FC 021

S-DIAS Counter Input Module

Instruction instructions

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Translation of the Original Instructions

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S-DIAS Counter Input Module FC 021

with 2 digital RS422 inputs with counter function

2 digital TTL inputs with counter function, galvanically separate

2 digital HTL inputs with counter function, galvanically separate

The S-DIAS counter input module FC 021 has 2 digital RS422 inputs, 2 digital TTL inputs and 2 digital HTL inputs. The module provides the option to configure 2 counter inputs or one incremental encoder input. The RS422, TTL or HTL inputs can thereby be optionally used for the counter function. Parallel to the inputs, the module also provides the actual status of all digital inputs (2x RS422, 2x TTL and 2x HTL). The TTL and HTL inputs are galvanically separated on the S-DIAS bus. The sensor supply connected to X3 is also galvanically separated on the S-DIAS bus and is available at both connectors X1 and X2.

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1 Introduction

1.1 Target Group/Purpose of this Operating Manual

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

This operating manual is intended for:

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

General knowledge of automation technology is required.

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

Our support team is happily available to answer your questions.
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 FC 021

2 Basic Safety Directives

2.1 Symbols Used

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

DANGER

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

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

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

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

WARNING

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

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

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

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

CAUTION

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

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

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

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

INFORMATION

Information

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

2.2 Disclaimer

INFORMATION

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

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

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

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

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

2.3 General Safety Directives

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

INFORMATION

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

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

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

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

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

CAUTION

Handle the device with care and do not drop or let fall.

Prevent foreign bodies and fluids from entering the device.

The device must not be opened!

Manipulez l'appareil avec précaution et ne le laissez pas tomber.

Empêchez les corps étrangers et les liquides de pénétrer dans l'appareil.

L'appareil ne doit pas être ouvert!

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

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

The module complies with EN 61131-2.

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

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

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

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

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

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 FC 021 conforms to the following European directives:

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

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

4 Type Plate

Exemplary nameplate (symbol image)

HW: Hardware version
SW: Software version

5 Technical Data

5.1 RS 422 Digital Input Specifications

Number of channels	2
Input signals	RS422 signal (inputs: 330 Ω bus termination, 1.2 kΩ spread each against 5 volts and ground)
Input delay	0.025 µs
Input frequency	maximum of 5 MHz in normal counter mode or in incremental counter mode with 4-edge analysis
Counter frequency	5 MHz in normal counter mode 20 MHz in incremental counter mode with 4-edge analysis
Galvanic isolation	no
Common mode range	-5 ... +10 V
Status LEDs	yes

5.2 HTL Digital Input Specifications

Number	2	
Input voltage	typically +24 V	maximum +30 V
Signal level	low: < +8 V	high: > +14 V
Switching threshold	typically +11 V	
Input current	3.7 mA at +24 V	
Input delay	10 µs	
Input frequency	maximum of 25 kHz in normal counter mode or in incremental counter mode with 4-edge analysis	
Counter frequency	25 kHz in normal counter mode 100 kHz in incremental counter mode with 4-edge analysis	
Galvanic isolation	yes (isolation voltage 125 V)	

5.3 TTL Digital Input Specifications

Number	2	
Input voltage	typically 5.0 V	maximum 5.5 V
Signal level	low 0.8 V	high 2.0 V
Switching threshold	typically 1.4 V	
Input current	1.5 mA at +5 V	
Input delay	typically 1 µs	
Input frequency	maximum of 125 kHz in normal counter mode or in incremental counter mode with 4-edge analysis	
Counter frequency	125 kHz in normal counter mode maximum 500 kHz in incremental counter mode with 4-edge analysis	
Galvanic isolation	yes (isolation voltage 125 V)	
Status LEDs	yes	

5.4 Counter Mode Specifications

Signal analysis	Period measurement falling/falling edges, Period measurement rising/rising edges, Time measurement falling -> rising edge Time measurement rising -> falling edge	
Counter resolution	32-bit	
Internal counter frequency	100 MHz	
Frequency precision	Frequency stability ±25 ppm, aging: ±3 ppm p.a.	
Prescaler	Configurable via software, 16-bit	
Input filter	Can be configured or deactivated via software, 12-bit (0-32.76 ms in 8-µs stages)	
Configuration	Up/Down Enable Load Edge Counter source	via software via software via software via software via software
Reference counter	Internal counter with programmable prescaler. If the counter of the respective channel is raised, the reference counter is saved.	

5.5 Incremental Encoder Specifications

Signal analysis	1-/2-/4x edge analysis	
Counter resolution	32-bit	
Input filter	Can be configured or deactivated via software, 12-bit (0-32.76 ms in 8-µs stages)	
Configuration	Up/Down	via software
	Enable	via software
	Load	via software
	Edge	via software
	Counter source	via software

5.6 Electrical Requirements

External supply voltage	4.75-30 V DC	
External current consumption Supply voltage[1]	corresponds to the load on the digital outputs + outgoing 24 V supply Maximum: 6 A	
Galvanic separation of external supply voltage	yes (isolation voltage 125 V)	
Voltage supply from the S-DIAS bus	+24 V	
Current consumption on the S-DIAS bus (+24 V supply)	typically 15 mA	maximum 20 mA
Voltage supply from the S-DIAS bus	+5 V	
Current consumption on the S-DIAS bus (+5 V supply)	typically 55 mA	maximum 65 mA
Current consumption of sensor supply	dependent on connected loads. However, maximum is 6 A	

[1] The outgoing sensor supply for X1, X2 are fed via the power supply X3. Due to space requirements, there is no fuse in the module. The U+ / U- supply connections are designed for a maximum current of 6 A. The supply therefore requires an external fuse with a maximum rating of 6 A.

