



HD 32.2, HD32.2A INSTRUMENT FOR THE ANALYSIS OF THE WBG INDEX

HD32.2 – WBG Index is an instrument made by Delta OHM srl for the analysis of WBG index (Wet Bulb Glob Temperature: wet bulb temperature and globe thermometer temperature) in presence or in absence of solar radiation.

Reference Regulations:

ISO 7243: Hot environments. Estimation of the heat stress on working man, based on WBG index (wet bulb temperature and Globe thermometer).

ISO 8996: Ergonomics of the thermal environment – Determination of the energy metabolism.

ISO 7726: Ergonomics of the thermal environment – Instruments for measuring physical quantities.

The instrument is provided with three inputs for probes with SICRAM module: the SICRAM module interface between the instrument and sensor connected and communicate the sensor parameters and calibration data to the instrument.

The instrument is equipped with three inputs for probes with SICRAM module: the probes have an electronic circuit that communicates with the instrument and stores the sensor calibration data. All SICRAM probes can be connected to any of the instrument's inputs, they are automatically recognized upon turning the Instrument on. The **main features** of the instrument are:

- **Logging:** data acquisition and logging to the internal instrument memory. Storage capacity: **64 different logging sections**, sample interval, user selectable.
- You can set the automatic logging start with **auto-start** function (**Start/Stop time**).
- The **measurement unit** of the temperature: °C, °F, °K.
- The display of **maximum, minimum, medium** statistic parameters.
- The data transfer via the RS232 or USB serial ports.

HD32.2 instrument can detect simultaneously the following quantities:

- Globe thermometer temperature **T_g**.
- Wet bulb temperature with natural ventilation **T_n**.
- Environment temperature **T**.

Starting from the detected values, HD32.2 can calculate:

- **WBG(in)** index (Wet Bulb Glob Temperature: wet bulb temperature and Globe thermometer) in absence of solar radiation.
- **WBG(out)** index (Wet Bulb Glob Temperature wet bulb temperature and Globe thermometer) in presence of solar radiation.

WBG index

WBG (Wet Bulb Globe Temperature – Wet bulb temperature and globe thermometer) is one of the indexes used to determinate the occupational heat exposure.

It represents the value, related to the metabolic expenditure linked to a specific work activity, that causes a thermal stress when exceeded.

WBG index combines the temperature measurement of wet bulb with natural ventilation t_{nw} with the globe thermometer t_g and, in some situations, with the air temperature t_a .

The calculation formula is the following:

- inside and outside a buildings in absence of solar radiation:

$$WBG_{close\ environments} = 0,7 t_{nw} + 0,3 t_g$$

- outside a building in presence of solar radiation:

$$WBG_{outside\ environments} = 0,7 t_{nw} + 0,2 t_g + 0,1 t_a$$

where:

t_{nw} = natural wet bulb;

t_g = globe thermometer temperature;

t_a = air temperature.

The measured data should be compared with the limit values prescribed by the regulations;

when exceeded you have to:

- reduce directly the thermal stress on the examined work place;
- proceed to a detailed analysis of the thermal stress.

In order to measure the WBG index, the following probes should be connected:

- **Natural wet bulb HP3201.2 (HP3201).**
- **TP3276.2 Globe thermometer probe (TP3276 or TP3275).**
- **TP3207.2 (TP3207) Dry bulb temperature, if the measurement is performed in presence of solar radiation.**

In order to measure the WBG index, you should refer to the following regulations:

- **ISO 7726**
- **ISO 7243**
- **ISO 8996**

Technical features

Instrument

Dimensions (Length x Width x Height)	185x90x40 mm
Weight	470 g (batteries included)
Materials	ABS, rubber
Display	back light, with dot-matrix 160x160 points, visible area 52x42mm



Working conditions

Working temperature -5 ... 50°C
 Storage temperature -25 ... 65°C
 Working relative humidity 0 ... 90% RH no condensation

Protection Degree

IP65

Instrument uncertainty

± 1 digit @ 20°C

Power supply

Mains power supply (code SWD10) 12Vdc/1A
 Batteries 4 batteries 1.5V type AA
 Autonomy 200 hours with 1800mAh alkaline batteries
 Power absorbed with instrument off < 45µA

