Ultrasonic Anemometer 2D WP
Instruction for Use

4.388x.00.000

Softwareversion V1.0   Stand: 02/2017

Dok. No. 021810/01/19 - Preliminary

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

- © Copyright **Adolf Thies GmbH & Co KG**, Göttingen / Germany

- Although these operating instruction has 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.

Inhaltsverzeichnis

Table

Patent Protection

This device is protected by the patents.
Patent No.: EP 1 448 966 B1
Patent No.: US 7,149,151 B2

Instructions for use

These instructions for use describe all application and adjustment options for the device.

These detailed instructions allow users to modify the factory settings to their needs via the serial interface of the Ultrasonic Anemometer 2D WP.

Included in delivery

1 x Ultrasonic Anemometer 2D WP
1 x Supplementary sheet with the factory settings.
1 x Short Manual.

For assisting the parameter settings and/or special configurations there is our cost-free "Device Utility Tool" art.-no. 9.1700.81.000 as well as the complete manual available for download on our homepage. Please download the tool with following link.

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

In section "General", the program "Thies Device Utility" is the program available for download.

In section „Wind" is the complete manual available for download.

1 Models available

Article No.	Designation	Parameters	Output / Interfaces / Features

4.3880.00.000	Ultrasonic Anemometer 2D WP	Wind speed
		Wind direction
		Virtual-Temperature
			- 0/4…20mA; 0/2...10V
			- RS485 / 422
			- Magnetic compass , optional
			- 8-pin plug connection
			- Data protocol:
			  ASCII- Thies-Format and
			  BINÄR- MODBUS RTU.
			- 35mm Ø mast support

4.3881.00.000	Ultrasonic Anemometer 2D WP	Wind speed
		Wind direction
		Virtual-Temperature
			- 0/4…20mA; 0/2...10V
			- RS485 / 422
			- Magnetic compass, optional
			- 8-pin plug connection
			- Data protocol:
			  ASCII- Thies-Format und
			  BINÄR- MODBUS RTU.
			- 50 mm Ø mast support

Table 1: Models available

2 Application

The Ultrasonic Anemometer is especially designed for the use in harsh ambient conditions for ex. on wind power plants. The instrument acquires the horizontal components of the wind speed and the wind direction. The measuring values can be delivered in digital or analogue form.

The acoustic-temperature is available as additional parameter. The acoustic measuring principle allows a inertia-free measurement of the wind vectors at highest precision.

A patent-registered heating which is integrated in the sensors as well as a regulated case heating guarantee a year-round operation even under extreme climatic conditions.

For a correct determination of the wind direction in the mobile application of the ULTRASONIC ANEMOMETER 2D WP, a magnetic compass is optionally integrated in all device variants.

The data output can be carried our via

- voltage output 0(2) … 10V

- current output 0(4) … 20mA or

- ASCII (THIES format)

- Binary (MODBUS RTU protocol)

The compact design, simple mounting and different options for data output permit operation with numerous applications.

The device is particularly suitable for use in the following sectors:

- Wind power plans
- Maritime applications
- Building services management.
- Traffic control.
- Meteorology.
- Industry.
- Energy Supply.
- Environmental monitoring.

The **wind speed** and **wind direction** are determined through the acquisition of 2-dimensional horizontal components of ultrasonic measurement paths positioned at right angles in relation to each other. The speed of sound can be additionally used to calculate and output the **acoustic virtual temperature**.

The principle of measuring, the ultrasonic propagation time, means that the device is ideal for the inertia-free measurement of gusts and peak values.

An optionally integrated electronic compass detects the horizontal aspecular angle of the instrument north marking to the magnetic north pole in angular degrees.

The analogue and digital interfaces are electrically isolated from the power supply and the housing potential. This means that there is no conductive connection that might result in the output signals being superposed by interference currents or voltages.

Digital output:
A RS485/422 interface is available for serial communication. It can be operated in full or half duplex mode. Predefined data telegrams are available for outputting measured values (e.g. VD, VDT, NMEA, etc.).

A **MODBUS RTU protocol** is additionally implemented for extended standardized communication. The device can be switched to MODBUS-RTU mode with the relevant command.

Analogue outputs:
There are 2 analogue outputs available for wind speed and wind direction (0/4…20mA; 0/2...10V).

Serial and analogue output of the data can take the form of an instantaneous value or a sliding mean.

The ULTRASONIC ANEMOMETER 2D WP is equipped with a built-in heating system, so more or less stopping ice or snow from building up on critical parts of the device, and meets the Thies factory standard 012002 "Icing requirements on heating units".

3 Construction and Mode of Operation

3.1 Wind measurement

The wind speed measuring module of the **ULTRASONIC ANEMOMETER 2D WP** consists of 4 ultrasonic converters, arranged in pairs of two facing each other via a reflector. The two resulting measurement paths are at right angles to each other. The converters function both as acoustic transmitters and acoustic receivers.
The electronic control system is used to select the respective measurement path and its measuring direction. When measurement starts, a sequence of 4 individual measurements is performed in all 4 directions of the measurement paths in a basic measuring cycle of one millisecond.
The measuring directions (sound propagation directions) rotate clockwise. Mean values are calculated from the 4 individual measurements of the path directions and then used for further calculations. The time required for a measuring sequence at the maximum measuring speed is exactly 10.0 milliseconds (measuring sequence 8ms + 2ms for analysis).

3.1.1 Measuring principle: Wind speed and direction

The propagation speed of sound in calm air is superposed by the speed components of an airflow in the direction of the wind. A wind speed component in the propagation direction of the sound supports its speed of propagation, so causing it to increase. On the other hand, a wind speed component against the propagation direction reduces the speed of propagation. The propagation speed resulting from superposition results in different propagation times of the sound at different wind speeds and directions over a fixed measurement path.

As the speed of sound greatly depends on the temperature of the air, the sound propagation time is measured on each of the two measurement paths in both directions. These rules out the measurement result being influenced by temperature.

By combining two measuring paths at right angles to each other, the sum and angle of the wind speed vector are obtained in the form of rectangular components. After the rectangular speed components have been measured, they are converted to polar coordinates by the ULTRASONIC ANEMOMETER 2D WP microprocessor and then output as a sum and angle of wind speed.

Moving averaging of the wind velocity and wind direction acc. to the **WMO-recommendations**:

The wind data can be averaged moving over a time span of up to 10 minutes on a base of 100 millisecond values. This averaging is calculated according the recommendation of the WMO as the FIFO-method. That means, that all data are kept in the memory up to the end of the averaging period. Thus, a data outlier can be identified as such, and - contrary to a first-order averaging – does not lead to a settling of its influence for a longer period.
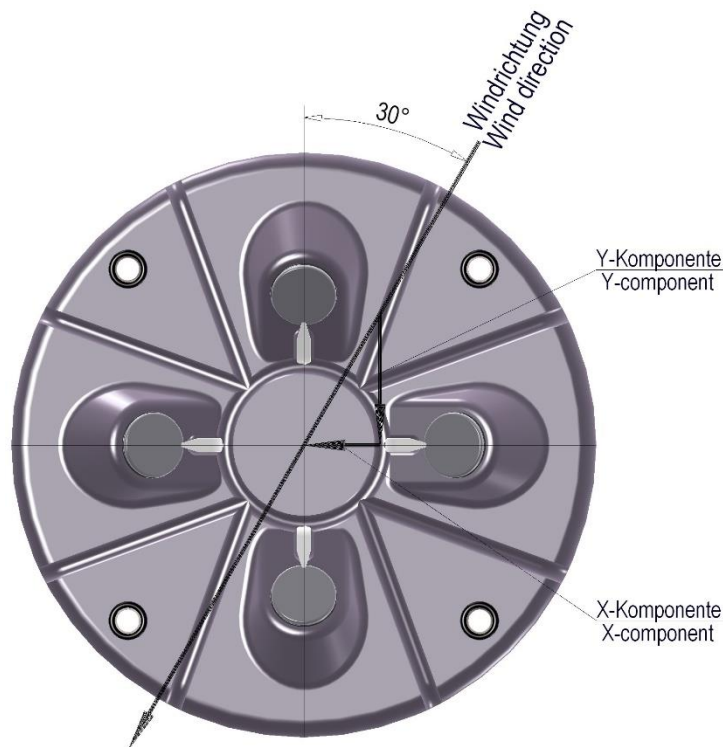
3.1.2 Measuring principle: acoustic-virtual temperature

The thermodynamic interrelationship between the propagation speed of sound and the absolute air temperature is defined by a root function. The speed of sound is also more or less independent of the air pressure and only depends on the absolute air humidity to an insignificant extent.

This physical relationship between the speed of sound and temperature can be used to measure the temperature of the air as long as its chemical composition is known and remains constant. The levels of gases in the atmosphere are constant and, with the exception of the content of water vapour, vary by no more than a few 100ppm (CO_2) even over lengthy periods.

The determination of gas temperature via its speed of sound is performed directly from measurement of its physical properties without the indirect step of thermal coupling of this gas to a sensor, which would otherwise be necessary.

Note:

If solar irradiation or heating activity cause the device to become hotter, this measured value cannot always be taken as real acoustic temperature of the air particularly in the case of low wind speeds.

3.2 Heating

For a multitude of applications the continuous output of real measuring data of the wind speed and wind direction even under extreme meteorological conditions, such as icing situations, is an indispensable measuring system requirement.

Hence, the Ultrasonic is equipped with a sophisticated heating system, which keeps all outside surfaces efficiently on a temperature above +5 °C so that they will not interfere the measuring value acquisition in case of ice formation.

The heated elements are: the housing surfaces which are within the measuring range, the reflecting surface carrying the spacing post as well as the ultrasonic converters themselves.

Here, please bear in mind that the weakest link controls the complete functionality. Instruments that do heat only parts of their construction, rarely show advantages in contrast to completely unheated devices in icing situations.

The ultrasonic is able to produce measuring data at high precision even in unheated state at temperatures falling below -40°C . The quality of the measuring data is not depending on the temperature. The heating is necessary only to avoid ice formation on the instrument-construction, thus preventing associated interferences of the measuring value acquisition.

The heating system effectively avoids icing acc. to the factory-based icing standard THIES STD 012002.

4 Storage and handling

The ULTRASONIC ANEMOMETER 2D WP should be stored in the original packing dry (relative humidity <60%), and at moderate temperatures (5°C…25°C).

Special requirements by the electronic magnetic field compass:
Please take care that the instrument is not exposed to **strong static magnetic fields > 1m Tesla** with storing, handling, and of course also in operation, as else the calibration of the magnetic compass might be changed permanently.
Otherwise, a demagnetization with subsequent re-calibration might be necessary.

.

5 Recommendation Side Selection/Standard Installation

For the location an exposed position should be selected. The measuring characteristics must not be affected by wind shadow. Protection against lightning and over-voltages should also be provided by the customer.

In general, wind meters should register wind conditions over a wide area. To obtain comparable values when measuring the ground wind, measurement should be performed at a height of 10 metres above even and undisrupted terrain. Undisrupted terrain means that the distance between the wind transmitter and the obstruction should be at least ten times the height of the obstruction (s. VDI 3786, sheet 2). If it is not possible to comply with this provision, the wind meter should be installed at a height at which measured values are influenced by obstructions located in the vicinity to the least possible extent (approx. 6 - 10 m above the interference level). On flat roofs the anemometer should be installed in the middle of the roof and not at the edge to thus avoid any preferential directions.

The ultrasonic-anemometer has an electro-magnetic compatibility, which is far in excess of the required standard threshold value.

Within the complete frequency range, required by standard, electro-magnetic fields with 20 V/m (capacity of the test transmitter) could not affect the measuring value acquisition of the instrument.

In case you intend to install the instrument at transmitter masts or other sources of strong electro-magnetic radiation, where the local field strength is far above the standard threshold value, please contact the manufacturer.

6 Installation

> ### Caution:
> **The working position of the ULTRASONIC ANEMOMETER 2D WP is vertical (plug connection at bottom).**
> **During storage, installation, dismantling, transport or servicing of the ULTRASONIC ANEMOMETER 2D WP, it must be ensured that no water gets into the base of the device or plug connector.**
> **When using a lightning rod, it should be installed at less than 45° to a wind measurement path to avoid any interference from reflections.**
>
> **When unpacking and further handling of the device, make sure that the surfaces of the ultrasonic transducers and the reflector (underside of the cover) are not touched with your fingers (avoiding contamination with skin fat).**
> **During storage, installation, dismantling, transport or servicing of the ULTRASONIC ANEMOMETER 2D WP, it must be ensured that no water gets into the base of the device or plug connector.**

6.1 Mechanical Installation

Proper installation of the ULTRASONIC ANEMOMETER 2D WP is carried out using a tube socket Ø 33.4mm and at least 30mm in length. The inside diameter of the tube socket must be at least 22mm as the electrical connection of the ULTRASONIC ANEMOMETER 2D WP is carried out at the bottom of the device.

For the exact determination of the wind direction the anemometer must be mounted respectively in **alignment to north** or **positioned**, depending on the application or site.

