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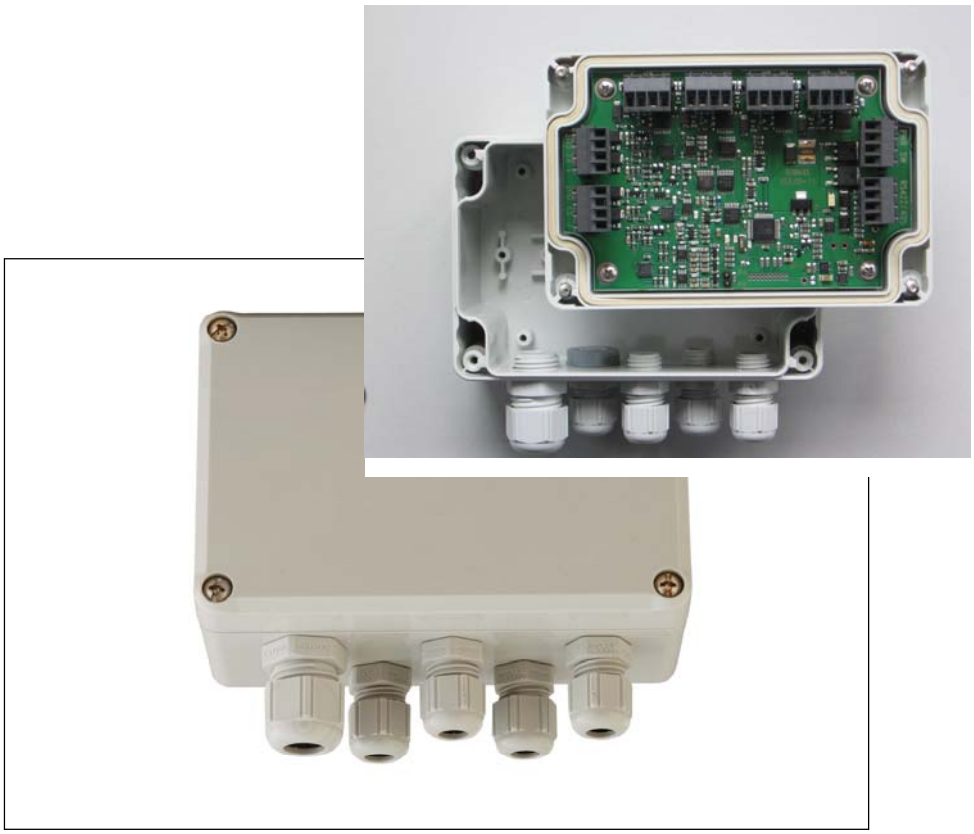
# Instructions for Use

021686/06/13

# *Universal Amplifier*

**7.1415.00.200**

**Version 1.1**

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## Safety Instructions

- Before working with or on the device/product, read through the operating instructions.
  This manual contains instructions which should be followed on mounting, start-up and operation.
  Non-observance might cause:
  - failure of important functions
  - endangerment of persons by electrical or mechanical effect
  - damage to property
- Mounting, electrical connection and wiring of the device/product may only be carried out by a qualified technician who is familiar with and observes the engineering regulations, provisions and standards applicable in each case.
- Repairs and maintenance may only be carried out by trained staff or **Adolf Thies GmbH & Co. KG**. Only components and spare parts supplied and/or recommended by **Adolf Thies GmbH & Co. KG** should be used for repairs.
- Electrical devices/products must be mounted and wired only in a voltage-free state.
- **Adolf Thies GmbH & Co KG** guarantees proper functioning of the device/products provided that no modifications have been made to the mechanics, electronics or software, and that the following points are observed:
- All information, warnings and instructions for use included in these operating instructions must be taken into account and observed as this is essential to ensure trouble-free operation and a safe condition of the measuring system / device / product.
- The device / product is designed for a specific application as described in these operating instructions.
- The device / product should be operated with the accessories and consumables supplied and/or recommended by **Adolf Thies GmbH & Co KG**.
- Recommendation: As it is possible that each measuring system / device / product may, under certain conditions and in rare cases, also output erroneous measuring values, it is recommended using redundant systems with plausibility checks in the case of **security-relevant applications**.

## Environment

- As a long-standing manufacturer of sensors, Adolf Thies GmbH & Co KG is committed to the objectives of environmental protection and is therefore willing to take back all supplied products governed by the provisions of "*ElektroG*" (German Electrical and Electronic Equipment Act) and to perform environmentally compatible disposal and recycling. We are prepared to take back all Thies products concerned free of charge if returned carriage-paid to Thies by our customers.

- Make sure you retain packaging for storage or transport of products. Should packaging however no longer be required, arrange for recycling as the packaging materials are designed to be recycled.

## Documentation

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- Subject to modification in terms of content.
- The device / product should not be passed on without the/these operating instructions.

## Instructions for Use

These Instructions for Use describe the options available for use and adjustment of the device. *The basic configuration of the Universal Amplifier has been factory-set.*

## Scope of supply

1 x Universal Amplifier
1 x Instructions for Use

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# 1 Models available

| Designation | Article No. | Features |
|---|---|---|
| **Universal Amplifier** | **7.1415.00.200** | • 4x analogue inputs (µV...V, PT100)<br>• 4x analogue outputs (U; I)<br>• 1x RS422/485<br>• 1x switching output<br>• plastic housing with cable gland |

# 2 Application

The Universal Amplifier is used to connect various Sensors e.g. radiation sensors without their own amplifier or PT100 temperature sensors. It is designed to amplify low measuring circuit voltages, to process and output them in standardised voltages or currents in analogue or also digital format.

