

MULTIPARAMETRIC RADIO SENSORS For INDOOR MEASUREMENTS





- Network of **indoor datalogger sensors** that communicate via **radio**
- Measurement quality at the highest market standards
- An entire family of multi-parameter sensors with an **innovative design** for the best location in the environment
- Integration of different measures within a single small body
- Thread protocol, allows the creation of an interconnected sensors network with high extension and flexibility of geometry
- **Extension of the radio range through the use of signal repeaters**
- **Installation flexibility** thanks to a wide variety of supports
- Data sent to LSI LASTEM INDOOR CUBE cloud software or server
- Local diagnostics through multicolored led crown
 - **High autonomy** of battery operation. Additional power supply via standard micro USB socket
- Three levels of **data storage**: sensor (for lack of communication), Sphensor Gateway and server with the "store and forward" function
- Availability of **additional inputs** for connection to external sensors
- O Automatic calculation of **derived quantities** on LSI LASTEM cloud platform

LSI LASTEM has been designing a new kind of indoor monitoring sensors. **SphensorTM** are spherical multiparametric radio data logger sensors, they can be built up to form a **network** and can be easily integrated with the **LSI LASTEM INDOOR CUBE cloud-based application platform**. SphensorTM have been designed with a pleasant visual impact, to be **harmoniously integrated into their surroundings**. The sensors are white spheres that act like black boxes, measuring several **physical and chemical quantities**, sending data through a robust mesh radio network to a border router (Sphensor Gateway) to be finally transferred to the LSI LASTEM INDOOR CUBE cloud platform.

SPHENSOR [™] MODELS					
PN	PRMPB0401	PRMPB0402	PRMPB0403	PRMPB0404	PRMPA0423
	**	×		×	
Temperature	1	1	1	1	Of the cell
Relative Humidity	1	1	1	1	
Illuminance		5 directions	5 directions		
Dig. Temp. Ext.				2 inputs	
Atmo. Pressure	1	1	1	1	Of the cell
UVA			1		
VOC					1
PM (1,2.5,4,10)					1
CO ₂					1
Battery R/NR	NR+micro-USB	NR+micro-USB	NR+micro-USB	NR+micro-USB	R+micro-USB

MW9001-ENG-14-18/1012023



MULTIPARAMETRIC RADIO SENSORS For INDOOR MEASUREMENTS

Sphensor Gateway



The primary function of the Sphensor Gateway is to decode and route the radio messages arriving from the sensors via the Thread protocol to the MQTT broker reachable via the Ethernet connection and, vice versa, to send the messages coming from the same MQTT broker to the sensors of the net.

The Sphensor Gateway also collects diagnostic information from the sensors in case the broker is not reachable due to unavailability of the network connection or the broker itself. The size of this memory space is determined by an editable configuration parameter.

The Sphensor Gateway also defines the system time by obtaining it from a suitably configured NTP server. There is also an alternative internal MQTT broker or that can be used as an integration to the one present on an external server.

The Thread protocol



▶ The Thread protocol allows the connection and communication of the Sphensor[™] data logger sensor network to one or more Sphensor Gateways.

The **Sphensor Gateway** communicates via the internet with external devices and with the network management software cloud.

The **cloud software** is accessible from any point connected to the internet via PC, Tablet, mobile phone.

To enlarge the signal coverage of the Thread network it is possible to add **repeaters.**



Sphensor[™]

Sphensor[™] network architecture



C The **Sphensor[™]** data logger sensors form an indoor sensor network and communicate with each other and with the Sphensor Gateway via **2.4 GHz radio**, **Thread protocol**.

The **Sphensor Gateway** acquires data from the network and processes them locally, allows local data storage, the execution of calculations and the implementation of alarms via 4 implemented outputs. The Sphensor Gateway can also act directly on third-party **BMS systems** (Building Management Systems) to regulate the environmental conditions of buildings.

The data are sent from the Sphensor Gateway via the internet to the **LSI LASTEM INDOOR CUBEcloud software** for managing and saving data.

The data can also be automatically exported directly from the Sphensor Gateway or by passing through the cloud software to **spe**cialized third-party software.

