SIGMATEK

AM 441

S-DIAS Analog Mixed Module ±10 V

Instruction Manual

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Translation of the Original Instructions

S-DIAS Analog Mixed Module ±10 V AM 441

with **4 analog outputs**
4 analog inputs or
potentiometer inputs
1 reference output

The S-DIAS AM 441 analog mixed module has four ±10 V analog outputs with a resolution of 12 bits and four ±10 V analog inputs or 0-100 % potentiometer inputs with a 16-bit resolution. For the potentiometer inputs, a 10 V reference is provided which can be loaded with a maximum of 16.7 mA.

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 AM 441

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 AM 441 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 Analog Inputs Specifications ±10 V or Potentiometer Inputs 0-100 %

Number of channels	4	
Input type	difference input	potentiometer input
Measurement range	-10 … +10 V	0-100 %
Measurement value	-10,000 ... +10,000 or -30,000 … +30,000 (at full range)	0 ... 10,000 or 0 ... 30,000 (at full range)
	With an open input, the firmware returns the positive maximum value and a status bit to indicate a cable break (HW class shows the value -2147483632)	
Resolution	16-bit (ca. 0.3 mV / LSB)	
Conversion time for all channels	FW version V01.00 – V01.20: 500 µs FW version ≥ V02.00: depending on the selected timing Speed mode: 200 µs Time offset mode: corresponds to the S-DIAS cyclic time	
Common mode range	±12 V	
Input resistance	> 10 MΩ	
Cable break monitor	yes	
Input filter hardware	typically 1 kHz, low pass 3rd order system	
Input filter software	configurable, low pass 1st order system	
Measurement precision	±0.3 % of maximum measurement value	±0.35 % of maximum measurement value

5.2 Reference Output Specifications

Number of channels	1
Reference voltage	+10 V
Allowable output current	maximum 10.0 mA (< HW version 3.5) maximum 16.7 mA (≥ HW version 3.5)
Allowable load per potentiometer input	2.50 mA (< HW version 3.5) 4.17 mA (< HW version 3.5) 4.0 mA (< HW version 3.5) 2.4 mA (< HW version 3.5)
Allowable capacitive load	maximum 100 nF
Short circuit protection	yes
Accuracy	±0.5 %

5.3 Analog Output Specifications

Number of channels	4
Output range	-10 … +10 V
Output value	-10,000 ... +10,000
Resolution	12-bit (ca. 5 mV / LSB)
Refresh time for all channels	≥ 500 µs (corresponds to the S-DIAS cyclic time)
Output voltage capacity	> 5 kΩ
Allowable capacitive load	maximum 100 nF
Short circuit protection	yes (1 min.)
Settling time	50 µs (63 % of the end value) 100 µs (86 % of the end value) 250 µs (99 % of the end value)
Output precision	±0.5 % of maximum output value

5.4 Electrical Requirements

Voltage supply from S-DIAS bus	+5 V	
Current consumption on the S-DIAS bus (+5 V supply)	typically 50 mA	maximum 55 mA
Voltage 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 and analog outputs) typically 60 mA (reference output loaded with 4x 4 kΩ and maximum load on the analog outputs) typically 70 mA (reference output loaded with 4x 2k4 kΩand maximum load on the analog outputs)	typically 50 mA (without load on reference output and analog outputs) maximum 80 mA (reference output loaded with 4x 4 kΩ and maximum load on the analog outputs) maximum 95 mA (reference output loaded with 4x 2k4 kΩand maximum load on the analog outputs)
Short circuit in analog inputs	typically an additional 30 mA per channel on a +24 V supply	

