

AI 075

S-DIAS Analog Input Module

Instruction Manual

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Translation of the Original Instructions

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S-DIAS Analog Input Module

AI 075

with 6 analog inputs or potentiometer inputs

1 temperature input

1 reference output

The S-DIAS AI 075 analog input module has six ± 10 V analog inputs or 0-100 % potentiometer inputs with a 16-bit resolution, whereby the first input can be used as a temperature input (KTY, PT1000). For the potentiometer inputs a separate temperature input (KTY, PT1000) and a 10 V reference output, which can be loaded with a maximum of 25 mA, are available.



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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 AI 075

2 Basic Safety Directives

2.1 Symbols Used

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

DANGER



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

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

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

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

WARNING



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

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

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

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

CAUTION



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

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

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

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

INFORMATION**Information**

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

2.2 Disclaimer

INFORMATION



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

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

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

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

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

2.3 General Safety Directives

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

INFORMATION



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

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

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

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

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

CAUTION

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

Prevent foreign bodies and fluids from entering the device.

The device must not be opened!

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

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

⇒ L'appareil ne doit pas être ouvert!

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

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

The module complies with EN 61131-2.

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

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

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

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

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

2.4 Software/Training

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

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

3 Standards and Directives

3.1 Directives

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

3.1.1 EU Conformity Declaration



EU Declaration of Conformity

The product AI 075 conforms to the following European directives:

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

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

4 Type Plate

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

Exemplary nameplate (symbol image)

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

HW: Hardware version

SW: Software version

5 Technical Data

5.1 Periphery Controller

Periphery Controller	yes
Functionality	The periphery controller executes the analog conversion, the standardization of the analog inputs and the software filtering of the analog inputs and provides the data on the S-DIAS bus via DPRAM with variable settings for the measuring time points.

5.2 Analog Inputs Specifications ± 10 or Potentiometer Inputs 0-100 %

Number of channels	6	
Measurement range	-10 ...+10 V	0-100 %
Measurement value	-10,000 ... +10,000	0-10,000
	An open input returns -2147483632 in the hardware class.	
Inputs	differential input	potentiometer input
Resolution	16 Bit (ca. 0.3 mV/LSB)	
Conversion time per channel	standard mode: 250 μ s variable sample points: S-DIAS cycle time (min. 250 μ s)	
Common mode range	± 12 V	
Input resistance	> 10 M Ω	
Cable break monitor	yes	
Hardware input filter	typically 1 kHz, low pass 3 rd order	
Input filter Software	configurable resp. to deactivate	
Measurement precision	± 0.3 % of maximum measurement value	± 0.35 % of maximum measurement value

5.3 Reference Output Specifications

Number of channels	1
Reference voltage	+10 V
Allowed output current	maximum 15 mA (< HW-Version 1.5, T _{MAX} = 60 °C) maximum 25 mA (≥ HW-Version 1.5, T _{MAX} = 55 °C)
Allowable load per potentiometer input	≤ 2.50 mA (< HW-Version 1.5, T _{MAX} = 60 °C) ≤ 4.17 mA (≥ HW-Version 1.5, T _{MAX} = 55 °C) ≥ 4.0 kΩ (< HW-Version 1.5, T _{MAX} = 60 °C) ≥ 2.4 kΩ (≥ HW-Version 1.5, T _{MAX} = 55 °C)
Allowed capacitive load	maximum 100 nF
Short-circuit protection	yes
Precision	±0.5 %

5.4 Temperature Input Specification

Number of channels	1	
Measurement range	500.6-3904.8 Ω	1035.9-4575.3 Ω
	PT1000	KTY10
	-125 ... +850 °C	-50 ... +150 °C
Measurement value	-1250 ... +8500	-500 ... +1500
	An open or shorted input returns -2147483632 in the hardware class.	
Resolution	0.1 °C	
Conversion time per channel	standard mode: 250 μs variable sample points: S-DIAS cycle time (min. 250 μs)	
Input resistance	33 kΩ	
Short circuit monitor	yes	
Cable break monitor	yes	
Hardware input filter	typically 1 kHz	low pass 3 rd order
Input filter Software	10 Hz	
Measurement precision	±0.5 % of maximum measurement value	

5.5 Electrical Requirements

Power supply from S-DIAS bus	+5 V	
Current consumption on the S-DIAS bus (+5 V power supply)	typically 50 mA	maximum 55 mA
Power supply from S-DIAS bus	+24 V	
Current consumption on the S-DIAS bus (+24 V power supply)	typically 40 mA (without load on reference output) typically 68 mA (reference output loaded with 6x 4 kΩ) typically 85 mA (reference output loaded with 6x 2k4 kΩ)	typically 50 mA (without load on reference output) maximum 80 mA (reference output loaded with 6x 4 kΩ) maximum 100 mA (reference output loaded with 6x 2k4 kΩ)

INFORMATION

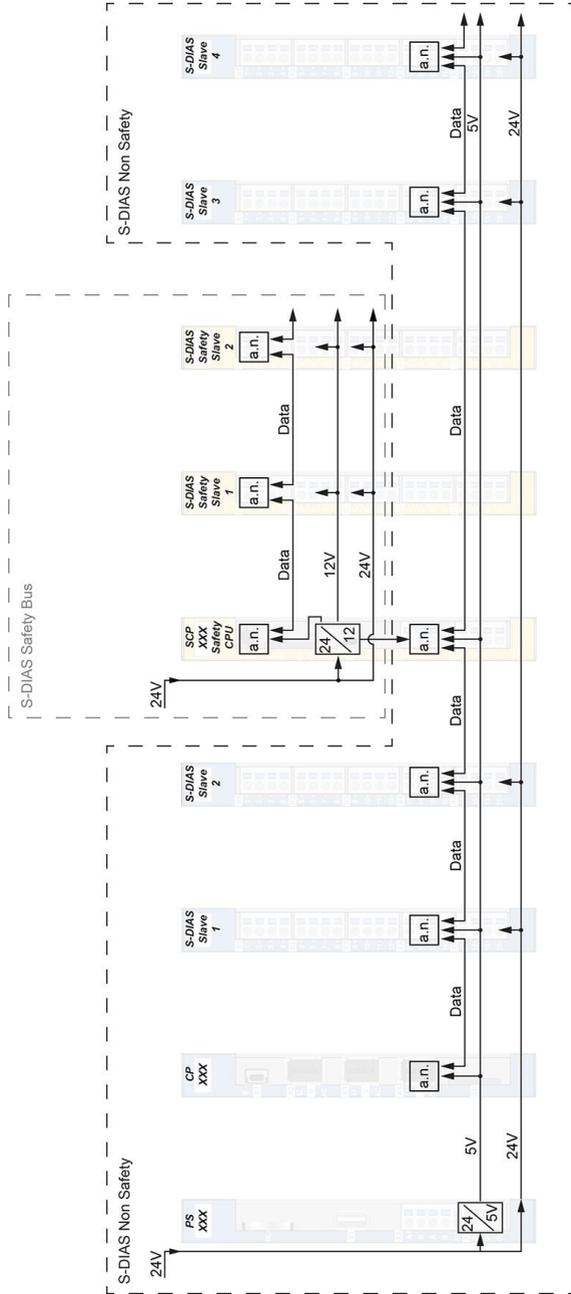


If this S-DIAS module is connected to an S-DIAS supply module with several S-DIAS modules, the total current of the modules used must be determined and checked.

