

 >> SENSORS TO MONITOR MATERIALS

General Catalogue

Components

# Sensors to monitor materials



waste and compost



Milano  
ITALY



## LSI LASTEM s.r.l

### 40 years of experience in environmental technology

Since 1972, LSI LASTEM Srl of Milano (Italy) develops, manufactures and delivers worldwide the most complete range of high quality environmental monitoring systems. LSI LASTEM instruments suits virtually any type of application, guaranteeing accurate and reliable measurement of environmental parameters both for portable and long term monitoring, outdoors and indoors. Our comprehensive range of products includes sensors, data acquisition systems, software and installation accessories.

#### ► Products

Instrumentation for indoor and outdoor environmental monitoring applications

LSI Lastem catalogue features one of the most complete ranges of instruments available on the market. We supply our products as complete, turn-key solutions or as components for third-party integration.



#### ► METEOROLOGICAL SENSORS

Our broad range of sensors covers virtually any meteorological parameter, including wind, temperature, relative humidity, solar radiation, rain, atmospheric pressure, evaporation, visibility and more.



#### ► INDOORS SENSORS

A full set of sensors for high-end indoors monitoring applications including solutions for temperature, relative humidity, air speed, light, radiative quantities, pressure, gas concentration and more.



#### ► DATA LOGGERS and SOFTWARE

A complete range of data loggers for environmental applications, featuring low power consumption, protection against severe environmental conditions and extensive set of signal supported and communication protocols.





## ▶ Systems

LSI Lastem knowledge and expertise, the result of 40 years of business in the environmental market, has helped customers put together an incredible number of application-specific monitoring solutions.

### ▶ INDOORS APPLICATIONS

#### ▶ Indoor Environmental Quality

Since his inception, indoor environmental assessment has been LSI Lastem's core business. Over the years, we implemented the most complete range of systems to measure the critical quantities defining health and comfort of building occupants.



#### ▶ Heat stress and thermal comfort

State-of-the-art systems for the measurement of thermal comfort and heat/cold stress in health and safety applications according to relevant ISO standards. Over the years this application has become a true LSI Lastem's specialty.



#### ▶ HVAC

Complete solutions for thermal comfort and indoor air quality monitoring in order to regulate HVAC (Heating, Ventilation Air Conditioning) systems performances and attain a better thermal sensation with optimal energy expenditures.



#### ▶ Buildings assessment/Wall insulation

Complete systems for testing building environmental performances as function of energy saving capacity and related environmental comfort (Green Building Rating Tools) - including wall thermal transmittance, thermal comfort, indoor air quality and ventilation, light controls.



#### ▶ Controlled Atmosphere Processing Environments

Monitoring of ambient temperature, relative humidity, air speed, pressure, IAQ and other parameters relevant for optimal storing and processing purposes in clean rooms, white chambers, laboratories, warehouses, caves and green houses.



#### ▶ Museums and heritage

Practicing on Italy's immense cultural and artistic heritage and in cooperation with the most renowned restoration institutes, LSI Lastem has implemented monitoring solutions for the critical environmental and chemical parameters affecting conservation of artworks in museums, archeological sites and natural caves.



## ▼ ENVIRONMENT AND POLLUTION

### ▶ **Air Quality Monitoring**

Meteorological measurements for the analysis of the atmosphere dynamics and data correlation for air quality networks, stack emissions and gas analyzers systems.



### ▶ **Landfills and waste plants monitoring**

Monitoring of meteorological parameters in environmental-hazardous plants such as landfills and waste treatment plants. Solutions for odours dynamics, rain quantity and deepwater level&quality.



### ▶ **Compost and biofilters**

Systems to monitor the compost maturation process and bio-filtration activity. We provide solutions for temperature, oxygen and water content monitoring, for on-line (wireless or cabled) and portable applications.



## ▼ METEOROLOGICAL APPLICATIONS

### ▶ **AWS and Synoptic Meteorological systems**

Complete surface weather observation systems according to WMO standards for general or specific meteorological observations, operating individually or in networks.