Tool:

        Hexagon socket wrench Gr.3

Procedure:

1. Conduct and connect the cable/ plug connection of the ultrasonic anemometer through the boring of the mast, tube, bracket etc.
2. Put the ultrasonic anemometer onto the mast, tube etc.
3. „Position" the ultrasonic anemometer acc. to **chap. 6.1.1**
   chap. 6.1.2
   chap. 6.1.3
4. Lock the ultrasonic anemometer afterwards at the mast by the two M4 hexagon socket screws.

    Caution: .
The Allen screws must be tightened to **7 Nm**
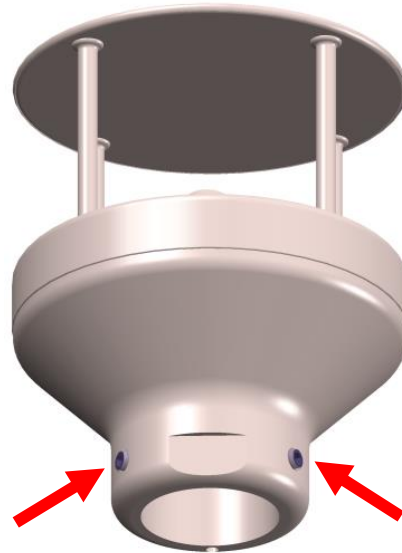
6.1.1 North Alignment

Procedure:

1. „Position" the ultrasonic anemometer by rotating on the mast tube until the **northern arrow/reference arrow** indicates to northern direction (geographical north).
   For this, please choose, in advance, a prominent point of the land scape in northern or southern direction by using a compass, und and rotate the mast or the anemometer until the northern arrow/reference arrow indicates to northern direction (geographical north).

2. Lock the ultrasonic anemometer afterwards at the mast by the two M4 hexagon socket screws.

Note:

When aligning / positioning the instrument to north using a compass, the magnetic variation (= deviation in direction of compass needle from true north) and local interfering magnetic fields (e.g. iron parts, electric cables).

As additional positioning aid, or for a simple change without re-alignment you may use also the **position drilling** in the base. Precondition, however, is a preparation by user at the mast.

6.1.2 Positioning of an Anemometer on a Wind Power Plant

For the exact determination of the wind direction the anemometer must be mounted in alignment with the generator hub, where the generator hub is considered as „**0°**".

Procedure:

1. „Position" the ultrasonic anemometer by rotating on the mast tube, until the **orientation arrow** (in parallel to the generator axis) indicates towards the generator-hub.

2. Lock the ultrasonic anemometer afterwards through the four M6 hexagon socket screw at the mast.

Remark:

In order to avoid the discontinuity of the wind direction at the north leap (360° - 1°) the ultrasonic anemometer should be aligned oppositely to the generator hub by means of the reference arrow.

6.1.3 Positioning of an Anemometer on a Ship

For the exact determination of the wind direction the anemometer must be mounted in alignment with the roll-axis, where the **bow** is related to **„0°" (north)**.

Procedure:
1. „Position" the ultrasonic anemometer by rotating on the mast tube, until the **orientation arrow** indicates towards the bow.

   Remark:
   If the anemometer is far away from the roll-axis (center line bow-rear), a parallel line (bow-rear) should be assumed.

2. Lock the ultrasonic anemometer afterwards through the four M6 hexagon socket screw at the mast.

6.2 Electrical Mounting

The ULTRASONIC ANEMOMETER 2D WP is equipped with a 8-pin plug for electrical connection. A socket outlet (mating connector) is included in the scope of supply.

6.2.1 Cable, cable preparation, connector installation
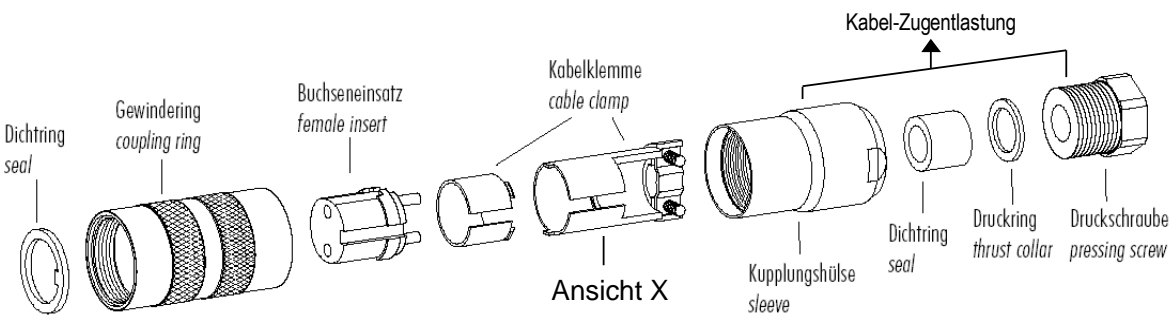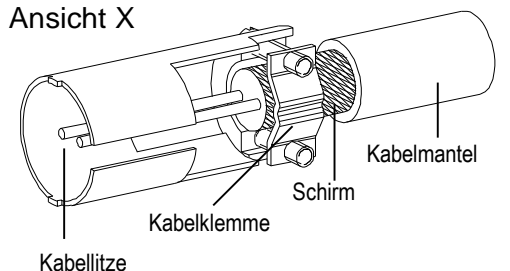
The cable must have the following properties:
8 cores; 0,5 to 0,75mm² core cross-section for supply; min. 0,14mm² core cross-section for data communications; 7- 8mm cable diameter, resistant to ultraviolet rays, overall shielding.
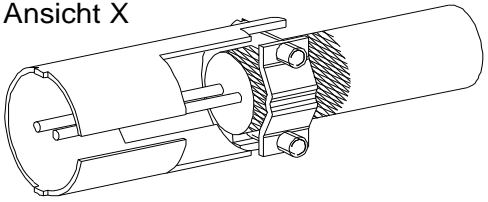
Note:

A prepared connecting cable is available for the ULTRASONIC ANEMOMETER 2D WP as an optional accessory (see accessories).

Coupling socket 507550 (Binder, Serial 423), EMC with cable clamp

Kabel-Zugentlastung

Dichtring / seal — Gewindering / coupling ring — Buchseneinsatz / female insert — Kabelklemme / cable clamp — Kupplungshülse / sleeve — Dichtring / seal — Druckring / thrust collar — Druckschraube / pressing screw

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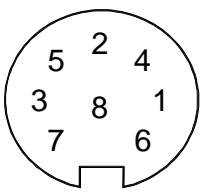
1. Stringing parts on cable acc. to plan given above.
2. Stripping cable sheath 20mm cutting uncovered shield 15mm Stripping wire 5mm.

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

   Cable mounting 2:

Kabelmontage 1
Ansicht X

Kabelmantel — Schirm — Kabelklemme — Kabellitze
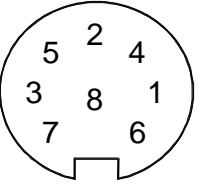
If cable diameter permits, put the shield backward on the cable sheath. 3. Soldering wire to the insert, positioning shield in cable clamp. 4. Screwing-on cable clamp. 5. Assembling remaining parts acc. to upper plan. 6. Tightening pull-relief of cable by screw-wrench (SW16 und 17).	*Kabelmontage 2* Ansicht X

6.2.2 Connector Pin Assignment (Examples of Function)

Remark:

- For exact allocation of function please refer to supplement "Factory Settings"
- The pins 1 – 6 (excepted pin 3) are galvanically isolated from the supply voltage and from housing.

Serial Interface, full-duplex			View of solder terminal of coupling socket
Pin	**Allocation**	**Function**	
1	RXD-	Serial interface	
2	TXD-	Serial interface	
3	ACDC	Supply heating	
4	RXD+	Serial interface	
5	TXD+	Serial interface	
6	AGND	Analogue ground	
7	AC/DC	Supply electronics & heating	
8	AC/DC	Supply, electronics	
⏚	Shield	Shield against electric fields	

Serial Interface, half-duplex and analogue outputs			View of solder terminal of coupling socket
Pin	**allocation**	**Function**	
1	WG	Analogue output wind velocity	
2	TXD- / RXD-	Serial interface	
3	ACDC	Supply heating	
4	WR	Analogue output wind direction	
5	TXD+ / RXD+	Serial interface	
6	AGND	Analogue ground	
7	AC/DC	Supply electronics & heating	
8	AC/DC	Supply, electronics	
⏚	Shield	Shield against electric fields	

6.2.3 Connection with optional 8-core cable 507751

The optional 507751 cable is a ready prepared 8-core cable, which has a plug connector on the transmitter side, and open, colour-coded wire ends on the user side.

7 Maintenance

The device has no moving parts, i. It works wear-free, only minimal service work is required.

In rare cases, and depending on the location, the device may become dirty.

If soiled by dust, sand or bird droppings, the cleaning should be done with water, detergent, and a soft cloth.

In case of contamination with grease or oil on the ultrasonic transducer surfaces or the reflector (for example, by finger, hand or oily gloves), isopropanol should be used as a cleaning agent with a soft cloth.

> ### Caution:
> **When unpacking and further handling of the device, make sure that the surfaces of the ultrasonic transducers and the reflector (underside of the cover) are not touched with your fingers (avoiding contamination with skin fat). During storage, installation, dismantling, transport or servicing of the ULTRASONIC ANEMOMETER 2D WP, it must be ensured that no water gets into the base of the device or plug connector.**

7.1 Calibration

The ULTRASONIC ANEMOMETER 2D WP does not contain any adjustable components such as mechanical or electrical trimming elements. All components and materials are invariant over time. There is thus no need for regular calibration due to ageing. Only major mechanical deformation of the device and a resulting change in the measurement path length of the ultrasonic converters can cause errors in measured values.

The acoustic-virtual temperature can be used for verifying the effective acoustic length of measured distance.
Without mechanical damage of the housing a significant change in measured distance length can be precluded due to the instrument construction.

> ### Important:
> **Mechanical damage involving deformation of the device may lead to errors in measured values.**

7.2 Warranty

Damage caused by improper handling or external influences, e.g. strike by lightning, are not covered by the warranty provisions. The warranty is void if the device is opened.

> ### Important:
> **The ULTRASONIC ANEMOMETER 2D WP must be returned in the original packaging.**

8 Functional Description

The functions of the ULTRASONIC ANEMOMETER 2D WP are described below.

The ULTRASONIC ANEMOMETER 2D WP has 2 command interpreters, one for the specific THIES **ASCII format** and one for **MODBUS communication**.

The relevant command interpreter must be switched on depending on the communication format required. In the standard configuration the THIES command interpreter is the default. This setting can be changed with **Command CI**.

8.1 Command Interpreter THIES ASCII Format

The ULTRASONIC ANEMOMETER 2D WP is equipped with a RS485 / RS422 interface for serial communication. It can be operated either in full or half duplex mode and at different baud rates.

A standard terminal program for example can be used for communication with the ULTRASONIC ANEMOMETER 2D WP. With a Windows-based operating system Hyper Terminal is included in the scope of supply. Should it not be included, subsequent installation is possible if required.

When the ULTRASONIC ANEMOMETER 2D WP is started, the firmware version, date of creation for the firmware, the serial number of the device, system time, device ID and duplex mode of the serial interface will be output. The last baud rate to be selected and stored is used for output.

Example:

```
-----------------------
 THIES-ULTRASONIC-WP
 Bootloader: V1.0
 Firmware: V1.00 HW-ID: 1
 Oct 15 2018 / 16:15:37
 Serial-No.: 010180001
 System-Time:  0:00:19
 Device-ID.: 00
 Serial-COM: 4-wire RS422
 Interpreter: Thies
 -----------------------
 Help: 00??<CR>
-----------------------
```

The example shows that the ULTRASONIC ANEMOMETER 2D WP with the device ID 00 is operating in full duplex mode.

8.1.1 Duplex mode

Duplex mode decides the type of physical connection of the serial interface. In full duplex mode the send and receive signals are each transmitted via separate pairs of cables. This means it is possible to send and receive signals in parallel, i.e. simultaneously. In half duplex mode transmission of the send and receive signals is via the same pair of cables and does not take place simultaneously, but in turn, see **Command DM**.

For bus mode with half duplex (RS485), in which the ULTRASONIC ANEMOMETER 2D WP is generally the "slave", the line transmitter has to be switched to the high impedance state in the transmission pauses so as not to suppress the responses of the other bus users.
With point-to-point connections in full duplex mode (RS422) it may be important to leave the line transmitter switched on during the transmission pauses so that a maximum differential input level results in a maximum signal-to-noise ratio. This depends on the interference conditions influencing the communication lines.

Command DM (Duplex Mode) can be used to select half duplex mode. In this setting the line transmitter is only ever switched on with transmission.
For full duplex operation there are 2 modes, one for bus mode (RS 485) in which the line transmitter is controlled as in half duplex mode, and an additional mode (RS 422) in which the line transmitter also remains switched on with receive. See **Command DM**.

The following table shows the functional options for full and half duplex mode.

