

Thermal environments

Swema equipment for the measurement of Moderate Thermal Environments is designed to comply with the standards:

ISO7726 - Thermal environments - Instruments and methods for measuring physical quantities

ISO7730 - Ergonomics of the thermal environment - Analytical determination and interpretation of satisfaction of thermal environment using calculation of the PMV and PPD indices and local thermal comfort criteria.

Swema Multipoint program (763710)

Swema 03 (767360) air velocity, temperature

or **Swema 03+** (767361) with barometer

Swema 05 (767370) black globe temperature

2x **USB-cable** (767300) Swema 03 / 05 to PC

HC2-S (859447) Humidity, temperature

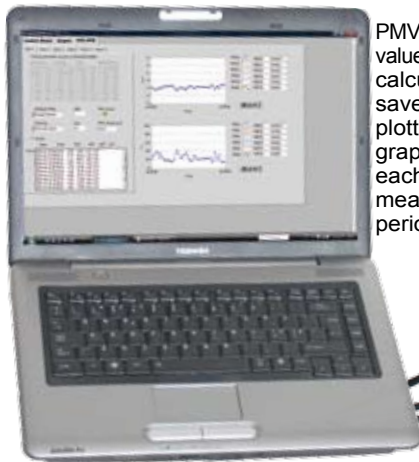
USB-cable (859466) USB: HC2-S to PC

3x **Probe clamp** (767460)

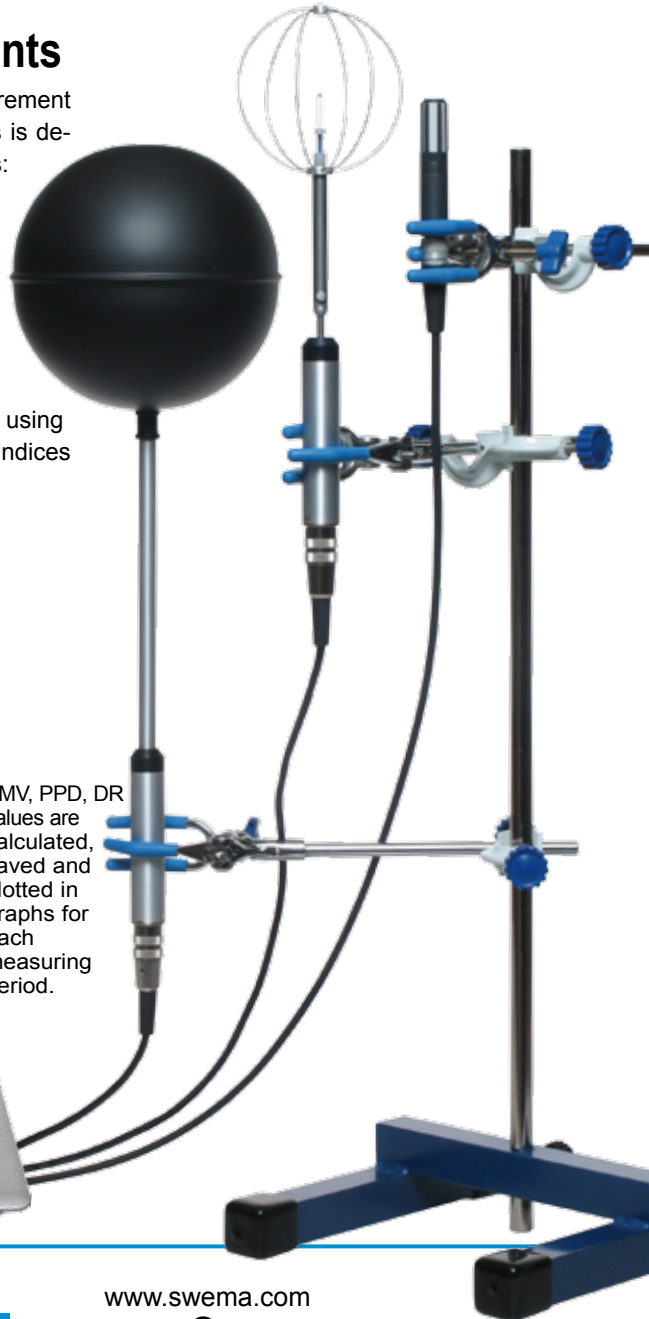
3 x **Clamp** (764550)

Rod (764540)

Foot (764530)



PMV, PPD, DR values are calculated, saved and plotted in graphs for each measuring period.



