1. Range of Application

The **Ultrasonic Anemometer 2D** is designed to detect the horizontal components of wind velocity and wind direction as well as the virtual temperature in two dimensions. Due to its very short measurement intervals, the instrument is ideal for the inertia free measurement of gusts and peak values.
The accuracy of the air temperature measurement (virtual temperature) surpasses that one of the classic method where the temperature transmitter is used in a weather and thermal radiation shield.
The measured data are available as analogue signals or as a data telegram over a serial interface. The anemometer is equipped with an automatic heating for the instrument body as well as for the sensors so that the measuring results, in case of critical ambient temperatures, are not affected by ice, snow or rainfall.

2. Mode of Operation

The **Ultrasonic Anemometer 2D** consists of 4 ultrasonic transformers, in pairs of 2 which are opposite each other at a distance of 200 mm.
The two measurement paths thus formed are vertical to each other.
The transformers act both as acoustic transmitters and acoustic receivers.
The respective measurement paths and their measurement direction are selected via the electronic control. When a measurement starts, a sequence of 8 individual measurements in all 4 directions of the measurement paths is carried out at maximum speed.
The measurement directions (acoustic propagation directions) rotate clockwise, first from south to north, then from west to east, from north to south and finally from east to west.
The mean values are formed from the 8 individual measurements of the path directions and used for further calculations.
A measurement sequence takes approx. 20 msec at +20°C.

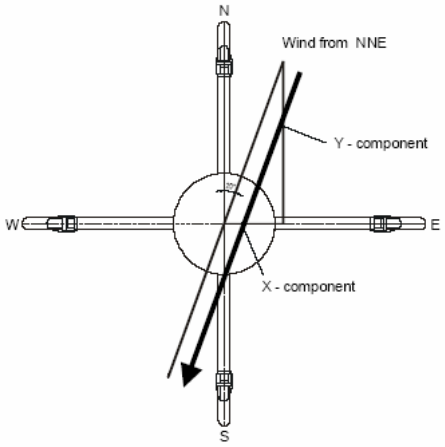
Feingerätebau K.Fischer GmbH
Venusberger Straße 24
D-09430 Drebach
Germany

Phone +49 (0) 37341 / 487-0
Fax +49 (0) 37341 / 487-30
E-mail info@meteoclima.de
Internet www.meteoclima.de

3. Measurement Principle

3.1 Wind velocity and direction

The speed of propagation of the sound in calm air is superposed by the velocity components of an air flow in wind direction.
A wind velocity component in the direction of the propagation of the sound supports the speed of propagation, thus leading to an increase in the speed. A wind velocity component opposite to the direction of propagation, on the contrary, leads to a reduction of the speed of propagation.
The speed of propagation resulting from the superposition leads to different propagation times of the sound at different wind velocities and directions over a fixed measurement path.
As the speed of sound is very dependent on the air temperature, the propagation time of the sound is measured on both of the measurement paths in **both** directions. In this way, the influence of the temperature dependent speed of sound on the measurement result can be eliminated by subtracting the reciprocals of the measured propagation times.
By combining the two measuring paths which are at right angles to each other, one obtains the measurement results of the sum and the angle of the wind velocity vector in the form of rectangular components.
After the rectangular velocity components have been measured over the measurement path, they are then transformed by the µ-processor of the anemometer into polar coordinates and output as sum and angle of wind velocity.



3.2 Virtual Temperature

As previously mentioned, the speed of the propagation of sound is highly dependent on the air temperature, but is hardly affected by air pressure and humidity. Thus these physical properties of gases can be used to measure air temperature.
As this is a measurement of gas temperature which is made without thermal coupling to a measurement sensor, it is called the "virtual temperature".
The advantages of this measured variable is, on the one hand, its inertia free reaction to the actual gas temperature, and, on the other, the avoidance of measurement errors such as those which occur when a solid state temperature sensor is heated up by radiation.
Measuring sensors in a weather and thermal radiation shield show values which are, on the one hand, too high, due to sun irradiation, and on the other hand too low, due to evaporation cooling with rain and wind. The measuring errors of those thermometers in practice can be up to ± 2 °K.
The 2D-Anemometer achieves a measuring accuracy of ± 1 °K over the entire temperature range from 40 °C to + 70°C, thus offering a very precise determination of the air temperature without the disadvantages caused by the use in a weather and thermal radiation shield.

