8.1.2.7 Measurement Delay

Messintervall (Measurement Delay)

Description: Indicates the time in 1ms increments from the beginning of one measurement cycle (4 TOF) to the beginning of the next and thus determines the repetition rate of the wind and acoustic temperature measurement. The parameter MD must always be set longer than the measurement time specified by the parameter AD from the sum of 4 individual TOF measurements. The MD parameter is automatically adjusted for longer times as the AD parameter is increased, but not automatically for shorter times.
In standard operation, the repetition rate is 20ms, so that a complete data set is recorded by all sensors every 20ms.

Values range: 20 ... 15000
Initial value: 20

8.1.2.8 North Correction

North Correction

Description: With the north correction, a constant angle is added to the measured angle. The value is used to correct a known misalignment. For example, if the ULTRASONIC is not aligned directly to the north, but rather to the north-west, the wind direction always shows 45° too little. In this case, a north correction of 45 must be set.
The north correction affects both the wind directions in the data telegrams and the vectorial output values.

Values range: 0 … 359 in 1° steps
Initial value: 0

8.1.2.9 Velocity Deviation

Velocity Deviation as meter per seconds

Description: With the Velocity Deviation parameter, the plausibility threshold of the wind speed scatter from measurement to measurement is set.

Values range: 3 … 10
Initial value: 6

8.1.3 Submodul Telegram

The "Telegram" submodule only contains input values. The table describes the data points. The "Status Word" data point is described in more detail under point 8.1.17 Status Word.

Name	Data type	Description	Unit	Scaling	Min	Max
wind direction	Integer32	wind direction	grad	10	0	3600
wind speed	Integer32	wind speed	m/s	10	0	750
wind speed vector y	Integer32	wind speed vector y	m/s	10	-750	750
wind speed vector x	Integer32	wind speed vector x	m/s	10	-750	750
heater current	Integer32	heater current	Ampere	10	0	100
supply voltage	Integer32	supply voltage	Volt	10	0	800
acoustical temperature	Integer32	acoustical temperature	°C	10	-400	850
housing temperature	Integer32	housing temperature	°C	10	-400	850
air pressure	Integer32	air pressure	hPA	100	26000	126000
data quality	Integer16	data quality	%	1	0	100
live counter	Integer32	live counter	ms	1	0	2147483647
predictive maintenance indicator	Unsigned32	predictive maintenance indicator	‰	1	0	1000
status word	Unsigned16	status word				

Table 3: Description of input data submodule telegram

8.1.4 Submodul PROFIsafe

The "Telegram" submodule only contains input values. Table 4 describes the data points. The "Status Word" data point is described in more detail under point 8.1.17 Status Word.

Name	Datentyp	Description	Unit	Scaling	Min	Max
status word low byte	Unsigned8	status word low byte				
status word high byte	Unsigned8	status word high byte				
data quality	Integer16	data quality	%	1	0	100
live counter	Integer32	live counter	ms	1	0	2147483647
wind direction	Integer32	wind direction	grad	10	0	3600
wind speed	Integer32	wind speed	m/s	10	0	750
wind speed vector y	Integer32	wind speed vector y	m/s	10	-750	750
wind speed vector x	Integer32	wind speed vector x	m/s	10	-750	750
air pressure	Integer32	air pressure	hPA	100	26000	126000

Table 4: Description of input data submodule PROFIsafe

8.1.5 Wind direction

The "wind direction" data point outputs the measured wind direction and is output in degrees with one decimal place.

8.1.6 Wind speed

The "wind speed" data point outputs the measured wind speed and the wind speed is output in meters per second with one decimal place.

8.1.7 Wind speed vector Y

The data point "wind speed vector Y" outputs the proportion of the measured wind speed in a north-south direction. The wind speed is given in meters per second with one decimal place.

8.1.8 Windspeed Vector X

The data point "wind speed vector X" outputs the proportion of the measured wind speed in east-west direction. The wind speed is given in meters per second, with one decimal place.

8.1.9 Heater current

Outputs the heating current in amperes with one decimal place. The current is determined as an RMS value over 100ms.

