Environmental Monitoring Solutions

Portable Heat Stress and Thermal Comfort meter

- Quick, real-time, reliable and accurate assessment of indoor and outdoor heat stress WBGT index (ISO7243)
- Real-time assessment of the thermal comfort PMV- PPD index (ISO7730)
- Verification probe for assessment of the system calibration
- Built-in radio technology for simultaneous wireless monitoring in different locations/heights
- Rated IP54 to withstand harsh environmental conditions
- 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 assesment and data reporting
- Data export to 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 indoor & outdoor indices plus Heat Index and Humidex indices. Furthermore, if ESV125 anemometer is connected, Heat Shield can calculate directly the PMV-PPD comfort index (ISO7730). Thanks to its built-in radio technology, Heat Shield 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 (Dlim). GIDAS-TEA program will also allow in-depth analysis of WBGT, PMV and PPD indexes (read Gidas-TEA catalogue MW9006-ENG-06).

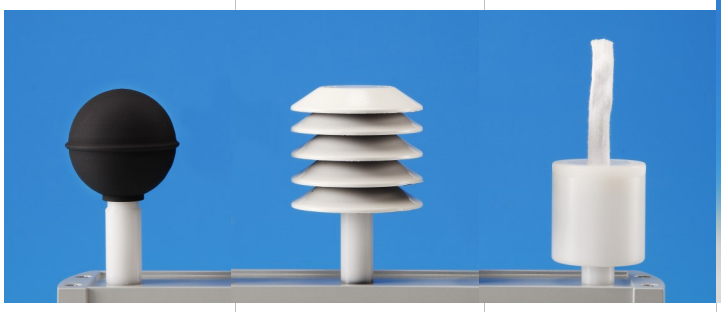
Main features

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

ESV125 Va sensor (hot wire)

ESV125 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 indoor & outdoor index (ISO7243). Up to 3 locations simultaneously when Satellite units are used
- Head-Torso-Ankle Weighted Average WBGT (ISO7243) (when Satellite units 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. Only when ESV125 anemometer sensor is connected. 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) (requires BSZ313 PC module)
- PHS Predicted Heat Strain (ISO7933) (requires BSZ317 PC module)
- IREQ Insulation Required, Duration Limit of the exposition (ISO11079) (requires BSZ313 PC 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).

Three measurement positions using satellite modules

Heat Shield can be supplied as a single base unit or 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 as required by the ISO 7243. Heat Shield radio can cover up to 300 m in

ELR610S:
5 cm diameter black globe sensor satellite modules

ELR615S:
15 cm diameter black globe sensor satellite modules

Two options black Globe diameter

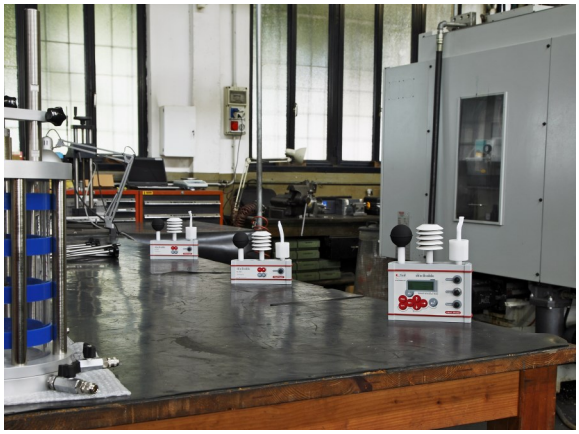
According to the country policy and regulation, Heat Shield can be supplied with 5 cm or 15 cm diameter globe temperature sensor:

- ELR610M: 5 cm diameter base module
- ELR615M: 11 cm diameter base module
- ELR610S: 5 cm diameter satellite modules
- ELR615S: 15 cm diameter satellite modules

ELR610M:
5 cm diameter black globe sensor Base modules

ELR615M:
15 cm diameter black globe sensor Base modules

Three levels WBGT on the same vertical



Assesments in three positions of the same environment

Verification probe (EST100)

Using the high accuracy temperature probe connected to Heat Shield Base unit, it is possible to check if the measurements coming from the Heat Shield Base and Satellite modules sensors (Ta, Tg, Tnw) are within the accuracy requirements by the ISO7043 standard. This procedure assesses the whole measurement chain from Heat Shield electronic part to the sensitive elements response. This operation can be done before each measurement.

Principle	Pt100
Range	0+50°C
Accuracy	0,01°C
Calibration certificate (included)	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 *Va* (anemometer) which is sampled every 1 s. Recording rate is 60 s average for all the quantities.