Full duplex mode	Half duplex mode
Autonomous telegram output possible (see **Command TT**).	Autonomous telegram output possible with the following restriction: Communication with the ULTRASONIC ANEMOMETER 2D WP is only possible in the first 10s after each restart. This is followed by autonomous telegram output.
Bus mode possible (RS 485, DM=1). Bus mode not possible (RS 422, DM=2).	Bus mode possible (RS 485, DM=0).

8.1.2 Delayed response

With serial communication it should be remembered that the ULTRASONIC ANEMOMETER 2D WP reacts very quickly to incoming telegrams. The response time of the device is in the low millisecond range. The delay between the receive and send signal may be too short for some interface converters. It is possible that an interface converter will not have switched over between the modes 'send' and 'receive' in this period. This may result in incomprehensible telegrams.

To avoid this effect the ULTRASONIC ANEMOMETER 2D WP offers the parameter RD (Response Delay). With this parameter the response is additionally delayed by the selected value in milliseconds on receive. The setting for this parameter on delivery depends on the article number of the device.

8.1.3 General telegram structure

For serial communication the ULTRASONIC ANEMOMETER 2D WP has a fixed telegram format, which also permits communication in bus mode. It has the following form:

NNBB<cr>   <cr> stands for Carriage return (Enter key)

for data request and

NNBBPPPPP<cr>   <cr> stands for Carriage return (Enter key)

for a change in parameters.

The individual letters have the following meanings:

NN: Two-position ID of ULTRASONIC ANEMOMETER 2D WP. It can be selected in the range from 00 to 98. The default is the ID '00'; see also **Command ID**.

BB: Two-position command. A complete list can be found in the section List of commands.

PPPPP: Parameter input is always left-justified and may be between 0 and 5 positions, with the exception of the parameters RT, SN and TA (see also section 10 List of commands).

Example:
Request for telegram No. 2. The relevant command is:

00TR2<cr>   <cr> stands for Carriage return (Enter key)

Alternatively,

00TR00002<cr>   can also be input.

The prerequisite in this example is that the device ID has the value '00'.

Example:

With the command

00BR<cr>   <cr> stands for Carriage return (Enter key)

the selected data record for the baud rate is returned.

!00BR01152   stands for 115200 baud

Note:

The input buffer of the ULTRASONIC ANEMOMETER 2D WP can be cleared by transmitting Carriage return <CR>. In case of possibly faulty communication it is recommended to transmit a Carriage return at the beginning of an entry, for ex.: <CR>00TR00002<CR>

8.1.4 Storage of parameters

After parameters have been changed with the user or administrator key, the ULTRASONIC ANEMOMETER 2D WP must be reset to the locked state with the command "00KY0" (key "00000"). (In this example the device ID is "00".)

Parameters will only be stored permanently if the key is reset (incl. after restart).

If the ULTRASONIC ANEMOMETER 2D WP is restarted without all edited parameters being stored beforehand, they will be lost. It is therefore advisable to save important parameters as soon as they are input by resetting the key (00KY0). Alternatively, the command "00CS1" can be used to save the configuration without having to leave the command level.

8.1.5 Return values

After a valid command has been input, the ULTRASONIC ANEMOMETER 2D WP sends an acknowledgement, e.g. acceptance of the parameter or outputs a data telegram.

For a standard command the response starts with '!', followed by the ID and the parameter value.

If the input command is TR or TT, the ULTRASONIC ANEMOMETER 2D WP transmits a data telegram as the response.

8.1.6 Access mode

For configuration the ULTRASONIC ANEMOMETER 2D WP has a set of commands, which determine behaviour in terms of the propagation time. There are three levels for commands:

- Query mode.
- User mode.
- Configuration mode.

Query mode ("READ ONLY"):

This mode comprises commands, which do not influence the parameters of the ULTRASONIC ANEMOMETER 2D WP. They include for example output of the system status and data telegram request with TR.

User mode ("USER"):

This mode comprises commands, which alter the behaviour of the ULTRASONIC ANEMOMETER 2D WP. The user can change these parameters. The system behaviour of the device is altered with these commands. This category of commands covers e.g. settings for output scaling and averaging.

Configuration mode ("ADMIN"):

This mode comprises commands, which are defaults-set at the factory for delivery.

The device is equipped with an access key KY to distinguish between commands of the three groups when parameterizing the ULTRASONIC ANEMOMETER 2D WP. Inputting the key accesses the individual levels. Access to higher-level commands includes access to commands at a lower level.

Access key	Response from ULTRASONIC ANEMOMETER 2D WP	Command level
00KY00000	READ ONLY !00KY00000	Query mode (default).
00KY00001	USER ACCESS !00KY00001	User mode.
00KY04711	ADMIN ACCESS !00KY04711	Configuration mode.

Table 2: Access keys for different command levels

After the access key has been changed, the ULTRASONIC ANEMOMETER 2D WP transmits a response, which contains not only the input parameter but also the access mode.

After parameters have been changed with the key '00001' or '04711', the ULTRASONIC ANEMOMETER 2D WP must be reset to the initial position with the command 00KY00000 for the parameters to be saved (see also section 10.1).

If the power supply is interrupted, the device is automatically reset to query mode.

Example:
00KY1   Switch to "USER ACCESS" mode

!00KY00001   Response from ULTRASONIC ANEMOMETER 2D WP
Setting rights -> USER   Response from ULTRASONIC ANEMOMETER 2D WP
00AV5   Command for changing the averaging period
!00AV00005   Response from ULTRASONIC ANEMOMETER 2D WP
New AVeraging time frame: 5   Response from ULTRASONIC ANEMOMETER 2D WP
00KY0   Command for "READ ONLY" mode
!00KY00000   Response from ULTRASONIC ANEMOMETER 2D WP
Setting rights -> READ ONLY   Response from ULTRASONIC ANEMOMETER 2D WP
Configuration saved.   Response from ULTRASONIC ANEMOMETER 2D WP

8.1.7 Baud rate

The baud rate is used to select the transmission speed via the serial interface. The parameter range is from 1200baud to 921.6kbaud.
Reprogramming of the baud rate with the command BR at once affects the ULTRASONIC ANEMOMETER 2D WP temporarily. After the transmission of a command, the user program used must be set to the corresponding baud rate. The baud rate will only be stored permanently after resetting to query mode (READ ONLY) or when using the command "CS". This means that unintentional resetting of the baud rate can be cancelled using the Off/On switch on the ULTRASONIC ANEMOMETER 2D WP (see also section 8.1.4).

Example:

The baud rate is to change to 115200baud:

Command:
00KY4711	Allow command for access
!00KY04711	Response from ULTRASONIC ANEMOMETER 2D WP
Setting rights -> ADMIN	Response from ULTRASONIC ANEMOMETER 2D WP
00BR1152	Command to change baud rate
!00BR01152	Response from ULTRASONIC ANEMOMETER 2D WP

The baud rate of the PC interface now has to be changed to 115200!

To save baud rate:
00KY0	Return to "READ ONLY" mode
!00KY00000	Response from ULTRASONIC ANEMOMETER 2D WP
Setting rights -> READ ONLY	Response from ULTRASONIC ANEMOMETER 2D WP
Configuration saved.	Response from ULTRASONIC ANEMOMETER 2D WP

Or alternatively with:
00CS1	Save without leaving command mode
!00CS00001	Response from ULTRASONIC ANEMOMETER 2D WP
Configuration saved.	Response from ULTRASONIC ANEMOMETER 2D WP

8.1.8 Device ID

The device ID specifies the address to which the ULTRASONIC ANEMOMETER 2D WP should respond with serial communication. The device ID is in the range from '00' to '98'. The default is '00'. Every telegram from the ULTRASONIC ANEMOMETER 2D WP starts with the ID selected. This provides for bus mode under certain conditions, see **section** Fehler! Verweisquelle konnte nicht gefunden werden..

The device ID "99" is a generic address to which all ULTRASONIC ANEMOMETER 2D WP will respond. The ID is reprogrammed with the command 'ID'. The new ID of the ULTRASONIC ANEMOMETER 2D WP is specified as the parameter. After the change has been made, the ULTRASONIC ANEMOMETER 2D WP immediately responds to the new address (see also section 8.1.4).

Example:
00KY4711	Allow command for access
!00KY04711	Response from ULTRASONIC ANEMOMETER 2D WP
Setting rights -> ADMIN	Response from ULTRASONIC ANEMOMETER 2D WP
00ID00004	Change ID to address 4
!00ID00004	Response from ULTRASONIC ANEMOMETER 2D WP The ULTRASONIC ANEMOMETER 2D WP now responds to the new ID '04'. To permanently change the ID, see section 9.1.4.
04AV	Query averaging time with new ID
!04AV00005	Return of averaging time

8.1.9 Bus mode

The concept of ID-based communication allows more than one ULTRASONIC ANEMOMETER 2D WP to be operated in bus mode. The prerequisites for this are:

- Individual bus users must have different IDs.

- Master-slave structure, i.e. there is a device in the bus (control, PC, etc.) that polls the data of the individual devices and possibly parameterises them.

In bus mode there are no restrictions on changing parameter values.
It is not recommended using a ULTRASONIC ANEMOMETER 2D WP with the ID '00' here as this ID is for devices that are integrated in the bus for the first time.

For the bus mode we recommend to switch off the Verbose mode, see Command HH.

8.2 Command interpreter MODBUS RTU

If the command interpreter MODBUS RTU has been selected, the transmitted bytes will be interpreted according to the MODBUS specification (http://www.modbus.org/). The ULTRASONIC ANEMOMETER 2D WP acts as a MODBUS slave here.

Data is transmitted in packets, so-called frames, max. 256 bytes in length.
Every packet includes a 16-bit CRC check sum (initial value: 0xffff).

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

Table 3 : 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 sensor supports write access for the slave address 0 ("Broadcast").

All MODBUS requests received are checked for validity before execution. With any error the ULTRASONIC ANEMOMETER 2D WP responds with one of the following exceptions (➔MODBUS Exception Responses).

Code	Name	Meaning
0x01	ILLEGAL FUNCTION	The function code in the request is not permissible for the register address.
0x02	ILLEGAL DATA ADDRESS	The register address in the request is invalid.
0x03	ILLEGAL DATA VALUE	The data given in the request are not allowed, or the parameter is write-protected.

Table 4 : MODBUS exceptions

8.2.1 Measured values (input register)

All measured values of the ULTRASONIC ANEMOMETER 2D WP occupy 32 bits, i.e. 2 MODBUS register addresses. The following table shows the assignment of measured values to the register address, with the measured values being sorted as follows:

- By type of measured value (30003 to 34999).

- In an unbroken sequence (35001 to 39999).

The measuring values are available also under protocol addresses 2 to 4998 resp. 5000 to 9998.
The protocol addresses arise from the register address less an offset of 30001.

> ### Remark:
> **Please note the following with the further processing of the measuring values: In the data output the following types of erroneous measuring values are reported: type S32 (signed integer 32Bit) by „0x7FFFFFFF",type U32 (unsigned integer 32Bit) by „0xFFFFFFFF".**
> **These outputs must be identified, and be discarded!**

Register-address	Parameter name	Unit	Multiplier	Explanation	Data type
30003 0x7533	Mean wind speed	m/s	10	Value / 10 (to 1 decimal place, e.g. 101=10.1m/s)	U32
30011 0x753B	Maximum value Wind velocity (gust)	m/s	10	Value / 10 (1 decimal place, e.g. 101=10.1m/s)	U32
30203 0x75FB	Mean wind direction	°	10	Value / 10 (to 1 decimal place, e.g. 1010=101.0°)	U32
30211 0x7603	Wind direction of the gust	°	10	Value / 10 (1 decimal place, e.g. 1010=101.0°)	U32
30403 0x76C3	Internal temperature of housing	°C	10	Value / 10 (to 1 decimal place, e.g. 355=35.5°C)	S32
30405 0x76C5	Acoustic temperature	°C	10	Value / 10 (to 1 decimal place, e.g. 255=25.5°C)	S32

Register-address	Parameter name	Unit	Multiplier	Explanation	Data type
34601 0x8729	Date		1	Value (no decimal place, YYYYMMDD, e.g. 20121210=10.12.2012)	U32
34603 0x872B	Time of day		1	Value (no decimal place, HHMMSS, e.g. 121035=12:10:35)	U32
34811 0x87FB	Sensor status		1	See sensor status chap. 7.2.4	U32
34837 0x8815	Magnetic compass Aspecular angle Instrument north marking to magnetic North Pole	°	10	Value (1 decimal place, e.g. 1234=123.4°)	U32
34995 0x88B3	Sensor power supply	V	10	Value /10 (to 1 decimal place, e.g. 241=24.1V)	U32
34997 0x88B5	Live Counter	ms	1	Value. (no decimal place, internal ms counter)	U32
34999 0x88B7	Error status of last measured value		1	Value (no decimal place, 0=no error, 1= measured value was incorrect)	U32
Register address	**Complete sequence of measuring values from 35001**	**Unit**	**Multiplier**	**Explanation**	**Data type**
35001 0x88B9	Mean wind speed (30003) [1]	m/s	10	Value / 10 (to 1 decimal place, e.g. 101=10.1m/s)	U32
35003 0x88BB	Maximum value Wind speed (gust) (30011) [1]	m/s	10	Value / 10 (1 decimal place, e.g. 101=10.1m/s)	U32
35005 0x88BD	Mean value wind direction (30203) [1]	°	10	Value / 10 (one decimal place, e.g. 1010=101.0°)	U32
35007 0x88BF	Wind direction of gust (30211) [1]	°	10	Value / 10 (1 decimal place, e.g. 1010=101.0°)	U32
35009 0x88C1	Internal temperature of housing (30403) [1]	°C	10	Value / 10 (1 decimal place, e.g. 355=35.5°C)	S32
35011 0x88C3	Acoustic temperature (30405) [1]	°C	10	Value / 10 (1 decimal place, e.g. 255=25.5°C)	S32
35013 0x88C5	Date (34601) [1]		1	Value (no decimal place, JJJJMMTT, z.B. 20121210=10.12.2012)	U32

Register-address	Parameter name	Unit	Multiplier	Explanation	Data type
35015 0x88C7	Time (34603) [1]		1	Value (no decimal place, HHMMSS, e.g. 121035=12:10:35)	U32
35017 0x88C9	Sensor status (34811) [1]		1	see sensor status chapt. 7.2.4	U32
35019 0x88CB	Magnetic compass Differential angle instrument north marking to the magnetic north pole (34837) [1]	°	10	Value (1 decimal place, e.g. 1234=123.4°)	U32
35021 0x88CF	Sensor supply (34995) [1]	V	10	Value /10 (1 decimal place, e.g. 241=24.1V)	U32
35023 0x88CF	Live Counter (34997) [1]	ms	1	Value (no decimal place, internal ms counter)	U32
35025 0x88D1	Error status of the last measuring value (34999) [1]		1	Value (no decimal place, 0=no error, 1= measuring value was erroneous)	U32

Table 5 : MODBUS Input register

[1]:The figures in brackets specify register addresses representing the same measured values.

