

Portable Heat Stress and Thermal Comfort meter



- ▶ Quick, real-time, reliable and accurate assessment of heat stress WBGT index (without or with solar load) (ISO7243)
- ▶ Real time assessment of the WBGT Eff and WBGT Ref with Delta to the limit calculation for immediate verification of the distance to the limit (ISO7243 2017-08 edition)
- ▶ Real-time assessment of the thermal comfort PMV- PPD index (ISO7730)
- ▶ Verification probe for temperatures measured by the system
- ▶ Stand-alone models (ELR600M / ELR605M) or with built-in radio technology (ELR610M / ELR615M) for simultaneous wireless monitoring in different locations/heights
- ▶ Rated IP54
- ▶ 8MB memory for extended data logging
- ▶ Battery Life: 200h (with radio on 20h)
- ▶ Automatic start / stop of measurements
- ▶ Design and performances according to ISO7243 and ISO7726
- ▶ HS Manager program included for data downloading, data assessment and data reporting
- ▶ Data export to GIDAS TEA software for additional features, including additional index calculation as: Predicted Heat Strain (PHS-ISO7923), Required Clothing Insulation (IREQ-ISO11079) indices

Heat Shield meter displays on-line WBGT index (without or with solar load), WBGT Eff and Delta to the WBGT Ref, plus Heat Index and Humidex indices. Furthermore, if ESV126 anemometer is connected, Heat Shield can calculate directly the PMV-PPD comfort index (ISO7730). The models with built-in radio technology can support up to two satellite units to assess analysis at different levels or in different locations. It is possible to download the stored data using HS Manager PC program included with Heat Shield. From HS Manager it is also possible to export the data to GIDAS TEA program, used for further thermal environments analysis as Predicted Heat Strain (PHS), Insulation Required (IREQ), Duration Limit of the exposition (im). GIDAS-TEA program will also allow post-processing analysis of WBGT, PMV and PPD indexes (read Gidas-TEA catalogue MW9006-ENG-06).

Main features

▶ Measurements

Heat Shield is equipped with built-in sensors to measure:

- globe temperature (tg)
- wet bulb temperature (tnw)
- dry bulb temperature (ta)
- relative humidity (rh)
- air speed (va) (external, optional)

Heat Shield supports both 15 cm (6") and 5 cm (2") black globes thermometers diameters.



Tg sensor, 5 cm (2") or 15 cm (6") diameter

Ta&rh% sensor

Tnw Sensor



ESV126 Va sensor (hot wire)

- ▶ *ESV126 hot wire anemometer sensor is optional and it is used to real-time calculations of PMV-PPD thermal comfort index (ISO7730). In case of using GIDAS-TEA program, post-processing assessment of Predicted Heat Strain (PHS-ISO7923) and Required Clothing Insulation (IREQ-ISO11079) indices is possible.*

▶ Calculations

Heat Shield calculates on-line and displays the following indexes:

- WBGT index (without/with solar load) (ISO7243)
- WBGT Eff (CAV—Clothing Adjustment Value selection by menù), WBGT Ref (Metabolism value selection by menù) for Acclimatized/ Not acclimatized subjects (ISO7243 2017-08 edition)
- Head-Torso-Ankle Weighted Average WBGT (when ELR610S or ELR615S satellites are used)
- Heat index According to 1990 National Weather Service (NWS) Technical Attachment (SR 90-23)
- Humidex According to J.M. Masterton and F.A. Richardson of Canada's Atmospheric Environment Service equation (1979)
- PMV-PPD (ISO7730) comfort index. Requires air flow using ESV126 anemometer sensor. Metabolism (Met), Cloth (Clo) and Mechanical ratio (ETA) values are required for the subject under evaluation

▶ Post-processing software

Once data are downloaded to a PC, LSI LASTEM suggests two software applications:

1) Using GIDAS TEA (optional) will be possible perform easy and quick creation of reports based on any available ISO index:

- PMV-PPD index, TO Operative Temperature index (ISO7730) (BSZ313 GIDAS-TEA module)
- PHS Predicted Heat Strain (ISO7933) (BSZ317 GIDAS-TEA module)
- IREQ Insulation Required, Duration Limit of the exposition (ISO11079) (BSZ313 GIDAS-TEA module)

2) Using HS Manager (included) will be possible to perform analysis of the results of Heat Shield and to evaluate working limits.

