SIGMATEK

NC 100

S-DIAS Positioning Module

Instruction Manual

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Translation of the Original Instructions

S-DIAS Positioning Module NC 100

with 4 digital inputs

4 digital outputs

1 Incremental encoder input

The S-DIAS NC 100 positioning module has four digital outputs, four digital inputs, as well as an incremental encoder (optional TTL or RS422 signal). With the digital inputs, the signal statuses ("0" and "1") can be read with a +24 V reference. The incremental encoder value can be latched.

Contents

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 NC 100

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 NC 100 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 Digital Input Specification

Number	4	
Input voltage	typically +24 V	maximum +30 V
Signal level (up to HW version 2.10)	low: < +8 V	high: > +14 V
Signal level (starting with HW version 2.20)	low: < +5 V	high: > +15 V
Input current	3.7 mA at +24 V	
Input delay	typically 10 µs	

5.2 Digital Output Specification

Number	4
Short-circuit proof	yes
Output voltage	typically +24 V
Maximum continuous current load allowed per channel	2 A
Max. total current (complete module)	6 A
Maximum braking energy of outputs (inductive load)	maximum 0.65 Joules/channel maximum 1.95 Joules/4 channels
Residual current (off)	≤ 12 µA
Turn-on delay	< 200 µs
Turn-off delay	< 200 µs

5.3 Incremental Encoder Input Specifications

Number of channels	1
Input signals	incremental encoder signals RS422 (A, /A, B, /B, R, /R) RS422 signal (120 Ω termination, integrated in module)
	incremental encoder signal TTL (A, B, R) TTL level (1200 Ω Pull-Up, integrated in module)
Input frequency	maximum 125 kHz
Counter frequency	maximum 500 kHz
Signal evaluation	4X
Counter resolution	16 bits
Power supply	+5 V/0.2 A short circuit protected

5.4 Electrical Requirements

Power supply +24 V	18-30 V	
Current consumption of +24 V power supply	maximum 250 mA/24 V	
Supply voltage Digital outputs	18-30 V	
Current consumption of digital output supply	load-dependent	
Voltage supply from the S-DIAS bus	+5 V	
Current consumption on the S-DIAS bus (+5 V supply)	typically 40 mA	maximum 50 mA

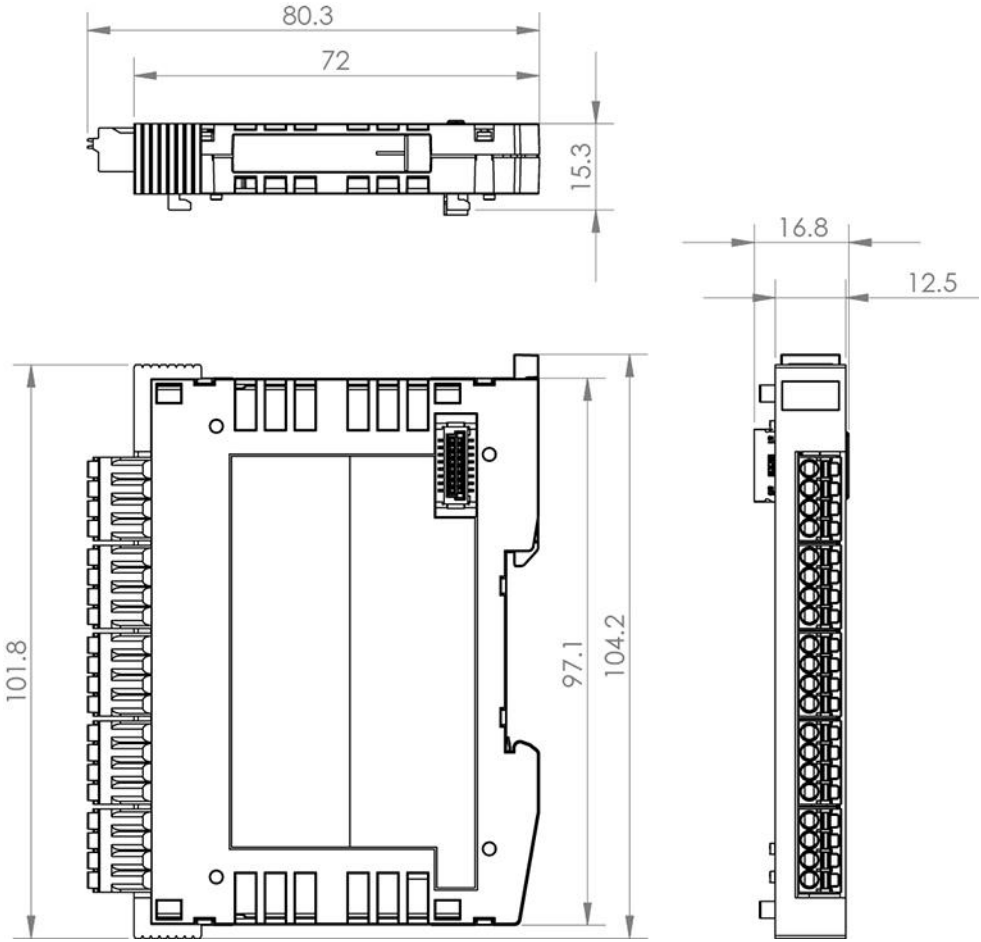
5.5 Miscellaneous

Article number	20-011-100
Standard	UL 508 (E247993)
Approbations	UL, cUL, CE, UKCA

