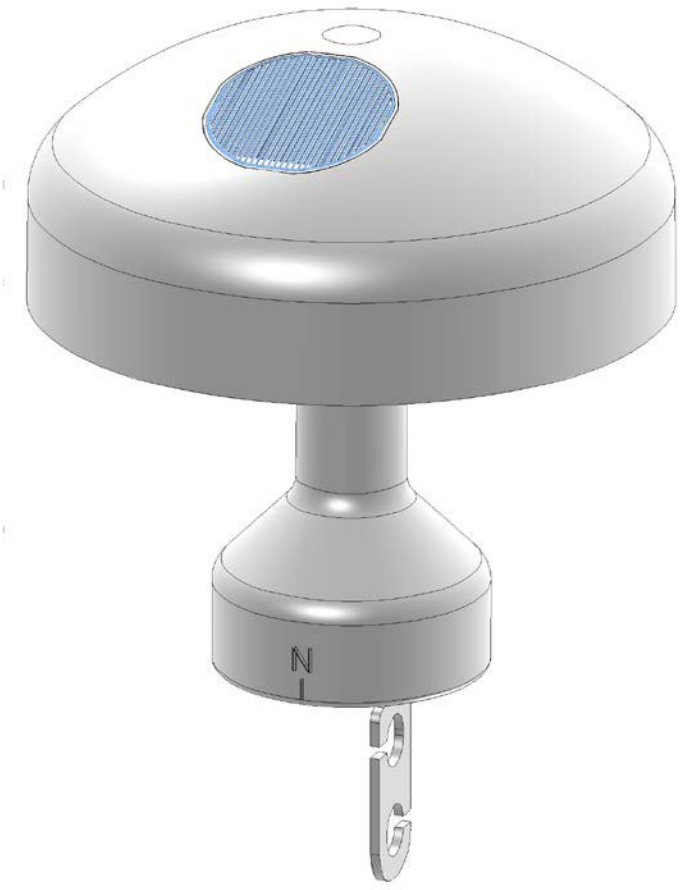
Weather Station Compact WSC4

Instruction for Use

4.9042.01.00x

Software version: V2.03 Status: 02/2025 update PSI 10/2025



Doc. No. 022076/03/25

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 typographical 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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Operating instructions

These operating instructions describe all the possible uses and settings of the device. The user can use these operating instructions to adjust the factory settings to his requirements via the serial interface of the weather station.

1 Device Versions

Designation	Order No.	Data format
WEATHER STATION COMPACT WSC4	4.9042.01.000	Data in ASCII format (command interpreter: THIES)
WETTERSTATION COMPACT WSC4	4.9042.01.001	Data in binary format (command interpreter: MODBUS RTU)

2 Application

The weather station is intended for use in building measurement technology and records the following measured variables:

- 4 x brightness
- Twilight
- Air temperature
- Wind speed
- Precipitation (0: No Precipitation, 1: Light rain — when the precipitation rate is < 2.5 mm (0.098 in) per hour, 2: Moderate rain — when the precipitation rate is between 2.5–7.6 mm (0.098–0.299 in) per hour, 3: Heavy rain — when the precipitation rate is > 7.6 mm (0.30 in) per hour)
- GPS data (time / date / geostationary data)

The interface to the device is digital and consists of an RS485 interface in half-duplex mode.

The following data protocols are available:

- Binary (Modbus RTU)
- ASCII (THIES format)

3 Structure / working method

Brightness

The brightness is measured using 4 silicon photo sensors, which are aligned in the 4 cardinal directions with an elevation angle of 90°.

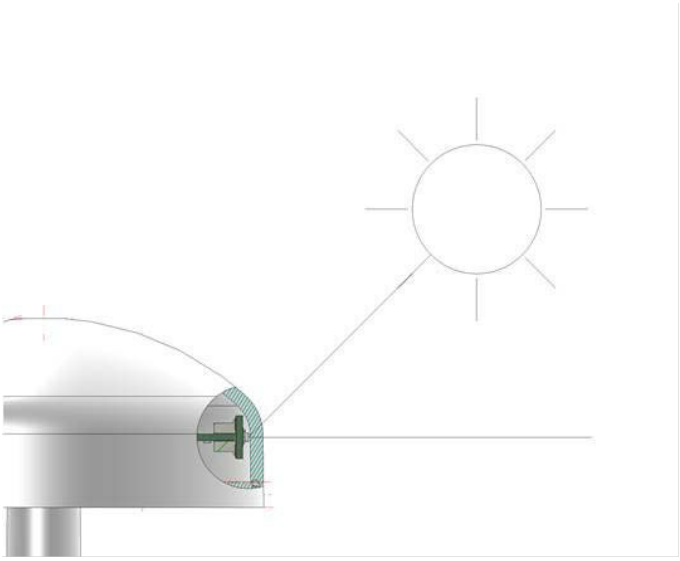


Figure 1: Elevation angle

Twilight

Twilight refers to the scattering of light in the atmosphere that occurs during the smooth transition between day and night before the beginning and after the end of the day.
This means, that the solar disk is not visible.
Twilight is independent of direction.
It is calculated from the sum of the 4 measured values of the direction-dependent brightness sensors. It is also possible to switch to the average value from the 4 brightness values using a command.

Air temperature

The air temperature is measured using a digital temperature sensor.
The sensor is located in the underside of the housing.

Wind speed

The wind measurement is based on the hot-wire principle. There are two heated wind sensors on the underside of the housing. The temperature of the wind sensors is regulated via a PID controller to a temperature that is constantly higher than the ambient temperature. The heating energy supplied is a measure of the wind speed.

Precipitation

Precipitation detection is based on a capacitance measurement, i.e. the capacitance of the sensor surface changes when it is wet.
The sensor is mounted in the housing cover. An integrated heater regulates the sensor surface to an excess temperature compared to the ambient temperature. This excess temperature (approx. 2K) prevents condensation from forming on the sensor surface.
The heat output is increased during precipitation. This accelerates the drying of the sensor.
The maximum temperature of the precipitation sensor is limited to 40°C.

The end of a precipitation event is detected due to a lack of capacity changes at the sensor and is output after a delay time of 2 minutes.