4.Technical Data:

Wind velocity

Measuring range	0...60 m/s
Resolution	0.1 m/s
Accuracy	± 0,1 m/s at, 0 ... 5 m/s resp. 2% ±0,1 m/s from meas. value > 5 m/s

Wind direction

Measuring range	0...360°
Resolution	1°
Accuracy	± 1.5°

Virtual Temperature

Measuring range	- 40...+70 °C
Accuracy	± 1 °C (-30...+50 °C ±0.5 °K)
Resolution	0.1 °C

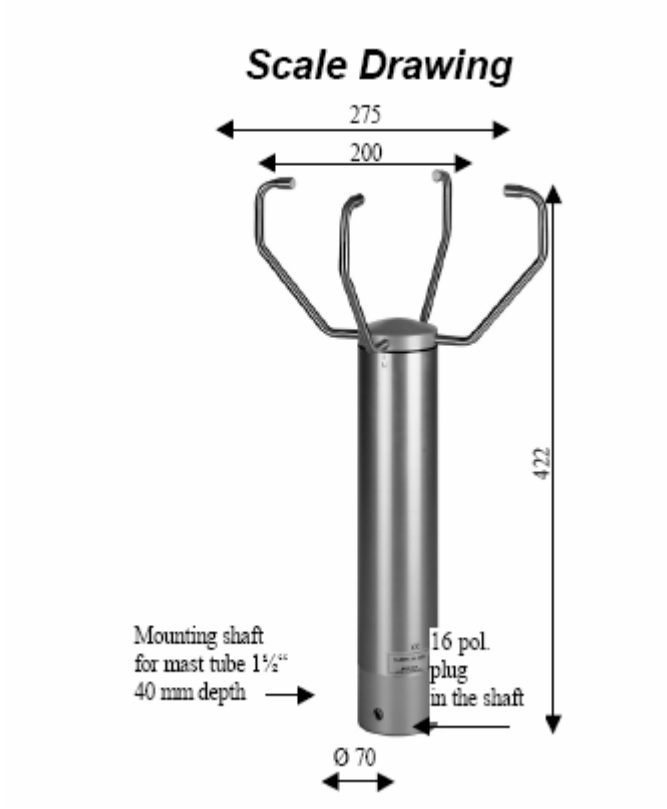
Dat output digital

Interface	RS 422/485
Baud rate	1200, 2400, 4800, 9600, 19200 adjustable
Output	Instantaneous value
Direction vectorial	Gliding mean values 1 sec.; 10 sec.; 1 min.; 2 min.; 10 min.
Output rate	10 per second
Status identification	heater, transformer, electronic

General

Internal meas. Rate	ca. 400 Hz at 25 °C
Operating voltage	
Electronic	12...24 V AC/DC, max. 3 VA
Heater	24 v AC/DC, max. 70 VA
Temperature range	- 40 ... +70 °C
Mounting	to a mast tube 1½", for ex. DIN 2441
Type of connection	16 pole plug connection in the shaft
Weight	approx. 2.5 kg

5. Plug Connection Assignment



Pin-No.	Function	Remark
1 (A)	Analogue output current WV	0 / 4 – 20 mA
2 (B)	Analogue output current WD	0 / 4 – 20 mA
3 (C)	Analogue Ground	AGND
4 (D)	Analogue output voltage WV	0 / 2 – 10 V
5 (E)	Analogue output voltage WD	0 / 2 – 10 V
6 (F)	TX+	serial interface
7 (G)	RX+	serial interface
8 (H)	GND	serial interface
9 (I)	RX-	serial interface
10 (K)	TX-	serial interface
11 (L)	Power electronics 12 ...24V AC/DC	
12 (M)	Power electronics 12 ... 24V AC/DC	
13 (N)	Power heater 24 V AC/DC	bridged with PIN 14
14 (O)	Power heater 24 V AC/DC	bridged with PIN 13
15 (P)	Power heater 24 V AC/DC	bridged with PIN 16
16 (R)	Power heater 24 V AC/DC	bridged with PIN 15

5.1 Remarks concerning Power Supply of Instrument:

The connecting cables for the heating (13 u. 14; 15 u. 16) must be bridged on the supply side in order to guarantee the complete heating power!
The electronics is additionally supplied uncoupled via diodes through the heating connections 13,14, and 15, 16. If the heating voltage exceeds the supply voltage the heating voltage takes on the supply of the electronics.