The mean value for wind speed can for example be found at address 30003 and 35001.

An incorrect measured value of the type S32 (signed integer 32-bit) is reported with "0x7FFFFFFF ". An incorrect measured value of the type U32 (unsigned integer 32-bit) is reported accordingly with "0xFFFFFFFF ". Alternatively, the error status can be queried via the register address 34999 or 35025 following a request for an individual measured value.

> **Note:**
> **Due to uninterrupted listing of the measured values from address 35001 the MODBUS Master can read out several measured values with one request!**

8.2.2 Commands (holding register)

All commands of the ULTRASONIC ANEMOMETER 2D WP occupy 32bits, i.e. 2 MODBUS register addresses and represent whole numbers with no leading sign except the TA command (64bit). The following example illustrates changing the baud rate to 19200 baud, with permanent storing of parameter, afterwards.

1. Set password for user level "ADMIN" (KY=4711)

Slave-address	Function code	Start address	No. of registers	No. of byte(s)	Data	CRC	
0x01	0x10	0x9C 49	0x00 02	0x04	0x00 00 12 67	0x83 B9	
						low-byte	high-byte

2. Command to set baud rate to 19200 baud (BR=192)

Slave-address	Function code	Start address	No. of registers	No. of byte(s)	Data	CRC	
0x01	0x10	0x9C 45	0x00 02	0x04	0x00 00 00 C0	0xCE F6	
						low-byte	high-byte

3. Storing of Parameter with Change-over to user-level „READ ONLY" (KY=0)

Slave-address	Function code	Start address	No. of registers	No. of byte(s)	Data	CRC	
0x01	0x10	0x9C 49	0x00 02	0x04	0x00 00 00 C0	0xCE F3	
						low-byte	high-byte

8.2.3 Commands and decription

The following table shows the available commands and associated passwords for read and write:

Command	MODBUS register address Protocol address	Description	Password	
			Read[1]	Write[2]
Command AV	40015 / 14	Averaging interval for wind speed and wind direction. 0..6000 (x100ms).	Without	Admin
Command BR	40005 / 4	Baud rate (see Command "BR" Thies format).	Without	Admin
Command CI	40013 / 12	Command interpreter (see Command "CI" Thies format).	Without	Admin
Command DM	40011 / 10	Duplex mode (see Command "DM" Thies format).	Without	Admin
Command HC	40023 / 22	Heating conditions.	Without	Admin
Command HS	40025 / 24	Height setting.	Without	Admin
Command HF	40027 / 26	Heating function.	Without	Admin
Command ID	40003 / 2	Identification number / slave address.	Without	Admin
Command KY	40009 / 8	Set key / password (admin = 4711).	Without	Without
Command MC	40029 / 28	Magnetic Compass correction, housing for sensor(0..359°).	Without	Admin
Command NC	40017 / 16	North correction of the wind direction (0..359°) / 1000 = automatic direction correction acc. to magnetic compass.	Without	Admin
Command RS	40253 / 252	Reset: 1 -> Warm start.	Without	Admin
Command SN	40007 / 6	Serial number.	Without	Not allowed
Command SV	45005 / 5004	Software Version e.g.: 100 = V1.00	Without	Not allowed
Command TA	45001 / 5000	Thies article number e.g: 4.3880.00.000 (64Bit).	Without	Not allowed
Command TZ	40021 / 20	Time zone (see Command "TZ" Thies format).	Without	Admin

Table 6 : List of commands

[1]: Command without parameter (used to read the selected parameter).

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

8.2.4 Sensor status of wind measurement

Explanation:

Bit-Number	Function	Description	
Bit 0	General error	Averaging time < 30sec (s. command ET)	An error is output when no new measuring value can be acquired over a period of 30 sec (s. command ET)
		Averaging time >= 30sec (s. command ET)	An error is output when the averaging buffer runs out of new values. Example: With an averaging time of 60 seconds an error is reported after 60 seconds.
Bit 1 Bit 2 Bit 3	User Averaging memory	Indicates the used averaging memory. Bit1 to bit3 indicates the space usage of the averaging buffer in binary format. 0: Buffer $0 < x \leq 1/8$. 1: Buffer $1/8 < x \leq 1/4$ filled. 2: Buffer $1/4 < x \leq 3/8$ filled. 3: Buffer $3/8 < x \leq \frac{1}{2}$ filled. 4: Buffer $\frac{1}{2} < x \leq 5/8$ filled. 5: Buffer $5/8 < x \leq 3/4$ filled. 6: Buffer $3/4 < x \leq 7/8$ filled. 7: Buffer $7/8 < x \leq 1$ filled.	
Bit 4	Plausibility on	Is set when plausibility is activated.	
Bit 5	Static error	Is set when a static error occurred. for ex. the general error lasts more than 60 seconds.	
Bit 6	Heating release	Is one, when the heating control is activated.	
Bit 7	Heating status	Is one, when the heating is activated.	

8.3 Analogue outputs

The connections WG/RXD- and WR/RXD+ offer the possibility to deliver the wind speed and wind direction as analogue value as well as voltage and as current value. Moreover, a starting offset of the current- and voltage output is settable. Thus, the interfaces 4..20mA or resp. 2..10V are implemented. For possible combinations, please refer to the table:

	Parameter SC=0	Parameter SC=1
Parameter AO=0	No output	No output
Parameter AO=1	WS: 0..10V, WD: 0..10V	WS: 2..10V, WD: 2..10V
Parameter AO=2	WS: 0..20mA, WD: 0..20mA	WS: 4..20mA, WD: 4..20mA
Parameter AO=3	WS: 0..20mA, WD: 0..10V	WS: 4..20mA, WD: 2..10V
Parameter AO=4	WS: 0..10V, WD: 0..20mA	WS: 2..10V, WD: 4..20mA
Parameter AO=11	as 1 with WD range 0..540°	as with WD range 0..540°
Parameter AO=12	as 2 with WD range 0..540°	as 2 with WD range 0..540°
Parameter AO=13	as 3 with WD range 0..540°	as 3 with WD range 0..540°
Parameter AO=14	as 4 with WD range 0..540°	as 4 with WD range 0..540°

Table 7: Configuration of analogue outputs WS/RXD- and WD/RXD+ with parameters AO and SC

8.3.1 Scaling of the analogue WS

The command AR can be used to determine the speed for the terminal value of the measuring range for the analogue wind speed. The scaling in the pre-set value is 0…60m/s, see **Command AR**.
The terminal value of the scaling is stated in m/s. The command 00AR00030, for example, can be used to scale the analogue output range of 0..30m/s wind speed.
With a setting of 4..20mA (AO=2, SC=1) the wind speed corresponds as follows:

WS = 0m/s -> 4mA and
WS =30m/s -> 20mA

8.3.2 North correction

The command NC can be used to shift the angle measured for wind direction by an angle offset in a positive direction. The device adds the value input to the angle measured for the wind direction. If the resulting value is greater than 360°, 360° is subtracted from the corrected angle value. This setting is used whenever it is not possible to align the ULTRASONIC ANEMOMETER 2D WP exactly to north and this angle needs to be electronically corrected afterwards.
See also **Command NC**.

If a wind speed < 0.1m/s is calculated, the wind direction is set to zero. The wind direction 0° is reserved for the calm.
In contrast to the calm, the precise wind direction north, i.e. 0°, is output as 360° with wind speeds > 0.1m/s.

8.4 Instantaneous values and output of raw measured values

The output of instantaneous values is generally a special case. Given the high acquisition speed for the measured values averaging of the data is advisable in most cases. If instantaneous values are to be output, averaging must not be switched on. The parameter AV should be set to '0'; see **Command AV**.
The OR parameter is used to adjust the output rate with autonomous output.

8.4.1 Averaging

Given the high data acquisition rate averaging is recommended in most cases. The averaging period is freely selectable from 100ms to 600 seconds. See also **Table 8** under **Command AV**.

Wind velocity and wind direction are averaged according to the recommendations of the WMO and to the FIFO storage method.
For detecting the gust and wind direction of the gust the averaging period must be set at least to 3 seconds (‚AV' >= 30)

It is a basic principle that only valid values are written to the averaging puffer. The size of the buffer is not determined by the number of data records but by the difference in the time stamp between the first and last data record. As a result any missing measured values do not influence the averaging result.

The ULTRASONIC ANEMOMETER 2D WP 2D offers two practical procedures for averaging:

- A **procedure for generating vectorial mean values** from the wind components and
- a **procedure for generating scalar mean values** from the wind components.

These different procedures can each be selected for averaging wind speed as well as wind direction depending on the actual application.

Vectorial averaging takes into account the wind direction for averaging the wind speed, and the wind speed when averaging the wind direction. Both averaged variables, wind speed and wind direction, are thus evaluated together with the other measured variable. This averaging procedure is very suitable e.g. for measuring and analysing the spread of pollutants.

Scalar averaging averages the two variables, wind speed and wind direction, independently of each other. This averaging procedure leads to comparable results with mechanical pickups for wind speed and wind direction. The scalar averaging procedure is suitable e.g. for analysing sites for wind turbines where only the wind vector variable relevant to energy generation is of interest and not its direction.

The vectorial and scalar averaging procedure for wind velocity and wind direction can be selected via the command **AM** like **Average Method**.

Command for selecting the averaging procedure:
AM00000   vectorial averaging of velocity and direction.
AM00001   scalar averaging of velocity and direction.

8.5 Serial data output

Data transmission via the RS485 interface is referred to as serial data output. Two modes are available for transmission of the data:

- Autonomous transmission of data.
- Transmission of data via request telegram.

Autonomous transmission of the data is selected using the command 00TT000XX, with XX standing for the relevant telegram number. In this case the ULTRASONIC ANEMOMETER 2D WP transmits its data cyclically at the repeat rate selected with the parameter OR.

8.5.1 Data request

Command TR is used to request data from the ULTRASONIC ANEMOMETER 2D WP. This command has no access protection. After processing the command the device sends back a response telegram. The time between the last sign in the request telegram and the first sign in the data telegram is pre-set for the „full-duplex" operation to at least 5ms, and for the „half-duplex" operation to at least 20ms, see also command RD.

The telegrams as described (see point 11 – appendix 1 Predefined data telegrams)' are available as data telegrams.

8.5.2 Autonomous telegram output

Autonomous telegram output is selected with the command TT. After a valid telegram type has been input, the ULTRASONIC ANEMOMETER 2D WP autonomously transmits the data telegram selected. The transmission interval is set in ms using the command OR.

By default, one telegram each second is sent. If the selected baud rate exceeds the output cycle (the time for data transmission is greater than the interval), telegram output may not be possible.

8.6 Behaviour of the device under extreme conditions of measuring value acquisition.

It is a basic rule that the measured values output are always valid and can be used by the target system. In case of error, i.e. when individual sensors are unable to supply valid measured values over a certain period of time, the data in the telegram is no longer updated and 'freezes up'. If the error lasts for more than 30s (see also **Command ET**), the values concerned are replaced in the telegram by an "F" instead of the outdated value, and a defined voltage value is transmitted to the analogue outputs (see also **Command EI**).

