PRECIPITATION ANALYZER

Instruction for Use

5.4107.00.xxx

At start of software version V2.02

Doc. No. 022049/08/23

THE WORLD OF WEATHER DATA

Safety Instructions

- Before operating with or at the device/product, read through the operating instructions.
  This manual contains instructions which should be followed on mounting, start-up, and operation.
  A non-observance might cause:
  - failure of important functions
  - endangerment of persons by electrical or mechanical effect
  - damage to objects
- Mounting, electrical connection and wiring of the device/product must be carried out only 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, may also output erroneous measuring values, it is recommended using redundant systems with plausibility checks for **security-relevant applications**.

Environment

- As a longstanding 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 to Thies by our customers carriage-paid.

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

Documentation

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- Although these operating instructions have been drawn up with due care, **Adolf Thies GmbH & Co KG** can accept no liability whatsoever for any technical and Typeographical errors or omissions in this document that might remain.
- We can accept no liability whatsoever for any losses arising from the information contained in this document.
- Subject to modification in terms of content.
- The device / product should not be passed on without the/these operating instructions.

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Illustrations:

The following parts are included in the scope of delivery:

1 x PRECIPITATION ANALYZER
1 x Instruction for use short version (included in the package)
1 x Factory setting (included in the package)
1 x Cable socket (mating connector) is included in the scope of delivery if no cable is sold with it.

The introduction for use for the PRECIPITATION ANALYZER are available for download under the following link:

https://www.thiesclima.com/db/dnl/5.4107.00.xxx_Niederschlags_Analyzer_deu.pdf(active_after_series_release)

For support with parameter settings, special configurations and firmware updates, our free "Device Utility Tool" Art. No. 9.1700.81.000 is available for download under the following link.

Link: https://www.thiesclima.com/en/Download/

in the "General" section the program "Thies Device Utility".

1 Models

Order no.	Serial interface / Data format	Supply	Model with	Info
5.4107.00.000	RS 485 HD / THIES ASCII	12 / 24VDC	8 pin connector	Customer specific
5.4107.00.100	RS 485 HD / THIES ASCII	12 / 24VDC	8 pin connector	-

2 Application

The PRECIPITATION ANALYZER is a compact precipitation measurement device designed to detect supercooled liquid precipitation. The term "supercooled" describes liquid precipitation that exhibits a temperature below freezing point (i.e. lower than 0°C) before reaching the ground. Supercooled precipitation is formed when liquid precipitation falls through a layer of air close to the ground that itself has a temperature below 0°C. If the precipitation does not crystallize at this point, but instead cools down to below 0°C without changing state, we call it supercooled precipitation.

The following precipitation types and sensor status are detected:

- Freezing drizzle (FZDZ)
- Freezing rain (FZRA)
- Supercooled water on the sensor
- Ice on sensor
- Drizzle
- Rain
- Sleet

Supercooled precipitation can freeze very quickly when it hits a surface, forming what is commonly known as black ice.

Supercooled precipitation is therefore a particular concern for road, air and shipping traffic. Since supercooled precipitation covers entire regions, there is also a risk of infrastructure, such as power lines and masts, as well as shrubs or trees collapsing or breaking when encased by layers of ice.

The PRECIPITATION ANALYZER reliably detects supercooled precipitation so that the resultant freezing conditions can be accurately assessed. Supercooled precipitation occurs in the form of freezing fog, freezing drizzle, and freezing rain.

The PRECIPITATION ANALYZER detects all three types of supercooled precipitation. The sensor also detects non-supercooled liquid precipitation (drizzle, rain). It can furthermore be used to determine the intensity of the precipitation.

The PRECIPITATION ANALYZER differs from conventional devices designed to detect freezing conditions. Up until now, devices aim to detect a layer of ice, and are therefore also known as ice detectors. The PRECIPITATION ANALYZER, by contrast, also detects supercooled precipitation that does not initially freeze over, but rather lies on the surface in a supercooled liquid state and then suddenly freezes at a later stage.

The PRECIPITATION ANALYZER is primarily used in the following areas of application:

- Transport (airports, roads, ports)
- Meteorology
- Renewable energies

The device has a digital interface comprising an RS485 interface in half-duplex mode. Combined with the ID-based communication it allows the operating of multiple sensors in bus operation.

3 Setup and Mode of Operation

The PRECIPITATION ANALYZER has four sensor surfaces. When these become wet, their electrical capacity changes, indicating precipitation appeared and from which the precipitation intensity is calculated. Furthermore, the device uses a calorimetric measuring method, whereby the heat released through crystallization is measured and evaluated as characteristic temperature increase. The capacity is calculated with multiple frequencies, enabling a distinction to be made between solid and liquid wetting on the device.

The PRECIPITATION ANALYZER has four separate ceramic heaters, which are switched on in case of icing or dewing of the device. Since the introduced heating power influences the temperature measurement of the device, the precipitation types detected by the instrument may be incorrect during the heating period and for a few minutes afterwards. Therefore, the heating status must always be taken into account when evaluating the data.

4 Recommendation Site Selection / Standard Installation

According to the WMO guideline for precipitation gauges, the sensor system should be placed at a distance of at least four times the height of the nearest obstacle. If this is not feasible, it should at least be noted that towards surrounding plants, structures, etc., an elevation angle of less than 45° is maintained. It also follows, that the sensor should be attached to the upper end of a mast. As measuring height, we recommend at least 1m or 1.5 to 2m in snowy areas. Below the sensor, other devices should only be attached to the mast with a minimum distance of 1m. The recommended lateral distance to other objects should be greater than 2m.

5 Installation

5.1 Mechanical Mounting

The sensor has a pole mount with an inner diameter of 35mm and can be mounted on a pipe, or appropriate holder. The coupling plug is located in the foot of the sensor.

5.2 Electrical Mounting

The PRECIPITATION ANALYZER is equipped with an 8-pin plug for electrical connection. A cable socket (mating connector) is included in the scope of delivery.

5.2.1 Cable

A shielded cable with a diameter of 6 ... 8 mm and a core cross section of 0.5 ... 0.75mm² must be soldered on.

- The number of cores required can be found in the connection diagram (chapter 5.3).

Cable recommendation

Number of cores / cross section / type / cable diameter
CABLE 5 x 0,5mm² LI9YC11Y BLACK, UV resistant, Ø 6,4mm

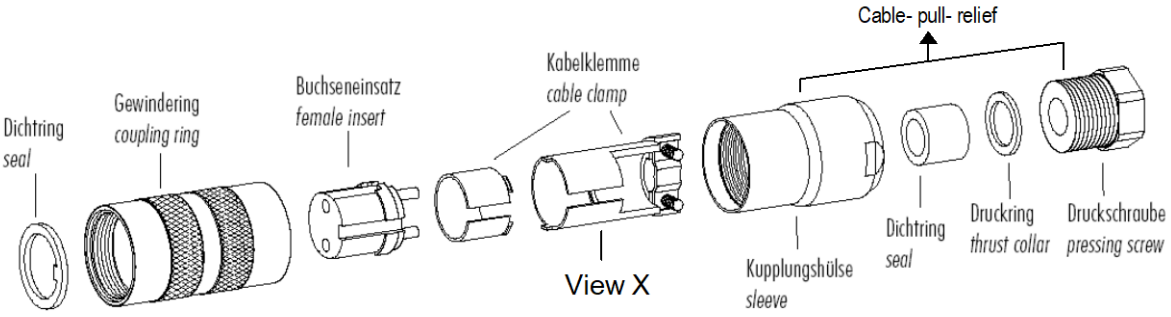
5.2.2 Cable Shield

In order to protect the electronic components, the connection of the cable shield between the sensor and the data acquisition system should be selected in such a way that no equalizing currents flow in the event of overvoltages.