6. Interface Description

Wind speed and wind direction
Telegram 00001 VD

Command: TR00001 Command: TT00001
Construction of telegram:
VD (STX)xx.x xxx*xx(CR)(ETX)

CH. NO.	Function
1	STX (HEX 02)
2	10^1 wind velocity
3	10^0 wind velocity
4	. (HEX 2E) decimal point
5	10^{-1} wind velocity
6	Blank character (HEX 20)
7	10^2 wind direction
8	10^1 wind direction
9	10^0 wind direction
10	* (HEX 2A) checksum identifier
11	High byte checksum in HEX (2..9)
12	Low byte checksum in HEX (2..9)
13	CR (HEX 0D) Carriage return
14	ETX (HEX 03)

Telegram output in case of error

CH. NO.	Function
1	STX (HEX 02)
2	'F'
3	'F'
4	. (HEX 2E) decimal point
5	'F'
6	Blank character (HEX 20)
7	'F'
8	'F'
9	'F'
10	* (HEX 2A) checksum identifier
11	High byte checksum in HEX (2..9)
12	Low byte checksum in HEX (2..9)
13	CR (HEX 0D) Carriage return
14	ETX (HEX 03)

Wind speed, wind direction, acoustic-virtual temperature
Telegram 00002 VDT Command: TR00002 command: TT00002
Construction of telegram:
(STX)xx.x xxx xxx.x xx*xx(CR)(ETX)

CH. NO.	FUNCTION
1	STX (HEX 02)
2	10^1 wind velocity
3	10^0 wind velocity
4	. (HEX 2E) decimal point
5	10^{-1} wind velocity
6	Blank character (HEX 20)
7	10^2 wind direction
8	10^1 wind direction
9	10^0 wind direction
10	Blank character (HEX 20)
11	+ or - sign
12	10^1 temperature
13	10^0 temperature
14	. (HEX 2E) decimal point
15	10^{-1} temperature
16	Blank character (HEX 20)
17	High byte status byte
18	Low byte status byte
19	* (HEX 2A) checksum identifier
20	High byte checksum in HEX (2..18)
21	Low byte checksum in HEX (2..18)
22	CR (HEX 0D) Carriage return
23	ETX (HEX 03)

Telegram output in case of error

CH. NO.	FUNCTION
1	STX (HEX 02)
2	'F'
3	'F'
4	. (HEX 2E) decimal point
5	'F'
6	Blank character (HEX 20)
7	'F'
8	'F'
9	'F'
10	Blank character (HEX 20)
11	+ or - sign
12	'F'
13	'F'
14	. (HEX 2E) decimal point
15	'F'
16	Blank character (HEX 20)
17	High byte status byte
18	Low byte status byte
19	* (HEX 2A) checksum identifier
20	High byte checksum in HEX (2..18)
21	Low byte checksum in HEX (2..18)
22	CR (HEX 0D) Carriage return
23	ETX (HEX 03)

Telegram 00003 V4DT Command TR00003 Command: TT00003
Construction of telegram: (STX)xxx.x xxx xxx.x x xx*xx(CR)(ETX)

CH. NO.	FUNCTION
1	STX (HEX 02)
2	10^2 wind velocity
3	10^1 wind velocity
4	10^0 wind velocity
5	. (HEX 2E) decimal point
6	10^{-1} wind velocity
7	Blank character (HEX 20)
8	10^2 wind direction
9	10^1 wind direction
10	10^0 wind direction
11	Blank character (HEX 20)
12	+ or - sign
13	10^1 temperature
14	10^0 temperature
15	. (HEX 2E) decimal point
16	10^{-1} temperature
17	Blank character (HEX 20)
18	K, N, M, S = km/h, Knots, m/s, mph
19	Blank character (HEX 20)
20	High byte status byte
21	Low byte status byte
22	* (HEX 2A) checksum identifier
23	High byte checksum in HEX (2..21)
24	Low byte checksum in HEX (2..21)
25	CR (HEX 0D) Carriage return
26	ETX (HEX 03)

Telegram output in case of error

CH. NO.	FUNCTION
1	STX (HEX 02)
2	'F'
3	'F'
4	'F'
5	. (HEX 2E) decimal point
6	'F'
7	Blank character (HEX 20)
8	'F'
9	'F'
10	'F'
11	Blank character (HEX 20)
12	+ or - sign
13	'F'
14	'F'
15	. (HEX 2E) decimal point
16	'F'
17	Blank character (HEX 20)
18	K, N, M, S = km/h, Knots, m/s, mph
19	Blank character (HEX 20)
20	High byte status byte
21	Low byte status byte
22	* (HEX 2A) checksum identifier
23	High byte checksum in HEX (2..21)
24	Low byte checksum in HEX (2..21)
25	CR (HEX 0D) Carriage return
26	ETX (HEX 03)