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".



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

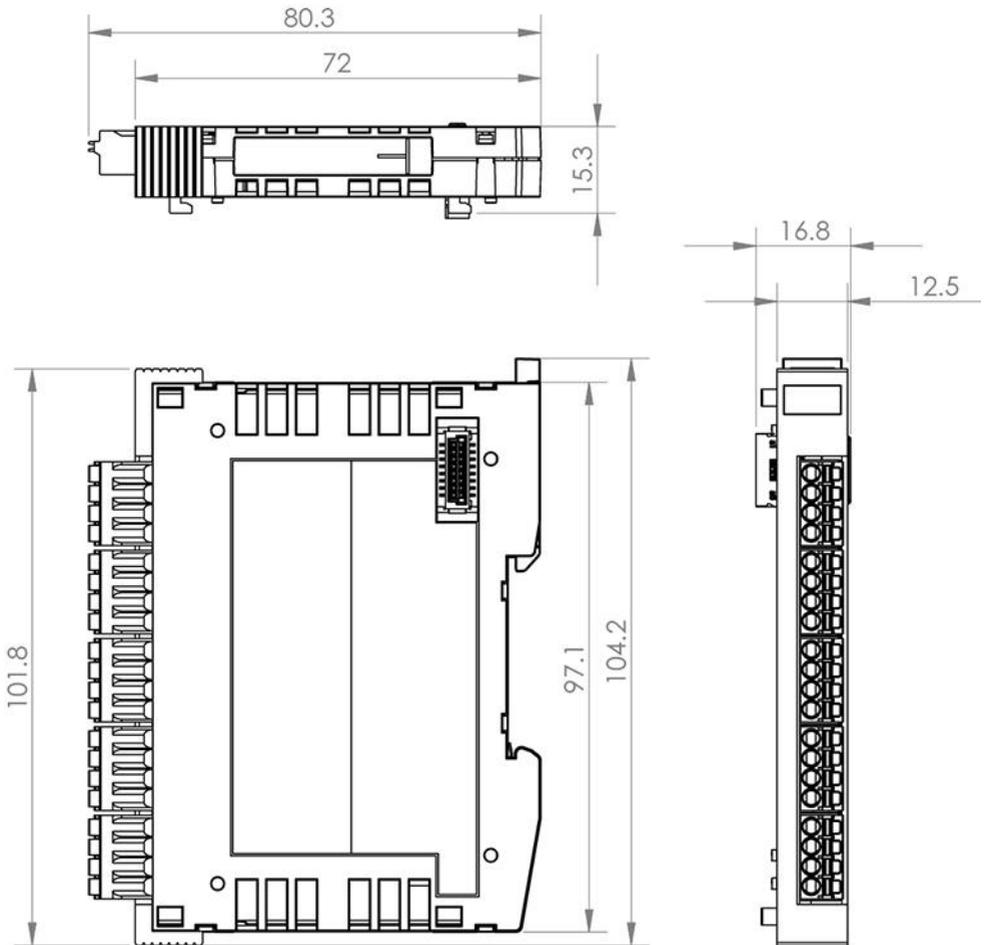
5.6 Miscellaneous

Article number	20-009-075
Standard	UL 508 (E247993)
Approbations	UL, cUL, CE, UKCA

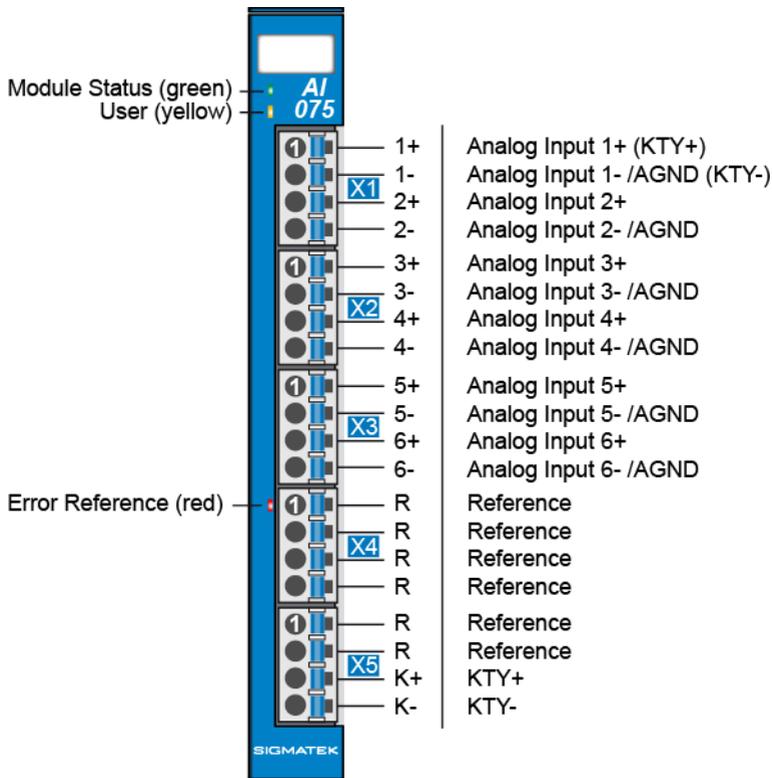
5.7 Environmental Conditions

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



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
		OFF	(e.g. the module LED can be set to blinking through the
		BLINKING (2 Hz)	visualization so that the module is easily found in the control
		BLINKING (4 Hz)	cabinet)
Error Reference	red	ON	10 V reference overload
		OFF	no error
		BLINKS (20 Hz)	GND overload, when AIx is switched to GND by the Software!