INFORMATION

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

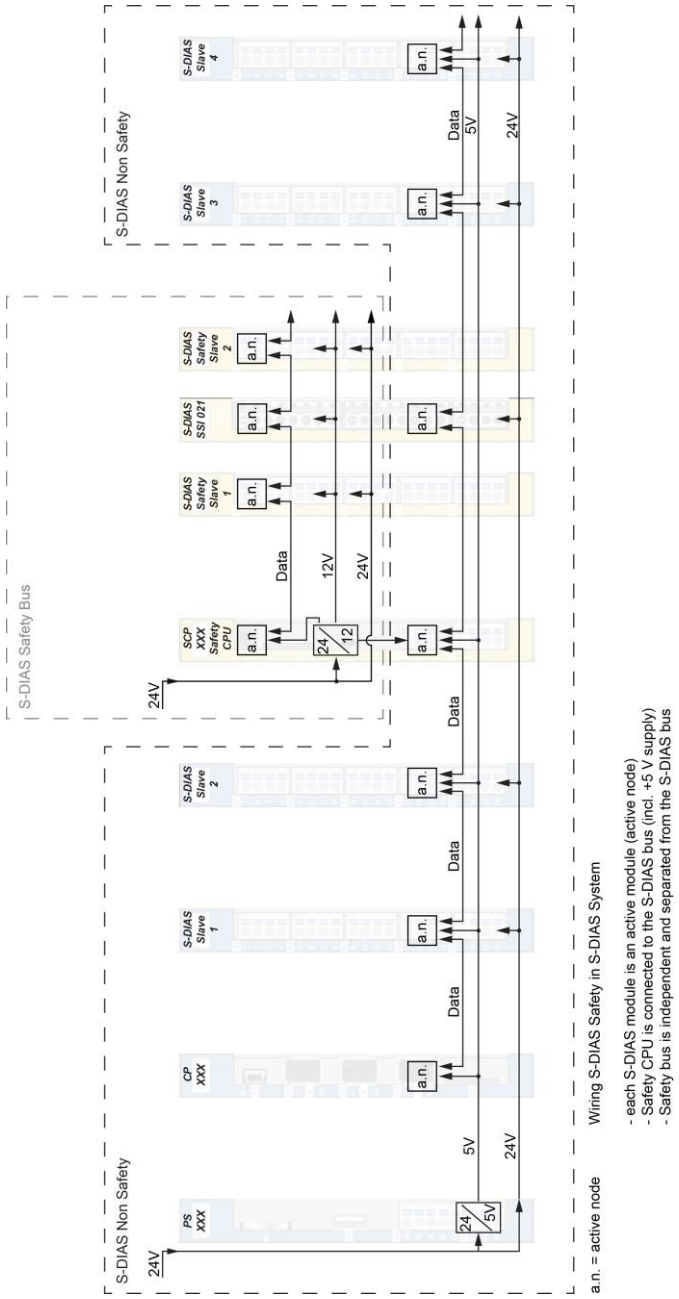
The total current of the +24 V supply cannot exceed 1.6 A!

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

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

5.7 Voltage Monitor

Power supply +24 V	Supply voltage > 18 V (+24 V DC OK-LED lights green)
Power supply +5 V	Supply voltage > 4.75 V (+5 V DC OK-LED lights green)


S-DIAS Non Safety
S-DIAS Safety Bus
S-DIAS Non Safety
24V
PS XXX
CP XXX
S-DIAS Slave 1
S-DIAS Slave 2
SCP XXX Safety CPU
S-DIAS Safety Slave 1
S-DIAS SSI 021
S-DIAS Safety Slave 2
S-DIAS Slave 3
S-DIAS Slave 4
a.n.
Data
5V
12V
24V
24/5V
24/12
a.n. = active node
Wiring S-DIAS Safety in S-DIAS System
- each S-DIAS module is an active module (active node)
- Safety CPU is connected to the S-DIAS bus (incl. +5 V supply)
- Safety bus is independent and separated from the S-DIAS bus

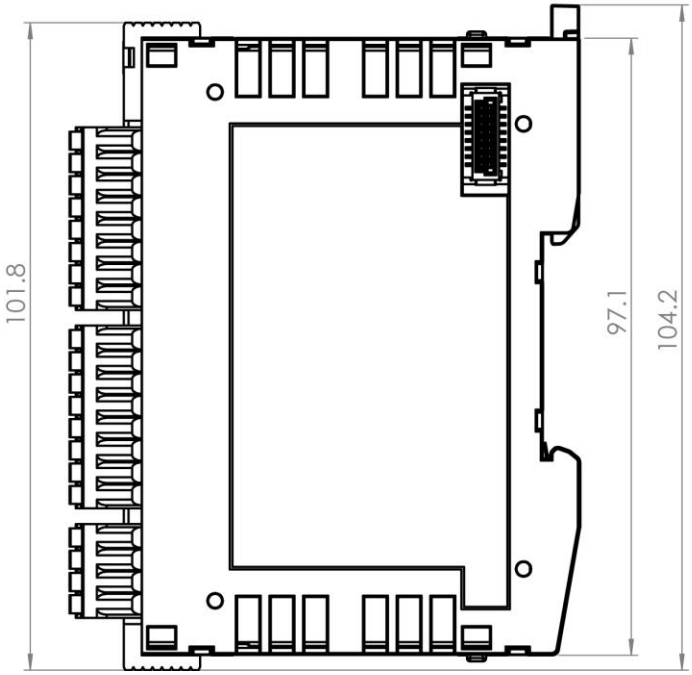
5.8 Environmental Conditions

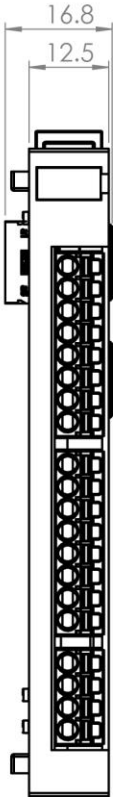
Storage temperature	-20 ... +85 °C	
Environmental temperature	0 ... +60 °C	
Humidity	0-95 %, non-condensing	
Installation altitude above sea level	0-2000 m without derating > 2000 m up to a maximum of 5000 m with derating of the maximum environmental temperature by 0.5 °C per 100 m	
Operating conditions	pollution degree 2	
EMC resistance	in accordance with EN 61000-6-2 (industrial area)	
EMC noise generation	in accordance with EN 61000-6-4 (industrial area)	
Vibration resistance	EN 60068-2-6	3.5 mm from 5-8.4 Hz 1 g from 8.4-150 Hz
Shock resistance	EN 60068-2-27	15 g
Protection type	EN 60529	IP20