Telegram 00004 NMEA NMEA V 2.0 Command: TR00004 Command TT00004
Construction of telegram: $WIMWV,xxx.x,R,xxx.x,N,A*xx(CR)(LF)

CH. 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 velocity
17	10^1 wind velocity
18	10^0 wind velocity
19	. (HEX 2E) decimal point
20	10^{-1} wind velocity
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) checksum identifier
26	High byte checksum in HEX (2..24)
27	Low byte checksum in HEX (2..24)
28	CR (HEX 0D) Carriage return
29	LF (HEX 0A) Line feed

Telegram output in case of error

CH. 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) checksum identifier
16	High byte checksum in HEX (2..14)
17	Low byte checksum in HEX (2..14)
18	CR (HEX 0D) Carriage return
19	LF (HEX 0A) Line feed

6.2 Definition of Checksum and Status byte

6.2.1 Forming of Checksum

The checksum is the result of the byte-wise EXOR-combination of the bytes output in the telegram. The EXOR-combination comprises all bytes between the telegram start sign „STX", or "$" within the NMEA telegram,
and the byte "*" as identifier for starting the checksum.
Thus, the bytes „STX" or. „$" and „* " will not be taken into consideration with the checksum calculation!

6.2.2 Definition of Status Byte

The status byte contains information about the current state of the system.
The information comprises:
? error events with the measurement value acquisition
? a possible de-calibration caused, e.g., by a change in the measurement path length (due to mechanical deformation of the transducer carrying arms)
? the operation state of the instrument heating.

Bit 0	**0 = no error**	**1 = general error event, measurement value probably correct, measurement value acquisition disturbed**
Bit 1	**0 = no error**	**1 = error event, deviation of the virtual temperature between both measurement paths is > 8 K.**
Bit 2	**reserved**	
Bit 3	**0 = heating switched off**	**1 = Heating switched on**
Bit 4 to 7	**reserved**	

The error event reported by Bit 0 does not necessarily cause the output of an erroneous measurement value.
Certain weather conditions like extreme precipitation and snowfall may disturb the measurement acquisition for a short time, caused by sonic burst-echoes at the precipitation particles.
Such an event, however, is realized by a plausibility-algorithm, which leads to an immediate re-measurement of the instrument – until a correct value is available.
The output measurement value is generally correct, in spite of the reported error, and does not contain the erroneous data.
If Bit 1 is continuously set during the operation, you should reckon on a de-calibration of the instrument due to mechanical deformation of the measurement arms.

6.3 Analogue Value Output

The analogue output is available only for wind speed, and wind direction.
The output signal of the wind speed (U;I) corresponds to a measuring range 0...60 m/s.
e.g.: 0-20 mA = 0...60 m/s
The measuring range of the wind direction 0...360 ° or 0...540° is selectable, and corresponds to the output
signal e.g. 0…20 mA = 0…360°
WR – relation at 0..360° :
0° / 360° = north; 90° = east; 180° = south; 270° = west
WR – relation at 0..540° (acc. to VDI 3786 sheet 2):
0° = west; 90° = north; 180° = east; 270° = south; 360° = west; 450° = north; 540° = east
Remark: In case of calm the output signal is always "North".

6.4 Telegram Output and Analogue Value Output in Case of Error Events

In the following cases the digital telegram outputs „F" as measurement value figure instead of numbers:

- ➔ If the measurement acquisition is constantly disturbed for more than 10 seconds in spite of multiple measurements
- ➔ If the deviation of the virtual temperature between both measurement paths is > 8 K**.**

In this case the analogue outputs are set on the maximum voltage-/current value(10V, 20mA).

