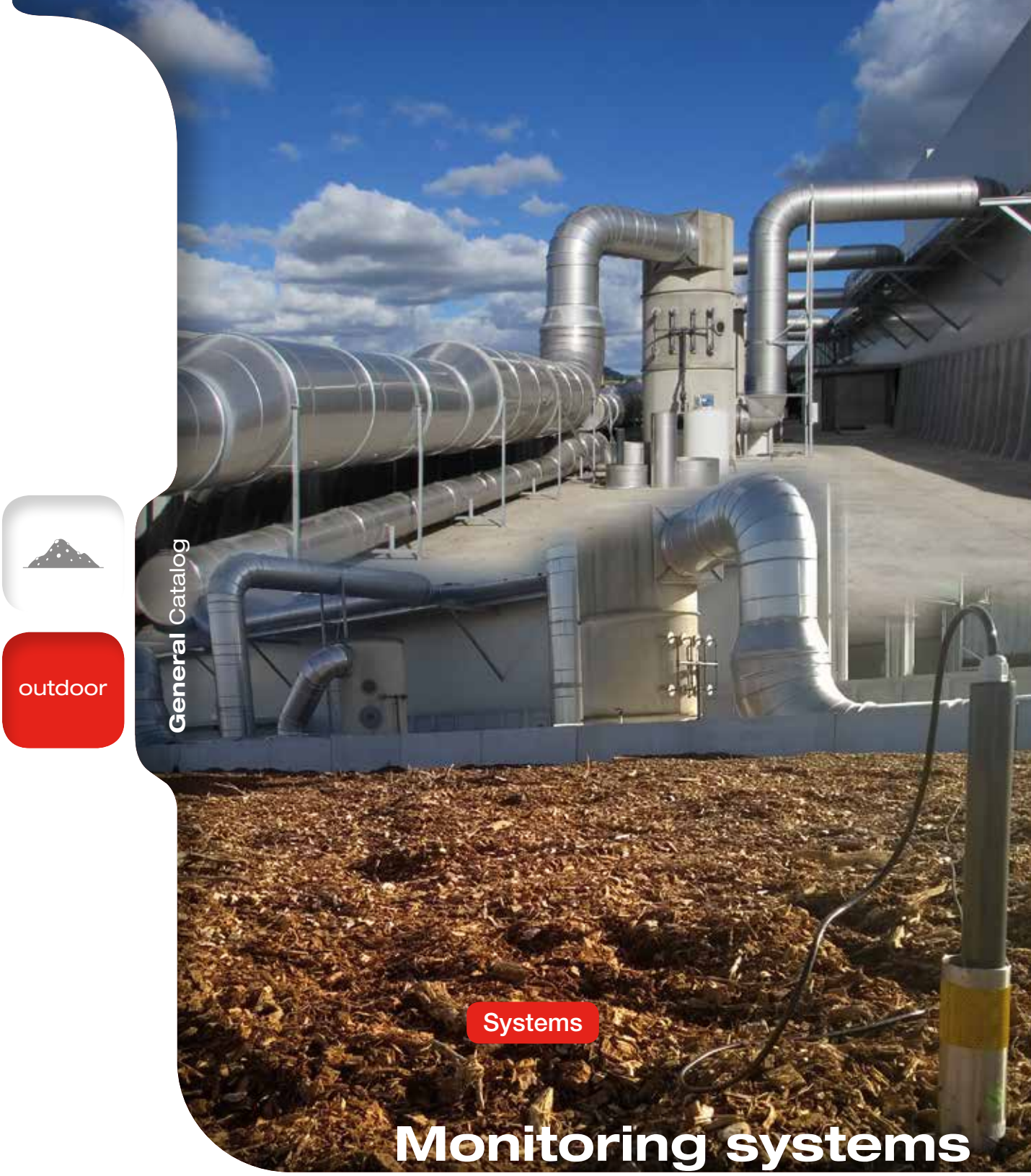


outdoor

General Catalog

Systems

Monitoring systems for compost and biofilters

LSI LASTEM

Milano
ITALY

|||| MW8540-ENG 10/2019

> Compost and biofilters

Monitoring systems for compost and biofilters

Monitoring systems and sensors for temperature, oxygen and water content in compost heaps and biofilters. Measurement of temperature, relative humidity, air velocity and pH in air ducts and catch basins.