The connection of the cable shield must be carried out depending on the selected insulated or non-insulated mounting of the sensors.

5.2.3 Plug and Cable Mounting

Coupling socket, Type: Binder, Serial 423, EMC with cable clamp



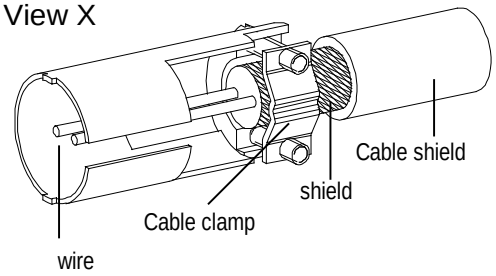
Cable connection: **with** cable shield

1. Stringing parts on cable acc. to plan given above.
2. Stripping cable sheath 20mm, cutting uncovered shield 15mm, Stripping wire 5mm.

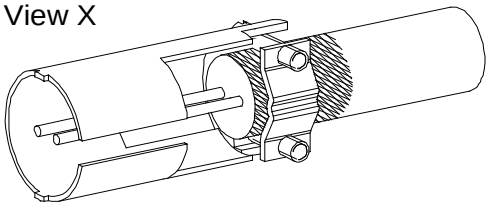
   Cable mounting 1
   Putting shrink hose or insolating tape between wire and shield.

   Cable mounting 2
   If cable diameter permits, put the shield backward on the cable sheath.
3. Soldering wire to the insert, positioning shield in cable clamp.
4. Screwing-on cable clamp.
5. Assembling remaining parts acc. to upper plan.
6. Tightening pull-relief of cable by screw-wrench (SW16 and 17).

Cable mounting 1
View X

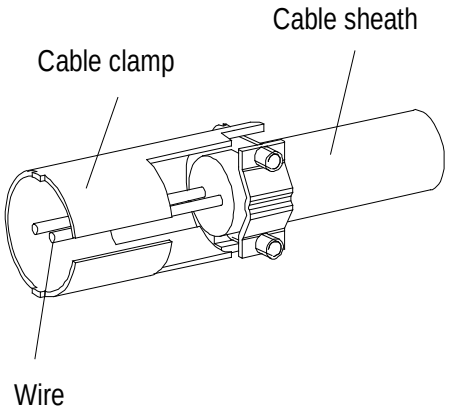


Cable mounting 2
View X



Cable connection: **without** cable shield

1. Stringing parts on cable acc. to plan given above.
2. Stripping cable sheath 20mm.
3. Cutting uncovered shield 20mm.
4. Stripping wire 5mm.
5. Soldering wire to the insert.
6. Positioning shield in cable clamp.
7. Screwing-on cable clamp.
8. Assembling remaining parts acc. to upper plan.
9. Tightening pull-relief of cable by screw-wrench (SW16 and 17).



5.3 Connection Diagram

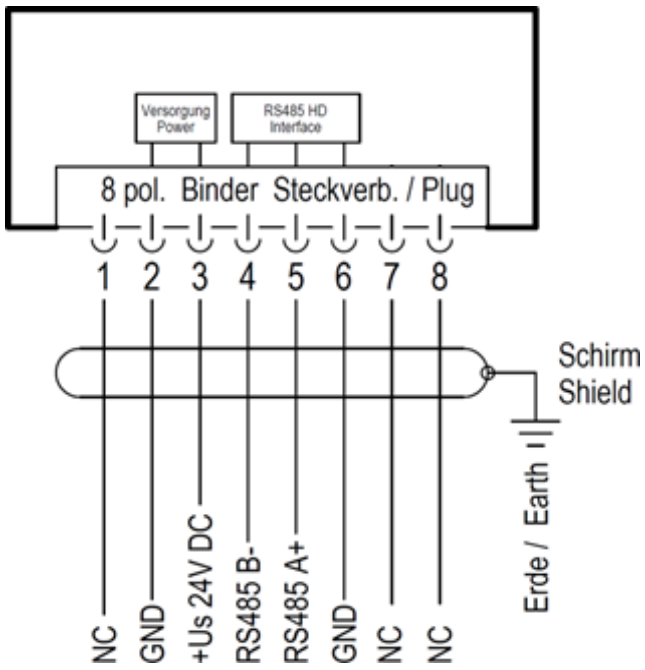
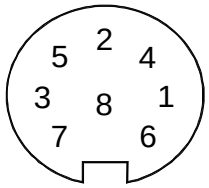
Order - No.	Connection Diagram	Plug
5.4107.00.xxx		View of solder connection of the mating Plugs 

Figure 1: Connection Diagram

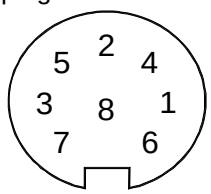
PIN	Name	Function	Connector
1	NC	Not connected	View of solder connection of the mating plug 
2	GND	Ground	
3	+Us	Supply 24 V DC	
4	Data-	RS485 Data - (B)	
5	Data+	RS485 Data + (A)	
6	GND	Ground RS485	
7	NC	Not connected	
8	NC	Not connected	

Figure 2: Pin assignment

6 Maintenance

The device has no moving parts, i.e. it works wear-free, only minimal service work is required. Depending on the location, the device may become dirty. Cleaning should be carried out with non-aggressive cleaning agents, water and a soft cloth.

Annotation:

We recommend that the threads of the connectors are regularly protected against corrosion with a suitable corrosion protection agent.

During storage, assembly, disassembly, transport or maintenance, water must not be allowed to enter the device and plugs.

7 Firmware versions / update

The firmware can be updated using Thies Device Utility or a terminal program, e.g. "TeraTerm". The description and the firmware files are provided directly by Thies.

8 Bootloader

The software in the device consists of 2 components:

-Bootloader
-Firmware

The bootloader is automatically active after the device start. For this purpose, the sensor outputs the characters "C" at a baud rate of 9600baud, 8 data bits, no parity and one stop bit (9600 8N1) for a time of 20 seconds. For update purpose, the sensor must be connected to the RS485 interface and the PC when the supply voltage is switched on. See also Command FB.

Within this period the firmware transfer can be started by means of XMODEM CRC.

9 Interface

The interface to the wind sensor consists of an RS485 connection (half-duplex mode), with the following data format:

- 4800 to 230400 baud
- 8 data bits
- No parity
- 1 stop bit

- Data in ASCII format (command interpreter: THIES)

The sensor is set so that the serial data telegram is output independently after startup.

9.1 Command Interpreter THIES

The sensor has the THIES type command interpreter, which can be used to change the settings of the device.

Basically, a command has the following structure:

- <id><command><CR> (No parameter: used to query the set parameter).
- <id><command><parameter><CR> (With parameter: is used to set a new parameters).

id:	Identification number ("00" to "99")
Command:	2 or 3 character command (see command list)
Parameter:	Parameter value with 5 digits (decimal value in ASCII representation di-
rectly	after the command without spaces)
<CR>:	Carriage Return (13_{dec} ; 0x0D)

The identification number 'id' can be used to operate several devices together in the bus operation. For this purpose, each device is assigned an individual 'id' (see Command ID).

A transmitted command is acknowledged with a corresponding echo telegram. The echo Telegram usually starts with a "!" followed by the id, the command and the set value. Finally, the characters "carriage return" and "new line" follow. Commands for status queries or in the case of faulty commands, the standard response is deviated from.

Commands can be sent either with or without parameters. Without specifying a parameter, the set value is output.