Averaging Procedure:

The Ultrasonic 2D forms the gliding mean value through a FIFO-memory the capacity of which comprises upto 600 values.
In the free running measurement mode the measurement data rate is exactly 10 Hz or 100msec, and forms, at the same time, the updating rate for the averaging memory (FIFO-memory).
If averaging is requested the measured data are recorded in the FIFO-memory stated above, the capacity of which is built-up depending on the selected averaging period.
If the averaging period is, for example, 10 seconds, 100 memory cells are used, and in case of an averaging period of 1 minute 600 cells.
From a selected averaging period > 1 minute up the data flow will be pre-averaged; because the memory capacity of 600 values cannot be exceeded.
The Ultrasonic 2 D combines two different and useful procedures of mean value forming:

- ? The forming of vectorial mean values
- ? The forming of scalar mean values

These different procedures can be selected for the averaging of both the wind speed and wind direction, depending on the application.
The procedure of forming the vectorial mean value takes the wind direction into account when averaging the wind speed and vice versa.
Thus, the averaged dimensions of wind speed and wind direction are valued each one with the other.
This procedure of forming the mean value is well suited, for example, for measurements and analysis of pollutant-propagation.
The procedure of forming the scalar mean value averages both dimensions of wind speed and wind direction independently from each other.
These averaging procedures lead to results comparable with mechanical wind speed- and wind direction transmitters.
The scalar averaging procedure is suited, for example, for location-analysis for wind power plants, where only the dimension of the wind vector – important for power generation – is interesting but not its direction.
The vectorial and scalar procedure can be used independently with wind speed and wind direction within an output telegram.
For this, you have to select one of the four possible combinations through the command **AM** (**Average Method)**.

Command for selecting the averaging procedure:

AM00000 (Average Method) vectorial averaging of speed and direction
AM00001 scalar averaging of speed and direction
AM00002 scalar averaging of speed and vectorial averaging of direction
AM00003 vectorial averaging of speed and scalar averaging of direction

8. Standard Deviation

Starting with the firmware version V 1.8 the ULTRASONIC is capable to calculate the standard deviation. The standard deviation for wind speed and wind direction is determined at an averaging period of > 1 sec. The calculation is carried out in accordance with the following formula:

$$Y = \sqrt{\frac{1}{n}\sum_{i=0}^{i<n}\left(\overline{M} - Xi\right)^2} \qquad \text{with} \qquad \overline{M} = \frac{1}{n}\sum_{i=0}^{i<n} Xi$$

The standard deviation is activated through the command “DE00001”. It is important that the ULTRASONIC reduces the measuring interval to 50 hz when calculating the standard deviation. This is necessary for the instrument to finish the calculations of the standard deviations between two measuring cycles. The calculation of the standard deviation is activated when the selected averaging period is > 1sec.

9. Bus-Ability, Synchronisation of the Measurement on the Query Telegram:

9.1 Duplex-Mode

The Ultrasonic supports absolutely any operation at an RS485/RS422 data bus in co-operation with further instruments (bus operation).
Supported are both semi-duplex bus-topologies and full duplex bus-systems.
In the semi- and full duplex operation the line drivers of the Ultrasonic are active only for the time of data transmission. The remaining time the line drivers are off-line (“three-state-mode”).
The direct connection to a PC with RS232 interface makes an interface-converter RS 485 / RS 232 necessary, e.g. our accessories order-no. 9.1702.20.000

Command for Selecting the duplex-mode (DM for duplex mode):
DM00000 for semi-duplex (2-wire operation)
DM00001 for full duplex (4-wire operation)
(state of delivery).

In case of bus operation a spontaneous output of the Ultrasonic is suppressed – the instruments respond only on request of the bus master.
When semi-duplex operation is set, a spontaneous telegram output is not selectable.
In case the spontaneous telegram output has been selected erroneously this could lead to a blocking of the receivers at slow baud rates.

9.2 Synchronisation on Data Query

Certain application make it necessary to interrogate cyclically a collective of instruments within a short time (e.g. 5 instruments within 100 ms).
There might be the following problem: the Ultrasonic can be contacted during a measurement by the asynchronous query and is then not ready for transmission.
In order to guarantee an immediate instrument response without delay, the possibility of temporal measurement synchronisation on the query is used.

Command for activating the ability for measurement-synchronisation on the query:
MT00001 (Measurement Trigger) Synchronisation Ability on.
MT00000 Synchronisation Ability off.

In case the instrument receives, with active synchronisation, a telegram inquiry through the command TR0000x, and further inquiry follow with intervals of less than 2,5 seconds, the instrument runs synchronously to the inquiries and responds with smallest possible delay.
If there are no queries for more than 2,5 seconds, the instrument leaves the synchronous mode and changes into a spontaneous measurement value acquisition.
This return to the spontaneous mode of measurement guarantees that all control functions derived from the measurement data (e.g. switch-on heating etc.) will be able to operate also in case of a failure of query telegram. As soon as a new query occurs in the spontaneous mode the instrument synchronises immediately on the query telegram.