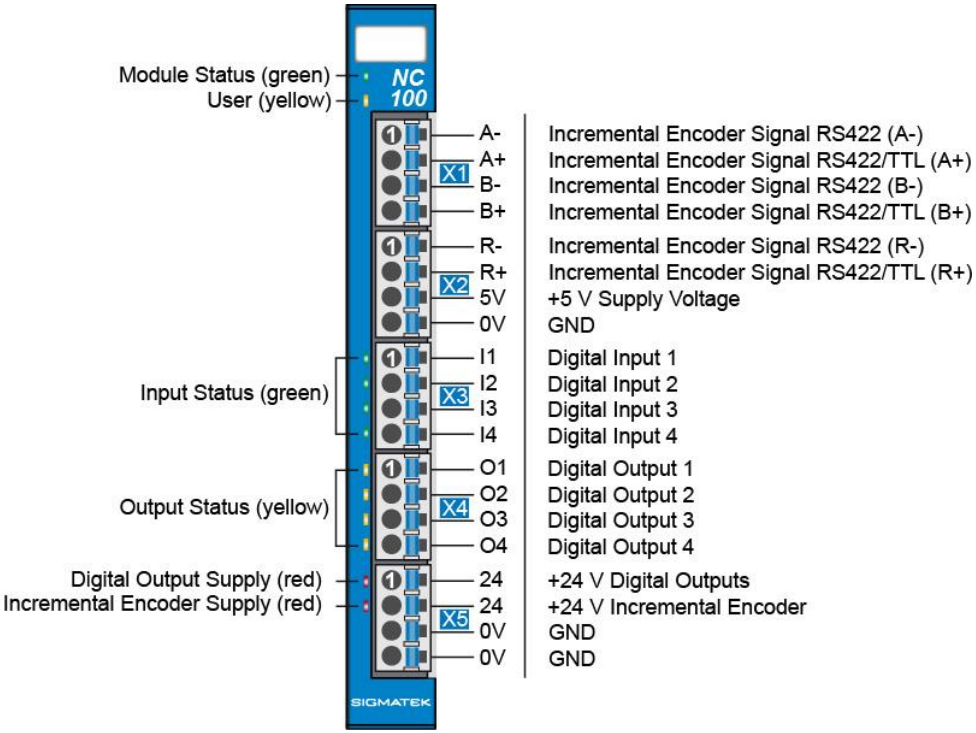
5.6 Environmental Conditions

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

6 Mechanical Dimensions



7 Connector Layout



INFORMATION

The connections of the GND supply (X5: pin 3 and pin 4) are internally bridged. To supply the module, only one connection a GND pin (pin 3 or pin 4) is required. The bridged connections may be used for further looping of the GND supply. However, it must be taken into account that a total current of 6 A per connection is not exceeded by the forward looping!

7.1 Status LEDs

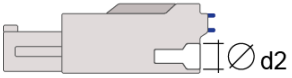
Module Status	green	ON	module active
		OFF	no supply available
		BLINKING (5 Hz)	no communication
User	yellow	ON	can be set from the application (e.g. the module LED can be set to blinking through the visualization so that the module is easily found in the control cabinet)
		OFF	
		BLINKING (2 Hz)	
		BLINKING (4 Hz)	
Input Status	green	ON	input ON
		OFF	input OFF
Output Status	yellow	ON	output ON
		OFF	output OFF
Digital Output Supply	red	ON	no digital output supply
		OFF	digital output supply available
Incremental Encoder Supply	red	ON	no incremental encoder supply
		OFF	incremental encoder supply available

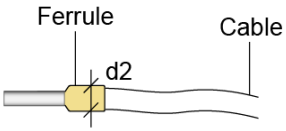
7.2 Applicable Connectors

Connectors:
X1 – X5: 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
Plug-in direction:	parallel to conductor axis or to PCB
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 (ground for reducing d2 of the ferrule)



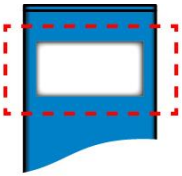


d2 = max. 2.8 mm

INFORMATION

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

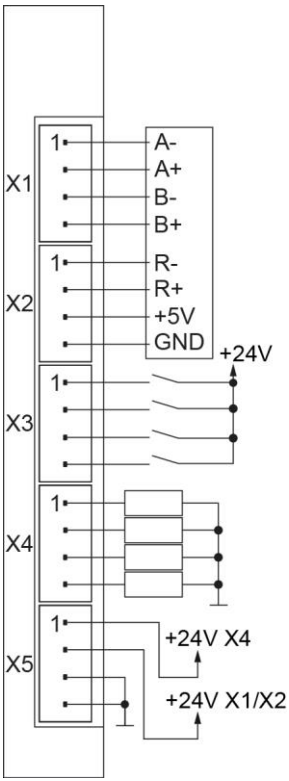
7.3 Label Field



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 General Information on the Digital Outputs

The cross section of the +24 V and 0 V supply must be designed for the maximum output current drawn by a group.