5.9 Miscellaneous

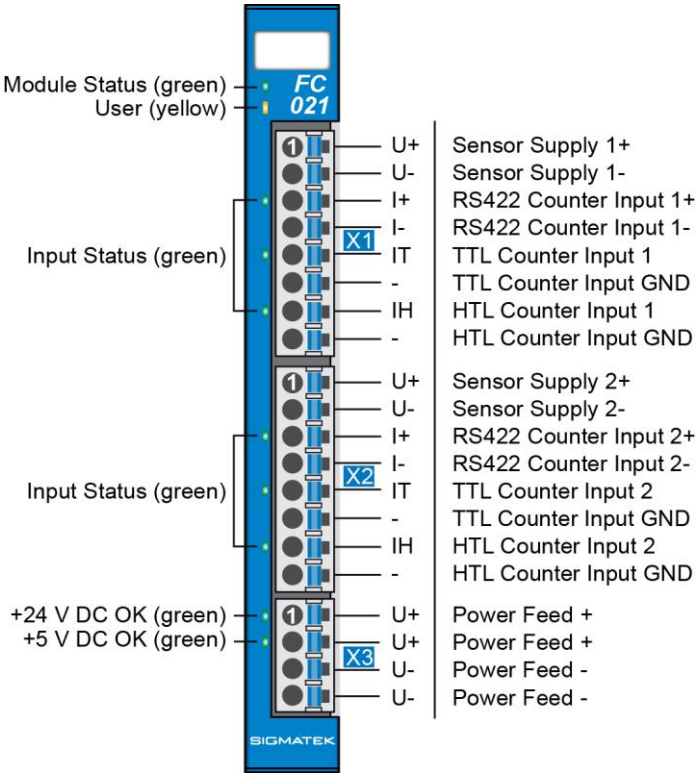
Article number	20-016-021
Standard	in preparation
Approbations	in preparation

6 Mechanical Dimensions





7 Connector Layout



INFORMATION

The sensor supplies 1 and 2 are connected directly to the power supply and do not have internal fuses.
The total current cannot exceed 6 A!
The appropriate protection must be provided externally!

7.1 Status LEDs

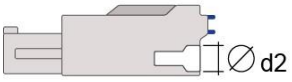
Module Status	green	ON	module active
		OFF	no supply available
		BLINKING (5 Hz)	no communication
User	yellow	ON	can be set from the application (e.g. the module LED can be set to blinking through the visualization so that the module is easily found in the control cabinet)
		OFF	
		BLINKING (2 Hz)	
		BLINKING (4 Hz)	
Input Status	green	ON	input on
		OFF	input OFF
+24 V DC OK	green	ON	Supply powered with +24 V
		OFF	Supply not powered
+5 V DC OK	green	ON	Supply powered with +5 V or +24 V
		OFF	Supply not powered

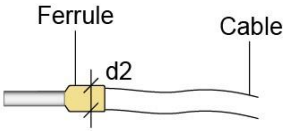
7.2 Applicable Connectors

Connectors:
X1-X3: Connectors with spring terminals (included in delivery)
The spring terminals are suitable connecting ultrasonically compacted (ultrasonically welded) strands.

Connections:

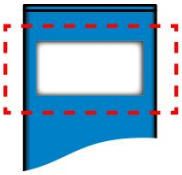
Stripping length/Sleeve length:	10 mm
Mating direction:	parallel to the conductor axis or circuit board
Conductor cross section rigid:	0.2-1.5 mm^2
Conductor cross section flexible:	0.2-1.5 mm^2
Conductor cross section ultrasonically compacted:	0.2-1.5 mm^2
Conductor cross section AWG/kcmil:	24-16
Conductor 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