Safety of the stored data

unlimited

TP3207.2 (TP3207) Temperature probe

Sensor type: Pt100 with thin-film
 Accuracy: Class 1/3 DIN
 Measurement range: -40 ÷ 100 °C
 Resolution: 0.1°C
 Temperature drift @20°C: 0.003%/°C
 Drift after 1 year: 0.1°C/year
 Connection: 4 wires plus SICRAM module
 Connector: 8 female poles DIN45326
 Dimensions: Ø=14 mm L= 150 mm
 Response time T₉₅: 15 minutes



Example of immediate data print, obtained with HD40.1 printer.

```

=====
ISO 7243 WBGT Index
=====
Model HD32.2 WBGT Index
Firm.Ver.=01.00
Firm.Date=2008/12/05
SN=12345678
ID=0000000000000000

Probe ch.1 description
Type: Pt100
Data cal.:2008/10/01
Serial N.:08109450
-----
Probe ch.2 description
Type: Pt100 Tg 50
Data cal.:2008/10/01
Serial N.:08109452
-----
Probe ch.3 description
Type: Pt100 Tw
Data cal.:2008/10/01
Serial N.:08109454
=====
Date=2008/11/21 15:00:00
Tnw      21.2 °C
Tg       24.9 °C
Ta       31.3 °C
WBGT (i) 22.3 °C
WBGT (o) 23.0 °C
=====
Notes:
=====
    
```

NOTES

Reference standard

Instrument Model
 Instrument firmware version
 Instrument firmware date
 Instrument Serial Number
 Identification Code

Description of the probe connected to input 1

Description of the probe connected to input 2

Description of the probe connected to input 3

Date and time
 Natural wet bulb
 Globe thermometer ventilation
 Dry bulb temperature
 WBGT in absence of direct solar radiation
 WBGT in presence of direct solar radiation



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TP3276.2 Globe thermometer probe Ø=50 mm (Ø=150mm TP3275)

Sensor type: Pt100
 Accuracy: Class 1/3 DIN
 Measurement range: -10 ÷ 100 °C
 Resolution: 0.1°C
 Temperature drift @20°C: 0.003%/°C
 Drift after 1 year: 0.1°C/year
 Connection: 4 wires plus SICRAM module
 Connector: 8 female poles DIN45326
 Stem dimensions: Ø=8 mm L= 170 mm
 Response time T₉₅: 15 minutes

HP3201.2 (HP3201) Natural ventilation wet bulb

Sensor type: Pt100
 Accuracy: Class A
 Measurement range: 4 °C ÷ 80 °C
 Resolution: 0.1°C
 Temperature drift @20°C: 0.003%/°C
 Drift after 1 year: 0.1°C/year
 Connection: 4 wires plus SICRAM module
 Connector: 8 female poles DIN45326
 Stem dimensions: Ø=14 mm L= 170 mm
 Braid length: 10 cm. at least
 Tank capacity: 15 cc.
 Tank autonomy: 96 hours with RH=50%, t = 23°C
 Response time T₉₅: 15 minutes

Connections

Input for probes with SICRAM module 3
 Connectors 8 male poles DIN 45326

USB Interface

Type: USB 1.1 or 2.0 not isolated
 Connection: Mini-USB
 Baud rate: 460800

RS232 Serial Interface:

Pin: M12-8 poles.
 Type: RS232C (EIA/TIA574) not insulated
 Baud rate: from 1200 to 38400 baud.
 Data bit: 8
 Parity: None
 Stop bit: 1
 Flow control: Xon-Xoff
 Cable length: max 15m

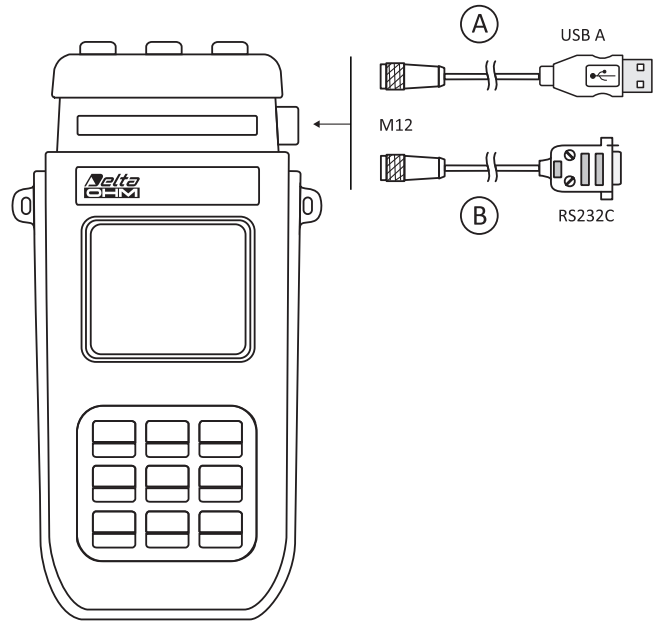
Memory Storage capacity

divided in 64 blocks.
 67600 memorizations for each of the 3 inputs.