Meteorological monitoring systems and sensors for odor dispersion in the surrounding area.

LSI LASTEM produces systems, sensors and software solutions for data measuring, processing, access, storage and transfer in order to support companies operating in the waste management industry.

As to compost heaps, the most significant parameters are temperature, oxygen and water content.

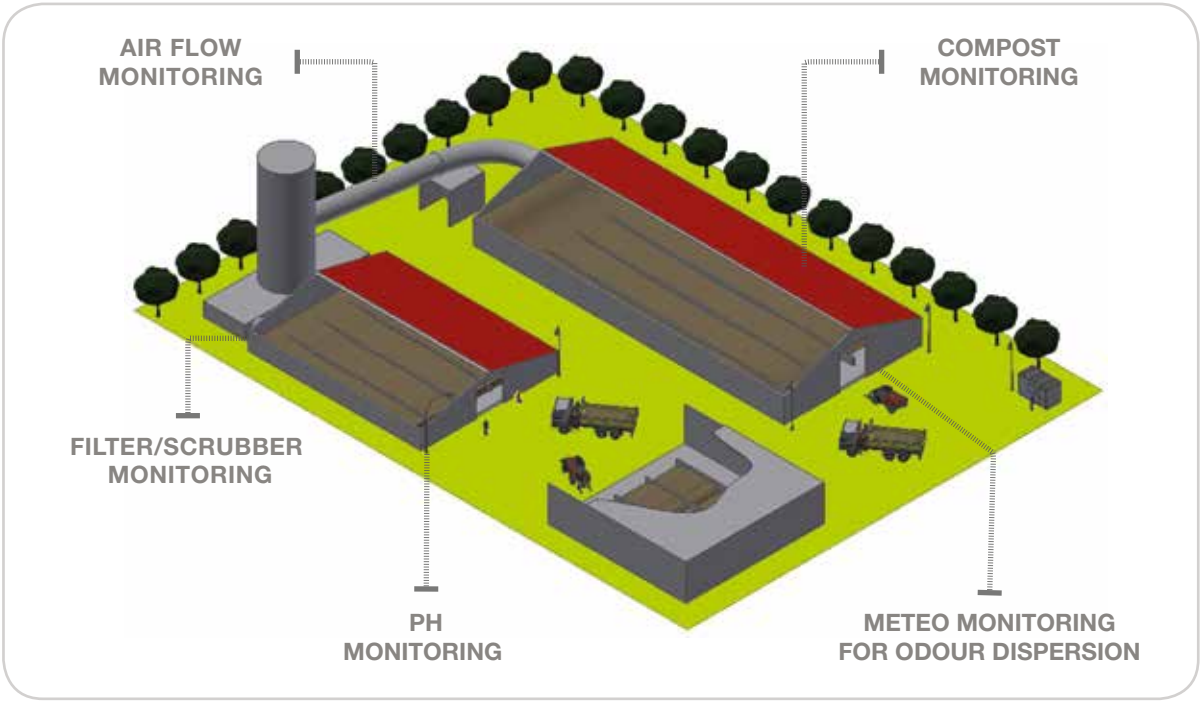
As to biofilters, the most significant parameters are temperature and water content as regards the filter bed; temperature, humidity and flow as regards the inlet duct and pH as regards catch basins.

LSI LASTEM also produces meteorological monitoring systems to tackle the problem of odor dispersion deriving from the composting process, which is one of the main issues concerning the nearby residential areas. This type of monitoring system calculates the concentration values and expresses them as odor units or as a percentage compared to the maximum value recorded in the surrounding area.

In this document: **Pag.**

The composting process and the need for monitoring

The bio fermentation process of the organic material is composed by several stages leading to the compost formation. Monitoring is essential in each stage in order to check the status of the process.



