



Environmental  
Monitoring Solutions

# **IEQ MONITORING STATIONS**

## **Indoor Environmental Quality**

◦ **Multi-parametric System  
for IEQ**

◦ **Radio Multi-parametric  
and Multi-positions System  
for IEQ**

## Summary of Solutions



- Thermal Comfort sensors
- Local Discomfort sensors
- Illuminance sensors
- Noise sensor
- IAQ

(see pag. 9)

### Multi-parametric System for IEQ

▶ **Multi-parametric system (M-Log):** the data logger is connected to up to 5 sensors via cable. To perform all the typical IEQ measurements, different sensors selection must be connected to the data logger.

#### STRENGTHS

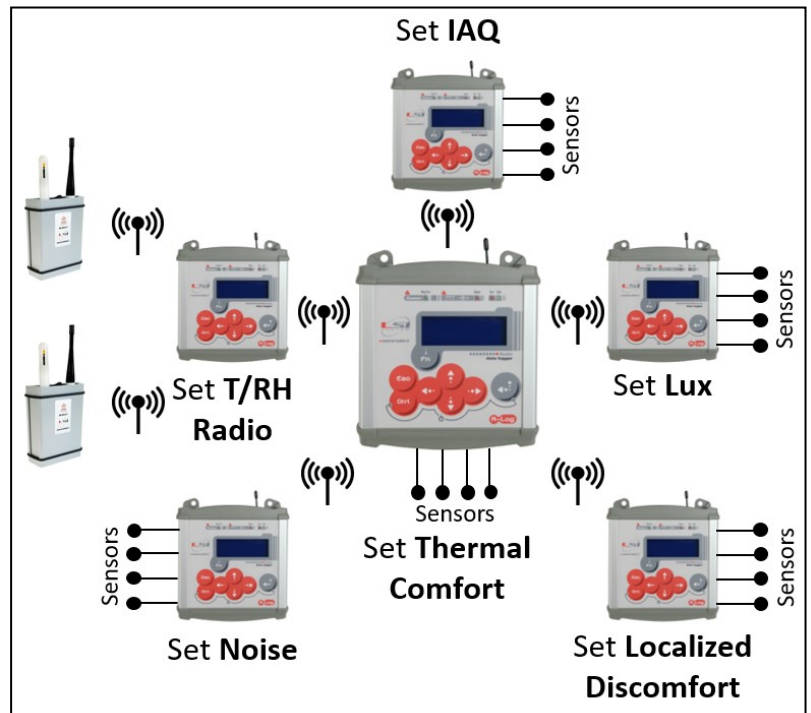
- ▶ Easy to use and deploy portable system
- ▶ Multi-parameter monitoring with IEQ sensors: Thermal, Light, Sound, Air Quality environments
- ▶ Very high standards of accuracy
- ▶ Software for calculating the PMV-PPD thermal comfort indexes
- ▶ Software for statistical data processing and data reporting (tables and graphs)

### Radio Multi-parametric and Multi-positions System for IEQ

▶ **Multi-parametric and multi-position radio system (R-Log):** a network of "Slave" RLog modules send, via radio, the measurements acquired by the connected sensors, to a Master unit which stores them. Each unit uses specific types of sensors for the **specific application**. They can also be connected T/RH sensors via radio

#### STRENGTHS

- ▶ Multi-position measurements with a network of radio modules
- ▶ Each module receives up to 5 sensors via cable to make up a measurement set
- ▶ Measurements of all the main IEQ parameters can be performed simultaneously
- ▶ Very high standards of accuracy
- ▶ Software for calculating the PMV-PPD thermal comfort indexes
- ▶ Software for statistical data processing and data reporting (tables and graphs)



(see pag. 12)

## Theory and Norms

**IEQ (Indoor Environmental Quality)** concerns the set of parameters that together define the environmental quality, the degree of healthiness and the well-being of people in a confined environment. The factors that define the IEQ are: thermal environment, lighting, acoustics and indoor air quality (IAQ).

The IEQ is the result of both the design solutions (choice of construction materials, architectural solutions and furnishings), and the choice, setting and efficiency of technical systems for heating, cooling and ventilation.

In recent years, attention to the **conditions of indoor spaces** has increased significantly. The population of European urban centers spends on average 95 to 97% of their time indoors. Living and working in healthy and comfortable environments has very important objective consequences, while a low level of IEQ can have a very negative impact on the performance, health and psyche of the occupants.

The management of the IEQ requires a **monitoring strategy**, in order to verify the environmental variables, both in the initial verification phase of the project, and during the use and maintenance of the building.

Achieving ideal IEQ conditions may require high energy consumption, both for artificial lighting and for ventilation, air conditioning and heating. A careful and conscious planning is therefore necessary.

Here are the most recent regulations and guidelines relating to confined spaces based on the topic of indoor quality and energy saving combined with the comfort of the occupants:

**UNI ES ISO 16000-1:2006—Indoor air - Part 1: General aspects of sampling strategy** : compliance with the requirements in indoor environments is prescribed, described as "environments not subject to the requirements aimed at protecting workers from the effects resulting from exposure to harmful substances". This standard and the others of the 16000 and 16017 series contain indications on the monitoring of the chemical and biological components of the air.