### ▶ **Road and transportation monitoring systems**

Meteorological measurements systems for roads, railroads, seaports and airports-including specific parameters such as wind, visibility, precipitation intensity and type, road-surface conditions and present weather.



### ▶ **Hydrology systems**

Meteorological systems to control water both as a resource and as a hazard in hydrological networks and water-basin management – including measures of rain intensity, level and quality of water and snow.



### ▶ **Agrometeorology**

Climate is the single most important factor for crops growth and health. We offer a complete range of application-specific monitoring for leaf wetness, evapotranspiration, soil water content and photosynthetic-active radiation.



### ▶ **Wind energy**

From site assessment to wind turbine control, our complete meteorological catalogue with its full range of anemometers and data logger, gives wind energy professionals one of the most complete arrays of solutions available on the market.



### ▶ **Solar energy**

As Italy evolved into a premium solar energy market, we became the preferred choice for plant owners, EPC contractors and monitoring systems producers as we developed a unique knowledge of the application to go along with our meteorological and radiometric know-how.



## ► The LSI LASTEM Story

40 years of experience in environmental technology



www.lsi-lastem.it

**LSI**  
LABORATORI  
DI STRUMENTAZIONE  
INDUSTRIALE S.p.A.



- ◀ **1972** - Laboratori di Strumentazione Industriale (LSI) Spa is organized in Milano by former members of a previously existing electronic research company (LRE) and begins the production of electrical thermometers. Soon afterwards, the company adds systems to measure relative humidity through the psychrometric method and hot-wire anemometers to his portfolio.



- ◀ **1975** - The company introduces graphic recorders for the online printing of the measured values and a line of converters for the connection of sensors to industrial systems. In just a short time, the range of products and measured quantities is remarkably increased with the introduction of sensors for the measurement of different types of temperature radiant, contact and of liquids, along with luxmetric sensors and hygrometers.

**LASTEM**



- ◀ **1979** - Introducing the LASTEM logo, the company begins the production and distribution of his line of sensors and data acquisition systems specific for meteorological applications. LASTEM Srl is now operative.



- ◀ **1980** - LSI is the first company in Italy to produce instruments for the measurement and storage of the thermal environments parameters requested in the health and safety regulations in working environments.



- ◀ **1985** - LSI and LASTEM transfer their head offices from Viale Liguria (Milan) to the current Settala (MI) headquarters, consisting in three twin buildings.

**1990** - After the consolidation of computer technology and storage possibilities, LSI develops a series of PC-compatible acquisition systems and software.



- ◀ **1995** - A new concept of measurement is then started: multi-measurement system - one single system able to measure not just a few parameters, but a whole range of quantities which, altogether, can solve a specific application need. The multi-measurement concept has been a company mainstay since, widening the range of sensors for the measurement of environmental quantities such as gas concentration, thermic flows, lux and radiation.



- ◀ **2000** - LSI further develops its range, with a new sensor line equipped with data transmission via radio to data acquisition systems.

**2004** - Aiming at offering a more complete range of services and better quality standards to his clients, LSI creates the new "After-Sale Services" division, designed to offer support and service after the purchase of the instruments: Telephonic Assistance, Data Collection, Repair Service and External Assistance.



- ◀ **2006** - LSI and LASTEM are united under the same brand and logo, with the new LSI LASTEM name.

**2010** - A new concept of multi-position measurement is started: thanks to radio technology applied to data loggers and sensors, the multi-measurement concept is extended to a multi-position concept. Now LSI Lastem can develop complex systems producing simultaneous measurement of a number of parameters in different positions of the targeted environment.







**LSI LASTEM headquarters in Settala, near Milano, Italy** is a 1325 m<sup>2</sup>, 3 twin-building structure that's been home to our company since 1985. Here, a team of 30 professionals is employed in engineering, production, aftersales, marketing and administration departments.

► **R&D**

Each and every LSI Lastem product is designed, developed and tested here. Our skill set includes physics, mechanics, electronics, firmware and software engineering.