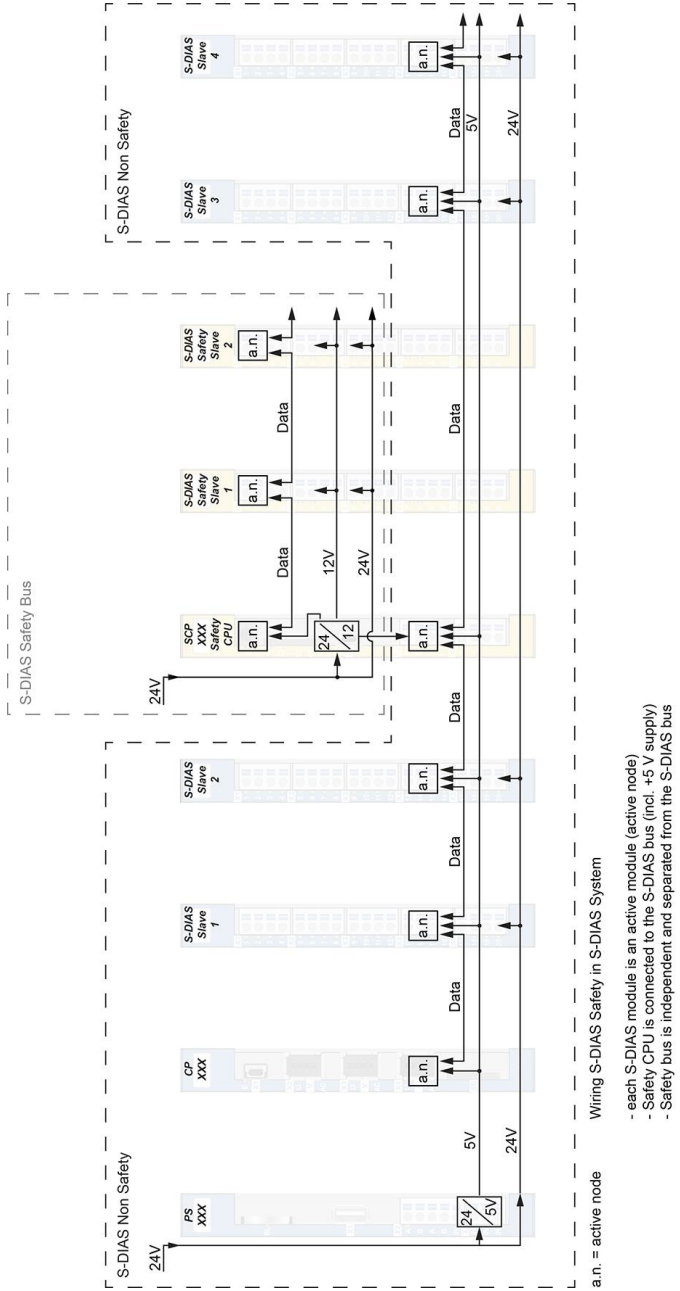
INFORMATION

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".


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 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

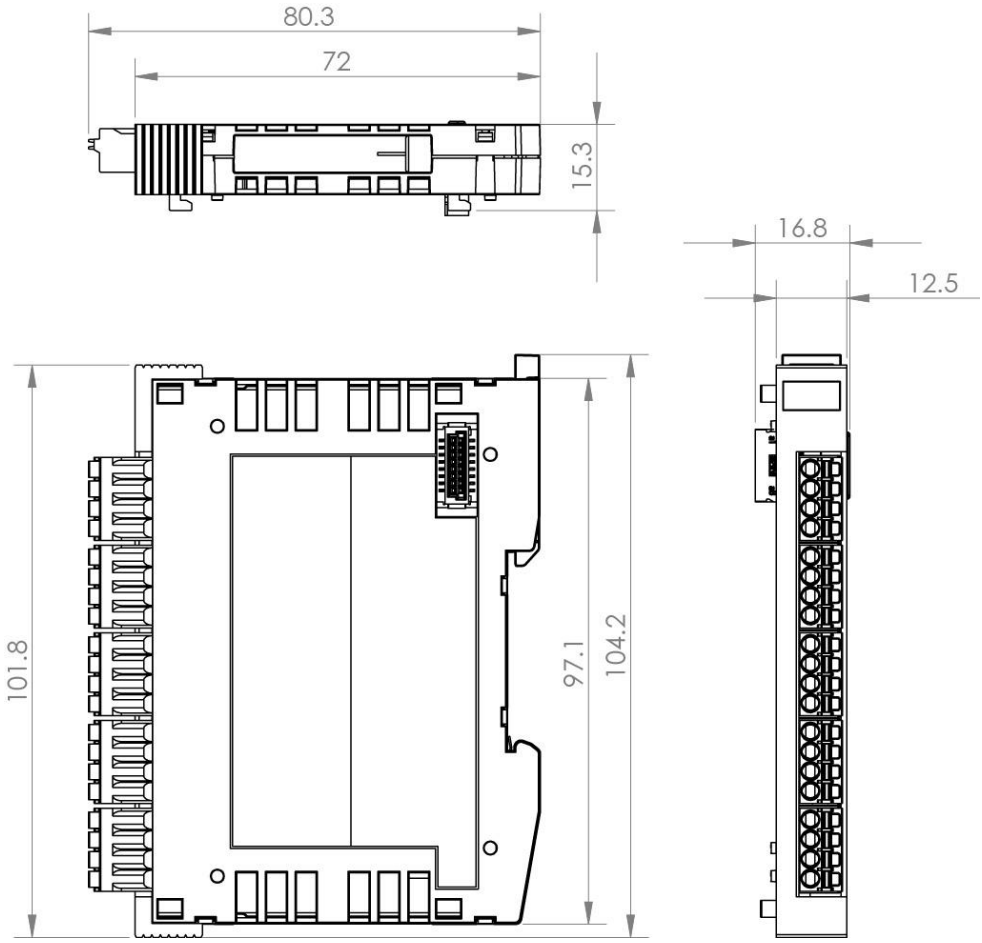
5.5 Miscellaneous

Article number	20-017-441 20-017-441-X (Printed circuit board with protective lacquer)
Standard	UL 508 (E247993)
Approbations	UL, cUL, CE