Read more about it in the LSI-LASTEM's Software catalogue (MW9006-ENG-06).

▶ Three measurement positions using satellite modules

The Heat Shield models with radio (ELR610M / ELR615M) can be supplied with additional two wireless satellite modules (ELR610S / ELR615S). The satellite units are used to measure environmental conditions at three positions or levels and calculate Head-Torso-Ankle Weighted Average WBGT. Heat Shield radio can cover up to 300 m in line-of-sight distance, in indoors conditions it may vary.



ELR610S:
5 cm diameter black globe sensor satellite modules



ELR615S:
15 cm diameter black globe sensor satellite modules

▶ Two options black Globe diameter

According to the country policy and regulation, Heat Shield can be supplied with 5 cm or 15 cm diameter globe temperature sensor:

Models without radio

- **ELR600M:** 5 cm diameter
- **ELR605M:** 15 cm diameter

Models with radio

- **ELR610M:** 5 cm diameter
- **ELR615M:** 15 cm diameter
- **ELR610S:** 5 cm diameter satellite
- **ELR615S:** 15 cm diameter satellite

Heat Shield has an algorithm that obtains the temperature of the 5 cm diameter globe (standard according to ISO 7726) starting from the data obtained from the 15 cm diameter globe.



ELR600M / ELR610M:
5 cm diameter black globe sensor



ELR605M / ELR615M:
15 cm diameter black globe sensor



Three levels WBGT on the same vertical



Assesments in three positions of the same environment

► Verification probe for temperatures (DMA033.3)

Using the high accuracy temperature probe connected to Heat Shield, it is possible to check if the temperature measurements (T_a , T_g , T_{nw}) are within the accuracy requirements by the ISO7043 standard. This operation can be done before each measurement.



| | |
|-----------------------------------|--------------------------------------|
| Principle | Pt100 Class A IEC60751 (DIN Class A) |
| Range | 0...+50°C |
| Accuracy | ±0,15 K @ 0 °C |
| Calibration certificate optional) | ACCREDIA (ISO17025) |
| Connection | By RS232 port |

► Easy to operate

Heat Shield Heat Shield is very stable when placed on any horizontal surface but it can be also held in hand or mounted on standard photographic tripod. With its on-and-play philosophy, measurements can be displayed in just a few instants from power on. No configuration is required by PC. Rechargeable batteries assure up to 200 hrs of measurement (20 hrs when using wireless Satellites).



► Memory and measurement time rates

Heat Shield has 8 Mb memory to store measurements and calculations performed during every survey. Acquisition rate is 10 s for all the acquired and calculated measurements, except for V_a (anemometer) which is sampled every 1 s. Recording rate is 60 s average for all the quantities.

Sales Kits



The kit consists of the **Heat Shield (1)** (with or without radio) which displays the WBGT online index (ISO7243), Heat Index (SR 90-23) and Humidex (Canadian atmospheric service equation, 1979). Other indices, which require complex calculations, are determined with the GIDAS TEA (Thermal Environments Application) software, such as the Predicted Heat Strain (PHS) and the Duration Limit of the exposure (Dlim). Thanks to the integrated radio model, the Heat Shield can support up to two **satellite units (2)** to calculate the WBGT in different positions. The system can be fixed on a **tripod (3)** or held in the hand for a quick scan of the thermal situation. Using the **high precision temperature probe (4)** connected to the Heat Shield, it is possible to evaluate the measurement differences between this reference sensor and the three values of the temperature sensors (T_a , T_g , T_{nw}).