8.1.10 Supply Voltage

Outputs the supply voltage with one decimal place. The voltage is determined as an RMS value over 100ms.

8.1.11 Accoustical Temperature

The acoustic temperature is measured using the transit times over the measurement sections and is output in degrees Celsius with one decimal place.

8.1.12 Housing Temperature

Outputs the housing temperature measured on the device with one decimal place. The measured value is internally the reference value for the device heating.

8.1.13 Air Pressure

Returns the air pressure in hectopascals with one decimal place. The air pressure is output in absolute terms, there is no compensation for sea level.

8.1.14 Data Quality

Indicates the number of valid values in the mean buffer as a percentage. 100% means that the buffer is completely filled with valid values.

8.1.15 Live Counter

Outputs an internal counter that is incremented every 1 ms. The start value is 0 and when the value 2147483647 is reached, the counter is reset to 0.

8.1.16 Predictive Maintenance Indicator

The status of the ultrasonic converters is output via the predictive maintenance indicator. The value range is between 0 and 1000. New converters have a value of 1000. If the converter degenerates, the value drops. The value is determined over a period of 24 hours.

8.1.17 Status Word

The status word is used in the Telegram submodule. Table 4 describes the individual data points of the status word.

Name	Bit	Description
general warning	0	General warning
general error	1	General error
exceeding max wind speed	2	Exceeding the maximum Wind Speed (Wind Speed will be capped at 750)
operational Temperature!	3	Exceeding the maximum operating temperature
measurement fails internal	4	Measurement fails internal
measurement fails external	5	Measurement fails external
heater malfunction	6	Heater error
power supply failure	7	Power supply failure
status run up	8	The sensor has completed the start-up process
status operation	9	The sensor has assumed the operation status and is ready for operation
status heater active	10	Heating active
status transducer heater active	11	Converter heating active

Table 5: Description status word

8.1.18 Status Byte Low

The status byte low is used in the PROFIsafe submodule. Table 6 describes the individual data points.

Name	Bit	Description
general warning	0	General warning
general error	1	General error
exceeding max wind speed	2	Exceeding the maximum Wind Speed (Wind Speed will be capped at 750)
operational Temperature!	3	Exceeding the maximum operating temperature
measurement fails internal	4	Measurement fails internal
measurement fails external	5	Measurement fails external
heater malfunction	6	Heater error
power supply failure	7	Power supply failure

Table 6: Description Status byte low

8.1.19 Status Byte High

The status byte high is used in the PROFIsafe submodule. Table 7 describes the individual data points.

Name	Bit	Description
status run up	0	The sensor has completed the start-up process
status operation	1	The sensor has assumed the operation status and is ready for operation
status heater active	2	Heating aktiv
status transducer heater active	3	Transducer heater active

Table 7: Description State High

8.1.20 F_Dest_Add

The sensor is delivered from the factory with the destination address 392. The address can be changed later via the web interface, under the PROFINET tab.

8.1.21 F_Src_Add

The sensor is delivered from the factory with the source address 1024. The address can be changed later via the web interface, under the PROFINET tab.

8.1.22 F_iPar_Crc

The iParameter CRC is calculated in the sensor from the parameters written by the controller and compared with the F_Dest_Add. If the CRC does not match, bit 4 "FV_activated" is set in the status byte. The calculation of the iParameter CRC is described in point 8.2.3 iParameter CRC.

8.1.23 F_SIL

Only the value NoSIL can be selected for the F_SIL parameter. The device **does not** meet a safety integrity level.

8.2 Web interface

A web interface is available in addition to the PROFINET interface. The web interface can be accessed by entering the IP address in the web browser. Current measured values can be read out via the interface, the time can be set, a firmware update can be carried out and the iParameter CRC can be calculated. Figure 3 shows the start page of the sensor.