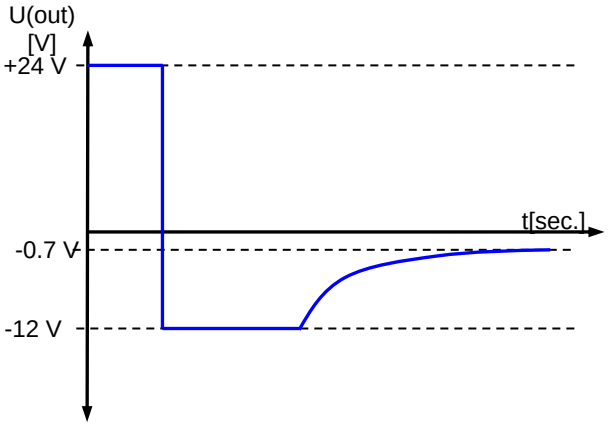
INFORMATION

When inductive loads are not equipped with a protective circuit, the high surge current flows over the 0 V line when the load is disconnected since the internal protective circuit is wired against 0 V. An excessively long or thin 0 V conductor can lead to undesired responses from the outputs or the affected module.

The outputs can be turned off by disconnecting the +24 V supply voltage.

Applying power to an output whose supply voltage exceeds 0.7 V is not allowed.

The outputs also have protective circuits. Braking of inductive loads is limited to -12 V as shown in the graph below. However, an additional protection circuit directly on inductive loads is recommended (freewheeling diode) to avoid a system failure caused by voltage spikes (cross talk on analog lines). However, this results in the internal voltage limit being effective up to -0.7 V only.



8.3 Notes

The input filters, which suppress noise signals, allow operation in harsh environmental conditions. In addition, a careful wiring method is 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 mass
- Wiring the incremental encoder a shielded cable has to be used. With a RS422 encoder it is recommended to use a shielded and twisted cable. The shield must be as close as possible to the front of the module.

INFORMATION

Connect the ground bus to the control cabinet.

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 Contents of Delivery.

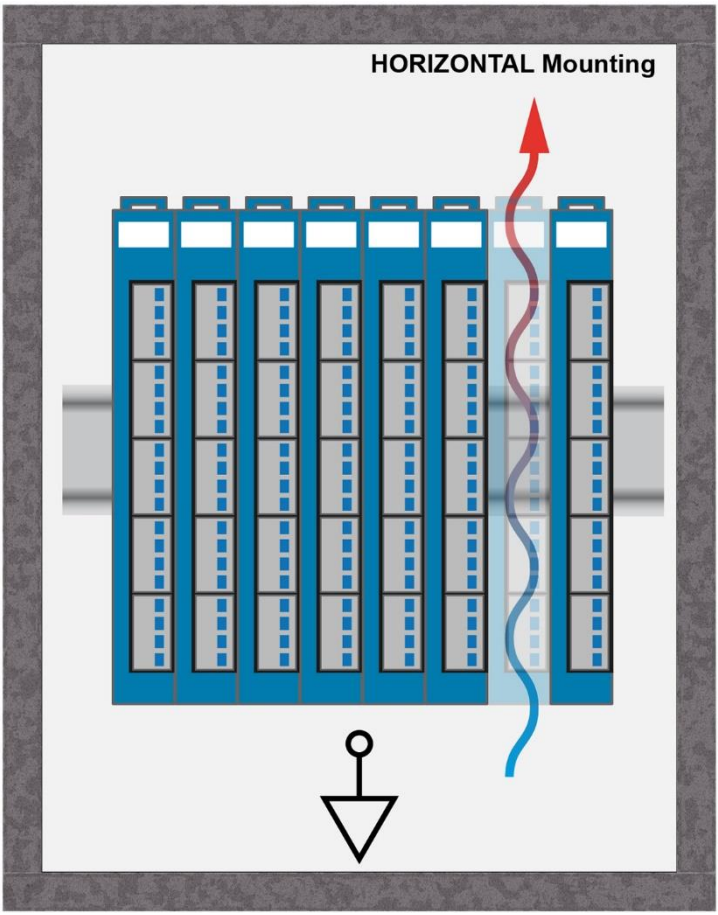
INFORMATION

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.

