Edition 23.1

Air Distribution Measuring System

AirDistSys 5000

Operator's Manual

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1. INTRODUCTION

The AirDistSys5000 enables air temperature and low air speed measurements at several points in spaces, as well as for measurement of flow characteristics in jets from air thermal devices. The AirDistSys5000 is wire-less system which makes it convenient for field and laboratory measurements. Many years experience with manufacturing of low velocity thermal anemometers and the latest development in the field of electronic equipment were used in designing of the system.

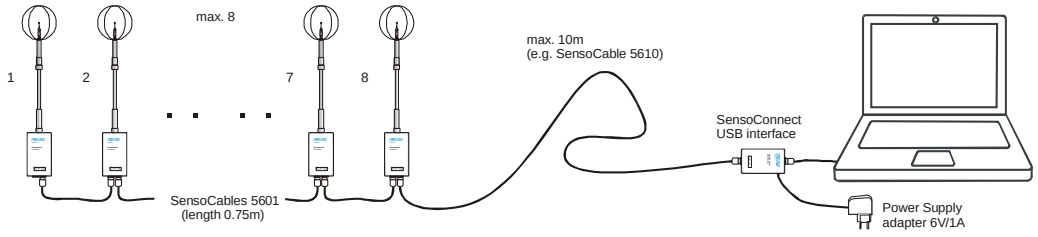
The system offers:

- simultaneous measurement of air speed and temperature at several points (up to 64 points)
- high measurement accuracy and sensitivity as recommended in the standards
- short response time suitable for measurement of fluctuating air velocity
- several measuring units can be serially connected with one single cable, no measuring station or AD converter are required
- individual calibration certificate traceable to present ISO 7726, ISO 7730, EN 13182 and ASHRAE 113 standards
- logging of the data can be done on a portable PC via USB port.
- wire-less communication enabling data logging from distance (up to 60 m), i.e. no cables between the transducers and the PC for data logging.
- the built-in TCP/IP connection enables transfer data from server (AirDistSys program) to different computers by the networks.
- the DataSocket technology (compatible with LabView platform) provides converting measurement data into a stream of bytes that is sent across the network to another application.

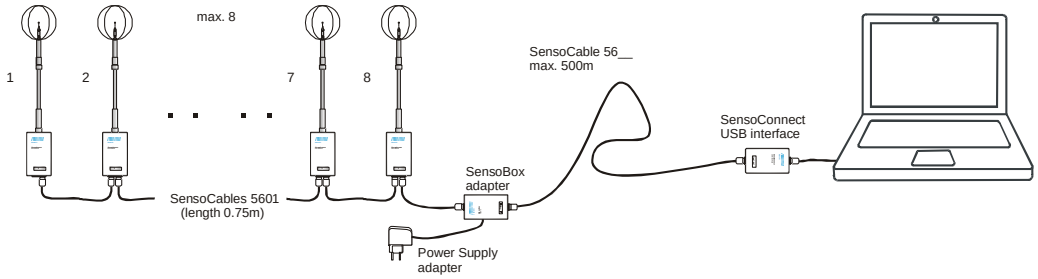
Optionally the system may be equipped with transducer SensoBar 5301 which makes it possible to compensate automatically the measurements for the influence of barometric pressure changes. Through a SensoConnect USB interface the transducers are connected with USB port of computer. The wire-less version of the system uses SensoBee transmitters which are connected with the transducers and SensoBeeUSB receiver which is connected with a computer.

2. EXAMPLES OF THE SYSTEM CONFIGURATION

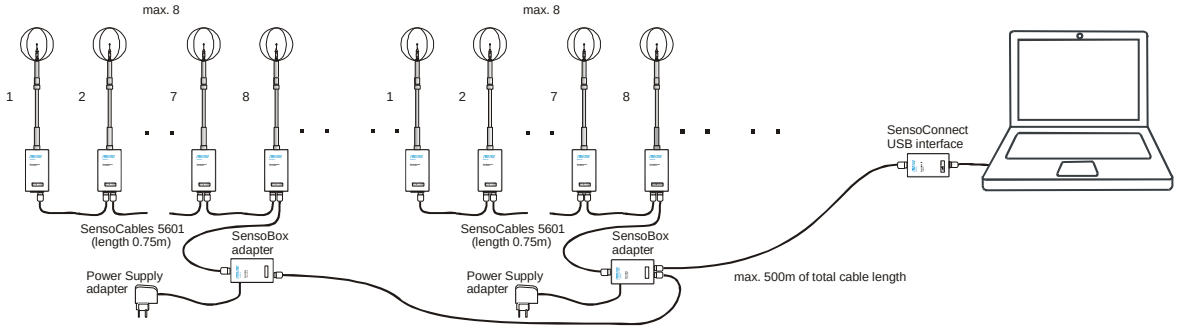
A. Standard data transmission - configuration for small distance (<10m)



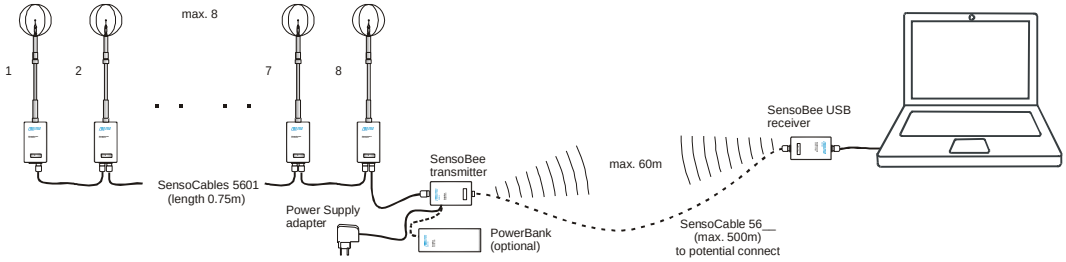
B. Standard data transmission - configuration for long distance (>10m)



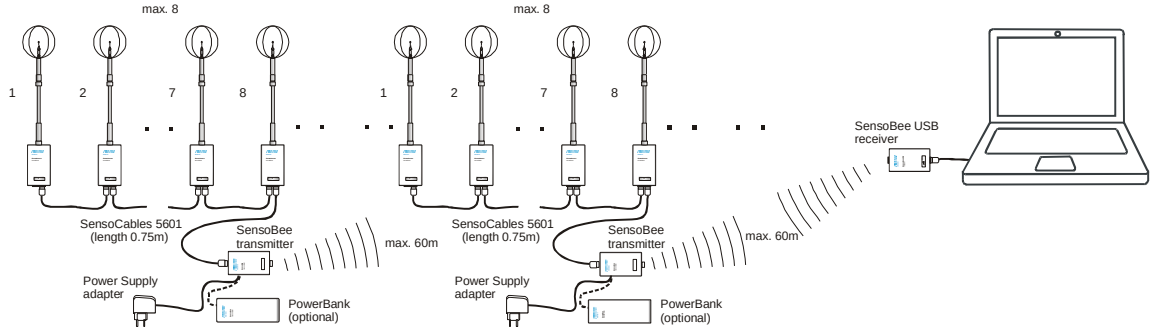
C. Standard data transmission – configuration for more measurement points



