

AI 088

S-DIAS Analog Input Module

Instruction Manual

Publisher: SIGMATEK GmbH & Co KG
A-5112 Lamprechtshausen
Tel.: +43/6274/4321
Fax: +43/6274/4321-18
Email: office@sigmatek.at
WWW.SIGMATEK-AUTOMATION.COM

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Translation of the Original Instructions

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S-DIAS Analog Input Module

AI 088

with 8 thermal element inputs

2 KTY temperature sensor inputs

1 KTY11-62 temperature sensor

The S-DIAS AI 088 analog input module has eight thermal element inputs for all conventional thermal element types. Two inputs for KTY temperature sensors for coupling compensation are also provided or starting with hardware version HW3.0 and firmware version FW2.0, additional temperature sensor for thermocouple compensation are integrated into the module.



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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 088

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 088 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 Thermal Element Input Specifications

Number of channels	8	
Measurement range	see the following table, Measurement Ranges Thermo Elements	
Converter resolution	16-bit	
Conversion time per channel	1 ms	
Common mode range	±10 V	
Input resistance	2 MΩ	
Cable break monitor	yes	
Measurement current for cable brake monitor	typically 3 μA ⁽²⁾	
Over voltage protection	265 V AC	
Input filter Hardware	typically 2 Hz	low pass 3 rd order
Input filter Software	50 Hz/60 Hz	
Measurement precision	±0.7 % of maximum measurement value ⁽¹⁾	

⁽¹⁾ Does not contain the measurement error the temperature measured at the coupling

⁽²⁾ The line resistance of the thermo elements cause a measurement error in combination with the measurement current for cable break monitor.

5.2 Measurement Ranges

5.2.1 Measurement Ranges Thermo Elements

Type	Thermocouple	Measurement range	Measurement value ⁽¹⁾	Measurement error ⁽²⁾
J	Fe-CuNi	-10 ... +690 °C (-0.501-38.512 mV)	-100-6900	0.0078 %/Ω
K	NiCr-Ni	-40 ... +940 °C (-1.527-38.918 mV)	-400-9400	0.0077 %/Ω
T	Cu-CuNi	-40 ... +400 °C (-1.475-20.872 mV)	-400-4000	0.0144 %/Ω
E	NiCr-CuNi	0 ... +520 °C (0-38.624 mV)	0-5200	0.0078 %/Ω
N	NiCrSi-NiSi	-80 ... 1080 °C (-1.972-39.326 mV)	-800-10800	0.0076 %/Ω
S	Pt10Rh-Pt	-50 ... 1760 °C (-0.236-18.609 mV)	-500-17600	0.0161 %/Ω
R	Pt13Rh-Pt	-50 ... 1760 °C (-0.226-21.003 mV)	-500-17600	0.0142 %/Ω
B	Pt30Rh-Pt6Rh	0 ... +1820 °C (0-13.820 mV)	0-18200	0.0217 %/Ω
L	Fe-CuNi	0 ... +680 °C (0-38.487 mV)	0-6800	0.0078 %/Ω
U	Cu-CuNi	0 ... +590 °C (0-33.606 mV)	0-5900	0.0089 %/Ω

⁽¹⁾ An open input returns -2147483632 in the hardware class.

⁽²⁾ Measurement error caused by line resistance of the thermal elements based on the measurement range.

5.2.2 Voltage Measurement Range

Type	Voltage range	Measurement value ⁽¹⁾
1	0-40 mV	0-40000

⁽¹⁾ An open input returns -2147483632 in the hardware class.

5.3 Temperature Sensor Input Specifications for Thermo Coupling Compensation

Number of channels	2	
Sensor type	KTY 10-62 or KTY 11-62	
Measurement range	-20 ... +80 °C	
Measurement value	-200 ... +800	
	An open or shorted input returns -2147483632 in the hardware class.	
Converter resolution	16-bit	
Conversion time per channel	1 ms	
Sensor current	typically 0.3 mA at 25 °C	
Cable break monitor	yes	
Short circuit monitor	yes	
Input filter	typically 2 Hz	low pass 3 rd order
Measurement precision	±0.7 % of maximum measurement value	

5.4 Electrical Requirements

Voltage supply from S-DIAS bus	+5 V	
Current consumption on the S-DIAS bus (+5 V power supply)	typically 62 mA	maximum 68 mA
Voltage supply from S-DIAS bus	+24 V	
Current consumption on the S-DIAS bus (+24 V power supply) HW1.x to HW3.10	typically 75 mA	maximum 90 mA
Current consumption on the S-DIAS bus (+24 V power supply) Starting with HW3.30	typically 80 mA	maximum 102 mA

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".

