

5500

ThermCondSys 5500

thermal conditions monitoring system

APPLICATION

The ThermCondSys5500 is user friendly instrument for measuring, calculating and logging indoor climate data in moderate, hot and cold environments. It has been developed to meet the growing need for indoor climate monitoring equipment. The main features of the equipment are:

- mobility (moving from place to place)
- easy fast configuration (connection)
- low power consumption and long logging time
- automatic sleeping mode and auto power down
- wire-less communication between computer and measuring instruments.

ThermCondSys5500 offers simultaneous measurement of several parameters at different locations and heights as prescribed in the present indoor climate standards.

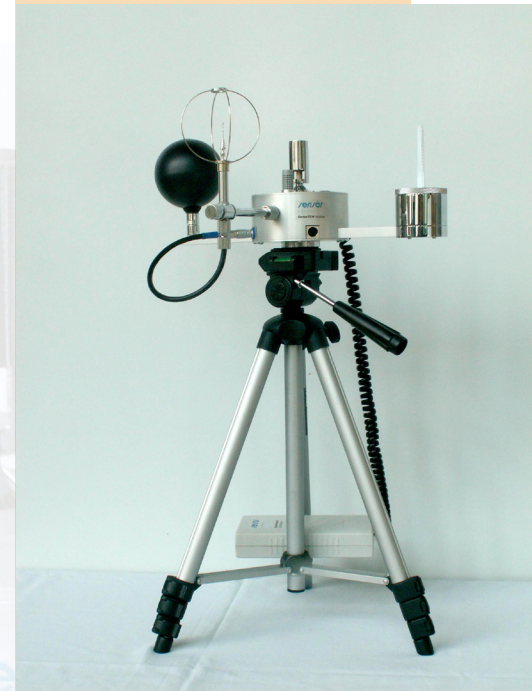
An optional wire-less communication based on WLAN or ZigBee protocol enables measurements at location placed far away from the mobile stand. ThermCondSys5500 is designed in compliance with ISO Standard 7726, ISO Standard 7730, ISO Standard 27243, ISO Standard 7933 and ASHRAE Standard 55.

ThermCondSys5500 can be equipped with probes for measurement of:

- t_g : globe temperature
- t_{nw} : natural wet temperature
- t_a : air temperature
- P_b : barometric pressure
- RH: relative humidity
- v_a : air speed

Based on the measurements the above parameters are calculated following indices:

- $WBGT_{in}$: wet bulb globe temperature
- $WBGT_{out}$: wet bulb globe temperature in the presence of radiation
- PMV: predicted mean vote
- PPD: predicted percentage of dissatisfied
- SD: standard deviation of air speed
- Tu: turbulence intensity of air speed
- DR: draught rating
- t_r : mean radiant temperature
- t_o : operative temperature
- t_{ad} : adjustable temperature
- t_{eq} : equivalent temperature
- E_{req} : required evaporation rate
- E_{max} : maximal evaporation rate
- W_{req} : required skin wettedness
- SW_{req} : required sweat rate
- p : air density
- p_a : partial water vapour pressure in the air
- x : specific humidity
- DEW: dew point temperature
- i : enthalpy for humid air
- WCI: wind chill index



sensor
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SYSTEM DESIGN

Measurements are performed by modules with integrated measuring probes (only the probes for measuring speed can be disconnected and transported separately). This makes the use of the system easy and fast. Single cables connect the modules and are used for data transmission and power supplying. Two types of measuring modules with relevant probes as selected by user can be configured. Digital RS485 output from the modules ensures data transmission to PC. The measuring system can be connected with computer by Senso-ConnectUSB interface. The wire-less version of the system employs SensoBee485 transmitter connected with the modules and Senso-BeeUSB receiver connected with computer.