Sales Kits

Kit 1.0: Base WBGT kit

Includes

- Heat Shield base module, complete with 110-220 Vac power charger, PC serial cable, USB adapter, HS Manager software and carrying case

Kit 1.1: WBGT + Thermal comfort kit

Includes

- Heat Shield base module, complete with 110-220 Vac power charger, PC serial cable, USB adapter, HS Manager software, supports and carrying case
- Hot wire anemometer

Code	Description	KIT 1.0	KIT 1.1	Notes
	Heat Shield Base modules			
ELR610M	Heat Shield Base module. Includes 110-220 Vac power charger, PC serial cable, USB adapter, HS Manager software and carrying case Small black globe sphere (5 cm diameter).	●	●	
ELR615M	Heat Shield base module. Includes 110-220 Vac power charger, PC serial cable, USB adapter, HS Manager software and carrying case. Large black globe sphere (15 cm diameter).			1
	Heat Shield satellite modules	Opt	Opt	2
ELR610S	N.2 Heat Shield satellite modules. Includes carrying case Small black globe sphere (5 cm diameter).			
ELR615S	N.2 Heat Shield base modules. Includes carrying case Large black globe sphere (15 cm diameter).			
	Tripod and fixing accessories	Opt		3
BVA304	Tripod		●	
BWA048	Soft bag for tripod and supports		●	
BVA314	Support for Heat Shield on tripods			
BVA326	Tripod extension for 3-level measurements and/or BVA308 mounting			
	Anemometer	Opt		4
ESV125	Hot wire anemometer		●	
BVA325	Support for Heat Shield and ESV125 anemometer on tripods or surfaces		●	
	Verification probe	Opt	Opt	5
EST100	Temperature sensor for the assessment of the measurement differences between the three temperature sensors (Ta, Tg, Tnw) values coming from Heat Shield modules and the reference sensor measurement. Complete with ACCREDIA certificate of calibration			
	GIDAS TEA modules	Opt	Opt	6
BSZ317	TEA module for hot environments. PHS index calculation. Calculator			
BSZ313	TEA module for comfort environments. PMV-PPD index calculation. Calculator		●	
BSZ315	TEA module for cold environments. ITR index calculation. Calculator			
	Calibration certificates	Opt	Opt	
SVICA8507	Calibration Certif./ISO9001/HeatShield			
SVICA2003	Calibration Certif./ISO9001/Air Speed/Hot-wire			
SVACA0116	Calibration Certif./ISO17025/Temp.Air, Contact/N.6 points (N.1 required)			
SVACA0115	Calibration Certif./ISO17025/Temp.Tg, Tnw/N.5 points/chain (N.2 required)			
SVACA2015	Calibration Certif./ISO17025/Air Speed/ Hot-wire/N.5 points/chain			

Note **1** Check your country policy and legislation to select the appropriate black globe sensor diameter.

Note **2** Satellite modules are optional and useful to produce Head-Torso-Ankle Weighted Average WBGT (ISO7243) or assess measurements at the same time in three different positions of the same environnement.

Note **3** Normally tripod can use useful for three levels WBGT measurement. In that case, BVA326 pole is also needed to fix one of the two satellites to the correct highness.
Heat Shield Base module is fixed to the tripod using BVA314 arm. When ESV125 anemometer is used, the BVA325 arm is required instead of BVA314.

Note **4** Anemometer is required for calculation of PMV-PPD, PHS and IREQ indices.

Note **5** Using Verification probe, before each survey, it is possible to check if the measurements coming from the Heat Shield sensors (Ta, Tg, Tnw) are within the accuracy requirements by the ISO7043 standard

Nota **6** GIDAS TEA modules are optional and performs in-depth index calculation, data analysis and reporting. HS Manager is included to each Base module, read technical specification in the last pages of this document. Read more about GIDAS-TEA in the LSI LASTEM's Software catalogue (MW9006).

Type	Element	Range	Accuracy (0÷60°C)
Natural Wet Bulb Thermometer (Cotton wick immersed into a built-in reservoir withdetachable cover)	1/3 DIN-A Pt100	-20÷60°C	± 0,3°C
Globe Thermometer ELR610M/S: 2" sphere (5 cm) ELR615M/S: 6" sphere (15 cm)	1/3 DIN-A Pt100	-20÷120 °C	± 0,3°C
Dry Bulb Thermometer (Equipped with radiant screen)	1/2 Pt100	-20÷60°C	± 0,8 °C ±0,4°C @ 10÷40°C
Relative Humidity Sensor	Capacitive sensing element	0÷100%	1,8 %RH @ 10÷90%
ESV125 Air Speed (optional)*	Hot wire (Tungsten wire diam. 9,45 µm)	0,01÷20 m/s	±10 cm/s (0,5÷1,5 m/s) 4% (>1,5 m/s)

Calculated parameters	WBGT (indoor) index WBGT (outdoor) index	According to ISO7243 For up to 3 locations simultaneously (Requires Satellite units)
	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 (Dlim)**	According to ISO11079
	**Riquires Air How measurement	** via post-processing Software (Gidas-TEA)

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 Vdc
	Power consumption (Radio ON)	TX ON: 180 mA, RX ON: 30 mA8 ÷ 14 Vdc
	Power consumption (Stand-by)	0,2 mA
Battery	Type	2 A (4,2 V) Lithium rechargeable
	Recharging time	~ 8 hrs
	Battery life	Standby: 9 months Radio OFF (without satellites): 200 hrs Radio ON (without satellites): 20 hrs
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	IP 54
	Standards / Approvals	CE Mark
	Weight	1,4 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
12VDC power jack	Waterproof jack	AC adapter wall power cube (90÷230VAC – 50÷60Hz)
Anemometer (only on Base module)	Waterproof jack	Compatible with ESV125 Hot wire anemometer
Verification probe	Waterproof jack	Common connector with RS232 port