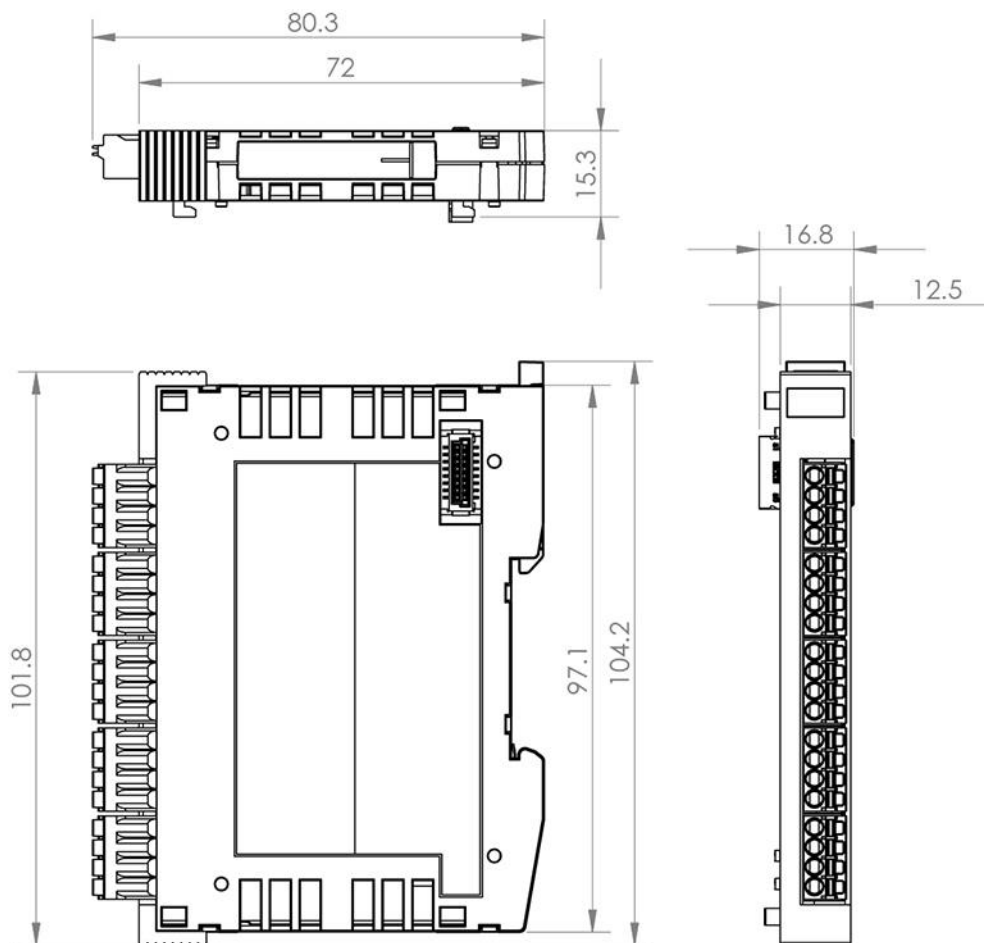
5.5 Miscellaneous

Article number	20-009-088
Standard	UL 508 (E247993)
Approbations	UL, cUL, CE, UKCA