To perform microclimatic surveys in a moderate environment, it is possible to connect a **hot wire anemometer (5)** for the calculation of Microclimatic indices like PMV-PPD.



| Ref. Fig. | PN | Description | Quantity | Ref. Note |
|-----------|------------------|--|-------------------------|-----------|
| | | Heat shield without radio | | |
| 1 | ELR600M | Heat Shield/Charger+USB+SW+ Case/Globe 5cm | 1 | |
| | ELR605M | Heat Shield/Charger+USB+SW+ Case/Globe 15cm | Altern. to ELR600M | A |
| | | Heat shield with radio | | |
| | | Base module | | |
| | ELR610M | Heat Shield/Base moduleCharger+USB+SW+ Case/Globe 5cm | Altern. to ELR600M | B |
| | ELR615M | Heat Shield/Base module/Charger+USB+SW+ Case/Globe 15cm | Altern. to ELR610M | A |
| | | Radio satellite | | |
| 2 | ELR610S | Heat Shield/n.2 Satellites/Case/Globe 5cm | Optional | |
| | ELR615S | Heat Shield/n.2 Satellites/Case/Globe 15cm | Altern. to ELR610S | A |
| | | Hot wire anemometer (see catalogue MW9001-ENG-08) | Optional | |
| 5 | ESV126 | Hot wire anemometer | 1 | C |
| | BVA328 | Mounting for HeatShield and anemometer ESV126 on tripod or surface | 1 | |
| | | Software (see catalogue MW9006-ENG-04, 06) | Optional | |
| | BSZ318 | SW Gidas TEA/All modules/PC | 1 | |
| | BSZ317 | SW Gidas TEA/Hot/PC | Altern. to BSZ318 | D |
| | BSZ313 | SW Gidas TEA/Moderate/PC | Altern. to BSZ318 | |
| | BSZ315 | SW Gidas TEA/Cold/PC | Altern. to BSZ318 | |
| | | Accessories (see catalogue MW9005-ENG-07) | Optional | E |
| 3 | BVA304 | Tripod | 1 | |
| | BVA314 | Mounting for HeatShield on tripod | 1 | |
| | BWA314 | Valigia 52x43x21 cm/antiurto/IP65 | 1 | |
| | BWA048 | Long bag for tripod | 1 | |
| | SVSKA2002 | USB communication interface for hot wire sensors with interchangeable head | 1 | |
| | | Verification probe | Optional | |
| 4 | DMA033.3 | Sensor/Temp.verification/Pt100/HeatShield | 1 | F |
| | | Calibration certificates | Optional | |
| | | ISO 9001 | | |
| | SVICA8507 | Calibration certificate/ISO9001/HeatShield | | |
| | SVICA2003 | Calibration certificate/ISO9001/Air velocity/Hot wire anemometer | In presence of ESV126 | |
| | | ISO 17025 | | |
| | SVACA2015 | Calibration certificate/ISO17025/Air velocity/Hot wire anemometer/Chain | In presence of ESV126 | |
| | SVACA0016 | Calibration certificate/ISO17025/Air.Temp, Contact/N.6 points/Chain | In presence of DMA033.3 | |

Note A Check your country's legislation to select the suitable globe diameter.

Note B The radio Heat Shield module and the Satellites are useful for producing the calculation of the weighted average WBGT of the three Head-Chest-Ankles levels, or to perform analyzes in three positions in the same environment.

Note C The air velocity is necessary for the calculation of the PMV-PPD, PHS and IREQ indices. The air velocity is necessary for the calculation of the PMV-PPD, PHS and IREQ indices.

Note D The GIDAS TEA modules are used to calculate a series of indices not calculated by Heat Shield, make in-depth analyzes and reports. Each module includes a handy calculator to simulate thermal environments using measured values or entered manually.