GPS receiver

The weather station has a GPS receiver to receive the position of the weather station and the time + date (UTC).
Alignment of the GPS receiver is not required.
When the device is started and once a day at 03:05, a satellite connection is established and the RTC and geostationary data are synchronized. Depending on the reception strength and the number of available satellites, the synchronization of the values can take several minutes. When used indoors, the sensor may not receive any GPS data. As a result, the date / time and geostationary data are not synchronized.

General information:
After switching on, the first satellite data is available after approx. 2.5 minutes.

When receiving signals from a satellite:	Time with an accuracy < 1µs.
When receiving signals from three satellites:	Position with an accuracy < 20m
When receiving signals from four satellites:	Altitude in relation to the WGS84 ellipsoid, with an accuracy < 30m

4 Installation

Attention:
The operating position of the WEATHER STATION is horizontal (plug connection at the bottom).
When installing, removing, transporting or maintaining the WEATHER STATION, ensure that no water penetrates into the device and plug.

4.1 Selection of the installation location

An exposed location should be chosen for the site. Wind shadow, light reflection and shadows must not affect the measurement properties.

Installation above dark roofs can lead to incorrect temperature and wind measurements, as solar radiation causes a significant increase in the temperature of the surface and creates a thermal effect.

The distance to surfaces below the weather station should be > 0.5m,
so that secondary drops do not wet the sensors on the underside.

Placement in the near of a smokestack can possibly adversely affect the surface of the housing by chemically combining the exhaust gases with water (rain) to form an acid.

Surge and lightning protection should be taken into account on site.

The weather station can be mounted on a pipe socket, pipe, bracket, etc. with **≤ Ø 26mm outer diameter**. The **inside diameter must be ≥ 21mm** to allow the supply/data cable to pass through.

To determine the exact direction of brightness, the WEATHER STATION must be aligned **to the north**.

4.2 Switch-on behavior of the temperature

The air temperature is initially set to invalid status for 10 seconds after the device is started.

4.3 Assembly work

4.3.1 Wall mounting

Mounting the sensor on a wall

Tool:

Allen key size 2

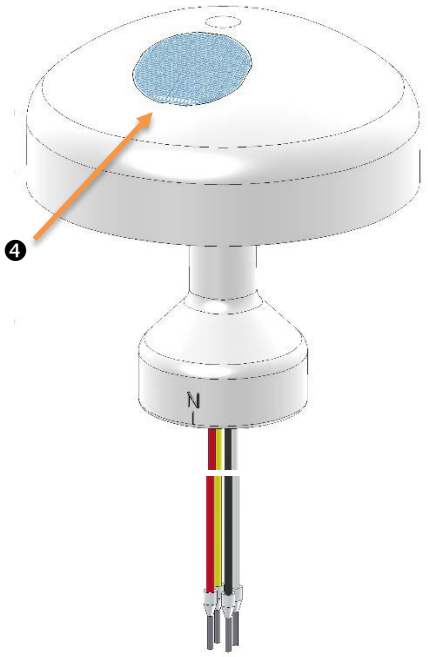
Procedure:

1. Feed the cable through the hole in the bracket, holder, etc.
2. Connecting cable strands

Function	Cable color
A = DATA +	red
+ = Supply 24VDC	yellow
B = DATA -	black
- GND (for supply and DATA)	white

3. Set up the weather station.
4. With the weather station at the prominent point using the north marker (N) and an imaginary north-south axis.
5. Align the weather station.
   The north mark (N) and precipitation sensor must point to true north.
6. Secure the weather station with the M4 hexagon socket head screw.

Attention:
The hexagon socket screw must be tightened to max. 0.6Nm.



Note: Tube and mounting bracket are not included in the scope of delivery.

4.3.2 Mounting on pole, tube

Attach the sensor to the mast, pipe, etc.

Tool:

Allen key size 2

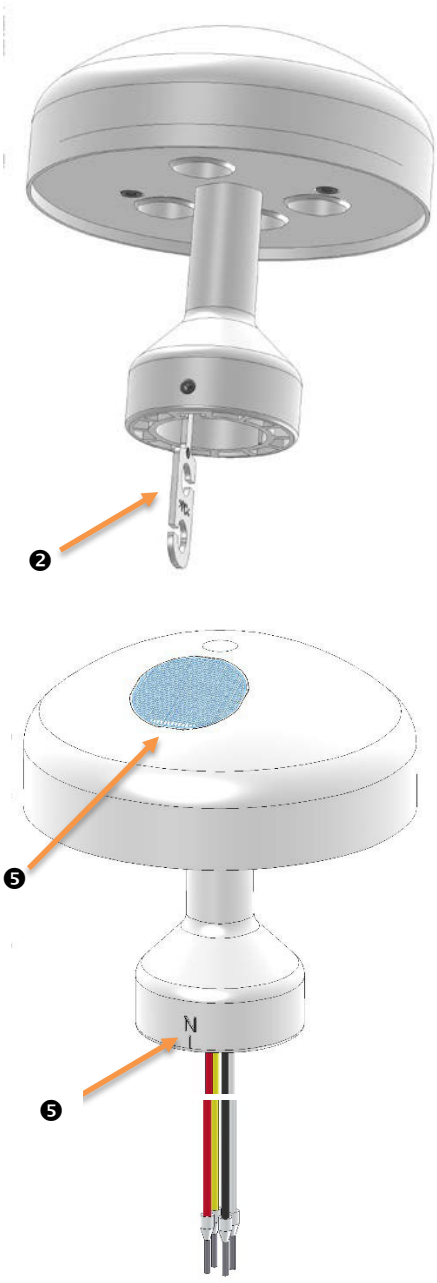
Procedure:

1. Connecting cable strands

Function	Cable color
A = DATA +	red
+ = Supply 24VDC	yellow
B = DATA -	black
- GND (for supply and DATA)	white

2. Attach the cable to the strain relief and insert the strain relief into the sensor base.
3. Set up the weather station.
4. Identify a prominent point in the landscape (tree, building, etc.) in a northerly direction using a compass.
5. The weather station is to be aimed at the prominent point via the north marker (N) and an imaginary north-south axis.
6. Align the weather station.
   The north mark (N) and precipitation sensor must point to ***the geographical north.***
7. The weather station must be secured with the M4 hexagon socket head screws if they match.