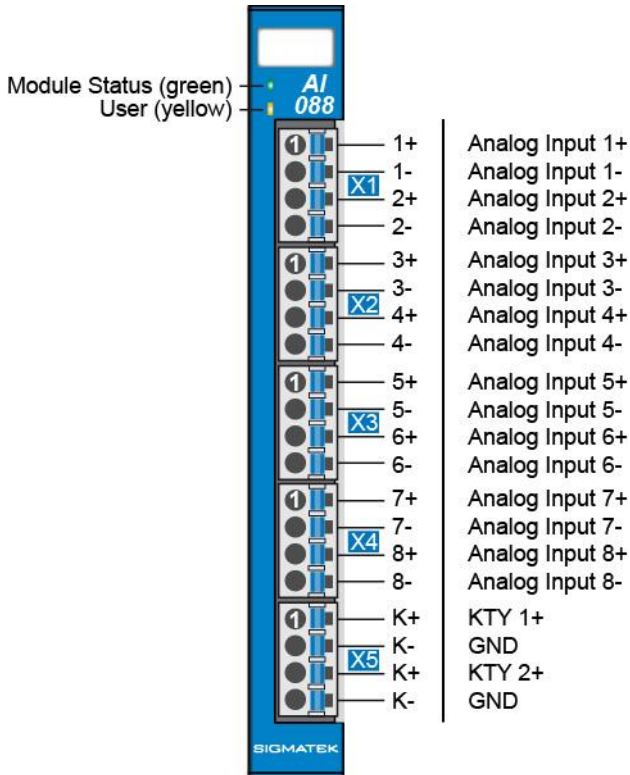
5.6 Environmental Conditions

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



The temperature sensors for the coupling compensation (KTY1, KTY2 or starting from HW3.0, internal temperature sensors) can be set individually for any thermal element input. If the KTY temperature inputs are not needed for the coupling compensation, they can also be used as independent temperature sensors as well.

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 visualization so that the module is easily found in the control cabinet)
		BLINKING (2 Hz)	
		BLINKING (4 Hz)	

7.2 Applicable Connectors

Connectors:

X1-X4: Connectors with spring terminals (gold plated) (included in delivery)

X5: Connector with spring terminals (tinned) (included in delivery)

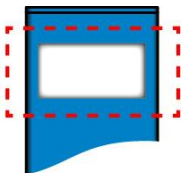
The spring terminals are suitable connecting ultrasonically compacted (ultrasonically welded) strands.

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)



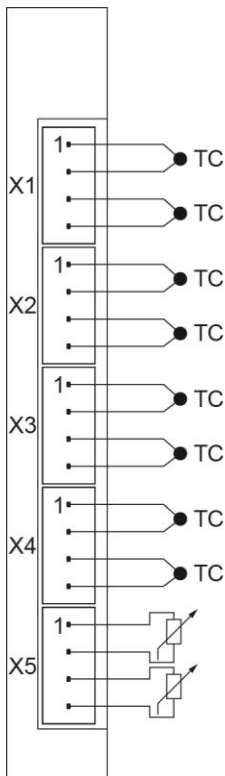
7.3 Label Field



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 Notes

8.2.1 General Notes

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!

8.2.2 Temperature Measurement with Thermo Elements

Temperature measurement using thermocouples is based on the temperature-dependent voltage, which is generated through the combination of two conductors from different metals (alloys); this is called the Seebeck effect.

This voltage exists therefore not only at the measurement point (where it is desired) but also at the coupling between the Thermocouple conductors and the copper connection. The thermo voltage at this location is not desired, however, it is unavoidable. This voltage falsifies the measurement value by that of the temperature at the coupling!

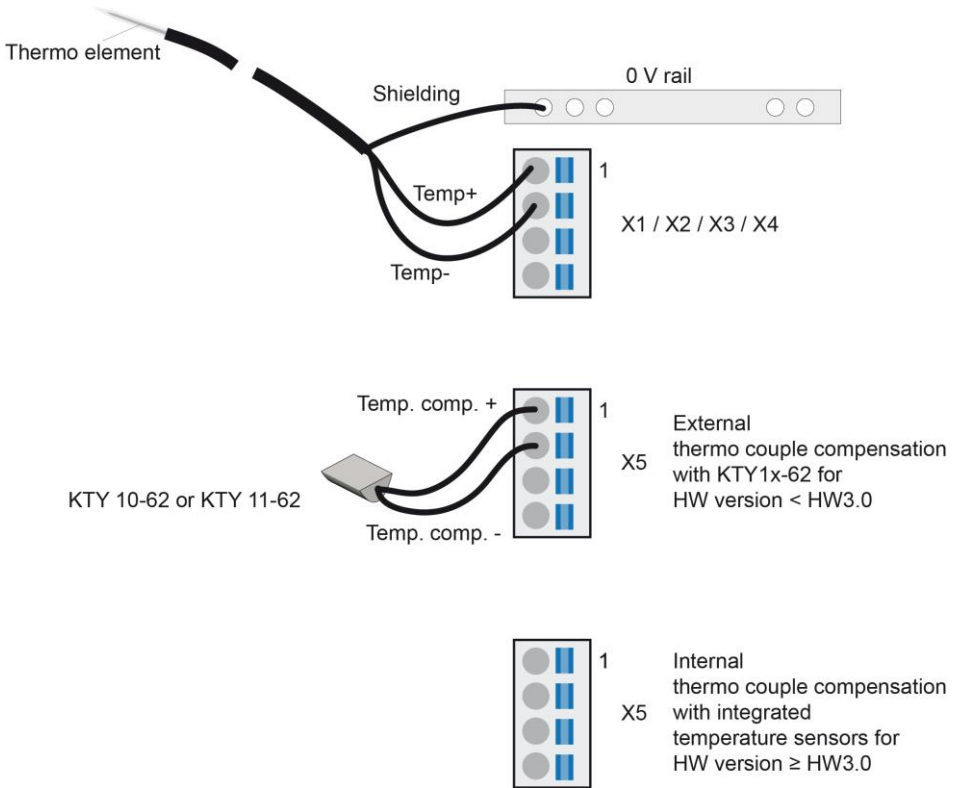
An exact measurement is therefore only possible if temperature of the coupling is measured, converted to the equivalent thermal voltage of the thermal element and added to measured thermal voltage of the servo element and the temperature calculated therefrom. The calculation is performed in the module directly.