Note E The Heat Shield Base module is fixed to a tripod by means of the BVA314 support, or when used the ESV126 anemometer, fixed to a tripod or placed on a surface by means of the BVA328 support.

Note F Useful for checking the deviation of the three temperature probes (Ta, Tg and Tnw) with respect to the reference sensor

Technical Specifications

| Type | Element | Range | Accuracy (0...60°C) | Resolution |
|--|--|--------------|----------------------------------|------------|
| Natural Wet Bulb Thermometer (Cotton wick immersed into a built-in reservoir with detachable cover) | Pt100 Class AA IEC60751 (DIN 1/3 Class B) | -20...60 °C | ± 0.3 °C | 0.1 °C |
| Globe Thermometer ELR610M/S: 2" sphere (5 cm) ELR615M/S: 6" sphere (15 cm) | Pt100 Class AA IEC60751 (DIN 1/3 Class B) | -20...120 °C | ± 0.3°C | 0.1 °C |
| Dry Bulb Thermometer (Equipped with radiant screen) | Pt100 Class A IEC60751 (DIN Class A) | -20...60 °C | ± 0.8 °C ±0.4 °C @ 10...40 °C | 0.1 °C |
| Relative Humidity Sensor | Capacitive sensing element | 0...100% | 1.8% RH @ 10...90% | 0.1% |
| ESV126 Air Speed (optional)* | Hot wire (Tungsten wire diam. 10 µm) | 0.1...20 m/s | Read pag.7 | 0.1 m/s |

| | | |
|------------------------------|---|---|
| Calculated parameters | WBGT (without solar load) index WBGT (with solar load) index | According to ISO7243 For up to 3 locations simultaneously (Requires Satellite units) |
| | WBGT Eff | According to ISO7243 CAV (Clothing Adjustment Value) selection by menù |
| | WBGT Ref | According to ISO7243 Metabolism value for Acclimatized/Not Acclimatized Subjects selection by menù |
| | Distance to the limit | Difference value between WBGT Eff and WBGT Ref |
| | Head-Torso-Ankle Weighted Average WBGT | According to ISO7243 (Requires Satellite units) |
| | Heat index | According to 1990 National Weather Service (NWS) Technical Attachment (SR 90-23) |
| | Humidex | According to J.M. Masterton and F.A. Richardson of Canada's Atmospheric Environment Service equation (1979) |
| | PMV-PPD* | According to ISO7730 |
| | Predicted Heat Strain (PHS)** | According to ISO7933 |
| | Insulation Required (IREQ) **, Duration Limit of the exposition | According to ISO11079 |
| | **Requires Air flow | ** using ESV125 hot wire anemometer |
| Data management | Acquisition rate | 10 s all the quantities 1 s air speed only (va) |
| | Storing rate | Average values every 1 min |
| | Memory | 8MB of flash data memory |
| | Survey identification | Time and date stamping with clock and calendar |
| | Software compatibility | HS Manager (included), Gidas TEA (optional) |
| | Languages | English, Spanish, Portuguese, Italian |

| | | |
|----------------------------|---------------------------------|---|
| Power supply | Power supply | 8...14 V DC |
| | Power consumption (Radio ON) | TX ON: 180 mA, RX ON: 30 mA 8...14 V DC |
| | Power consumption (Stand-by) | 0.2 mA |
| Battery Base Module | Type | 2 A (4.2 V) Lithium rechargeable |
| | Recharging time | ~ 8 h |
| | Battery life (Base Module) | Standby: 9 months Radio OFF (without satellites): 400 hrs Radio ON (connection to satellites): 20 hrs |
| | Battery life (Satellite Module) | Standby: 9 months Radio ON (connection to base module): < 1 year |
| Radio | Type | ZigBee |
| | Frequency | ISM 2.4 GHz direct sequence channels |
| | Strength | 10 mW (+10 dBm) |
| Other features | Internal clock | Accuracy: 30 sec/month (T=25°C) |
| | Display | LCD 4 x 20 car |
| | Keyboard | N. 8 keys |
| | Processor | 1 RISC 8 bit, clock 16 MHz |
| | ADC resolution | 16 bit |
| | Sampling time | 80 ms (rejection 50 Hz) |
| | Environmental limits | -20...60 °C |
| | Protection grade | IP54 |
| | Standards / Approvals | CE Mark |
| | Weight | Stand-alone and Base module: 1.4 kg Satellite module: 1.05 kg |
| | Dimensions | 185 x 220 x 55 mm |
| | Mounting | Threaded bushing allows mounting to standard photographic tripods |