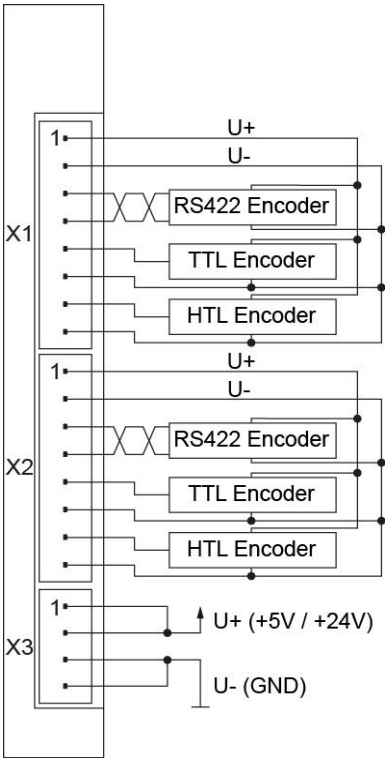
7.3 Label Field



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

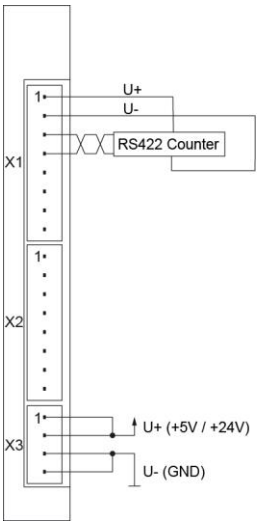
8 Wiring

8.1 Wiring Example

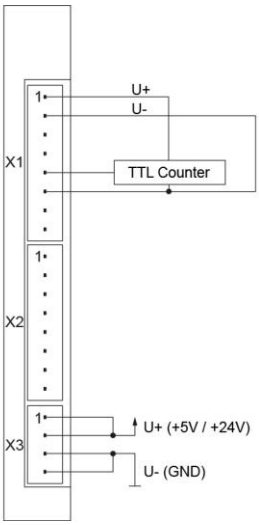


8.2 Connection examples counter inputs

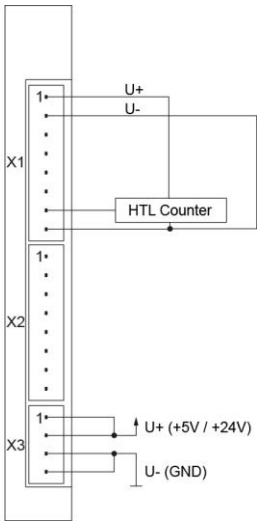
RS422



TTL

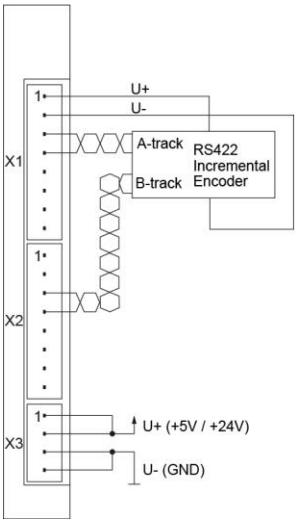


HTL

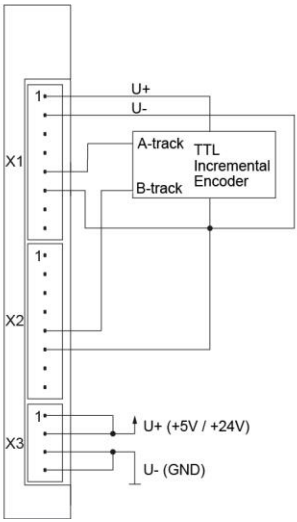


8.3 Connection examples incremental encoder input

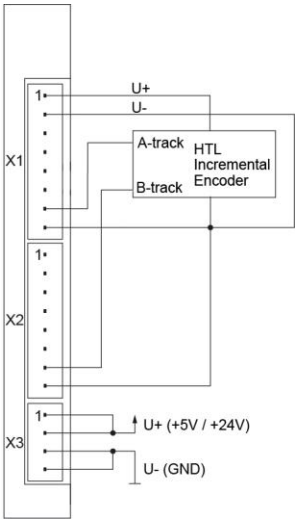
RS422



TTL



HTL



8.4 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
- To wire the RS422 and TTL encoder, shielded cables must be used. With the RS422 encoder, the use of shielded, twisted pair cables is recommended. The shield must be placed as close as possible before the module.

INFORMATION

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

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

9 Assembly/Installation

9.1 Check Contents of Delivery

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

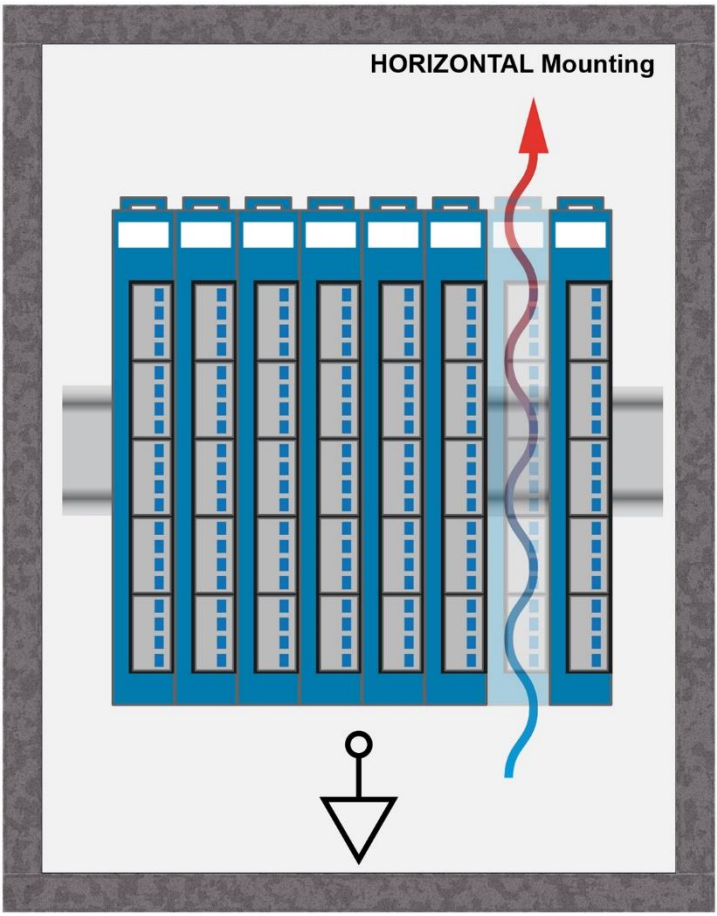
INFORMATION

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

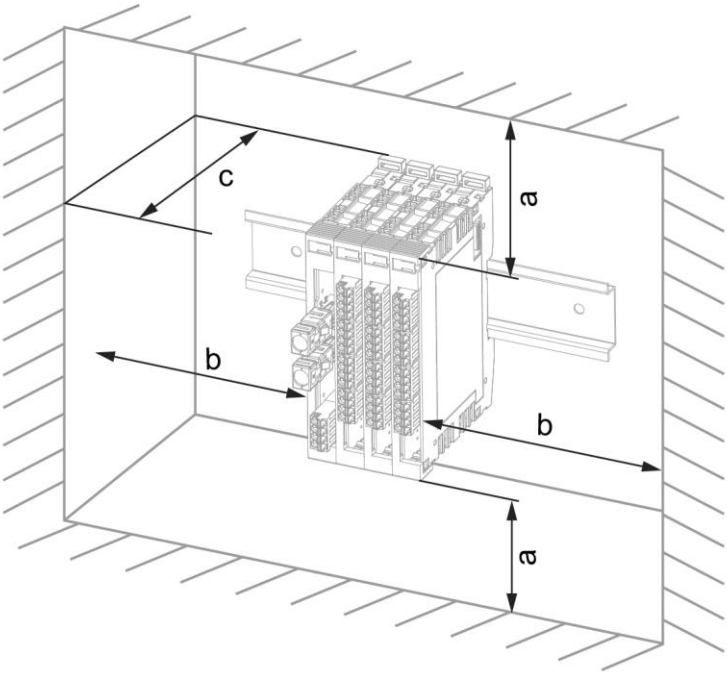
Damaged components can disrupt or damage the system.