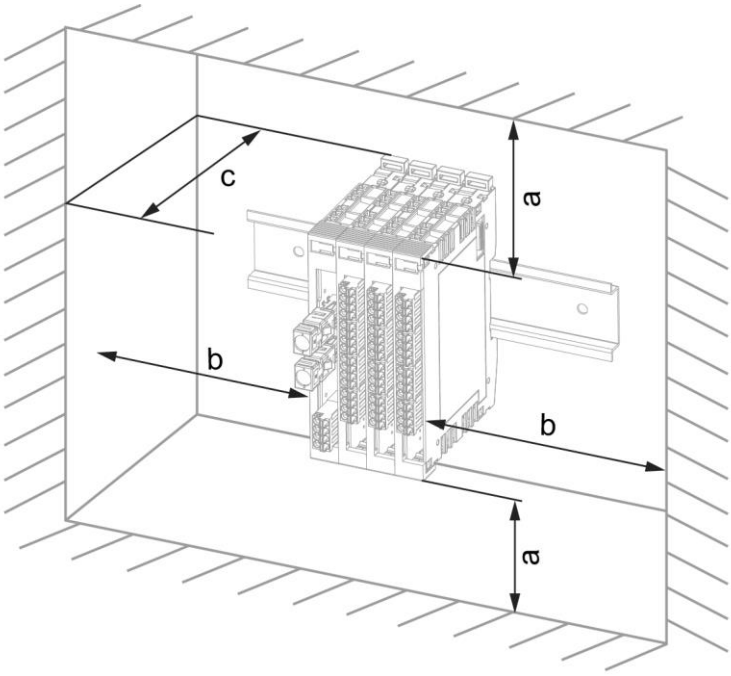
Damaged components can disrupt or damage the system.

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 Addressing

10.1 Address Mapping Overview

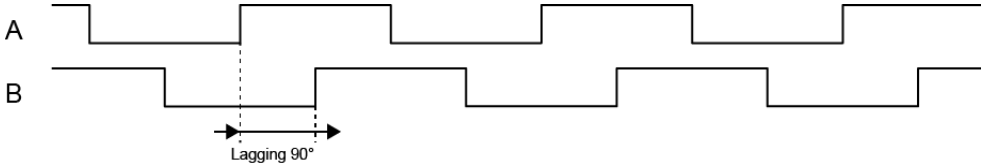
Address (hex)	Size (bytes)	Access Type	Description
Read Cyclically			
0003	1	r	Digital input register Bit 0: input 1 Bit 1: input 2 Bit 2: input 3 Bit 3: input 4 Bit 7..4: reserved
0004	4	r32	Period Counter latched Mirrors address 0x0010
0008	2	r16	Incremental Encoder Counter Mirrors address 0x0018
000A	2	r16	Incremental Encoder Counter latched Mirrors address 0x001C
000C	1	r	Incremental encoder status register Bit 0..3: reserved Bit 4: Zero Position Bit 5: null position latched (reset when read) Bit 6: 24 V DC OK output Bit 7: 24 V DC OK incremental encoder
Write Cyclically			
0003	1	w	Digital output register Bit 0: output 1 Bit 1: output 2 Bit 2: output 3 Bit 3: output 4 Bit 7..4: reserved

SDO			
0000	2	r/w	Input latch configuration Bit 1..0: Input 1 latches incremental encoder value 00: inactive 01: rising edge 10: falling edge 11: both edges Bit 3..2: Input 2 latches incremental encoder value 00: inactive 01: rising edge 10: falling edge 11: both edges Bit 5..4: Input 3 latches incremental encoder value 00: inactive 01: rising edge 10: falling edge 11: both edges Bit 7..6: Input 4 latches incremental encoder value 00: inactive 01: rising edge 10: falling edge 11: both edges Bit 9..8: Z-Pulse latches incremental encoder value 00: not active 01: rising edge 10: falling edge 11: both edges Bit 15..10: Reserved Note: The signals are connected using an OR gate. Each configured input latches the encoder value
0002	1	r/w	incremental encoder control register Bit 0: incremental encoder selection 0: TTL encoder 1: RS 422 encoder
0010	4	r32	Period counter latched 32-bit value with sign
0010	4	w32	Period counter level (31-bit)
0014	2		Reserved
0000	1	r/w	Period prescale register Period prescale = frequency[Hz]* measuring time[sec]
0017	1	r	Clock frequency Frequency in MHz
0018	2	r16	Incremental encoder counter The counter value represents the number of rising/falling incremental encoder edges. The counter value is incremented/decremented upon 1, 2 or 4 edges per pulse (selected by Byte 0x001A/ Bit 5..4).

001A	1	r/w	Incremental encoder command register Bit 1..0: reserved Bit 2: null position input inversion (1 = inverted) Bit 3: Phase B inversion (1 = inverted) Bit 5..4: edge sampling time 0 = incremental encoder disabled 1 = 1 edge 2 = 2 edges 3 = 4 edges Bit 7..6: reserved
001B	1	r	Incremental encoder status register Bit 0..3: reserved Bit 4: null position Bit 5: null position latched Bit 6..7: reserved
001C	2	r16	Incremental encoder counter latched This register is the latched version of the incremental encoder counter.
Cyclic read 2			
0020	2	r	Incremental Encoder Counter latched from DigIn1
0022	2	r	Incremental Encoder Counter latched from DigIn2
0024	2	r	Incremental Encoder Counter latched from DigIn3
0026	2	r	Incremental Encoder Counter latched from DigIn4
0028	2	r	Incremental Encoder Counter latched from Zero Position

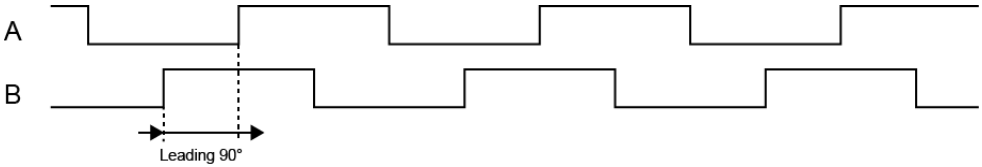
10.2 Count Up

When input B lags the input A, the counters (Period Counter Latch and Incremental Encoder Counter) increment.