The INDOOR CUBE cloud platform

SphensorTM sensors are managed by the **INDOOR CUBE** cloud platform, with desktop and mobile version. The features are:

- Dinamic dashboard visualization with last data
- **LSIndex** visualization, the synthetic index for indoor environmental quality
- Calculate quantities configuration
- Historical data visualization and download, comparisons
- Alarm setting
- **Report** download

(see catalogue MW9006-ENG-15-LSI-INDOOR-CUBE)





Sphensor[™] Applications

Sphensor[™] sensors are designed for **long-term monitoring** of physico-chemical quantities of indoor environments. The goal of this line of multi-parametric wireless data logger sensors is to monitor the **healthiness** of indoor environments, or the **IEQ** (Indoor Environmental Quality) Monitoring, which includes **IAQ** (Indoor Air Quality).

Among the strengths of the system is the ability to monitor the **state of the environment in real time**, continuously and simultaneously monitoring all the main variables for the definition of healthiness. Another key feature of the range of sensors is the **accuracy** of the measurements at the highest market standards, combined with the **modern and attractive design**, which allows the introduction of the monitoring network even in a central position with respect to the area to be monitored.

The possibility of data transmission to customer servers, to those of **system integrators** or to the **LSI LASTEM cloud platform** allows **remote control** of the quantities of interest, even in the case of complex monitoring projects. The platform allows the execution of **analyzes** and **comparisons** of data even from different environments, as well as the management of **alarms**.

All these features make **Sphensor**[™] the most suitable solution for monitoring:

- Museums
- Buildings (residential and public)
- Offices and Workplaces
- Schools / Universities
- Hospitals
- Shopping centers
- Close Control Laboratories and Productions







Sphensor[™] Common Technical Specifications

Temperature	Principle	RTD Pt100 1/3 DIN B (Class AA EN60751)	
	Measure range	-3060°C	
	Accuracy	 ±0.1 °C; Max ±0.3 °C (@2060 °C) ±0.2 °C; Max ±0.3 °C (@-4020 °C; 6080 °C) 	
	Resolution	0,015°C	
	Response time (T63)	> 2 sec	
	Long term stability	<0.03 °C/yr	
Relative Humidity	Principle	Capacitive	
	Measure range	0100%	
	Accuracy	 ±1.5 %; Max ±2 % (@25 °C; 080 %) ±2 %; Max ±3 % (@25 °C; 80100 %) 	
	Resolution	0.01%	
	Response time (T63)	8 sec	
	Long term stability	<0.25 %RH/yr	
Atmospheric Pressure	Principle	Piezoresistive	
	Measure range	6001100 hPa	
	Accuracy	0.18 hPa (@ 25 °C); ±0.6 hPa (@ -4085 °C)	
	Resolution	0.1 hPa	
General Information	Protection grade	IP30	
	Operative temperature	-3060°C	
	Sampling rate	Programmable from 1 to 600 s	
	Power supply	 Lithium battery: non-rechargeable, 3.6 V 1.2 Ah, ½ AA size, replaceable. Micro-USB socket for additional external power supply. 	

Sphensor[™] Technical Specifications

Lux	Principle	Ambient Light Photodiode Sensor
(PRMPB0402-3)	Measure direction	 0°, 90°, 180°, 270° with elevation of 45° with respect to the sensor plane 1 measure on the normal of the sensor plane
	Measure Range	0.190 klx
	Accuracy	±5% MV ± 5 lx
	Resolution	1 lx
	Sensitivity	3 lx
	Cosine response	2% (for incidence angle < 50°)