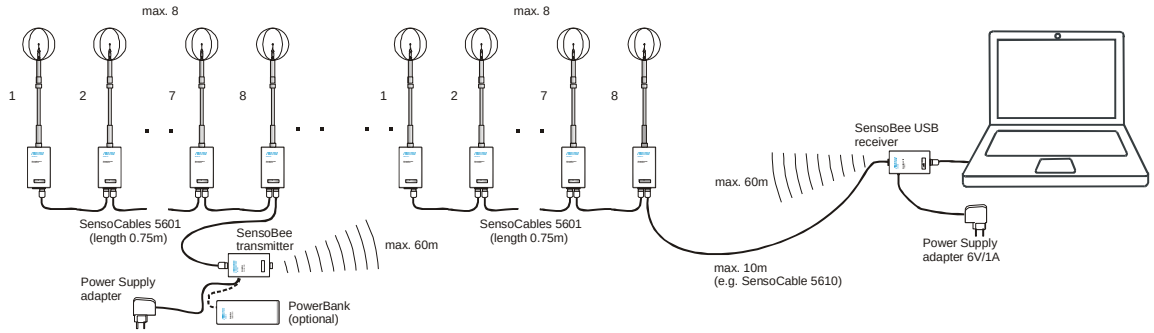
D. Wire-less data transmission (max distance <60m)



E. Wire-less data transmission – configuration for more measurement points



F. Hybrid data transmission

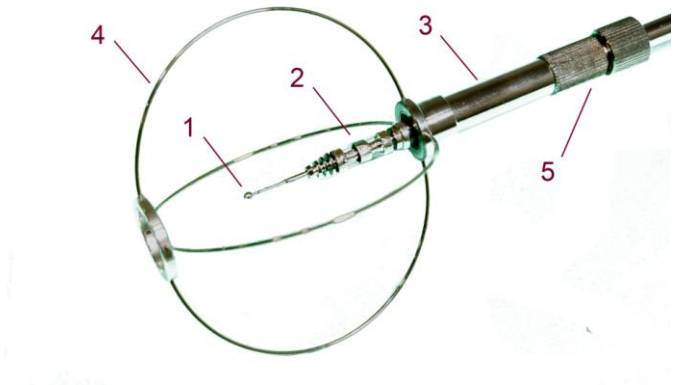


3. ELEMENTS OF THE SYSTEM

A. SensoAnemo series 5100LSF transducer

SensoAnemo5100LSF is a transducer with omnidirectional (spherical) sensor for measurement of air speed (magnitude of velocity vector) sensor. The sensor, designed for low speed measurement indoors, has wide range of frequency response and high sensitivity. The transducer measures instantaneous speed, mean air speed and standard deviation of air speed as well as the air temperature, draught rate and turbulence intensity.

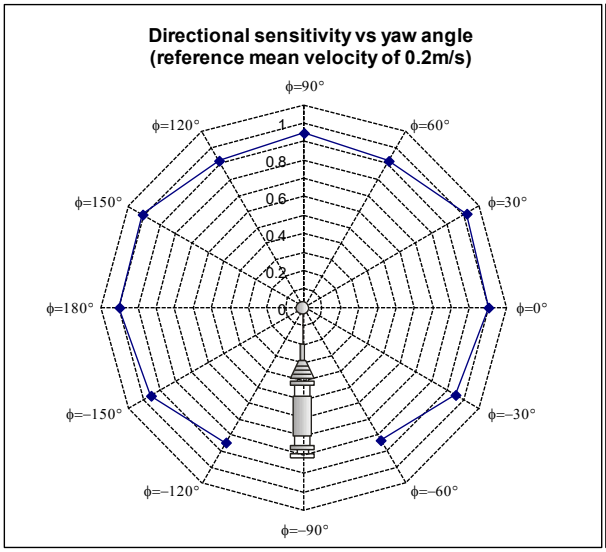
The probe can be integrated into the transducer or connected via cable with transducer connector. The second solution allows fast exchanges of damaged probe or use several probes to one transducer. The probe is automatically recognized by the transducer. In the case of wrong connection of the probe error code is generated. Each probe is individually calibrated and compensated for impact of temperature changes on velocity measurements (air temperature different than the air temperature during calibration). The compensation and calibration coefficients are programmed into EEPROM memory.

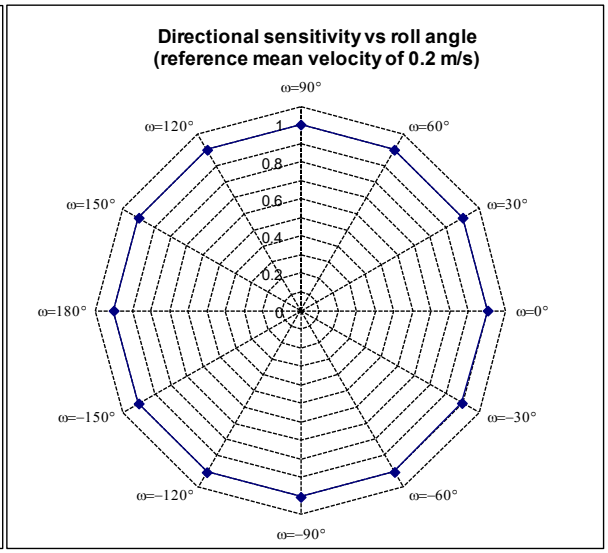


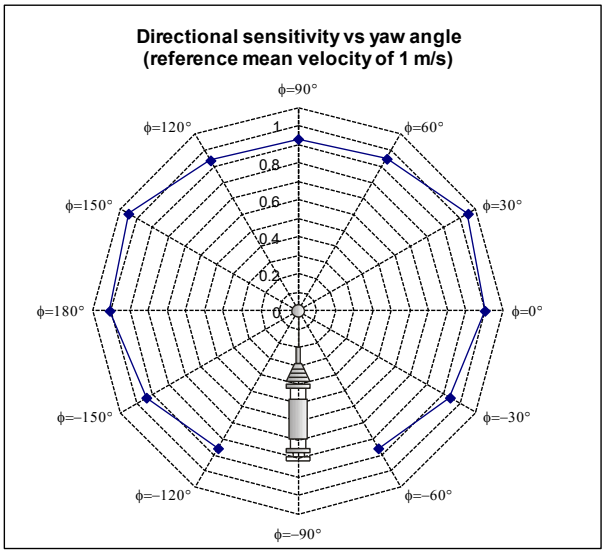
The probe is shown in the figure beside. The velocity sensor (1) is made of special wire pressed into the shape of a sphere with diameter of 2mm. The temperature sensor (2) is made of the thin nickel wire and its shape is cylindrical. The temperature sensor measures temperature of the ambient air. The two sensors are vacuum covered with a special aluminium coating that increases their resistance to contamination and decreases the effect of thermal radiation on the accuracy of velocity measurement.