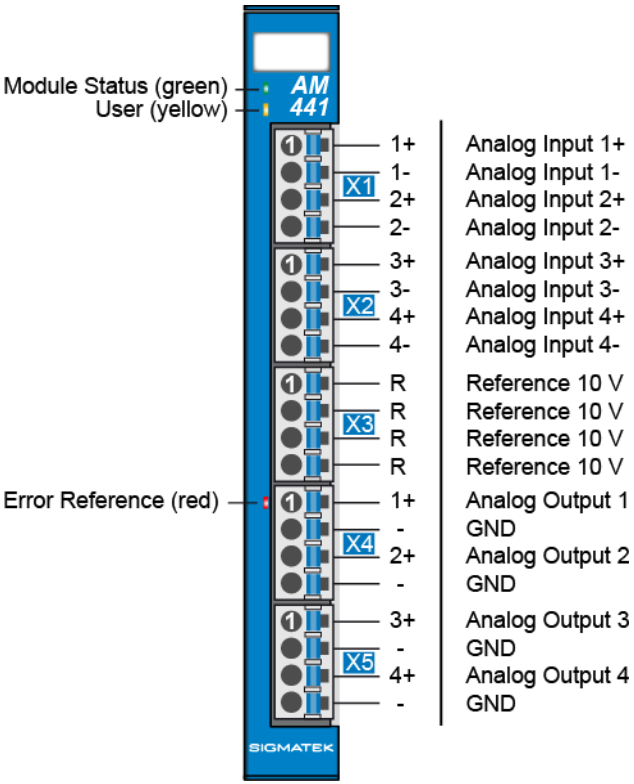
5.6 Environmental Conditions

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



7.1 Status LEDs

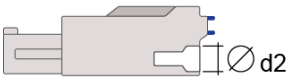
Module Status	green	ON	module active
		OFF	No supply available
		BLINKING (5 Hz)	no communication
User	yellow	ON	can be set from the application (e.g. the module LED can be set to blinking through the visualization so that the module is easily found in the control cabinet)
		OFF	
		BLINKING (2 Hz)	
		BLINKING (4 Hz)	
Error reference	red	ON	10 V reference overload
		OFF	no errors
		BLINKING (20 Hz)	overload GND, if Aix- is switched to GND through the software!

7.2 Applicable Connectors

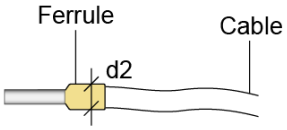
Connectors:
X1-X5: Connectors with spring terminals (included in delivery)
The spring terminals are suitable connecting ultrasonically compacted (ultrasonically welded) strands.

Connections:

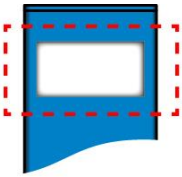
Stripping length/Sleeve length:	10 mm
Mating direction:	parallel to the conductor axis or circuit board
Conductor cross section rigid:	0.2-1.5 mm^2
Conductor cross section flexible:	0.2-1.5 mm^2
Conductor cross section ultrasonically compacted:	0.2-1.5 mm^2
Conductor cross section AWG/kcmil:	24-16
Conductor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



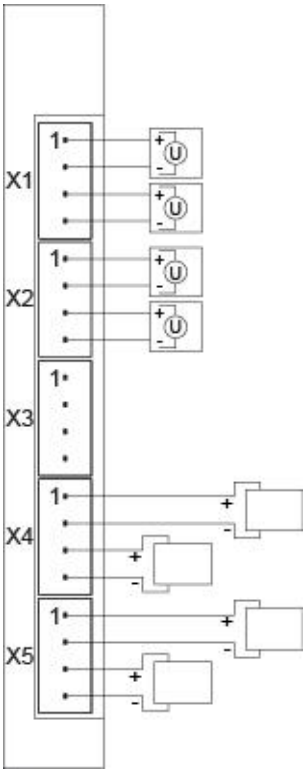
7.3 Label Field



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 Note

To ensure error-free operation, a careful wiring method must be followed:

- The 0 V connection of the supply voltage must be connected with the 0 V collection point over the shortest route possible.
- The DIN rail must have an adequate mass connection.
- The lines connected to the source of the analog components 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.
- Protective circuits for all relays (RC networks or free-wheeling diodes)
- Correct wiring to mass

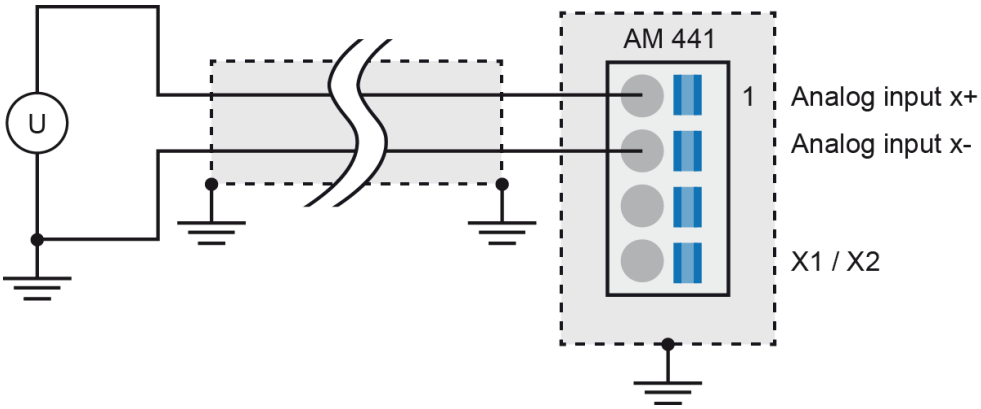
INFORMATION

Connect the ground bus to the control cabinet.

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

8.3 Connection Variants

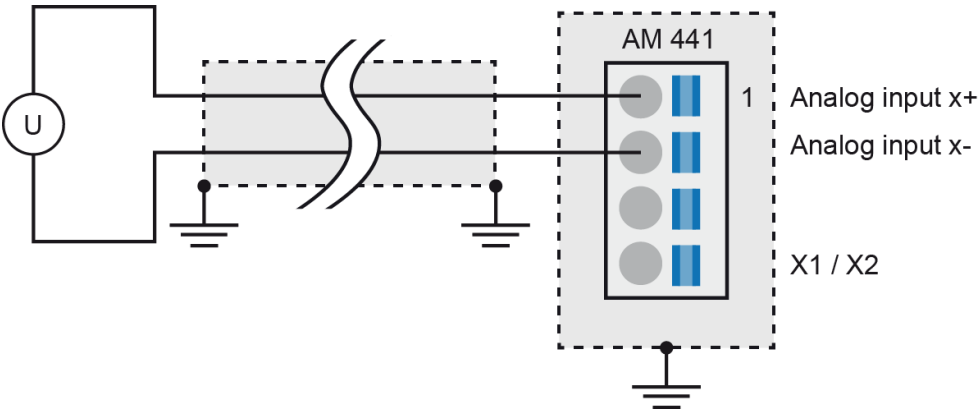
8.3.1 Voltage Measurement of not Potential-free Voltage Sources



Connection scheme 1

When using a non potential-free voltage source (voltage source with connection to the ground or GND), the input must be configured as a differential analog input via the software. For the analog input of the module, no connection to AGND, GND or ground can be made. Otherwise compensating currents and measurement error can occur.