► **Mechanical Shop**

The backbone of LSI Lastem products takes shape in our in-house shop. Our expert craftsmen produce here sensor bodies, supports and mechanical components.



► **Sensors assembly division**

Given our extensive range of sensors, this is always one of the busiest areas of the company. After completion, sensors are moved in the nearby calibration laboratories for testing.



► **Data Loggers Assembly division**

Data Loggers are the absolute core of our systems. Here they are assembled, configured and tested – the latter activity lasts for a 7-day period.



adquarters  
Settala (MI) ITALY



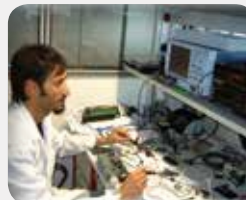
#### **Calibration Laboratories**

To ensure consistent and dependable performance, we calibrate each sensor against traceable standards in a specific calibration facility. Our laboratory is accredited by ACCREDIA Italian Accreditation System, the National Body for accreditation activities, equivalent to ISO/IEC 17025.



#### **Aftersales**

We have a skilled, dedicated team for aftersales services. Their duties include repairs, calibrations, on-site installations and maintenance. In addition, we perform data management services to our customer - data download, validation and web publication.



#### **Training**

We have always believed in the benefit of offering training for our customers to make the use of our system more productive and easier. That's why we have a dedicated room for our year-round training seminars.



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## LSI-LASTEM Sensors for the monitoring of temperature, oxygen and volumetric water content in waste materials and compost heaps

General catalogue

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### LSI-LASTEM Sensors for the monitoring of temperature, oxygen and volumetric water content in waste materials and compost heaps

LSI LASTEM provides a wide range of sensors for the monitoring of compost heaps during the bio oxidation process and for monitoring waste material, in order to better define the treatment process.

The range of sensors includes wireless and cabled sensors with analog and digital output. Wireless sensors are designed for long-term applications; the absence of cables makes them particularly suitable for installations where there are moving vehicles or a long distance between sensors and its control system. Cable-connected sensors have analog (4-20 mA) and RS-485 (Modbus-RTU) outputs. Sensors can be connected to LSI LASTEM data acquisition systems or third party systems. Radio repeaters providing long-distance coverage are also available, as well as units conveying 4÷20 mA signals by radio which are then re-converted into 4÷20 mA at the reception side. In addition, portable systems are provided featuring only an integrated display for fast visualization of instant values without data storage or transmission.



### Oxygen and temperature in materials

Sensor for Oxygen and Temperature monitoring in compost heaps during the bio oxidation process.

The sensor is particularly sturdy and has been designed to be used in corrosive materials during continuous measurements, where the sensor tip is not immersed in water. Wireless version (via radio) and version with cable having analog (4-20 mA) or digital (RS-485-Modbus) outputs are available. All signals can be received and managed by LSI-LASTEM data acquisition systems (M/E-Log)

- To obtain a RS-485 output from radio version, they must be connected to a data logger (M/E-Log), featuring Modbus-RTU configurable serial output.
- To obtain 4-20 mA signals from radio version to the receiving side, they must be connected by radio to EXP304 (n.8 4-20 mA outputs) receivers/converters.
- To run by radio 4-20 mA signals generated by versions with 4-20 mA output, it is needed to connect these sensors to EXP820 unit, which sends – via radio – signals to EXP304 (n.8 4-20 mA outputs) receivers/converters.