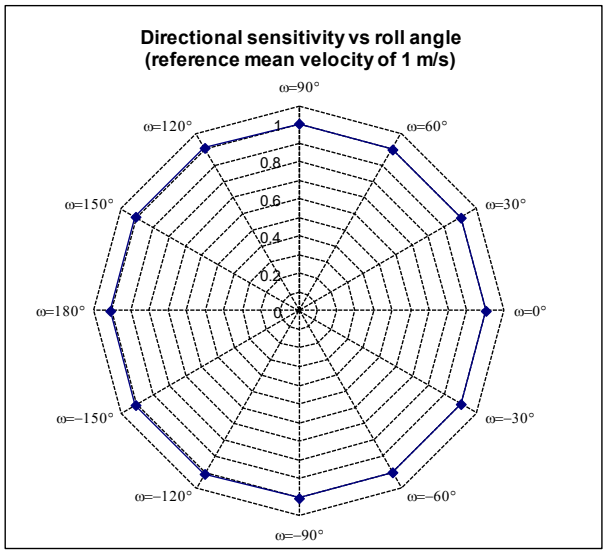
Both sensors can be also protected against mechanical damage using a openwork basket (4) made with wire circles. If such protection is not necessary it is recommended to remove the openwork safety basket (4) from the shielding tube (3). The shielding tube (with or without attached basket) can be moved along the probe support and can be locked at certain position by a clamp screw (5).

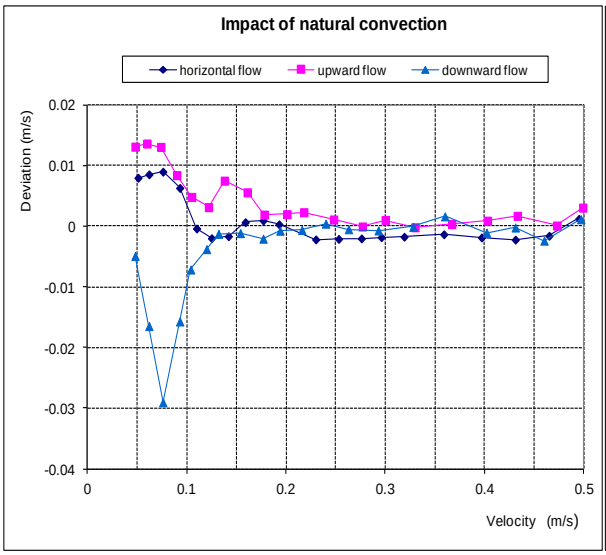
The transducer has a digital output RS485. Thanks optional analog output of velocity, transducer can work also with analog datalogger, A/D converter or any multimeter. Drivers for LabView which can be delivered to user allows to create your own software or connect transducers with other measuring system.

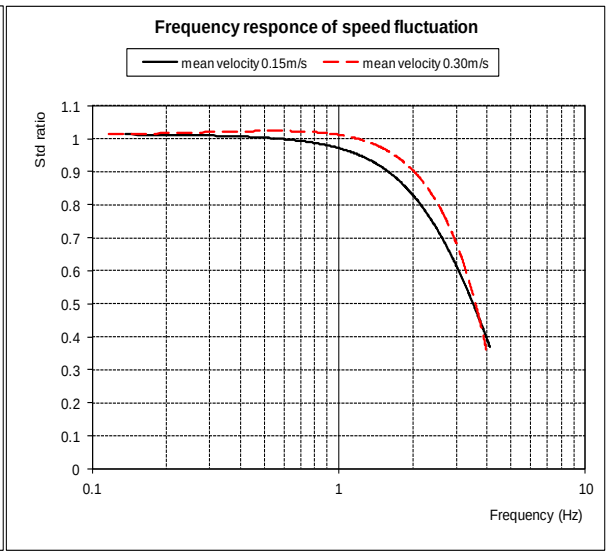

Directional sensitivity vs yaw angle
(reference mean velocity of 0.2m/s)
ϕ=90°
ϕ=60°
ϕ=30°
ϕ=0°
ϕ=−30°
ϕ=−60°
ϕ=−90°
ϕ=−120°
ϕ=−150°
ϕ=180°
ϕ=150°
ϕ=120°
1
0.8
0.6
0.4
0.2
0


Directional sensitivity vs roll angle
(reference mean velocity of 0.2 m/s)
ω=90°
ω=60°
ω=30°
ω=0°
ω=−30°
ω=−60°
ω=−90°
ω=−120°
ω=−150°
ω=180°
ω=150°
ω=120°
1
0.8
0.6
0.4
0.2
0


Directional sensitivity vs yaw angle
(reference mean velocity of 1 m/s)
ϕ=90°
ϕ=60°
ϕ=30°
ϕ=0°
ϕ=−30°
ϕ=−60°
ϕ=−90°
ϕ=−120°
ϕ=−150°
ϕ=180°
ϕ=150°
ϕ=120°
1
0.8
0.6
0.4
0.2
0

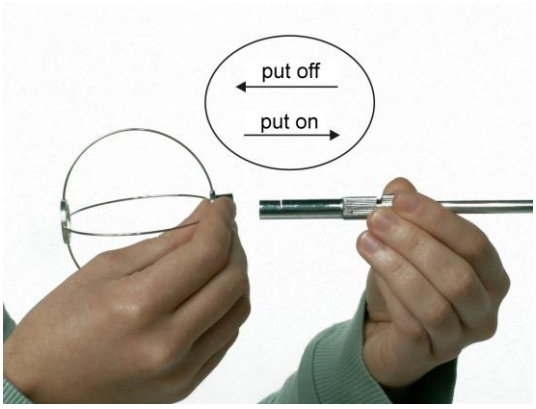

Directional sensitivity vs roll angle
(reference mean velocity of 1 m/s)
ω=90°
ω=60°
ω=30°
ω=0°
ω=−30°
ω=−60°
ω=−90°
ω=−120°
ω=−150°
ω=180°
ω=150°
ω=120°
1
0.8
0.6
0.4
0.2
0