9.3 Averaging with Active Synchronisation

In case the measurement values should be averaged please take care that – with active synchronisation – the exact, internal time basis of 100 ms for forming the measurement values is not used. In this case, the time is determined by the query-repetition-rate.
It is advisable to switch-off the synchronisation ability if it is not absolutely necessary.

Command list

List of Commands, brief

10.1 List of commands

Command	Function	Remark
<ID> AM 00000	**Vectorial averaging**	**Vectorial averaging of wind speed and direction**
<ID> AM 00001	**Scalar averaging**	Scalar averaging of wind speed and direction
<ID> AM 00002	**Scalar / vectorial averaging**	Scalar averaging of speed / vectorial averaging of direction
<ID> AM 00003	**Vectorial / Scalar averaging**	Vectorial averaging of speed / scalar averaging of direction
<ID> AO 00000	**Wind direction output 0-360°**	Scaling of the analogue output
<ID> AO 00001	**Wind direction output 0-540°**	Scaling of the analogue output
<ID> AV 00000	**Instantaneous value**	**Output of the instantaneous values**
<ID> AV 00001	**Mean value over 1 second**	Output of the gliding mean value over 1 second
<ID> AV 00002	**Mean value over 10 seconds**	Output of the gliding mean value over 10 seconds
<ID> AV 00003	**Mean value over 1 minute**	Output of the gliding mean value over 1 minute
<ID> AV 00004	**Mean value over 2 minutes**	Output of the gliding mean value over 2 minutes
<ID> AV 00005	**Mean value over 10 minutes**	Output of the gliding mean value over 10 minutes
<ID> BR 00002	**1200 Baud N 8 1**	Data rate 1200 Baud, 8 Data bits, No Parity, 1 Stop bit
<ID> BR 00010	**1200 Baud E 7 1**	Data rate 1200 Baud, 7 Data bits, Parity Equal, 1 Stop bit
<ID> BR 00003	**2400 Baud N 8 1**	Data rate 2400 Baud, 8 Data bits, No Parity, 1 Stop bit
<ID> BR 00011	**2400 Baud E 7 1**	Data rate 2400 Baud, 7 Data bits, Parity Equal, 1 Stop bit
<ID> BR 00004	**4800 Baud N 8 1**	Data rate 4800 Baud, 8 Data bits, No Parity, 1 Stop bit
<ID> BR 00012	**4800 Baud E 7 1**	Data rate 4800 Baud, 7 Data bits, Parity Equal, 1 Stop bit
<ID> BR 00005	**9600 Baud N 8 1**	Data rate 9600 Baud, 8 Data bits, No Parity, 1 Stop bit
<ID> BR 00013	**9600 Baud E 7 1**	Data rate 9600 Baud, 7 Data bits, Parity Equal, 1 Stop bit
<ID> BR 00006	**19200 Baud N 8 1**	Data rate 19200 Baud, 8 Data bits, No Parity, 1 Stop bit
<ID> BR 00014	**19200 Baud E 7 1**	Data rate 19200 Baud, 7 Data bits, Parity Equal, 1 Stop bit
<ID> DE 00000	**Standard deviation of**	**De-activate calculation of the standard deviation**
<ID> DE 00001	**Standard deviation on**	Activate calculation of the standard deviation
<ID> DM 00000	**Duplex mode half duplex (HD)**	Half duplex, 2-wire operation
<ID> DM 00001	**Duplex mode full duplex (FD)**	**Full duplex, 4-wire operation**
<ID> ES 00000	**Sign-echo switched off**	Echo operation of transmitted characters switched off
<ID> ES 00001	**Sign-echo switched on**	Echo operation of transmitted characters switched on
<ID> KY 00000	**Key, no access**	Software-key, access to EEPROM closed
<ID> KY 00001	**Key, open access**	Software- key, access to EEPROM open
<ID> MT 00000	**Measurement trigger off**	**No synchronization of measurement onto request poss.**
<ID> MT 00001	**Measurement trigger on**	**Synchronization of measurement onto request possible**
<ID> NC 00xxx	**North correction in 1°**	Input of north correction, value range 00000 up to 00360
<ID> OR 00xxx	**Output rate online (spontaneous)**	Output rate xxx times 100ms, value range 00001 up to 00255
<ID> OS 00000	**Wind speed in m/s**	Scale of Wind speed in meter per second
<ID> OS 00001	**Wind speed in Km/h**	Scaling of Wind speed in kilo meter per hour
<ID> OS 00002	**Wind speed in mph**	Scaling of Wind speed in miles per hour
<ID> OS 00003	**Wind speed in Knots**	Scaling of Wind speed in knots (nautically)
<ID> SC 00000	**Start value of current 0mA**	Analogue output current 0 - 20mA / 0 – 10 V
<ID> SC 00001	**Start value of current 4mA**	Analogue output current 4 - 20mA / 2 – 10 V
<ID> TR 00000	**no Telegram on request**	
<ID> TR 00001	**Telegram VD on request**	single output of the telegram form, see 6.1.1
<ID> TR 00002	**Telegram VDT on request**	single output of the telegram form, see 6.1.2
<ID> TR 00003	**Telegram V4DT on request**	single output of the telegram form, see 6.1.3
<ID> TR 00004	**Telegram NMEA on request**	single output of the telegram form, see 6.1.4
<ID> TT 00000	**No telegram output**	
<ID> TT 00001	**Telegram VD spontaneous**	Online output of telegram form, see 6.1.1
<ID> TT 00002	**Telegram VDT spontaneous**	Online output of telegram form, see 6.1.2
<ID> TT 00003	**Telegram V4DT spontaneous**	Online output of telegram form, to 6.1.3
<ID> TT 00004	**Telegram NMEA V 2.0**	Online output of telegram form, to 6.1.4
<ID> VE	**Firmware version**	Release of firmware version