8.6.1 Occurrence of errors:

An error may occur under the following circumstances:

Averaging time(AV) < 30sec Error Timeout, see **Command ET**	An error is output (s. " ET"), when no new wind data could be acquired over 30sec.
Averaging time(AV) >= 30sec Error Timeout, see **Command ET**	An error is output, when the averaging buffer runs out of valid data.

8.6.2 Behaviour of analogue outputs

If the analogue outputs are active, they are switched to the minimum or maximum value in case of error. The parameter EI determines which of the two values is output; see **Command EI**.

8.6.3 Behaviour of telegram output

In case of error the relevant error telegram is output; see Fehler! Verweisquelle konnte nicht gefunden werden.**s**.

8.7 Output of all system parameters

Most parameters of the ULTRASONIC ANEMOMETER 2D WP are stored internally in an EEPROM. The command SS can be used to output all stored parameters.
Before editing parameters it is recommended making a backup copy of existing settings and storing them in a text file; see also **Command SS**.

8.8 Query software version

The software version is queried using the command SV. For further details see **Command SV**.

8.9 Force restart

The command RS can be used to force a restart of the ULTRASONIC ANEMOMETER 2D WP. The command

00RS00001 <cr>   Warm boot

are only possible with ADMIN rights; see Command KY.

8.10 Plausibility test

In order to recognize erroneously measured wind values, the ULTRASONIC ANEMOMETER 2D WP includes an internal plausibility test, assessing the measuring values on the basis of the history. Erroneous measuring values can be caused, for example, by foreign objects in the ultrasonic measuring distance.

8.11 Online Help

For a short description of commands the ULTRASONIC ANEMOMETER 2D WP includes an Online Help feature which provides information about individual commands. The Help text for the command is returned by inputting the command and '?'.
If the following commands are input:

00?? <cr>   <cr> stands for Carriage return (Enter key)

the ULTRASONIC ANEMOMETER 2D WP will list all commands with the relevant Help.

Example:
Help with setting the baud rate is required: see **Command BR**.
If the command

00BR?<cr>   <cr> stands for Carriage return (Enter key)

is input, the ULTRASONIC ANEMOMETER 2D WP responds as follows:

Baud Rate in baud per second

12:	1200 Baud
24:	2400 Baud
48:	4800 Baud
96:	9600 Baud
192:	19200 Baud
384:	38400 Baud
576:	57600 Baud
1152:	115200 Baud
2304:	230400 Baud
4608:	460800 Baud
9216:	921600 Baud

Only admin authorised!

9   Configuration by customer

The ULTRASONIC ANEMOMETER 2D WP is factory-set before delivery to the customer.

•   This is described in the supplementary sheet with the factory settings ("Werkseinstellung").

The customer can alter the factory settings of the ULTRASONIC ANEMOMETER 2D WP or adapt them to new requirements. It should be borne in mind here that if settings are changed, the order number allocated at the factory can then no longer help with identification.

The ULTRASONIC ANEMOMETER 2D WP can be configured via its serial data interface using commands.

See sections:

- Access mode.
- List of commands.

For this purpose, please use any standard terminal program for ex. Hyper Terminal or "TeraTerm"

Recommendation:

After performing configuration please amend the supplementary sheet for the factory settings and send in to the manufacturer when the device is returned for servicing or repair.

10 List of commands

	Command	Description
Command AM	<id>AM<para5>	Setting of averaging method (Averaging Mode).
Command AO	<id>AO<para5>	Switch the analogue outputs on/off/over (I / U) (Analogue On).
Command AR	<id>AR<para5>	Scale the analogue wind speed output (Analogue Range).
Command AV	<id>AV<para5>	Averaging period (AVerage).
Command BP	<id>BP<para5>	Select parity for the interfaces (Baud Parity).
Command BR	<id>BR<para5>	Select baud rate for the interfaces (Baud Rate).
Command BT	<id>BT<para5>	Activating termination of RS485 – bus (Bus Termination).
Command CI	<id>CI<para5>	Select command interpreter (Command Interpreter).
Command CS	<id>CS<para5>	Saving configuration (Configuration Save).
Command DM	<id>DM<para5>	Duplex mode (Duplex Mode).
Command DT	<id>DT<para5>	Date and time stamp (Date and Timestamp).
Command EI	<id>EI<para5>	Analogue values in case of error (Error Inversion).
Command ET	<id>ET<para5>	Time until a measuring value error sets the generic error bit (Error Timeout).
Command HC	<id>HC<para5>	Defines the lower threshold for heating operation (Heating Condition).
Command HCF	<id>HF<para5>	Heating function, selection between regular and test operation
Command HH	<id>HH<para5>	Output modes of Help (complete Help with: <id>??<para5>).
Command HP	<id>HP<para5>	Maximum heating power in % (Heating Power).
Command ID	<id>ID<para5>	ULTRASONIC ANEMOMETER 2D WP ID (IDentifier).
Command II	<id>II<para5>	Setting of identifier after start sign(STX) of the telegram
Command KY	<id>KY<para5>	Access key (Key).
Command MC	<id>MC<para5>	Magnetic compass correction
Command NC	<id>NC<para5>	Correction to north (North Correction).
Command OP	<id>OP<para5>	For extending the output telegrams by optional parameters.
Command OR	<id>OR<para5>	Telegram output interval (Output Rate).
Command OS	<id>OS<para5>	Scale wind speed output (Output Scale).
Command RD	<id>RD<para5>	Delayed response (Response Delay).
Command RS	<id>RS<para5>	Warm-boot ULTRASONIC ANEMOMETER 2D WP (ReSet).
Command RT	<id>RT<para7>	Set real-time clock (Real Time Clock).
Command SC	<id>SC<para5>	Setting the offset value of the analog outputs (start current / voltage)
Command SM	<id>SM<para5>	Energy saving mode (Sleep Mode).
Command SN	<id>SN<para8>	Output serial number.(Serial Number)
Command SS	<id>SS<para5>	System Status.
Command SV	<id>SV<para5>	Version of software (Software Version).
Command TA	<id>TA<para9>	Thies order number e.g. **4.388x.xx.xxx.**
Command TI	<id>TI<para5>	Short information about the telegram (Telegram Info).
Command TR	<id>TR<para5>	Telegram Request.
Command TT	<id>TT<para5>	Autonomous telegram output (Telegram Transmission).

10.1 Commands and descriptions

Command AM

\<id\>AM\<para5\>	Select the averaging method of wind measurement (Average Method).
Access:	Configuration mode (ADMIN).
Description:	This command can be used to select the averaging method. Averaging can be either vectorial or scalar; see also section **Fehler! Verweisquelle konnte nicht gefunden werden.**.

Parameter description:

	0:	Vectorial-averaged velocity and vectorial -veraged direction.
	1:	Scalar-averaged velocity and scalar-averaged direction.
Value range:	0..1	
Initial value:	1	

Command AO

\<id\>AO\<para5\>	Analogue output mode
Access	Configuration mode (ADMIN).
Description:	Command used to switch the analogue outputs on/off.

Parameter description:

```
 0 -> off
 1 -> voltage output
 2 -> current output
 3 -> WV current output, WD voltage output
 4 -> WV voltage output, WD current output
11 -> like '1' but 0..540° WD range
12 -> like '2' but 0..540° WD range
13 -> like '3' but 0..540° WD range
14 -> like '4' but 0..540° WD range
```

Value range:	0..14
Initial value:	0

Command AR

\<id\>AR\<para5\>	Scale the analogue wind speed output (Analogue Range).
Access:	Configuration mode (ADMIN).
Description:	Determines the measuring range final value for the analogue wind velocity output. The standard ULTRASONIC ANEMOMETER 2D WP scales the wind speed as follows: 0..10V corresponds to 0..60m/s. It may however also be advisable to scale the wind speed of 0..30m/s: 0..10V correspond to 0..30m/s. The end of the measuring range is specified with this parameter. Specification is made in m/s.

Parameter description:

	1..80:	Specifies the end of the measuring range for wind speed (WS). If the command AR00045 is input for example, 10V corresponds to a wind speed of 45m/s.
Value range:	1..80[m/s]	
Initial value:	60	

Command AV

<id>AV<para5>	Averaging period (AVerage time).
Access:	User mode.
Description:	This command determines the period when the ULTRASONIC ANEMOMETER 2D WP averages all measuring values.
	The wind measuring values are gliding-averaged, corresponding to WMO-regulation acc. to the FIFO method. No gust is calculated for averaging times below 3s!

Parameter description:

Parameter for AV	Selected averaging time
0	No averaging
1	Averaging over 100ms
10..6000	Averaging over 1..600.0s

Table 8: Selection of averaging periods with parameter AV

The averaging memory is designed as a sliding memory.
On start-up the data of the averaging memory is instantly valid. Averaging is performed immediately using the measured values available.

Value range:	0..6000
Initial value:	10

Please note: For output rates of less than 250ms, the averaging is limited to: AV = AV * OutputRate/250

Command BP

<id>BP<para5>	Determines the parity of the serial interface (Baud Parity)
Access:	Configuration mode (ADMIN)
Description:	Parameter 7: parity 7E1 Parameter 8: parity 8N1- Parameter 9: Parity 8E1
Value range:	7 -> 7E1 (only Thies command interpreter, CI=0)
	8 -> 8N1
	9 -> 8E1
	10 -> 8N27..9
Initial value:	8

Command BR

<id>BR<para5>	Select baud rate (Baud Rate)
Access:	Configuration mode (ADMIN)
Description:	ULTRASONIC ANEMOMETER 2D WP communication can take place at different baud rates.
	The following baud rates are defined for BR:

Parameter description:

12:	1200 baud
24:	2400 baud
48:	4800 baud
96:	9600 baud
192:	19200 baud
384:	38400 baud
576:	57600 baud

1152:	115200 baud
2304:	230400 baud
4608:	460800 baud
9216:	921600 baud

Table 9: List of baud rates with telegram BR

If the baud rate is changed, the ULTRASONIC ANEMOMETER 2D WP will return the value of the new baud rate selected in the baud rate set previously to show command acceptance.

When the baud rate is queried with Command BR, the ULTRASONIC ANEMOMETER 2D WP returns the baud rate last programmed and the selected parity.

See also Command BP.

Example: 00BR
!00BR00096
Actual baud rate ->   9600 8N1

Initial value: 96

Command BT

<id>BT<para5>	Activating and deactivating of the 120-ohms load resistance on the serial interface (Bus Termination)
Access:	Configuration mode (ADMIN)
Description:	Command for connecting / disconnecting a load resistance of approx.120ohms on the RS485-wires

Parameter description:

	0:	Bus termination off.
	1:	Bus termination on.
Initial value:	0	

Command CI

<id>CI<para5>	Select the command interpreter
Access:	Configuration mode (ADMIN)
Description:	This command is used to select the required command interpreter.
Parameter description:	

Parameter	Description
0	THIES
1	MODBUS RTU

Value range: 0 to 1

Initial value: 0

Command CS

<id>CS<para5>	Save configuration (Configuration Saving).
Access:	Configuration mode (ADMIN).
Description:	Command to save the configuration without leaving configuration mode. A new configuration will only be written to the EEPROM when the command "CS1" or "KY0" is executed.
Parameter:	1: Save configuration.

Command DM

<id>DM<para5>	Duplex mode..	
Access:	Configuration mode (ADMIN)	
Description:	Duplex mode decides the type of physical connection of the serial data interface. In full duplex mode the send and receive signals are transmitted via separate pairs of cables. This means it is possible to send and receive signals simultaneously.	
	In half duplex mode transmission of the send and receive signals is via the same pair of cables. (Time multiplex).	

Parameter description:

	0:	Half duplex mode (RS485).
	1:	Full duplex mode (RS485 transmission drivers are switched off if no data is transmitted).
	2:	Full duplex mode (RS422 transmission drivers are not switched off).

Value range:	0..2
Initial value:	1

Command DT

<id>DT<para5>	Date and time stamp (Date and Timestamp).
Access:	Configuration mode (ADMIN).
Description:	Adds the date and/or time from the internal real-time clock (see Command RT) to the output telegrams. This information is always found at the end of the telegram before the check sum.
TR1 mit DT0:	00.1 338*07
TR1 mit DT1:	00.1 315 24.01.17 08:07:45*07
TR1 mit DT2:	00.2 360 08:09:41*2D
TR1 mit DT3:	00.1 349 24.01.17*20

Parameter description:

	0:	No date and time stamp.
	1:	With date and time stamp.
	2:	With time stamp.
	3:	With date stamp.
Value range:	0..3	
Initial value:	0	

Command EI

<id>EI<para5>	Analogue value in case of error (Error inversion).
Access:	Configuration mode (ADMIN).
Description:	Specifies whether 0 or maximum value is output at the analogue outputs in case of error. If the ULTRASONIC ANEMOMETER 2D WP determines a static error during a measurement, it will output an error under certain conditions. This output prevents the user from interpreting incorrect measured values. If the analogue signals of wind direction and wind speed are used for analysis, the ULTRASONIC ANEMOMETER 2D WP switches the outputs to the maximum or minimum output value in case of error. This parameter is used to specify whether it is the minimum or maximum value that is output in such case.