Note: The

TR command can be used to query the sensor measured values. The sensor does not respond with the echo telegram, but with the requested data telegram!

In order to avoid an unintentional parameter adjustment, some commands (see command list) are secured by a password. This password must be sent before the actual command.

Example: Changing the time

00KY00001<CR>	Enable user level commands
00ZH00004<CR>	Set to hour 4
!00ZH00004<CR>	Hour was set to '4
00KY00000<CR>	Reset user access

If the sensor responds with "idCI..." after the command has been entered, the following error has occurred:

CI=4 Parameter outside allowed range "!idCI00004"
CI=8 no access authorization ("!idCI00008", see "KY")

10 Command list

Command	Initial value / factory set-ting	Description	Password	
			Read	Writing
Command BR	5	Baud rate	Without	User
Command FB	1	Quick start mode	Without	User
Command ID	0	Identification number	Without	User
Command KY	0	Key / Password	Without	Without
Command OR	60	Output rate	Without	User
Command RD	20	Response delay	Without	User
Command RS	-	Reset / Restart	Without	User
Command SV	-	Query the firmware version	Without	-
Command TT	12	Independent telegram output	-	User
Command TR	-	Measured value request	Without	-
Command ZD	1	Date: Day of the month	Without	User
Command ZH	0	Time: Hourly value	Without	User
Command ZM	0	Time: Minute value	Without	User
Command ZN	1	Date: Month	Without	User
Command ZS	0	Time: Second value	Without	User
Command ZT	-	Date and time output	Without	-
Command ZY	0	Date: Year	Without	User

Figure 3: Command list

10.1 Description of the commands

10.1.1 Command BR

<id>BR<parameter><CR>Baudrate RS485

Access Mode (Key): Without / User
Access: Read / write
Description: The command selects the baud rate of the RS485 serial interface.
Parameter type: Unsigned integer
Parameter: 4: 4800 Bd
5: 9600 Bd
6: 19200 Bd
7: 38400 Bd
8: 57600 Bd
9: 115.2 KBd

	10: 230.4 KBd
Type Return Value:	Unsigned integer
Return value:	See parameter
Value range:	4...10
Initial value:	5

10.1.2 Command FB

<id>FB<parameter><CR>Quick	start mode
Access Mode (Key):	Without / User
Access:	Read / write
Description:	The command is used to select the quick start mode or to query the set mode. In quick start mode, the bootloader jumps immediately to the firmware and does not output any data. Also the firmware does not output a telegram to the encoder status. If the quick start mode is inactive, the bootloader outputs the character C for 9 times.
Parameter type:	Unsigned integer
Parameter:	0: Quick start mode off 1: Quick start mode on
Type Return Value:	Unsigned integer
Return value:	See parameter
Value range:	0 ... 1
Initial value:	1

10.1.3 Command ID

<id>ID<parameter><CR>	Identification number
Access Mode (Key):	Without / User
Access:	Read / write
Description:	This command sets the identification number. Only if the 'ID' contained in the command matches the one set in the sensor, a response telegram is sent. An exception is the generic 'ID', where all sensors answer. After the 'ID' has been changed, the device responds immediately with the new 'ID'.
Parameter type:	Unsigned integer
Parameters:	0 to 98: Individual ID
Type Return Value:	Unsigned integer
Return value:	See parameter
Value range:	0 … 98
Initial value	0

10.1.4 Command KY

<id>KY<parameter><CR> Key/password
Access Mode (Key): Without / User
Access: Read / write
Description: The value for the key (password) is set with this command. The following 2 password levels are possible:

Query (only read access)
User (general settings)
Admin (Thies configuration level)

Parameter Type: Unsigned integer
Parameter:

Parameter	Description
Without	Query = read
1	User = write
*	Admin (Thies internal)

Type Return value: Unsigned integer
Return value: See parameter
Value range: 0, 1, *
Initial value: 0
Sample: Set user level: 00KY00001

10.1.5 Command OR

<id>KY<parameter><CR> Telegram output interval (Output Rate)
Access Mode (Key): Without / User
Access: Write
Description: With independent telegram output, this parameter specifies the time interval in which telegrams are output via the serial interface. The specification is made in seconds. The parameter OR has no influence on the data acquisition - the internal sampling rate of the data is fixed at 1 second. See also command TT.
Parameter Type: Unsigned integer
Parameter: 1 ... 600: Specifies the output interval in seconds.
Type Return value: Unsigned integer
Return value: Currently set value
Value range: 1 ... 600 [sec]
Initial value: 60

10.1.6 Command RD

<id>RS<parameter><CR>Reset

Access Mode (Key):	Without / User
Access:	Read / write
Description:	Set the response delay to a command sent to the sensor in milliseconds. Sample: 00RD00020<CR>
Parameter type:	Unsigned integer
Parameters:	Delay time in milliseconds
Type Return value:	Integer
Return value:	Current set value
Value range:	20 … 50
Initial value:	20

10.1.7 Command RS

<id>RS<parameter><CR>Reset

Access Mode (Key):	Without / User
Access:	Write
Description:	The RS command triggers a restart of the sensor. After the reset, the sensor is restarted. See also Command FB
Parameter type:	Unsigned integer
Parameters:	1
Value range:	1
Initial value:	-

10.1.8 Command TT

<id>TT<parameter><CR>	Autonomous telegram output (Telegram Transmission).
Access Mode (Key):	User
Access:	Write
Description:	Defines the type number of the telegram that is sent cyclically automatically. The definition of the available telegrams is described under **Command TR** is described. To switch off the independent telegram output, the parameter of TT must be set to 0.
Type Return value:	String
Return value:	See **Appendix data telegram**
Value range:	0 ... 12
Initial value:	12

10.1.9 Command TR

<id>TR<parameter><CR>	Measurement request
Access Mode (Key):	Without
Access:	Reading
Description:	The command triggers the one-time transmission of the current data telegram.
Parameter type:	Unsigned integer
Parameter:	1: Query measured value telegram 1 2: Query measured value telegram 2 9: Query measured value telegram 9 11: Query measured value telegram 11
Type Return value:	String
Return value:	String see also **Appendix data telegram**
Value range:	1 ... 12
Initial value:	-

10.1.10 Command SV

<id>SV<parameter><CR>	Query firmware version
Access Mode (Key):	Without
Access:	Reading
Description:	Firmware version output [1/100]
Parameter type:	unsigned integer
Parameter:	no parameter
Type Return value:	String
Return value:	Output of the firmware version in 1/100 e.g. 151 -> V1.51
Value range:	-
Initial value:	-

10.1.11 Command ZD

<id>ZD<parameter><CR>	Date: day of the month
Access Mode (Key):	Without / User
Access:	Read / write
Description:	This command reads / writes the day of the current month
Parameter type:	Unsigned integer
Type Return Value:	Unsigned integer
Return Value:	Day of the month
Value range:	1 to 31
Initial value	1

10.1.12 Command ZH

<id>ZH<parameter><CR>	Time: hour value
Access Mode (Key):	Without / User
Access:	Read / write
Description:	This command reads / writes the current hour
Parameter type:	Unsigned integer
Type Return Value:	Unsigned integer
Return Value:	Hour of the time
Value range:	0 … 23
Initial value:	0

10.1.13 Command ZM

<id>ZM<parameter><CR>	Time: minute value
Access Mode (Key):	Without / User
Access:	Read / write
Description:	This command reads / writes the current minute
Parameter type:	Unsigned integer
Type Return Value:	Unsigned integer
Return Value:	Minute of the time
Value range:	0 … 59
Initial value:	0