7.2 Applicable Connectors

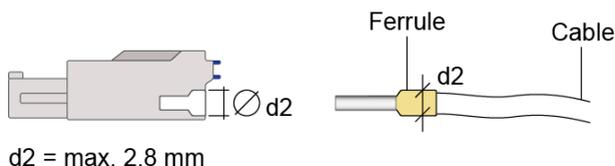
Connectors:

X1-X5: Connectors with spring terminals (included in delivery)

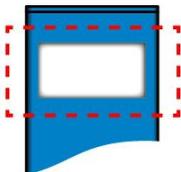
The spring terminals are suitable connecting ultrasonically compacted (ultrasonically welded) strands.

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)



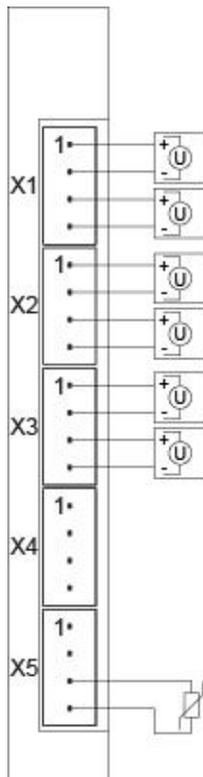
7.3 Label Field



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 Note

The signals recorded by the analog modules are very small, as compared to the digital signals. To ensure error-free operation, a careful wiring method must be followed:

- The DIN rail must have an adequate mass connection.
- The lines connected to the source of the analog signals must be as short as possible and parallel wiring to digital signal lines must be avoided.
- The signal lines must be shielded.
- The shielding must be connected to a shielding bus.
- Avoid parallel connections between input lines and load-bearing circuits.
- Protective circuits for all relays (RC networks or free-wheeling diodes).

INFORMATION

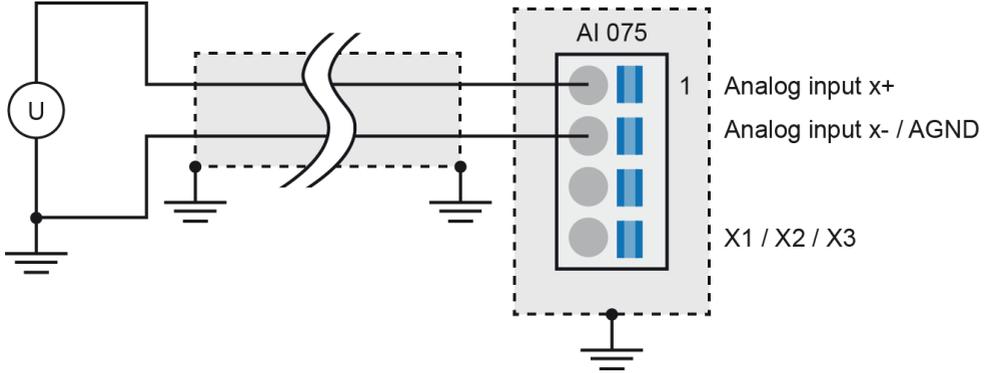


Connect the ground bus to the control cabinet.

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

8.3 Connection Variants

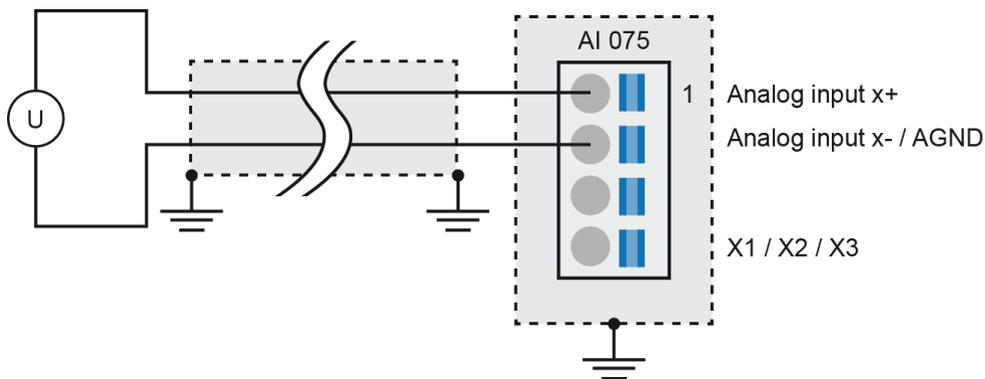
8.3.1 Voltage Measurement of Non Potential-free Voltage Sources



Schematic 1

When using a voltage source that is not potential-free (voltage source to earth or GND), the input must be configured as a differential input via the software. No connection to AGND, GND or earth can be made with the analog input. Otherwise, compensation currents and measurement errors can be generated.

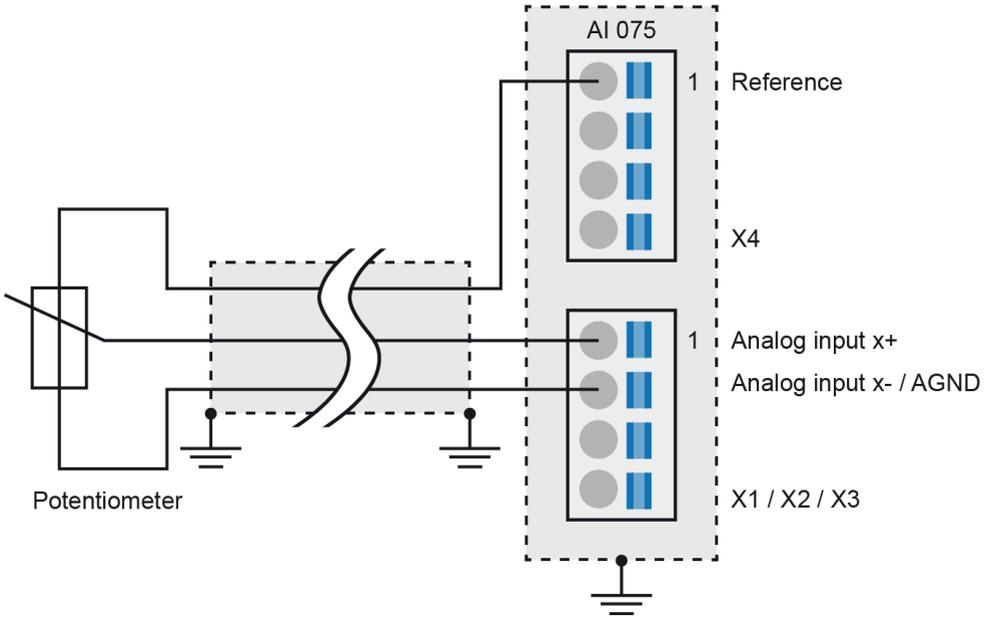
8.3.2 Voltage Measurement of Potential-free Voltage Sources



Schematic 2

When using a potential-free voltage source (voltage source with no connection to earth or GND), the input must be configured via the software either as "Input with Mass Reference" so that the analog input connection x- / AGND is internally switched to AGND or it must be configured via the software as a differential analog input and the mass reference of the analog signal is generated externally.