Order numb.	EXP831	EXP421	EXP486
Output	Radio	2x4÷20 mA	RS-485-Modbus RTU, TTY
Radio Frequency	869,450 MHz	NA	NA
Canalization	25 kHz	NA	NA
Radio transmission power	25 ± 3 mW	NA	NA
Radio transmission distance (line-of-sight)	600 m	NA	NA
Radio Bit rate	9600 bps	NA	NA
Transmission rate	10'	NA	NA
Radio antenna	Housed inside box	NA	NA
Configuration	Dip switch	Via RS-232 by Terminal Emulation program	
Battery	AA 3,6 V non rechargeable lithium battery	NO	
Battery life	>2 years	NA	
Power supply	Battery	9÷30 Vac/cc	
Consumption	<10 µW stand-by 250 mW during transmission	< 0.4 W	
Signal and power supply connector	NO	Waterproof male connector for DWA3xx cables	
Radio receiver	EXP301, output RS-232	NA	
Output values	Temperature, Oxygen, Battery voltage, % battery charge	Temperature, Oxygen	
Electrical protections	NO (electrically insulated system)	Against power supply polarity inversion; electrostatic discharge on sensors line and power supply line	Against power supply polarity inversion; electrostatic discharge on sensors line and on RS-485 communication line
O <sub>2</sub> calibration	Using trimmer	Via RS-232 with Terminal Emulation program	

continued



## Common features

Oxygen	<i>Sensitive element</i>	Electrochemical cell
	<i>Measuring range</i>	0÷25%
	<i>Accuracy</i>	0,3%
	<i>Resolution</i>	0,01%
	<i>Response time (T63)</i>	40"
	<i>Output long term drift</i>	<10% of signal/year
	<i>Cell operative life time</i>	3÷4 months (T<50°C)
Temperature	<i>Sensitive element</i>	Pt100
	<i>Measuring range</i>	0÷100 °C
	<i>Accuracy</i>	±0,12 °C
	<i>Resolution</i>	0,03 °C
	<i>Response time (T63)</i>	80"
General information	<i>Protection</i>	IP66
	<i>Operative Temperature</i>	-20÷70 °C (sensor surface temperature)
	<i>Dimensions</i>	H. 2000 mm Ø 50 mm
	<i>Weight</i>	8 Kg
	<i>Material</i>	Electronics box: reinforced polyester Shank: AISI304
	<i>Mounting</i>	Vertical insertion with BYA500 handle
	<i>Calibration</i>	O <sub>2</sub> cell (user executable)
	<i>Maintenance</i>	Electrochemical cell replacement (typically 3÷4 months)







### Temperature monitoring sensors inside materials

Sensor to monitor temperature inside compost heaps during the bio oxidation process or in bio-filters or any other aggressive material located at the waste management facility. The sensor is particularly sturdy and has been designed to be used in corrosive materials and in continuous measurements as well. Sensors measure temperature at two levels along their rod. Wireless version (via radio) and cabled version having analog (4-20 mA) or digital (RS-485-Modbus) outputs are available. All signals can be received and managed by LSI-LASTEM data acquisition systems (M/E-Log).

- To obtain a RS-485 output from radio versions, they must be connected to a data logger (M/E-Log), featuring Modbus-RTU configurable serial output.
- To obtain 4-20 mA signals from radio versions to the receiving side, they must be connected by radio to EXP304 (n.8 4-20 mA outputs) receivers/converters.
- To run by radio 4-20 mA signals generated by versions with 4-20 mA output, it is needed to connected these sensors to EXP820 unit, which sends – via radio – signals to EXP304 (n.8 4-20 mA outputs) receivers/converters.

Order numb.	EXP830	EXP420	EXP485
Output	Radio	2x4÷20 mA	RS-485
Measurement levels	N.2: puntale + H.1 m		
Radio frequency	869,450 MHz	NA	NA
Canalization	25 kHz	NA	NA
Radio Transmission Power	25 ± 3 mW	NA	NA
Radio Transmission distance (line-of-sight)	600 m	NA	NA
Radio Bit rate	9600 bps	NA	NA
Transmission Rate	10'	NA	NA
Radio Antenna	Housed in box	NA	NA
Configuration	Dip switch	Via RS-232 with Terminal Emulation program	
Battery	AA 3,6 V non rechargeable lithium battery	NO	
Battery life	>2 years	NA	
Power Supply	Battery	9÷30 Vca/cc	
Consumption	<10 µW stand-by 250 mW n transmission	< 0.4 W	
Signal and power supply connector	NO	Waterproof male connector for DWA3xx cables	
Radio receiver	EXP301 output RS-232	NA	
Output values	Temperature 1 Temperature 2 Battery voltage, % Battery charge	Temperature 1 Temperature 2	
Electric protections	NO (electrically insulated system)	Against power supply polarity inversion; electrostatic discharge on sensors line and power supply line	Against power supply polarity inversion; electrostatic discharge on sensors line and on RS-485 communication line