A) First stage or Mesophilic stage
In this phase, there are mesophilic bacteria with an optimal growth temperature of 25-45°C. These bacteria are responsible for the transformation of simple organic material (carbohydrates, lipids and proteins) into water, heat and CO2. Heat is essential during this stage because the progressive heating up leads to an optimal metabolic activity for mesophilic bacteria. However, this causes a further heating up, which causes the appearance of stronger bacterial populations (thermophilic bacteria) and triggers the thermophilic stage. In this first stage, monitoring the temperature is essential.

B) Thermophilic stage
Thermophilic bacterial populations appear during this phase and they can live through high temperatures (50-70°C to 90°C max). In these conditions, thermophilic bacteria use chemical substances like hydrogen to produce the energy necessary for transforming the carbon dioxide present in energetic compounds. During this phase, steamy clouds evaporate and the temperature increases to 70 °C approximately. The bacteria disappear rapidly due to the lack of water and the thermophilic stage ends. In this phase it is important to monitor temperature, O_2 and water content.

C) Maturation stage
In the previous phase, fungi have spread by sporulation thanks to the increasing temperatures. During this phase, fungi grow and spread thanks to low humidity levels. These fungi secrete enzymes that gradually break down complex compounds like cellulose, lignin and hemicellulose. During all these stages, it is important to frequently turn over the material in order to re-establish the correct porosity and homogeneity. This matter will eventually turn into the final product. In this last phase as well, it is important to monitor temperature, O_2 and water content.

1. Composting process in turned compost heaps

It is an extensive system suitable for low-fermentability masses, such as green waste or cellulose materials. The initial mass is disposed in long heaps of variable height, generally with a triangular or trapezoidal section. It is periodically stirred up so that the material is well-aerated. The turning process ensures the mixing of the starting materials, reduces the mass, facilitates the aeration, regulates the temperature and ensures sanitization and a uniform stabilization. Turning operations must be carried out on a daily basis during the first phase because the microbial activity is higher and over-heating conditions must be avoided. As the stabilization increases, turning operations can be less frequent. During this process it is important to monitor temperature.

2. Composting process in static heaps

It is a system suitable for high-fermentability biomasses, especially for agricultural and food waste (canning and fishing industry, slaughter waste, animal sewage, etc.) with a strong odor or a high nitrogen compounds concentration. The material is disposed in static heaps; therefore, conditioning is essential before to molding the heaps. Oxygenation is ensured by pipes through which air circulates naturally or artificially. The heaps have a maximum height of 1-1.2 m and can be covered by an insulating layer usually made up by mature compost, which absorbs malodorous emissions. In this phase it is possible to monitor odor dispersion with a meteorological station.

3. Composting process in bioreactors

It is an intensive composting technique suitable for high-fermentability biomasses like household organic waste, waste from restaurants and markets, wastewater and other liquid-carried commercial wastes. The first stage of the process is the most fermentative and it is carried out in different bioreactors.

- Closed reactors: rotating cylinders, silos, biocells, etc.
- Open reactors: dynamic trenches, etc.

This phase provides for:

- Soil conditioning with structuring material (usually ligno-cellulosic material) to maintain porosity and reduce humidity;
- Oxygenation assured by turning systems and/or artificial aeration;
- Aeration, preferably negative aeration, to ensure the detection and treatment of process air;
- Parameters monitoring (especially temperature).

The second stage of the process concerns the aerobic bio-stabilization of the material, which usually takes place exiting the reactors through a mound system.

Biofilter processes and the need for monitoring

As regards requirements for compost and bio-drying systems on gas emissions, there are some obligations that must be respected as to waste recovery and atmospheric emissions.
Regulations applying to notified bodies shows that the main monitoring requests concern the following aspects:

- Biofilters must be constantly functioning during working hours (most of the times also at night).
- Biofilters must ensure an average contact time of >30 seconds, a humidity level of 50-70% of the weight (related to water content), a pH of 5-8.5 and an operating temperature of 10-45°C. They must also be equipped with humidifiers for negative airflow and a filter bed dampening system.
- Biofilters must be equipped with an automatic continuous monitoring system for temperature (10 to 45°C), humidity (water content >50%) and inlet pressure drop. All constantly-monitored parameters must be recorded and stored on a data storage device always available for audits.