ISO 7730 measurements

Many test data shows that four measured environmental variables and two personal variables determine how warm or cold a person feels:

Environmental variables:

- Air temperature
- Air velocity
- Air humidity
- Mean radiant temperature (measured values).

Personal variables:

- Personal activity
- Clothing insulation (individual selected in SwemaMultipoint)

Comfort indices

Thermal comfort is defined as persons satisfaction of the thermal environment. According to ISO 7730 there are three indices to describe satisfaction rate in thermal environment: PMV, PPD and DR.

PMV: Predicted Mean Vote, is the sensation of body heat, from +3 (hot) to -3 (cold).

PPD: Predicted Percentage Dissatisfied, is the percentage of people dissatisfied with the thermal environment.

DR: Draught Rate is the percentage of people predicted to be bothered by draught. Draught is an unwanted local cooling of the body caused by air movements.

SwemaMultipoint

For ISO 7730 setup the SwemaMultipoint PC program collects data from the three sensors:

- Swema 03 - air velocity and temperature
- Swema 05 - black globe temperature
- HC2-S - air humidity and temperature

Recommended ISO 7730 setup with SwemaMultipoint: sampling frequency: 10 Hz, time constant: 0.1s.

SwemaMultipoint has three separate windows: one for the setup and storing data in files, one for presenting data in online graphs and one for presenting graphs PMV, PPD, Operative temperature and Wet Bulb Globe temperature for an averaging period.

Swema 03 values are selectable to calculate the Draught rate according to ISO 7730. From the Swema 03 and Swema 05 mean radiant temperature and operative temperature can be calculated.

From the HC2-S humidity and temperature sensor dew point, mixing ratio and wet bulb temperature can be calculated.

From HC2-S and Swema 05 the wet bulb globe temperature can be calculated.

Select measured and calculated values to be presented in online graphs and to be saved into files.

SwemaMultipoint communicates with all the sensors via USB. Saved data can be analyzed in a separate SwemaMultipoint Analyze program or in a standard spreadsheet program.

LOW AIR VELOCITY

Multiple probes to PC

Swema equipment for measuring air velocity in many points in order to evaluate the air velocity pattern from ventilation valves in rooms or vehicles.

The Swema 03 sensors are directional independent and measures air with up to 100 Hz. Draught can be calculated according ISO 7730 in the SwemaMultipoint program for each sensor during selectable time.

Set up according to picture:

SwemaMultipoint program (763710)