10.3 Count Down

When input B leads the input A, the counters (Period Counter Latch and Incremental Encoder Counter) decrement.

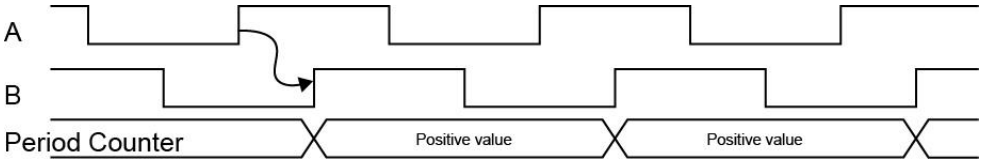


10.4 Register Period Counter

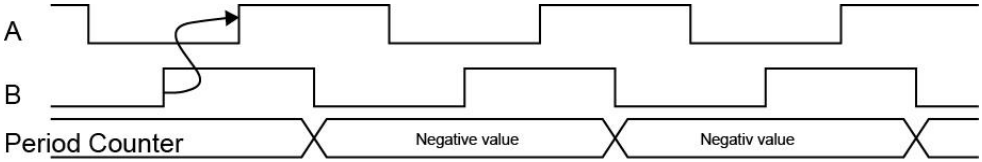
The Period Counter counts between two rising edges (or between two falling edges when phase B Inversion is active) of input B. The counter is not affected due to other counters like Incremental Encoder Counter (in component wb_inc_encoder).

It is a register by an own component (wb_inc_encoder_edge_cnt).

The register informs about the rotational direction of the motor by positive or negative value. When the rising edge of input B lags the rising edge of input A, the register latches a positive value.



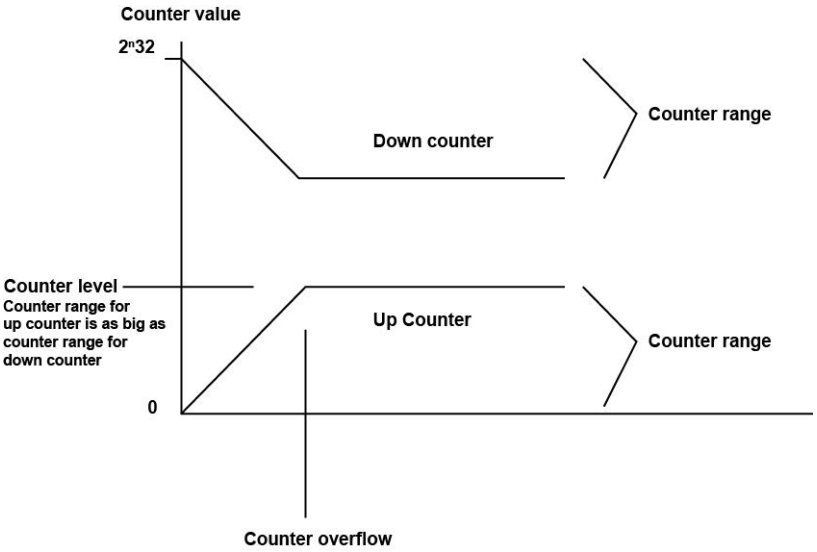
When the rising edge of input B leads rising edge of input A, the register latches a negative value.



After start the first value is not valid.

10.5 Register Period Counter Level

The counter range is between 0 and the counter level. The up counter is used for the positive direction of rotation, the down counter is used for the negative direction of rotation.



If the counter level is reached, an idle motor is detected (period count output = is always the positive counter level). The counter level limits the measurement range of the period time but it allows a faster detection.

10.6 Register Incremental Encoder Counter

Bits 5...4 of Incremental Encoder Command register sets the counter mode:

0b00 (0): the counter doesn't count.

0b01 (1): 1-Edge mode => the counter counts on rising edge of input A only

0b10 (2): 2-Edge mode => the counter counts on rising and falling edge of input A.

0b11 (3): 4-Edge mode => the counter counts on rising and falling edge of A and B

So the counter will increase (or decrease) more rapidly by 4 edges than by 1 edge mode.

11 Supported Cycle Times

11.1 Cycle Times below 1 ms (in µs)

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

x= supported

11.2 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

12 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.

13 Storage

INFORMATION

When not in use, store the operating panel according to the storage conditions. See chapter 12.

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

14 Maintenance

INFORMATION

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

14.1 Service

This product was constructed for low-maintenance operation.

14.2 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 12 Transport/Storage.