Thermal elements can be connected directly to the connector plug (over compensating circuits when possible). For thermocouple applications where the compensating circuit is not connected to the control, the comparison measurement must be made at the junction of the thermocouple (or compensating circuit) and copper conductor.

For reasons for precision, a remote coupling is recommended. Hereby, the KTY should be placed as close as possible to the coupling.

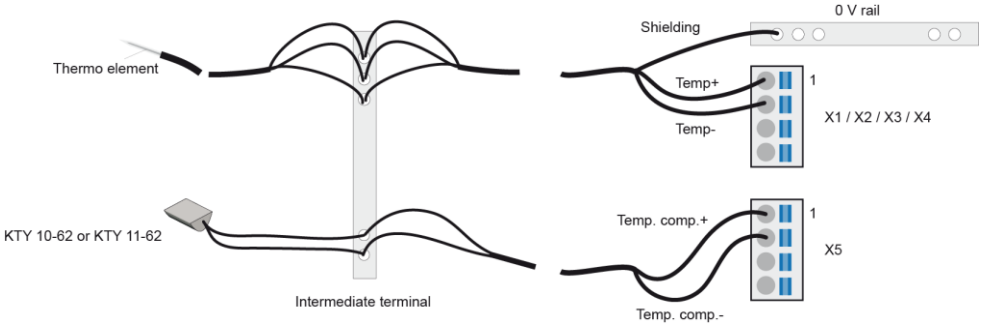
If the coupling is located directly on the module, the heat generated by the module and the warming of neighboring modules can lead to a greater measurement deviation than stated in the technical data.

8.2.3 Connecting the Thermo Element to the Control



- If the thermo element is galvanically isolated – meaning not connected to earth – it is recommended that when using the thermo elements to measure the temperature in ceramic heating elements, the thermos element should be connected to the GND terminal of the control to prevent measuring signal errors caused by the voltage coupling.
- With a HW version < HW3.0, or firmware version < FW2.00-10, a KTY 62-1110-61 or KTY 11-62 is used for thermocoupling compensation and in this case, measures the temperature directly from the S-DIAS connector X5.
- Starting with a hardware version \geq HW3.0 and a firmware version \geq FW2.00, the module has additional temperature sensors for thermo coupling compensation integrated. It is therefore recommended that the internal thermos coupling compensation be used when the thermal elements are connected directly to the control, so that the error can be reduced to $\leq \pm 2$ °C via the compensation.

8.2.4 Connecting the Thermo Element over an Intermediate Coupling without Equalization Cable



- If the thermo element is galvanically isolated – meaning not connected to earth – it is recommended that when using the thermo elements to measure the temperature in ceramic heating elements, the thermo element should be connected to the GND terminal of the control to prevent measuring signal errors caused by the voltage coupling.
- The KTY 10-62 or KTY 11-62 is used for thermo couple compensation and in this case, measures the temperature directly on the intermediate coupling