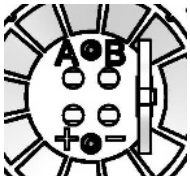
Attention:
The hexagon socket screw must be tightened to max. 0.6Nm



Note:

When aligning to north using a compass, the misalignment (deviation of the direction of a magnetic needle from the true north direction) caused by interfering magnetic fields and magnetic field influences from iron parts and electrical cables must be taken into account.

4.4 Electrical connection

Sensor / Clamp	Function	Cable color (KNX)
	A = DATA +	red
	+ = Supply 24VDC	yellow
	B = DATA -	black
	- GND (for supply and DATA)	white

4.4.1 Cables

The shielded cable to be connected should have the following properties:
4 cores, 0.28 ... 0.5mm ² core cross-section, cable diameter max. 5.0mm, UV resistance, shielding applied on one side.

Attention:
For long cable connections, the voltage drop on the cable must be taken into account so that the required supply voltage is applied to the WEATHER STATION.

Calculation of the voltage drop on the cable. $U_{Ltg} = R_L * I$; $R = 2 * l * \rho/A$; ρ (rho) = 0.018

Example: I = 0.1A, A = 0.14mm², L = 100m

$R = 2 * l * \rho/A$, R = 25.7Ω

$U_{Ltg} = R_L * I$, **U_{Ltg} = 2.6V**

5 Maintenance

As the appliance operates without moving parts, i.e. wear-free, only minimal servicing is required.
Depending on the location, the appliance may become dirty. Cleaning should be carried out with water and a soft cloth. Do not use any aggressive cleaning agents.

Caution:

When storing, installing, dismantling, transporting or maintaining the WEATHER STATION, ensure that no water penetrates into the device and plug.

6 Interface

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

- 19.2k baud (the baud rate can be set with the **BR Command**).
- 8 data bits.
- No parity.
- 1 Stop bit.
- Data in binary format (command interpreter: Modbus RTU)
- Data in ASCII format (command interpreter: THIES)

The behavior (configuration) of the weather station can be changed with the available commands (see **Commands and description**). For the command interpreter. The query of the measured values with the **TR Command.**

6.1 Command interpreter MODBUS RTU (4.9042.xx.xx1)

This command interpreter is used to interpret the transmitted bytes in accordance with the MODBUS specification (http://www.modbus.org/). The weather station represents a MODBUS slave.

Data is transmitted in packets, known as frames, of a maximum of 256 bytes. Each packet contains a 16-bit CRC checksum (initial value: 0xffff).

Slave address	Function code	Data	CRC	
1byte	1byte	0...252Byte(s)	2Bytes	
			CRC low byte	CRC high byte

Table 1 MODBUS Frame

The following MODBUS functions are supported:

- 0x04 (Read Input Register).
- 0x03 (Read Holding Registers).
- 0x06 (Write Single Register).
- 0x10 (Write Multiple Registers).

The weather station supports write access for slave address 0 ("Broadcast").

The **default Modbus address** is 1.

All MODBUS requests received are checked for validity before execution. In the event of an error, the weather station responds with one of the following exceptions (➔ MODBUS Exception Responses).

Code	Name	Meaning
0x01	ILLEGAL FUNCTION	The function code in the request is not permitted for the register address.
0x02	ILLEGAL DATA ADDRESS	The register address in the request is not valid.
0x03	ILLEGAL DATA VALUE	The data specified in the request is not permitted.

Table 2 MODBUS Exceptions

6.1.1 Measured values (input register)

All measured values of the weather station occupy 32 bits, i.e. 2 MODBUS register addresses. The following table shows the assignment of measured value to register address, whereby the measured values are sorted as follows:

- By measured value type (30001 to 34999).
- In complete sequence (35001 to 39999).

Register address	Parameter name	Unit	Multiplier	Explanation	Data type
30001	Wind speed	m/s	10	Value / 10 (1 decimal place, e.g. 101=10.1m/s)	U32
30401	Air temperature	°C	10	Value / 10 (1 decimal place, e.g. 255=25.5°C)	S32
30403	Internal housing temperature	°C	10	Value / 10 (1 decimal place, e.g. 355=35.5°C)	S32
30407	Air temperature raw value (debug only)	°C	10	Value / 10 (1 decimal place, e.g. 355=35.5°C)	S32
30413	Rain temperature, only if ceramic is unheated (debug only)	°C	10	Value / 10 (1 decimal place, e.g. 355=35.5°C)	S32
31209	Twilight	Lux	1	(no decimal place, e.g. 500=500Lux)	U32
31215	Brightness north	Lux	1	(no decimal place, e.g. 12000=12000Lux)	U32
31217	Brightness east	Lux	1	(no decimal place, e.g. 12000=12000Lux)	U32
31219	Brightness south	Lux	1	(no decimal place, e.g. 12000=12000Lux)	U32
31221	Brightness west	Lux	1	(no decimal place, e.g. 12000=12000Lux)	U32
31401	Precipitation status		1	(no decimal place, (0=no rain, 1=light, 2=moderate, 3=heavy rain)	U32
31415	Precipitation level		1	1 no to minimal drop 2 light precipitation 3 moderate precipitation 4 heavy precipitation	U32
34601	Date		1	(no decimal place, YYYYMMDD, e.g. 20121210=10.12.2012)	U32
34603	UTC Time		1	(no decimal place, HHMMSS, e.g. 121035=12:10:35)	U32