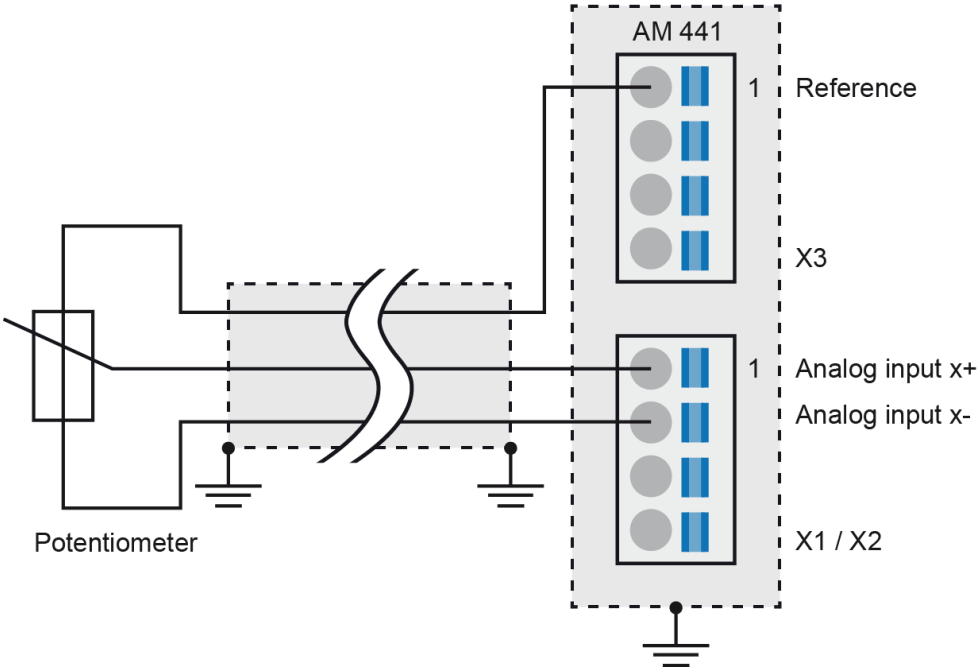
8.3.2 Voltage Measurement of Potential-free Voltage Sources



Connection scheme 2

When using a potential-free voltage source (voltage source without connection to the earth or GND), the input must either be configured via the software as an "Input with reference to mass" so that the analog input connection x- internal is connected to AGND, or as a differential analog input and the reference to mass for the analog signal made externally.

8.3.3 Voltage Measurement with a Potentiometer

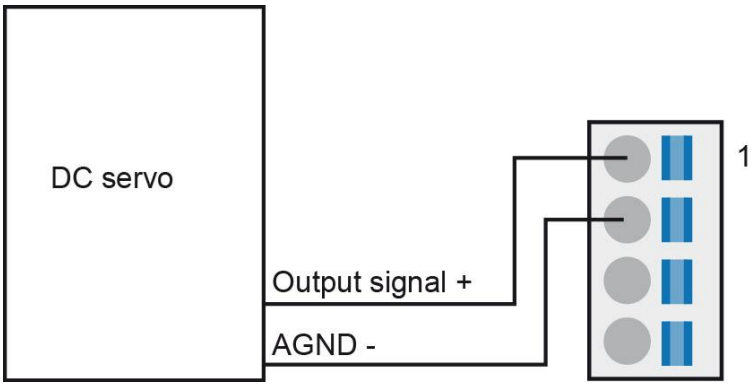


Schematic 3

The analog inputs can also be used to connect a potentiometer. The input must be thereby configured via the software as an "input with reference to mass". The analog input x- internal is then connected to AGND. For the potentiometer supply, the reference connection provided should be used.

8.3.4 Connection to Analog Outputs

Example application: axis control for a DC servo, frequency converter.



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.

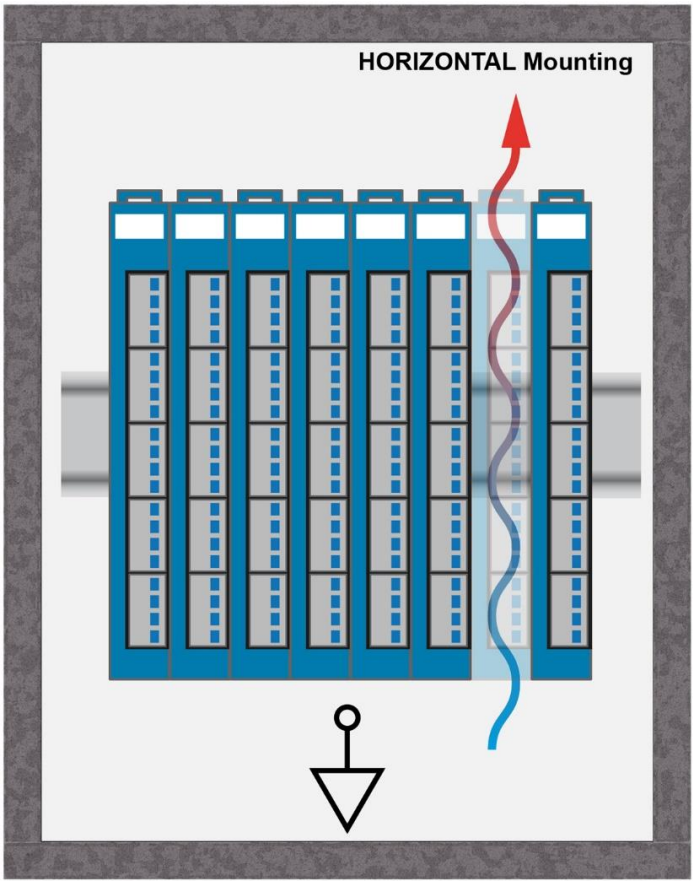
INFORMATION

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.