Interfaces

| | On instrument | External |
|-------------------------------------|-----------------|---|
| RS232 PC Interface (Base unit only) | Waterproof jack | Supplied with USB converter for PC connection |
| 12 V DC power jack | Waterproof jack | AC adapter wall power cube (90...230 V AC – 50...60 Hz) |
| Anemometer (only on Base module) | Waterproof jack | Compatible with ESV126 Hot wire anemometer |
| Verification probe | Waterproof jack | Common connector with RS232 port |

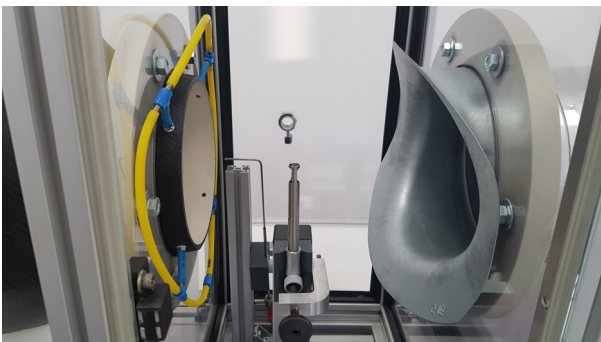
Hot wire anemometer



- ▶ Very low measurement threshold: 0.1 m/s
- ▶ Special electronic allows to obtain 10 ms acquisition time rate and average production every 1 s
- ▶ Because of the omni-directional sensitivity, this sensor is very suitable in applications where the air flow is not directional as in Heat stress and Thermal comfort applications
- ▶ Internal ISO17025 accredited calibration laboratory

Compliance to ISO7726 standard excluding omni-directional feature (300° arc). Air speed is measured every 100 ms, output of the sensor is the average air speed (va) every one second.

| Code | ESV126 | |
|------------------|---|--|
| Air speed | Principle | Hot wire |
| | Range | 0.1...20 m/s |
| | Accuracy (10...30 °C), (1013 hPa) (0...300° arc directions) | <ul style="list-style-type: none"> • NA (0...0.1) • ±0.06 m/s (0.1...0.4 m/s) • ±0.08 m/s (0.4...3.0 m/s) • ±0.035 * VM (3.0...20 m/s) |
| | Output on Heat Shield | 1 min average over 1 s measurements |
| | Resolution | 0.1 m/s |
| | Response time | 10 Hz |
| | Power supply | 9...30 V DC |
| | Power consumption | 0.9 W @ 9 V DC (vel. 20 m/s) |
| | Protection grade | IP54 |



▶ LSI LASTEM is an ISO17025 accredited laboratory for air speed measurements. All sensors manufactured are tested inside our laboratory. LSI LASTEM provides Test report for any sensor and, under request, ISO17025 or ISO9001 calibration certificates.