*Analogue outputs:* Measured values, can be output either as a current or voltage signal. Scaling of the measured variables is adjustable.

*Digital output:* An RS485/422 is available for serial communication. It can be operated in full or half duplex mode. Predefined telegrams are available for the output of measured values.

A switching output for control purposes is programmable.

An RS422/485 interface is used for the necessary input and output scaling. The settings are made at the factory.

# 3 Functional description

The **Universal Amplifier** is equipped with 4 analogue inputs, which can be used either as voltage inputs or PT100 inputs. The channels configured e.g. as radiation input can capture both positive and negative measured values.
With PT100 measurement a constant current of 1mA is applied.
The measuring interval can be determined with the parameter "Output Rate". During this interval all configured channels undergo sequential measurement one after the other, followed by scaling, and then by updating of the assigned analogue outputs. In addition, the measured values can be queried via the serial RS422/485 interface or output automatically (only full duplex mode).
4 analogue outputs are available and can each be assigned to one input. They can be separately set to 0...1V, 0...5V, 0...10V, 0...20mA or 4...20mA.
Additionally, there is one switching output which can also be linked to any input. This output can for example be used for control purposes.

# 4 Mechanical installation

The housing of the Universal Amplifier is designed for mounting on a wall or other flat surface. The cover should be removed for installation. This exposes the drill holes (Ø 4 mm) in the lower section of the housing, so allowing it to be mounted with screws.

***Caution:***

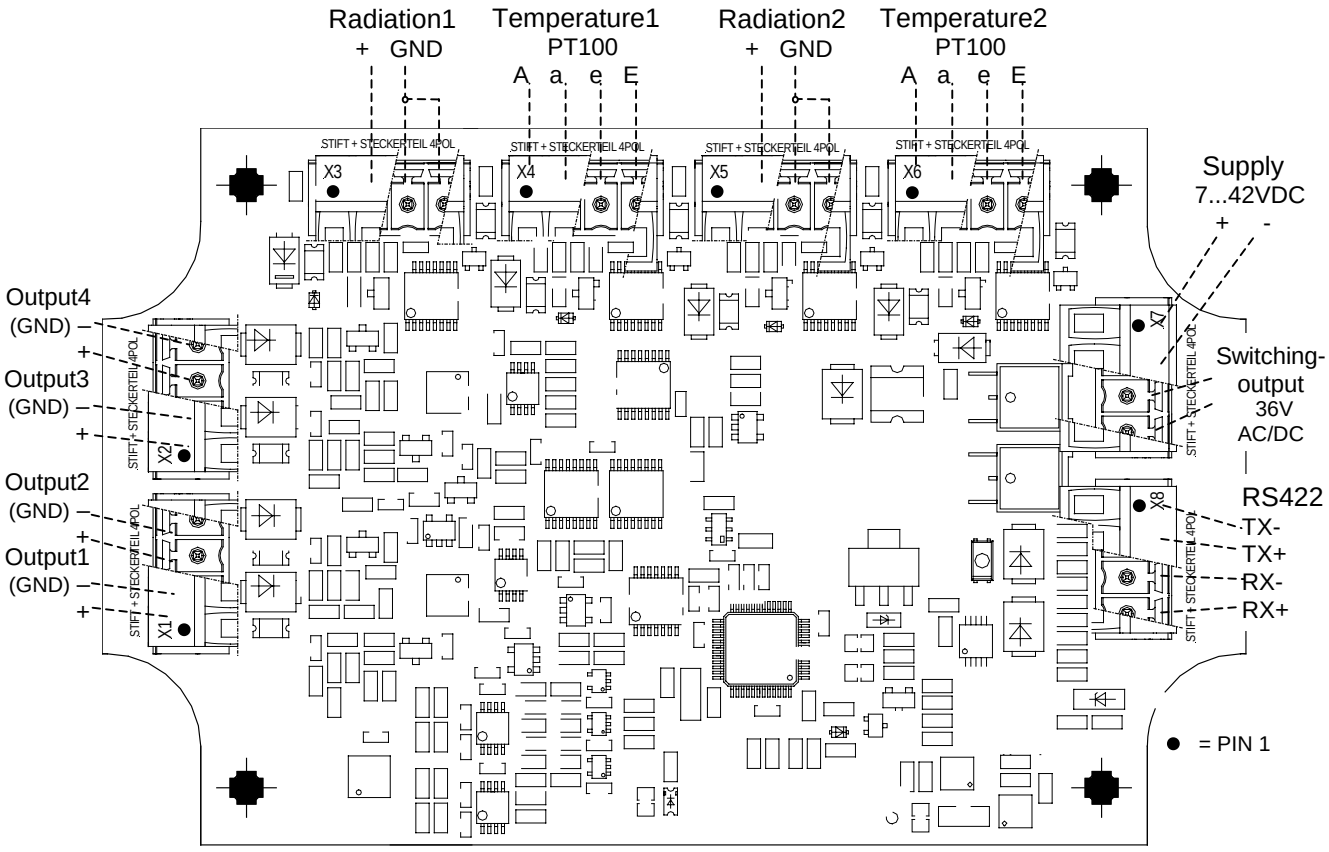
***The electronics of the Universal Amplifier can be found in its cover.***
***The device should only ever be opened in a dry environment.***
***Make sure you do not damage the electronics when exposed.***

# 5 Pin assignment

The type of connection, pin assignment and positioning of connections depends on the components connected.