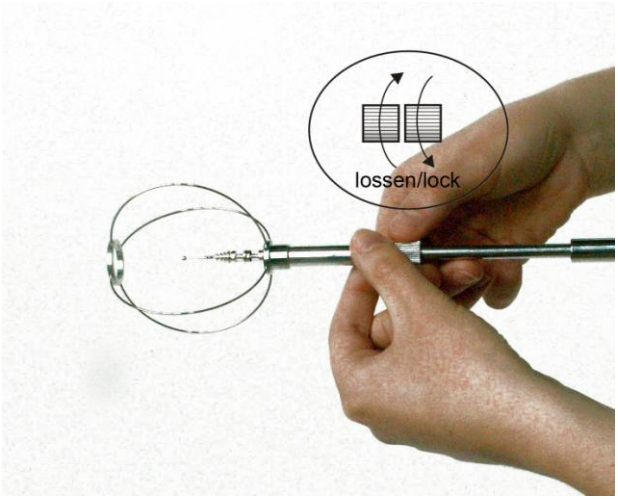

Impact of natural convection
horizontal flow
upward flow
downward flow
Deviation (m/s)
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
0
0.1
0.2
0.3
0.4
0.5
Velocity (m/s)


Frequency responce of speed fluctuation
mean velocity 0.15m/s
mean velocity 0.30m/s
Std ratio
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.1
1
10
Frequency (Hz)

Preparation for measurement:

1. First install the measurement transducer or probe on a tripod.
2. Check if the openwork basket (4) is on the shielding tube (3). If not put openwork basket (4) on the shielding tube (3). Be particularly careful not to damage the speed sensor (1). To this purpose check if the shielding tube (3) is on the end of the probe completely covering the speed sensor and the clamp screw (5) is properly locked (it does not move!). Put on the openwork safety basket (4) only then when the sensor (1) is covered by the shielding tube (3).





3. Loosen the clamp screw (5) and move the shielding tube (3) with the openwork basket (4) towards the holder uncovering the sensors (1) and (2).
4. Lock the clamp screw (5) so that the speed sensor (1) was in the middle of the openwork basket (4).
5. After the measurements move the shielding tube (3) back on the sensors (1) and (2).
6. Connect the SensoCable to the one of RJ45 sockets on the back wall of the transducer casing and to the SensoBox adapter (SensoBee wire-less transmitter or SensoConnect USB interface). Use the second RJ45 socket to make connection between the transducers.
7. Turn on the power supply. The power led on the casing should blink firstly for a few seconds and next will remain ON. If the led blinks permanently it means that is the error. The case of the error might to be too low voltage of power supply caused for example by unloaded batteries.

Remarks:

1. The speed sensor (1) must be protected during transport by the shielding tube (3). Note that the clamping screw (5) has been properly lock.
2. The openwork safety basket (4) should be put on and put out only then when the speed sensor (1) is covered and secured by the shielding tube (3).
3. Use the openwork basket (4) if you are not sure of the safety of the sensors during measurements.

Technical Data:

• type of speed sensor:	omnidirectional, spherical
• diameter of speed sensor	2 mm
• measurement speed range:	0.05… 5 m/s
• accuracy of speed measurement:	±0.02 m/s ±2% of readings
• directional sensitivity error (for v>2m/s)[1)]:	±2.5% the actual value
• automatic temperature compensation:	< ±0.1%/K
• upper frequency of speed fluctuation[2)]:	typ. 1.5 Hz, min. 1 Hz
• response time 90%:	typ. 0.2s, max. 0.3s
• temperature range:	-10…+50 °C
• accuracy of temperature:	0.2 °C
• sampling rate:	8 Hz
• interface:	port RS485
• baud rate:	115000 bps
• optional analog output:	voltage 0...2V, 0...5V or current 0...20 mA
(only for velocity)	non-linear (set of equations V [m/s]= $f(U_v,I_v)$

- max analog output resistance: 100 Ohm
- power supply: 3.3…9 VDC
- power consumption: typ.60mA, peak. 110mA, economy mode 6mA

[1] The error of directional sensitivity occurs when the direction of air flow is other than during the calibration of the probe. When measuring low velocity characteristic for indoor environment, this error is negligible (see the above graph). For velocity above 2 m/s, this error can be up to 2.5% and it should be taken into account when measuring. At such velocity the flow direction may be easily determined. In order to minimize this error, place the probe (transducer) in the same position as at the time calibration procedure. The probes position in calibration procedure are the following:
- for probe integrated with transducer casing - flow directed on the front wall (logo) of the transducer casing,
- for probe with cable – flow directed on the sign (dot) on the handle of the probe.

[2] The upper frequency is defined as the highest frequency of speed fluctuation up to which the instrument measures the standard deviation of the fluctuations not more than 10% different than the true standard deviation (see EN 13182 Ventilation in buildings – Instrumentation requirements for air velocity measurements in ventilated spaces, 2002, European Committee for Standardization, Brussels).

B. SensoDACon converter

SensoDACon converter series 5400 allows to change a digital signal from Sensoanemo transducer (socket RJ45) on the analog signal of temperature and velocity (output terminal block). There are offered the following type:

- SensoDACon 5420 with voltage output 0-2V
- SensoDACon 5450 with voltage output 0-5V
- SensoDACon 54C0 with current output 0-20mA

Each of above types can be made from one of the following speed ranges: 0-1 m/s, 0-5 m/s or 0-10 m/s.

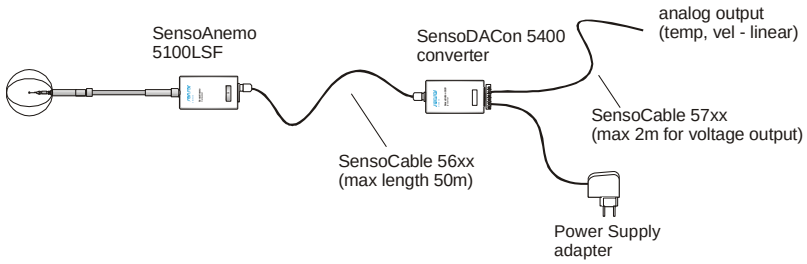
Both outputs (one for speed air and one for temperature) are linearized, this means that the temperature and speed are a linear function of the voltage or current output (see table below).

Type	Range	Output	Speed	Temperature
SensoDACon 5420	0-1m/s 0-5m/s	0-2V	$V[m/s]=0.5U_v[V]$ $V[m/s]=2.5U_v[V]$	$t[^OC]=25U_t[V]$
SensoDACon 5450	0-1m/s 0-5m/s	0-5V	$V[m/s]=0.2U_v[V]$ $V[m/s]=U_v[V]$	$t[^OC]=10U_t[V]$
SensoDACon 54C0	0-1m/s 0-5m/s	0-20mA	$V[m/s]=0.05I_v[mA]$ $V[m/s]=0.25I_v[mA]$	$t[^OC]=2.5I_t[mA]$

Remark:

First connect the converter to SensoAnemo transducer and next turn on the power to the terminal block. After turning on the power converter establishes communication with anemo transducer and initializes a read-mode instantaneous values.