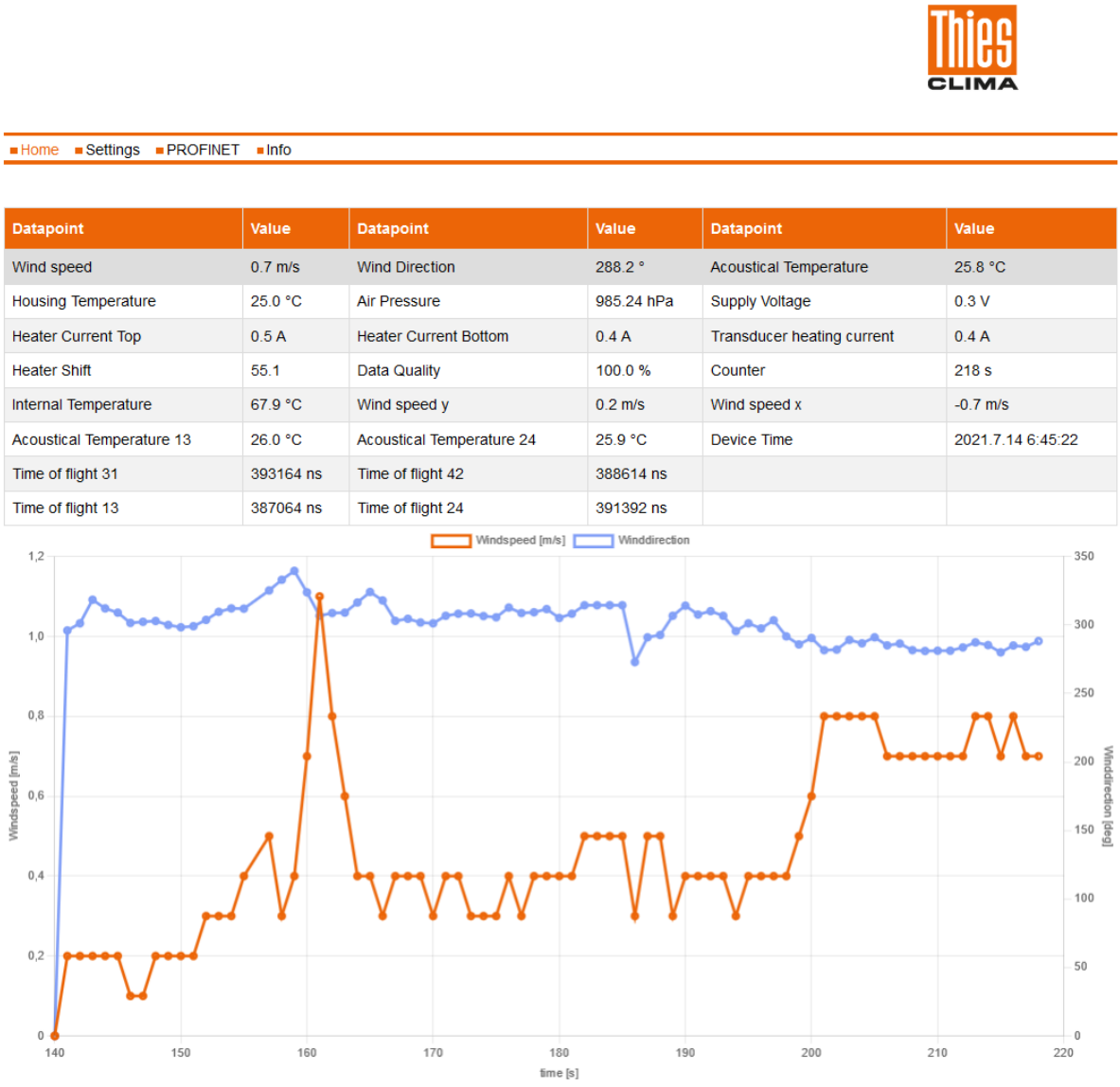


Figure 3: Web interface

8.2.1 Setting the time

The time can be set via the "Settings" tab. Two different times can be set. Once the UTC and the local time provided by the operating system. There is no automatic changeover between winter and summer time on the device. The time is set using the "Set UTC Time" and "Set Local Timer" buttons and is applied directly.