Software built on the LabView platform is used for logging and reporting of the data with a PC notebook or PDA. The software enables for:

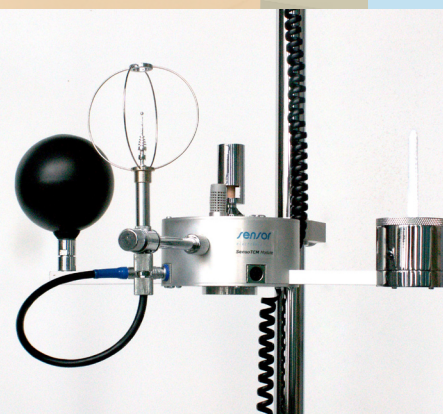
- automatic scanning of the configuration of the measuring system
- calculation of all parameters of the thermal environment
- energy saving of the battery by setting the system in automatic sleeping mode (due to this feature the system works longer on battery mode).

MEASURING MODULES

The measuring modules consist of cylindrical box (100 mm diameter and 48 mm height). Air temperature and humidity probes are placed on the top of the cylindrical box while natural wet temperature, globe temperature and air speed probes are placed on side supports with length of 100mm. Additional RTD probe may be connected with the measuring module and can be used for additional temperature measurement, eg. floor surface temperature, air inlet temperature, etc. The air speed probe can be disconnected from the measuring module and transported, stored or calibrated separately. The measuring modules can be mounted on a moveable support at different heights or on a tripod. The lowest height sensors can be placed is 0.1 m above the floor.

MAIN TECHNICAL SPECIFICATION

- | | |
|--------------------------------|------------------------------------|
| ■ operative temperature: | -10...50 °C |
| ■ operative relative humidity: | 0...90% RH non condensing |
| ■ measurement speed range: | 0.05...5 m/s |
| ■ measurement pressure range: | 500...1500 hPa |
| ■ power supply: | |
| | mains adapter: 6Vdc/1A |
| | batteries: four Ni-Mh accu size AA |
| ■ interfaces: | RS485, USB |
| ■ wire-less interfaces: | Zig-Bee |



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Air speed probe includes a spherical omnidirectional air speed sensor and temperature compensation sensor. These sensors are vacuum covered with special aluminium coating that increases their resistance to contamination and decreases the effect of thermal radiation on the accuracy of the speed measurement. The sensors are mounted on a rotary support arm which enables to set it in three positions (vertically, horizontally or obliquely). The speed sensor operates in a constant temperature anemometer bridge (CTA) with automatic temperature compensation. Air speed probe is individually calibrated in wind tunnel with LDA as reference.

TECHNICAL DATA

- | | |
|---------------------------------------|----------------------------|
| ■ type of the speed sensor: | omnidirectional, spherical |
| ■ diameter of the speed sensor: | 2 mm |
| ■ measurement range: | 0.05...5 m/s |
| ■ accuracy: | ±0.02 m/s ±1% of readings |
| ■ automatic temperature compensation: | < than ±0.1%/K |
| ■ upper frequency $f_{up}^{1)}$ | min. 1Hz, typ. 1.5 Hz |

¹⁾ The upper frequency is defined as the highest frequency up to which the standard deviation ratio remains in the limits of 0.9 to 1.1 (see EN13182 Ventilation in buildings - Instrumentation requirements for air velocity measurements in ventilated spaces, 2002, European Committee for Standardization, Brussels).

Air, natural wet, globe and supplementary temperature probes measure temperature using RTD sensors. Each sensor is individually calibrated. The calibration coefficients are stored in EEPROM's located in the connectors. The automatic correction of drifts ensures high thermal stability of measurement.

TECHNICAL DATA

- | | |
|-------------------------------|-------------|
| ■ type of temperature sensor: | Pt-100 |
| ■ measurement range: | -10...50 °C |
| ■ accuracy: | ±0.1 °C |

Barometric pressure probe is located inside the measuring module casing. The probe utilizes specialized piezoresistive micro-machined sensing element. The probe is thermally compensated.