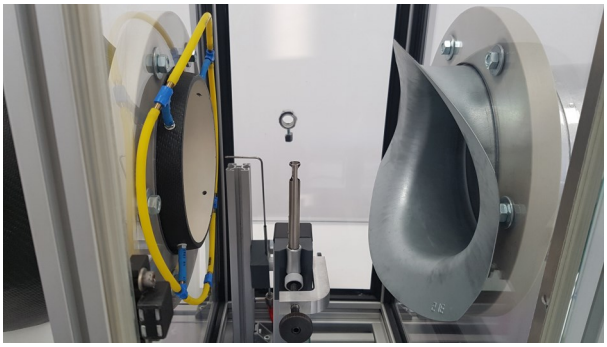
Hot wire anemometer

- Very low measurement threshold: 0,01 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 accreditated calibration laboratory

Compliance to ISO7726 standard (STRESS class) excluding omni-directional feature (300° arc) and the accuracy in the range 0-1 m/s. Air speed is measured every 100 ms, output of the sensor is the average air speed (va) every one second.

Technical Specifications

Code	ESV125	
Air speed	Principle	Hot wire
	Range	0,01÷20 m/s
	Accuracy (10÷30 °C), (1013 hPa) (0÷300° arc directions)	0÷0,1 m/s = NA 0,1÷0,5 m/s = ± 0.083 m/s 0,5÷1 m/s = ± (0,05+0,05 Va) m/s
	Output on Heat Shield	1 min average over 1 s measurements
	Resolution	0,01 m/s
	Response time	10 Hz



LSI LASTEM is an ISO17025 accreditated laboratory for air speed measurements. All sensors manufactured are tested inside this laboratory. LSI LASTEM provides Test report for any sensor supplied and on request, ISO17025 or ISO9001 calibration certificates (see Accessories list).

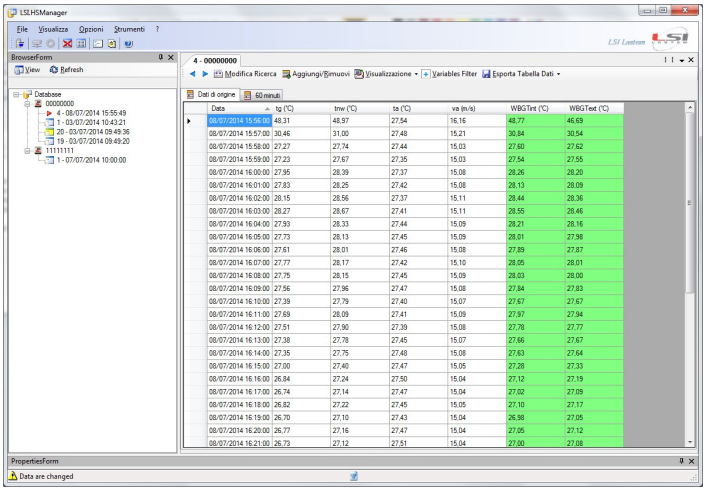
LSI LASTEM is an ISO17025 accredited laboratory for temperature measurements. All sensors manufactured are tested inside our laboratory. LSI LASTEM provides Test report for any sensor and, under request, ISO17025 or ISO9001 calibration certificates (see Accessories list).

HS Manager software

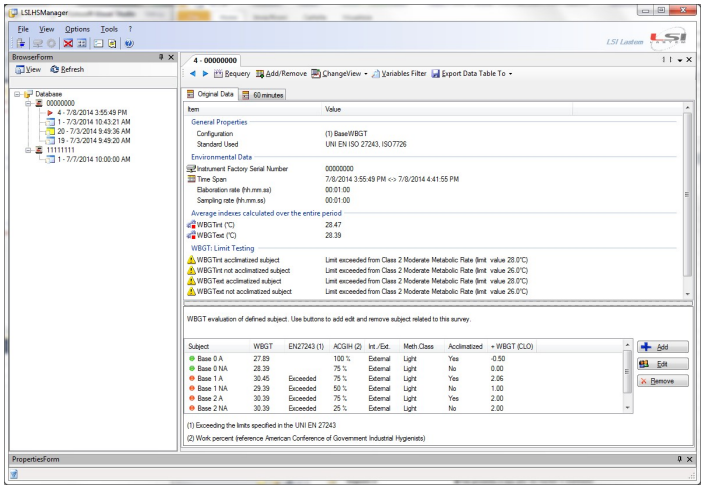
HS-Heat Shield Manager program is supplied together with each Heat Shield system for the management of the measurements and data evaluation of the thermal risk using the WBGT indoor & outdoor standard. HS downloads the measurements from the Heat Shield base unit and assesses the values including limits, 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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