4 x **Swema 03** (767360) air velocity, temperature

or 4 x **Swema 03+** (767361) with barometer

4 x **USB-cable** (767300) Swema 03 / 05 to PC

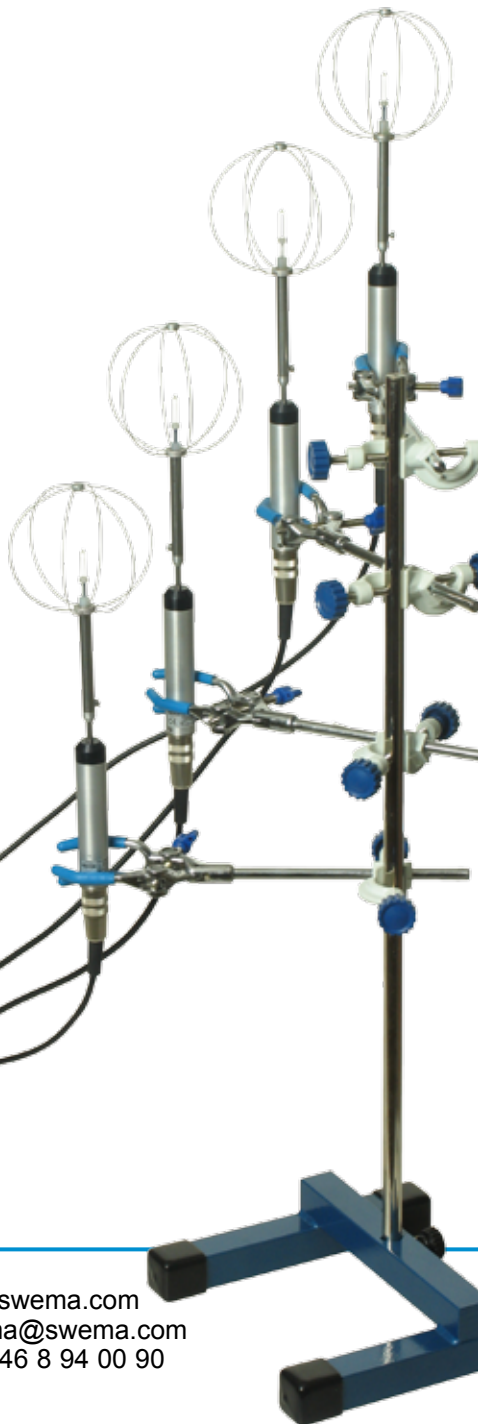
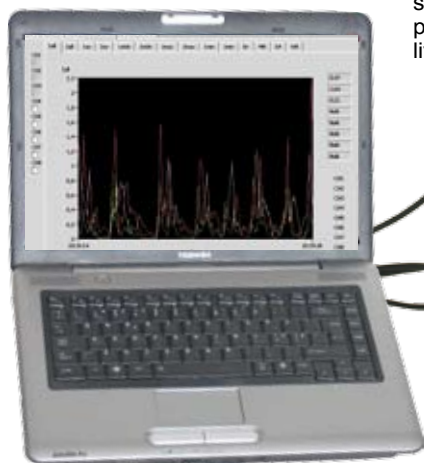
4 x **Probe clamp** (767460)

4 x **Clamp** (764550)

1 x **Rod** (764540)

1 x **Foot** (764530)

Air velocity values are saved and plotted in live graphs.



SwemaMultipoint

Swema 03 low air velocity sensors connect to SwemaMultipoint PC program. Either through USB or RS 485. Air velocity and temperature values are shown, logged and presented in live graphs. Draught rate calculation (DR) according to ISO 7730 can be calculated for each probe.

Multiple location of air velocity is available with up to six Swema 03 sensors with the standard SwemaMultipoint program and up to 255 probes with a customized program can be connected.

SwemaMultipoint communicates with the sensors via USB or RS485. Saved data can be analyzed in a included SwemaMultipoint Analyze program or in a standard spread sheet program.

SwemaMultipoint can log and save data for each sensor at a recommended rate of 10 times per second.

Alternative four sensors setup with RS 485:

- 4 x Swema 03 (767360)
- 4 x RS 485 Swema cable (767630)
- 4 x RS 485 3-way-splitter (767660)
- 1 x RS 485 terminator (767690)
- 3 x RS 485 cable 2m (767670)
- 1 x USB-RS485 (767300) to PC
- 4 x Probe clamp (767460)
- 4 x Clamp (764550)
- 1 x Rod (764540)
- 1 x Foot (764530)
- 4 x Probe clamp (767460)
- 4 x Clamp (764550)
- 1 x Rod (764540)
- 1 x Foot (764530)
- 1 x SwemaMultipoint (763710)



Instrument

The omni-directional low air velocity sensor is also available as SWA 03 for the universal instrument Swema 3000. This is useful for field measurements where a computer setup is time and space consuming. For example in vehicles. Any model of Swema 3000 is useful for logging and saving measurements.

Calculating the draught rate (DR) is also made with the instrument. The 220V adapter 764.610 connects to USB and is recommended for use for more than one working day. It is possible to connect Swema 3000 via USB to the PC program SwemaMultipoint.