Example of conection to the anemo transducer:



C. SensoBar 5301 transducer

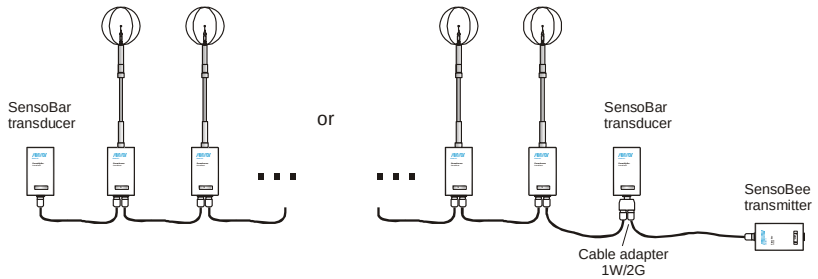
Optionally the system may be equipped with transducer SensoBar 5301 which enables the automatic correction of anemometer readings at changes of the barometric pressure. The transducer utilizes specialized piezoresistive micro-machined sensing element. Each transducer is individually calibrated and thermally compensated. The calibration coefficients are programmed into EEPROM memory. The transducer casing can optionally be fitted with a latch for mounting it in the DIN rail.

Technical Data:

- measurement range: 500…1500 hPa
- accuracy: ±3 hPa
- response time: 2s
- humidity measurement range: 0…100 % RH
- humidity accuracy: ±2% in range 10…90% RH
- long term stability of humidity: <1% RH/year
- response time of humidity: <4s
- interface: port RS485
- baud rate: 115000 bps
- power supply: 3.3…9 VDC
- power consumption: 6mA, economy mode 1mA

Connecting to the measuring system:

The SensoBar 5301transducer can be connected at any place of the RS485 bus to the measuring system, for example: to SensoAnemo transducer, either SensoBee wire-less transmitter or SensoBox adapter using the Cable adapter 1W/2G or another (see figure below).



D. SensoConnect USB interface

The SensoConnect USB interface enables data transmission to a computer through the USB port. It is being powered from the USB port of computer, therefore doesn't require external power supply adapter. The power socket located on the side of the casing allows the user to connect an external power supply adapter used to power the transducer. The USB led indicates the connection interface to the computer.

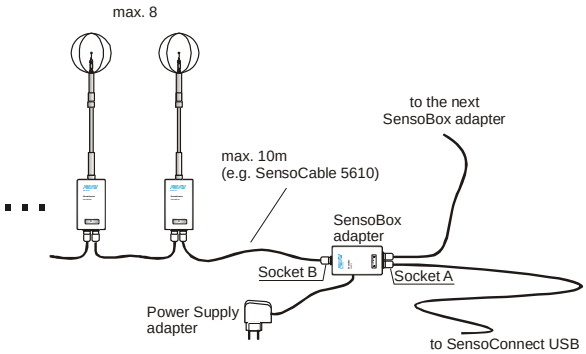
E. SensoBox adapter

The SensoBox adapter allows to separate the power supply of the group several measurement transducers. This allows to increase the distance between transducers and the SensoConnect USB connected to the computer port. The adapter is necessary when:

- the distance between transducers and the computer is greater than 10 m
- number of transducers is greater than 8.

The power led lights up continuously when connecting an external power supply into a power socket. Adapter casing is equipped with a latch for mounting it in the DIN rail.

Connecting to the measuring system:

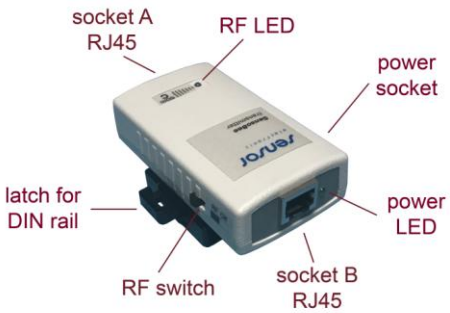


Remark!

Pay attention that the power supply adapter should have the voltage polarity on the plug compatible with power socket in the casing (+ out).

F. SensoBee wire-less transmitter

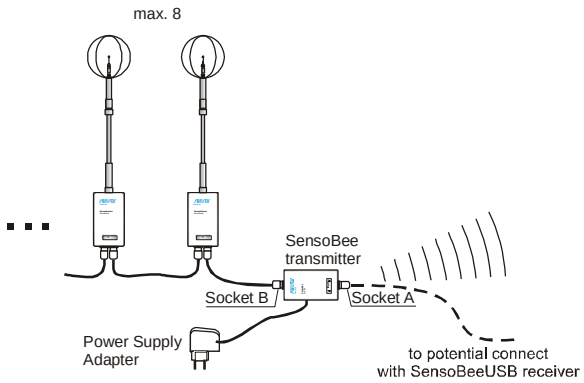
The SensoBee transmitter contains an RF module for wire-less data transmission. The RF module operates under ZigBee (802.15.4) protocol accepted by ETSI/EC (Europe), FCC (U.S.A) and IC (Canada). The transmitter should be powered by an external power supply adapter or by PowerBank. RF switch should be in the position RF and RF led should flash. Measurement transducers must be connected to the socket B. In the case of the absence or errors in the wire-less transmission, the socket A enables optional wired connection of the transmitter with wire-less receiver. To do this, move RF switch to the Off position, the RF led is not lit. The transmitter is equipped with a latch for mounting it in a DIN rail.



Technical Data:

- indoor (urban) range: up to 60m
- outdoor line-of-sight range: up to 100m
- transmit power output: 100mW (20dB) EIRP
- operating frequency: 2.4GHz
- RF data rate: 250 kbps
- power supply: 5…9 VDC/1A

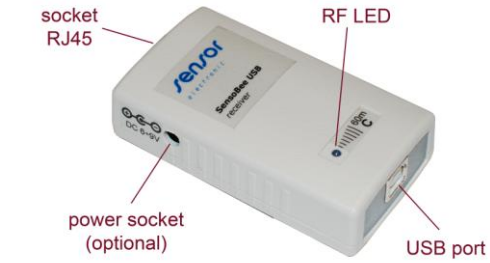
Connecting to the measuring system:



Remark:

Pay attention that the power supply adapter should have the voltage polarity on the plug compatible with power socket in the casing (+ out).

G. SensoBee USB wire-less receiver



The SensoBeeUSB wire-less receiver contains the RF module for wire-less data transmission. It enables wire-less data transmission between transducers (via SensoBee) and USB port of computer. The RF module operates under ZigBee (802.15.4) protocol accepted by ETSI/EC (Europe), FCC (U.S.A) and IC (Canada). The receiver is being powered from the USB port of computer (RF led flashes when connected to USB port), therefore it doesn't require the use of external power supply adapter.