9.2 Mounting

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



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



a	b	c
30 mm (1.18″)	**30 mm** (1.18″)	**100 mm** (3.94″)

a, b, c … distances in mm (inches)

10 Description of the Counters

Five modes for configuring the counters are available:

1. Period measurement for slow signals
2. Pulse Width Measurement
3. Period Measurement for "Fast" Signals (gate-time measurement)
4. Universal counter (pulse counter)
5. Incremental encoder function

10.1 Period Measurement for "Slow" Signals

In the channel configuration tab, the counter mode (default setting) is selected and in the counter configuration tab, the count direction UP as well as the internal frequency and edge detection are chosen. The latter allows the period to be measured using a rising or falling edge as a reference point. The difference is in the last detected edge (rising or falling) stored as reference point, which is for example, relevant for measuring the phase comparison between multiple channels. Measuring is started by setting the enable bit in the channel and the reference counter registers.

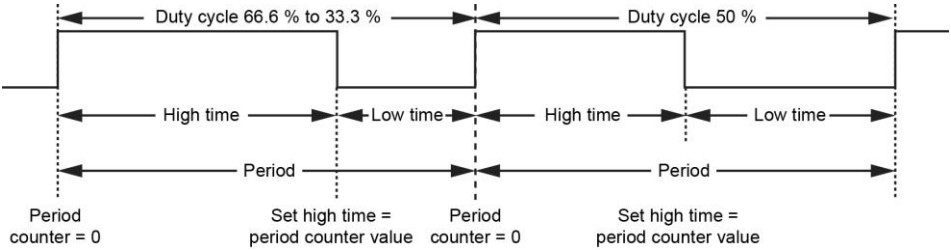
The measurement results are provided in the counter register of the channel as a 32-bit value with a resolution of 10 ns (time base 100 MHz). If the load value of the counter is set to the (Default) value 0, it must be ensured that the counter value is increased by 1 for calculation of the period and signal frequency in the software!

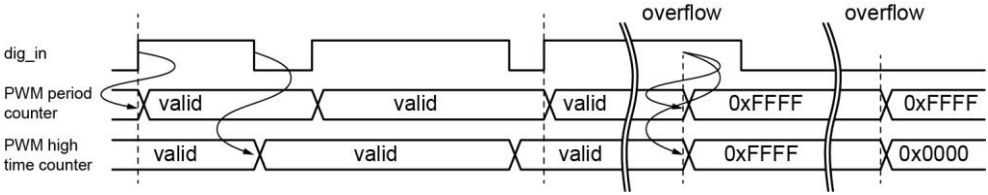
In addition to the relevance for measuring phase comparisons, the extra counter value reference stored in each channel (also a 32-bit value with a 10-ns resolution (100 MHz time base)) also gives information on the availability of new measurement values.

10.2 Pulse Width Measurement

In the channel configuration tab, the counter mode (default setting) is selected and in the counter configuration tab, the count direction UP as well as the internal frequency and edge detection are chosen. The latter allows the time measurement of the high or low section of a square wave signal. The stored reference time, which is relevant for measuring the phase comparison between multiple channels, is the last measured rising edge for the low section or the falling edge for the high section. Measuring is started by setting the enable bit in the channel and the reference counter registers.

The measurement results are provided in the counter register of the channel as a 32-bit value with a resolution of 10 ns (time base 100 MHz). If the load value of the counter is set to the (Default) value 0, it must be ensured that the counter value is increased by 1 for calculation of the high and low periods in the software! In addition to the relevance for measuring phase comparisons, the extra counter value reference stored in each channel (also a 32-bit value with a 20-ns resolution (50 MHz time base)) also gives information on the availability of new measurement values.





10.3 Period Measurement for "Fast" Signals

The period and frequency measurements for fast signals are based on a gate time measurement (average of the counted signal pulses divided by the measurement time). In the channel configuration tab, the counter mode (default setting) is selected and in the counter configuration tab, the count direction UP as well as the internal frequency and edge analysis are chosen. The 2-edge evaluation setting doubles the measurement resolution.

The stored reference point, which is for example, relevant for measuring the phase comparison between multiple channels, is the last measured rising or falling edge (depending on how the edge evaluation is configured). Measuring is started by setting the enable bit in the channel and the reference counter registers.

The measurement result (the number of measured pulses) is provided in the count value register of the channel as a 32-bit value and the corresponding reference counter value is provided in the reference counter register. The result of the period or frequency measurement can be calculated from the difference between the actual and last counter values as well as the difference between the actual and last reference counter values. The gate time is generated from the time between the readings of two measurement values. The measurement channel for the stored reference counter value is latched while reading so that data consistency is ensured. The read-time jitter therefore does not affect the measurement.

10.4 Universal Counter (pulse counter)

In the channel configuration tab, the counter mode (default setting) is selected and in the counter configuration tab, the external frequency. Depending on the application, the counter can be configured as an incremental or decremental counter. It can be set to a predefined load value - from which the activated counter immediately continues to count up or down. With enable, starting or stopping is possible at any time.

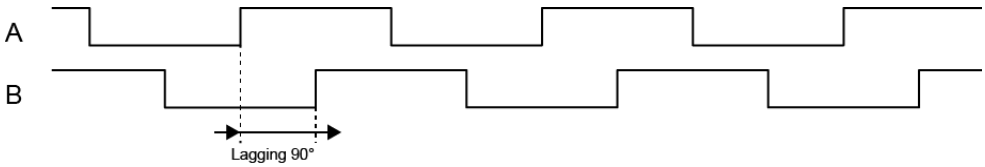
The configurable prescaler allows the counter to increment or decrement with every nth pulse (n = 1 to 65535; 0 is 65536). The reference counter is equipped with a configurable prescaler. It should be taken into account that the setting for the prescaler factor affects the reference counter register of all channels.

For exact synchronization of the counter values read from several channels, the latches for the counters and reference counters of all channels can be switched to Hold (see register 16#F7). This keeps the counter status of the various channels from changing while reading. After the required data has been read, the latches are re-enabled.

10.5 Incremental Encoder Function

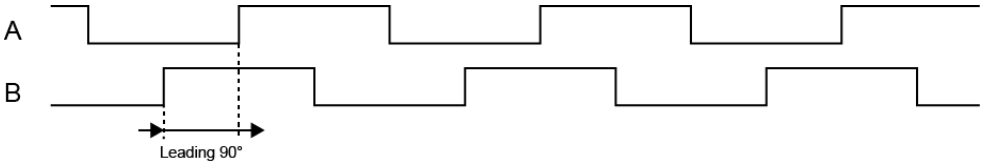
10.5.1 Counting Up

If input B is delayed, the counters (period counter latch and incremental encoder) count upwards.