15 Disposal

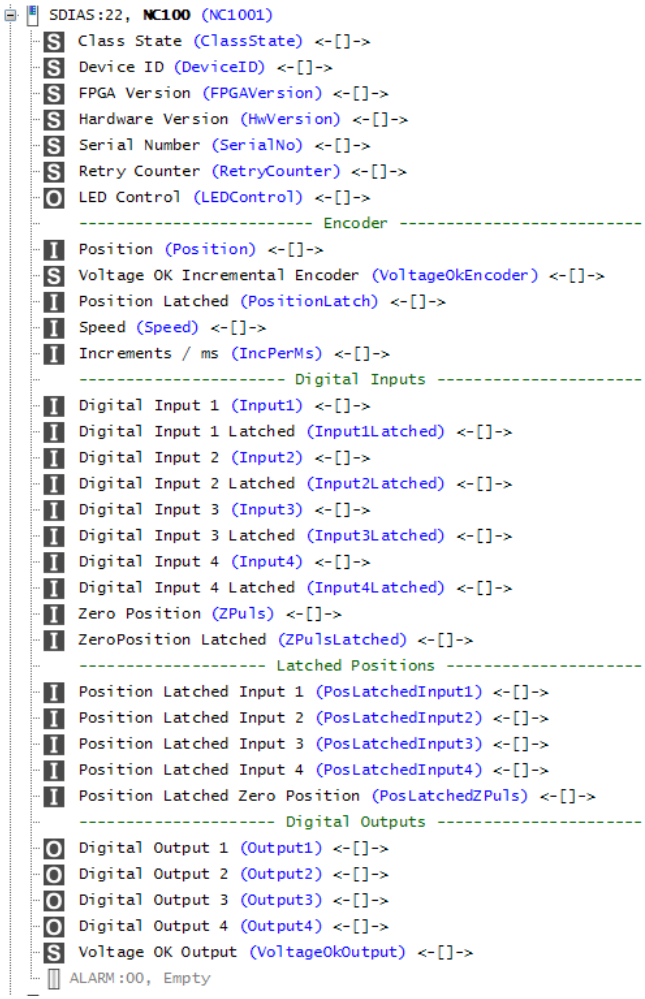
INFORMATION

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.

16 Hardware Class NC100

Hardware class NC100 for the S-DIAS NC100 encoder module



This hardware class is used to control the NC 100 hardware module with an incremental encoder input, four digital inputs and four digital outputs. More information on the hardware can be found in the module documentation.

16.1 Interfaces

16.1.1 Clients

SdiasIn	The client must be connected to an S-DIAS port, an "SdiasOut"_[x]" server.
Place	The physical location of the hardware module is entered in this client. Up to 64 modules, 0 to 63, can be assigned.
Required	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 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.
EncMode	Encoder mode. 0 Off 1 TTL mode (Default) 2 RS422 mode as initialization value
EncDirection	Direction of the encoder count. 0 normal (Default) 1 inverse as initialization value
EncSpeed	Displays the encoder speed. This client can only be set to 1 if the encoder is activated (EncMode client = 1 or 2). 0 speed display disabled (= Default) 1 speed display enabled as initialization value
EncCPR	Encoder increments per rotation in CPR (Default: 500). as initialization value
Encoder Sampling	Here, the edge evaluation of the encoder can be set. 0 Encoder off 1 1x evaluation 2 2x evaluation 3 4x evaluation (Default) This client must be set as an initialization value.
SpeedMeasure Limit	Limit for the encoder speed measurement in increments per millisecond (Default: 100). Raises the incremental encoder position one millisecond more than the specified value. The speed measurement is therefore no longer made through the period counter, rather over the frequency measurement due to the incremental encoder. as initialization value
PeriodPrescale	Here, the scaling for the period counter is set (default: 4). Value range 1-255; For details, see the chapter "internal Properties". as initialization value

PeriodCounterBits	Here, the length of the signed period counter is defined. The entry is made in bits (default: 16). The maximum length is 32 bits. If for example, the value 16 is entered, the period counter operates with a length of 16 bits and can therefore have a value range of -32767 to +32767. For details, see the chapter "internal Properties". as initialization value
InvertZeroPosition	When this client is activated, the ZeroPosition and ZeroPositionLatched servers are inverted. This setting is used by the encoder and must therefore be configured so that in the ZeroPosition and ZeroPositionLatched servers, the idle status is shown as "0" and the reference signal as "1". 0 normal (default) 1 inverted as initialization value
Input[1-4]Latch, ZPulseLatch	Inputs DigIn[1-4] and/or Z-signal (support for Z-signal with FPGA version 1.4 or higher) can be used to latch the incremental encoder value. 0 inactive 1 rising edge from Z-signal or the respective input 2 falling edge from Z-signal or the respective input 3 both edges from Z-signal or the respective input Note: The signals are linked via an OR gate. The incremental encoder value is latched by each configured input. as initialization value
AdditionalLatchInfo	Since FPGA version 1.5, the latch position of each latch input can be read. 0 Only 1 server is available, which shows the latched position of the incremental encoder. 1 For each latch input (Input1-4, Zero Position) a separate server is available, which shows the latched position of the incremental encoder.