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

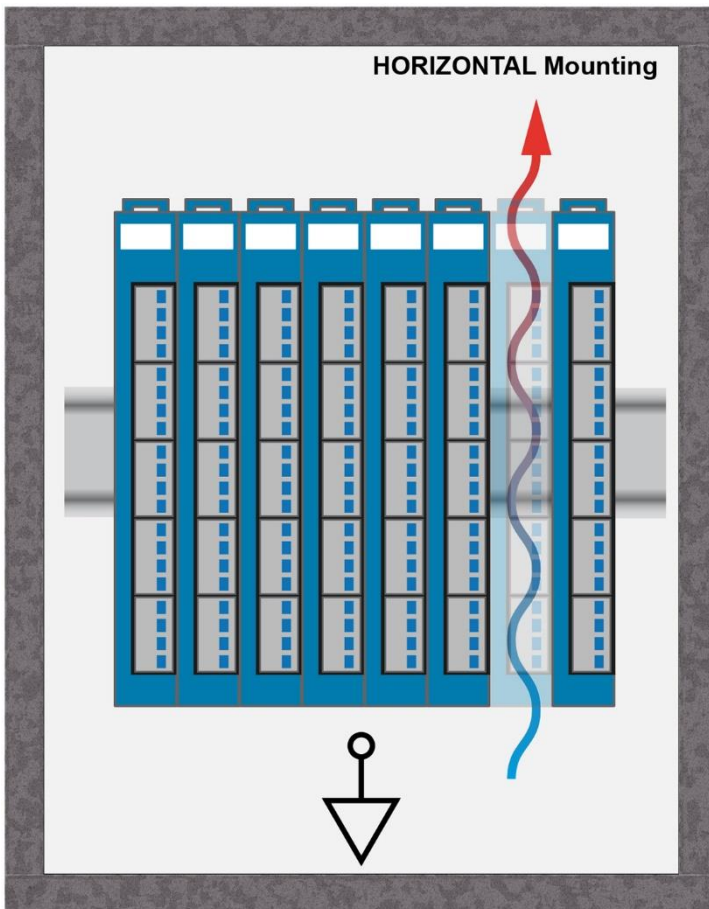


On receipt and before initial use, check the device for damage. If the device is damaged, contact our customer service and do not install the device in your system.

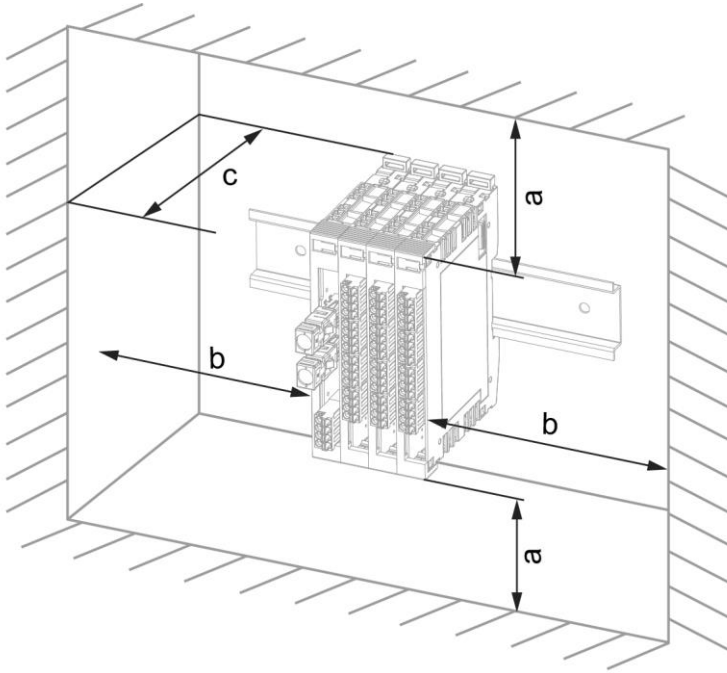
Damaged components can disrupt or damage the system.

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 (FW V1.00 to V1.10)

Address (hex)	Size (bytes)	Access Type	Description
0000	128	w	Cyclic Data for Firmware
0000	0	w	No data available
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 checksum error Bit 3 RAM calibration data checksum error Bit 4 Invalid calibration data Bit 5-15 reserved
0082	2	r	Temperature input 1
0084	2	r	Temperature input 2
0086	2	r	Temperature input 4
0088	2	r	Temperature input 4
008A	2	r	Temperature input 5
008C	2	r	Temperature input 6
008E	2	r	Temperature input 7
0090	2	r	Temperature input 9
0092	2	r	KTY Temperature input 1
0094	2	r	KTY Temperature input 2

0096	2	r	<p>Cable break detection</p> <p>Bit 0 Cable break TMP_1 Bit 1 Cable break TMP_2 Bit 7 Cable break TMP_8 Bit 8 Cable break KTY_1 (external) Bit 9 Cable break KTY_2 (external)</p> <p>Short-circuit detection</p> <p>Bit 10 Cable break KTY_1 (external) Bit 11 Cable break KTY_2 (external)</p> <p>Bit 12-15 reserved</p>
0100	128	w	Firmware Configuration Data
0100	2	w	Checksum over the entire configuration data
0102	2	w	Length of the configuration data
0104	1	w	<p>Info (special purpose or status bits)</p> <p>Bit 0 Raw value mode 0 ... normal mode (input values compared) 1 ... raw values are used and provided</p> <p>Bit 1-7 reserved</p>
0105	1	w	reserved
0106	1	w	<p>Thermal element select</p> <p>Bit 3 ... 0 TMP_1 Bit 7 ... 4 TMP_2</p>
0107	1	w	<p>Thermal element select</p> <p>Bit 3 ... 0 TMP_3 Bit 7 ... 4 TMP_4</p>
0108	1	w	<p>Thermal element select</p> <p>Bit 3 ... 0 TMP_5 Bit 7 ... 4 TMP_6</p>