10.5.2 Counting Down

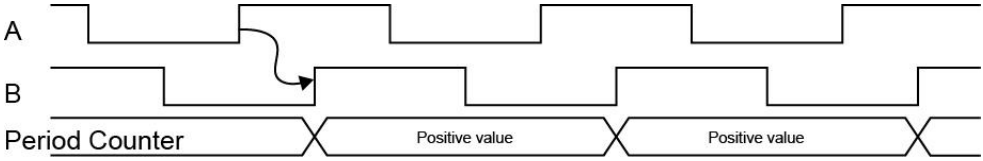
If input B leads input A, the counters (period counter latch and incremental encoder) then count down.



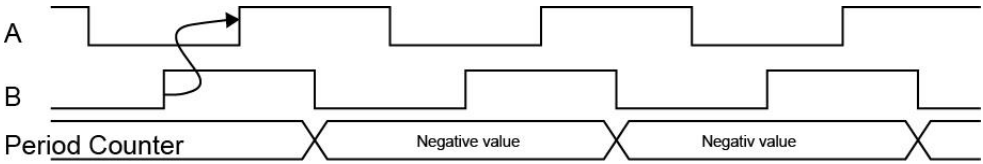
10.5.3 Period Counter Tab

The period counter counts between two rising edges (or between two falling edges, if phase B inversion is activated).

The tab indicates the rotational direction of the motor through a positive or negative value. If the rising edge of input B to the rising edge of input A is delayed, the tabs the latches a positive value.



If the rising edge of input B leads the rising edge of input A, the tab then latches a negative value.



After the start, the first value is invalid.

10.5.4 Incremental Encoder Counter Tab

The bits 5...4 of the incremental encoder command tab set the counter mode:

- 0b00 (0): the counter does not count.
- 0b01 (1): 1-Edge mode => counts with the rising edge of input A only
- 0b10 (2): 2-Edge mode => counts with the rising and falling edge of input A only
- 0b11 (3): 4-Edge mode => counts with the rising and falling edge of input A and B

The counter therewith counts in 4-edge mode faster than in 1-edge mode.

11 Addressing

Address (hex)	Size (bytes)	Access Type	Description	Reset value
PDO READ (incremental encoder extra register property = 1)				
Register component part 2				
0030	4	Block Read 8 Byte	Incremental-encoder Bit 31..0: current counter value [20 ns]	0..0
0034	4		Incremental-encoder Bit 31..0: saved reference counter (last edge) [20 ns]	0..0
0038	4	r32	Incremental-encoder Bit 31..0: Period counter [20 ns]	0..0
003C	2	r16	Reserve	0000
PDO READ default				
003E	1	r	Digital inputs Bit 0: RS422 input 1 Bit 1: RS422 input 2 Bit 2: TTL input 1 Bit 3: TTL input 2 Bit 4: HTL input 1 Bit 5: HTL input 2 Bit 7…6: reserved	00
003F	1	r/w	DC Status Info Bit 0: DC OK 5V via SDIAS (read only) Bit 1: DC OK 5V external (read only) Bit 2: DC OK 24V external (read only) Bit 6...3: Reserved Bit 7: Incremental encoder counter function (1 = up / 0 = down)	00
0040	4	r32	Reference counter Bit 31...0: Actual counter value	00000000
0044	4	Block read 8 bytes	Counter input counter mode Bit 31...0: Actual counter value Incremental encoder mode Bit 31...0: Actual counter value	00000000
0048	4		Counter input 1, stored reference counter Bit 31...0: stored reference counter Incremental encoder mode Bit 31...0: Period counter	00000000
004C	4	Block read 8 bytes	Counter input 2 Bit 31...0: Actual counter value	00000000
0050	4		Counter input 2, stored reference counter Bit 31...0: stored reference counter	00000000
PDO WRITE				

003F	1	w	Check Bit 6...0: Reserved Bit 7: Counter latch	-
0040	4	w32	Reference counter (load value when load bit = 1) Bit 31...0: New counter value specification	-
0044	4	w32	Counter mode counter input 1 (load value when load bit = 1) Bit 31...0: New counter value	-
0048	4	w32	Counter mode counter input 2 (load value when load bit = 1) Bit 31...0: New counter value	-
004C	1	w	Reference counter configuration PDO Bit 0: Enable (1 = counter active) Bit 1: Load (1 = assume load value) Counter input 1 Configuration PDO Bit 2: Enable (1 = counter active) Bit 3: Load (1 = assume load value) Counter input 2 Configuration PDO Bit 4: Enable (1 = counter active) Bit 5: Load (1 = assume load value) Bit 7...6: Reserved	
SDO				
Reference counter				
0054	2	w16	Reference counter prescaler Bit 15...0: Prescaler (0 not allowed)	0001
0056	1	w	Reference counter configuration Bit 0: Counter direction: 1 = Up / 0 = Down Bit 7...1: Reserved	00
0057	3	w	Reserved	0..0
Counter input 1				
005A	2	w16	Counter input 1 prescaler Bit 15...0: Prescaler (0 not allowed)	0001
005C	2	w	Counter input 1 Configuration SDO Bit 0: Counter direction: 1 = Up / 0 = Down Bit 2...1: Reserved Bit 3: Pulse: internal = 0 / external = 1 Bit 5...4: Reserved Bit 7...6: Counter mode Internal pulse: “00“: falling to rising edge – low component “01“: falling to falling edge – period length “10“: rising to rising edge – period length “11“: rising to falling edge – high component External pulse: “00”, “11” 2-edge analysis	0000