Logging interval

selectable among: 15, 30 seconds, 1, 2, 5, 10, 15, 20, 30 minutes and 1 hour.

Logging interval	Storage capacity
15 seconds	Approx. 11 days and 17 hours
30 seconds	Approx. 23 days and 11 hours
1 minute	Approx. 46 days and 22 hours
2 minutes	Approx. 93 days and 21 hours
5 minutes	Approx. 234 days and 17 hours
10 minutes	Approx. 1 year and 104 days
15 minutes	Approx. 1 year and 339 days
20 minutes	Approx. 2 years and 208 days
30 minutes	Approx. 3 years and 313 days
1 hour	Approx. 7 years and 261 days



- A** USB connection to PC using type A USB - M12 cable, code HD2110USB. **USB drivers are required.**
- B** RS232C connection to PC. It allows you to connect the RS232C serial port of a PC or the printer HD40.1 with the cable HD2110RS.

ORDERING CODES

HD32.2 consisting of:

- **HD32.2 WBGT Index instrument**, 4 alkaline batteries 1.5V AA type, instruction manual, case. **DeltaLog10 Software Warm environments: WBGT analysis downloadable from Delta OHM website. Probes and cables have to be ordered separately.**

Required probes for the measurement of WBGT:

- **TP3207.2** Probe of dry bulb temperature.
- **TP3276.2** Globe thermometer probe.
- **HP3201.2** Natural ventilation wet bulb

HD32.2A consisting of:

- **HD32.2 WBGT Index instrument**, 4 alkaline batteries 1.5V AA type, instruction manual, case. **DeltaLog10 Software Warm environments: WBGT analysis downloadable from Delta OHM website. Probes and cables have to be ordered separately.**

Required probes for the measurement of WBGT version A:

- **TP3207** Dry bulb temperature.
- **TP3275** Globe thermometer probe.
- **HP3201** Natural ventilation wet bulb.