0109	1	w	Thermal element select Bit 3 ... 0 TMP_7 Bit 7 ... 4 TMP_8
010A	1	w	Thermal element reference select Bit 0 TMP_1: 0 ... KTY_1, 1 ... KTY_2 Bit 1 TMP_2: 0 ... KTY_1, 1 ... KTY_2 Bit 7 TMP_8: 0 ... KTY_1, 1 ... KTY_2
0180	128	r	HW Class Configuration Data
0180	2	r	Checksum over the entire configuration data
0182	2	r	Length of the configuration data
0184	2	r	Firmware version

10.2 Address Mapping Overview (starting with FW V2.00)

Address (hex)	Size (bytes)	Access Type	Description
0000	128	w	Cyclic Data for Firmware
0000	0	w	No data available
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 checksum error Bit 3 RAM calibration data checksum 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	Temperature input 1
0084	2	r	Temperature input 2
0086	2	r	Temperature input 4
0088	2	r	Temperature input 4
008A	2	r	Temperature input 5
008C	2	r	Temperature input 6
008E	2	r	Temperature input 7
0090	2	r	Temperature input 9
0092	2	r	KTY Temperature input 1
0094	2	r	KTY temperature input 2

0096	2	r	<p>Bit 0 Cable break TMP_1</p> <p>Bit 1 Cable break TMP_2</p> <p>.....</p> <p>Bit 7 Cable break TMP_8</p> <p>Bit 8 Cable break KTY_1 (external)</p> <p>Bit 9 Cable break KTY_2 (external)</p> <p>Short-circuit detection</p> <p>Bit 10 Cable break KTY_1 (external)</p> <p>Bit 11 Cable break KTY_2 (external)</p> <p>Bit 12-14 reserved</p> <p>Error information</p> <p>Bit 15 Over voltage at a thermal input (TMP_ to TMP_) TMP_8)</p>
0098	2	r	<p>Internal KTY temperature input 1 (KTY_INT_1)</p> <p>(remains at "invalid-temperature" (= -30000) if the hardware does not support this feature)</p>
009A	2	r	<p>Internal KTY temperature input 2 (KTY_INT_2)</p> <p>(remains at "invalid-temperature" (= -30000) if the hardware does not support this feature)</p>

0100	128	w	Firmware Configuration Data
0100	2	w	Checksum over the entire configuration data
0102	2	w	Length of the configuration data
0104	1	w	<p>Info (special purpose or status bits)</p> <p>Bit 0 Raw value mode 0 ... normal mode (in and output values compared) 1 ... raw values are used and provided</p> <p>Bit 1 reserved</p> <p>Bit 2 Expanded function 0 ... additional features are deactivated (compatibility) 1 ... additional features are activated. Contained therein, is the message counter function as well as testing the measurement range (if voltage mode is active in the thermal inputs). Additionally, the internal KTY sensors can thereby be used as a reference for the thermal inputs (address 0x010B).</p> <p>Bit 3-7 reserved</p>
0105	1	w	Message Counter (only used when bit 2 in the Info-Byte is set to address 0x0104)
0106	1	w	<p>Thermal element select</p> <p>Bit 3 ... 0 TMP_1</p> <p>Bit 7 ... 4 TMP_2</p>
0107	1	w	<p>Thermal element select</p> <p>Bit 3 ... 0 TMP_3</p> <p>Bit 7 ... 4 TMP_4</p>
0108	1	w	<p>Thermal element select</p> <p>Bit 3 ... 0 TMP_5</p> <p>Bit 7 ... 4 TMP_6</p>
0109	1	w	<p>Thermal element select</p> <p>Bit 3 ... 0 TMP_7</p> <p>Bit 7 ... 4 TMP_8</p>