			“01” 1-edge analysis (falling edge) “10” 1-edge analysis (rising edge) Bit 15...8: Reserved	
005E	2	w16	Counter input 1 pulse signal suppression Bit 11...0: Pulse suppression time (pulses that is smaller than the defined time are filtered out) (value setting * 8µs corresponds to the filter time) Bit 15...12: Reserved	0000
Counter input 2				
0060	2	w16	Counter input 2 prescaler Bit 15...0: Prescaler (0 not allowed)	0001
0062	2	w	Counter input 2 Configuration SDO Bit 0: Counter direction: 1 = Up / 0 = Down Bit 2...1: Reserved Bit 3: Pulse: internal = 0 / external = 1 Bit 5...4: Reserved Bit 7...6: Counter mode Internal pulse: “00“: falling to rising edge – low component “01“: falling to falling edge – period length “10“: rising to rising edge – period length “11“: rising to falling edge – high component External pulse: “00”, “11” 2-edge analysis “01” 1-edge analysis (falling edge) “10” 1-edge analysis (rising edge) Bit 15...8: Reserved	0000
0064	2	w16	Counter input 2 pulse signal suppression Bit 11...0: Pulse suppression time (pulses that is smaller than the defined time are filtered out) (value setting * 8µs corresponds to the filter time) Bit 15...12: Reserved	0000
Dig IO				
0066	2	r/w	Reserved	00
Register component part 1				
0068	1	r/w	Incremental encoder control register Bit 2…0: Reserved Bit 3: Invert phase B (1 = inverted) Bit 5...4: Edge detection “00”: Incremental encoder inactive “01”: 1 edge “10”: 2 edges “11”: 4 edges Bit 6: Reserved	30

			Bit 7: Incremental encoder extra register (1 = available) (read only)	
0069	1	r/w	Response and status info Bit 0: Mode 0 = counter mode, 1 = Incremental encoder mode (input 1/input 2 == A/B) Bit 1: Reserved Bit 3...2: Counter input selection 1 (if multiplexer mode = 0) “00”: RS422 – Input “01”: TTL input “10”: HTL input “11”: Reserved Bit 5...4: Selection counter input 2 (if multiplexer mode = 1) “00”: RS422 – Input “01”: TTL input “10”: HTL input “11”: Reserved Bit 6: Reserved Bit 7: Multiplexer mode for selection counter input 0 = 1-fold multiplexer mode for selection counter input 1 = 2-fold multiplexer mode for selection counter input	00
006A	2	r/w	Period counter prescaler Bit 15…0: Prescaler (0 not allowed)	0001

12 Supported Cycle Times

12.1 Cycle Times below 1 ms (in µs)

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

x= supported

12.2 Cycle Times equal to or higher than 1 ms (in ms)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

x= supported

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

x= supported

13 Hardware Class FC021

Hardware Class FC021 For the S-DIAS FC021 analog module

```
---------------------- Counter Input 2 ----------------------
Channel 2 Input (CH2_Input) <-[]->
Channel 2 Reference Input (CH2_Ref_Input) <-[]->
Channel 2 Channel Input Mode (CH2_InputMode) <-[]->
Channel 2 Direction (CH2_Direction) <-[]->
Channel 2 Enable (CH2_Enable) <-[]->
Channel 2 Impulse Oppression (CH2_Impuls_Oppression) <-[]->
Channel 2 Load Input (CH2_Load_Input) <-[]->
Channel 2 Mode (CH2_Mode) <-[]->
Pre Divider 2 (CH2_Pre_Divider) <-[]->
Channel 2 RS422 Digital Input (CH2_RS422DigIn) <-[]->
Channel 2 TTL Digital Input (CH2_TTLDigIn) <-[]->
Channel 2 HTL Digital Input (CH2_HTLDigIn) <-[]->
ALARM:00, Empty
```

Properties

Object of class FC021	FC0211
Place	0
Required	Module is not required
Seperate channel InputMode	InputMode for the 2 channels is com
Input Channel Mode	RS422
Impuls Oppression Resolution	800
Reference Direction	Up
Reference Enable	Off
Reference Pre Divider	1
⊞ Settings for 'FC0211'	
⊞ Voltage 5000 [mV]	
⊞ Voltage 24000 [mV]	

Properties

Channel	CH1_Input
Channel 1 Channel Mode	HTL
Pre Divider	1
Impulse Oppression	10
Mode	neg. to pos. edge
Direction	Up
Enable	On

This hardware class is used to control the FC 021 hardware module. The SDIAS counter input module FC 021 has 6 digital inputs (2x RS422, 2x TTL and 2x HTL) resp. 2 counter inputs or an incremental encoder input, which can be switched to RS422, TTL or HTL. More information on the hardware can be found in the module documentation.

13.1 General

ClassState	State	This server shows the actual status of the hardware class.
DeviceID	State	The device ID of the hardware module is shown in this server.
FPGAVersion	State	FPGA version of the module in 16#XY (e.g. 16#10 = version 1.0).
Hardware version	State	Hardware version of the module in format 16#XXYY (e.g. 16#0120 = Version 1.20)
Serial Number	State	The serial number of the hardware module is shown in this server.
Retry counter	State	This server increments when a transfer fails.
LED control	Output	With this server, the application LED of the S-DIAS module can be activated to find the module in the network more quickly. The following statuses are possible: 0 LED off 1 LED on 2 blinks slowly 3 blinks rapidly
Required	Property	This client is active by default, which means that the S-DIAS hardware module at this position is mandatory for the system and can under no circumstances be disconnected or return an error. Otherwise, the entire hardware deactivated. If the hardware module is missing or removed, an S-DIAS error is triggered. If his client is initialized with 0, the hardware module located in this position is not mandatory. This means that it can be inserted or removed at any time. However, which components identified as "not required" should be selected with regard to the safety of the system.
Seperate Channel Input Mode	Property	Separates the Input Channel Mode for the two inputs. 0 The Input Mode for the two inputs is combined. 1 The Input Mode for the two channels is separated (this option requires FPGA version 1.2 or higher).
Config Valid	State	Shows whether the configuration of analog inputs is valid. 1 configuration is valid 0 configuration is written
Input Channel Mode	Output	Defines the mode in which the inputs are operated. 0 RS422 1 TTL 2 HTL This output can only be used, if the property "SeperateCHInputMode" is initialized with 0. If "Seperate Channel Input Mode" is initialized with 1, CH1_InputMode/CH2_InputMode must be used instead.