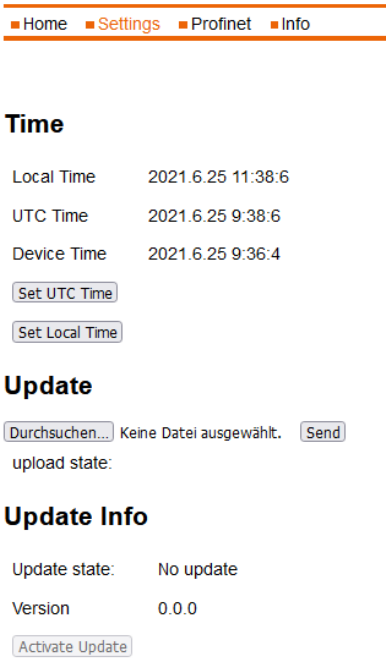


Figure 4: Web interface Settings

8.2.2 Firmware Update

The firmware can also be updated via the web interface. The update file is selected with the "Browse" button and transferred to the device with the "Send" button. The current status is displayed after "upload state". It says "uploading..." while the update is being sent. If the transfer is successful, "success" is displayed. In the event of a faulty transmission, "error". If the transfer was successful, the status of the update file (OK, faulty file...) and the version are displayed under "Update Info". An update can only be carried out with a more recent version. The new update can be activated using the "Activate Update" button and the device restarts with the new version. To check the version, the current software version can be read out in the "Info" tab.

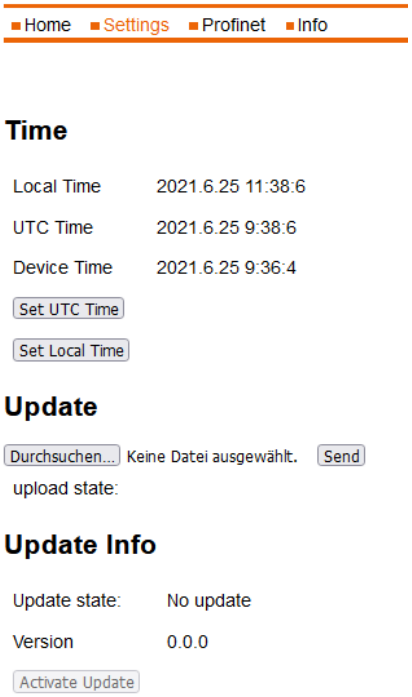


Figure 5: Web interface Update

8.2.3 iParameter CRC

The parameters set in section 8.1.2 Parameterization are checked with a 32-bit CRC. The calculation can be done via the "PROFINET" tab. The same settings must be made in the input mask as in the programming environment. Behind the input fields, a cross or a tick indicates whether the input was valid or not. The actual calculation is started with the "Calculate iPar CRC" button and then displayed. The calculated CRC can now be copied into the programming environment in the PROFIsafe submodule. If the expected CRC does not match the calculated CRC on the device, the device sends a diagnosis message "0x4B Inconsistent iParameters (iParCRC error)". The message can be read from the alarm list of the controller.