> ***Caution:***
> ***For the actual pin assignment see the diagram of connections provided with the scope of supply.***

## 5.1 Example of pin assignment




# 6 Servicing

The device does not require servicing. All components used in it show invariant behaviour in terms of time.

# 7 Serial communication

An RS422/485 interface is available for serial communication. It can be operated in half duplex mode with different baud rates.

When the Universal Amplifier is started, the firmware version, date of creation for the firmware, the serial number, the device ID and the duplex mode of the serial interface will be output. Output takes place at the baud rate set.

**Example:**

```
-------------------------
THIES-UNIVERSAL-AMPLIFIER
Version: 1.10
May 14 2013 / 14:54:51
Serial-No.: 005130001
System-ID.: 00
SERIAL: 4-wire RS422
-------------------------
Help: 00HH<CR>
-------------------------
```

**Factory setting: ID = 0, baud rate = 9600 8N1, RS422**

**Bus mode:**

The concept of ID-based communication provides for operation in a bus segment. The conditions for this are as follows:

- Individual bus users must have different IDs
- Master-slave structure, i.e. there is a device in the bus that performs cyclic query of the data from the individual devices.

## 7.1 General command structure

For serial communication the Universal Amplifier is equipped with a fixed command format, which also permits communication in bus mode.

| | |
|---|---|
| Data enquiry | <id><Command><CR> |
| Parameter change | <id><Command><Parameter><CR> |

The individual sections have the following meaning:

| | |
|---|---|
| id: | Universal Amplifier ID. Always consisting of two digits ranging between 00 and 99. |
| Command: | 2-place command. A complete list of commands can be found in Chapter 8. |
| Parameter: | Parameter input is always left-justified and may be between 0 and 6 digits. |
| <CR>: | Carriage return, ($13_{dec}$; 0x0D). |

The Universal Amplifier checks the command syntax. The receipt of a valid command is acknowledged with an "echo telegram".

| | | |
|---|---|---|
| Example: | 00BR00096<CR> | Transmission command |
| | !00BR00096<CR> | Echo telegram |

If a command is transmitted to the device without the parameter value, the value currently selected will be output.

| | | |
|---|---|---|
| Example: | 00BR<CR> | Transmission command |
| | !00BR00096CR> | Echo telegram |

To avoid any unintentional change in parameters, some commands (see Description of commands Chapter 8.1) are protected with a "key". This key must be transmitted before the actual command.

| | |
|---|---|
| Example: | Change in baud rate |
| 00KY04711<CR> | Release key-protected commands (see Command KY, Chapter 8.1.10) |
| 00BR01152<CR> | Baud rate set to 115200 |

***Caution:***

***The key-protected commands are released as long as the supply voltage is switched off or the command 00KY0<CR> is transmitted.***
***For changed parameters to be saved, the command 00KY0<CR> or 00CS1<CR> must be transmitted.***

# 8 List of commands

| | Command | Description |
|---|---|---|
| **Command AO** | <id>AO<para5> | Analogue output mode 0..1V/5V/10V, 0(4)..20mA (Analogue Output) |
| **Command AS** | <id>AS<para5> | Sets the analogue outputs to preselected values (Analogue Static) |
| **Command BP** | <id>BP<para5> | Select interface parity (Baud Parity) |
| **Command BR** | <id>BR<para5> | Select interface baud rate (Baud Rate) |
| **Command CS** | <id>CS<para5> | Save configuration (Configuration Saving) |
| **Command DM** | <id>DM<para5> | Duplex mode (Duplex Mode) |
| **Command EA** | <id>EA<para5> | Final value for analogue output 1 (end output A) |
| **Command EB** | <id>EB<para5> | Final value for analogue output 2 (end output B) |
| **Command EC** | <id>EC<para5> | Final value for analogue output 3 (end output C) |
| **Command ED** | <id>ED<para5> | Final value for analogue output 4 (end output D) |
| **Command EE** | <id>EE<para5> | Final value for switching output (end output E) |
| **Command HH** | <id>HH<para5> | Output Help (Help) |
| **Command ID** | <id>ID<para5> | Universal Amplifier ID (IDentifier) |
| **Command KK** | <id>KK<para5> | Channel configuration (Channel Configuration) |
| **Command KY** | <id>KY<para5> | Access mode (Key) |
| **Command OL** | <id>OL<para5> | Output linked to an input (Output Link) |
| **Command OR** | <id>OR<para5> | Telegram output interval (Output Rate) |
| **Command MA** | <id>MA<para5> | Minimum value for analogue output 1 (minimum output A) |
| **Command MB** | <id>MB<para5> | Minimum value for analogue output 2 (minimum output B) |
| **Command MC** | <id>MC<para5> | Minimum value for analogue output 3 (minimum output C) |
| **Command MD** | <id>MD<para5> | Minimum value for analogue output 4 (minimum output D) |
| **Command ME** | <id>ME<para5> | Minimum value for switching output (minimum output E) |
| **Command RS** | <id>RS<para5> | Warm-boot Universal Amplifier (Reset) |
| **Command SA** | <id>SA<para6> | Input radiation constant for Input 1 (X3) (Scale A) |
| **Command SB** | <id>SB<para6> | Input radiation constant for Input 2 (X4) (Scale B) |
| **Command SC** | <id>SC<para6> | Input radiation constant for Input 3 (X5) (Scale C) |
| **Command SD** | <id>SD<para6> | Input radiation constant for Input 4 (X6) (Scale D) |
| **Command SN** | <id>SN<para8> | Output serial number (Serial Number) |
| **Command SS** | <id>SS | Output system status (System Status) |
| **Command SV** | <id>SV<para5> | Output software version (Software Version) |
| **Command TA** | <id>TA<para5> | Select sensor type at Input 1 (X3) (Type A) |
| **Command TB** | <id>TB<para5> | Select sensor type at Input 2 (X4) (Type B) |
| **Command TC** | <id>TC<para5> | Select sensor type at Input 3 (X5) (Type C) |
| **Command TD** | <id>TD<para5> | Select sensor type at Input 4 (X6) (Type D) |
| **Command TR** | <id>TR<para5> | Telegram request (Telegram Request) |
| **Command TT** | <id>TT<para5> | Independent telegram output (Telegram Type) |