10.1.14 Command ZN

<id>ZN<parameter><CR>	Date: month
Access Mode (Key):	Without / User
Access:	Read / write
Description:	This command reads / writes the month of the year
Parameter type:	Unsigned integer
Type Return Value:	Unsigned integer
Return Value:	Month
Value range:	1 … 12
Initial value:	1

10.1.15 Command ZS

<id>ZS<parameter><CR>	Time: seconds value
Access Mode (Key):	Without / User
Access:	Read / write
Description:	This command reads / writes the current second
Parameter type:	Unsigned integer
Type Return Value:	Unsigned integer
Return value:	Second of the time
Value range:	0 … 59
Initial value	0

10.1.16 Command ZT

<id>ZT<CR>	Date and time output
Access Mode (Key):	Without
Access:	Reading
Description:	This command reads the date and time
Parameter type:	none
Type Return value:	String
Return value:	Date and time e.g. 03.02.2021 17:29:34

10.1.17 Command ZY

<id>ZY<parameter><CR>	Date: Year
Access Mode (Key):	Without / User
Access:	Read / write
Description:	This command reads / writes the year (from 2000).
Parameter type:	Unsigned integer
Type Return Value:	Unsigned integer
Return Value:	Year from 2000
Value range:	0 … 99
Initial value:	0

11 Appendix data telegram

11.1 Telegram 1

The sensor responds to the command "00TR00001\r" with the measured value telegram. The telegram structure is shown in the following table:

Position	Length	Sample	Ceramics	Description
1	1	<STX>	---	Start of text
2	10	2000-01-04	---	Sensor date
12	8	02:46:25	---	Sensor time
20	1	0	--	**Status freezing precipitation**
21	7	0.000	--	Precipitation intensity in mm/h
28	1	0	--	**Electrical status**
29	1	0	--	Status electronics, reserved
30	1	0	--	**Heating status**
31	1	0	--	**Error code 1**
32	1	0	--	**Error code 2**
33	1	0	--	**Error code 3**
34	2	F8	--	**Checksum** (telegram 1)
36	1	<EOT>	--	End of transmission
37	1	<CR>	--	Carriage return
38	1	<LF>	--	Line break

Table 1: Telegram 1

Sample telegram 1: 2000-01-04;02:46:25;0; 0.000;000;000;F8

11.2 Telegram 2

The sensor responds to the command "00TR00002\r" with the measured value telegram. The telegram structure is shown in the following table:

Position	Length	Sample	Ceramics	Description
1	1	<STX>	---	Start of text
2	2	00	---	Devices ID
4	5	V1.86	---	Firmware version
9	8	04.01.00	---	Sensor date
17	8	02:46:01	---	Sensor time
25	1	0	--	**Quality index FZRA type 1**
26	1	0	--	**Quality index FZDZ type 2**
27	1	0	--	**Quality index FZRA type 3**
28	1	0	--	**Quality index supercooled water**
29	1	0	--	**Quality index liquid** precipitation
30	1	0	--	Reserved
31	1	0	--	Reserved
32	2	00	--	**Combined Quality index FZRA type 1**
34	2	00	--	**Combined Quality index FZDZ type 2**
36	2	00	--	**Combined Quality index FZDZ, non-crystallizing**
38	2	00	--	**Combined Quality index FZRA type 3**
40	1	0	--	Reserved
41	7	000.000	--	Precipitation in mm/h
48	3	0.0	1	Reserved
51	3	0.0	2	Reserved
54	3	0.0	3	Reserved
57	3	0.0	4	Reserved
60	5	+25.9	--	Air temperature
65	8	000004	-	**Sensor status**
73	1	*	--	<2A>, *
74	3	7A	--	**Checksum** (telegrams 2, 9)
77	1	<CR>	--	Carriage return
78	1	<LF>	--	Line break (Line feed)
79	1	<ETX>	--	End character (End of text)

Table 2: Telgram 2

Sample Telegramm 2:
00;V1.86;04.01.00;02:46:01;0;0;0;0;0;0;0;00;00;00;00;0;000.000;0.0;0.0;0.0;0.0;+25.9;000004
01*7A

11.3 Telegram 3

The sensor responds to the command "00TR00003\r" with the measured value telegram. The telegram structure is shown in the following table:

Position	Length	Sample	Ceramics	Description
1	1	<STX>	---	Start of text
2	10	2000-01-04	---	Sensor date
12	8	02:46:25	---	Sensor time
20	1	0	--	**Status freezing precipitation**
21	7	0.000	--	**Quality index FZRA/FZDZ**
28	1	0	--	**Electrical status**
29	1	0	--	Status electronics, reserved
30	1	0	--	**Heating status**
31	1	0	--	**Error code 1**
32	1	0	--	**Error code 2**
33	1	0	--	**Error code 3**
34	2	F8	--	**Checksum** (telegram 1)
36	1	<EOT>	--	End of transmission
37	1	<CR>	--	Carriage return
38	1	<LF>	--	Line break

Table 3: Telegram 3

Sample telegram 3: 2000-01-01;02:27:50;0;000.000;000;100;E2

11.4 Telegram 9

The sensor responds to the command "00TR00009\r" with the measured value telegram. The telegram structure is shown in the following table:

Position	Length	Sample	Ceramics	Description
1	1	<STX>	---	Start of text
2	2	00	---	Devices ID
4	5	V1.87	---	Firmware version
9	8	04.01.00	---	Sensor date
17	8	02:19:11	---	Sensor time
25	1	0	--	**Quality index liquid precipitation**
26	1	0	--	**Quality index FZRA type1**
27	1	0	--	**Quality index FZDZ type 2**
28	1	0	--	**Quality index FZRA type 3**
29	1	0	--	**Quality index supercooled water**
30	1	0	1	**Quality index ice**
31	1	0	2	**Quality index ice**
32	1	0	3	**Quality index ice**
33	1	0	4	**Quality index ice**
34	1	0	--	Reserved
35	1	0	--	Reserved
36	1	0	--	Reserved
37	5	+25.3	--	Air temperature
42	8	00000401	-	**Sensor status**
50	1	*	--	<2A>, *
51	3	54	--	**Checksum** (telegrams 2, 9)
54	1	<CR>	--	Carriage return
55	1	<LF>	--	Line break (Line feed)
56	1	<ETX>	--	End character (End of text)

Table 4: Telegram 9

Sample Telegramm 9: 00;V1.87;04.01.00;02:19:11;1;0;0;0;0;0;0;0;0;0;0;+25.3;00000401;*54

11.5 Telegram 11

The sensor responds to the command "00TR00011\r" with the measured value telegram. The telegram structure is shown in the following table:

Position	Length	Sample	Ceramics	Description
1	5	V1.86	---	Firmware version
6	8	04.01.00	---	Sensor date
14	8	01:47:39	---	Sensor time
22	5	00.00	---	Precipitation intensity in mm/h
27	4	0000	1	[16Bit Hex]² **Status detection precipitation**
31	4	0000	2	[16Bit Hex]² **Status detection precipitation**
35	4	0000	3	[16Bit Hex]² **Status detection precipitation**
39	4	0000	4	[16Bit Hex]² **Status detection precipitation**
43	4	00.0	1	Heating [W]
47	4	00.0	2	Heating [W]
51	4	00.0	3	Heating [W]
55	4	00.0	4	Heating [W]
59	5	62827	1	Frequency High [Hz] Raw
64	5	62322	2	Frequency High [Hz] Raw
69	5	62626	3	Frequency High [Hz] Raw
74	5	62826	4	Frequency High [Hz] Raw
81	7	+025.11	1	Temperature 1 [°C]
88	7	+025.09		Temperature 2 [°C]
95	7	+024.97		Temperature 3 [°C]
102	7	+024.98	2	Temperature 1 [°C]
109	7	+025.02		Temperature 2 [°C]
116	7	+024.85		Temperature 3 [°C]
123	7	+024.83	3	Temperature 1 [°C]
130	7	+024.83		Temperature 2 [°C]
137	7	+024.93		Temperature 3 [°C]
144	7	+024.90	4	Temperature 1 [°C]
151	7	+024.89		Temperature 2 [°C]
158	7	+025.00		Temperature 3 [°C]
165	7	+025.19	---	Temperature inside [°C]
172	7	+025.19	---	Temperature outside [°C]
179	4	23.6	---	Supply [V]
183	5	64086	1	Frequency High Medium [Hz] (Temp. Compensated)
187	5	64083		Frequency High Current [Hz] (Temp. Compensated)
192	5	64191	2	Frequency High Medium [Hz] (Temp. Compensated)
197	5	64191		Frequency High Current [Hz] (Temp. Compensated)
202	5	64506	3	Frequency High Medium [Hz] (Temp. Compensated)
207	5	64504		Frequency High Current [Hz] (Temp. Compensated)
212	5	64086	4	Frequency High Medium [Hz] (Temp. Compensated)
217	5	64082		Frequency High Current [Hz] (Temp. Compensated)
222	1	0	---	Knock sensor

223	5	32714	---	Knock sensor analog value
228	5	01129	1	Frequency Low Current [Hz] (Temp. Compensated)
233	5	01134	2	Frequency Low Current [Hz] (Temp. Compensated)
238	5	01127	3	Frequency Low Current [Hz] (Temp. Compensated)
243	5	01129	4	Frequency Low Current [Hz] (Temp. Compensated)
248	1	<CR>	--	Carriage return

Table 5:Telegram 11

Sample telegram 11:
V1.86;04.01.00;01:47:39;00.00;0000;0000;0000;0000;00.0;00.0;00.0;00.0;62827;62322;62626;62826;+025.11;+025.08;+025.09;+024.97;+024.98;+025.02;+024.85;+024.83;+024.83;+024.93;+024.90;+024.89;+025.00;+025.19;23.6;64086;64083;64191;64191;64506;64504;64086;64082;0;32714;01129;01134;01127;01129;

11.6 Telegram 12

The sensor responds to the command "00TR00012\r" with the measured value telegram. The telegram structure is shown in the following table:

Position	Length	Sample	Ceramics	Description
1	1	<STX>	---	Start of text
2	10	2000-01-01	---	Sensor date
12	8	02:27:50	---	Sensor time
20	1	0	--	**Status freezing precipitation**
21	7	000.000	--	**Quality index FZRA/FZDZ**
28	1	0	--	**Electrical status**
29	1	0	--	**Electrical status, reserved**
30	1	0	--	**Status heating**
31	1	1	--	**Error code 1**
32	1	0	--	**Error code 2**
33	1	0	--	**Error code 3**
35	2	F8	--	**Checksum** (telegram 1)
36	1	<EOT>	--	End of transmission
37	1	<CR>	--	Carriage return
38	1	<LF>	--	Line feed)

Tabelle 6: Telegramm 12

Sample Telegram 12: 2000-01-01;02:27:50;0;000.000;000;100;E2

11.7 Explanation of the data telegrams

Error detection: Largest value that can be displayed (e.g. "+99.99")

Output frequency: 1Hz

Control characters:

<CR> - Carriage Return (13_{dec} ; 0x0D)
<LF> - Line Feed (10_{dec} ; 0x0A)
<START CHARACTER (START OF TEXT)> - Start of Text (2_{dec} ; 0x02)
<ETX> - End of Text (3_{dec} ; 0x03)
<EOT> - End of Transmission (4_{dec} ; 0x04)

For the designation of the temperature measuring points see **Figure 4**

Separation character:

Separation character between the individual measured values in the string is the semicolon ';'.

11.7.1 Status freezing precipitation (Telegram 1 and 3)

Description: The "Freezing precipitation status" becomes logical 1 when the following following condition is fulfilled:

Combined quality index FZRA type 1 ≥ 5
OR
Combined quality index FZDZ type 2 ≥ 5
OR
Combined quality index FZDZ non-crystallizing ≥ 5

Value range: 0/1

11.7.2 Status freezing precipitation (Telegram 12)

Description: The "Freezing precipitation status" becomes logical 1 when the following following condition is fulfilled

Quality index FZRA Typ 1 * Quality index precipitation ≥ 6
OR
Quality index FZDZ Typ 2 * Quality index precipitation ≥ 6
OR
Quality index supercooled water * Quality index precipitation ≥ 6

For details see chapter 11.7.4.

Value range: 0/1

11.7.3 Quality index and combination quality index FZRA FZDZ (Telegram 3)

Description:

From position 21 of telegram 3, the quality index and combination quality index of the detected supercooled sensor output. At the first three positions a quality index for crystallization (A, B) and / or supercooled water on the sensor surface (C) is output. In the last three positions, a combined quality index is output, which shows whether the sensor has also detected precipitation simultaneously with the detection of crystallization and supercooled water. I.e. position D shows the quality index for whether precipitation is also detected at the same time as crystallization A, correspondingly positions E and F show quality index if precipitation is also detected at the same time as crystallization (B) or supercooled water (C).

The value range of the respective quality index is from 0 ... 4
and the value range of the combined quality index is from 0 ... 9.

0	0	0	.	0	0	0
A	B	C		D	E	F

A= Quality index FZRA type, crystallization type 1 (value range 0...4)
B= Quality index FZDZ type, crystallization type 2 (value range 0...4)
C= Quality index FZDZ type, supercooled water (value range 0...4)
D= Combined quality index FZRA, type 1 (value range 0...9)
E= Combined quality index FZDZ, type 2 (value range 0...9)
F= Combined quality index FZDZ, non-crystallizing (value range 0...9)

Examples :

000.000 -> No precipitation
023.000 -> Freezing Wetness
300.000 -> Freezing Wetness
340.680 -> Freezing Rain and Freezing Drizzle
004.005 -> Freezing Drizzle

11.7.4 Quality index FZRA/FZDZ (Telegram 12)

Description: From position 21 of telegram 12, the quality index and combination quality index of the detected supercooled sensor output. In the first three positions, a quality index for crystallization (A, B) and / or supercooled water on the sensor surface (C) is output. In the last three positions, the quality index precipitation (D), the highest determined value of the quality index ice (E) and the quality index FZRA type 3 (F) are output.

The value range of the respective quality index goes from 0 … 4

0	0	0	.	0	0	0
A	B	C		D	E	F

A= Quality index FZRA Typ, crystallization Typ 1 (Value range 0…4)
B= Quality index FZDZ Typ, crystallization Typ 2 (Value range 0…4)
C= Quality index FZDZ Typ, supercooled water (Value range 0…4)
D= Quality index precipitation (Value range 0…4)
E= Maximum value Quality index (QI) ice of all ceramics (Value range 0…4)
F= Quality index FZRA Typ 3 (Value range 0…4)

Examples:

000.000 → No precipitation, no ice, no supercooled wetting on sensor
023.000 → Freezing Wetness
(Crystallization and supercooled water on sensor plates but no precipitation)
300.400 → Freezing Rain
(because Crystallisation and Precipitation appears at the same time and 3x4 ≥ 6, “status freezing precipitation = 1“ is set, see chapter 11.7.2)
300.100 → Crystallization detected
(because 3x1=3 < 6, “status freezing rain = 0“ is set, see chapter 11.7.2)
330.420 → Freezing Rain and Freezing Drizzle
(at least one ceramic with QI 2 iced; because 3x4 ≥ 6 “status freezing precipitation = 1“ is set, see chapter 11.7.2)
000.031 → at least one ceramic with QI 3 iced; freezing wetness, QI 1
003.200 → (non-crystallizing) Freezing Drizzle
(because 3x2≥6 “status freezing precipitation = 1“ is set, see chapter 11.7.2)

11.7.5 Electrical status

Description: "Electrical status" is set to 1 if the operating voltage is greater than 28V or less than 11V.