16.1.2 Servers

ClassState	This server shows the actual status of the hardware class.
DeviceID	The device ID of the hardware module is shown in this server.
FPGAVersion	FPGA version of the module in 16#XY (e.g. 16#10 = version 1.0).
SerialNo	The serial number of the hardware module is shown in this server.
RetryCounter	This server increments when a transfer fails.
LEDControl	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 slow blinking 3 fast blinking
Position	Incremental encoder position (32 Bit Up-/Down counter with sign). The status is queried over read().
PositionLatch	Latch position of the incremental encoder (32 Bit Up-/Down counter with sign). The status is queried over read().
Speed	Encoder speed in rotations / minute (rpm). Only displayed when the “EncSpeed” client is set to 1. The status is queried over read().
IncPerMs	Number of increments by which the incremental encoder position is increased per milliseconds. Only displayed when the “EncSpeed” client is set to 1. The status is queried over read().
ZPuls	Encoder reference position. 0 Actual position unequal reference position 1 Actual position equal reference position The status is queried over read().
ZPulsLatched	Latched reference position of the encoder. 0 Reference position has not been reached since the last status query 1 Reference position has been achieved since the last status query In the course of status query the server is reset to 0.
Input[1-4]	Digital Input 1-4.
Input[1-4]Latched	Latched digital input (requires FPGA version 1.4 or higher.) 0 input was not set since last reading 1 input has been set since the last reading The status is queried over read(). During the status query, the server is reset to 0.
Output[1-4]	Digital outputs 1 - 4; output set over write().
VoltageOkOutput	Supply voltage of the outputs. 0 power supply error 1 power supply OK

VoltageOkEncoder	Supply voltage of the incremental encoder. 0 power supply error 1 power supply OK
PosLatchedInput[1-4], PosLatchedZpuls	Latch position of the incremental encoder of the according latch input. (Needs FPGA version 1.5 or higher)

16.1.3 Communication Interfaces

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

16.2 Internal Properties

16.2.1 Influence of the Setting for “UseNewLatchConfig”

With the client "UseNewLatchConfig", the feature available since FPGA version 1.5 can be activated, that provides an own latch value for each input (Input 1-4, ZeroPos).

For this, there are the servers PosLatchedInput[1-4] and PosLatchedZPuls in the hardware class.

16.2.2 Influence of the Setting for “PeriodPrescale”

Due to this setting, the time interval is determined using the following formula, in which the scanning of the incremental encoder value and thus the increase of the period counter should be made:

$$Messzeit\,(\text{sec}) = \frac{Period\,\text{Pr}escale}{Clock(Hz)}$$

Internal clock of the FPGA (= 50 MHz)

A smaller value in the "PeriodPrescale" results to the fact that a measurement of the speed is possible only at a higher speed. In return a more accurate measurement takes place at higher speeds.

A higher value effects, however, that a measurement is already possible at a lower speed. But the measurement becomes less accurate at higher speeds.

16.2.3 Influence of the Setting for “PeriodPrescale”

The period counter for speed measurement is reset at each increment of the incremental encoder. Between two increments the period counter is increased by 1 in each cycle of the internal clock. With increasing engine speed, the time between two increments is shorter.

Therefore, the value of the period counter is reduced. With decreasing rotation speed, the value of the period counter increases until it has reached the maximum possible value. Then, it is started from a rotation speed of 0 rotations / minute.

Via the "PeriodCounterBits" client now the length of the period counter and thus its maximum value can be set. The longer the period counter is defined, the lower rotation speeds can be measured as the period counter can reach a higher value, and thus the counting between 2 increments can take longer.

By increasing the period counter the time to the detection of an engine stop is extended, because only at reaching the maximum value of the period counter, a rotation speed of 0 rotations / minute can be asssumed.

16.2.4 Calculation Examples for Settings of:

- PeriodPrescaler
- PeriodCounterBits

The value for Clock is set to 50 Mhz.
The setting of "EncoderSampling" has no effect on the calculation!
The server "Speed" shows the rotation speed in RPM only in integer.

Formulas:

$$\text{Time to detect stop}\ (s) = \frac{PeriodCounterBits * PeriodPrescaler}{Clock(Hz)}$$

$$\text{measuring time} = \text{Time one period}(s) = \frac{PeriodPrescaler}{Clock(Hz)}$$

Calculation for the lowest measurable speed:

$$\min Speed(RPM) = \frac{1}{EncCPR * TimeToDetectStop(s)/60}$$

Calculation for the highest measurable speed:

$$\max Speed(RPM) = \frac{1}{EncCPR * TimeOnePeriode(s)/60}$$

Example 1: Calculation with default settings

Clock	50	[MHz]	
EncCPR	500		
PeriodPrescaler	4		
PeriodCounterBits (1-32)	16	=	-32768 to +32767

Time to detect stop	2,6	ms	
Time one period	0,08	µs	
min Speed	46	RPM	
max Speed	1500000	RPM	

A prescale factor of 4 (= default) and a clock frequency of 50 MHz result in a PeriodTime of 0.08 µs. The period counter is defined with 16 bits (= default), so a value range of -32768 to +32767.

The time until the server "Speed" is set to 0 with a stop, so is 32767 * 0.08 µs = 2.6 ms. For an incremental encoder with 500 increments per rotation, this results in a minimum measurable speed of about 46 rotations per minute.