8.3.3 Voltage Measurement with a Potentiometer



Schematic 3

The analog inputs can also be used to connect a potentiometer. Hereby, the input must be configured via the software as "Input with Mass Reference". The analog input connection x- / AGND is internally switched to AGND. An existing reference connection must be used for the potentiometer supply.

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

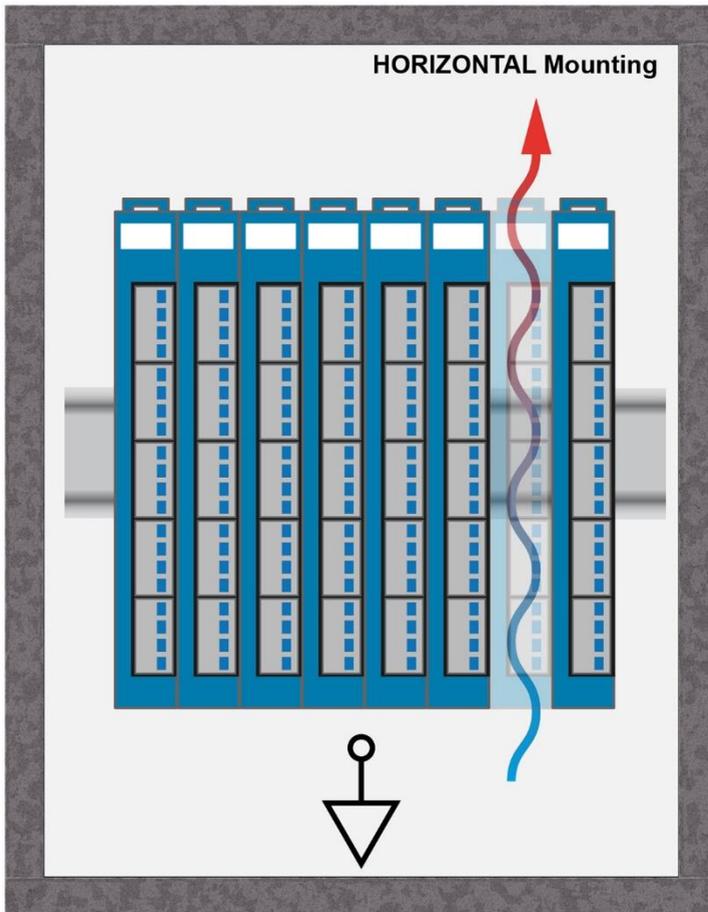


On receipt and before initial use, check the device for damage. If the device is damaged, contact our customer service and do not install the device in your system.

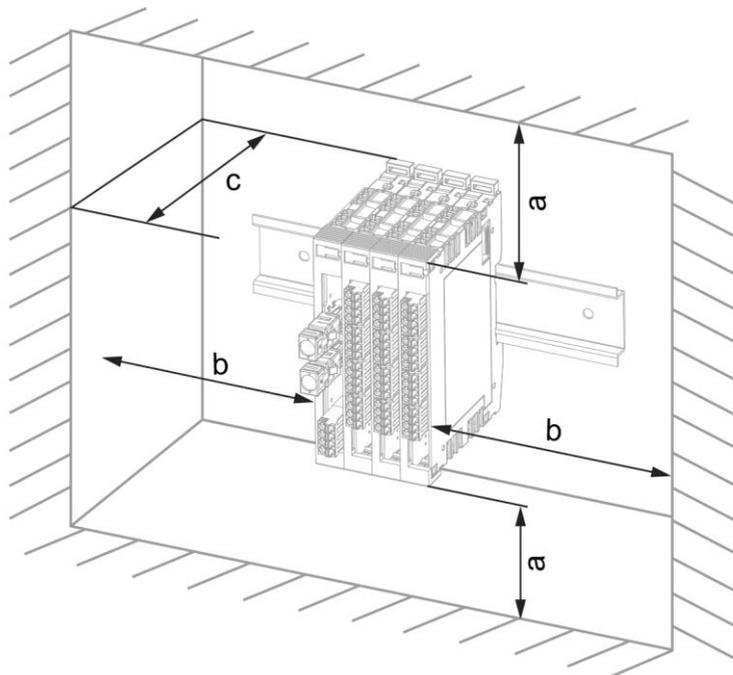
⇒ Damaged components can disrupt or damage the system.

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 Mode Variable Sample Points

The firmware since version 02.00 supports the possibility to vary the time of the sample points. For this the according bit in the communication has to be set and valid sample points have to be transmitted.

This mainly makes sense, if e.g. the measurement values should be measured in different sequence.

Additionally this points can be changed during runtime, and be activated and deactivated. This provides the possibility to change the sample points from cycle to cycle without the need to pause the system between.

10.1 Limitation of Variable Sample Points

When using variable sample points, some things have to be cared for:

Variable sample points are not possible with S-DIAS cycle times below 500 μs . If such cycle times are configured, measurement is done with the standard sample points.

Samples are only allowed **from 15 μs after the sync**. All entries smaller than 15 μs are not accepted resp. lead to an error -> measurement procedure is stopped.

Samples are only allowed **up to 162 μs before the sync**. All entries greater than this limit are not accepted resp. lead to an error -> measurement procedure is stopped.

The **distance between 2 sample points** must **at least be 8 μs** . All other inputs are moved to the according range by the firmware and indicated with a bit. If one or more sample points are out of the valid range because of moving, the measurement procedure is stopped.

The configuration of the new sample points (as PDO) is accepted in the next cycle.

If the variable sample points are used, the internal timing is adjusted to the sync (i.e. no more 250 μs but directly the cycle time of the higher system). For this it has to be transmitted in the configuration and match with the measured cycle time. So it is not possible to set the cycle time for the variable sample point mode different to the sync time.

In order to guarantee downwards compatibility to existing hardware classes, the variable sample point mode has to be activated with a newly added bit. Initially this bit is set to 0, so that this mode can only be used with the according configuration.