## 8.1 Description of commands

### 8.1.1 Command AO

<id>AO<para5> Analogue output mode (Analogue Output)

Access: Configuration mode (ADMIN)

Description: Sets the analogue output variable / type per output. This command allows you to switch between different voltage and current output ranges. The position gives the number of the relevant output.
Example: AO=3366 means, the output1+2 = 0..10V, output 3+4 = 0..20mA.

Parameter:

| | |
|---|---|
| 0: | Off, analogue output not in use. |
| 1: | Voltage output 0..1V |
| 2: | Voltage output 0..5V |
| 3: | Voltage output 0..10V |
| 4: | Voltage output 2..10V |
| 5: | Power output 4..20mA |
| 6: | Power output 0..20mA |

Value range: 0...6666

### 8.1.2 Command AS

<id>AS<para5> Set analogue outputs to a fixed value (Analogue Static Output)

Access: Configuration mode (ADMIN)

Description: This command allows you to set the analogue outputs to a fixed value. It is required to test the analogue outputs.

Parameter:

| | |
|---|---|
| 00AS00225 | Sets all analogue outputs to 22.5% of the terminal value 2.25V / 4.5mA (depending on output type, see also **Command AO**) |
| 00AS10500 | Sets analogue Output 1 to 50% of the terminal value 5V / 10mA (depending on output type, see also **Command AO**) |
| 00AS21000 | Sets analogue Output 2 to 100% of terminal value 10V / 20mA |
| 00AS00000 | Sets all analogue outputs to 0% = 0V / 0mA |
| 00AS | Resets all analogue outputs to normal operation |

Value range: 0...21000

Initial value: 0

### 8.1.3 Command BP

<id>BP<para5> Parity of interface (Baud Rate Parity)

Access: Configuration mode (ADMIN)

Description: Specifies the parity of the interfaces. See also Command BR.

Parameter:

| | |
|---|---|
| 7: | Parity 7E1 |
| 8: | Parity 8N1 |

Value range: 7...8

Initial value: 8

### 8.1.4 Command BR

<id>BR<para5> Adjust baud rate (Baud Rate)

Access: Configuration mode (ADMIN)

Description: The Universal Amplifier can communicate at different baud rates. If the baud rate is changed, the Universal Amplifier will return the value of the new baud rate selected in the baud rate last set to ensure that the command echo remains visible.

When the baud rate is requested with Command BR, the Universal Amplifier returns the current baud rate and selected parity. See also Command BP.

Parameter table:

| Parameter | Baud rate |
|---|---|
| 12 | 1200 |
| 24 | 2400 |
| 48 | 4800 |
| 96 | 9600 |
| 192 | 19200 |
| 384 | 38400 |
| 576 | 57600 |
| 1152 | 115200 |

Initial value: 96 (9600 baud)

### 8.1.5 Command CS

<id>CS<para5> Save configuration (Configuration Saving)

Access: Configuration mode (ADMIN)

Description: Command to save the configuration without leaving configuration mode.

Parameter: 1: Save configuration

### 8.1.6 Command DM

<id>DM<para5> Duplex mode

Access: Configuration mode (ADMIN)

Description: Duplex mode decides the type of physical connection of the serial data interface. In full duplex mode the send and receive signals are each transmitted via separate pairs of cables. This means it is possible to send and receive signals simultaneously.

In half duplex mode transmission of the send or receive signals is via the pair of cables TX-(PIN1) / TX+(PIN2).
In half duplex mode there is no independent telegram output.