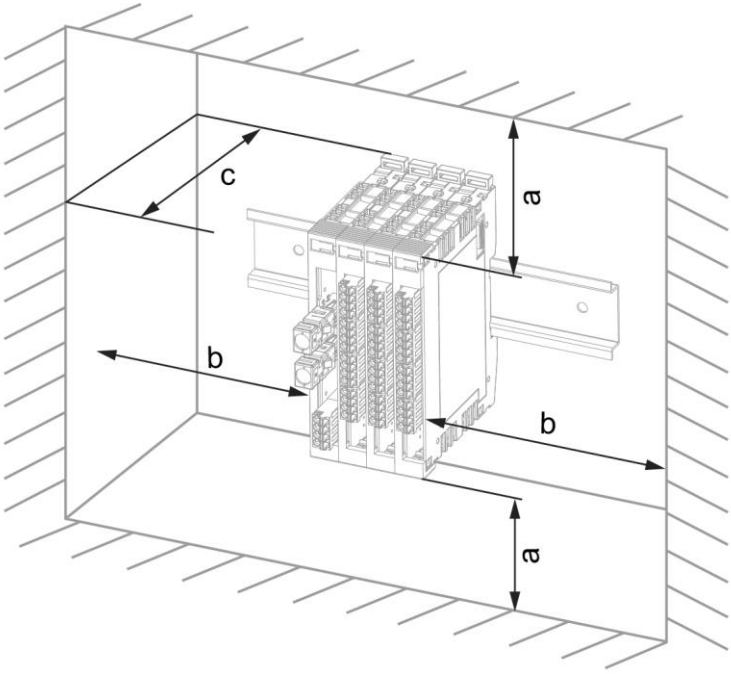
Damaged components can disrupt or damage the system.

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 Expanded Timing Modes (FW version ≥ V02.00)

The AM 441can operate the analog inputs in either speed mode (highest possible scan rate) or in time-offset mode (measuring active only once per cycle at a defined time). This can be configured via bit 3 in the Info byte of the configuration data (address 0x0104).

The analog outputs on the contrary, are always operated in time-offset mode. By default however, predefined time offsets (at the start of a cycle) are used for this purpose. By setting bit 4 in the Info byte of the configuration data (address 0x0104), the time offsets can also be predefined for the analog outputs of the HW class.

Thereby, it is important to note that the time offsets for the analog outputs can only be exactly stopped when the analog inputs are also operated in the same operating mode, since they are assigned to the analog outputs. If the analog inputs should be operated in speed mode, the actual time point of the defined analog value output can deviate up to 200 µs.

10.1 Speed Mode

The speed mode is available for the analog inputs only. In this mode, the analog inputs are scanned as fast as possible and filtered to achieve the highest possible sampling rate. The time point of the individual measurements cannot be defined since measuring is continuous and is therewith performed several times per S-DIAS cycle.

The analog outputs are activated during the sections of free time between measurements of the analog inputs. A constant sampling rage is thereby guaranteed.

10.2 Time-Offset Mode

The time-offset mode is basically used for the analog outputs, since they must be written only once per S-DIAS cycle. However, it also available for the analog inputs (the appropriate bit must be set in the info byte of the configuration data).

In the time-offset mode, the analog in and outputs (depending on the configuration of both or only the outputs) are measured only once per cycle (the duration of a cycle corresponds to the S-DIAS cycle time). The measurement or output time can be defined in µs as an offset to the S-DIAS Sync (cycle start point).

The time for the analog inputs are thereby predefined by the hardware class directly (in the cyclic data for the Firmware. A time offset can be set per channel)

In the analog outputs, predefined time offsets configured so they correspond to the earliest time possible are used by default.
If however, bit 4 in the info byte of the configuration file (Address 0x0104) is set, the offsets in the cyclic data provided by the HW class are used. Here, it is important to note that deviations can occur if the analog inputs are operated in speed mode.

The settable values (time offsets) are subject to the following limits:

- **Minimum time offset value:** Since the firmware must process the incoming cyclic data immediately after the S-DIAS sync, only offset values of **130 µs** and higher can be used.

- **Maximum time offset value:** Since cyclic Data for the HW class must be written at the end of an S-DIAS cycle, only offset values up a maximum cycle time **below 160 µs** can be used.

- **Interval between time offsets:** Since it is not possible to measure or set multiple analog inputs simultaneously, the interval between offsets must be at least **20 µs**.

- **Correction within the firmware:** If offset values beyond the limits are set or too close together, these are corrected (shifted) by the firmware where possible. To signal the correction or incorrect values to the HW class, the appropriate status bit is set (bit 7 of 8 in the cyclic data for the HW class to address 0x000A).

11 Supported Cycle Times

11.1 Cycle Times below von 1 ms (in µs)

FW	50	100	125	200	250	500
< V3.00						x
≥ V3.00						x

11.2 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
< V3.00		**x**	**x**													
≥ V3.00	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

FW	1	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
< V3.00																
≥ V3.00	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

12 Addressing

12.1 Firmware – HW Class Addressing (FW Version V01.00 – V01.20)

The address allocation defined here applies to the FW versions V01.00, V01.10 and V01.20. for FW version ≥ V02.00, see 12.2.