11 Addressing

11.1 Address-Mapping Overview

Address (hex)	Size (bytes)	Access Type	Description
0000	128	w	Cyclic Firmware Data (PDO)
0000	2	w	Sample point offset from Sync for AI1 in μ s
0002	2	w	Sample point offset from Sync for AI2 in μ s
0004	2	w	Sample point offset from Sync for AI3 in μ s
0006	2	w	Sample point offset from Sync for AI4 in μ s
0008	2	w	Sample point offset from Sync for AI5 in μ s
000A	2	w	Sample point offset from Sync for AI6 in μ s
000C	2	w	Sample point offset from Sync for TI in μ s
000E	1	w	Configuration byte: Bit 0-6 reserved Bit 7 1 = use variable sample points 0 = use standard sample points
0080	128	r	Cyclic Hardware Class Data (PDO)
0080	2	r	Status Bit 0 no 24 V connection Bit 1 no Sync exists Bit 2 alignment data could not be read Bit 3 alignment data invalid (CRC error) Bit 4 CfgVersion < 0x100 (resembles PMB mode) Bit 5 bus time is not supported Bit 6 invalid configuration Bit 10 Measurement data not ready/valid
0082	2	r	Analog input 1 (optional temperature input)
0084	2	r	Analog input 2
0086	2	r	Analog input 3
0088	2	r	Analog input 4
008A	2	r	Analog input 5
008C	2	r	Analog input 6
008E	2	r	KTY temperature input

0090	2	r	Cable break detection Bit 0 Input AI1 Bit 1 Input AI2 Bit 5 Input AI6 Bit 6 Input TI Short circuit detection Bit 7 Input AI1 (when defined as a temperature input) Bit 8 Input TI Bit 9 LowReference Bit 10 AiOvercurrent Sample point status Bit 11 Sample points must be corrected Bit 12 Sample points out of allowed range Bit 13 No cycle time in CFG data Bit 14 measured SDIAS cycle time varies too much
0100	128	w	CFG to the Firmware (SDO)
0100	2	w	CRC16 Calculated from 0x104 over the length corresponding to the length field (0x102)
0102	2	w	Data length 16, if bit 0 and bit 2 are set to 0 in 0x104 20, if bit 0 0 and bit 2 1 are set in 0x104
0104	1	w	Info (Special-Purpose respectively Status Bits) Bit 0 PMB mode Bit 1 Bootloader/update request Bit 2 Message Counter is used
0105	1	w	reserved
			Standard Mode (Info Register Bit 0 = 0)

0106	2	w	<p>Temperature sensor selection for analog input 1</p> <p>Bit 0 = 0 Input 1 as analog input Bit 0 = 1 Input 1 as temperature input</p> <p>Bit 1 = 0 Input 1 as temperature input with KTY sensor Bit 1 = 1 Input 1 as temperature input with PT1000 sensor</p> <p>Bit 2 = 0 Input 1 as normal analog input, when defined as analog input Bit 2 = 1 Input 1 with ground reference, when defined as analog input</p> <p>Bit 3 = 0 Input 2 as normal analog input, when defined as analog input Bit 3 = 1 Input 2 with ground reference, when defined as analog input</p> <p>Bit 4 = 0 Input 3 as normal analog input, when defined as analog input Bit 4 = 1 Input 3 with ground reference, when defined as analog input</p> <p>Bit 5 = 0 Input 4 as normal analog input, when defined as analog input Bit 5 = 1 Input 4 with ground reference, when defined as analog input</p> <p>Bit 6 = 0 Input 5 as normal analog input, when defined as analog input Bit 6 = 1 Input 5 with ground reference, when defined as analog input</p> <p>Bit 7 = 0 Input 6 as normal analog input, when defined as analog input Bit 7 = 1 Input 6 with ground reference, when defined as analog input</p> <p>Bit 8 = 0 Temperature input is KTY Bit 8 = 1 Temperature input is PT1000</p> <p>Since FW V3.10: Bit 9 = 0 Input 1 is filtered with a 10 Hz low-pass filter, if input is defined with ground reference. Bit 9 = 1 Input 1 is filtered with a low-pass filter at the set cut-off frequency, if input is defined with ground reference.</p>
0108	2	w	<p>Cut-off frequency low pass filter input 1</p> <p>Valid values 0 (off), 10, 25, 50, 100, 500, 1000</p>
010A	2	w	<p>Cut-off frequency low pass filter input 2</p> <p>Valid values 0 (off), 10, 25, 50, 100, 500, 1000</p>
010C	2	w	<p>Cut-off frequency low pass filter input 3</p> <p>Valid values 0 (off), 10, 25, 50, 100, 500, 1000</p>
010E	2	w	<p>Cut-off frequency low pass filter input 4</p> <p>Valid values 0 (off), 10, 25, 50, 100, 500, 1000</p>
0110	2	w	<p>Cut-off frequency low pass filter input 5</p> <p>Valid values 0 (off), 10, 25, 50, 100, 500, 1000</p>
0112	2	w	<p>Cut-off frequency low pass filter input 6</p> <p>Valid values 0 (off), 10, 25, 50, 100, 500, 1000</p>
0114	2	w	<p>Message Counter (from HWK)</p>
0116	2	w	<p>Cycle time in μs (min. 250 μs, then multiples up to 32000 μs) Only relevant when using the variable sample points</p>
PMB mode (info bit 0 = 1)			

CFG/version to the HW Class (mem – address range)			
0180	2		CRC16
0182	2		Data length
0184	2		Firmware version
0186	2		Message Counter (back to HWK)
Firmware update (mem – address range)			
0200	x		Firmware update

12 Supported Cycle Times

The AI 075 supports, depending on the firmware version, different cycle times. If variable sample points are deactivated, the analog inputs are scanned with 4 kHz at cycle times of 250 μ s to 32 ms. If the cycle time is lower than 250 μ s, the inputs are scanned with 3 kHz and PDO data are transmitted in a millisecond cycle.

12.1 Cycle Times Below 1 ms (in μ s)

FW	50	100	125	200	250	500
V2.10						x
\geq V3.00		x	x	x	x	x

x= supported

12.2 Cycle Times Equal to or Higher than 1 ms (in ms)

FW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
V2.10	x	x		x				x								x
\geq V3.00	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

x= supported

FW	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
V2.10																x
\geq V3.00	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

x= supported

13 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.

14 Storage

INFORMATION



When not in use, store the operating panel according to the storage conditions. See chapter 13.

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

15 Maintenance

INFORMATION



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

15.1 Service

This product was constructed for low-maintenance operation.

15.2 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 13 Transport/Storage.

16 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.