Register address	Parameter name	Unit	Multiplier	Explanation	Data type
34605	UTC Offset	h	1	(no decimal place, offset to UTC in hours, e.g. 1=UTC+1h)	S32
34801	Longitude	°	1000000	Value / 1000000 (6 decimal places, e.g.)	S32
34803	Latitude	°	1000000	Value / 1000000 (6 decimal places, e.g.)	S32
34805	Position of the sun elevation	°	10	Value / 10 (1 decimal place, e.g. 900=90.0°)	S32
34807	Position of the sun azimuth	°	10	Value / 10 (1 decimal place, e.g. 1800=180.0° / 0°=north, 180°=south, clockwise 0...360°)	S32
34809	Height above sea level	m	1	(no decimal place, e.g. 240=240m above sea level)	U32
31415	Sensor status It has to be decoded to bin code to check the values shown table 6.2.2		1	(no decimal place, bit coded, depending on the sensor)	U32
31845	Frequency precipitation sensor (Not applicable)	Hz	1	(no decimal place, (e.g. 40000=40000Hz)	U32
35001	Wind speed (30001)[1]	m/s	10	Value / 10 (1 decimal place, e.g. 101=10.1m/s)	U32
35003	Air temperature (30401) [1]	°C	10	Value / 10 (1 decimal place, e.g. 255=25.5°C)	S32
35005	Internal housing temperature (30403) [1]	°C	10	Value / 10 (1 decimal place, e.g. 355=35.5°C)	S32
35007	Air temperature RAW value (30407) [1]	°C	10	Value / 10 (1 decimal place, e.g. 355=35.5°C)	S32
35009	Rain temperature, only if ceramic is unheated. (30413) [1]	°C	10	Value / 10 (1 decimal place, e.g. 355=35.5°C)	S32
35011	Twilight (31209) [1]	Lux	1	(no decimal place, e.g. 500=500Lux)	U32
35013	Brightness north (31215) [1]	Lux	1	(no decimal place, e.g. 12000=12000Lux)	U32
35015	Brightness east (31217) [1]	Lux	1	(no decimal place, e.g. 12000=12000Lux)	U32
35017	Brightness south (31219) [1]	Lux	1	(no decimal place, e.g. 12000=12000Lux)	U32
35019	Brightness west (31221) [1]	Lux	1	(no decimal place, e.g. 12000=12000Lux)	U32

Register address	Parameter name	Unit	Multiplier	Explanation	Data type
35021	Precipitation status (31401) [1]		1	(no decimal place, (0=no precipitation, 1=precipitation)	U32
35023	Date (34601) [1]		1	(no decimal place, YYYYMMDD, e.g. 20121210=10.12.2012)	U32
35025	Time (34603) [1]		1	(no decimal place, HHMMSS, e.g. 121035=12:10:35)	U32
35027	Time format (34605) [1]	h	1	(no decimal place, offset to UTC in hours, e.g. 1=UTC+1h)	S32
35029	Longitude (34801) [1]	°	1000000	Value / 1000000 (6 decimal places, e.g.)	S32
35031	Latitude (34803) [1]	°	1000000	Value / 1000000 (6 decimal places, e.g.)	S32
35033	Position of the sun Elevation (34805) [1]	°	10	Value / 10 (1 decimal place, e.g. 900=90.0°)	S32
35035	Position of the sun Azimuth (34807) [1]	°	10	Value / 10 (1 decimal place, e.g. 1800=180.0° / 0°=north, 180°=south, clockwise 0...360°)	S32
35037	Height above sea level (34809) [1]	m	1	(no decimal place, e.g. 240=240m above sea level)	U32
35039	Sensor status (34811) [1]		1	(no decimal place, bit coded, depending on sensor)	U32
35041	Frequency precipitation sensor (34845) [1]	Hz	1	(no decimal place, (e.g. 40000=40000Hz)	U32
35043	Reserve	-	-	-	-
35045	Precipitation level (31415)[1]	-	1	1 no to minimal drop 2 light precipitation 3 moderate precipitation 4 heavy precipitation	U32

Table 3 MODBUS Input Register

[1] The numbers in brackets indicate the register addresses that represent the same measured values. For example, the wind speed is located at address 30001 and at address 35001.

Note:

The MODBUS master can read out all measured values with one request due to the gapless arrangement of the measured values from address 35001!

6.1.2 Commands (Holding Register)

All commands of the weather station occupy 32 bits, i.e. 2 MODBUS register addresses and represent unsigned integers. The following example shows how to change the baud rate to 19200 baud.

1. Set password for the user level (KY=2007)

Slave address	Function code	Start address	Number of registers	Number of byte(s)	Data	CRC	
0x01	0x10	0x9C 49	0x00 02	0x04	0x00 00 00 EA	0x4F 7C	
						CRC low byte	CRC high byte

2. Command Set baud rate to 19200 baud (BR=6)

Slave address	Function code	Start address	Number of registers	Number of byte(s)	Data	CRC	
0x01	0x10	0x9C 45	0x00 02	0x04	0x00 00 00 06	0x4E A4	
						CRC low byte	CRC high byte

6.2 Command interpreter THIES

When the weather station is started, the character string "Weather station", software version, is output.

Example: v02.02 (Sep 30 2024/10:41:19)
SN0005240001
Interpreter: THIES

The weather station has the THIES command interpreter, which can be used to change the behavior of the device. For example, the averaging periods for wind speed and wind direction can be changed. A command basically has the following structure:

- <ID><Command><CR> (No parameter: is 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-character command (see command list)
Parameter: Parameter value with 1 to 10 digits (decimal value in ASCII format)
<CR>: Carriage Return (13_{dec} ; 0x0D)

Using the identification number 'ID', several devices can be operated together in the bus system. For this purpose, each device is assigned an individual 'ID' (see **Command ID**).

A sent command is acknowledged with a corresponding echo telegram. The echo telegram begins with a "!" followed by the ID, the command and the set value. This is followed by the characters "carriage return" and "new line".

Commands can be sent either with or without parameters. If no parameter is specified, the set value is output.

Example: 00BR<CR>
!00BR00096<CR>

If a command with a parameter is sent, the parameter is checked. If the parameter is valid, it is saved and specified in the "echo telegram". If the parameter is invalid, the parameter is ignored and the set value is output in the "echo telegram".

Examples:

00BR00096<CR>	Send command
!00BR00096<CR>	Echo telegram (parameter valid and password OK)
00BR00097<CR>	Send command
!00BR00096<CR>	Echo telegram (parameter valid but key incorrect).

Note:

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

Some commands (see command list) are protected by a password to prevent unintentional parameter adjustment. This password must be sent before the actual command.