Value range: 0/1

11.7.6 Heating status

Description: "Heating status" is set to 1 if one or more ceramic heaters are switched on.

Value range: 0/1

11.7.7 Error code 1

Description: "Error code 1" is set to 1 during the startup phase. The device needs 90s until all ring memories are filled. After that, the error code 1 is set to 0.

Value range: 0/1

11.7.8 Error code 2

Description: Error code 2" indicates after the start phase whether a ceramic is contaminated.

Each ceramic is assigned a bit position, and the resulting 4-bit number is output in hexadecimal.

Ceramic 1 is assigned to bit 0, ceramic 2 to bit 1, and so on.
(see also Precipitation detection status).

Value range: 0

11.7.9 Error code 3

Description: Reserved

Value range: 0

11.7.10 Checksum (telegram 1)

Description: The checksum is calculated from bytes 1 to 39 and 42 to 44 (position 1 - 25 and 27) as two's complement.
The checksum of a data telegram is calculated from the sum of all of all characters (alphanumeric characters and control codes like <START OF TEXT)> <EOT>, <LF>). From this sum the two's complement
is formed and the lower byte of this two's complement is used as a checksum.
is used. The higher nibble and the lower nibble of the checksum are each output as a HEX number.

Value range: 00-FF

11.7.11 Checksum (telegrams 2, 9)

Description: XOR checksum over all characters of the telegram, without consideration of the
control characters (<START OF TEXT)>, <ETX> ,<CR>).

Value range: -

11.7.12 Quality index FZRA type 1

Description: Quality index freezing rain FZRA type 1. The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

Value range: 0...4

11.7.13 Quality index FZDZ type 2

Description: Quality index freezing rain FZDZ type 2. The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

Value range: 0...4

11.7.14 Quality index FZRA type 3

Description: Quality index freezing rain FZRA type 3 (heavy freezing rain). The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

Value range: 0...4

11.7.15 Quality index supercooled water

Description: Quality index supercooled water. The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

Value range: 0...4

11.7.16 Quality index liquid precipitation

Description: Quality index precipitation (Mixed precipitation) (not implemented). The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

Value range: 0...4

11.7.17 Combined Quality index FZRA type 1

Description: Combined Quality index FZRA type 1. The combined Quality index FZRA type 1 is the product of the quality index precipitation and the Quality index FZRA type 1. The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

For the calculation, the quality index precipitation and the quality index FZDZ type 1 are multiplied with each other. The result of the multiplication of the two quality indices lies in the value range from 0 to 16 and is broken down to the value range from 0 to 9.

	0	1	2	3	4
0	0/0	0/0	0/0	0/0	0/0
1	0/0	1/1	2/2	3/3	4/4
2	0/0	2/2	4/4	6/5	8/6
3	0/0	3/3	6/5	9/7	12/8
4	0/0	4/4	8/6	12/8	16/9

Value range: 0 ... 9

11.7.18 Combined Quality index FZDZ type 2

Description: Combined Quality index FZDZ type 2. The combined Quality index FZRA type 2 is the product of the quality index precipitation and the Quality index FZDZ type 2. The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

For the calculation, the quality index precipitation and the quality index FZDZ type 2 are multiplied with each other. The result of the multiplication of the two quality indices lies in the value range from 0 to 16 and is broken down to the value range from 0 to 9.

	0	1	2	3	4
0	0/0	0/0	0/0	0/0	0/0
1	0/0	1/1	2/2	3/3	4/4
2	0/0	2/2	4/4	6/5	8/6
3	0/0	3/3	6/5	9/7	12/8
4	0/0	4/4	8/6	12/8	16/9

Value range: 0 ... 9

11.7.19 Combined Quality index FZDZ, non-crystallizing

Description: Combined Quality index FZDZ, non-crystallizing. The Combined Quality index FZRA, non-crystallizing is the product of the quality index precipitation and the Quality index supercooled water. The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

For the calculation, the quality index precipitation and the quality index supercooled water are multiplied with each other. The result from the multiplication of the two quality indices lies in the value range from 0 to 16 and is broken down to the value range from 0 to 9.

	0	1	2	3	4
0	0/0	0/0	0/0	0/0	0/0
1	0/0	1/1	2/2	3/3	4/4
2	0/0	2/2	4/4	6/5	8/6
3	0/0	3/3	6/5	9/7	12/8
4	0/0	4/4	8/6	12/8	16/9

Value range: 0 ... 9

11.7.20 Combined Quality index FZRA type 3

Description: Combined Quality index FZDZ, type 3. The combined Quality index FZRA, type 3 is the product of the quality index FZRA, type 3 and the Quality index precipitation. The higher the number, the "safer" the respective event was detected. Valid for the entire sensor.

For the calculation, the combined quality index FZRA, type 3 and the quality index precipitation are multiplied with each other. The result of the multiplication of the two quality indices lies in the value range from 0 to 16 and is broken down to the value range from 0 to 9.

	0	1	2	3	4
0	0/0	0/0	0/0	0/0	0/0
1	0/0	1/1	2/2	3/3	4/4
2	0/0	2/2	4/4	6/5	8/6
3	0/0	3/3	6/5	9/7	12/8
4	0/0	4/4	8/6	12/8	16/9

Value range: 0...9

11.7.21 Quality index ice

Description: Quality index ice. The higher the number, the "safer" the respective event was detected. Valid for the respective ceramic.

Value range: 0...4

11.7.22 Precipitation

Description: Precipitation in mm/h

Value range: 0…999.999 mm/h (Telegram 1 and 2) bzw. 99.99 mm/h (Telegram 11)

11.7.23 Status detection precipitation

Bit	Precipitation type	Meaning	Value
0	Liquid precipitation	Yes / No	1 / 0
1	FZRA	Yes / No	1 / 0
2	FZDZ	Yes / No	1 / 0
3	FZRA type 3	Yes / No	1 / 0
4	Supercooled Water	Yes / No	1 / 0
5	Ice	Yes / No	1 / 0
6	Reserved	Yes / No	1 / 0
7	Reserved	Yes / No	1 / 0
8	Reserved	Yes / No	1 / 0

Table 7: Precipitation type

Via the fields "[16Bit Hex][2] Status Detection Precipitation" (see also Table 5) the detected precipitation types are output coded as 16-bit HEX number (For hex coding, see also 11.5.22). Each precipitation type is coded via a bit position which is set to logical '1' when this precipitation type occurs. The output of the 16-bit long sequence then takes place as hex number.

A 16-bit number is provided for each ceramic. For a precipitation type to be detected, the corresponding quality index must be >=2. This quality index applies to all precipitation types for the entire sensor. Precipitation is therefore displayed on all ceramics. The quality index ice is considered separately for each ceramic and is therefore also output in this way.