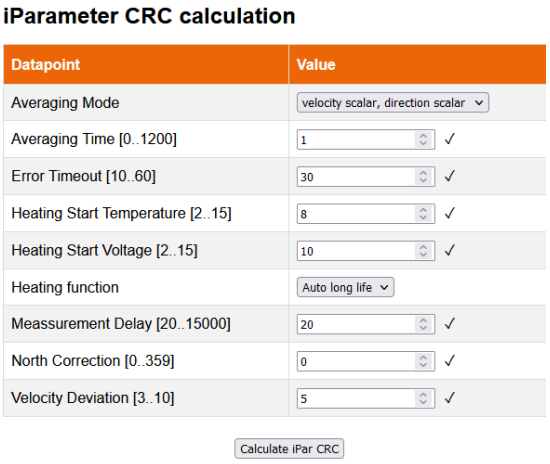


Figure 6: Calculation of iParameter CRC

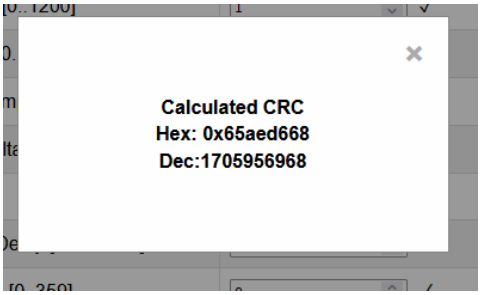


Figure 7: Display of the calculated CRC

8.3 Instantaneous Values and Output of Raw Measured Values

The output of instantaneous values is generally a special case. Due to the high acquisition speed for the measured values averaging of the data is sensible in most cases. If instantaneous Values range: are to be output, averaging must not be switched on. The parameter AV should be set to '0': see 8.1.2 Parameterization.

8.3.1 Averaging

Given the high data acquisition rate averaging is to be recommended in most cases. The averaging period is freely selectable from 100ms to 120 seconds within wide limits. See 8.1.2 Parameterization.

It is a basic rule 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 range: do not influence the averaging result. The content level of the averaging buffer is shown in the status value of the ULTRASONIC. It is the ratio between the memory actually occupied and the maximum required memory (calculated value).

The Ultrasonic 2D compact incorporates two different practical procedures for averaging:

- one **procedure for generating vectorial mean values** and
- one **procedure for generating scalar mean values**

These different procedures can be selected for averaging wind velocity as well as wind direction depending on the actual application.
Vectorial averaging involves the wind direction for averaging of the wind velocity, and wind velocity for averaging of the wind direction.
Both averaged variables, wind velocity and wind direction, thus each undergo evaluation with the other measured variable.
This averaging procedure is very suitable e.g. for measuring and evaluating the propagation of pollutants.
Scalar averaging averages both variables, wind velocity and wind direction, independently of each other.
This averaging procedure leads to comparable results with mechanical wind velocity and wind

direction pickups.
The scalar averaging procedure is suitable e.g. for location analysis for wind turbines where only the wind vector variable relevant for the generation of energy is of interest and not its direction.
The vectorial and scalar procedure can be used within one output telegram independently of the wind velocity and wind direction see 8.1.2 Parameterization.

8.4 Behaviour of Instrument under extreme Conditions of Measurement Value Acquisition

The ULTRASONIC is equipped with a highly effective internal fault detection and correction system. This allows it to detect incorrect measured values using the history and to correct them where possible. It cannot however be ruled out that the ULTRASONIC will get into a situation in which the acquisition of new data is impossible. In this case the error bits are set in the status values and a defined value possibly output at the analogue outputs.

It is a basic rule that the measured values output are always valid and can be interpreted by the target system (unless a specific error telegram is output in the in the case of error). In the case of error might happen that the data become 'too old', i.e. they are not updated over a certain time and freeze. In the event of an error, it can happen that the data becomes 'too old', i.e. it is not updated for a certain time and freezes. In this case, the error bits are set in the status byte.

8.5 Behaviour in Case of Error

An error case occurs in the following circumstances:

Averaging time(AV) < 30s, see “ET“ Command Error Timeout	An error is output in case that for a time period of > 30s (s. “ET“) no new measuring value has been detected.
Averaging time >= 30s pre-set error Timeout, see command ET	An error is output in case that the averaging buffer does include no more valid values.

8.5.1 Behaviour of Analogue Outputs

If the analogue outputs are active, they are switched to the minimum or maximum value in the case of error. The parameter EI determines which of the two values is output: see **8.15 Status Word.**

8.5.2 Behaviour of Telegram Output

In the case of error the relevant error telegram is output. In parallel the error information is shown in the status byte: see **Fixed telegram formats**.

8.6 Output of all System Parameters

Most parameters of the ULTRASONIC are stored internally in an EEPROM. The command SS can be used to output all stored parameters.
Before amending parameters it is recommended making a backup copy of existing settings and storing them in a text file.

8.7 Enquiry about Software Version

The software version can be read out via PROFINET or via the webpage.