Example: Changing the baud rate

00KY1<CR>	Enable user level commands (password)
00BR48<CR>	Set baud rate to 4800
!00BR00048<CR>	Baud rate is set to 4800

> *Attention:*
>
> ***The password-protected commands are enabled until one of the following conditions is met:***
> ***- The supply voltage is switched.***
> ***- The command 00KY0<CR> is sent.***
> ***- No new command is sent for at least 120s.***

6.2.1 Data telegram

Data is output on request using the TR command. The following telegram is possible:

- Measured value telegram (parameter = 1)

The calculation of the checksum, the composition of the status word and the control/separation characters used in the telegrams are listed below.

Control character:

CR - Carriage Return (13_{dec} ; 0x0D)
LF - Line Feed (10_{dec} ; 0x0A)
STX - Start of Text (2_{dec} ; 0x02)
ETX - End of Text (3_{dec} ; 0x03)

Separation sign:

Separation character between the individual measured values in the string is the semicolon ';'.
The checksum separation character is the multiplication character '*'.

Checksum:

The checksum is the XOR combination of all characters between <STX> and the byte <*>. The asterisk serves as a separator character for the checksum and is no longer included in the checksum.

6.2.2 Status

A status word is available within the weather station, which provides information about the status of the weather station. The measured values are subjected to a plausibility check and displayed in the status word.

Bit number	Function	Description
Bit 0	Precipitation sensor	Condensation protection
Bit 1	Precipitation sensor	Heating status
Bit 2	GPS data	No valid RMC telegram received
Bit 3	RTC data	No valid time
Bit 4	ADC	ADC values invalid
Bit 5	-	reserved
Bit 6	Brightness north (front)	Brightness north invalid
Bit 7	Brightness east (right)	Brightness east invalid
Bit 8	Brightness south (wall)	Brightness south invalid
Bit 9	Brightness West (left)	Brightness West invalid
Bit 10	Twilight	Twilight invalid
Bit 11	-	reserved
Bit 12	Temperature	Temperature invalid
Bit 13	Precipitation	Precipitation, invalid status
Bit 14	Wind speed	Wind speed invalid
Bit 15	-	reserved
Bit 16	-	reserved
Bit 17	-	reserved
Bit 18	Flash	Initialization error
Bit 19	Flash	deleted
Bit 20	-	reserved
Bit 21	Calibration parameters	Invalid
Bit 22	-	reserved
Bit 23	-	reserved
Bit 24	-	reserved
Bit 25	GPS	UTC - Time
Bit 26	GPS	CET - Time

Table 4 Status word

6.2.3 Measured value telegram 1

The weather station responds to the command "00TR1\r" with the measured value telegram. The telegram structure is shown in the following table:

Position	Length	Example	Description
1	1	<STX>	Start of text character (0x02)
2	4	WSC4	Designation for the weather station
6	1	;	Semicolon
7	2	##	Identification number of the weather station
9	1	;	Semicolon
10	19	dd.mm.yyyy hh:mm:ss	Date and time separated by a space dd: day, mm: month, yyyy: year, hh: hour, mm: minute, ss: second
29	1	;	Semicolon
30	6	######	Specification of the time format: UTC, UTC+xh, CEST, CET
36	1	;	Semicolon
37	5	###.#	Brightness North (kLux)
42	1	;	Semicolon
43	5	###.#	Brightness East (kLux)
48	1	;	Semicolon
49	5	###.#	Brightness South (kLux)
54	1	;	Semicolon
55	5	###.#	Brightness West (kLux)
60	1	;	Semicolon.
61	3	###	Twilight (Lux)
64	1	;	Semicolon
65	5	###.#	Air temperature from PT1000(°C)
70	1	;	Semicolon
71	1	#	Precipitation status (0: no precipitation, 1: precipitation)
72	1	;	Semicolon
73	4	##.#	Wind speed (m/s)
77	1	;	Semicolon
78	5	###.#	PCB temperature (internal temperature)
83	1	;	Semicolon
84	11	####.######	Longitude (°) GPS position Positive sign for longitude in an easterly direction Negative sign for longitude in westerly direction
95	1	;	Semicolon
96	10	###.######	Latitude (°) (GPS position) Positive sign for latitudes in a northerly direction Negative sign for latitudes to the south
106	1	;	Semicolon
107	6	######	Station height (m)
113	1	;	Semicolon
114	5	###.#	Position of the sun, elevation or elevation angle (°) At sunrise and sunset, the elevation is 0°. Between these prominent points (i.e. during the course of the day), the elevation assumes positive values
119	1	;	Semicolon

Position	Length	Example	Description
120	5	###.#	Position of the sun, azimuth or cardinal point (°) The azimuth is counted positively from north to south 0° = North ; 180° = South
125	1	;	Semicolon
126	8	########	32 bit sensor status
134	1	*	Asterisk as a separator for the checksum
135	2	##	8-bit checksum in hexadecimal representation (00 - FF). The checksum is calculated from the exclusive-or combination of all characters after the STX up to the character before the "*"
137	1	<ETX>	End of text character (0x03)
138	1	<CR>	Carriage Return (0x0D)
139	1	<LF>	Line feed (line break, 0x0A)

Table 5: Measured value telegram

Measured values

The measured values are instantaneous values.

If the specified measuring range is exceeded (see **Technical data**), the measured value is limited to the maximum (measuring range end value) and the corresponding bit in the status is set (see **Table 4 Status** word).

6.2.4 Measured value telegram 2

The weather station responds to the command “00TR2\r” with the measured value telegram.