Address (hex)	Size (bytes)	Access Type	Description
0000	**128**	**w**	**Cyclic Data for Firmware**
0000	2	w	Analog output 1
0002	2	w	Analog output 2
0004	2	w	Analog output 3
0006	2	w	analog output 4
0080	**128**	**r**	**Cyclic Data for the HW class**
0080	2	r	status Bit 0 24 V DC not OK Bit 1 not synchronized Bit 2 FLASH calibration data CRC error Bit 3 FLASH calibration data CRC error Bit 4 invalid calibration data Bit 5-15 reserved
0082	2	r	Analog input 1
0084	2	r	Analog input 2
0086	2	r	Analog input 3
0088	2	r	Analog input 4

008A	2	r	cable break detection Bit 0 cable break AI1 Bit 1 cable break AI2 Bit 2 cable break AI3 Bit 3 cable break AI4 Module status Bit 4 reference voltage 0 ... Reference voltage OK 1 ... Voltage too low Bit 5 AI overload (at least 1 analog input is overloaded) Bit 6-15 reserved
0100	**128**	**w**	**Firmware Configuration Data**
0100	2	w	CRC16 over the entire configuration data
0102	2	w	Length of the configuration data
0104	1	w	info (special-purpose or status bits) Bit 0 Raw value mode 0 ... normal mode (in and output values compared) 1 ... raw values are used and provided Bit 1-7 reserved
0105	1	w	Reserved

0106	2	w	Configuration of the analog inputs Bit 0 analog input 1 0 … differential analog input 1 ... analog input with reference to mass Bit 1 analog input 2 0 … differential analog input 1 ... analog input with reference to mass Bit 2 analog input 3 0 … differential analog input 1 ... analog input with reference to mass Bit 3 analog input 4 0 … differential analog input 1 ... analog input with reference to mass Bit 4-15 reserved
0108	2	w	Frequency limit low pass filter in Hz analog input 1 (with a frequency limit setting of 0 Hz, the software low pass filter is deactivated. Compliance with the sampling theorem must be ensured)
010A	2	w	Frequency limit low pass filter in Hz analog input 2 (Note, see address 0x0108)
010C	2	w	Frequency limit low pass filter in Hz analog input 3 (Note, see address 0x0108)
010E	2	w	Frequency limit low pass filter in Hz analog input 4 (Note, see address 0x0108)
0180	**128**	**r**	**HW Class Configuration Data**
0180	2	r	CRC16 over the entire configuration data
0182	2	r	Length of the configuration data
0184	2	r	Firmware version

12.2 Firmware – HW Class Addressing (FW Version ≥ V02.00)

The address allocation defined here applies to the FW version ≥ V02.00. For older FW versions see 12.1.

Address (hex)	Size (bytes)	Access Type	Description
0000	**128**	**w**	**Cyclic Data for Firmware**
0000	2	w	Analog output 1
0002	2	w	Analog output 2
0004	2	w	Analog output 3
0006	2	w	Analog output 4
0008	2	w	AI 1 – Time-Offset from Sync in µs (the time offsets are automatically adjusted, see 10.2)
000A	2	w	AI 2 – Time-Offset from Sync in µs (Note, see address 0x0008)
000C	2	w	AI 3 – Time-Offset from Sync in µs (Note, see address 0x0008)
000E	2	w	AI 4 – Time-Offset from Sync in µs (Note, see address 0x0008)
0010	2	w	AO 1 – Time-Offset from Sync in µs (the time offsets are adjusted automatically, see 10.2. If the analog inputs are operated in speed mode, the analog value output can deviate up to 200 µs)
0012	2	w	AO 2 – Time-Offset from Sync in µs (Note, see address 0x0010)
0014	2	w	AO 3 – Time-Offset from Sync in µs (Note, see address 0x0010)
0016	2	w	AO 4 – Time-Offset from Sync in µs (Note, see address 0x0010)
0080	**128**	**r**	**Cyclic Data for the HW class**

0080	2	r	status Bit 0 24 V DC not OK Bit 1 not synchronized Bit 2 FLASH calibration data CRC error Bit 3 FLASH calibration data CRC error Bit 4 invalid calibration data Bit 5 S-DIAS cyclic time not supported Bit 6-11 reserved Error information Bit 12-15 Error codes 00 …….. no errors occurred 01 …….. periphery could not be initialized 02 …….. System clock could not be initialized 03-14 ..... reserved 15 …….. undefined error occurred
0082	2	r	Analog input 1
0084	2	r	Analog input 2
0086	2	r	Analog input 3
0088	2	r	Analog input 4

008A	2	r	Cable break detection and measurement range testing Bit 0 cable break AI1 (also corresponds to AI1 Overrange when the new features (Bit 2 at address 0x0104) are activated) Bit 1 cable break AI2 (also corresponds to AI2 Overrange when the new features (Bit 2 at address 0x0104) are activated) Bit 2 cable break AI3 (also corresponds to AI3 Overrange when the new features (Bit 2 at address 0x0104) are activated) Bit 3 cable break AI4 (also corresponds to AI4 Overrange when the new features (Bit 2 at address 0x0104) are activated) Module status Bit 4 reference voltage 0 ... Reference voltage OK 1 ... Voltage too low Bit 5 AI overload (at least 1 analog input is overloaded) Bit 6 24 V DC not OK Time Offset Information Bit 7 Time offset must be corrected (interval was too short or is beyond the limit) Bit 8 Time offsets exceed the allowed limits and cannot be corrected (the defined time offsets are invalid or became invalid by shifting the offsets within the firmware) Expanded measurement range testing Bit 9 AI1 Under range (only when the new features (Bit 2 in the info byte at address 0x0104) are activated) Bit 10 AI2 Under range (only when the new features (Bit 2 in the info byte at address 0x0104) are activated) Bit 11 AI3 Under range (only when the new features (Bit 2 in the info byte at address 0x0104) are activated) Bit 12 AI4 Under range (only when the new features (Bit 2 in the info byte at address 0x0104) are activated) Bit 13-15 reserved
0100	**128**	**w**	**Firmware Configuration Data**
0100	2	w	CRC16 over the entire configuration data
0102	2	w	Length of the configuration data