Applicable law

Compost
D. Lgs 22/05/1997 and further modifications

Waste
D. Lgs 22/07 (*decreto Ronchi*) and D.M. 05/02/1997 art. 31 and 33 (implementation of directives 91/56/CEE, 91/689/CEE and 94/62/CE)

Fertilizers
D. Lgs 748/84 and further modifications of D.M. 27/03/1998, attachment 1c of law 19/10/1994 (published on *Gazzetta ufficiale* no. 141 on 20/06/2006) and D.L. 29/04/2006 (amendment of the regulation on fertilizers)

Waste
Framework Directive on waste 75/442/EEC

Hazardous waste
Framework Directive on waste 91/689/EEC

Landfills
Directive on landfills 99/31/EC

Incineration
Directive on incineration 2000/76/EC

Sewage sludge
Directive on sewage sludge 86/278/EEC

Animal by-products
Regulation CE 1069/09 (ex CE 1774/02)

Packaging
Directive on packaging 94/62/EC

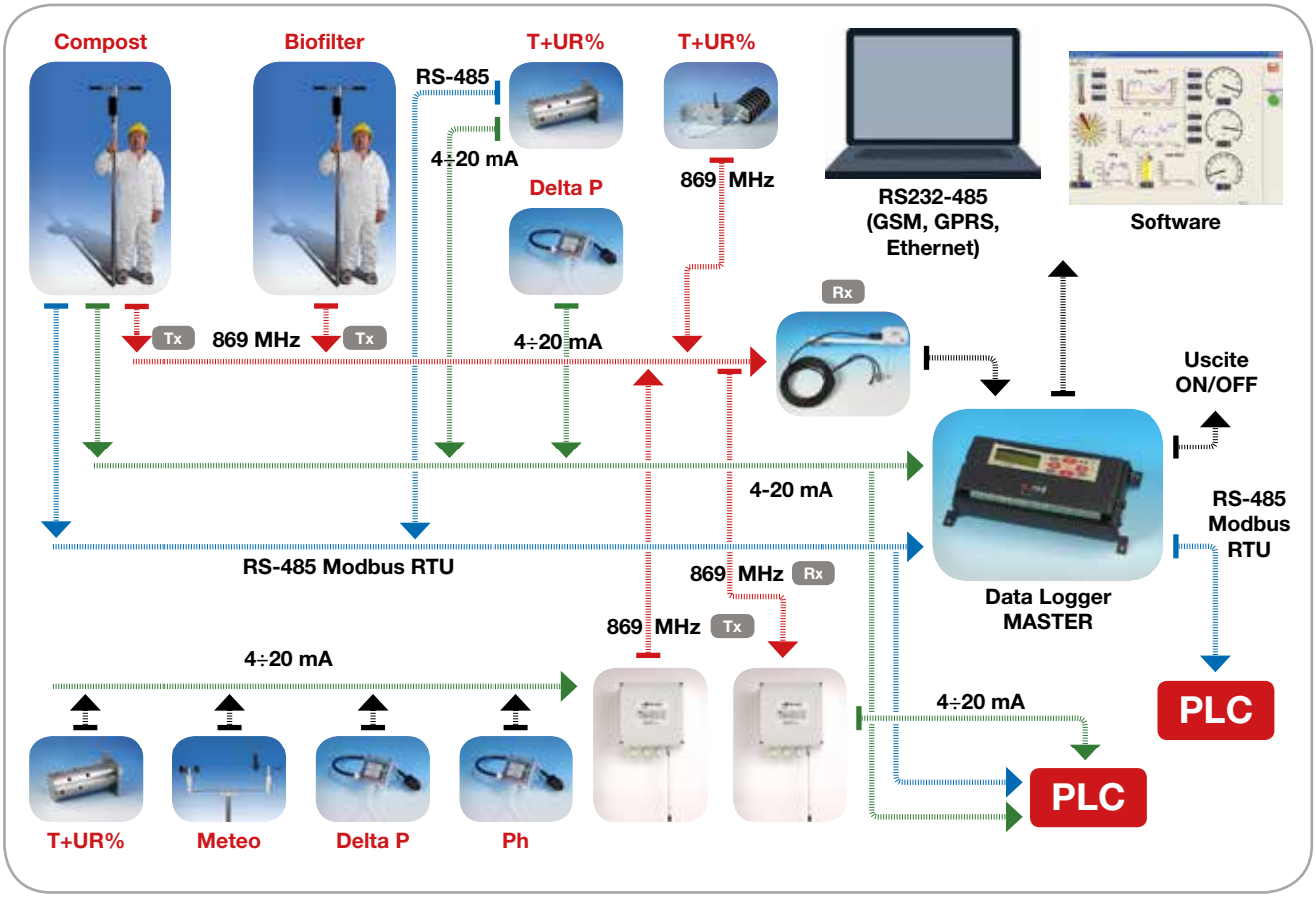
Manure
Regulation 13/10/2003 on manure (L304/1 of 21/11/2003 on the UE Official Gazette)