Parameter description:

0:	Analogue outputs are set to maximum in case of error.
1:	Analogue outputs are set to 0 in case of error.
2:	Analogue outputs: The wind speed and all optional measured values are set to minimum (0V) in case of error, and the analogue output for wind direction is set to maximum (10V) in this case.
3:	Analogue outputs: The wind speed and all optional measured values are set to maximum (10V) in case of error, and the analogue output for wind direction is set to minimum (0V) in this case.

Value range:	0..3
Initial value:	0

Command ET

<id>ET<para5>	Time in ms, until the generic error bit is set (Error Timeout).
Access:	Configuration mode (ADMIN).
Description:	Determines, after which time span the generic error bit is set.
	The static error bit is always set when the generic error exists more than 60 s.
	Special case: With output rates (OR) < 100ms the error basis reduces by the ratio OR/100.

Value range:	10..60 [s]
Initial value:	30

Command HC

<id>HC<para5>	Heating Condition.
Access:	Configuration mode (ADMIN).
Description:	This command defines the lower threshold of supply voltage, when the heating is no more activated.

Parameter description:

When the supply voltage drops below the set value, the heating is no more activated. Only when the voltage exceeds the set value by 2 volts, the heating is reactivated. A request without parameters outputs the currently measured peak value of the supply voltage in the extended help.

Value range:	5..48 (Volt)
Initial value:	10

Command HF

<id>HF<para5>	Heating Function.
Access:	Configuration mode (ADMIN).
Description:	The command HF is used to determine the heating mode, i.e. the conditions of heating.

    0:   heating always off.

    1:   heating switches on at housing temperature <5°C.

    2:   heating is completely switched on for 15 seconds as function test (100% heating power).
This setting is reset automatically after a time period of 15 seconds, in order to avoid a damage of the heating elements.

    3:   Like HF1 but the heating of the ultrasonic converter is connected only after a malfunction of the sonar logging (only with the risk of icing).

Value range:	0..3
Initial value:	1

Command HH

<id>HH<para5>	Help
Access:	Configuration mode (ADMIN).
Description:	The command HH allows detailed Help to be switched off (Verbose Mode).

Parameter description:

0:	Detailed messages in command mode on (Verbose Mode on). With restart a start-up message is outputted (see chapter 6.1), main program starts afterwards.
1:	Messages switched off, only command echo with '!' e.g. !00TT00001 (verbose mode off).
2:	No restart messages output (silent boot mode).
3:	All messages and restart-messages deactivated (s. 1+2).
a:	The pin assignment is outputted in the standard configuration.
??:	A detailed help text is outputted about all available commands.

Value range:	0..3, a, ??
Initial value:	0

Command HP

<id>HP<para5>	Heating Power
Access:	Configuration mode (ADMIN)
Description:	The command HP is used to determine the maximum heating power in%. This command is effective only when the heating function (see command HF) is switched on.

Parameter description:

The heating power always starts at 20%, and increases to the pre-set value HP within a few minutes.

Value range:	20..100
Initial value:	100

Command ID

<id>ID<para5>	Device identifier (IDentifier)
Access:	Configuration mode (ADMIN)
Description:	This command is used to specify the identification number of the ULTRASONIC ANEMOMETER 2D WP.
	The ID is required to address the ULTRASONIC ANEMOMETER 2D WP with every command.
	Whenever its ID is changed, the ULTRASONIC ANEMOMETER 2D WP will respond to its new identifier immediately.
	The ID 99 is an universal ID. **Every** ULTRASONIC ANEMOMETER 2D WP will **always** respond to commands with the ID 99 (with the correct baud rate).
	The ID 99 must not be used in bus mode under any circumstances.

Example:	00KY04711	Open with user key.
	00ID00023	Change ID from 0 to 23.
	!00ID00023	ULTRASONIC ANEMOMETER 2D WP acknowledges change.
	23DM	Query of duplex mode with new ID.
	!23DM00000 WP.	Response from ULTRASONIC ANEMOMETER 2D
	23ID00000	Change ID from 23 to 0.
	!23ID00000	ULTRASONIC ANEMOMETER 2D WP acknowledges change.

Value range:	0..98
Initial value:	0

Command II

<id>HT<para5>	Identifier Index
Access:	Configuration mode (ADMIN).
Description:	Adds the identifier of the device after the start character (STX) of the telegram, also see 'ID'. Exception: the standardized NMEA telegram.

Parameter description:

	0 -> no identifier
	1 -> id as identifier
Value range:	0..1
Initial value:	0

Command KY

<id>KY<para5>	Access mode (Key).
Access:	Query mode.
Description:	When editing the parameters of the ULTRASONIC ANEMOMETER 2D WP access authorisations are required for most commands. This prevents any accidental change in parameters. Access consists of three levels:

- Query mode   "0"
- User mode   "1"
- Configuration mode   "4711"

Parameter description:

0:     Query mode
Parameters which have no access restrictions are those not stored in the EEPROM, e.g. cyclic telegram enquiry or output of system status.

1:     User mode (USER ACCESS)
The user key protects parameters, which influence the behaviour of the ULTRASONIC ANEMOMETER 2D WP, e.g. averaging period and baud rate. The user can change these parameters but should realise that this will modify the behaviour of the ULTRASONIC ANEMOMETER 2D WP. Before any change it is recommended using the command SS to output and then save the current configuration.

4711: Configuration mode (ADMIN ACCESS)

Parameters protected with this key are only available to the administrator. They were set as defaults at the factory.

If the user switches from a higher access mode to the query mode by command, e.g.: with "00KY0", the edited parameters will be permanently stored in the EEPROM. Query mode is always switched on after a restart.

Value range:	0,1,4711
Initial value	0

Command MC

<id>MC<para5>	Magnetic compass correction
Access:	Configuration mode (ADMIN).
Description:	With the magnetic compass correction a constant angle is added to the measured direction of the magnetic compass. The parameter serves for compensating a magnetic variation. The direction of the magnetic compass can be used for automatic north correction of wind direction. See also **command NC**.
Value range:	0..359 [°]
Initial value:	0

Command NC

<id>NC<para5>	North Correction of the wind direction.
Access:	Configuration mode (ADMIN).
Description:	With the north correction a constant angle is added to the measured wind direction. The parameter is used to correct electronically a possible alignment error subsequently after mounting. If the ULTRASONIC ANEMOMETER 2D, for example, is not aligned directly to north but to northeast, the wind direction always indicates 45° too little. In this case a north correction of 45 must be set. North correction influences the wind directions output in the data telegrams as well as the analogue output values.

Parameter description:

	1000 :	Automatic north correction via magnetic compass (optional), see also **command MC**.
	0..359:	Set north correction in °.
Value range:	0..359 / 1000	
Initial value:	0	

Command OP

<id>OP<para5>	Possible parameter for the output of calculated values (Optional Parameters)
Access:	Configuration mode (ADMIN).
Description:	By means of this parameter, it is possible to output additionally to each telegram – excepted the NMEA telegram (TR4/TT4) the parameters stated below. The output is carried out always after the measuring values, and before date/time resp. before the checksum, see parameter DT. The order is defined by the position from left to right in the parameter. If, for ex., parameter OP=32 is selected, first the value „supply voltage", and afterwards the value „housing temperature" is attached to the measuring values.

Parameter description:

	0:	No additional values in the output telegram (off).
	1:	Output of direction of magnetic compass in degree.
	2:	Output of the housing temperature in degree Celsius.
	3:	Output of the supply voltage in Volt.
Value range:	00000...33333	
Initial value:	0 (see factory setting: supplement sheet)	

Command OR

<id>OR<para5>	Telegram output interval (Output Rate).
Access:	Configuration mode (ADMIN).
Description:	When the telegram output is autonomous, the time distance between the telegrams is specified by means of this parameter. The selection is carried out in increments of milliseconds. If the output rate is higher than the data transmission speed, the upcoming output is rejected. If the output repetition rate is several times faster than the measuring value acquisition, the available measuring values are double- or multiple-output.

Parameter description:

	20..60000	Specifies the output interval in milliseconds.
Value range:	20..60000 [ms]	
Initial value:	1000 (see factory setting: supplement sheet).	

Command OS

<id>OS<para5>	Meas. Unit of the wind speed output (Output Scale)
Access:	Configuration mode (ADMIN)
Description:	This command specifies the unit used for output of the wind speed in the serial telegram. Different units of measurement are available for this purpose.

Parameter description:

Parameter	Meas. unit	Conversion factor referred to m/s
0	m/s	1
1	Km/h	1m/s => 3.6km/h
2	miles/h	1m/s => 2.236936292 miles/h
3	Knots	1m/s => 1.94253590 knots

Table 10: Conversion factors between different wind speeds

Value range:	0..3
Initial value:	0

Command RD

<id>RD<para5>	Delayed response (Response Delay).
Access:	Configuration mode (ADMIN).
Description:	The response of the ULTRASONIC ANEMOMETER 2D WP is delayed by the time specified in ms with a command via the serial interface. The minimum delay time from the end of the last character of the request telegram until transmission of the first character of the response telegram is 5ms. For the half duplex mode we recommend RD=20 in order to guarantee a smooth communication with diverse interface converters.
Value range:	5...1000 [ms]
Initial value:	5

Command RS

<id>RS<para5>	Re-start ULTRASONIC ANEMOMETER 2D WP (Reset).
Access:	Configuration mode (ADMIN).
Description:	The ULTRASONIC ANEMOMETER 2D WP is restarted on transmission of this command.

Parameter description:

1:	The ULTRASONIC ANEMOMETER 2D WP performs a warm boot, behaving as if the supply voltage had just been connected.
Value range:	1

Command RT

<id>RT<para7>	Used to set the real-time clock of the ULTRASONIC ANEMOMETER 2D WP (Real Time).
Access:	Configuration mode (ADMIN).
Description:	Output and setting of time and date of ULTRASONIC ANEMOMETER 2D WP.

Parameter description:

T:	System time of ULTRASONIC ANEMOMETER 2D WP output in the format: "**hh:mm:ss**". Example for setting the system time to 12 noon: "00RTT120000"
D:	System date of ULTRASONIC ANEMOMETER 2D WP output in the format: "**dd:mm:yy**". Example for setting the date to 25.01.2017: "00RTD250117"

Command SC

<id>SC<para5>	Minimum value of the analogue outputs (Start Current)
Access:	User mode
Description:	The minimum value which is to be transmitted can be set when using the analogue outputs. The terminal value of the output is, thus, not affected. The minimum value is 0% or 20% of the terminal value. Depending on the parameter AN the set minimum value is transformed into a current- or resp. a voltage value. Thus, the current- and voltage outputs of 0...20mA, 4..20mA, 0...10V, und 2...10V can be implemented, see **Command AO**.

Parameter description:

0:	Minimum value 0% of maximum value
1:	Minimum value 20% of maximum value

Value range:	0...1
Initial value:	0

Command SM

<id>SM<para5>	Energy saving mode (Sleep Mode).
Access:	Configuration mode (ADMIN).
Description:	Entry of the alarm interval for measurement and telegram output. The ULTRASONIC ANEMOMETER 2D WP is called up by the RTC in a specified interval, measures once, and outputs afterwards the current measuring values via the set telegram. The heating is deactivated for the sleep mode, and the averaging „AV" is switched off, in order to receive up-to-date measuring values. Normally, the analog data outputs will be switched off at entry of sleep mode. If the connected analysis system is able to process the synchronized analogue values, the analogue output can be reactivated afterwards by the command "AO" (>0).

Parameter description:

0:	Energy saving mode off.
1...600:	Alarm interval in seconds.
Initial value:	0

Command SN

<id>SN	Output of 8-digit serial number (Serial Number).
Access:	Query mode.
Description:	During factory setting of the device every ULTRASONIC ANEMOMETER 2D WP is given a serial number. This serial number is a unique identifier for the ULTRASONIC ANEMOMETER 2D WP.

Parameter description:

The ULTRASONIC ANEMOMETER 2D WP responds e.g. with the serial number "12345678":

!00SN12345678

	Serial number: 12345678	(see also **Command HH** "Verbose ON")
Value range:	0..99999999	

Command SS

<id>SS<para5>	System status
Access:	Query mode.
Description:	Outputs the selected parameters of all commands. All parameters stored in the EEPROM are output here.
	Before editing parameters of the ULTRASONIC ANEMOMETER 2D WP, this command should be used to generate and save a list of the selected parameters, e.g. by copying the parameters to a text file.

Parameter description:

No parameter is necessary when using the command SS. Call-up with the selected device ID 00 is as follows:

00SS<cr>   with <cr> Carriage return (Enter key)

Command SV

<id>SV<para5>	Version of software (Software Version).
Access:	Query mode.
Description:	Without parameter the command outputs the software version.

Parameter description:

1:	Output of the detailed start message included the software version.

Command TA

<id>TA	Thies article number.
Access:	Query mode.
Description:	Without parameter the factory-determined Thies article number is output without the leading 4 e.g.. 388000000, for 4.3880.00.000.

Parameter description:

1:	Output of the first 5 characters of the Thies article number e.g. „49200".
2:	Output of the last 5 characters of the Thies article number, e.g. „00000".