0104	1	w	info (special-purpose or status bits) Bit 0 Raw value mode 0 ... normal mode (in and output values compared) 1 ... raw values are used and provided Bit 1 reserved Bit 2 Expanded functionality 0 … additional features are deactivated (compatibility) 1 … additional features are activated. Included therein is the use of the message counter, as well as testing the measure-ment range for all analog inputs and the connected under and over range bits at address 0x008A. Bit 3 ADC - timing mode 0 ... speed mode (the ADC is read over a measurement timer as fast as possible) 1 ... time-offset mode (the analog inputs are sampled with the predefined time offsets of the HW class) Bit 4 Configurable DAC time offsets 0 … predefined offsets are used for the time point of the analog value output (at the beginning of the S-DIAS cycle) 1 … The time offsets set by the HW class is used of the analog value outputs. Bit 5 full 16-bit resolution (full-range mode) 0 ... full-range mode is deactivated (the voltage values are provided in a range from -10000 mV to +10000 mV) 1 ... full-range mode (the resolution of the values is increased by a factor of 3, whereby the voltages are provided in a range from -30000 to +30000 units the measurement range remains unchanged) Bit 6 Module version (to distinguish the hardware, only required when time offsets are used to deactivate the deactivate unavailable in and outputs) 0 … AM 221 1 … AM 441 Bit 7 reserved
0105	1	w	Message Counter (used when bit 2 in the Info-Byte is set to address 0x0104)

0106	2	w	Configuration of the analog inputs Bit 0 analog input 1 0 … differential analog input 1 ... analog input with reference to mass Bit 1 analog input 2 0 … differential analog input 1 ... analog input with reference to mass Bit 2 analog input 3 0 … differential analog input 1 ... analog input with reference to mass Bit 3 analog input 4 0 … differential analog input 1 ... analog input with reference to mass Bit 4-15 reserved
0108	2	w	Frequency limit low pass filter in Hz analog input 1 (with a frequency limit setting of 0 Hz, the software low pass filter is deactivated. Compliance with the sampling theorem must be ensured)
010A	2	w	Frequency limit low pass filter in Hz analog input 2 (Note, see address 0x0108)
010C	2	w	Frequency limit low pass filter in Hz analog input 3 (Note, see address 0x0108)
010E	2	w	Frequency limit low pass filter in Hz analog input 4 (Note, see address 0x0108)
0180	**128**	**r**	**HW Class Configuration Data**
0180	2	r	CRC16 over the entire configuration data
0182	2	r	Length of the configuration data
0184	2	r	Firmware version
0186	1	r	Message Counter (only used when bit 2 in the info byte is set to address 0x0104)
0187	1	r	Reserved