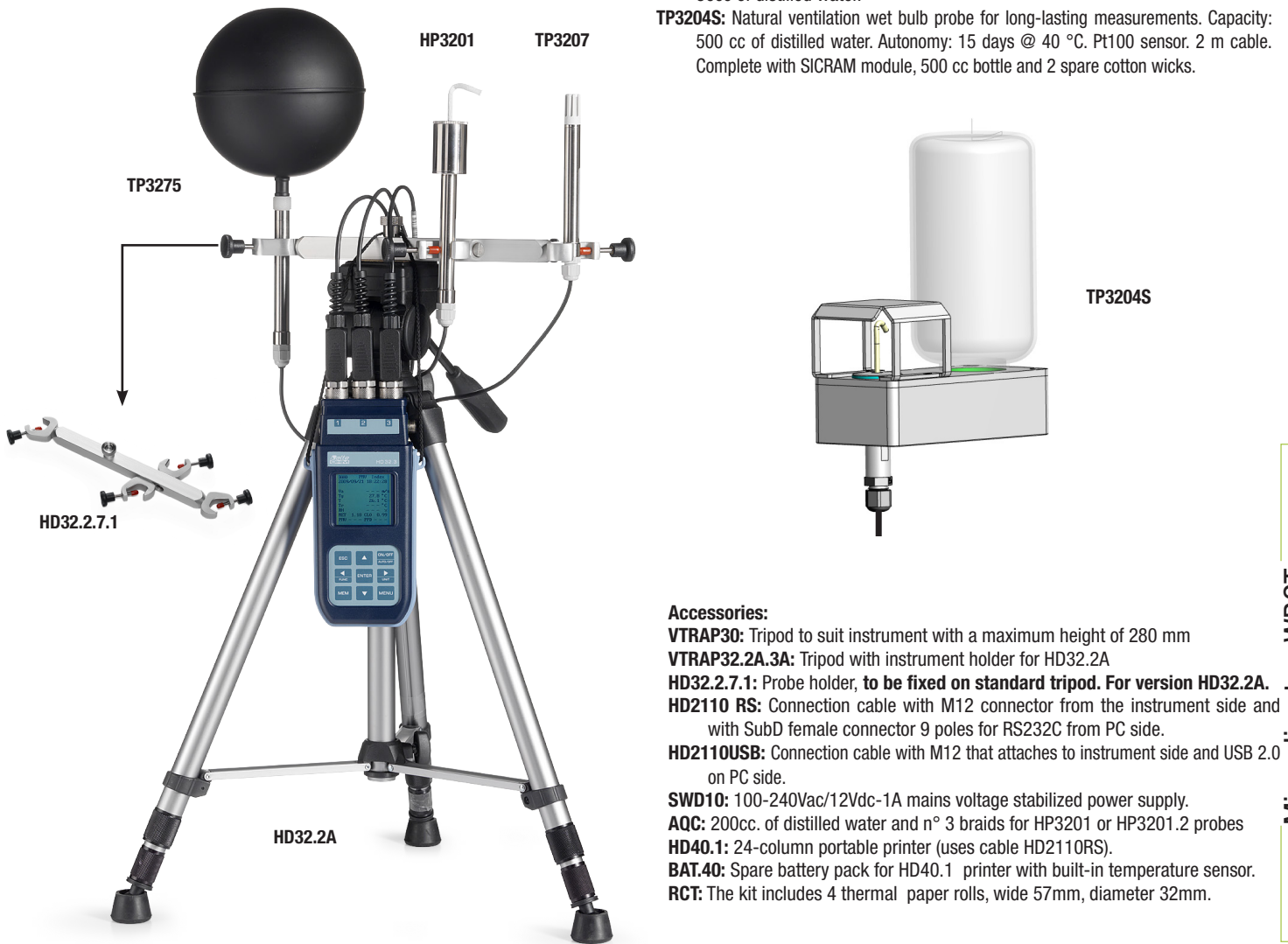


Probes for HD32.2 WBGT Index (without cable):

- TP3207.2:** Temperature probe with Pt100 sensor. Probe stem \varnothing 14mm, length 150 mm. Equipped with SICRAM module.
- TP3276.2:** Globe thermometer probe with Pt100 sensor, globe \varnothing 50 mm. Stem \varnothing 8 mm, length 170 mm. Equipped with SICRAM module.
- HP3201.2:** Natural wet bulb. Pt100 sensor. Probe stem \varnothing 14 mm, length 170 mm. Equipped with SICRAM module, spare parts of the braid and case of 50cc. distilled water.

Probes for HD32.2 version A (with cable):

- TP3207:** Temperature probe with Pt100 sensor. Probe stem \varnothing 14mm, length 140 mm. Cable length 2m. Equipped with SICRAM module.
- TP3275:** Globe thermometer probe with Pt100 sensor, globe \varnothing 150 mm. Stem \varnothing 14 mm, length 110 mm. Cable length 2m. Equipped with SICRAM module.
- HP3201:** Natural ventilation wet bulb. Pt100 sensor. Probe stem \varnothing 14 mm, length 110 mm. Cable length 2m. Equipped with SICRAM module, spare braids and 50cc of distilled water.
- TP3204S:** Natural ventilation wet bulb probe for long-lasting measurements. Capacity: 500 cc of distilled water. Autonomy: 15 days @ 40 °C. Pt100 sensor. 2 m cable. Complete with SICRAM module, 500 cc bottle and 2 spare Pt cotton wicks.



Accessories:

- VTRAP30:** Tripod to suit instrument with a maximum height of 280 mm
- VTRAP32.2A.3A:** Tripod with instrument holder for HD32.2A
- HD32.2.7.1:** Probe holder, to be fixed on standard tripod. For version HD32.2A.
- HD2110 RS:** Connection cable with M12 connector from the instrument side and with SubD female connector 9 poles for RS232C from PC side.
- HD2110USB:** Connection cable with M12 that attaches to instrument side and USB 2.0 on PC side.
- SWD10:** 100-240Vac/12Vdc-1A mains voltage stabilized power supply.
- AQC:** 200cc. of distilled water and n° 3 braids for HP3201 or HP3201.2 probes
- HD40.1:** 24-column portable printer (uses cable HD2110RS).
- BAT.40:** Spare battery pack for HD40.1 printer with built-in temperature sensor.
- RCT:** The kit includes 4 thermal paper rolls, wide 57mm, diameter 32mm.

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