The telegram structure is shown in the following table:

Position	Length	Example	Description
1	1	<STX>	Start of text character (0x02)
2	4	WSC4	Designation for the weather station
6	1	;	Semicolon
7	2	##	Identification number of the weather station
9	1	;	Semicolon
10	19	dd.mm.yyyy hh:mm:ss	Date and time separated by a space dd: day, mm: month, yyyy: year, hh: hour, mm: minute, ss: second
29	1	;	Semicolon
30	6	######	Specification of the time format: UTC, UTC+xh, CEST, CET
36	1	;	Semicolon
37	5	###.#	Brightness North (kLux)
42	1	;	Semicolon
43	5	###.#	Brightness East (kLux)
48	1	;	Semicolon
49	5	###.#	Brightness South (kLux)
54	1	;	Semicolon
55	5	###.#	Brightness West (kLux)
60	1	;	Semicolon.
61	3	###	Twilight (Lux)
64	1	;	Semicolon
65	5	###.#	Air temperature from PT1000(°C)
70	1	;	Semicolon
71	1	#	Precipitation status (0: no precipitation, 1: precipitation)

Position	Length	Example	Description
72	1	;	Semicolon
73	4	##.#	Wind speed (m/s)
77	1	;	Semicolon
78	5	###.#	PCB temperature (internal temperature)
83	1	;	Semicolon
84	11	####.######	Longitude (°) GPS position Positive sign for longitude in an easterly direction Negative sign for longitude in westerly direction
95	1	;	Semicolon
96	10	###.######	Latitude (°) (GPS position) Positive sign for latitudes in a northerly direction Negative sign for latitudes to the south
106	1	;	Semicolon
107	6	######	Station height (m)
113	1	;	Semicolon
114	5	###.#	Position of the sun, elevation or elevation angle (°) At sunrise and sunset, the elevation is 0°. Between these prominent points (i.e. during the course of the day), the elevation assumes positive values
119	1	;	Semicolon
120	5	###.#	Position of the sun, azimuth or cardinal point (°) The azimuth is counted positively from north to south 0° = North ; 180° = South
125	1	;	Semicolon
126	1	#	Precipitation level
127	1	;	Semicolon
128	8	########	32 bit sensor status
136	1	*	Asterisk as a separator for the checksum
137	2	##	8-bit checksum in hexadecimal representation (00 - FF). The checksum is calculated from the exclusive-or combination of all characters after the STX up to the character before the "*"
139	1	<ETX>	End of text character (0x03)
140	1	<CR>	Carriage Return (0x0D)
141	1	<LF>	Line feed (line break, 0x0A)

Table 6: Measured value telegram 2

Measured values

The measured values are instantaneous values.

If the specified measuring range is exceeded (see technical data), the measured value is limited to the maximum (measuring range end value) and the corresponding bit is set in the status (see Table 4: Status word).

6.3 Commands and description

The following table shows the available commands and the associated passwords for reading and writing:

Command	Initial value Factory setting	MODBUS Register addresse	Description	password Reading[1] / Writing[2]	
Command BR	192	40005	Select the baud rate	Without	Users
Command CI	0	40013	Selection of the command interpreter	Without	Users
Command DC	1	40081	Calculation type for twilight	Without	Users
Command EA	90	-	Elevation Angle	Without	Users
Command FB	1	40001	Fastboot	Without	Users
Command FW	1500	40039	Precipitation sensor sensitivity	Without	Users
Command HP	5	40035	Heating capacity Dew protection	Without	Users
Command ID	0	40003	Identification number or slave address	Without	Users
Command KY	0	40009	Set key / password	Without	Without
Command RD	20	40019	Response delay	Without	Users
Command RS	-	40029	Reset.	Without	Users
Command SF	0	40075	Frame format	Without	Users
Command SN	-	40007	Serial number	Without	Users
Command SV	-	45005	Software version	Without	Without
Command TA	-	45001	Thies part number	Without	Without
Command TR	-		Telegram output	Without	Without
Command TZ	-	-	Time zone	Without	Users
Command VA	0	40073	Velocity Averaging	Without	Users

Table 7 List of Commands

[1]Command without password (used to read the set parameter).

[2]Command with password (used to write a new parameter).

Note:

All values of the commands from Table 6 (except KY) are saved in the EEPROM. The number of memory cycles is limited, memory cycles >100000 can lead to a device defect.

6.3.1 Command BR

<ID>BR<parameter><CR>Setting the baud rate

Access: Read / write.

Description: The BR command is used to set the desired build rate. See also command SF.

Parameter description:

Parameters		Description
12	(or 2)	1200baud (8n1)
24	(or 3)	2400baud (8n1)
48	(or 4)	4800baud (8n1)
96	(or 5)	9600baud (8n1)
192	(or 6)	19200baud (8n1)
384	(or 7)	38400baud (8n1)
576	(or 8)	57600baud (8n1)
1152	(or 9)	115200baud (8n1)

Value range: 12 / 24 / 48 / 96 / 192 / 384 / 576 / 1152

Initial value: 192

6.3.2 Command CI

<id>CI<parameter><CR> Selection of the command interpreter

Access: Read / write.

Description: The desired command interpreter is set with the CI command.

Parameter description:

Parameters	Description
0	Thies interpreter
1	Modbus RTU
2	Reserved

Switching from Thies interpreter to Modbus RTU interpreter e.g. with 01KY1; 01CI1 is possible with any terminal.

Switching from Modbus RTU interpreter to the Thies interpreter is only possible with the ThiesDeviceUtility or a suitable script because of the tinning and the checksum!

00KY1; 00CI0; 00KY0

Value range: 0, 1, 2

Initial value: 0

Note:
If the identification number (ID) is greater than 98, it is automatically set to 0 when switching to the THIES interpreter!

Note:
If the identification number (ID) is 0, it is automatically set to 1 when switching!

6.3.3 Command DC

<ID>DC<parameter><CR>	Calculation type for twilight
Access:	Read / write.
Description:	The DC command is used to specify the calculation type for twilight. The twilight is calculated from the 4 direction-dependent brightness values. You can choose between the sum and the mean value.
Parameter description:	0: Twilight corresponds to the sum of the 4 brightness values 1: Twilight corresponds to the mean value of the 4 Brightness values
Value range:	0...1
Initial value:	1

6.3.4 Command EA

<ID>EA<parameter><CR>	Elevation Angle
Access:	Read / write.
Description:	The EA command can be used to change the angle of incidence of the sun to the sensor.
Parameter description:	90: the detection angle is vertical 0: the detection angle is horizontal
Value range:	0...90
Initial value:	90

6.3.5 Command FB

<ID>FB<parameter><CR>	Fastboot (start bootloader)
Access:	Read / write.
Description:	The FB command is used to specify whether the bootloader is executed when the sensor is started.
Parameter description:	0: The bootloader is started after the power supply is applied 1: The bootloader is not started
Value range:	0...1
Initial value:	1