The SensoBeeUSB can also be used for wired data transmission (see example "D" or "F" in the chapter 2). In this case, you should:

- connect to the RJ45 socket one end of the connecting cable and the other end depending on the configuration, either the SensoBox adapter or SensoBee wire-less transmitter, either directly to one of the measurement transducer *),
- RF switch in the SensoBee transmitter change from RF position to Off (disable RF module).

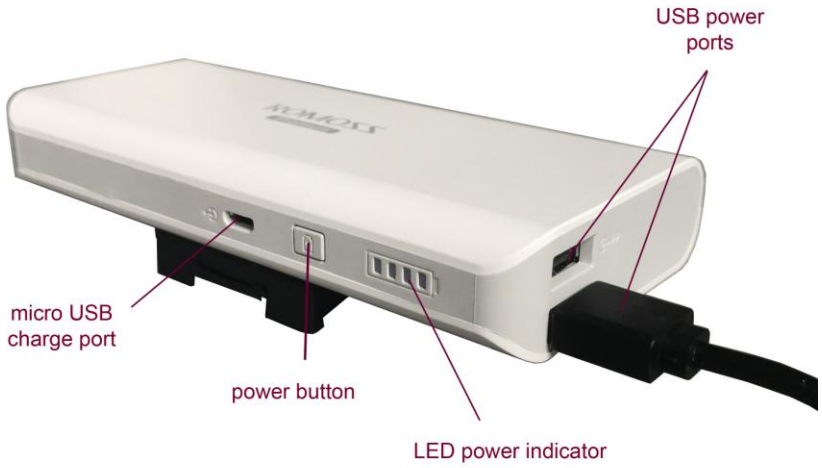
Power socket (optional) placed on the side of the casing is used to connect the power supply adapter for configuration with hybrid data transmission (see example "F" in Chapter 2).

*) in case of use the SensoBee wire-less transmitter without optional power socket you can directly connect no more than three SensoAnemo transducers due to the limited power of the USB port.

4. ACCESSORIES

A. PowerBank

PowerBank is a high performance external battery pack with latch for DIN rail. The latch allows for easy installation of the device on a tripod along with other parts of the measuring system. Includes a white charging cable (USB to micro USB) and spiral power cable (USB-plug DC) with a length of 30-100 cm.



Technical Data:

- Power port: 2 x USB DC 5V/1A
- Real capacity*): 7000-8500mA
- Minimum supply current: 135mA
- Charging port: micro USB 5V/2.1A max
- Charging time: 15 h
- Long time efficiency: 300 cycles of full charge and discharge cycles will leave 85% of nominal capacity)

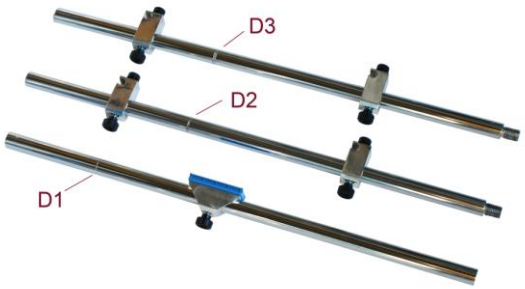
*) Capacity due to reduced efficiency when converting from battery voltage 3.6 V to output voltage 5V (theoretical capacity of the battery is 10000-13000mAh)

Remarks:

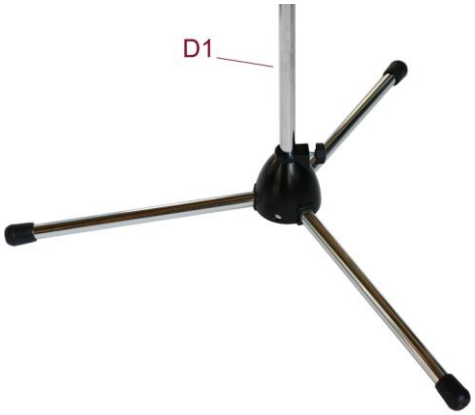
1. Turn off the PowerBank by disconnecting the power cable when you are finished working. Otherwise, this may lead to rapid discharge of the battery.
2. Charge and discharge the device once every 3 months, if it is not used for a longer period of time.
3. In order to charging connect USB white cable to micro USB charge port on PowerBank and to USB port on DC5V USB charger or computer. If LED signal flickers, it means PowerBank is being charged.
4. Due to the minimal supply current, PowerBank may automatically turn off after a few seconds in the case of smaller receivers power supply current consumption.
5. See picture next to how to connect the PowerBank with SensoBee wire-less transmitter.

B. Fold-out tripod

Measurement system can be equipped with a fold-out tripod adapted to mount several measuring transducers with accessories. The tripod consists of a fold-out base and 3 re-screwable vertical pipe D1-D3 60cm long, its max height is 180cm.



The way of assembling of the tripod is shown in the photos below. Attention should be paid to the pipes D1 ... D3 turn in the order corresponding to the incisions, ie. D1 pipe (single) to the D2 (dual), and D2 to D3 pipe (triple). D1 pipe should be inserted to the base of the tripod and locked by the knob. Then place the grips for fastening the measuring transducers and DIN grips for the accessories and lock them using the knobs.



C. Standard grip for transducers

The grip enables to mount on the tripod the probes or measuring transducers at the any height from the floor.

D. DIN rail-mounted grip

The rail-mounted grip enables to mount the devices equipped with latch for DIN rail, so as: SensoBar transducer, SensoBee wire-less receiver, SensoBox adapter or PowerBank. You can mount it on a tripod in two positions: vertical or horizontal.

5. SOFTWARE AND DRIVER INSTALLATION

1. Power on your computer and boot to Windows.
2. Insert the CD-ROM in CD drive (or pendrive disk in USB port), choose setup.exe in folder AirDistSys_Inst and run.
3. Follow the on-screen instructions.
4. The driver for new device will be installed automatically after finishing the installation. In the case of trouble it is possible to install the driver into the following way:

   Option 1
   - select SensoUSB DriverInstaller icon from SENSOR Electronic folder located in Program Menu Folder or click it on the Desktop Panel (the SensoUSB DriverInstaller.exe file is also in SensoUSB_driver folder on the CD-ROM.
   - locate the USB port and plug in the device (SensoConnect USB or SensoBee USB).
   - Windows automatically will detect the new device and will install the software for the detected USB device.

   Option 2
   - locate the USB port and plug in the device (SensoConnect USB or SensoBee USB).
   - Windows will detect the new device and will initiate the Found New Hardware Wizard prompting you to install the software for the detected USB device.
   - select the "Specify a location" and choose the correct path. Enter E:\SensoUSB_driver\. The "E" is the Disk that Package CD put in. Click "OK" to start the search.
   - once Windows finds the correct driver, click "Next" to install the driver.