UV-A	Principle	Indium Gallium Nitride Photodiode		
(PRMPB0403)	Measure direction	On the normal of the sensor plane		
	Measure Range	0200 µW/cm ²		
	Accuracy	±5% VL		
	Resolution	0.05 μW/cm ²		
VOC and equivalent CO ₂	Range (ethanol, H ₂)	01000 ppb		
(PRMPA0423)	Accuracy	Ethanol: 15% of measured value		
		H ₂ : 10% of measured value		
	Resolution (ethanol, H ₂)	0.2% of measured value		
	Thermal drift (ethanol, H ₂)	1.3% of measured value		
	Operative temperature	-1060 °C		
PM (1, 2.5, 4, 10)	Range	01000 µg/m3		
(PRMPA0423)	Precision	 PM1 and PM2.5: 0100 μg/m³ ±10 μg/m³ 1001000 μg/m³ ±10 % of measured value 		
		 PM4 and PM10: 0100 μg/m³ ±25 μg/m³ 1001000 μg/m³ ±25 % of measured value 		
	Temperature drift	 0100 μg/m³ ±1.25 μg/m³/year 1001000 μg/m³ ±1.25 % of measured value/year 		
	Life time	24h/g > 10 years		
	Acoustic emission level	25 dB		
	Noise emission level drift	+0.5 dB		
	Operative temperature	-1060 °C		
CO ₂	Range	05000 ppm		
(PRMPA0423)	Accuracy	<± (50 ppm + 3% of measured value)		
	Response time (T63)	140 s (with measured average), 75 s (without measured aver- age)		
	Automatic calibration	Present: it does not require positioning of the sensor		
	Periodic calibration	5 years		
	Temperature influence	± (1+CO ₂ [ppm]/1000) ppm/°C (-20±45°C)		
Internal Temperature (PRMPA0423)	Range	-40±60 °C		
	Accuracy	±0.5 °C @ 25 °C		
Internal Pressure	Range	7001100 mbar		
(PRMPA0423)	Accuracy	±2 mbar @ 20±80% RH @ 25 °C		



	Non-Rechargeable Battery Life			
Sampling Rate	PRMPB0401	PRMPB0402	PRMPB0403	PRMPB0404
30″	1 year e 3 months		1 year e 1 month	
1′	2 years e 1 month		1 year e 10 months	
2'	2 years e 9 months		2 years e 5 months	
5′	4 years e 2 months	3 years e 9 months		
10′	5 years		4 years e 6 months	

Border Router TXRGA1001 Technical Specifications

Power Supply	Connector	Mini-USB
	Switch	External button
	Backup batteries	Rechargeable with Li-Ion or Li-Po, up to 4x2.9 Ah
	Power consumption	200-500 mA @ 5 V (without radio)
	Autonomy	3 h with 1 3.7 V battery LiPo
	Charging time	2 h (1 battery)
Diagnostic	Green led USB pwr	Presence of 5 Vdc power supply from micro-USB cable
	Green led On	Power on state
	Blue led Active	Activity state
	Red led Alarm/Err	Alarm status according to pre-set or error logics
Thread Radio	Module	Minew
	Antenna connector	SMA
	Antenna	External
Network connection	Connection 1	Ethernet RJ45
	Connection 2	USB key for external modem connection



Fixing systems



• Fixing system with **BASE**

System suitable for the temporary positioning of sensors on a flat surface for easy repositioning. The system also allows the inclination of the sensor towards the horizontal up to a maximum inclination of 45°.

Fixing system with PRIGIONIERO

This system is very practical and allows the sphere to rotate in any direction by acting on the joint that connects it to the sphere in case of fixing on a pre-drilled rod or indoor support (see Accessories).

Fixing system to WALL

Directly derived from the previous method, the sensor can be easily fixed to a wall through the use of a plug (see Accessories).



• Fixing system to **PLATE**

A similar method to fixing to the wall with a plug, but with greater control over the position, axis and direction of the sensor is fixing with a plate (see Accessories).



SUSPENSION fixing system

Should the Sphensor be suspended from a ceiling, the stem can be replaced by a hook. The fixing to the ball takes place in the same way as the stem, but the presence of a hole allows the passage of the wire (Accessory included).



Fixing systems



• Fixing system with **MINI TRIPODE**

Possibility of anchoring the stem with nut to a mini photographic tripod for a fast and stable positioning of the sensor on a flat, inclined or uneven surface.

• Fixing system with **PLIER**

• Fixing system with **ARTICULATED ARM**

Accessories

MC8113	Shank containing nut for thread W 1/4 "
PRTHA0701	Thermo-hygrometric cell for PRMPB04xx spare part
PRTEA0922	Contact temperature sensor for PRMPB0404. Flat cable L=5 m
PRWSA3023	Air speed hot wire sensor for PRMPB0405
TXMRB1100	Sphensor Repeater

LSI LASTEM Srl Via Ex SP. 161 Dosso, 9 20049 Settala (MI) Italy Tel. +39 02 954141 Fax +39 02 95770594 Email info@lsi-lastem.com www.lsi-lastem.com