**UNI EN ISO 7730:2006 - Ergonomics of the thermal environment:** analytical determination and interpretation of thermal well-being through the calculation of indices and criteria of local thermal well-being. Creation of a single parameter able to synthesize the thermohygro-metric sensation of the occupants in confined spaces, defined as PMV or Predicted Mean Vote described in this standard.

- *PMV (Predicted Mean Vote)*: defines a comfort scale ranging from -3 (sensation of cold) to +3 (sensation of hot), passing through 0 (thermal neutrality).
- *PPD (Predicted Percentage Dissatisfied)*: represents in relative terms the incidence of subjects who do not like the environment from a thermal point of view.

▶ **Sick building syndrome (SBS)** indicates well-defined symptoms occurring in a large number of modern buildings which tend to be "sealed" with respect to the external climate.

*In the workplace, SBS can cause decreased productivity and worker absences.*

*Many chemical compounds present in indoor air are known for or suspected of **causing irritation or stimulation of the sensory system** and can give rise to the symptoms commonly present in the SBS. Studies conducted on offices and other public buildings in different countries have revealed a frequency of disturbances among occupants between 15% and 50%.*



**WHO (OMS) Guidelines for indoor air quality (2010):** guidelines for the protection of public health from risks due to chemicals commonly found in indoor air. The substances considered (benzene, carbon monoxide, formaldehyde, naphthalene, nitrogen dioxide, polycyclic aromatic hydrocarbons, radon, trichlorethylene and tetrachlorethylene), have their sources in confined spaces and are dangerous for health.

**EU Directive 2018/844 concerning the energy performance of buildings and energy efficiency:** the objective is to pursue "the development of a sustainable, competitive, safe and decarbonised energy system", taking into account that the real estate sector is attributable to the 36% of all CO<sub>2</sub> emissions in the EU. It introduces the obligation to improve the energy performance of new and existing buildings and requires national building renovation strategies to be considered. The EU directive introduces an "intelligence readiness indicator of buildings", the Smart Readiness Indicator (SRI), which also includes the comfort needs of the occupants.

**ISO 17772-1:2017—Energy performance of buildings—Indoor environmental quality—Part 1: Indoor environmental input parameters for the design and assessment of energy performance of buildings:** specifies the requirements for the thermal environment, indoor air quality, lighting and acoustics, and how to establish these parameters for building and plant design and for energy performance calculations. It also includes design criteria for local thermal discomfort factors, air currents, radiant temperature asymmetry, vertical differences in air temperature and floor surface temperature. The standard is applicable where the criteria for the indoor environment are established by human occupation and where the production or process does not have a major impact on the indoor environment.

A good design is aimed at the rational use of energy (good/excellent energy performance) as well as obtaining a satisfactory thermal comfort and indoor air quality.

The standard can be used during the design phase and during the verification phase. In the design phase, comfort project parameters are defined to be used as input for system sizing and building design calculations. In the verification phase it is possible to measure the environmental variables to assess whether the categories defined in the design phase are respected.

**UNI EN 16798-1:2019— Energy performance of buildings - Ventilation for buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics :** implementation of the ISO 17772-1: 2017 standard at UNI EN level.

The importance of assessing the quality of confined spaces has led to greater attention during the design phases, but also during the operation of the building: the monitoring of internal environmental conditions can in fact allow to take virtuous initiatives to improve the IEQ and energy efficiency.

One of the initiatives in this regard is the **LEED (Leadership in Energy and Environmental Design)** certification, born in the U.S.A. thanks to the U.S. Green Building Council, but also adopted throughout Europe. It proposes a voluntary certification of the quality of buildings with an approach oriented towards sustainability and the management of safety and comfort. For indoor environments, LEED has a special section, named LEED IEQ. It is applicable to every phase of the life of a building and is able to decree whether and how much a confined environment is safe for the occupants and at the same time how sustainable it is. LEED IEQ also includes LEED IAQ, which is the specific certification area for assessing indoor air quality.



For a correct assessment of the quality of indoor environments it is necessary to consider all the parameters that are involved in the definition of thermal, light, acoustic and air quality comfort, namely: **air temperature and relative humidity, radiant asymmetry, air, lighting, noise, gas concentration in the air.**

The table shows the parameters required by the standard **ISO 17772-1:2017—Energy performance of buildings—Indoor environmental quality—Part 1: Indoor environmental input parameters for the design and assessment of energy performance of buildings** for the classification of a building with respect to its IEQ grade:

Objective	Method	Needed quantities
<b>Thermal environment</b>		
Check of <b>general thermal comfort</b>	PMV-PPD Indexes calculation	Air temperature and RH%, Radiant temperature, Air velocity
Check of <b>general thermal comfort</b>	Operative Temperature Index calculation	Air temperature and RH%, Radiant temperature, Mobile average outdoor temperature
Check of <b>general thermal comfort</b>	Measurement of the increase in air speed to mitigate high temperatures	Air velocity
Check of <b>localized air currents</b>	Dissatisfied from air currents Index calculation	Air velocity, Turbulence index
Check of the <b>radiant asymmetry</b> between the walls and between the floor and ceiling	Unsatisfied with radiant asymmetry Index calculation	Net radiation
Check of <b>vertical temperature gradients</b>	Dissatisfied with vertical temperature gradient Index calculation	Temperature at 10 cm and 110 cm in height
Check of the <b>floor temperature</b> too hot or too cold	Dissatisfied with floor temperatures Index calculation	Floor contact temperature
Check of <b>air temperature</b>	Air temperature measurement	Air temperature
<b>Air quality</b>		
Check the ventilation system in order to ensure a certain <b>air flow</b> per occupant	Calculation of air flow (l/s per m <sup>2</sup> , l/s per occupant)	Air velocity
Dilution of <b>CO<sub>2</sub> concentration</b> through air changes	Calculation of air flow and number of air changes to dilute the gas concentration	CO <sub>2</sub> measurement, Air velocity
<b>Illuminance</b>		
Check of the <b>amount of light</b> present in the environment	Illuminance measurement	Illuminance
Verification of the <b>quantity of natural lighting</b> present inside the building	Daylight factor calculation	Indoor and outdoor illuminance
<b>Noise</b>		
Verification of plant <b>noise</b>	dB Level (A) measurement	Equivalent level (L-Aeq)



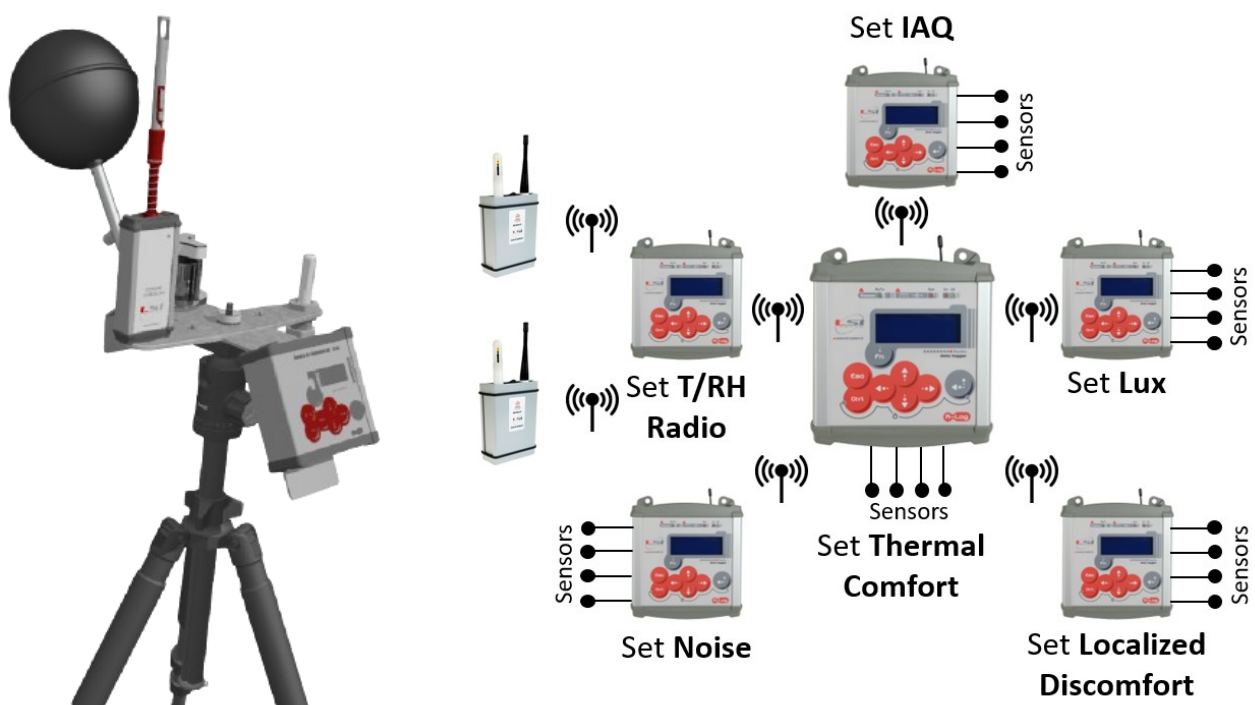
## LSI LASTEM's Solutions

The classification of buildings is carried out with the measurement of environmental variables and data processing according to the criteria defined by the regulations. The values obtained are then verified according to the limits required for the purpose of classification. LSI LASTEM offers systems where many of the defined calculations are already available as "derived quantities" obtained directly in the data logger or with post-processing calculations via software. Other elaborations can be subsequently calculated via software starting from the data reports downloaded from the data logger.