5. To verify whether the device is properly installed and to determine the COM port assignment for the device follow the steps:
   - click "Settings" and "Control Panel", and then double click on the "System" icon.
   - once the System Properties window is displayed select the "Device Manager" button.
   - double-click on Ports (COM &LPT).
   - if the device is correctly installed, you should now see the USB device listing and the assigned COM port.
6. If you need to assign the COM port name to another Port Number:
   - double-click on the USB device to view the properties
   - once the properties window opens click on the Port Settings tab and select the advanced button
   - when the Advanced Settings dialog box appears on the screen, click on the COM Port Number drop down the box to check what other port number are available
   - try to reassign COM port to a unused port number
   - click OK when finished.

6. DESCRIPTION OF THE PROGRAM

Features and Requirements

- The AirDistSys 5000 program makes possible for:
  - automatic scanning of the configuration of the measuring system
  - calculating average temperature, average and standard deviation of air speed, turbulence intensity, draught rate (as recommended in ISO Standard 7730, ISO standard 7726, EN 15251, ASHRAE Standard 113)
  - automatic compensation for the impact of changes in the barometric pressure
  - logging and reporting all data in a PC computer
- Program requirements:
  - operating system: Microsoft Windows XP, Vista, 7, 8, 10, 11
  - minimal monitor resolution: 1024x600 pixels
  - size of text and other elements in Windows: default 100%

- The program contains the Context Help window which displays a description when the user moves the cursor over the property. Updating the program and newest version of the instruction are available from the menu bar.
- The program communicates only at the speed 115 200 BPS. It is very important not to start up the program before SensoConnectUSB interface or SensoBeeUSB receiver are connected to the USB port and the power supply is turned on.

Starting and Configuration

- In the case of select automatic mode the program is scanning all ports of the computer in order to find connected devices. In the manual mode the user must choose the number of COM port. After establishing contact the program is reading the information of all devices.
- All connected devices are specified on the 'Configuration' window which appears after establishing contact. The user can deactivate (set as OFF) or activate (set as ON) the devices to be used. The program automatically will adjust the device as OFF if the calibration date is expired. However the user can change it and to activate him. If the voltage of power supply is too small or batteries are discharge the indicator of power supply is shining red and the transducer is automatically deactivate.

Front Panel

- Measuring data is being shown on the front panel as:

Running Data

Results are displayed every 2 seconds with the chosen averaging time. Averaging Time determines the time of calculating an average of the measurement results. Averaging is continuous, i.e. the oldest result is being replaced with the youngest result in the cycle of averaging. Averaging Time is independent from Interval Time which is a parameter of logging.

Logged Data

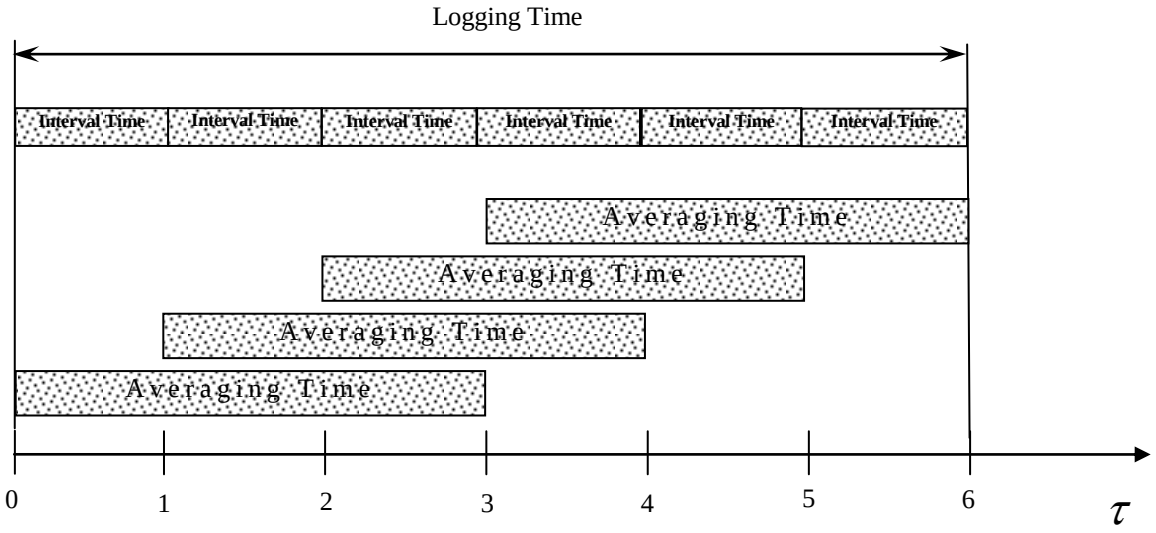
Only logged results are displayed according to logging parameters: Interval Time and Logging Time.

Data Graph

Results are shown as vertical strips. Numbers of a probe are presented on an X axis.

Logging Procedure

- In order to begin the logging procedure one should press the ' START ' button. A ' Select file for data logging ' window appears and the user should choose the name of a file for data logging. Next, there appears a new window ' Comment ' in which the user can enter any comment which will be placed at the beginning of a logging file. After pressing ' OK ' the logging procedure starts. The start time of the logging and remaining time to the end of logging are shown on appropriate indicators. During the logging procedure the logging indicator is blinking. Some buttons on the front panel are disabled in order not to disturb the logging process. Interrupting the logging in every moment is possible, after pressing the ' STOP ' button.
- Interval Time determines an interval between logged data. It can be chosen in the range from 2s to 60min.
- Logging Time determines how long a data will be logged. It can be chosen in the range from 10s to 48h. If the ' Repeat " switch is set to On, the logging procedure will be repeated several times, and the data will be written to separates files. Change the file will rely on automatically adding to its name a suffix, for example. name-1, name-2, and so on. It is possible to choose unlimited time as well.
- The logged data are stored in the text file. This file can be easily imported to MS Excel.
- The data logging and statistical analyzing procedure used is made clear in the following figure. An example of settings with Interval Time of 1 min, Averaging Time of 3 min and Logging Time of 6 min.



Economy Mode

- If the Economy Mode switch is ON, devices can be switch into the state of asleep when reading results isn't necessary. Asleep is only possible during the logged. Economy Mode is lowering the consumption of energy what influences increasing the working time on batteries.
- The Economy Mode switch is active when the Interval Time is bigger than 3 min and the Averaging Time is smaller than the half of the Interval Time.

Automatic End

- When AutoEnd switch is ON, the program automatically will be closed and all devices will be switched into the state of asleep after finishing the logging procedure.