Remark:
Due to the compatibility the telegrams VD and VDT supply the wind speed in 3 digits form
In order to avoid that the measuring range is exceeded the telegrams deliver the wind speed exclusively in the unit of m/s (meters per second)!

10.2 Command Input

Please find your ID (identifier-number) in the works certificate included in the delivery.
For the input of commands and parameters please open first the access to the EEPROM by entering the command (ID) KY00001.
After all inputs have been made the access to the EEPROM should be locked again through the command (ID) KY00000 in order to avoid unauthorised changes of the system parameters.
The command is input by entering the instrument identification number (ID) followed by two letters which specify the actual command followed by a 5-digit code number respective value.
The characters are entered **without a space** and are **activated with Return**.
Entering the command without the 5-digit code number is interpreted as a query of the command status and leads to the output of the current command status.
Correcting the command word during input when an error has occurred is **not allowed** and the command will not be accepted.
All letters must be **capitalised**, otherwise they will not be accepted.
Example: Correcting an angle of displacement while setting up the anemometer by entering a corrective angle:
Instrument ID is accepted as 12. The necessary angular correction is 47°. The angle stored in the system up to that time was 15°. Attention: Input and representation in units of 1°.
The correction angle is added clockwise to the measured wind direction angle.
First opening of the EE-prom access:

Input: 12NC System response: !12NC00015
Input: 12NC00047 System response: !12NC00047
Input into the system: 12KY00000 System response: protection

The system verifies the accepted input and displays the set value.
Attention: After the supply voltage of the instrument has been switched on or switched off the locking is automatically activated.
For **bus operation** in RS485 interface mode the permanent output of the measuring data must be stopped through the command **(ID)TT00000**. In addition, the echo operation for characters ES00000 must be switched off in order to avoid a bus conflict.
A single data telegram can then be called in through the command **(ID)TR0000(x)** in a telegram form described under item 6.1.
The „X“ in the command string means the selected telegram form (1, 2 or 3).
The ID-number selects the required instrument.

10.3 Pre-setting of Instruments (Models for Delivery)

Order-No.	**Output parameter**
451301	RS485 / 422, 0-20mA / 0-10V, VDT, 9600 N 8 1, FD
Optional	customer requirements

11. Preparation for Use

11.1 Selecting the Site

As already described above the ultrasonic anemometer transmits sonic bursts which are necessary for the measurement of the propagation speed. If these sonic bursts hit a well sonic-reflecting surface they are reflected as echo and might cause error measurements – under unfavourable conditions. It is, therefore, advisable to install the US-anemometer with a minimum distance of 1 meter to objects in the measurement area.
In general wind measurement instruments should be able to detect the wind conditions over a wide area. In order to obtain comparative values when determining the surface wind, measurements should be taken at a height of 10 meters above a plane, unobstructed area. An unobstructed area is one where the distance between the wind transmitter and any obstacle is at least 10 times greater than the height of the obstacle. (s. VDI (German Engineers Association) 3786). If this requirement cannot be fulfilled, then the wind measurement instrument should be set up at a height where the measured values are not influenced by any local obstacles (approx. 6-10 m above the level of the obstacle). The anemometer should be set up in the center of flat roofs, not at the edge in order to avoid possible preferred directions.