010A	1	w	<p>Thermal element reference select</p> <p>Bit 0 TMP_1: 0 ... KTY_1, 1 ... KTY_2</p> <p>Bit 1 TMP_2: 0 ... KTY_1, 1 ... KTY_2</p> <p>.....</p> <p>Bit 7 TMP_8: 0 ... KTY_1, 1 ... KTY_2</p>
010B	1	w	<p>Thermal element reference selection – internal/external (only when the new features (Bit 2 in the info-byte at address 0x0104) are activated)</p> <p>Bit 0 TMP_1: 0 ... KTY external, 1 ... KTY internal</p> <p>Bit 1 TMP_2: 0 ... KTY external, 1 ... KTY internal</p> <p>.....</p> <p>Bit 7 TMP_8: 0 ... KTY external, 1 ... KTY internal</p> <p>Note: If "KTY external" is selected, the KTY input configured at address 0x010A is used. If "KTY internal" is selected, KTY_INT_1 is used for TMP_1 to TMP_4 and for TMP_5 to TMP_8, KTY_INT_2 is used.</p>
0180	128	r	HW Class Configuration Data
0180	2	r	Checksum 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

11 Supported Cycle Times

Depending on the firmware version, the AI 088 supports different cycle times.

11.1 Cycle Times below 1 ms (in μs)

FW	50	100	125	200	250	500
V1.xx						
V2.00				x	x	x
V2.10				x	x	x
V2.20		x	x	x	x	x

x= supported

11.2 Cycle Times equal to or above 1 ms (in ms)

FW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
V1.xx	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
V2.00	x	x		x				x								x
V2.10	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
V2.20	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
V1.xx	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
V2.00																x
V2.10	x	x	x	x												
V2.20	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 AI088

Hardware Class AI088 for the S-DIAS AI088 analog input module

```
SDIAS :12, AI088 (AI0881)
[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) <-[]->
----- Temperature Inputs -----
[I] Temperature Input 1 (TMP_1) <-[]->
[I] Temperature Input 2 (TMP_2) <-[]->
[I] Temperature Input 3 (TMP_3) <-[]->
[I] Temperature Input 4 (TMP_4) <-[]->
[I] Temperature Input 5 (TMP_5) <-[]->
[I] Temperature Input 6 (TMP_6) <-[]->
[I] Temperature Input 7 (TMP_7) <-[]->
[I] Temperature Input 8 (TMP_8) <-[]->
[I] KTY Input 1 (KTY_1) <-[]->
[I] KTY Input 2 (KTY_2) <-[]->
[I] Internal KTY 1 (KTY_Int_1) <-[]->
[I] Internal KTY 2 (KTY_Int_2) <-[]->
[S] Cable Break (CableBreak) <-[]->
[S] Short circuit (ShortCircuit) <-[]->
ALARM:00, Empty
```

This hardware class is used to control the AI 088 hardware module. The thermal element input card has 8 thermal element inputs for all conventional thermal element types Two inputs for KTY temperature sensors for coupling compensation are provided. More information on the hardware can be found in the module documentation.

16.1 General

ClassState	State	This server shows the actual status of the hardware class.										
DeviceID	State	The device ID of the hardware module is shown in this server.										
FPGAVersion	State	FPGA version of the module in 16#XY (e.g. 16#10 = version 1.0).										
Hardware version	State	Hardware version of the module in format 16#XXYY (e.g. 16#0120 = Version 1.20)										
Serial Number	State	The serial number of the hardware module is shown in this server.										
Retry counter	State	This server increments when a transfer fails.										
LED control	Output	<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											
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.										
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> </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 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											

16.2 Analog Inputs 1-8

Temperature Input [1-8]	Input	Temperature input 1-8, status query over read() Temperature values in 1/10 °C. With open input the hardware class returns -2147483632.
Cable Break	State	Cable break detection Bit 0 cable break at temperature input TMP_1 Bit 1 cable break at temperature input TMP_2 Bit 2 cable break at temperature input TMP_3 Bit 3 cable break at temperature input TMP_4 Bit 4 cable break at temperature input TMP_5 Bit 5 cable break at temperature input TMP_6 Bit 6 cable break at temperature input TMP_7 Bit 7 cable break at temperature input TMP_8 Bit 8 cable break at temperature input KTY_1 Bit 9 cable break at temperature input KTY_2
Short Circuit	State	Short circuit detection: Bit 0 short circuit at temperature input KTY_1 Bit 1 short circuit at temperature input KTY_2
Thermocouple element select [1-8]	Property	Thermocouple selection for the temperature inputs 0 Type J (Fe-CuNi -10 ... +690 °C) 1 Type K (NiCr-Ni -40 ... +940 °C) 2 Type T (Cu-CuNi -40 ... +400 °C) 3 Type E (NiCr-CuNi 0 ... +520 °C) 4 Type N (NiCrSi-NiSi -80 ... 1080 °C) 5 Type S (Pt10Rh-Pt -50 ... 1760 °C) 6 Type R (Pt13Rh-Pt -50 ... 1760 °C) 7 Type B (Pt30Rh-Pt6Rh 0 ... +1820 °C) 8 Type L (Fe-CuNi 0 ... +680 °C) 9 Type U (Cu-CuNi 0 ... +590 °C) 10 AnalogIn [µV]
Reference temperature sensor select [1-8]	Property	Selecting the reference temperature sensor. 0 KTY1 1 KTY2 1 Internal KTY
KTY Input [1-2]	Input	KTY temperature inputs, status query via read(). With open input, the hardware class returns -2147483632.
Internal KTY [1-2]	Input	Temperature value internal KTY (only available since hardware version 3.0) Internal KTY 1: for the inputs TMP_1 to TMP_4. Internal KTY 2: for the inputs TMP_5 to TMP_8. The temperature values are shown in 1/10 °C. If the hardware does not support internal KTY sensors or no internal KTY is used, -2147483632 is displayed.