Parameter: 0: Half duplex mode (RS485)

1: Full duplex mode (RS485 transmission drivers are switched off if no data are transmitted)

2: Full duplex mode (RS422 transmission drivers are not switched off)

Value range: 0...2

Initial value: 2

### 8.1.7 Command EA

| | | |
|---|---|---|
| <id>EA<para5> | Final value for analogue output 1 (X1.PIN1+2), see also Command MA. | |
| Access: | Configuration mode (ADMIN) | |
| Description: | This command determines the measuring value, where the analogue output has its final value. | |
| Parameter: | 0..32767: | positive final value |
| | 32768...65535: | final value -32767...-1 |
| | Alternatively, a negative final value can also be entered by: -1..-32767. | |
| Value range: | 0..65535 | |
| Initial value: | 0 | |

### 8.1.8 Command EB

| | |
|---|---|
| <id>EB<para5> | Final value for analogue output 2 (X1.PIN3+4), see command EA. |

### 8.1.9 Command EC

| | |
|---|---|
| <id>EC<para5> | Final value for analogue output 3 (X2.PIN1+2), see command EA. |

### 8.1.10 Command ED

| | |
|---|---|
| <id>ED<para5> | Final value for analogue output 4 (X2.PIN3+4), see command EA. |

### 8.1.11 Command EE

| | | |
|---|---|---|
| <id>EE<para5> | Final value for switching output 5 (X7.PIN3+4), see also command ME. | |
| Access: | Configuration mode (ADMIN) | |
| Description: | Upon reaching/exceeding of the measuring value the switching output is closed. | |
| Parameter: | 0..32767: | positive minimum value |
| | 32768...65535: | minimum value -32767...-1 |
| | Alternatively, a negative minimum value can also be entered by: -1..-32767. | |
| Value range: | 0..65535 | |
| Initial value: | 0 | |

### 8.1.12 Command HH

| | | |
|---|---|---|
| <id>HH<para5> | Help | |
| Access: | Configuration mode (ADMIN) | |
| Description: | The Command HH allows you to activate and disable a detailed Help feature (verbose mode). | |
| Parameter: | 0: | Detailed messages in command mode on (verbose mode on). With a restart an info block as described under Chapter 7.1 is output. |
| | 1: | Detailed messages switched off. Restart messages and command echo with '!', e.g. !00TT00001, remain on. (verbose mode off) |
| | 2: | No restart messages output. Command echo remains on (silent boot mode). |
| Value range: | 0...2 | |
| Initial value: | 0 | |

### 8.1.13 Command ID

<id>ID<para5> Universal Amplifier ID (IDentifier)

Access: Configuration mode (ADMIN)

Description: This command can be used to specify the identification number of the Universal Amplifier. The ID is required for every command to address the Universal Amplifier. Whenever its ID is changed, the Universal Amplifier will immediately respond to its new identifier.
ID 99 has a special function. Every Universal Amplifier responds to commands with ID 99, regardless of which ID happens to be set. For this reason ID 99 should not be used in bus mode.

Value range: 0...99

Initial value: 0

### 8.1.14 Command KK

<id>KK<para5> Channel configuration

Access: Configuration mode (ADMIN)

Description: Command for login/logoff of measuring channels.

Binary description which channel is logged in.

Parameter:
- 1: Measuring channel A(X3) logged in
- 2: Measuring channel B(X4) logged in
- 4: Measuring channel C(X5) logged in
- 8: Measuring channel D(X6) logged in

For multiple channel login this is based on the sum of the individual parameters, for example, if only measuring channels A and B are to be logged in, KK=3 is set.

Value range: 0...15

Initial value: 15 (all channels on)

### 8.1.15 Command KY

<id>KY<para5> Access key (Key)

Access: Request mode

Description: Access authorisations are required to change the parameters of the Universal Amplifier. This prevents parameters being changed accidentally.
It is recommended querying and saving the current configuration with the command SS before any change. To permanently save changed parameter the access key has to be reset to '0', or the command "CS1" initiated. After restart of the Universal Amplifier it automatically switches back to request mode.

Parameter:
- 0: Request mode
  For parameters which have no access restrictions or are not saved, e.g. telegram request or output of system status.
- 1: User mode (USER ACCESS)
  The user key protects parameters which influence the behaviour of the Universal Amplifier, e.g. cyclic telegram output, see TT.
  It is recommended outputting and saving the current configuration with the command SS before any change.
- 4711: Configuration mode (ADMIN ACCESS)
  This key protects parameters which influence the behaviour of the Universal Amplifier, e.g. analogue output mode and baud rate.

Value range: 0,1,4711

Initial value 0

### 8.1.16 Command MA

<id>MA<para5> Minimum value for analogue output 1 (X1.PIN1+2), see also command EA.

Access: Configuration mode (ADMIN)

Description: This command determines the measuring value, where the analogue output has its minimum value.

Parameter:
- 0..32767: positive minimum value
- 32768...65535: minimum value -32767...-1

Alternatively, a negative minimum value can also be entered by: -1..-32767

Value range: 0..65535

Initial value: 0

### 8.1.17 Command MB

<id>MB<para5> Minimum value for analogue output 2 (X1.PIN3+4), see command MA.

### 8.1.18 Command MC

<id>MC<para5> Minimum value for analogue output 3 (X2.PIN1+2), see command MA.

### 8.1.19 Command MD

<id>MD<para5> Minimum value for analogue output 4 (X2.PIN3+4), see command MA.

### 8.1.20 Command ME

<id>ME<para5> Minimum value for switching output 5 (X7.PIN3+4), see also command EE.

Access: Configuration mode (ADMIN)

Description: Upon reaching/exceeding of the measuring value the switching output is opened.