Method	Derived quantity from Data Logger (ELO009-ELR510.1)	Post-processing via Software
<b>PMV-PPD Index</b>		<b>GIDAS TEA (BSZ313)</b> (see MW9006-ITA-06)
<b>Operative Temperature Index</b>	YES	
<b>Unsatisfied by air currents Index</b>	YES	
<b>Unsatisfied by radiant asymmetry Index</b>	YES	
<b>Unsatisfied by vertical temperature gradient Index</b>	YES	
<b>Unsatisfied by floor temperatures Index</b>	YES	
<b>Air flow</b> (l/s per m <sup>2</sup> , l/s per occupant) meas.	YES	
<b>Air flow</b> and number of <b>air changes</b>	YES	
<b>Daylight factor</b>	YES	

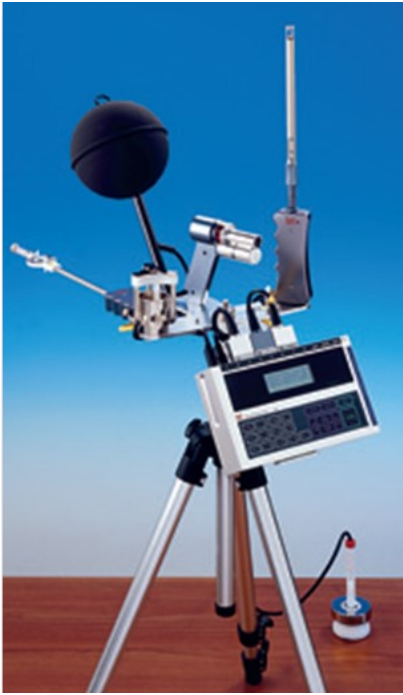
### Multi-parameter and multi-position systems

LSI LASTEM proposes systems for the measurement of the requested quantities based on a single unit of measurement (M-Log) in which not all the quantities can be acquired at the same time. Or systems made up of various measurement units (R-Log), each dedicated to a type of measurement and each connected via radio to a data collection Master System that can be connected to the PC for data downloading and data reporting.



► **Multi-parametric system (M-Log):** the data logger is connected to up to 5 sensors via cable. To perform all the typical IEQ measurements, the different selection of sensors must be connected to the data

► **Multi-parametric and multi-point radio system (R-Log):** a network of "Slave" RLog modules send, via radio, the measurements acquired by the connected sensors, to a Master unit which stores them. Each unit uses specific types of sensors for the **specific application**. They can also be connected **T/RH sensors via radio**



**LSI LASTEM** is a historic company in the production of instrumentation for measuring the microclimate. Since 1972, the then LSI Laboratories of Industrial Instrumentation, for the growing market of thermal microclimate for evaluations in the workplace, had put on the market the first equipment for this purpose. Over the years, the range of sensors has been enriched towards the completion of the typical IEQ parameters.

**▶ 1985: BABUC-A MICROCLIMATE Station**

*First multi-measurement acquisition system with self-recognition of connected sensors. Babuc could memorize the data from the connected sensors and was connected to the PC to download the measurements. LSI ASTEM had created the first application on PC (Infogen), which in post-processing, calculated the main microclimatic indices.*





▶ **Globo-thermometric sensor**

The average radiant temperature is responsible for the heat exchanges by radiation between the individual and the environment and is involved in the definition of the term "R" in the thermal balance formula. Indices based on the heat balance require the radiant temperature obtained with the globe thermometer sensor.



▶ **Thermo-hygrometric sensor**

The temperature is the form assumed by energy exchanged between man and the environment, a fundamental parameter for the definition of heat exchanges by convection and conduction. The amount of water contained in the air is of fundamental importance for well-being, as it is linked to the transfer of heat through the skin.



▶ **Air speed sensor**

The air speed influences the heat exchange by convection and is a common cause of localized discomfort described by the "Draught Rate" (DR) index. The hot wire sensor ensures the omni-directionality of the measurement, a low threshold and fast response time, essential in measuring the air speed and Turbulence index.



▶ **Floor temperature sensor**

For the discomfort due to the high floor temperature  $t_f$  (eg. due to underfloor heating) or too low, it is possible to estimate the percentage of dissatisfied, under the condition ( $5^{\circ}\text{C} < t_f < 35^{\circ}\text{C}$ ).



▶ **Radiant asymmetry sensor**

For the discomfort due to a radiant asymmetry it is possible to estimate the percentage of dissatisfied by different situations: warm ceiling, warm wall, cold ceiling, cold wall (eg. glass walls).



▶ **Illuminance sensor**

To enable visual tasks to be performed efficiently, appropriate lighting must be provided. The criteria must be selected based on the activities carried out to provide comfortable conditions for the occupants.



▶ **CO<sub>2</sub> and CO sensors**

Pollutants present in indoor environments can derive from the external environment, and penetrate by infiltration, or from sources present inside the buildings. WHO recommends maximum gas thresholds.



▶ **VOC sensor**

In the indoor air, more than 900 VOCs (Volatile Organic Compounds) have been identified, released by: construction and furniture materials, upholstery, adhesives, detergents, cigarette smoke and the occupants themselves.



▶ **Noise sensor**

The standards require the measurement of the equivalent continuous level of sound pressure, weighted "A" (L Aeq, nT) to verify the noise emitted by technical systems of building, as well as the sound insulation of its structures.