[2] Status detection precipitation Hexadecimal 16Bit:

11.7.24 Sensor status

Bit	Name	Description
0	STS_MEAS_INVALID	Measurement data invalid
1	STS_MEAS_INIT	Initialization phase (90s after start)
2	RESVD_0_INVALID	reserved
3	RESVD_1_INVALID	reserved
4	STS_HEATING_K1_ENABLED	Heater ceramic 1 active
5	STS_HEATING_K2_ENABLED	Heater ceramic 2 active
6	STS_HEATING_K3_ENABLED	Heater ceramic 3 active
7	STS_HEATING_K4_ENABLED	Heater ceramic 4 active
8	STS_K1_DIRT_DETECTED	Ceramic 1 dirty
9	STS_K2_DIRT_DETECTED	Ceramic 2 dirty
10	STS_K3_DIRT_DETECTED	Ceramic 3 dirty
11	STS_K4_DIRT_DETECTED	Ceramic 4 dirty
12	STS_K1_TEMP_INVALID	Ceramic 1, invalid temperature
13	STS_K2_TEMP_INVALID	Ceramic 2, invalid temperature
14	STS_K3_TEMP_INVALID	Ceramic 3, invalid temperature
15	STS_K4_TEMP_INVALID	Ceramic 4, invalid temperature
16	STS_K1_FREQ_INVALID	Ceramic 1, invalid frequency
17	STS_K2_FREQ_INVALID	Ceramic 2, invalid frequency
18	STS_K3_FREQ_INVALID	Ceramic 3, invalid frequency
19	STS_K4_FREQ_INVALID	Ceramic 4, invalid frequency
20	STS_AIR_TEMP_INVALID	Invalid air temperature
21	STS_HAIL_SENSOR_ERROR	Error hail sensor
22	STS_VOLTAGE_INVALID	Supply voltage outside the permitted range (11V >Vs > 28V)
23	STS_WD_RESET_FLAG_SET	Sensor reset by watchdog timer
24	STS_FLASH_PARAMETER_INVALID	Flash parameter invalid
25	STS_FLASH_PARAMETER_DEFAULT	Flash parameters set to default values
26	STS_FLASH_ERASED	Flash deleted
27	STS_FLASH_INIT_FAILED	Initialization of the flash memory failed
28	RESVD_2_INVALID	Reserved
29	RESVD_3_INVALID	Reserved
30	RESVD_4_INVALID	Reserved
31	RESVD_5_INVALID	Reserved

Table 8: 32 bit sensor status

Activated functions and errors of the FZRA sensor are displayed via the sensor status. Bit 0 (STS_MEAS_INVALID) indicates whether the measured values and forecasts of the sensor can be used. In this bit the status bits:

STS_MEAS_INIT, STS_Kx_DIRT_DETECTED, STS_Kx_FREQ_INVALID, STS_AIR_TEMP_INVALID, STS_HAIL_SENSOR_ERROR, STS_VOLTAGE_INVALID

ORDERED.

As soon as one of these status bits is set, the bit 0 is set and thus the measured values and forecasts are invalid. The output of the status is in hexadecimal. The following Samples are to show the coding of the status bits into a corresponding hexadecimal number.

Sample 1:

STS_K1_FREQ_INVALID and therefore also STS_MEAS_INVALID is set.

The status bit STS_K1_FREQ_INVALID is at position 16 of the sensor status.

Representation of the sensor status with bit 16 set as binary number:

0000 0000 0000 0001 0000 0000 0000 0000

The status bit STS_MEAS_INVALID is at position 0 of the sensor status.

Representation of the sensor status with bit 0 set as binary number:

0000 0000 0000 0000 0000 0000 0000 0001

The counting of the bits and thus the digit in the binary number is from the right starting with bit 0. If the two bits in the status are set, the following binary number results:

0000 0000 0000 0001 0000 0000 0000 0001

The significance of a bit results from the position in the binary number, starting with the least significant position (bit 0). The significance of a bit at position n is 2^n. So, if only bit 0 is set, the binary number will be

0000 0000 0000 0000 0001 or expressed as a decimal number 1 (2^0).

If the bits 0 and 16 are set, then the binary number is obtained

0000 0000 0001 0000 0000 0001 or as decimal number 65537 (2^0+2^16).

The sensor status is output as a hexadecimal number. The conversion of a binary number into a hexadecimal number is quite simple to implement, in which the binary number is always represented as a block of 4. A digit in the hexadecimal system represents the decimal numbers from 0-15. To represent the two-digit numbers from 10-15 in the decimal system, the letters A-F are used. To binary code a digit in the hexadecimal system, 4 bits are needed (2^4 = 16 possible combinations) to represent the number 0-15, hence the division of the binary number into blocks of four.

Now, to convert the binary number divided into blocks of four into a hexadecimal number, the significance of the bits in each block of four is set from 2^0 to 2^3. From the set bits in the block of four, the valence is added and the result is converted into a hexadecimal digit. This procedure is applied to all blocks of four of the binary number. The hexadecimal number now results from the hexadecimal digits of the converted binary blocks written together. The order of the hexadecimal digits corresponds to the blocks of four of the decimal number. Sample conversion of a 16 bit binary number:

Binary: 0010 0001 1000 1011 Decimal (2^0+2^1+2^3+2^7+2^8+2^13) = 8587

Hexadecimal:

Block 1 (starting from the right): Binary 1011, Decimal 11, Hexadecimal B

Block 2: Binary 1000, Decimal 8, Hexadecimal 8

Block 3: Binary 0001, Decimal 1, Hexadecimal 1

Block 4: Binary 0010, Decimal 2, Hexadecimal 2

Result in hexadecimal: 0x218B

Ceramic surfaces and temperature measuring points

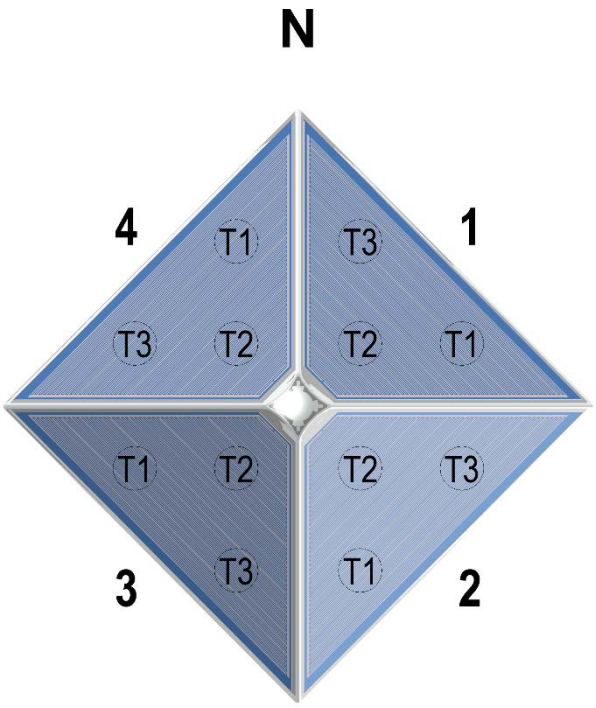


Figure 4: Designation of the ceramic surfaces and the position of the temperature measuring points.