DataSocket Connection

- When you use this protocol, the program communicates with the DataSocket Server. You must provide a named tag for the data, which is appended to the URL. The data connection uses the named tag to address a particular data item on a DataSocket Server. To use this protocol, you must run a DataSocket Server.
- In order to enable or disable the DataSocket connection, select 'DataSocket' from the menu item 'Data Communication…' on the menu bar on front panel.
- You publish (write) data by specifying a URL. You should enter 'localhost' on the publisher computer and IP address of the publisher on the subscriber computer.
- The example of Data Socket Reader is available in the Program Menu Folder (SENSOR Electronic\Examples).

TCP/IP Connection

- The built-in TCP/IP connection enables to communicate between different computers by the networks. TCP/IP routes data from server (ThermCondSys 5500 program) to client.
- The default TCP port number is 5000. In order to change the TCP port number select 'TCP connection' from the menu item 'Data Communication…' on the menu bar on front panel.
- The frequency of data transfer for TCP connection is specified by the Interval Time.

- The data transferred by TCP server are separated by TAB delimiters. The data string can be column headers or the results depending on setting the TCP connection. The part of string with column headers is ended by
  CR carriage return element. On the end of result string is EOL

  Example data string with results:
  23.1 TAB 23.2 TAB 22.9 EOL

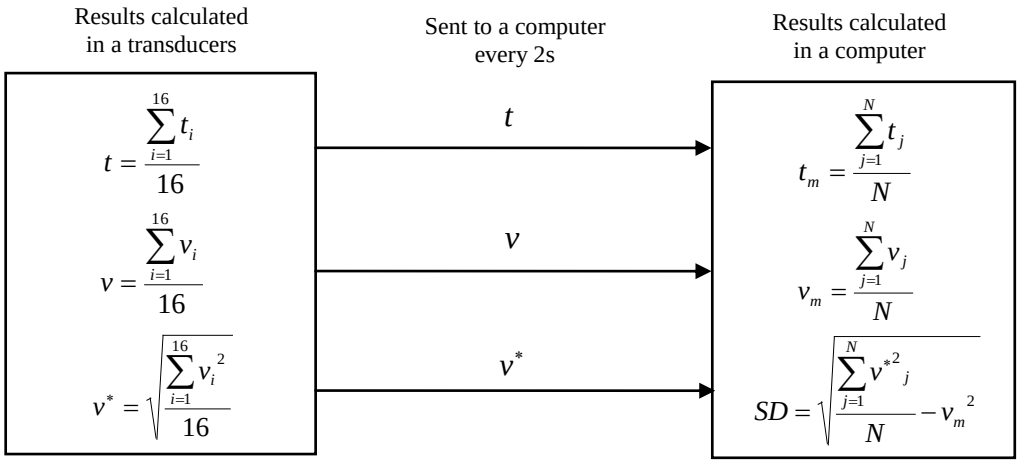
  Example data string with column headers:
  ta[degC] TAB tnw[degC] TAB tg[degC] CR 23.1 TAB 23.2 TAB 22.9 EOL
- The example of TCP Data Client is available in the Program Menu Folder (SENSOR Electronic\Examples).

Calculation of Results

- Air temperature, average speed and standard deviation of speed are calculated as shown in the below figure.
- The sampling rate is a constant and is 8 Hz regardless of the selected mode to display the results. To increase the bandwidth of the communications, the transducers send to the computer average values every 2s (i.e., an averages of 16 results). To be able to calculate correctly the standard deviation of the speed any time, transducers send also the roots of two second average value of square speed.
- Turbulence intensity and draught rate are calculated in accordance with the following equation:

  $Tu = \frac{SD}{v_a}100\%$, where SD – standard deviation

  $DR = (34 - t_a)(v_a - 0{,}05)^{0{,}62}(37SD + 3.14)$, for t_a>34 or v_a<0.05 $\Rightarrow$ DR=0
- It is important to set the barometric pressure if a SensoBar transducer is not connected to the system.



t_i – instantaneous temperature

v_i – instantaneous speed

t – two second average value of temperature

v – two second average value of speed

v^* – root of two second average value of square speed

t_m – average temperature in any averaging time

v_m – average speed in any averaging time

SD – standard deviation of speed in any averaging time

$N = \frac{T_a}{2s}$ where T_a is averaging time

Instantaneous Mode

- Instantaneous Mode enables displaying and logging results with frequency 8 times for the second.
- In order to choose the Instantaneous Mode one should press the ' INST ' button and then the 'Instantaneous Measurement' front panel appears. The user can select probe for observation the temperature and the speed in the real time on charts on the right side of panel. On the left side there is the chart with a logged speed. The number of probe for logging is selected independently in the control ' Logged probe select ' below the chart. On the panel is also a table with the current results for all of the probes.
- Logging time is selected in the control ' Logging Time '. After pressing the ' START ' button shows a window ' Select file for data logging ', in which the user should enter a file name for the logging and the logging procedure starts. Interrupting the logging in every moment is possible, after pressing the ' STOP ' button.

  Remarks:

  1. It is not recommended to use wire-less communication in Instantaneous Mode.
  2. For more than five SensoAnemo transducers the instantaneous results are shown on the charts with delayed 1s.

DataSocket Connection

- When you use this protocol, the program communicates with the DataSocket Server. You must provide a named tag for the data, which is appended to the URL. The data connection uses the named tag to address a particular data item on a DataSocket Server. To use this protocol, you must run a DataSocket Server.
- In order to enable or disable the DataSocket connection, select 'DataSocket' from the menu item 'Data Communication…' on the menu bar on front panel.
- You publish (write) data by specifying a URL. You should enter 'localhost' on the publisher computer and IP address of the publisher on the subscriber computer.
- The example of Data Socket Reader is available in the Program Menu Folder (SENSOR Electronic \Examples).

TCP/IP Connection

- The built-in TCP/IP connection enables to communicate between different computers by the networks. TCP/IP routes data from server (AirDistSys 5000 program) to client.
- The default TCP port number is 5000. In order to change the TCP port number select 'TCP connection' from the menu item 'Data Communication…' on the menu bar on front panel.
- The frequency of data transfer for TCP connection is specified by the Interval Time.
- The data transferred by TCP server are separated by TAB delimiters. The data string can be column headers or the results depending on setting the TCP connection. The part of string with column headers is ended by CR carriage return element. On the end of result string is EOL.

  Example data string with results:
  23.1 TAB 23.2 TAB 22.9 EOL

  Example data string with column headers:
  ta[degC] TAB tnw[degC] TAB tg[degC] CR 23.1 TAB 23.2 TAB 22.9 EOL
- The example of 'TCP Data Client' is available in the Program Menu Folder (SENSOR Electronic\Examples).

7. GUARANTEE AND REPAIRS

Sensor Electronic guarantees the correct operation of the instruments. The guarantee period is 24 months, beginning from the date of sale. All defects due to faulty material or manufacturing will be repaired. The guarantee covers repair and replacement of detective system components. The guarantee does not apply to damages of the instruments due to wrong transport or incorrect use and operation.