Parameter:
- 0..32767: positive minimum value
- 32768...65535: minimum value -32767...-1

Alternatively, a negative minimum value can also be entered by: -1..-32767

Value range: 0..65535

Initial value: 0

### 8.1.21 Command OL

<id>OL<para5> Output link (Output Link)

Access: Configuration mode (ADMIN)

Description: This command can be used to link outputs to inputs.

Parameter:
- 1: Output N is linked to Input X3.
- 2: Output N is linked to Input X4.
- 3: Output N is linked to Input X5.
- 4: Output N is linked to Input X6.

The position of N describes the number of the relevant output.
Example: OL=13002 means that Output 1 is linked to Input 1(X3), Output 2 is linked to Input 3(X5) and the switching output (SW) is linked to Input 2(X4).

Value range: 0...44444

Initial value: 12340

### 8.1.22 Command OR

<id>OR<para5> Telegram output interval (Output Rate)

Access: Configuration mode (ADMIN)

Description: With independent telegram output this parameter is used to specify the time interval in which telegrams are output via the serial interface. This parameter is simultaneously used to specify the measuring rate.
Specification is made in milliseconds. If the time interval for the measuring cycle is too short, or the output rate too slow, the available telegram output will be delayed.

Parameter:
- 0: Measurement only takes place with the "TR" command on request.
- 100...10000 Specifies the output interval in milliseconds.

Value range: 0,100...10000 [ms]

Initial value: 1000

### 8.1.23 Command RS

<id>RS<para5> Restart Universal Amplifier (Reset)

Access: Configuration mode (ADMIN)

Description: With transmission of this command the Universal Amplifier is restarted by the watchdog.

Parameter:
- 1: Universal Amplifier performs a warm boot. It behaves as with an interruption in the supply voltage.
- 2: Universal Amplifier no longer operates the watchdog. This results in a restart after approx. 11 seconds (watchdog test function).

Value range: 1...2

Initial value: No initial value

### 8.1.24 Command SA

<id>SA<para6> Scales Input 1(X3) with factor 1/10000.

Access: Configuration mode (ADMIN)

Description: This command is used to set the radiation constant.
The value should always be 100000 for all other sensors.

Value range: 30000..500000 corresponds to 3,0000-50,0000 [µV/W/m$^2$]

Initial value: 100000

### 8.1.25 Command SB

<id>SB<para6> Scales Input 2(X4) with factor 1/10000.
See Command SA.

### 8.1.26 Command SC

<id>SC<para6> Scales Input 3(X5) with factor 1/10000.
See Command SA.

### 8.1.27 Command SD

<id>SD<para6> Scales Input 4(X6) with factor 1/10000.
See Command SA.

### 8.1.28 Command SN

<id>SN Output serial number (Serial Number)

Access: Request mode

Description: During factory setting of the device every Universal Amplifier is given a serial number for identification purposes.

For example, with serial number "123456789" the Universal Amplifier responds:

!00SN56789

Serial number: 123456789 (see also **Command HH** "Verbose ON")

Value range: 0...999999999

### 8.1.29 Command SS

<id>SS System status (System Status)

Access: Request mode

Description: Outputs the selected parameters of all commands. All stored parameters are output.

Before changing the parameters of the Universal Amplifier, this command should be used to generate and save a list of the parameters selected.

### 8.1.30 Command SV

<id>SV<para5> Software version (Software Version)

Access: Request mode

Description: Outputs the version number of the software.

### 8.1.31 Command TA

<id>TA<para5> Selects the type of sensor connected for Input 1(X3).

Access: Configuration mode (ADMIN)

Description: This command is used to set the input variable and format to the type of sensor.

Parameter table:

| Parameter | Sensortypen | Measuring range |
|---|---|---|
| 1 | Radiation : ----- $W/m^2$ | -999 $W/m^2$..+99999 $W/m^2$ |
| 2 | Radiation : -----.- $W/m^2$ | -999.9 $W/m^2$..+99999.9 $W/m^2$ |
| 3 | Temperature : ---.- °C | +/- 999.9 °C |
| 4 | Temperature : ---.-- °C | +/- 999.99 °C |
| 5 | Temperature : ---.--- °C | +/- 999.999 °C |
| 6 | Voltage10mV : ------- µV | -100000 / +1000000 µV |
| 7 | Voltage 1V : ---- mV | -100 / +1000 mV |
| 8 | Voltage 10V : ----- mV | -100 / +10000 mV |

Value range: 1...8

Initial value: 1

### 8.1.32 Command TB

<id>TB<para5> Selects the type of sensor connected for Input 2(X4).
See Command TA.

### 8.1.33 Command TC

<id>TC<para5> Selects the type of sensor connected for Input 3(X5).
See Command TA.

### 8.1.34 Command TD

<id>TD<para5> Selects the type of sensor connected for Input 4(X6).
See Command TA.

### 8.1.35 Command TR

<id>TR<para5> Telegram request (Telegram Request)

Access: Request mode

Description: The command TR can be used to request a telegram from the Universal Amplifier. The Universal Amplifier responds with the requested telegram after ≥ 20ms.

Parameter:

| Telegram number | Description |
|---|---|
| 1 | Detailed telegramm for calibration and service |
| 2 | Long telegram with all inputs |
| 3 | Short telegram, only contains released inputs |

Value range: 1,2,3

Initial value: No initial value

Examples: Telegrams with 2x radiation, 2x temperature and second temperature channel are hidden in the channel configuration.