Documentation Changes

Change date	Affected page(s)	Chapter	Note
04.10.2013	4	1.4	
10.10.2013	4	1.3	Measurement range extended
23.10.2013	5	1.6	Added Vibration resistance
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 French notes added
01.04.2014	5	1.5 Miscellaneous	UL added
	11	5 Mounting	Text updated
30.01.2015	10	4.2 Notes	Added note concerning connecting the S-DIAS module while voltage is applied
18.03.2015	13	6.1 Address-Mapping Overview	Changed Address (hex) under <i>Standard Mode</i> (<i>Info Register Bit 0 = 0</i>) from 0100 to 010A
26.03.2015	8	3.2 Applicable Connectors	Added Connections
08.04.2015	4	1.1 Thermal Element Input Specifications	Changed Common mode range, added <i>Input filter hardware</i> and <i>Input filter software</i>
	4	1.2 Measurement Range	Expanded <i>Measurement Ranges Thermo Elements</i> table and added <i>Voltage Measurement Ranges</i> table
	5	1.3 Temperature Sensor Input Specifications for Thermo Coupling	Adapted description and technical data
	11-13	4.2 Notes	Updated complete chapter
09.07.2015	4	1.1 Thermal Element Input Specifications	Added Mnemonic
		1.4 Electrical Requirements	Changed current consumption on the S-DIAS bus (+5 V power supply)
		4.2.1 Changed Temperature Measurement with Thermo Elements	Changed text

25.01.2016	5	1.4 Electrical Requirements	Graphics added
28.04.2016	18	5 Mounting	Graphics distances
31.10.2016	4	1.1 Thermal Element Input Specifications	Measurement current for cable brake monitor added
	5	1.2 Measurement Ranges	Table measurement error added
27.03.2017		1.2.1 Measurement ranges Thermo Elements	Added value for cable break monitoring
		1.2.2 Voltage Measurement Range	Added value for cable break monitoring
		1.3 Temperature Sensor Input Specifications for Thermo Coupling Compensation	Added value for cable break and short circuit monitoring
17.08.2017	9	1.6 Environmental Conditions	Added operating conditions
	12	3.2 Applicable Connectors	Added sleeve length Added info regarding ultrasonically welded strands
18.10.2017	13	3.3 Label Field	Added chapter
	20	5 Mounting	Graphic replaced
12.12.2017	1		Introduction text
	8	1.5 Miscellaneous	Hardware version
	10	3 Connector Layout	Supplement expanded
	15	4.2.2 Temperature Measurement with Thermo Elements	Remote terminal clamp deleted
	16	4.2.3 Connecting the Thermo Element to the Control	New graphic and additions
	20	Addressing	per each HW Version a single addressing
14.05.2019	28	7 Supported Cycle Times	Added chapter
15.07.2019	1		KTY11-82 temperature sensor added
14.02.2020	28	7 Supported Cycle Times	FW 1.00 and FW 1.10 combined to FW 1.xx
03.04.2020	5	1.2.1 Measurement Ranges Thermal Elements	Values adjusted
08.09.2020		8 Hardware Class AI088	Chapter added
04.11.2020	19	5 Mounting	Expansion functional ground connection
21.09.2021	6	1.4 Electrical Requirements	Current consumption changed
08.04.2022	9	1.5 Miscellaneous	Hardware version

06.12.2022	9	1.5 Miscellaneous	UKCA conformity
26.07.2023		Document	General chapters added, design