continued



**Common features**

Temperature	<i>Principle</i>	Pt100 1/3 DIN A
	<i>Measuring range</i>	0÷100 °C
	<i>Accuracy</i>	0,12 °C (@ 0 °C)
	<i>Resolution</i>	0,03 °C
	<i>Response time (T90 air)</i>	5' (air speed 0,2 m/s)
General information	<i>Protection</i>	IP66
	<i>Operating Temperature</i>	-20÷70 °C (sensor surface temperature)
	<i>Dimensions</i>	H. 2000 mm Ø 50 mm
	<i>Weight</i>	8 Kg
	<i>Material</i>	Electronics box: reinforced polyester Shank: AISI304
	<i>Mounting</i>	Vertically inserted with BYA500 handle



# ► Temperature and Water content inside materials

Technical features - MODELS



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## Temperature and Water content monitoring sensors inside materials

Sensor for the monitoring of water content and temperature inside compost heaps during the bio-oxidation process or in bio filters for continuous measurements. The sensor is suitable for measurements in homogeneous and compact materials, without water and no air between the two measuring electrodes, with a maximum temperature of 60°C. The sensor can be inserted in a stainless steel well (DYA105) so as to create a hole suitable for the measurement point.

Versions with analog (4-20 mA) or digital (RS-485-Modbus) output are available. All signals can be received and managed by LSI-LASTEM data acquisition systems (M/E-Log).

To run by radio 4-20 mA signals generated by versions with 4-20 mA output, it is needed to connected these sensors to EXP820 unit, which sends – via radio – signals to EXP304 (n.8 4-20 mA outputs) receivers/converters.

Order numb.	EXP427	EXP487
Output	2x4÷20 mA	RS-485-Modbus RTU
Configuration	Via RS-232 with terminal emulation program	
Power supply	9 ÷ 30 Vca/cc	9 ÷ 30 Vca/cc
Power consumption	2 W	
Signal and power supply connector	Waterproof male connector for DWA3xx cables	
Output values	Temperature, Water Content	
Electric protections	Against power supply polarity inversion; electrostatic discharge on sensors line and power supply line	Against power supply polarity inversion; electrostatic discharge on sensors line and on RS-485 communication line

### Common features

Temperature	Measuring range	-10÷60 °C
	Sensitive Element	Pt100
	Accuracy	±0,2 °C
	Resolution	0,05 °C
	Response Time (T63)	80"
Water Volume	Measuring range	0÷100% water volumetric content
	Sensitive Element	TDR (Time-Domain-Reflectometry)
	Accuracy	@ 0÷40%: 2,5%, @ 40÷70%: 3,5%
	Resolution	1%
	Response Time (T63)	15"
General information	Measuring Volume	Ø 160x100 mm
	Operating Temperature	-10÷60°C
	Dimensions	H. 2170 mm Ø 50 mm
	Tips	L. 85 mm. Ø 6 mm
	Weight	5 Kg
	Material	Radio box: reinforced polyester Shank: watertight PVC + metal tips
	Protection	Sensor: IP66
	Mounting	Vertically inserted using stainless steel well DYA105
	Calibration	Every 12 months
	Maintenance	Sensor cleaning







### Portable system for water content measurement in materials

Easy-to-handle, quick and sturdy, for fast determination of water content and temperature in sand, gravel and other inert materials used in construction industry such as cement companies, quarries and in waste disposal and composting installations.

The instrument provides two parameters:

- 1) Volumetric percentage (% water volume /material volume) or gravimetric percentage (% water weight/dry weight) of water content
- 2) Number of water liters for m<sup>3</sup> (in case of material density value)

The instrument can measure the water content of 1 kg of material with a single measurement.