Command TI

<id>TI<para5>   Telegram information.
Access: Query mode.
Description: Telegram information about the type of measured value is output in abbreviated form.

Value range: 1,2,3,4,7,10,12   valid telegrams; see also **Command TR.**

Command TR

<id>TR<para5>   Telegram request
Access: Query mode.
Description: The command TR can be used to specifically request a telegram from the ULTRASONIC ANEMOMETER 2D WP. The device offers a series of predefined telegrams.
With a telegram request the response time of the ULTRASONIC ANEMOMETER 2D WP is the delay time from the last character of the request telegram until transmission of the first character of the response telegram. The minimum delay is 5msec and can be selected from 5...1000 ms using Command RD.

Parameter description:

     1:     VD telegram (wind speed, wind direction).
     2:     VDT telegram (wind speed, wind direction and temperature)
     3:     VD with high resolution (wind speed, wind direction)
     4:     NMEA 0813 ver 3
     5:     VDM (wind speed, wind direction, monitoring)
     6:     Components telegram
     7:     VDT telegram with additional output of gust
     12:     Scientific analysis telegram

Value range: 1,2,3,4,5,6,7,12
Initial value: No initial value.

Command TT

<id>TT<para5>   Autonomous telegram output (Telegram Transmission).
Access: User mode.
Description: Specifies the number of the telegram that the ULTRASONIC ANEMOMETER 2D WP autonomously transmits on a cyclic basis. The same telegrams are available as described under **Command TR**. The time interval in which telegrams are transmitted is specified with **Command OR**.
In half duplex mode (see also **Command DM**) the automatic output is started with delay, so that saving of the parameters is possible.
Deactivating the automatic output is, subsequently, only possible after restart, as the output starts with delay, or by entry of the key combination <Strg-D> at sufficient output interval, caused by: 1. a slow output rate OR, 2. short telegram 3. Quick baud rate (>=9600Bd).
When TT = 0, the autonomous telegram output is switched off.

Value range: 1,2,3,4,5,6,7,12
Initial value: See factory settings on the supplement sheet.

11 Appendix 1 Predefined data telegrams

11.1 Fixed Telegram Formats

For the telegram output there are several pre-defined telegrams available for the autonomous output (**Command TT**) and data query (**Command TR**). The detailed construction is described in appendix 1 (pre-defined data telegram). A reference list of the telegram formats is given in **Table 11**.

Telegram name	Telegram number	Telegram construction
VD	00001	(STX)VV.V DDD*CC(CR)(ETX)
VDT	00002	(STX)VV.V DDD TTT.T SS*CC(CR)(ETX)
VD2	00003	(STX)VVV.VV DDD.D*CC(CR)(ETX)
NMEA 0831 Ver 3	00004	$WIMWV,DDD.D,R,VVV.V,X,S*CC(CR)(LF)
VDM	00005	(STX)VVV.VV DDD.D SS MM*CC(CR)(ETX)
Vx, Vy, VT	00006	(STX)+Vx.x;+Vy.y;+TT.T;SS;CC(CR)(ETX)
VDT with gust	00007	(STX)VVV.V BVV.V DDD BDD ±TT.T *CC(CR)(ETX)
Scientific telegram	00012	See appendix (chapter 10)

Table 11: List of pre-defined data telegrams

Declaration:
V: Wind speed (see Command OS)
Vx.x: Wind speed X-components (see Command OS)
Vy.y: Wind speed Y-components (see Command OS)
VT: virtual-acoustic temperature
D: Wind direction
BV: Gust of wind speed
BD: Wind direction of gust
M: Monitoring of voltage supply
T: Temperature
S: Status byte
C: Check sum (EXOR-relation)
X: Identification for scaling of wind speed (K, N, M, S = km/h, Knots, m/s, mph)

11.2 Formation of Checksum

The check sum results from the byte-wise EXOR-relation of the bytes delivered in the telegram between the telegram starting sign „STX", or resp. „$" with NMEA – telegram, and the byte „* " as identification for start of check sum.
The bytes „STX" or resp. „$" and „* " are not considered with the check sum calculation!

11.3 Telegram 1 VD

Wind speed and Wind direction and
Command: TR1   Command: TT1

Telegram Construction: (STX)xx.x xxx*xx(CR)(ETX)

Character No.	Function
1	STX (HEX 02)
2	10^1 wind speed
3	10^0 wind speed
4	. (HEX 2E) decimal point
5	10^{-1} wind speed
6	space (HEX 20)
7	10^2 wind direction
8	10^1 wind direction
9	10^0 wind direction
10	* (HEX 2A) check sum identification
11	High byte check sum in HEX (2..9)
12	Low byte check sum in HEX (2..9)
13	CR (HEX 0D) Carriage Return
14	ETX (HEX 03)

Telegram structure in case of error

Character No.	Function
1	STX (HEX 02)
2	‚F'
3	‚F'
4	. (HEX 2E) decimal point
5	‚F'
6	space (HEX 20)
7	‚F'
8	‚F'
9	‚F'
10	* (HEX 2A) check sum identification
11	High byte check sum in HEX (2..9)
12	Low byte check sum in HEX (2..9)
13	CR (HEX 0D) Carriage Return
14	ETX (HEX 03)

11.4 Telegram 2 VDT

Wind speed, wind direction and acoustic-virtual temperature

Command: TR2   command: TT2

Telegram construction: (STX)xx.x xxx xxx.x xx*xx(CR)(ETX)

Character No.	Function
1	STX (HEX 02)
2	10^1 wind speed
3	10^0 wind speed
4	. (HEX 2E) decimal point
5	10^{-1} wind speed
6	space (HEX 20)
7	10^2 wind direction
8	10^1 wind direction
9	10^0 wind direction
10	space (HEX 20)
11	+ or - sign
12	10^1 temperature
13	10^0 temperature
14	. (HEX 2E) decimal point
15	10^{-1} temperature
16	space (HEX 20)
17	High byte status byte
18	Low byte status byte
19	* (HEX 2A) check sum identification
20	High byte check sum in HEX (2..18)
21	Low byte check sum in HEX (2..18)
22	CR (HEX 0D) Carriage Return
23	ETX (HEX 03)

Telegram structure in case of error

Character No.	Function
1	STX (HEX 02)
2	‚F'
3	‚F'
4	. (HEX 2E) decimal point
5	‚F'
6	space (HEX 20)
7	‚F'
8	‚F'
9	‚F'
10	space (HEX 20)
11	‚F'
12	‚F'
13	‚F'
14	. (HEX 2E) decimal point
15	‚F'
16	space (HEX 20)
17	High byte status byte
18	Low byte status byte
19	* (HEX 2A) Prüfsummenkennung
20	High byte check sum in HEX (2..18)
21	Low byte ckeck sum in HEX (2..18)
22	CR (HEX 0D) Carriage Return
23	ETX (HEX 03)

11.5 Telegram 3 VD2

Wind speed, wind direction with extended resolution
Command: TR3   command: TT3
Telegram construction: (STX)xxx.xx xxx.x*xx(CR)(ETX)

Character No.	Function
1	STX (HEX 02)
2	10^2 wind speed
3	10^1 wind speed
4	10^0 wind speed
5	. (HEX 2E) decimal point
6	10^{-1} wind speed
7	10^{-2} wind speed
8	space (HEX 20)
9	10^2 wind direction
10	10^1 wind direction
11	10^0 wind direction
12	. (HEX 2E) decimal point
13	10^{-1} wind direction
14	* (HEX 2A) check sum identification
15	High byte check sum in HEX (2..13)
16	Low byte check sum in HEX (2..13)
17	CR (HEX 0D) Carriage Return
18	ETX (HEX 03)

Telegram structure in case of error

Character No.	Function
1	STX (HEX 02)
2	‚F'
3	‚F'
4	‚F'
5	. (HEX 2E) decimal point
6	‚F'
7	‚F'
8	space (HEX 20)
9	‚F'
10	‚F'
11	‚F'
12	. (HEX 2E) decimal point
13	‚F'
14	* (HEX 2A) check sum identification
15	High byte check sum in HEX (2..13)
16	Low byte check sum in HEX (2..13)
17	CR (HEX 0D) Carriage Return
18	ETX (HEX 03)

11.6 Telegram 4 NMEA

NMEA 0831 Ver3

Command: TR4   Command: TT4
Telegram structure: $WIMWV,xxx.x,R,xxx.x,N,A*xx(CR)(LF)

Character No.	Function
1	$ (HEX 24) dollar
2	W (HEX 57)
3	I (HEX 49)
4	M (HEX 4D)
5	W (HEX 57)
6	V (HEX 56)
7	, (HEX 2C) comma
8	10^2 wind direction
9	10^1 wind direction
10	10^0 wind direction
11	. (HEX 2E) decimal point
12	10^{-1} wind direction
13	, (HEX 2C) comma
14	R (HEX 52)
15	, (HEX 2C) comma
16	10^2 wind speed
17	10^1 wind speed
18	10^0 wind speed
19	. (HEX 2E) decimal point
20	10^{-1} wind speed
21	, (HEX 2C) comma
22	K, N, M, S = km/h, Knots, m/s, mph
23	, (HEX 2C) comma
24	A, V A = valid, V = invalid
25	* (HEX 2A) check sum identification
26	High byte check sum in HEX (2..24)
27	Low byte check sum in HEX (2..24)
28	CR (HEX 0D) Carriage Return
29	LF (HEX 0A) Line Feed

Telegram structure in case of error:

Character No.	Function
1	$ (HEX 24) dollar
2	W (HEX 57)
3	I (HEX 49)
4	M (HEX 4D)
5	W (HEX 57)
6	V (HEX 56)
7	, (HEX 2C) comma
8	, (HEX 2C) comma
9	R (HEX 52)
10	, (HEX 2C) comma
11	, (HEX 2C) comma
12	K, N, M, S = km/h, Knots, m/s, mph
13	, (HEX 2C) comma
14	V (V = invalid)
15	* (HEX 2A) check sum identification
16	High byte check sum in HEX (2..14)
17	Low byte check sum in HEX (2..14)
18	CR (HEX 0D) Carriage Return
19	LF (HEX 0A) Line Feed

11.7 Telegram 5 VDM

Wind speed, wind direction with extended resolution and supply voltage monitor
Command: TR5   command: TT5
Telegram construction: (STX)VVV.VV DDD.D XX MM*XX(CR)(ETX)

Character No.	Function
1	STX (HEX 02)
2	10^2 wind speed
3	10^1 wind speed
4	10^0 wind speed
5	. decimal point(HEX 2E)
6	10^{-1} wind speed
7	10^{-2} wind speed
8	Leerzeichen (HEX 20)
9	10^2 wind direction
10	10^1 wind direction
11	10^0 wind direction
12	. decimal point (HEX 2E)
13	10^{-1} wind direction
14	Space (HEX 20)
15	Status byte (high byte)
16	Status byte (low byte)
17	Space (HEX 20)
18	Supply voltage monitor (HEX high byte)
19	Supply voltage monitor (HEX low byte)
20	* (HEX 2A) check sum identification
21	High byte check sum in HEX (2..22)
22	Low byte check sum in HEX (2..22)
23	CR (HEX 0D) Carriage return
24	ETX (HEX 03)

Telegram structure in case of error

Character No.	Function
1	STX (HEX 02)
2	'F'
3	'F'
4	'F'
5	. decimal point (HEX 2E)
6	'F'
7	'F'
8	space (HEX 20)
9	'F'
10	'F'
11	'F'
12	. decimal point (HEX 2E)
13	'F'
14	space (HEX 20)
15	Status byte (high byte)
16	Status byte (low byte)
17	space (HEX 20)
18	Supply voltage monitor (HEX High Byte)
19	Supply voltage monitor (HEX Low Byte)
20	* (HEX 2A) check sum identification
21	High byte check sum in HEX (2..22)
22	Low byte check sum in HEX (2..22)
23	CR (HEX 0D) Carriage return
24	ETX (HEX 03)

11.8 Telegram 6 Vx, Vy, Vt

Speed components Vx and Vy

Command: TR6   command: TT6

Telegram construction: (STX)+Vx.x;+Vy.x;+TT.T;SS;CC(CR)(ETX)

Character No.	Function
1	STX (HEX 02)
2	+ or - sign
3	10^1 wind speed X
4	10^0 wind speed X
5	. (HEX 2E) decimal point
6	10^{-1} wind speed X
7	; (semicolon)
8	+ oder - Vorzeichen
9	10^1 wind speed Y
10	10^0 wind speed Y
11	. (HEX 2E) decimal point
12	10^{-1} wind speed Y
13	; (semcolon)
14	+ or - sign
15	10^1 temperature
16	10^0 temperature
17	. (HEX 2E) decimal point
18	10^{-1} temperature
19	; (semicolon)
20	High byte status byte
21	Low byte status byte
22	; (semicolon)
23	High byte check sum in HEX (2..21)
24	Low byte check sum in HEX (2..21)
25	CR (HEX 0D) Carriage Return
26	ETX (HEX 03)