Telegram 1:

```
      Instantaneous measured data:
      ----------------------------
IN1-Radiation  :  5617 W/sm   [1] X3.2(10mV) X3.3(-)
IN2-Radiation  :  2414 W/sm   [2] X4.2(10mV) X4.3(-)
IN3-Temperature:  14.5 °C     [3] X5 1E,2e,3a,4A
IN4-Temperature: ---.- °C     [4] X6 1E,2e,3a,4A
CNT-Live       :    1020
END
```

Calibration voltage

Terminal assignment

Channel number

Live counter = Measurements since restart
After 9999999 this begins with 100 to identify a restart.

Telegram 2:

```
<STX>RAD00  5617  2414  14.5 ---.-    1020*42<CR><LF><ETX>
```

Check sum

Telegram 3:

```
<STX>RAD00  5617  2414  14.5    1020*4C<CR><LF><ETX>
```

Check sum

Generation of check sum

The check sum is the result of bytewise EXOR linking of the bytes output in the telegram. The EXOR link encompasses all bytes between "STX" and the byte "*".
The bytes "STX" and "*" are not taken into account for calculation of the check sum.

**Information about telegram structure:**

- All characters are shown in ASCII code.
- Leading zeros for the measured values are replaced by "spaces" (20 HEX).
- Negative values are identified by a leading sign, e.g. temperature "`-1.0`".
- All decimal points have a fixed position.
- Incorrect measured values are replaced by one or more ? depending on the number of places, e.g. "**???.?**" for incorrect temperature.
- Errors occurring when the display size is exceeded are indicated by !, e.g. "**!!!.!**".
- The individual measured values are separated with blank characters "SPACE" (20 Hex).

### 8.1.36 Command TT

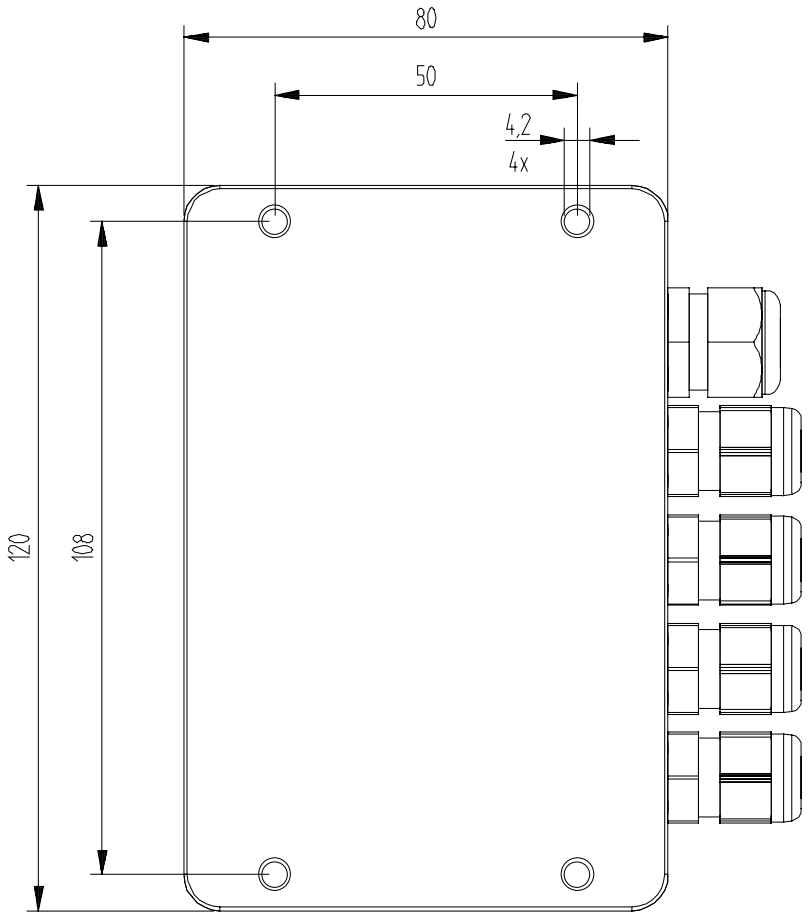
| | |
|---|---|
| <id>TT<para5> | Independent telegram output (Telegram Type) |
| Access: | User mode |
| Description: | Specifies the number of the telegram that the Universal Amplifier independently transmits on a cyclic basis. The same telegrams are available as described under the command TR. The time interval in which telegrams are transmitted is specified with the command OR.<br>Independent transmission is only possible in full duplex mode, see Command DM. |
| Value range: | 1,2,3 |
| Initial value: | 0 (independent telegram output switched off) |