According to the application, up to 15 values of specific calibration of the selectable materials can be selected. In configuration mode, users can customize their own material by storing the curve and by entering its density (kg/dm<sup>3</sup>), a necessary parameter to obtain the correct gravimetric water content. After a few seconds of measuring, the system shows the mean values as a result.

#### Order numb.

#### DQA345

Water volume	<i>Measurement 1</i>	Gravimetric or volumetric water content 0÷100%
	<i>Measurement 2</i>	% water for m <sub>3</sub> of material
	<i>Sensitive element</i>	TDR (Time-Domain-Reflectometry)
	<i>Accuracy</i>	±0,2%
	<i>Resolution</i>	0,1%
	<i>Measurement Volume</i>	1 Kg
	<i>Response Time (T90)</i>	3"
Temperature	<i>Measuring range</i>	-15÷50 °C
	<i>Sensitive element</i>	Digital sensor
	<i>Accuracy (absolute)</i>	±1,0 °C
	<i>Accuracy (relative)</i>	±0,5 °C
	<i>Resolution</i>	0,1 °C
	<i>Response Time (T63)</i>	600"
General information	<i>Power supply</i>	4,8 Vdc
	<i>Battery</i>	Up to 1500 measuring cycles
	<i>Battery recharge time</i>	120'
	<i>Housing</i>	Watertight (IP67)
	<i>Fixed Calibration</i>	Calibrations for sand, gravel and inert materials are pre-installed
	<i>Custom Calibration</i>	Storage of 15 user-defined calibration curves



## Accessories for EXP sensors

### Order numb.

#### DYA500



Removable handle with bayonet plug for sensor insertion in material.  
Not available for water content sensors (EXP427-487)

#### DWA301



Cable L = 10 m for connection of 4÷20 mA output versions to M-Log (ELO009) data logger with Mini-DIN connector

#### DWA310

Reinforced cable L = 10 m for sensor (4÷20 mA and RS485 versions)

#### DWA325

Reinforced cable L = 25 m for sensor (4÷20 mA and RS485 versions)

#### DWA326

Reinforced cable L = 50 m for sensor (4÷20 mA and RS485 versions)

#### DWA327

Reinforced cable L = 100 m for sensor (4÷20 mA and RS485 versions)

#### MG0510

AA 3,6 V spare battery for wireless versions

#### MGO513

NiCd 9 V spare battery for EXP301 receivers, EXP401 repeater, EXP820 transmitters

#### EXP301



Radio signal receiver from radio sensors or from EXP820 RS-232 Output compatible with data loggers (M/E-Log)

*Maximum number of receivable sensors* 200

*Battery* NiCd 9 V

*Power supply* 12 Vcc

#### DEC254

Omni-directional antenna for EXP301-401-304-820 units

#### DWA601

Serial cable L = 10 m for connection of EXP301 to E/M-Log data logger RS-232 port

#### EXP401



“Store and forward” repeater for radio signals, version IP65. Power supply 12 Vdc through DWAXxx cable.

continued



**EXP304**

Radio signal receiver/converter from radio sensors or from EXP820 and conversion into 4-20 mA signals corresponding to received measures

Radio frequency	869,450 MHz
Outputs	N.4 (4-20 mA)
Power supply	12 Vdc
Batteries	Lithium, 3.6 V

**EXP820**

Radio transmitter of 4÷20 mA signals to EXP301 receiver connectable to data logger, or EXP304 Receiver reconverts signals into 4-20 mA signals

Radio frequency	869,450 MHz
Inputs	N.4 (4-20 mA)
Power supply	12 Vcc
Batteries	Lithium, 3.6 V

**Specific accessories****ML3390**

O<sub>2</sub> cell (replacement) for EXP831-421-486 sensors

**DME835.1**

Spare electrodes for EXP427-487 sensors

**DYA105**

Stainless steel well for sensor insertion in material  
Compatible with EXP427-487 sensors







## >> SENSORS TO MONITOR MATERIALS



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