Instrument setup

- 1 x SWA 03 (764730) air velocity, temperature
- 1 x Swema 3000 (764200) nincl. USB-cable
- 1 x One channel freeware - SwemaTerminal 2



LOW AIR VELOCITY

Swema 03

(767360)
ISO7726 gives all the required and desirable characteristics of measuring instruments for thermal comfort ISO 7730.

Swema 03 is an omnidirectional anemometer designed with a fast microcontroller and a small sensing element to achieve specially good dynamic qualities for response time and turbulence. Swema 03 has exceptionally low self convection. Swema 03 fulfills ISO 7726 requirements. Swema 03+ (767361) has an additional inbuilt barometer for automatic compensation air density depending and temperature and air atmospheric pressure. The barometric pressure can be set in Swema 03 for the same compensation. The number of read values is max 100 per second. With more probes connected less values per probe may be obtained due to computer limitations. Swema 03 can be set up with multiple probes with SwemaMultipoint PC-program.



SWA 03

Swema 3000 with SWA 03 low air velocity sensor for measurement, logging and draught calculation in the field.



Technical data:

Swema 03 & SWA 03

Air velocity: 0,05...3,00 m/s at 15...30 °C
Accuracy at 23 °C: $\pm 0,03$ m/s at 0,05...1,00 m/s,
 $\pm 3\%$ read value at 1,00...3,00 m/s
at 15...30 °C: $\pm 0,04$ m/s at 0,05...1,00 m/s,
 $\pm 5\%$ read value at 1,00...3,00 m/s

Response time air velocity (90%): 0,2 s

Temperature: 10...40 °C

Accuracy:

at calibration temperature (approx. 23 °C): $\pm 0,3$ °C,
at 10...40 °C: $\pm 0,5$ °C

95% coverage probability in non condensing, non moist air, <80%RH, non aggressive gases

SwemaMultipoint connection:

Swema 03: USB and RS485

SWA 03 via Swema 3000 to USB, RS 232

Sampling frequency: Recommended 10Hz
(up to 100Hz for one sensor)

Included:

Traceable calibration certificate

Fulfills ISO 7726

HUMIDITY, TEMPERATURE

Relative Humidity

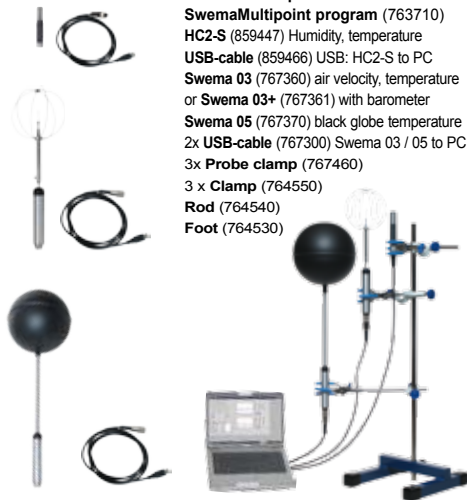
HygroClip2-S (859447) measures humidity and temperature using Rotronic sensing element and digital calibration. Dew point and water content (g water / kg dry air) is calculated in SwemaMultipoint.



Technical data:

Relative humidity: 0...100 %RH
HC2-S: $\pm 0,8$ %RH at 23 °C
Temperature:
-40...+60 °C
Accuracy: $\pm 0,3$ °C at 23 °C
Communication; USB
Sampling frequency:
Recommended 10Hz
Fullfils ISO 7726
Included:
Traceable calibration certificate

ISO 7730 Setup:
SwemaMultipoint program (763710)
HC2-S (859447) Humidity, temperature
USB-cable (859466) USB: HC2-S to PC
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Black Globe temperature

Swema 05 (767.370)

Ø150 mm Black Globe sensor. Together with air velocity from Swema 03 the mean radiant temperature can be calculated.



Technical data:

Swema 05
at 0...50 °C: $\pm 0,1$ °C
Communication; USB and RS485
Sampling frequency:
Recommended 10Hz
(up to 100Hz on some PC-installation)
Fullfils ISO 7726
Included:
Traceable calibration certificate



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