## Multi-parametric System for IEQ



- ▶ Portable system that can be easily repositioned in different measurement positions
- ▶ Multi-parameter monitoring unit with the ability to connect a large variety of probes for the different aspects of the IEQ: Thermal environments, Light, Sound, Air Quality
- ▶ Sensors for measuring thermal comfort (temperature and humidity, radiant temperature, air speed) and local discomfort (floor temperatures, radiant asymmetry, air flows)
- ▶ Sensors for the measurement of IAQ (Indoor Air Quality) for the measurement of the main gases present in confined environments (CO<sub>2</sub>, VOC, and many others).
- ▶ Gidas-TEA software for calculating the PMV-PPD indexes (ISO7730)
- ▶ Gidas-Viewer software for statistical reprocessing of acquired data and creation of data tables and graphs

The system consists of an instrumental assembly (data logger and sensors) mounted on a tripod. Depending on the type of site and the related survey on the quality of the internal environment, it is possible to choose different types of sensors. It is possible to **connect a maximum of 5 different sensors via cable** to the **M-Log data logger**, for this reason, to carry out all the measurements relating to the typical quantities of the IAQ it is necessary to connect the probes to the system at different times.

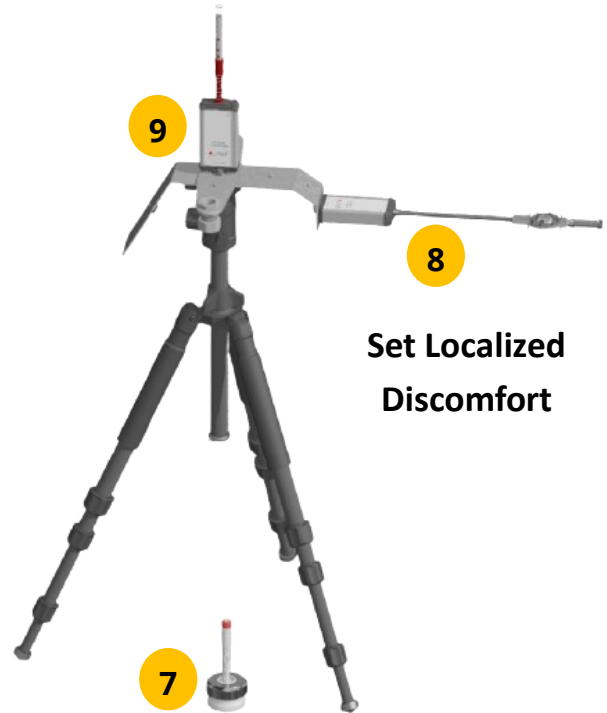
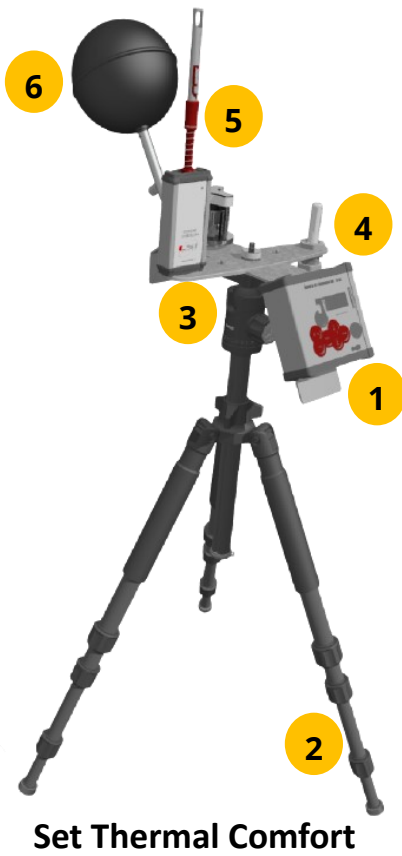
The monitoring areas that can be achieved concern all the variables indicated by the standards as characterizing the indoor environment, for the measurement of these parameters, different sets of sensors are available:

- **Thermal Comfort:** sensors for the calculation of microclimatic indices for the evaluation of the global thermal comfort of the confined environment, such as temperature and relative humidity, radiant temperature, air speed.
- **Localized Discomfort:** sensors for evaluating the variables that affect localized discomfort, such as the temperature gradient, the floor temperature, the air velocity and the radiant asymmetry.
- **Illuminance:** lux meters for evaluating the illuminance and calculating the Daylight Factor.
- **Indoor Air Quality:** sensors for monitoring the gases present in the confined environment, typically CO<sub>2</sub> and VOC. LSI Lastem has additional sensors for other gases (eg CO, SO<sub>2</sub>, H<sub>2</sub>S, etc.).
- **Noise:** noise level probe for the evaluation of the equivalent continuous level of sound pressure, weighted "A".

The data logger stores the data by dividing them into "surveys"; The surveys are then downloaded to the PC for statistical processing and post-processing calculation of PMV-PPD indices using Gidas-Viewer and Gidas-TEA programs. Some indices are calculated directly by the M-Log data logger (see Table on page 6).