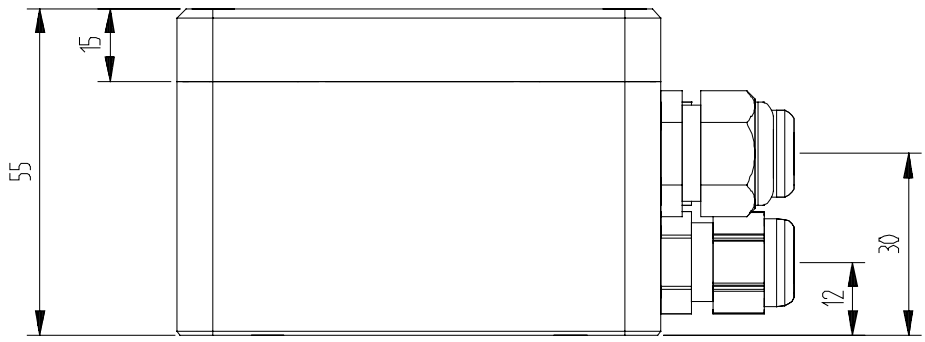
# 9 Technical data

| | |
|---|---|
| Supply voltage | 7...42V DC |
| Power consumption | <25mA @ 7...42V DC, without current output<br>max. 120mA@ Iout = 4x20mA |
| Connections | Terminal strips (clamp connectors), pluggable |
| Type of protection | IP65 |
| Telegram output interval | <500ms (as a function of the number of activated measuring channels) and activated output rate |
| Analogue inputs | 4 x –0.1...+1.0V ; resolution 1µV switchable to –1V...+10V<br>Alternatively, every channel is switchable to PT100:<br>max. –99.0°C…+99.0°C<br>PT100 resolution: 1/10, 1/100, 1/1000 °C, adjustable |
| Measuring interval | < 500ms |
| Accuracy<br>Analogue inputs | Voltage inputs: < +/- 0.2% FS<br>PT100 inputs: < +/- 0.05K |
| Analogue outputs, selectable | 0…1V, 0…5V<br>0...10V @ $U_{VCC} \geq 10.5V$<br>4…20mA, 0…20mA<br>Resolution 1/10000 FS |
| Burden | 500Ω @ $U_{VCC} \geq 15V$<br>300Ω @ $U_{VCC} \geq 10V$ |
| Short-term stability (dispersion of individual measured values) | typ. <2µVpp ≙ 0.2Wpp @ 10mV FS ≙ 1000W/m$^2$ |
| Long-term stability | typ. <0.05% deviation over 10 years |
| Accuracy<br>Analogue outputs | Voltage output: Channel 1...3 < +/- 0.1%<br>Voltage output: Channel 4 < +/- 0.5%<br>Current output: Channel 1..3 < +/- 0.4%<br>Current output: Channel 4 < +/- 0.5% |
| Serial interface | 1 x RS422/485 for operation, calibration and telegram output<br>Baud rates: 1200,2400,4800,9600(default),115200Bd 8N1 |
| Programmable input scaling | 1.) Radiation : ----- W/m$^2$<br>2.) Radiation : -----.- W/m$^2$<br>3.) Temperature : ---.- °C<br>4.) Temperature : ---.-- °C<br>5.) Temperature : ---.--- °C<br>6.) Voltage 10mV : ------- µV<br>7.) Voltage 1V : ---- mV<br>8.) Voltage 10V : ----- mV |
| Programmable output scaling | 1.) 0...2000 W/m$^2$<br>2.) 0...1600 W/m$^2$<br>3.) 0...1400 W/m$^2$<br>4.) 0...1300 W/m$^2$ |

| | |
|---|---|
| | 5.) 0...1000 W/m$^2$<br>6.) 0...500 W/m$^2$<br>7.) 0...100 W/m$^2$<br>8.) -300...1500 W/m$^2$<br>9.) -40...+60°C<br>10.) -30...+50°C<br>11.) -20...+80°C |
| Ambient conditions | |
| Operating temperature | -40°C...+60°C |
| Storage temperature | -40°C...+85°C |
| 7.1415.00.200 | |
| Housing | Polycarbonate |
| Measurements | see Dimension drawing |
| Weight | approx. 0.25 kg |
| Type of protection | IP 65 |
| Type of connection | Cable glands and 4-pin terminal strips (clamp connectors) |
| 508936 | |
| Measurements | 110 x 70 x 22 mm |
| Weight | 0.06 kg |
| Type of connection | 4-pin terminal strips (clamp connectors) |

# 10 Dimension drawing



# 11 EC Declaration of Conformity

Document-No.: **000310** Month: 06 Year: 13

Manufacturer: **A D O L F T H I E S G m b H & C o. K G**

Hauptstr. 76
D-37083 Göttingen
Tel.: (0551) 79001-0
Fax: (0551) 79001-65
email: Info@ThiesClima.com

Description of Product: **AMPLIFIER, universally**

Article No. **508936** **7.1415.00.200**

specified technical data in the document: **021682/06/13**

The indicated products correspond to the essential requirement of the following European Directives and Regulations:

| | |
|---|---|
| 2004/108/EC | DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC |
| 2006/95/EC | DIRECTIVE 2006/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits |
| 552/2004/EC | Regulation (EC) No 552/2004 of the European Parliament and the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation) |

The indicated products comply with the regulations of the directives. This is proved by the compliance with the following standards:

| Reference number | Specification |
|---|---|
| IEC 61000-6-2: 2005 | Electromagnetic compatibility<br>Immunity for industrial environment |
| IEC 61000-6-3: 2006 | Electromagnetic compatibility<br>Emission standard for residential, commercial and light industrial environments |
| IEC 61010-1: 2010 | Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1: General requirements |

Place: Göttingen Date: 23.06.2013

Legally binding signature:

.....

Wolfgang Behrens, General Manager

issuer:

.....

Joachim Beinhorn, Development Manager

This declaration certificates the compliance with the mentioned directives, however does not include any warranty of characteristics.
Please pay attention to the security advises of the provided instructions for use.

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