17 Hardware Class AI075

Hardware Class AI075 for the S-DIAS AI075 analog module

```

SDIAS:07, AI075 (AI0751)
S Class State (ClassState) <-[]->
S Device ID (DeviceID) <-[]->
S FPGA Version (FPGAVersion) <-[]->
S Hardware Version (HwVersion) <-[]->
S Serial Number (SerialNo) <-[]->
S Retry Counter (RetryCounter) <-[]->
O LED Control (LEDControl) <-[]->
S Firmware Version (FirmwareVersion) <-[]->
+ S Firmware Status (FWErrorBits) <-[]->
----- Analog Inputs -----
I Analog Input 1 (AI1) <-[]->
I Analog Input 1 Sample Point (AI1SamplePoint) <-[]->
I Analog Input 2 (AI2) <-[]->
I Analog Input 2 Sample Point (AI2SamplePoint) <-[]->
I Analog Input 3 (AI3) <-[]->
I Analog Input 3 Sample Point (AI3SamplePoint) <-[]->
I Analog Input 4 (AI4) <-[]->
I Analog Input 4 Sample Point (AI4SamplePoint) <-[]->
I Analog Input 5 (AI5) <-[]->
I Analog Input 5 Sample Point (AI5SamplePoint) <-[]->
I Analog Input 6 (AI6) <-[]->
I Analog Input 6 Sample Point (AI6SamplePoint) <-[]->
I Temperature Input (TI) <-[]->
I Temperature Input Sample Point (TISamplePoint) <-[]->
I Activate Sample Point Configuration (ActivateSamplePointConfig) <-[]->
+ I Sample Point State (SamplePointState) <-[]->
S Cable Break (CableBreak) <-[]->
S Short Circuit (ShortCircuit) <-[]->
S Reference Voltage OK (RefVoltageOK) <-[]->
S Input Over Current (OverCurrent) <-[]->
S Configuration Error (ConfigurationError) <-[]->
[] ALARM:00, Empty

```

This hardware class is used to control the AI 075 hardware module. The module has 6 x ± 10 V analog outputs, where by the first input is optionally a temperature input (KTY PT1000). A separate KTY temperature is also provided. More information on the hardware can be found in the module documentation.

17.1 General

Class State	State	This server shows the actual status of the hardware class.														
Device ID	State	The device ID of the hardware module is shown in this server.														
FPGA Version	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	<p>With this server, the application LED of the S-DIAS module can be activated to find the module in the network more quickly.</p> <table border="1"> <tr> <td>0</td> <td>LED off</td> </tr> <tr> <td>1</td> <td>LED on</td> </tr> <tr> <td>2</td> <td>blinks slowly</td> </tr> <tr> <td>3</td> <td>blinks rapidly</td> </tr> </table>	0	LED off	1	LED on	2	blinks slowly	3	blinks rapidly						
0	LED off															
1	LED on															
2	blinks slowly															
3	blinks rapidly															
Firmware Version	State	The Firmware version of the hardware module is shown in this server.														
Firmware Status	State	<p>In this server, the status bits of the FW are shown.</p> <table border="1"> <tr> <td>Bit 0</td> <td>DC not OK</td> </tr> <tr> <td>Bit 1</td> <td>no Sync available</td> </tr> <tr> <td>Bit 2</td> <td>Flash Data CRC Error</td> </tr> <tr> <td>Bit 3</td> <td>Ram Data CRC Error</td> </tr> <tr> <td>Bit 4</td> <td>invalid EEPROM version</td> </tr> <tr> <td>Bit 5</td> <td>bus cycle time not supported</td> </tr> <tr> <td>Bit 6</td> <td>invalid configuration</td> </tr> </table>	Bit 0	DC not OK	Bit 1	no Sync available	Bit 2	Flash Data CRC Error	Bit 3	Ram Data CRC Error	Bit 4	invalid EEPROM version	Bit 5	bus cycle time not supported	Bit 6	invalid configuration
Bit 0	DC not OK															
Bit 1	no Sync available															
Bit 2	Flash Data CRC Error															
Bit 3	Ram Data CRC Error															
Bit 4	invalid EEPROM version															
Bit 5	bus cycle time not supported															
Bit 6	invalid configuration															
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.														

17.2 Analog Inputs

AI1 Config	Property	0	AI1 used as analog input (range: -10 ... +10 V).
		1	AI1 used as analog input with mass reference (range: -10 ... +10 V). (Attention: 10 Hz are always used for filtering regardless of the setting AI1_Freq)
		2	AI1 used as KTY temperature input (range: -50 ... +150 °C).
		3	AI1 used as PT1000 temperature input (range: -125 ... +850 °C)
		Available since FW version 3.10	
		4	AI1 used as analog input with mass reference (range: -10 V ... +10 V). (filter frequency is used from client AI1_Freq).
AI[2-6] Config	Property	0	AI[2-6] used as analog input (range: -10 ... +10 V)
		1	AI[2-6] used as analog input with mass reference (range: -10 ... +10 V).
AI[1-6] cut off frequency	Property	In this client, the cutoff frequency for the software low pass filter is set. Value setting options are:	
		0	1000 Hz
		1	500 Hz
		2	250 Hz
		3	100 Hz
		4	50 Hz
		5	25 Hz
		6	10 Hz
AI[1-6] minimal value	Property	This value indicates the minimum value for the channel. If -10 V is measured at the channel, this value is output in the software. The range of the measurement values are defined by the setting in the clients I[1-6]_Min + AI[1-6]_Max.	
AI[1-6] maximal value	Property	This value indicates the maximum value for the channel. If +10 V is measured at the channel, this value is output in the software. The range of the measurement values are defined by the setting in the clients I[1-6]_Min + AI[1-6]_Max.	
TIConfig	Property	0	temperature input used as KTY input (range: -50 ... +150 °C).
		1	temperature input used as PT1000 input (range: -125 ... +850 °C)
Use Sample Point Configuration	Property	This setting can define, whether the Samplepoint Feature should be used.	
		0	Sample point feature is not used.
		1	Sample point feature is used
		If 1 is set and the firmware of the module does not support this mode, the Class State is set to _ClientNotReady and a log message is output. As initialization value	