## Kit 1—Multi-parametric System for IEQ



NOTE	
A	The BSZ313 software is used to calculate the PMV-PPD index (ISO7730)
B	The EST130 sensor, if used for the calculation of the "Dissatisfied with vertical temperature gradient" Index, must be combined with an air temperature sensor placed at about 110 cm in height. For this it is possible to use the air temperature acquired by the ESU403.1 probe already present in the module for the calculation of thermal comfort

Ref. Fig.	PN	Description	Kit1	Ref. Note
		<b>Data Logger</b>		
1	<b>ELO009</b>	M-Log/N.5 inputs/8MB/Batt/MiniDIN	1	
	<b>BSC015</b>	Power charger 230Vac->9Vdc/M-RLog/IP54	1	
		<b>Cases for the transport of data loggers and sensors</b>		
	<b>BWA319</b>	Trolley/68x53x28cm/antishock/IP65	1	
	<b>BWA048</b>	Long bag for tripod	1	
		<b>Software</b>		
	<b>BSZ311</b>	SW Gidas Viewer/PC	1	A
		<b>Mounting accessories</b>		
2	<b>BVA304</b>	Tripod	1	
3	<b>BVA305</b>	Stand for M/RLog sensors	1	
		<b>Set of sensors and software for thermal comfort (PMV-PPD, Operating Temperature)</b>		
4	<b>ESU403.1</b>	Sensor/T+RH%/Pt100+0±1V/12V/Cable+MiniDin	1	
5	<b>ESV307</b>	Sensor/Air speed/Hot-wire/RS232/Cable+ DB	1	
6	<b>EST131</b>	Sensor/Temp.globo nero/Pt100/Cable+MiniDin	1	
	<b>BSZ313</b>	SW Gidas TEA/Comfort/PC	1	
		<b>Set of sensors for localized thermal discomfort (floor temperature, radiant asymmetry, air currents)</b>		
7	<b>EST130</b>	Sensor/Double Temp./Surface+H=10cm/2xPt 100/Cable+MiniDin	1	B
8	<b>ESR231</b>	Sensor/Radiant Asymetry/Cable+MiniDIN	1	
9	<b>ESV306</b>	Sensor/Air speed+Turbolence/Hot-wire/RS232/Cable+DB	1	

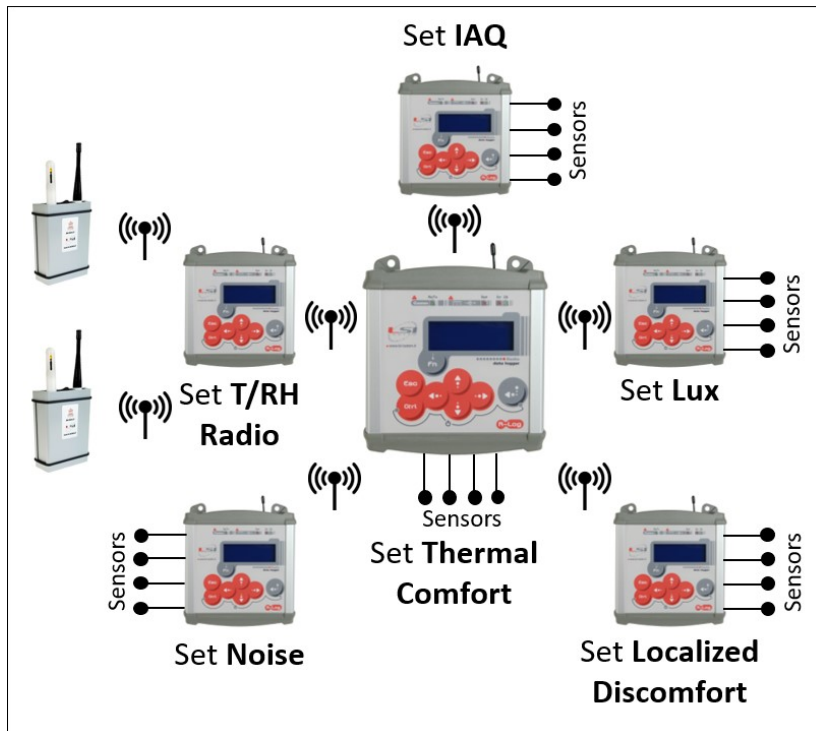


**NOTE**

- C The ESR001 probe is useful if the calculation of the daylight factor is required
- D In addition to the probes for the measurement of CO<sub>2</sub> and VOC, LSI LASTEM offers many other probes for the measurement of other gases. See catalog MW9001-ENG-12. Each ELR510.1 radio module can receive 4 gas probes at the same time

Ref. Fig.	PN	Description	Kit1	Ref. Note
<b>Illuminance sensor set (daylight factor calculation)</b>				
10	<b>ESR000</b>	Sensor/Lux CIE/0÷5Klux/Cable+MiniDIN	1	
11	<b>ESR001</b>	Sensor/Lux CIE/0÷25Klux/Cable+MiniDIN	Optional	C
<b>Indoor Air Quality and ventilation sensor set</b>				
12	<b>ESO203</b>	Sensor/CO <sub>2</sub> /0÷5000ppm/Cable+MiniDIN	1	D
13	<b>ESO150</b>	Sensor/VOC/0÷20ppm/Cable+MiniDIN	1	D
14	<b>ESV307</b>	Sensor/Air.Vel/hot wire/RS232/Cable+ DB	1	
<b>Noise sensor</b>				
15	<b>PRSLA1000</b>	Noise sensor	1	
	<b>DEA999</b>	Connection cable for noise sensor to radio module	1	
	<b>BVA327</b>	Accessory to fix PRSLA1000 to tripod	1	