Impuls Oppression Resolution	Output	Pulse suppression resolution of input 1 and input 2 in 10 ns. (=LSB) The minimum possible value is 10 (=100 ns). The maximum possible value is 65535. To set values other than the default value of 800 (8 µs), an FPGA version 1.2 or higher is required.
Position	Input	Shows the position as 32-bit value. Is only used in encoder mode, see “Channel Mode”.
Extern 5V Supply	State	Indicates whether the 5 V supply is OK. 0 not OK 1 OK
Extern 24V Supply	State	Indicates whether the 24 V supply is OK. 0 not OK 1 OK

13.2 Reference Counter

Reference Input	Input	Shows the current 32-bit reference counter value.
Reference Load Input	Output	With write access to this server, the reference counter (Ref_Input) is set to this value (32 bits).
Reference Pre Divider	Output	Sets the reference counter prescaler (1-65535).
Reference Direction	Output	Here, the count direction is defined 0 down 1 up
Reference Enable	Output	Activating the reference counter. 0 counter stopped 1 counter running
Latch Hold	Output	Sets the hold function. 0 hold off 1 hold on

13.3 Frequency Inputs [1-2]

<table>
<tr><td>Channel Input Mode</td><td>Output</td><td>Defines the mode for the inputs.
<table><tr><td>0</td><td>RS422</td></tr><tr><td>1</td><td>TTL</td></tr><tr><td>2</td><td>HTL</td></tr></table>This output can only be used if "Seperate Channel Input Mode" is initialized with 1.</td></tr>
<tr><td>Channel Input</td><td>Input</td><td>In counter mode (see channel mode):
Displays the counter value as 32 bit value in 10*ns steps.
In encoder mode:
Period duration in 10*ns resolution.
If the server CH_Mode is changed, the counter value is set to 0 until the next valid value is reached. (FPGA version ≥ V1.4)</td></tr>
<tr><td>Channel Load Input</td><td>Output</td><td>With a writing access to this server the according counter (Ch1[1-2]_Input) is set to this value (32-bit).</td></tr>
<tr><td>Channel Reference Input</td><td>Input</td><td>Shows the saved reference counter value (32-bit).</td></tr>
<tr><td>Channel Pre Divider</td><td>Output</td><td>Sets the channel prescaler (1-65535).
Is only used in counter mode.</td></tr>
<tr><td>Channel Impuls Oppression</td><td>Output</td><td>Pulse suppression counter value bit 0-11 (Default = 0); valid value range 0-4094, 4095 not allowed!
(Default resolution 1 LSB = 8 µs)
Is only used in counter mode.
The value of the output "Impulse Oppression Resolution" is used for the LSB</td></tr>
<tr><td>Channel Mode</td><td>Output</td><td>Mode of the respective channel:
Counter mode:
<table><tr><td>0</td><td>falling to rising edge - low part</td></tr><tr><td>1</td><td>falling to falling edge - period duration</td></tr><tr><td>2</td><td>rising to rising edge - period duration</td></tr><tr><td>3</td><td>rising to falling edge - high part</td></tr><tr><td>4</td><td>two edge evaluation</td></tr><tr><td>5</td><td>one edge evaluation (falling edge)</td></tr><tr><td>6</td><td>one edge evaluation (rising edge)</td></tr></table>Encoder mode (can only be set on channel 1):
<table><tr><td>7</td><td>1 edge evaluation</td></tr><tr><td>8</td><td>2 edge evaluation</td></tr><tr><td>9</td><td>4 edge evaluation</td></tr></table>Phase B inverted:
<table><tr><td>10</td><td>1 edge evaluation</td></tr><tr><td>11</td><td>2 edge evaluation</td></tr><tr><td>12</td><td>4 edge evaluation</td></tr></table>
<table><tr><td>-1</td><td>invalid input</td></tr></table>If the separate encoder mode is activated and the position mode is set, the encoder settings 7-12 cannot be used.</td></tr>
</table>

Channel Direction	Output	Here, the count direction is defined. 0 down 1 up Is only used in counter mode.
Channel Enable	Output	Activating the counter. 0 counter stopped 1 counter running
Channel RS422 Digital Input	Input	Input RS422, status request via read(). 0 off 1 on
Channel TTL Digital Input	Input	Input TTL, status request via read(). 0 off 1 on
Channel HTL Digital Input	Input	Input HTL, status request via read(). 0 off 1 on

13.4 Separate Encoder Mode

Position Mode	Output	If the client SeparateEncMode = 1, the desired mode for the encoder can be selected here: 0 deactivated 1 1 edge evaluation 2 2 edges evaluation 3 4 edges evaluation Phase B inverted: 4 1 edge evaluation 5 2 edges evaluation 6 4 edges evaluation (this option requires a FPGA version 1.3 or higher) -1 invalid input -2 encoder mode was set with the server CH1_Mode
Encoder Input	Input	Period duration in 10*ns resolution.
Reference Counter Latch Input	Input	Shows the stored reference counter value (32 bits).

13.5 Communication Interfaces

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

14 Transport/Storage

INFORMATION

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

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

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

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

15 Storage

INFORMATION

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

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

16 Maintenance

INFORMATION

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

16.1 Service

This product was constructed for low-maintenance operation.

16.2 Repair

INFORMATION

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

For transport conditions, see chapter 14 Transport/Storage.

17 Disposal

INFORMATION

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

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

Documentation Changes

Change date	Affected page(s)	Chapter	Note
17.08.2017	10	1.8 Environmental Conditions	Pollution Degree added
	14	3.2 Applicable Connectors	Sleeve length added Added info regarding ultrasonically welded strands
18.10.2017	15	3.3 Label Field	Added chapter
	19	5 Mounting	Graphic replaced
17.06.2019	25	7 Addressing	0030-003C added
14.11.2019		8 Supported Cycle Times	Chapter added
11.02.2020	17	4.2 Connection examples counter inputs	Chapter added
	17	4.3 Connection examples incremental encoder input	Chapter added
28.02.2020	30	8 Supported Cycle Times	Text adapted
08.09.2020	31	9 Hardware Class FC021	Chapter added
04.11.2020	19	5 Mounting	Expansion functional ground connection
26.07.2023		Document	General chapters added, design