12 Technical data

Detection of crystallizing and non-crystallizing supercooled precipitates.		
Measuring output	Yes / No	
Minimum intensity	≥ 0.4mm/h	
Period until precipitation signal	≤ 5min. from minimum intensity	
Accuracy (Detection of supercooled precipitation).	≥ 95% of the events (Reference to DWD Weather Observer)	
Precipitation type / measured variables		
Liquid precipitation	Intensity in mm / h	
Supercooled drizzle (freezing drizzle, FZDZ)	Yes / No	Combined quality indices for crystallizing and non-crystallizing supercooled spray
Supercooled rain (freezing rain, FZRA)	Yes / No	Combined quality index
Crystallization (type 3)	Yes / No	Quality index
Supercooled Water[1]	Yes / No	
Ice[2]	Yes / No	
Precipitation	Yes / No	Quality index
Sensor soiling	Yes / No	
Serial interface		
	Type Operating Data Baudrate Data format	RS485 modeHalf-duplex mode format8N1 4800 to 230400 Bd, Bootloader 9600 Bd ASCII (command interpreter: THIES)
General		
Operating voltage	11 ... 28V DC	
Current consumption	< 100mA (max. 800mA, with heating on)	
Heating	4 x separate heating control of the ceramic surfaces	
Permitted Environmental conditions	-40 ... +85 °C 0 ... 100 rel. humidity, including condensation	
Mounting	Mounting on mast Outer diameter ≤ 34mm Inner diameter ≥ 22mm Note: Mounting on other mast tubes with separate Adapter (option) possible.	
Housing		
Material	Anodized aluminum / plastic / ceramic	
Dimensions	See 14. dimensional drawing.	
Weight	approx. 0,25kg	
Protection class	IP 65	

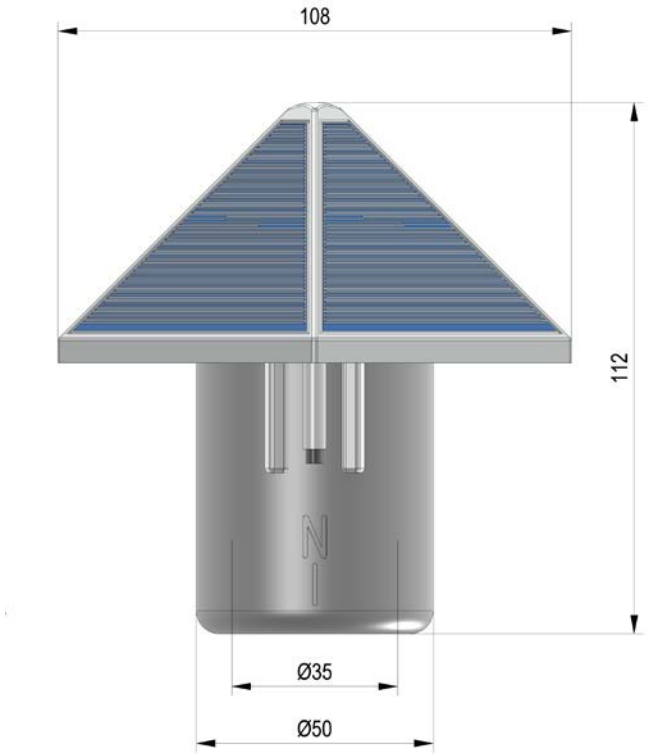
Connection type	8-pin connector for shielded cable in shaft (see connection diagram

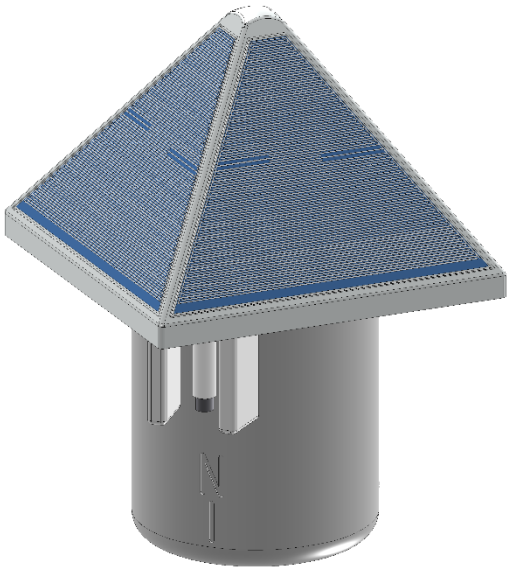
[1] Related to non-crystallized water on the sensor,
although the temperature is below 0 °C. Surrounding surfaces may already be crystallized.
[2] Ice is detected on the sensor. The conditions of surrounding surfaces can deviate from this despite the expected close correlation.

13 Accessories / Spare parts

Cable Pre-assembled connection cable for PRECIPITATION ANALYZER. Cable with cable socket on the device side and open ends on the receiving side.	**Article No. 510597**	Length: 4m
Coupling socket / plug 8-pin, EMC, with knurl	**Article No. 507550**	-
Mast adapter Ø50mm	**Article No. 510471**	Adapter PRECIPITATION ANALYZER to mast tube Ø50mm
Mast adapter Ø60mm	**Article no. 510472**	Adapter PRECIPITATION ANALYZER to mast tube Ø60mm

14 Dimension drawing





15 EC Declaration of Conformity

Manufacturer: Adolf Thies GmbH & Co. KG
Hauptstraße 76
37083 Göttingen, Germany
http://www.thiesclima.com

Product: Freezing-Rain-Detektor / Precipitation-Analyzer

Doc. Nr. 2012-44853_CE

Article Overview:

5.4107.00.000	5.4107.00.100

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

2014/30/EU	26.02.2014	DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility.
2014/35/EU	26.02.2014	DIRECTIVE 2014/35/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.
2017/2102/EU	15.11.2017	DIRECTIVE (EU) 2017/2102 of the European Parliament and of the Council of November 15, 2017 amending Directive 2011/65 / EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
2012/19/EU	13.08.2012	DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 on waste electrical and electronic equipment (WEEE).
2018/1139/EU	04.07.2018	Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.

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

DIN EN 50625-1	2014-09	Collection, logistics & Treatment requirements for WEEE. General treatment requirements.
DIN EN IEC 61000-6-1	2019-11	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments (IEC 61000-6-1:2016)
DIN EN IEC 61000-6-2	2019-11	Electromagnetic compatibility Immunity for industrial environment
DIN EN 61000-6-3:2007 + A1:2011	2011-09	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments
DIN EN IEC 61000-6-4	2020-09	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4:2018)
DIN EN 61010-1	2020-03	Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements
DIN EN 61326-1	2013-07	Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements
DIN EN IEC 63000	2019-05	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Legally binding signature:

General Manager - Dr. Christoph Peper

Legally binding signature:

Development Manager - ppa. Jörg Petereit

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.

16 UK-CA Declaration of Conformity

Manufacturer: Adolf Thies GmbH & Co. KG
Hauptstraße 76
37083 Göttingen, Germany
http://www.thiesclima.com

Product: Freezing-Rain-Detektor / Precipitation-Analyzer

Doc. Nr. 2012-44853_CA

Article Overview:

5.4107.00.000	5.4107.00.100

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

1091	08.12.2016	The Electromagnetic Compatibility Regulations 2016
1101	08.12.2016	The Electrical Equipment (Safety) Regulations 2016
RoHS Regulations 2012	01.01.2021	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
3113	01.01.2021	Regulations: waste electrical and electronic equipment (WEEE)
2018/1139/EU	04.07.2018	Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.

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

BS EN 50625-1	31.03.2014	Collection, logistics & Treatment requirements for WEEE. General treatment requirements
BS EN 61000-6-1	28.02.2007	Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments
BS EN IEC 61000-6-2	25.02.2019	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
BS EN IEC 61000-6-3	30.03.2021	Electromagnetic compatibility (EMC). Generic standards. Emission standard for equipment in residential environments
BS EN IEC 61000-6-4	30.09.2019	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments
BS EN 61010-1+A1	31.03.2017	Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements
BS EN IEC 61326-1	07.06.2021	Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements
BS EN IEC 63000	10.12.2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Legally binding signature:

General Manager - Dr. Christoph Peper

Legally binding signature:

Development Manager - ppa. Jörg Petereit

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.

Talk to us about your system requirements.
We will be happy to advise you.

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