8.8 Plausibility

To identify incorrectly measured values the ULTRASONIC offers an internal plausibility check, which assesses measured values using the history. Incorrect measured values can be caused for example by heavy rainfall or foreign bodies in the measurement path.
If an incorrect measured value is identified, the ULTRASONIC sets its acquisition of measured values to the maximum speed. In this mode it is more likely to obtain a valid measured value in fault conditions (e.g. horizontal rain). A complete data record is now made every 12ms using all 4 sensors so that the ULTRASONIC generates approx. 80 measured values per second.

9 Technical Data

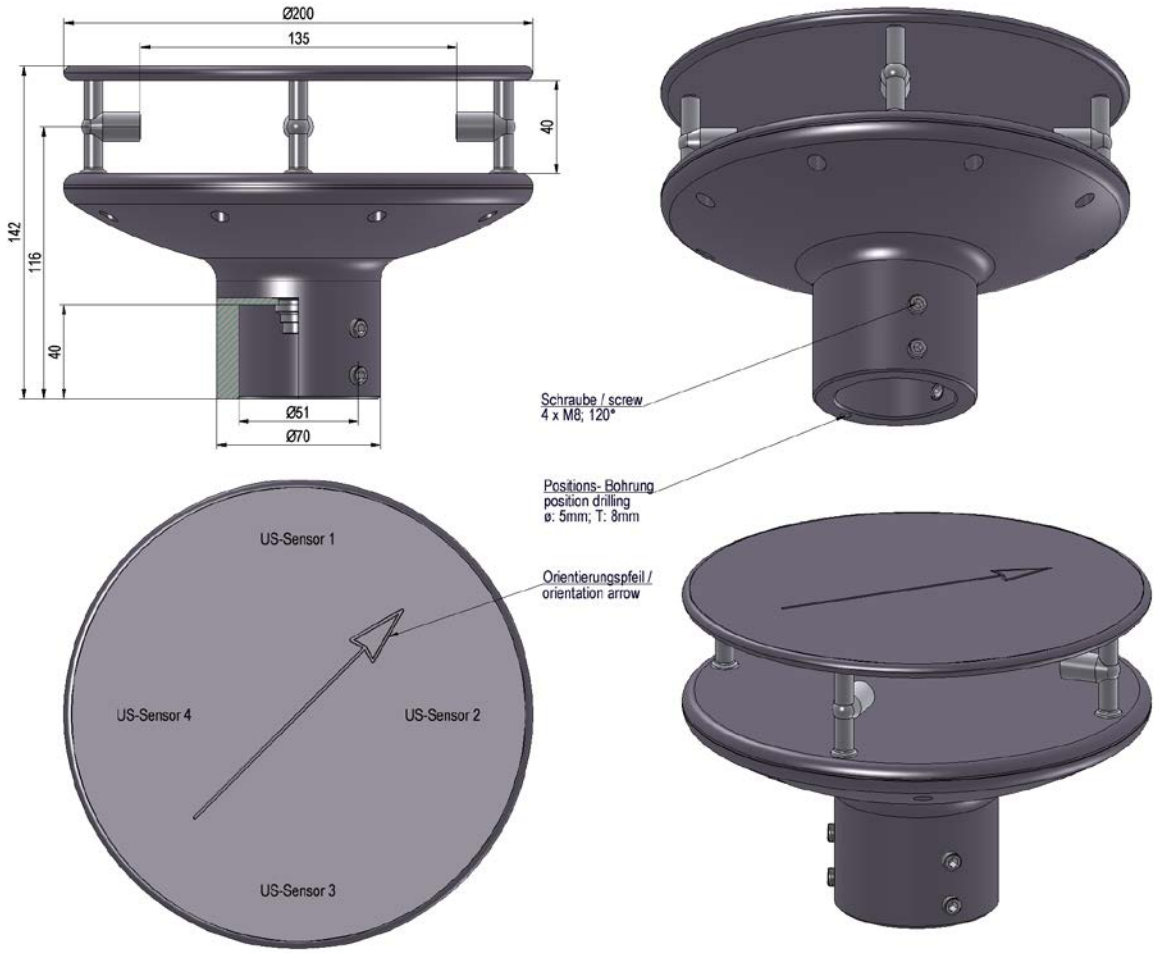
Wind velocity	Measuring range	0.01 ... 75m/s Scaling of analogue output freely selectable	
	Accuracy	≤5m/s:	±0.2m/s (rms, mean over 360°)
		5 … 60m/s:	±2% of meas. value (rms- mean over 360 °)
		60 … 75m/s:	±3% of meas. value (rms- mean over 360 °)
	Resolution	0.1m/s:	
		0.01m/s:	
Wind direction	Measuring range	0 ... 360°	
	Accuracy	± 2.0° at WV >1m/s	
	Resolution	1°:	
		0.1°:	
Virtual temperature	Measuring range	-50 ... +70 °C	
	Accuracy	±2.0K	
	Resolution	0.1K (in the telegrams 2 and 7	
Air pressure	Measuring range	300 ...1100hPa	
	Accuracy	± 0.25hPa @ 700 ... 1050hPa and +25 ...+40 °C ± 2.0hPa @ 300 ... 1100hPa, -40...+60 °C and activated heating	
	Resolution	0.1hPa	
	Long-term stability	< ± 1hPa per year	
Data output digital	Interface	PROFINET V2.42 CLASS B, PROFIsafe V2.6.1, Webinterface	
	Data rate	10-Mbit/s, 100-Mbit/s	
	Conformance Class	B	
	Netload Class	III	
General	Internal measuring rate	Up to 1000 runtime-measurements per seconds, up to 250 complete measurement sequences/second inclusive calculations	
	Firmware update	Firmware update via Ethernet	