## Radio Multi-parametric and Multi-positions System for IEQ



- ▶ Possibility of carrying out multi-positions measurements thanks to the setup of a network consisting of measurement modules connected via radio to each other
- ▶ Each network consists of a Master module and several Slave and Repeater modules. Each module is connected via cable to five sensors to make up a measurement set
- ▶ It is possible to connect via radio the Temperature and RH% sensors to a Slave or Repeater module of the network
- ▶ Thanks to the possibility of connecting different modules, measurements of all the main IEQ parameters can be performed simultaneously
- ▶ Sensors for measuring thermal comfort (temperature and humidity, radiant temperature, air speed) and local discomfort (floor temperatures, radiant asymmetry, air flows)
- ▶ Sensors for measuring IAQ (Indoor Air Quality) for measuring the main gases present in confined environments (CO, CO<sub>2</sub>, VOC and many others)

Multi-parametric and multi-point radio system thanks to the **R-Log radio data logger**.

The network of measurement points consists of a series of **"Slave"** and **"Repeater"** RLog modules **connected by cable to the various sensors**. Each module sends the acquired measurements to a Master unit which stores them. Each unit can be connected to specific types of sensors for the specific indoor application (maximum 4 analog sensors + 1 serial sensor).

For a complete monitoring of the typical variables of Indoor Environmental Quality, we suggest specific sensor sets for the following purposes:

- **Thermal Comfort:** sensors for the calculation of microclimatic indices, for the evaluation of the global thermal comfort of the confined environment, such as temperature and relative humidity, radiant temperature, air speed.
- **Local Discomfort:** sensors for evaluating the variables that affect localized discomfort, such as floor temperature, air draughts and radiant asymmetry.
- **Illuminance:** lux meters for evaluating indoor but also outdoor lighting (for calculating the Daylight Factor).
- **Indoor Air Quality:** sensors for monitoring the gases present in the confined environment, typically CO<sub>2</sub> and VOC. LSI Lastem has additional sensors for other gases (eg. CO, SO<sub>2</sub>, H<sub>2</sub>S, etc. ...).
- **Noise:** sound level meter for the evaluation of noise discomfort in indoor environments.
- **Set Temperature and Relative Humidity via radio:** it is also possible to connect to the R-log data logger, sensors that communicate temperature and humidity via radio, in order to acquire a greater number of points even at greater distances.

The measuring points are equipped with **accessories** for the temporary or fixed installation of data loggers and sensors, thanks to tripods and stands.

The R-log data logger allows the **on-board calculation** of the main indices for assessing the quality of indoor environments as defined by the standards, LSI Lastem provides the **Gidas-TEA** software to calculate Microclimatic indices (see Table on page 6) in addition to **Gidas-Viewer** software for statistical calculations and creation of graphs and tables.



## Kit 2—Radio Multi-parametric and Multi-point System for IEQ



**Local Discomfort**



**Thermal Comfort**

**NOTE**

- A Each ELR510.1 module can be configured as MASTER, SLAVE or REPEATER. Each network (maximum 55 channels) must contain at least one module configured as MASTER
- B The ESV306 probe measures air velocity and Turbulence index. The ESV107 probe measures only air velocity. The latter may not be useful if the network already contains one or more ESV306 probes. The calculation of the PMV-PPD will be performed considering ESV306 probe
- C The BSZ313 software is used to calculate PMV-PPD index (ISO7730)
- D The EST130 sensor, used for the calculation of the "Dissatisfied with vertical temperature gradient" Index, must be combined with an air temperature sensor placed at about 110 cm in height. For this it is possible to use the air temperature acquired by the ESU403.1 probe already present in the module for the calculation of thermal comfort

Ref. Fig.	PN	Description	Kit2	Ref. Note
		<b>Sensor set and MASTER radio module with software for thermal comfort (PMV-PPD, Operating Temperature)</b>		
1	<b>ELR510.1</b>	R-Log Radio MSR/ZB/N.5 inputs/8MB/Display/Batt/MiniDIN	1	A
	<b>BSC015</b>	Power charger 230Vac->9Vdc/M-RLog/IP54	1	
2	<b>ESU403.1</b>	Sensor/T+RH%/Pt100+0÷1V/12V/Cable+MiniDin	1	
3	<b>ESV107</b>	Sensor/Air speed/Hot-wire/RS232/Cable+ DB	1	B
4	<b>EST131</b>	Sensor/Temp.globo nero/Pt100/Cable+MiniDin	1	
	<b>BSZ313</b>	SW Gidas TEA/Comfort/PC	1	C
5	<b>BVA304</b>	Tripod	1	
6	<b>BVA305</b>	Stand for M/RLog sensors	1	
		<b>Set of sensors and radio module for localized thermal discomfort (floor temperature, radiant asymmetry, air currents)</b>		
	<b>ELR510.1</b>	R-Log Radio MSR/ZB/N.5 inputs/8MB/Display/Batt/MiniDIN	1	A
	<b>BSC015</b>	Power charger 230Vac->9Vdc/M-RLog/IP54	1	
7	<b>EST130</b>	Sensor/Double Temp./Surface+H=10cm/2xPt 100/Cable+MiniDin	1	D
8	<b>ESR231</b>	Sensor/Radiant Asymetry/Cable+MiniDIN	1	
9	<b>ESV306</b>	Sensor/Air speed+Turbolence/Hot-wire/RS232/Cable+DB	1	B
	<b>BVA304</b>	Tripod	1	
	<b>BVA305</b>	Stand for M/RLog sensors	1	