Analog Input [1-6]	Input	Analog input 1-6, status query over read(). An open input returns -2147483632 in the hardware class.														
Temperature Input	Input	Temperature input, status queried over the read(). An open or shorted input returns -2147483632 in the hardware class.														
Cable Break	State	<p>Cable break detection</p> <table border="1"> <tr> <td>Bit 0</td> <td>cable break at input AI1</td> </tr> <tr> <td>Bit 1</td> <td>cable break at input AI2</td> </tr> <tr> <td>Bit 2</td> <td>cable break at input AI3</td> </tr> <tr> <td>Bit 3</td> <td>cable break at input AI4</td> </tr> <tr> <td>Bit 4</td> <td>cable break at input AI5</td> </tr> <tr> <td>Bit 5</td> <td>cable break at input AI6</td> </tr> <tr> <td>Bit 6</td> <td>cable break at temperature input AI1</td> </tr> </table>	Bit 0	cable break at input AI1	Bit 1	cable break at input AI2	Bit 2	cable break at input AI3	Bit 3	cable break at input AI4	Bit 4	cable break at input AI5	Bit 5	cable break at input AI6	Bit 6	cable break at temperature input AI1
Bit 0	cable break at input AI1															
Bit 1	cable break at input AI2															
Bit 2	cable break at input AI3															
Bit 3	cable break at input AI4															
Bit 4	cable break at input AI5															
Bit 5	cable break at input AI6															
Bit 6	cable break at temperature input AI1															
Short Circuit	State	<p>Short circuit detection:</p> <table border="1"> <tr> <td>Bit 0</td> <td>short circuit at AI1 (as temperature input only)</td> </tr> <tr> <td>Bit 1</td> <td>short circuit at temperature input TI</td> </tr> </table>	Bit 0	short circuit at AI1 (as temperature input only)	Bit 1	short circuit at temperature input TI										
Bit 0	short circuit at AI1 (as temperature input only)															
Bit 1	short circuit at temperature input TI															
Reference Voltage OK	State	The reference voltage for sever value 0 is too low.														
Input Over Current	State	The current at the input is too high.														
Analog Input [1-6] Sample Point	Input	<p>Sample point for the respective analog input in μs. Valid limits: 15 μs to (CycleTime – 162 μs). For example, the limits with a cyclic time of 1 ms lie between 15 and 838 μs.</p> <table border="1"> <tr> <td>-1</td> <td>feature not supported by current firmware (available starting with FW version 2.00 or higher)</td> </tr> <tr> <td>-2</td> <td>defined value exceeds the valid limits.</td> </tr> </table>	-1	feature not supported by current firmware (available starting with FW version 2.00 or higher)	-2	defined value exceeds the valid limits.										
-1	feature not supported by current firmware (available starting with FW version 2.00 or higher)															
-2	defined value exceeds the valid limits.															
Temperature Input Sample Point	Input	<p>Sample point for the respective analog input in μs. Valid limits: 15 μs to (CycleTime – 162 μs). For example, the limits with a cyclic time of 1 ms lie between 15 and 838 μs.</p> <table border="1"> <tr> <td>-1</td> <td>feature not supported by current firmware (available starting with FW version 2.00 or higher)</td> </tr> <tr> <td>-2</td> <td>defined value exceeds the valid limits.</td> </tr> </table>	-1	feature not supported by current firmware (available starting with FW version 2.00 or higher)	-2	defined value exceeds the valid limits.										
-1	feature not supported by current firmware (available starting with FW version 2.00 or higher)															
-2	defined value exceeds the valid limits.															
Activate Sample Points Configuration	Input	<p>This setting is used to adjust the ADC measurement value recording mode.</p> <table border="1"> <tr> <td>0</td> <td>Sample point setting inactive</td> </tr> <tr> <td>1</td> <td>Sample point setting active</td> </tr> </table>	0	Sample point setting inactive	1	Sample point setting active										
0	Sample point setting inactive															
1	Sample point setting active															
Sample Point State Bits	State	<p>Shows the current status bits of the Sample Point Features.</p> <table border="1"> <tr> <td>Bit 0</td> <td>The sample point settings were invalid and have been adjusted by the firmware automatically. This can happen when the distance between two sample points is too small (<8 μs).</td> </tr> <tr> <td>Bit 1</td> <td>The sample point settings were invalid and could not be automatically adjusted in the firmware. This can happen when the sample points are set too close. For example, sync 1 ms and several sample points are exactly 162 μs before the sync.</td> </tr> <tr> <td>Bit 2</td> <td>The bus cycle time, which is sent from the hardware to the firmware, is invalid.</td> </tr> <tr> <td>Bit 3</td> <td>The transmitted and currently measured bus cycle time differ.</td> </tr> </table> <p>When one of the bits from bit 1 to bit 3 is set, the analog measuring in the firmware stops.</p>	Bit 0	The sample point settings were invalid and have been adjusted by the firmware automatically. This can happen when the distance between two sample points is too small (<8 μs).	Bit 1	The sample point settings were invalid and could not be automatically adjusted in the firmware. This can happen when the sample points are set too close. For example, sync 1 ms and several sample points are exactly 162 μs before the sync.	Bit 2	The bus cycle time, which is sent from the hardware to the firmware, is invalid.	Bit 3	The transmitted and currently measured bus cycle time differ.						
Bit 0	The sample point settings were invalid and have been adjusted by the firmware automatically. This can happen when the distance between two sample points is too small (<8 μs).															
Bit 1	The sample point settings were invalid and could not be automatically adjusted in the firmware. This can happen when the sample points are set too close. For example, sync 1 ms and several sample points are exactly 162 μs before the sync.															
Bit 2	The bus cycle time, which is sent from the hardware to the firmware, is invalid.															
Bit 3	The transmitted and currently measured bus cycle time differ.															

Configuration Error	State	Shows whether there is an error with the current configuration.			
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 5%;">0</td> <td>Configuration OK</td> </tr> <tr> <td style="text-align: center;">1</td> <td>Incorrect configuration (AI1Config = 4 but an old firmware version is used).</td> </tr> </table> <p>The setting of AI1_Freq is ignored (due to a FW error is always filtered with 10 Hz). To avoid this error either the FW version of the module must be updated to 3.10 or higher or AI1Config must be adapted.</p>	0	Configuration OK	1
0	Configuration OK				
1	Incorrect configuration (AI1Config = 4 but an old firmware version is used).				

17.3 Communication Interfaces

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

17.4 Sample Point Feature

Available starting with firmware version 2.00 and hardware class version 1.31

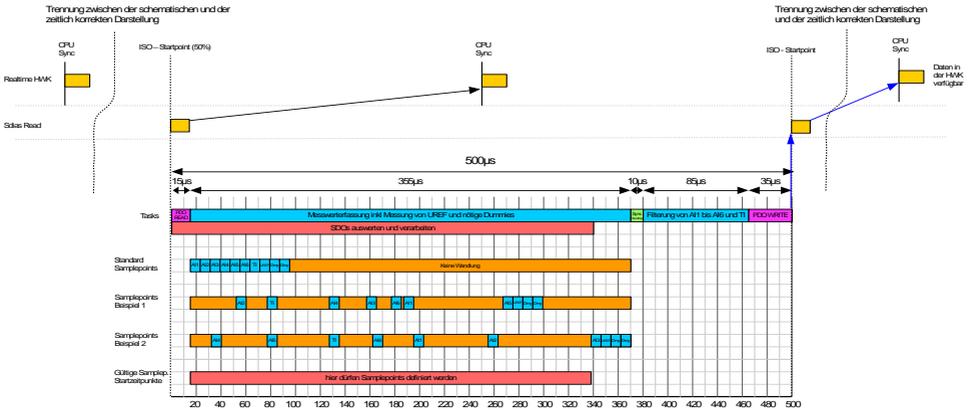
With this feature, the conversion time point in μs can be entered during runtime for each individual analog channel in reference to the SDIAS - Sync. The appropriate value must simply be written to the "AI[1-6]Samplepoint" or "TISamplePoint" server. This is then assumed by the firmware with the next SDIAS - Sync.