	Temperature range	Operating temperature - 50 ... + 80 °C heated - 30 ... + 80 °C unheated Storing - 50 ... + 80 °C Measuring operation possible with heating up to -75°C at temperatures > - 60°C a lower MTBF is to be expected.
	safety integrity level	Not certified
Operating voltage	Supply w/o heating	U: 15V... 48V DC P: typ. 4,5W, max. 6W SELV or PLEV
Operating voltage	Supply with heating	U: 48V DC ± 2% P: typ. 240 W, max. 250 W SELV or PLEV
	Protection	IP 68 - applies with proper installation, see section 4. Preparation for operation
Icing resistance	W/o US converter heating	Acc. to THIES STD 012001
Icing resistance	With US converter heating	Acc. to THIES STD 012002
Icing resistance	With US converter heating	Acc. to MIL-STD-810G, METHOD 521.3, 2008/10 Configuration: Initial value
Housing		Aluminium, seawater-resistant Surface: hard-anodized with basic colouring Coat thickness: 40 … 60µm
	Installation type	e.g. Mast tube Ø 50mm (see dimension drawing)
	Connection type	8-pole plug connection in shaft
	Weight	approx. 2kg

Note on the operating voltage:

An AC supply of 15 ... 34V AC is possible, but in this case the heating output < 250VA and icing resistance according to the Thies standard are not guaranteed.

10 Dimension Drawing



11 Accessories (available as optional features)

Lightning rod	**4.3100.99.150**	As lightning protection
Nordring	**508696**	Dient als Montage- und Ausrichthilfe.

12 EC-Declaration of Conformity

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

Product: Ultrasonic Anemometer 2D compact

Doc. Nr. 2010-44659_CE

Article Overview:

4.3877.27.000	4.3877.07.000

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

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

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

DIN EN 55011+A1:2017	2018-05	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement (CISPR 11:2015, modified + A1:2017); German version EN 55011:2016 + A1:2017
DIN EN 61000-4-2	2009-12	Electromagnetic Compatibility (EMC) - Part 4-2: Testing and measuring procedures - Testing of immunity to static electricity discharge
DIN EN 61000-4-3	2011-04	Electromagnetic compatibility (EMC) - Part 4-3: Test and measurement procedures - Testing of immunity to high-frequency electromagnetic fields
DIN EN 61000-4-4	2013-04	Electromagnetic compatibility (EMC) - Part 4-4: Test and measurement methods - Testing of immunity to fast transient electrical disturbances / burst
DIN EN 61000-4-5	2019-03	Electromagnetic compatibility (EMC) - Part 4-5: Test and measurement procedures - Testing of immunity to surge voltages
DIN EN 61000-4-6	2014-08	Electromagnetic compatibility (EMC) - Part 4-6: Test and measurement methods - Immunity to conducted disturbances, induced by high-frequency fields
DIN EN 61000-4-8	2010-11	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test (IEC 61000-4-8:2009); German version EN 61000-4-8:2010
DIN EN 61000-4-9	2017-05	Electromagnetic compatibility (EMC) - Part 4-9: Testing and measurement techniques - Impulse magnetic field immunity test
DIN EN 61000-4-10	2018-01	Electromagnetic compatibility (EMC) - Part 4-10: Testing and measurement techniques - Damped oscillatory magnetic field immunity test (IEC 61000-4-10:2016); German version EN 61000-4-10:2017
DIN EN 61000-6-1	2019-11	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments (IEC 61000-6-1:2016)
DIN EN 61000-6-2	2019-11	Electromagnetic compatibility Immunity for industrial environment
DIN EN 61000-6-3:2007 + A1:2011	2011-09	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments
DIN EN 61000-6-4	2020-09	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4:2018)
DIN EN 61010-1	2020-03	Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements
DIN EN 61326-1	2013-07	Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements
DIN EN 63000	2019-05	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Legally binding signature:

General Manager - Dr. Christoph Peper

Legally binding signature:

Development Manager - ppa. Jörg Petereit

This declaration certificates the compliance with the mentioned directives, however does not include any warranty of characteristics.

Please pay attention to the security advises of the provided instructions for use.

13 UK-CA-Declaration of Conformity

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

Product: Ultrasonic Anemometer 2D compact

Doc. Nr. 2010-44659_CA

Article Overview:

4.3877.27.000	4.3877.07.000

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

1091	08.12.2016	The Electromagnetic Compatibility Regulations 2016
1101	08.12.2016	The Electrical Equipment (Safety) Regulations 2016
RoHS Regulations 2012	01.01.2021	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
3113	01.01.2021	Regulations: waste electrical and electronic equipment (WEEE)

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

BS EN 55011+A2:2016	31.05.2016	Industrial, scientific and medical equipment. Radio-frequency disturbance characteristics. Limits and methods of measurement
BS EN 61000-4-2	31.05.2009	Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrostatic discharge immunity test
BS EN IEC 61000-4-3	04.11.2020	Electromagnetic compatibility (EMC). Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test
BS EN 61000-4-4	30.11.2012	Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrical fast transient/burst immunity test
BS EN 61000-4-5+A1	30.09.2014	Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test
BS EN 61000-4-6	28.02.2014	Electromagnetic compatibility (EMC). Testing and measurement techniques. Immunity to conducted disturbances, induced by radio-frequency fields
BS EN 61000-4-8	30.04.2014	Electromagnetic compatibility (EMC). Testing and measurement techniques. Power frequency magnetic field immunity test
BS EN 61000-4-9	31.10.2016	Electromagnetic compatibility (EMC). Testing and measurement techniques. Impulse magnetic field immunity test
BS EN 61000-4-10	31.03.2017	Electromagnetic compatibility (EMC). Testing and measurement techniques. Damped oscillatory magnetic field immunity test
BS EN 61000-6-1	28.02.2007	Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments
BS EN IEC 61000-6-2	25.02.2019	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
BS EN IEC 61000-6-3	30.03.2021	Electromagnetic compatibility (EMC). Generic standards. Emission standard for equipment in residential environments
BS EN IEC 61000-6-4	30.09.2019	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments
BS EN 61010-1+A1	31.03.2017	Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements
BS EN IEC 61326-1	07.06.2021	Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements
BS EN IEC 63000	10.12.2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

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

Legally binding signature:

General Manager - Dr. Christoph Peper

Legally binding signature:

Development Manager - ppa. Jörg Petereit

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

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