11  
**Illuminance**



**IAQ**



**Noise**

NOTE	
E	The ESR001 probe is useful if the calculation of the daylight factor is required
F	In addition to the probes for the measurement of CO <sub>2</sub> and VOC, LSI LASTEM offers many other probes for the measurement of other gases. See catalog MW9001-ENG-12. Each ELR510.1 radio module can receive 4 gas probes simultane-

Ref. Fig.	PN	Description	Kit2	Ref. Note
<b>Set of sensors and radio module for illuminance (Daylight factor)</b>				
	<b>ELR510.1</b>	R-Log Radio MSR/ZB/N.5 inputs/8MB/Display/Batt/MiniDIN	1	A
	<b>BSC015</b>	Power charger 230Vac->9Vdc/M-RLog/IP54	1	
10	<b>ESR000</b>	Sensor/Lux CIE/0÷5Klux/Cable+MiniDIN	1	
11	<b>ESR001</b>	Sensor/Lux CIE/0÷25Klux/Cable+MiniDIN	1	E
	<b>BVA304</b>	Tripod	1	
	<b>BVA305</b>	Stand for M/RLog sensors	1	
<b>Sensor set and radio module for Indoor Air Quality</b>				
	<b>ELR510.1</b>	R-Log Radio MSR/ZB/N.5 inputs/8MB/Display/Batt/MiniDIN	1	A
	<b>BSC015</b>	Power charger 230Vac->9Vdc/M-RLog/IP54	1	
12	<b>ESO203</b>	Sensor/CO <sub>2</sub> /0÷5000ppm/Cable+MiniDIN	1	F
13	<b>ESO150</b>	Sensor/VOC/0÷20ppm/Cable+MiniDIN	1	F
14	<b>BVA304</b>	Tripod	1	
	<b>BVA305</b>	Stand for M/RLog sensors	1	
<b>Sensor set and radio module for Noise</b>				
	<b>ELR510.1</b>	R-Log Radio MSR/ZB/N.5 inputs/8MB/Display/Batt/MiniDIN	1	A
	<b>BSC015</b>	Power charger 230Vac->9Vdc/M-RLog/IP54	1	
15	<b>PRSLA1000</b>	Noise sensor	1	
	<b>DEA999</b>	Connection cable for noise sensor to radio module	1	
	<b>BVA327</b>	Accessory to fix PRSLA1000 to tripod		
	<b>BVA304</b>	Tripod	1	
	<b>BVA305</b>	Stand for M/RLog sensors		



**Radio Sensors**

**(869 MHz)**



**NOTE**

G	It is possible to create a network of EXP812.1 radio sensors (frequency 869 MHz) for temperature and RH%. This network flows the data to a SLAVE or REPEATER unit to which an EXP301 radio receiver is connected.
H	In the EXP812.1 radio sensor network it is also possible to combine an EXP815 sensor for measuring the T&RH outside
I	The number of suitcases and transport bags depends on the number of sets present. Usually one for each set.
L	The BSZ311 GIDAS-Viewer software is required to create graphs and tables of the measured values. Indispensable if the BSZ313 (GIDAS-TEA) software is selected for calculating the PMV-PPD index (ISO7730)

**Set of sensors and radio module for Temp. + RH% (indoor and outdoor)**

	<b>ELR510.1</b>	R-Log Radio MSR/ZB/N.5 inputs/8MB/Display/Batt/MiniDIN	1	A
	<b>BSC015</b>	Power charger 230Vac->9Vdc/M-RLog/IP54	1	
16	<b>EXP812.1</b>	Sensor/Temp+RH%/869 MHz/Battery	n	G
17	<b>EXP815</b>	Sensor/Temp+RH% meteo/869 MHz/Battery	1	H
18	<b>EXP301</b>	Receiver EXP sensors radio signals/12V	1	G
	<b>DWA601.2</b>	Cable/L=2m/EXP301-401-402		
	<b>Cases for the transport of data loggers and sensors</b>			
	<b>BWA314</b>	Carrying case 52x43x21cm/antishock/IP65	n	I
	<b>BWA048</b>	Long bag for tripod	n	I
	<b>Software</b>			
	<b>BSZ311</b>	SW Gidas Viewer/PC	1	L

**Contact LSI LASTEM for more information  
about system configurations and options**

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