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

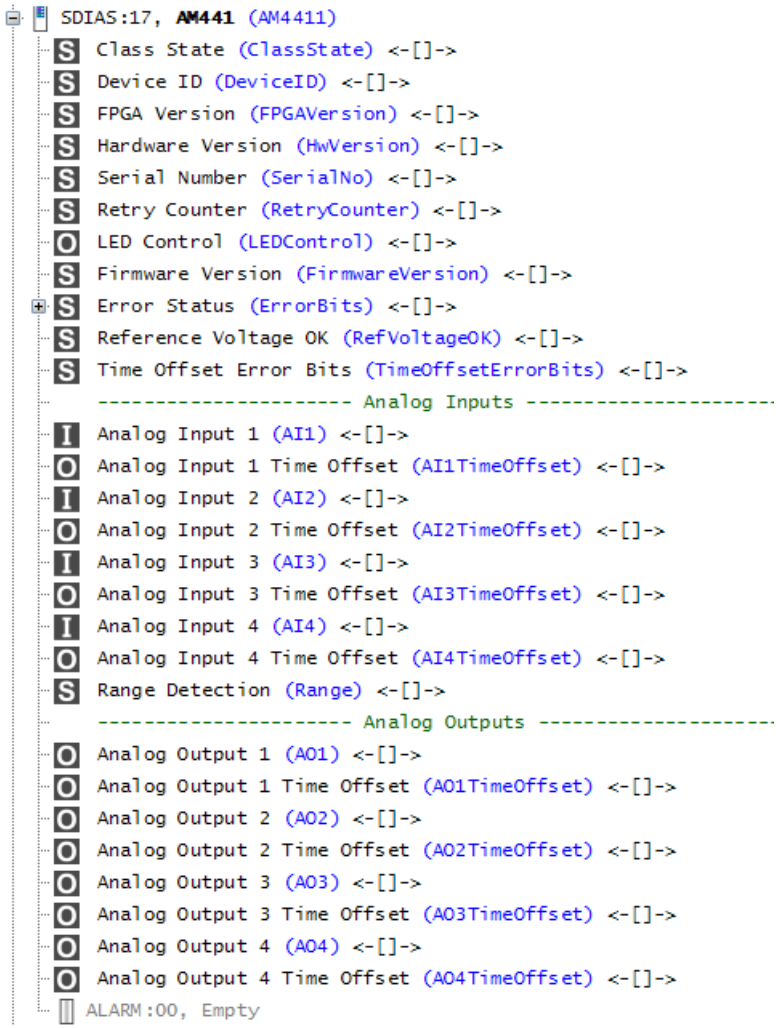
INFORMATION

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 AM441

Hardware Class AM441 for the S-DIAS AM441 analog module



This hardware class is used to control the AM441 hardware module. The module has 4 analog inputs (+/- 10 V) and 4 analog outputs (+/- 10 V). 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	With this server, the application LED of the S-DIAS module can be activated to find the module in the network more quickly. 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.
Error Status	State	In this server, the status bits of the FW are shown. Bit 0 Not defined Bit 1 No Sync available Bit 2 Flash Data CRC Error Bit 3 Ram Data CRC Error Bit 4 Invalid EEProm version Bit 16 Cable break at input AI1 Bit 17 Cable break at input AI2 Bit 18 Cable break at input AI3 Bit 19 Cable break at input AI4 Bit 20 Voltage too low Bit 21 Analog input current too low Bit 22 Supply +24 V on the S-DIAS bus not OK
Reference Voltage OK	State	The reference voltage for sever value 0 is too low.
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.
AI[1-4] Config	Property	0 AI[1-4] used as analog input (range: -10 ... +10 V) 1 AI[1-4] used as analog input with mass reference (Range: -10 ... +10 V).

AI[1-4] 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[1-4] 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[1-4]_Min + AI[1-4]_Max.
AI[1-4] 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[1-4]_Min + AI[1-4]_Max.
AO[1-4] minimal value	Property	Minimum output value AO[1-4]. If this value is written to the respective channel server, the module outputs -10 V
AO[1-4] maximal value	Property	Maximum output value AO[1-4]. If this value is written to the respective channel server, the module outputs +10 V.
Analog Input [1-4]	Input	Analog input 1-4, status query over read(). An open input returns -2147483632 in the hardware class.
Analog Output [1-4]	Output	Analog output [1-4].

17.2 Communication Interfaces

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

Documentation Changes

Change date	Affected page(s)	Chapter	Note
23.10.2013	5	1.6 Environmental Conditions	Vibration resistance added
18.12.2013	1		Potentiometer inputs added
	3	1.1 Analog Inputs Specifications ±10 V or Potentiometer Inputs 0-100 %	Table expanded
	5	1.4 Electrical requirements	Values changed and grey info box added
	8	3. Connector Layout	Image changed
	10	4.1 Wiring Example	Wiring example added
16.01.2014	3	1.1 Analog Inputs Specifications ±10 V or Potentiometer Inputs 0-100 %	Analog measurement precision extended, value changed
11.02.2014	7	3. Connector Layout	Image changed
	8	3.2 Applicable Connectors	Connections added French notes added
01.04.2014	5	1.5 Miscellaneous	UL added
	13	5 Mounting	Text updated
05.06.2014	3	1.2 Reference Output Specification	Allowable load per potentiometer input added
30.01.2015	10	4.2 Notes	Note regarding connecting/disconnecting the S-DIAS module under voltage.
26.03.2015	8	3.2 Applicable Connectors	Added connections
08.04.2015	12-14	4.3 Connection Variants	Chapter edited
27.07.2015	4	1.2 Reference Output Specification	Allowable output current and load per potentiometer input expanded
	5	1.4 Electrical requirements	Current consumption on the S-DIAS bus (+24 V supply) changed
29.09.2015	4, 12, 13	1.1 Analog Inputs Specifications ±10 V 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	Differential inputs modified

02.10.2015	6	1.5 Miscellaneous	UL, cUL, CE added
18.02.2016	6	1.4 Electrical requirements	Graphic added
09.03.2016	4	1.1 Analog Inputs Specifications ±10 V or Potentiometer Inputs 0-100 %	Input type changed
28.04.2016	19	5 mounting	Graphic distances
17.05.2016	4	1.2 Reference Output Specification	short-circuit protection (1 min.) stricken
11.01.2017	5	1.3 Analog Output Current Specifications	Formulation of analog precision
27.03.2017	4	1.1 Analog Inputs Specifications ±10 V or Potentiometer Inputs 0-100 %	Value for the sensor break detection expanded
11.07.2017	4 5 22-29	1.1 Analog Inputs Specifications ±10 V or Potentiometer Inputs 0-100 % 1.3 Analog Output Specifications ±10 V 7 Addressing	Corrected specifications regarding the measurement value and the conversion time Corrected refresh time specification Addressing corrected (firmware dependency)
19.07.2017	4 5	1.1 Analog Inputs Specifications ±10 V or Potentiometer Inputs 0-100 % 1.3 Analog Output Specifications	Conversion time for all channels 500 µs Refresh time for all channels
17.08.2017	8 11	1.6 Environmental Conditions 3.2 Applicable Connectors	Added operating conditions Added sleeve length Added info regarding ultrasonically welded strands
18.10.2017	12 20	3.3 Label Field 5 Mounting	Added chapter Graphic replaced
13.08.2020	4, 21, 23, 26	Entire document	FW version V02.00 adapted to FW version ≥ V02.00
08.09.2020		8 Hardware Class AM441	Chapter added
04.11.2020	19	5 Mounting	Expansion functional ground connection
20.02.2023	23	7 Supported Cycle Times	Chapter added
26.07.2023		Document	General chapters added, design
05.03.2024	15	5.5 Miscellaneous	AM 441-X added