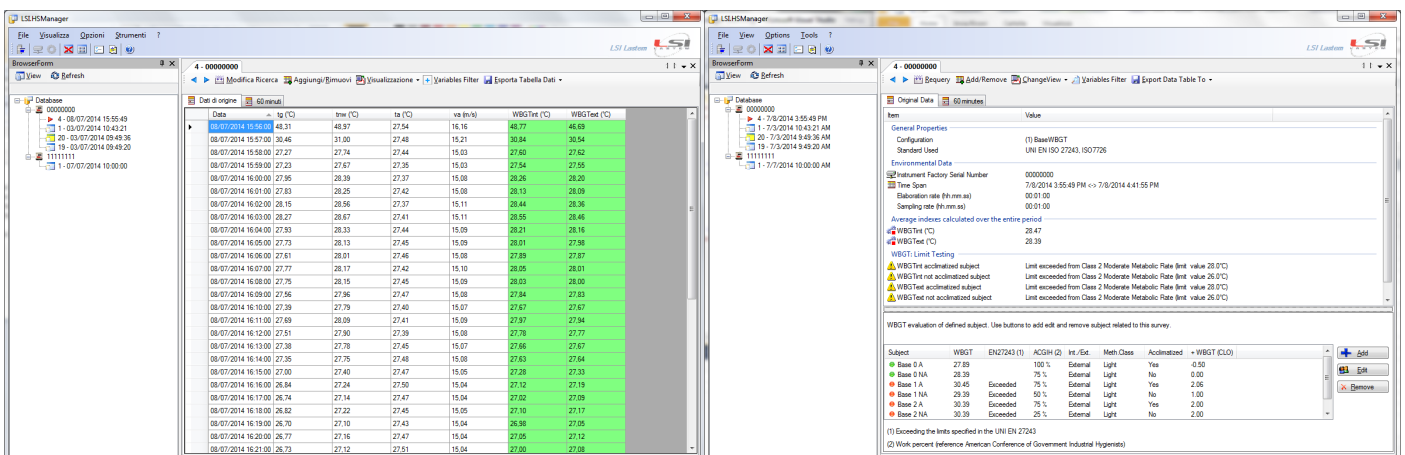
▶ LSI LASTEM is an ISO17025 accredited laboratory for temperature measurements. All sensors manufactured are tested inside our laboratory. LSI LASTEM provides Test report for any sensor and, under request, ISO17025 or ISO9001 calibration certificates.

▶ HS Manager software

HS-Heat Shield Manager program is supplied together with each Heat Shield system for the management of the measurements and data evaluation of the thermal risk using the WBGT with/without solar load. HS downloads the measurements from the Heat Shield base unit and assesses the values including limits, alarm and reports. It is dedicated to the Heat Shield data management, it works in compliance with the configuration chosen as number of measurement points: one or three, or one point including three levels on the same vertical (Head-Torso-Ankle Weighted Average WBGT).

Main functions

- Data downloading using RS232 cable and USB adapter
- Real time data display from the connected instrument
- Data browser inside data base. List of surveys as number, data/time start/stop and type are available
- Raw data display including environmental data and thermal indexes as they arrive from the Heat Shield system.
- Query on the raw data: using different statistical time bases, including min/max values, its occurrence date/time and average within the chosen time base
- Chart of the WBGT values with clear indication of the limits as given by ISO7243 for acclimates and not acclimates subjects
- Setup of the subject parameters to perform assessment under ISO7243 and ACGIH standards
- Setup of a free limit to assess the WBGT values using specific requirements
- Assessment of the limits for each subject. Limits are verified against ISO7243 as "over" or "not over" the threshold, against ACGIH as percentage of admitted work duration time (within n.8 hours) and against the free limit imposed
- Assessment of the PMV-PPD (ISO7730) as they are downloaded from the Heat Shield system
- Data export to GIDAS-TEA program for a more complete surveys and data management, including more detailed data assessment and reports
- Data export to TXT and XML files
- Reports of the environmental data and indexes. Report are produced in Open Office XML documents (docs). Four document templates are available with possibility to customized them or to create brand new documents template as the user's needs



▶ Query on the raw data: using different statistical time bases, including min/max values and its occurrence date/time and average within the chosen time base.

▶ Assessment of the limits for each subject. Limits are verified against ISO7243 as "over" or "not over" the threshold, against ACGIH as percentage of admitted work duration time (within n.8 hours) and against the free limit imposed.

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