HD 32.2
INSTRUMENT FOR THE ANALYSIS OF THE WBGT INDEX

HD32.2 – WBGT Index is an instrument made by **Delta Ohm srl** for the analysis of **WBGT 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 WBGT 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.

All SICRAM probes can be plugged into any of the inputs: they are automatically recognized upon turning the Instrument on.

The **main features** of the instrument are:

- **Logging:** data acquisition and logging to the integral 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.
- **Date and time** of the instrument.
- The display of **maximum, minimum, medium** statistic parameters and their deletion.
- The data transfer speed via the RS232 serial port.

HD32.2 instrument can detect simultaneously the following quantities:
- Globe thermometer temperature **Tg**.
- Wet bulb temperature with natural ventilation Tn.
- Environment temperature **T**.

Starting from the detected values, HD32.2 can calculate:
- **WBGT(in)** index (Wet Bulb Glob Temperature: wet bulb temperature and Globe thermometer) in absence of solar radiation.
- **WBGT(out)** index (Wet Bulb Glob Temperature wet bulb temperature and Globe thermometer) in presence of solar radiation.

WBGT

WBGT (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.

WBGT 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:

$$WBGT_{close\ environments} = 0.7\ t_{nw} + 0.3\ t_g$$

- outside a building in presence of solar radiation:

$$WBGT_{outside\ environments} = 0.7\ t_{nw} + 0.2\ t_g + 0.1\ t_a$$

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 WBGT 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 WBGT index, you should refer to the following regulations:
- **ISO 7726**
- **ISO 7243**
- **ISO 8996**

HD2110/USB

HD2110/RS

SWD10

VTRAP30

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	**IP67**
Instrument uncertainty	± 1 digit @ 20°C

Power supply

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

TP3276.2
HP3201.2
TP3207.2
RS232 USB
HD32.2

External power supply

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

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========================
  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
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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:
========================
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NOTES

Reference regulation

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 buld
Globe thermometer ventilation
Dry bulb temperature
WBGT in absence of direct solar radiation
WBGT in presence of direct solar radiation

HD40.1

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 T_{95}:	15 minutes

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 T_{95}:	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 T_{95}:	15 minutes

Connections

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

AP3203.2   HP3217.2   TP3276.2

Serial Interface:

Pin:	M12-8 poles.
Type:	RS232C (EIA/TIA574) or USB 1.1 o 2.0 not insulated
Baud rate:	from 1200 to 38400 baud. with USB baud=460800
Data bit:	8
Parity:	None
Stop bit:	1
Flow control:	Xon-Xoff
Cable length:	max 15m
Memory	divided in 64 blocks.
Storage capacity	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

Ordering codes

HD32.2 consisting of:
- **HD32.2 WBGT Index instrument**, 4 alkaline batteries from 1.5V type AA, instruction manual, case. **DeltaLog10 Software Warm environments: WBGT analysis. 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.
- **TP3201.2** Natural ventilation wet bulb

HD32.2A consisting of:
- **HD32.2 WBGT Index instrument**, 4 alkaline batteries from 1.5V type AA, instruction manual, case. **DeltaLog10 Software Warm environments: WBGT analysis. 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.
- **TP3201** Natural ventilation wet bulb.

HP3201.2   TP3276.2   TP3207.2

Probes for HD32.2 WBGT Index:

TP3207.2: Temperature probe with Pt100 sensor. Probe stem Ø 14mm, length 150 mm. Equipped with SICRAM module.

TP3276.2: Globe thermometer probe with Pt100 sensor, globe Ø 50 mm. Stem Ø 8 mm, length 170 mm. Equipped with SICRAM module.

HP3201.2: Natural wet bulb. Pt100 sensor. Probe stem Ø 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:

TP3207: Temperature probe with Pt100 sensor. Probe stem Ø 14mm, length 140 mm. Cable length 2m. Equipped with SICRAM module. Used for the calculation of the indicies: **IREQ,WCI, DLE, RT, PMV, PPD, WBGT, SR**. Used for calculating Mean radiant temperature.

TP3275: Globe thermometer probe with Pt100 sensor, globe Ø 150 mm. Stem Ø 14 mm, length 110 mm. Cable length 2m. Equipped with SICRAM module. Used for calculating Mean radiant temperature and WBGT.

HP3201.2: Natural ventilation wet bulb. Pt100 sensor. Probe stem Ø 14 mm, length 110 mm. Cable length 2m. Equipped with SICRAM module, spare braids and 50cc of distilled water. Used for the measurement for WBGT calculation.

Accessories:

VTRAP30: Tripod to suit HD32.2 instrument with a maximum height of 280 mm

HD2110/RS: Connection cable with M12 connector from the instrument side and with SubD female connector 9 poles for RS232C from PC side.

HD2110/USB: Connection cable with M12 connector from the instrument, USB 2.0 connector from PC side.

SWD10: 100-240Vac/12Vdc-1A mains voltage stabilized power supply.

AQC: 200cc. of distilled water and n° 3 braids for HP3201 or HP3217DM probes

BAT.40: Spare battery pack for HD40.1 and HD40.2 printer with built-in temperature sensor.

RCT: The kit includes 4 thermal paper rolls, wide 57mm, diameter 32mm.

TP3275

HP3201 TP3207

HD32.2A

HD32.2.7