6.3.6 Command FW

<ID>FW<parameter><CR>	Sensitivity of the precipitation measurement
Access:	Read / write.
Description:	The sensitivity of the precipitation measurement is defined with the FW command. The smaller the value, the more sensitive the ceramic is to frequency changes caused by precipitation. A value that is set too low leads to continuous precipitation messages.
Value range:	100...20000 (Recommended range: 1000…3000)
Initial value:	1500

6.3.7 Command HP

<ID>HP<parameter><CR>	Heating Power
Access:	Read / write.
Description:	The Command HP is used to set the heating power of the condensation protection of the condensation ceramic appliance.
Value range:	0...50, 101(=permanently off)
Initial value:	5

6.3.8 Command ID

<ID>ID<parameter><CR>Identification number

Access:	Read / write.
Description:	This command sets the identification number. A response telegram is only sent if the 'ID' contained in the command matches the one set in the weather station. An exception is the generic 'ID', for which all weather stations respond. After the 'ID' has been changed, the device responds immediately with the new 'ID'.
Parameter description:	99 generic 'ID'
Value range:	0 to 99
Initial value:	0

6.3.9 Command KY

<ID>KY<parameter><CR>	Key/password
Access:	Read / write.
Description:	The "KY" command is used to set the value for the key (password). The required password must be set to change parameters.
Parameter description:	0/1 no password / password for user level
Value range:	0 /1
Initial value:	0

6.3.10 Command RD

<ID>RD<parameter><CR>	Response Delay
Access:	Read / write.
Description:	The RD command is used to set the response delay in ms.
Value range:	5...50
Initial value:	20 (Recommended for half-duplex operation)

6.3.11 Command RS

<ID>RS<parameter><CR>Reset

Access: Read / write.

Description: The RS command is used to reset the microcontroller. Without specifying a parameter, the cause of the last reset is output. The output is in the form of strings (see table below), which are separated by spaces:

String	Description
GENERAL RESET	Power-On Reset
BACKUP RESET	Reset from backup mode
WATCHDOG RESET	Reset by watchdog
SOFTWARE RESET	Reset by software
USER RESET	Reset by NRST pin

Parameter description:
1 Watchdog reset
2 Software reset

Value range: 1 / 2

Initial value: -

6.3.12 Command SF

<id>SF<parameter><CR> Frame format

Access: Read / write.

Description: The command is used to set the frame format of the weather station.

Parameter description:
0: 8N1 (8 data bits, no parity, 1 stop bit)
1: 8E1 (8 data bits, even parity, 1 stop bit)
2: 8O1 (8 data bits, odd parity, 1 stop bit)
3: 8S1 (8 data bits, space parity, 1 stop bit)
4: 8M1 (8 data bits, mark parity, 1 stop bit)
5: 8N2 (8 data bits, no parity, 2 stop bits)
6: 8E2 (8 data bits, even parity, 2 stop bits)
7: 8O2 (8 data bits, odd parity, 2 stop bits)

Value range: 0...7

Initial value: 5

6.3.13 Command SN

<ID>SN<CR> Software Version

Access: Read

Description: The serial number can be queried using the command SN.

6.3.14 Command SV

<ID>SV<CR> Software Version

Access:	Read
Description:	The Command SV can be used to query the current version of the firmware.

6.3.15 Command TA

<ID>TA<CR> Software Version

Access:	Read
Description:	The Thies article number can be queried with the command.

6.3.16 Command TR

<ID>TR<parameter><CR>Telegram output

Access:	Read / write.
Description:	The command triggers the one-off transmission of a telegram. The parameter specifies the telegram type.
Parameter description:	1 Measured value telegram
Reply telegram:	see **chapter 6.2.1**
Value range:	1
Initial value:	-

6.3.17 Command TZ

<id>TZ<parameter><CR>Time zone

Access: Read / write.

Description: The TZ command can be used to change the date/time ´ output.

Parameter description: 0UTC
23: UTC time - 1 hour
24: UTC time
25: UTC time + 1 hour
48: CEST or CET
The changeover between summer and winter time is automatic

TZ	Meaning
0	UTC
1	UTC - 23 hours
...	...
24	UTC
...	+1
47	UTC + 23 hours
48	CEST or CET

Reply telegram: -

Value range: 0...48

Initial value: 0

6.3.18 Command VA

<ID>VA<parameter><CR> Velocity Averaging

Access: Read / write.

Description: The command VA is used to set the averaging period of the wind speed in seconds.

The natural averaging method is used.

Value range: 1...30

Initial value: 2

6.4 Bootloader

The sensor is internally equipped with a bootloader that is executed at startup. The bootloader is started at a fixed baud rate of 115200 baud and the transmission frame 8N1.

The protocol of the bootloader is X-Modem CRC. The sensor's firmware file ends with the identifier *.hex (Intel hex format). The "TeraTerm" program, for example, can be used to copy the firmware to the sensor.

The FB (Fastboot) command can be used to set whether or not the bootloader is executed after the supply voltage is applied.

If the bootloader is switched on (parameter FB0), the sensor outputs the character C 10 times after starting. This is the signal for a connected terminal program to start the firmware transfer.