11.2 Mounting the wind transmitter

The wind transmitter must be mounted to a pipe piece of R 1 ½" (Ø 48.3 mm) which is 50 mm long. The internal diameter of the pipe must be at least 40 mm as the wind transmitter is connected electrically from below with a plug. Solder a flexible control line LiYCY with the corresponding number of cores to the enclosed plug. After the wind transmitter has been connected, set it onto the pipe piece respectively the mast piece. The branch of the red marked sonic transducer must be aligned to North. To do this, take a bearing via the ultrasonic transducer of the North/South path onto an object to the North, for example a building or a special geographic feature. Use the four screws with hexagonal recessed holes (SW 4 mm) to attach the instrument to the shaft.
Note :
The anemometer is used in vertical position.
Please make sure that no precipitation gets into the shaft or plug when mounting, de-mounting, transporting, or maintaining the anemometer.
When using a lightning rod please take care that it is mounted always in an angle of 45° to the measuring distance, as otherwise there might be deviations of measuring value.

11.3 North Alignment

For the alignment of the anemometer the **branch of the red marked sonic transducer must indicate to North**. For this, you select an obvious point in a northerly or southerly direction in the surroundings with the aid of a compass; then turn the mast or the anemometer into this direction until both arms opposite are situated in a straight line.
It is also possible that oneself stands in a northerly or southerly direction with respective distance, and a partner turns the anemometer or mast by command until both sensor arms are situated in a straight line. In this case, it is advisable to use a pair of field glasses.

Maintenance
As the instrument does not have moving parts, i.e. is not subject to wear during operation, only minimal servicing is required. Given that the sensor surfaces are normally kept clean by rain, it will only be necessary to occasionally remove residues from the sensor surfaces in regions with very little rain. Cleaning can be carried out as required using non-aggressive cleaning agents in water and a soft cloth during routine checks.
Attention: During storage, installation, de-installation, transport or maintenance of the anemometer it must be ensured that no water gets into the shaft and connector or cable gland of the anemometer.

Calibration
The ultrasonic anemometer does not contain any adjustable components such as electrical or mechanical trimming elements. All components and materials used show invariant behaviour in terms of time. This means that no regular calibration is required due to ageing. Errors in measured values are only caused by mechanical deformation of the transformer arms and associated changes in measurement path lengths.
The virtual temperature can be used to check the measurement path length. A change of 0.17% in the measurement path length and thus a measuring error of 0.17% for the wind velocity corresponds to a deviation in the virtual temperature of 1 K at 20°C; there is a measuring error of approx. 1% for the wind velocity with a 6 K temperature deviation.
In the event of any change in the measurement paths of the anemometer the manufacturer should be consulted regarding recalibration.
Attention: Mechanical deformation of the measuring arms results in errors in the measured values, which involve the output of error telegrams / error signals to the analog interfaces.

Warranty
Damage caused by improper handling or external influences, e.g. lightning, do not fall under the warranty provisions. The warranty entitlement expires if the instrument is opened.
Important: The ultrasonic anemometer must be returned in the original packaging as the warranty entitlement otherwise expires with mechanical damage, e.g. deformation of measuring arms.

Accessories (available as optional features)

Connecting cable, complete	507751	15 m cable with socket outlet on transmitter side. The other end of the cable is equipped with core identification rings.
PC-Program Meteo-Online	9.1700.98.000	For graphical display of measured values on a PC
Power supply unit	9.3388.00.000	For power supply to the ultrasonic anemometer
Interface converter	9.1702.xx.000	For RS 422 signal conversion in RS 232
Lightning rod	4.3100.99.150	As lightning protection

Important:
Instruments must be returned in the original packaging; otherwise the warranty entitlement expires with mechanical damage, e.g. deformation of measuring arms.

Feingerätebau K.Fischer GmbH
Venusberger Straße 24
D-09430 Drebach
Germany

Phone +49 (0) 37341 / 487-0
Fax +49 (0) 37341 / 487-30
E-mail info@meteoclima.de
Internet www.meteoclima.de