Example 2: Increasing the PeriodPrescaler

Clock	50	[MHz]	
EncCPR	500		
PeriodPrescaler	255		
PeriodCounterBits (1-32)	16	=	-32768 to +32767

Time to detect stop	167,1	ms	
Time one period	5,10	µs	
min Speed	1	RPM	
max Speed	23529	RPM	

A prescale factor of 255 (= maximum) and a clock frequency of 50 MHz result in a PeriodTime of 5.1 µs. The period counter is defined with 16 bits (= default), so a value range of -32768 to +32767.

The time until the server "Speed" is set to 0 with a stop, so is 32767 * 5.1 µs = 167.1 ms. For an incremental encoder with 500 increments per rotation, this results in a minimum measurable speed of about 1 rotation per minute.

Example 3: Increasing the PeriodCounterBits

Clock	50	[MHz]	
EncCPR	500		
PeriodPrescaler	4		
PeriodCounterBits (1-32)	32	=	-2147483648 to +2147483647

Time to detect stop	171798,7	ms	
Time one period	0,08	µs	
min Speed	1	RPM	
max Speed	1500000	RPM	

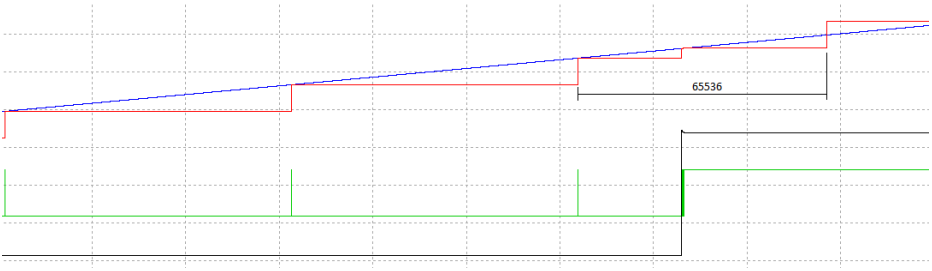
A prescale factor of 4 (= default) and a clock frequency of 50 MHz result in a PeriodTime of 0.08 µs. The period counter is defined with 32 bits (= maximum), so a value range of -2147483648 to +2147483647.

The time until the server "Speed" is set to 0 with a stop, so is 2147483647* 0.08 µs = 171798.7 ms. For an incremental encoder with 500 increments per rotation, this results in a minimum measurable speed of about 1 rotation per minute.

16.2.5 Cable Break at ZPuls Inputs

A cable break can be recognized by a permanent 1 at the servers **"ZPulse"** and **"ZPulse-Latched"** and a changing "position".

Attention!
Due to a natural overflow of the 2-byte values, the "PositionLatch" server can be larger than the “Position” server in this state.



Blue: Position
Red: PositionLatched
Green: ZPulse bzw. ZPulseLatched
Black: Cable break time (R- or R+)

Documentation Changes

Change date	Affected page(s)	Chapter	Note
10.10.2013	3	1.1	Changed values
24.10.2013	5	1.6	
23.12.2013	7	3 Connector Layout	Changed image
	9	4.1 Wiring Example	Added wiring example
11.02.2014	7	3 Connector Layout	Changed image
	8	3.2 Applicable Connectors	Connection capacity added
01.04.2014	4	1.5 Miscellaneous	UL added
	10	5 Mounting	Text updated
18.07.2014	7	3 Connector Layout	Added wiring notice
30.01.2015	8	3.2 Applicable Connectors	Added note concerning connecting the S-DIAS module while voltage is applied
26.03.2015	9	3.2 Applicable Connectors	Added connections
01.04.2015	13-15	6.1 Address Mapping Overview	Updated Address descriptions
	15-18	6.2 to 6.6	Added chapters
16.06.2015	12-13	4.2 General Information on the Digital Outputs	Added chapter
		4.3 Notes	Added chapter
28.04.2016	15	5 Mounting	Graphics distances
23.11.2016	18	6.1 Adress Mapping Overview	Cylic read 2 added
17.08.2017	6	1.6 Environmental Conditions	Added operating conditions
	10	3.2 Applicable Connectors	Added sleeve length Added info regarding ultrasonically welded strands
20.09.2017	17,18	6.1 Adress Mapping Overview	updated
18.10.2017	11	3.3 Label Field	Added chapter
	16	5 Mounting	Graphic replaced
20.09.2018		3 Connector Layout	Note added

14.11.2019		7 Supported Cycle Times	Chapter added
28.02.2020	23	7 Supported Cycle Times	Text adapted
25.03.2020	8	3 Connector Layout	Text corrected
08.09.2020	24	8 Hardware Class NC100	Chapter added
04.11.2020	15	5 Mounting	Expansion functional ground connection
01.07.2021		1.3 Incremental Encoder Input Specifications	Integrated in module
30.08.2021	4	1.1 Digital Input Specifications	Signal level and Switching threshold
03.06.2022	5	1.5 Miscellaneous	HW version
06.12.2022	5	1.5 Miscellaneous	UKCA conformity
26.06.2023		Document	General chapters added, design