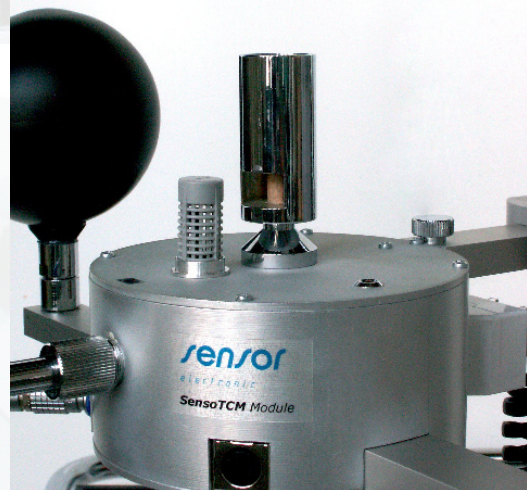
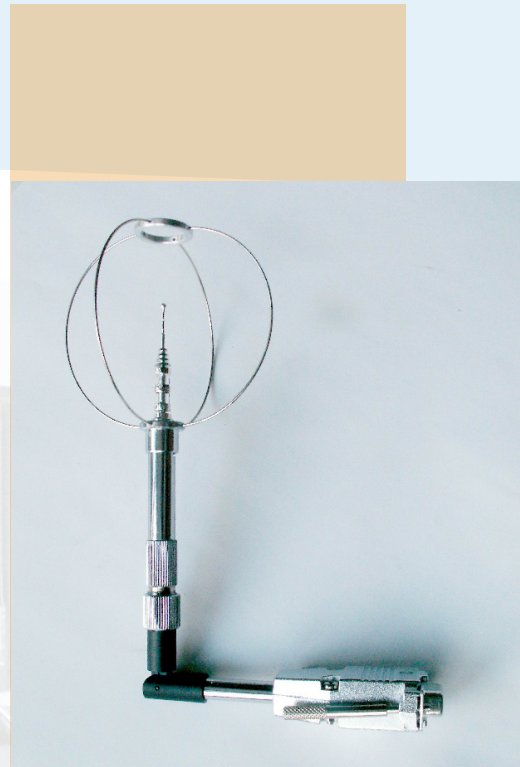
TECHNICAL DATA:

- | | |
|----------------------|----------------|
| ■ measurement range: | 500...1500 hPa |
| ■ accuracy: | ±3 hPa |

Relative humidity probe is located on the top of the measuring module. The probe includes a capacitive polymer sensing element and compensation bandgap temperature sensor.

TECHNICAL DATA:

- | | |
|------------------------|--------------------------|
| ■ measurement range: | 0...100% RH |
| ■ accuracy: | ±2% in range 10...90% RH |
| ■ long term stability: | <1% RH/year |
| ■ response time: | <4 s |



Modules	Thermal indices
SensoTCMod 5503	$t_a, t_g, t_{nw}, t_s, WBGT_{in}, WBGT_{out}, v_a, SD, DR, Tu, t_r, t_{ad}, t_{eq}, WCI$
SensoTCMod 5507^{*)}	$t_a, t_g, t_{nw}, t_s, WBGT_{in}, WBGT_{out}, v_a, SD, DR, Tu, t_r, t_o, t_{eq}, PMV, PPD, WCI, RH, P_b, p_a, x, \rho, DEW, i, E_{req}, E_{max}, W_{req}, SW_{req}$

^{*)} only one of three or four modules is needed for calculating mentioned thermal indices on all heights

ACCESSORIES

SensoConnect USB

interface RS485/USB (to computer)

SensoConnect USB Mobile

interface RS485/USB with battery compartment for 4 Ni-Mh accu 1.2 V (operating time: 8-30 h depending on the amount of measuring modules); preferred to portable configuration

SensoBee 485

wire-less transmitter with battery compartment for 4 Ni-Mh accu 1.2 V (operating time: 5÷20 h depending on the amount of measuring modules)

SensoBee USB

wire-less receiver with USB port (to connect with computer)

Power supply adaptor

DC6-9V1A/110...230V 50...60Hz

EXAMPLES OF CONFIGURATION