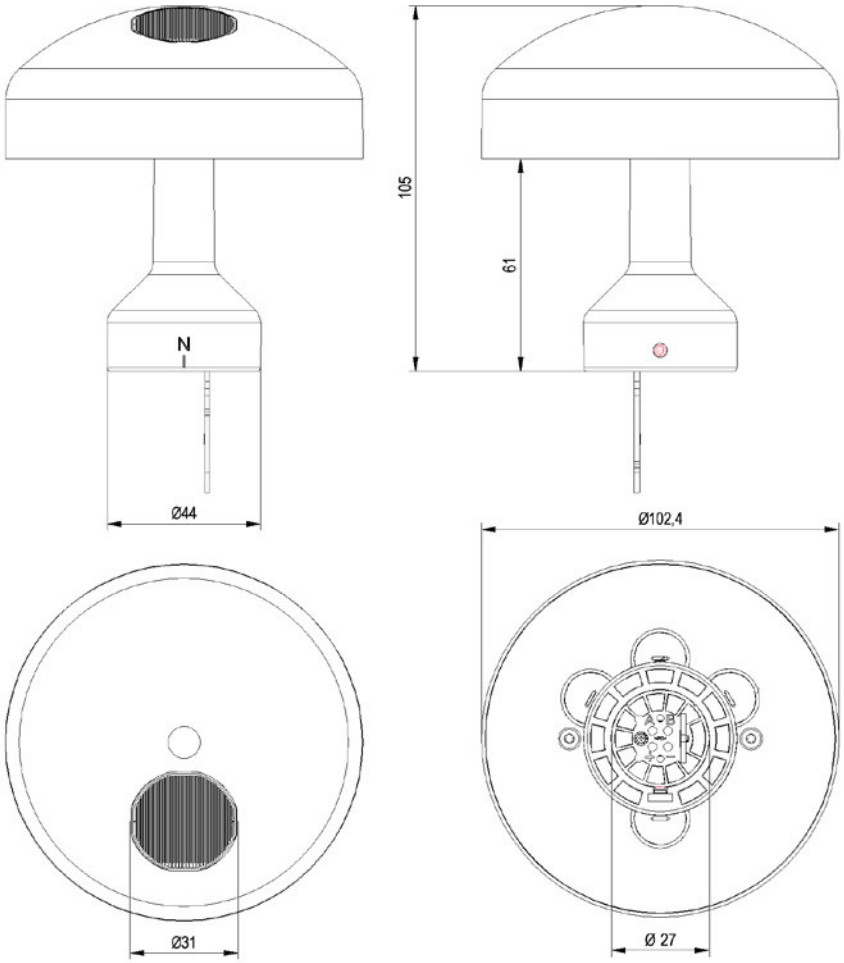
If the firmware transfer is canceled before the end, the firmware on the device is not functional. However, the bootloader will continue to start and an attempt can be made to transfer the firmware again.

7 Technical data

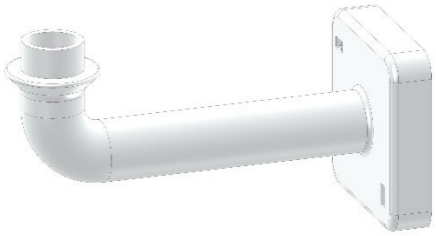
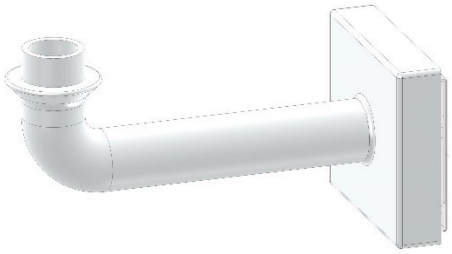
Brightness		
	Type	Silicon sensor
(0°; 90°, 180°, 270°)	Measuring range	0 ... 150kLux
	Resolution	0.1kLux
	Accuracy	± 200Lux at < 2kLux; ± 10% at ≥ 2kLux
	Spectral range	475 ... 650nm
Twilight		
	Type	Silicon sensor
	Measuring range	0 ... 1kLux
	Resolution	1Lux
	Accuracy	± 20Lux at < 100Lux; ± 20% at ≥ 100Lux
Temperature		
	Type	Digital temperature sensor
	Measuring range	-30 ... +60°C
	Resolution	0,1°C
	Accuracy	± 1°C with laminar flow and wind speed > 2m/s
Wind speed		
	Type	Thermal anemometer
	Measuring range	0 ... 35m/s
	Resolution	0.1m/s
	Accuracy	±5% (± 1m/s) RMS over 360°
Precipitation		
	Type	Ceramics, capacitance measurement
	Measuring range	1 / 0 (precipitation yes/no)
Digital interface		
	Type	RS485
	Operating mode	Half-duplex mode
	Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
	Data format	Binary, ASCII
General		
Operating voltage		24VDC +10% , -30%
	Power consumption	< 100mA @ 24VDC (precipitation sensor dry)
Ambient condition	Temperature range	-40 ... +70°C
	Humidity range	Non-condensing
GPS reception	GPS receiver with low power consumption and integrated antenna	GPS / GLONAS / GALILEO
Housing	Material	PC (polycarbonate), white transparent
	Assembly	Mast tube

		Outer diameter: ≤ Ø 26mm Inner diameter ≥ Ø 21mm With pole adapter 3/4" to tube Ø50mm
	Dimensions	See dimensional drawing
	Weight	0.162kg
	Protection class	IP44 in operating position
	Connection type	4-pin cable clamp connector

8 Dimensional drawing [in mm]



9 Accessories (optional)

Wall bracket for direct wall mounting	**510576**	
Wall bracket complete with counterpart - IP44	**510960**	
Pole adapter 1.5" (50 mm) - 3/4" (27mm) Used to reduce the diameter of a mast tube from Ø 50mm to Ø 27mm in order to be able to mount the weather station.	**510808**	Dimension (outside): 90mm high Dimension (adaptation): Inner diameter 51mm Outer diameter 27mm Material: Polycarbonate (PC) Color: white Weight: 0,013kg 

10 EC Declaration of Conformity

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

Product: Weather station basic / Wetterstation Compact WSC4

Doc. Nr. 2020-45567_CE

Article Overview:

4.9043.00.001	4.9042.01.000	4.9042.01.001

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).

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

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 61010-1	2020-03	Safety requirements for electrical equipment for measurement, control, and laboratory use. 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.

Göttingen, 02.10.2024

General Manager - Dr. Christoph Peper

Development Manager - ppa. Jörg Petereit

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

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.

11 UK-CA-Declaration of Conformity

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

Product: Weather station basic / Wetterstation Compact WSC4

Doc. Nr. 2020-45567_CA

Article Overview:

4.9043.00.001	4.9042.01.000	4.9042.01.001

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)

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

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 61010-1+A1	31.03.2017	Safety requirements for electrical equipment for measurement, control, and laboratory use. 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

Göttingen, 02.10.2024

Legally binding signature:

General Manager - Dr. Christoph Peper

Legally binding signature:

Development Manager - ppa. Jörg Petereit

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

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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