By writing to the ActivateSamplePointConfig server, the feature can be activated and deactivated during runtime.

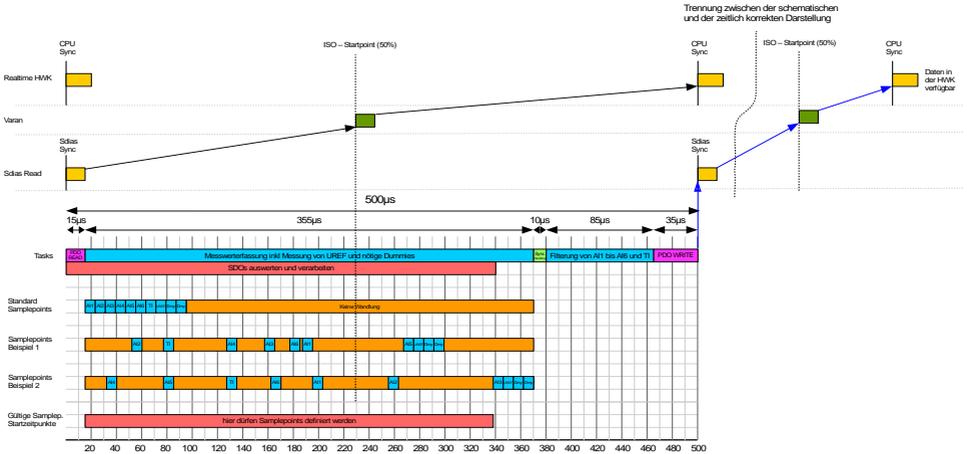
17.4.1 Limitations of this Feature

- The configuration of the new sample points (as PDO) is
- then assumed with the next cycle.
- Samples are first allowed starting from 15 μs after the SYNC. The hardware class does not allow any inputs less than 15 μs .
- Samples are allowed up to 162 μs before the SYNC only. The hardware does not allow any inputs greater than this value.
- The distance between 2 sample points must be at least 8 μs . All other inputs are moved from the firmware to the appropriate areas.

17.5 Time Response on Local S-DIAS Bus



17.6 Time Response Behind VARAN



Documentation Changes

Change date	Affected page(s)	Chapter	Note
04.10.2013	4	1.3	Note
23.10.2013	5	1.5	Added Vibration resistance
18.12.2013	1		Added Potentiometer inputs
	3	1.1 Analog Inputs Specifications ± 10 or Potentiometer Inputs 0-100 %	Expanded table
	7	3. Connector Layout	Changed image
	9	4.1 Wiring Example	Added wiring example
16.01.2014	3	1.1 Analog Inputs Specifications ± 10 or Potentiometer Inputs 0-100 %	Expanded Measurement precision, changed values
		1.2 Reference Output Specifications	Added table
11.02.2014	7	3 Connector Layout	Changed image
	8	3.2 Applicable Connectors	Connection capacity added French notes added
01.04.2014	5	1.5 Miscellaneous	UL added
	12	5 Mounting	Text updated
05.06.2014	3	1.2 Reference Output Specifications	Allowable load per potentiometer input added
30.01.2015	10	4.2 Notes	Added note concerning connecting the S-DIAS module while voltage is applied
26.03.2015	8	3.2 Applicable Connectors	Added connections
08.04.2015	12-14	4.3 Connection Variants	Updates complete chapter
01.07.2015	5	1.4 Electrical Requirements	Current consumption on the S-DIAS bus (+5 V power supply) and Current consumption on the S-DIAS bus (+24 V power supply) changed
27.07.2015	4	1.2 Reference Output Specifications	Changed Allowed output current and Allowable load per potentiometer input
	5	1.3 Temperature Input Specifications	Changed Measurement range

	5	1.4 Electrical Requirements	Changed Current consumption on the S-DIAS bus (+24 V power supply)
29.09.2015	3, 12, 13	1.1 Analog Inputs Specifications ± 10 or Potentiometer Inputs 0-100 % 4.3.1 Voltage Measurement of Non Potential-free Voltage Sources 4.3.2 Voltage Measurement of Potential-free Voltage Sources	Adjusted for differential inputs
02.10.2015	6	1.5 Miscellaneous	UL, cUL, CE inserted
22.01.2018	6	1.4 Electrical Requirements	Graphics added
28.04.2016	17	5 Mounting	Graphics distances
17.05.2016	4	1.2 Reference Output Specifications	Short-circuit protection (1 min.) removed
16.06.2016	4	1.1 Periphery Controller	Chapter added
24.10.2016	4	1.1 Periphery Controller	Variable measurement time points
	4	1.2 Specifications	Conversion time adjusted Input filter SW can be deactivated
	5	1.4 Temperature Input Specifications	Conversion time adjusted
	19	6 Mode Variable Sample Points	Chapter added
	21	7 Addressing	Different changes
27.03.2017	4	1.2 Analog Inputs Specifications ± 10 or Potentiometer Inputs 0-100 %	Added value for cable break monitoring
	5	1.4 Temperature Input Specifications	Added value for cable break and short circuit monitoring
17.08.2017	8	1.7 Environmental Conditions	Added operating conditions
	11	3.2 Applicable Connectors	Added sleeve length Added info regarding ultrasonically welded strands
18.10.2017	12	3.3 Label Field	Added chapter
	19	5 Mounting	Graphic replaced
18.06.2019	26	8 Supported Cycle Times	Added chapter
03.07.2019	24	7 Addressing	0106 extended
19.12.2019	26	8 Supported Cycle Times	FW3.20 added

14.02.2020	26	8 Supported Cycle Times	FW 3.20 removed and V3.00 replaced with \geq V3.00
31.07.2020	22	7.1 Address-Mapping Overview	0080 extended, 0090 corrected, 0100 extended, 0102 extended, 0116 extended
08.09.2020		9 Hardware Class AI075	Chapter added
04.11.2020	18	5 Mounting	Expansion functional ground connection
06.12.2022	8	1.6 Miscellaneous	UKCA conformity
26.07.2023		Document	General chapters added, design