Telegram structure in case of error

Character No.	Function
1	STX (HEX 02)
2	+
3	F
4	F
5	. (HEX 2E) decimal point
6	F
7	; (semicolon)
8	+
9	F
10	F
11	. (HEX 2E) decimal point
12	F
13	; (semicolon)
14	+
15	F
16	F
17	. (HEX 2E) decimal point
18	F
19	; (semicolon)
20	High byte status byte
21	Low byte status byte
22	; (semicolon)
23	High byte check sum in HEX (2..21)
24	Low Byte check sum in HEX (2..21)
25	CR (HEX 0D) Carriage Return
26	ETX (HEX 03)

11.9 Telegram 7 VDT with Gust

Wind speed, wind direction with gust and temperature

command: TR7   command: TT7

Telegram structure: (STX)VVV.V BVV.V DDD BDD ±TT.T *CC(CR)(ETX)

Character No.	Function
1	STX (HEX 02)
2	10^2 wind speed
3	10^1 wind speed
4	10^0 wind speed
5	. decimal point (HEX 2E)
6	10^{-1} wind speed
7	Leerzeichen (HEX 20)
8	10^2 gust of wind speed
9	10^1 gust of wind speed
10	10^0 gust of wind speed
11	. decimal point (HEX 2E)
12	10^{-1} gust of wind speed
13	space (HEX 20)
14	10^2 wind direction
15	10^1 wind direction
16	10^0 wind direction
17	space (HEX 20)
18	10^2 wind direction of gust
19	10^1 wind direction of gust
20	10^0 wind direction of gust
21	Space (HEX 20)
22	+ or - sign of temperature
23	10^1 temperature
24	10^0 temperature
25	. (HEX 2E) decimal point
26	10^{-1} temperature
27	* (HEX 2A) check sum identification
28	High byte check sum in HEX (2..22)
29	Low byte check sum in HEX (2..22)
30	CR (HEX 0D) Carriage return
31	ETX (HEX 03)

Telegram structure in case of error

Character No.	Function
1	STX (HEX 02)
2	F
3	F
4	F
5	. decimal point (HEX 2E)
6	F
7	Space (HEX 20)
8	F
9	F
10	F
11	. decimal point (HEX 2E)
12	F
13	Space (HEX 20)
14	F
15	F
16	F
17	Space (HEX 20)
18	F
19	F
20	F
21	Space (HEX 20)
22	F
23	F
24	F
25	. (HEX 2E) decimal point
26	F
27	* (HEX 2A) check sum identification
28	High byte check sum in HEX (2..22)
29	Low byte check sum in HEX (2..22)
30	CR (HEX 0D) Carriage return
31	ETX (HEX 03)

11.10 Telegram 12 Scientific Telegram

Scientific analysis telegram

Command: TR12   command: TT12

Telegram structure:
WG;WR;VT;V13;V24;T13;T24; C31; C42; C13; C24;N1;N2;N3;N4;TS;TC

WG	Wind speed (7,2;)
WR	Wind direction (6,2;)
VT	Virtual temperature (6,2;)
V13	Speed of distance 13 (7,2;)
V24	Speed of distance 24 (7,2;)
T13	Virtual temperature of distance 13 (7,2;) (last measured value in averaging interval; -273,15 in case of no valid value)
T24	Virtual temperature of distance 24 (7,2;) (last measured value in averaging interval; -273,15 in case of no valid value)
SN	Measuring value run-time converter 3 into direction converter 1 (south direction north) (5;)
WE	Measuring value run-time converter 4 into direction converter 2 (west direction east) (5;)
NS	Measuring value run-time converter 1 into direction converter 3 (north direction south) (5;)
EW	Measuring value run-time converter 2 into direction converter 4 (east direction west) (5;)
PA	Internal counter, pre-averaging(100ms) (5;)
INTER	Time interval for writing the values into the main average memory (5;)
AV	Number of values in the main average memory (5;)
Sth	THIES Status (2;) (hexadecimal display)
STgen	Telegram status , siehe Fehler! Verweisquelle konnte nicht gefunden werden. (hexadecimal display) (4;)
LC	Internal tick-count in ms from processor (7;\r\n)

Meaning (7,2;)   (x;y)

X = number of all digits in the telegram

Y = number of decimal places

z. B. (7;2;) = 0000.00;

11.11 Telegram Addition by Parameter OP

This parameter is used to deliver the direction of the magnetic compass, the housing temperature, and the supply voltage additionally to each telegram, excepted NMEA telegram (TR4/TT4). The output occurs always after the measuring values and before date/time resp. before the check sum when DT=0.

"OP=123" is used to output all parameters in the order of the following table.
Order and number of the optional parameters can be arbitrarily determined by **command OP**.

Telegram construction:

Length	Example	Description	Meas. value error
---	*s. telegram*	*Last measuring value of set telegram.*	*s. telegram*
1	**' ' or ;**	**Space (pre-set telegram separator).**	**' ' or ;**
5	**###.#**	**Direction of magnetic compass [°] (optionally).**	**FFF.F**
1	**' ' or ;**	**Space (pre-set telegram separator).**	**' ' or ;**
5	**###.#**	**Housing temperature [°C].**	**FFF.F**
1	**' ' or ;**	**Space (pre-set telegram separator).**	**' ' or ;**
4	**##.#**	**Supply voltrage [V]**	**FF.F**
---	*s. telegram*	*Date/time when DT>0, or check sum*	*s. telegram*

12 Technical Data

Wind speed	Measuring range	0.02m/s ... 75m/s Scaling of analogue output freely selectable.	
	Accuracy	≤ 5m/s:	± 0.2m/s (rms - mean over 360°).
		5...50m/s:	± 2% of measured value (rms - mean over 360°).
	Resolution	0.1m/s:	in telegrams 1, 2
		0.01m/s:	in telegram 3
Wind direction	Measuring range	0° … 360°, 0° ≙ calm, wind speed < 0,1 m/s.	
	Accuracy	± 2.0° with WS > 2m/s	
	Resolution	1°:	in telegrams 1, 2, 3, 4, 6, 7
		0.1°:	in telegrams 5, 14
Acoustic temperature	Measuring range	-40°C ... +60°C	
	Accuracy	± 0,2 Kelvin at absolutely dry air in the range from +10 °C to + 30 °C, at wind speeds < 15m/s and without heating, and radiant warming of the instrument. The acoustic temperature is not suited for an exact measurement of the air-temperature, as instrument heating and sun radiation at light wind and high wind speeds may falsify the measuring values.	
	Resolution	0.1K	
magnetic compass	Measuring range	1° … 360°	
	Accuracy	Typically <2 ° in magnetically undisturbed environment.	
Data output digital	Interface	RS 485 / RS 422 Electrically isolated from supply	
	Baud rate	1200…921600 bit/s selectable	
	Output	Instantaneous values, sliding means from 100msec to 10min in increments of 100msec freely selectable.	
	Output rate	One per 20msec to one per 60 seconds in increments of 1msec freely selectable.	
	Protocol	ASCII- Thies-Format and MODBUS RTU	

| Data output analogue	Electrical outputs	0/4…20mA; 0/2...10V Electrically isolated from supply.
		Admissible load at current output: ≤ 500Ω
		Permissible burden on voltage output: ≥ 50kΩ.

	Output	Instantaneous values, sliding means from 100msec to 2min in increments of 100msec freely selectable.
	Output rate	Update rate 10msec.
	Resolution	16bit
	Accuracy	≤ 0,2% at power output, ≤ 0,5% at voltage output
General	Internal measuring rate	Wind: up to 500 propagation time measurements per second, up to 125 complete measuring sequences/second incl. calculations.
	Bus mode	Bus mode with up to 99 devices possible (ID0..ID98)
	Firmware update	Firmware update via RS422/485 with 4800Bd..115200Bd 8N1 in full duplex and half duplex mode.
	Temperature range	Operating temperature -40 ... +60°C Storage temperature -55 ... +65°C
Operating voltage	Electronic	8V…40V DC or 12V…28V AC 50Hz / 60Hz; 0,7 W @ 24V
Operating voltage	with heating	24V AC/DC ± 15%, 100 VA typically
	Type of protection	IP 67 (when mounted correctly, see section "Preparation for operation").
Housing	Material	ASI316 (V4A), aluminium hard-anodized, seawater-proof
	Mounting @ 4.3880.00.000	e.g. on mast tube Ø 33.4mm (see dimension drawing)
	Mounting @ 4.3881.00.000	e.g. on mast tube Ø 48,3mm (see dimension drawing)
	Type of connection	8-pin plug connection.
	Weight	approx. 900g

13 Accessories

Connecting cable, complete	507751	15m, 8-pin cable (4 x 0,75mm² + 2x2x0,14mm²) with socket outlet on transmitter side.
PC program Meteo- Online	9.1700.98.001	For visualising and archiving measured data on a PC with WIN7.
Interface converter	9.1702.40.002	For signal conversion: RS422 to USB.
Power supply unit compact	9.3389.10.100	For power supply to the ULTRASONIC ANEMOMETER 2D WP. Primary: 230V AC Secondary: 24V AC, 205VA.
Lightning rod	4.3100.99.000	To protect the sensors.

Other accessories available on request.

14 Dimension drawing 4.3880.00.000

DIN 916-M6x8-45H
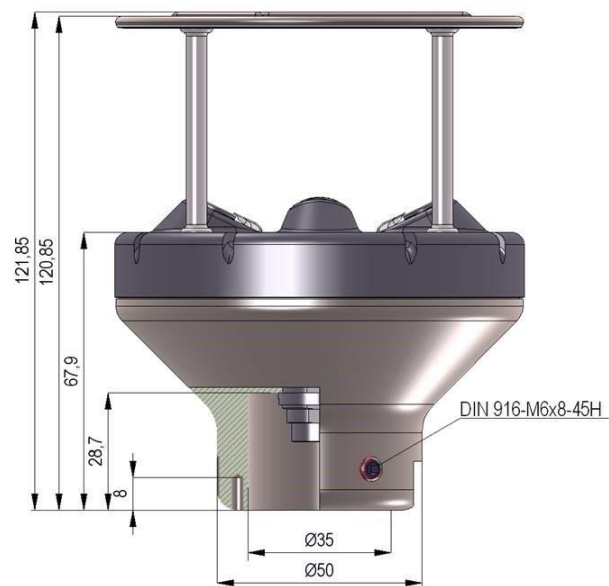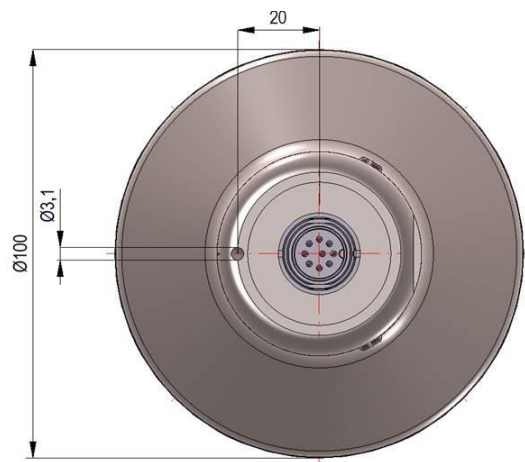
15 Dimension drawing 4.3881.00.000

DIN 916-M8x12-45H

16 EC-Declaration of Conformity

Document-No.: 000609   **Month: 02   Year: 17**

Manufacturer: **A D O L F   T H I E S   G m b H   &   C o. K G**
Hauptstr. 76
D-37083 Göttingen
Tel.: (0551) 79001-0
Fax: (0551) 79001-65
email: Info@ThiesClima.com

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

Description of Product: **Ultrasonic Anemometer 2D WP**

Article No.   **4.3880.00.000   4.3881.00.000**

specified technical data in the document: **021809/02/17**

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

2014/30/EU   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   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

552/2004/EC   Regulation (EC) No 552/2004 of the European Parliament and the Council of 10 March 2004
on the interoperability of the European Air Traffic Management network (the interoperability Regulation)

2011/65/EU   DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

2012/19/EU   DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 4 July 2012 on waste electrical and electronic equipment (WEEE)
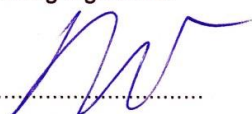
The indicated products comply with the regulations of the directives. This is proved by the compliance with the following standards:

EN 61000-6-2   Electromagnetic compatibility
Immunity for industrial environment

EN 61000-6-3   Electromagnetic compatibility
Emission standard for residential, commercial and light industrial environments

EN 61010-1   Safety requirements for electrical equipment for measurement, control, and laboratory use.
Part 1: General requirements

EN 50581   Technical documentation for the assessment of electrical and electronic products with respect to the restriction
of hazardous substances

Place: Göttingen   Date: 01.02.2017
Signed for and on behalf of:

Legally binding signature: issuer:

....
Thomas Stadie, General Manager   Joachim Beinhorn, Development Manager

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

Please contact us for your system requirements.
We advise you gladly.

ADOLF THIES GMBH & CO. KG
Meteorology and environmental metrology
Hauptstraße 76 · 37083 Göttingen · Germany
Phone +49 551 79001-0 · Fax +49 551 79001-65
info@thiesclima.com

www.thiesclima.com