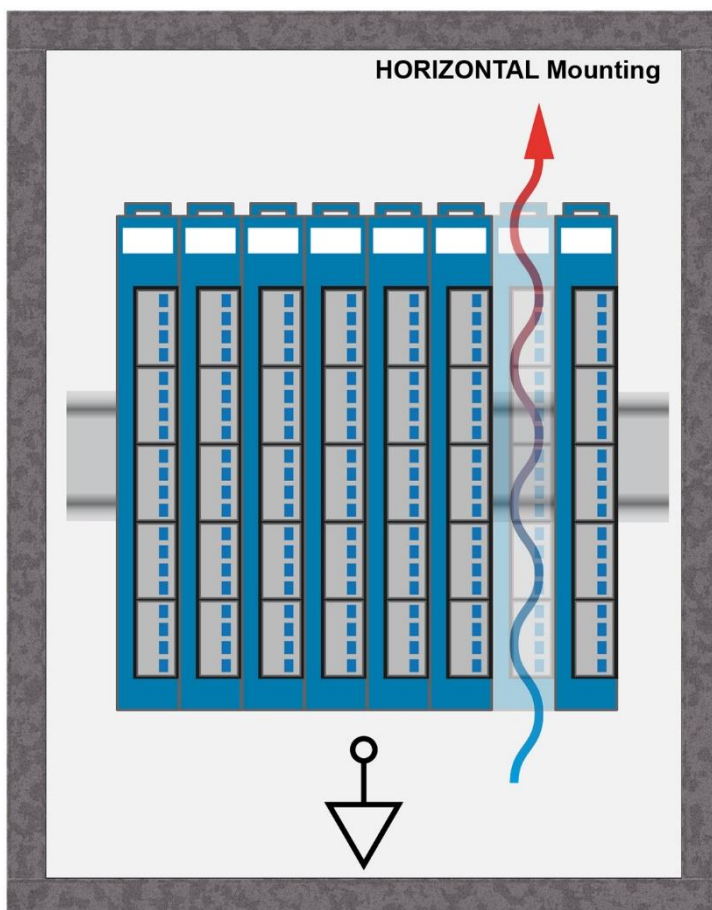
This device contains sensitive electronics. During transport and storage, high mechanical stress must therefore be avoided.

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

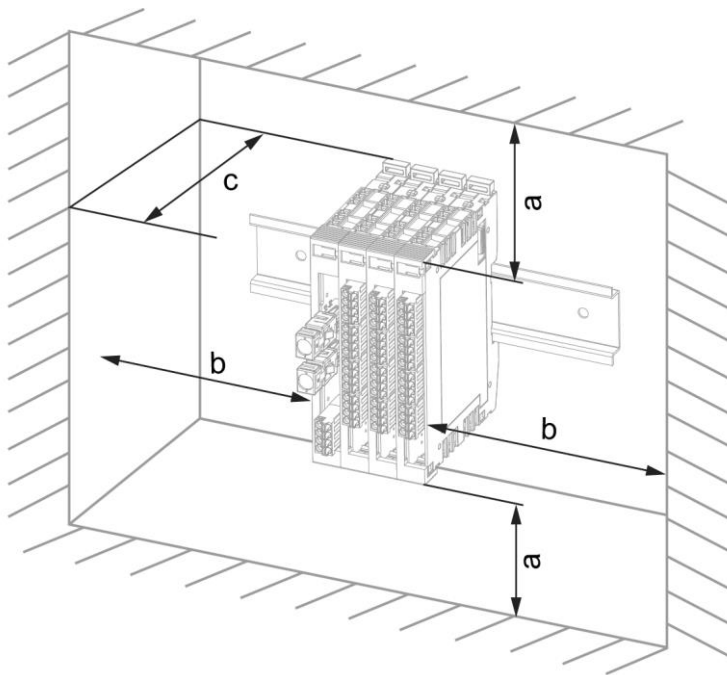
During transport, temperature and humidity fluctuations may occur. Ensure that no moisture condenses within or on the device.

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



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



a	b	c
30 mm (1.18")	30 mm (1.18")	100 mm (3.94")

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

15 Maintenance



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

15.1 Service

This product was constructed for low-maintenance operation.

15.2 Repair



When sent for repair, the panel 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.

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

16 Disposal



When disposing of the panel, the national electronic scrap regulation must be observed.

The panel cannot be discarded with domestic waste.



Documentation Changes

Change date	Affected page(s)	Chapter	Note
12.05.2020	12	4.3 Electrical requirements	UL info added
	14	4.4 Environmental Conditions	Environmental temperature changed to +60 °C
28.05.2020	21	7.2 Supported S-DIAS Modules	Serial number added
	57	11.3 File Names	Expansion added
02.07.2020	14	4.5 Miscellaneous	UL in preparation changed to 508 (E247993)
30.09.2020	23	7.2 Supported S-DIAS Modules	In table "SCP 011 independent" removed
04.11.2020	63	14 Mounting	Expansion functional ground connection
17.11.2020		10.4 Information on the EC 121 Objects	Description more precise