Environmental matters
D. Lgs. 03/04/2006 no. 152 “Environmental Regulation”. Part II implemented on 31/07/2007 “procedures for Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA) and Integrated Environmental Authorization (IEA) of D.L. 1652/2006. This decree was amended on 16/01/2008 no. 4 “Further corrective measures and amendments to D.L. no. 152 of 03/04/2006 on environmental regulations”, D. Lgs no. 2 of 25/01/2012

Environmental Attachment to stability law 2016
(law no. 221 of 28/12/2015 published on *Gazzetta Ufficiale* no. 13 on 18/01/2016 and effective from 02/02/2016) repeals art. 6, par. 1, letter P

Sensors and systems

Our sensors are available in three types of outputs: radio (869 MHz), 4÷20 mA and RS485 (Modbus-RTU protocol). They can be connected directly to data management systems of the composting plant or through LSI-LASTEM data acquisition systems. LSI-LASTEM data acquisition systems can simultaneously receive and manage signals. These signals can come from sensors situated in the compost and biofilter or from environmental meteorological sensors suitable for the composting process management or the odor levels assessment. All data are sent in real time (via RS485 or Modbus-RTU) to the PC or other centralized management systems of the composting plant. Data acquisition systems can also control the switching on/off of control systems like aerators, sprinklers and deflators through ON/OFF outputs.

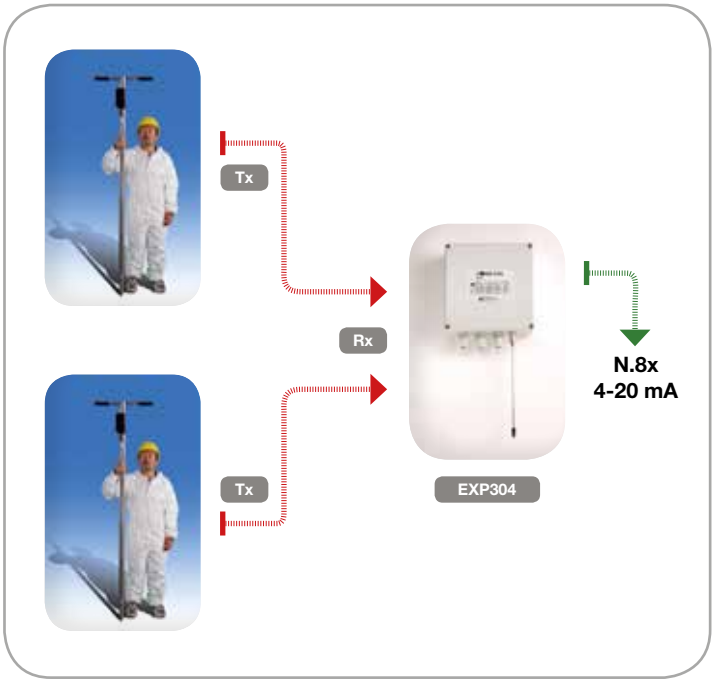


Sensors with built-in radio

These models have a built-in 869 MHz radio. Sensors can be 600 m far from the receiver in a free field (line of sight). The distance can be increased through store&forward repeaters. This allows to move and reposition the sensors without worrying about cables and wires that could cause problems to the handling equipment, especially in case of frequent mixing of the compost material.

4÷20 mA signals from networks of radio sensors

When 4÷20 mA signals are needed, radio sensors can send them to 4÷20 mA receivers/converters EXP304 (no. 8 outputs).

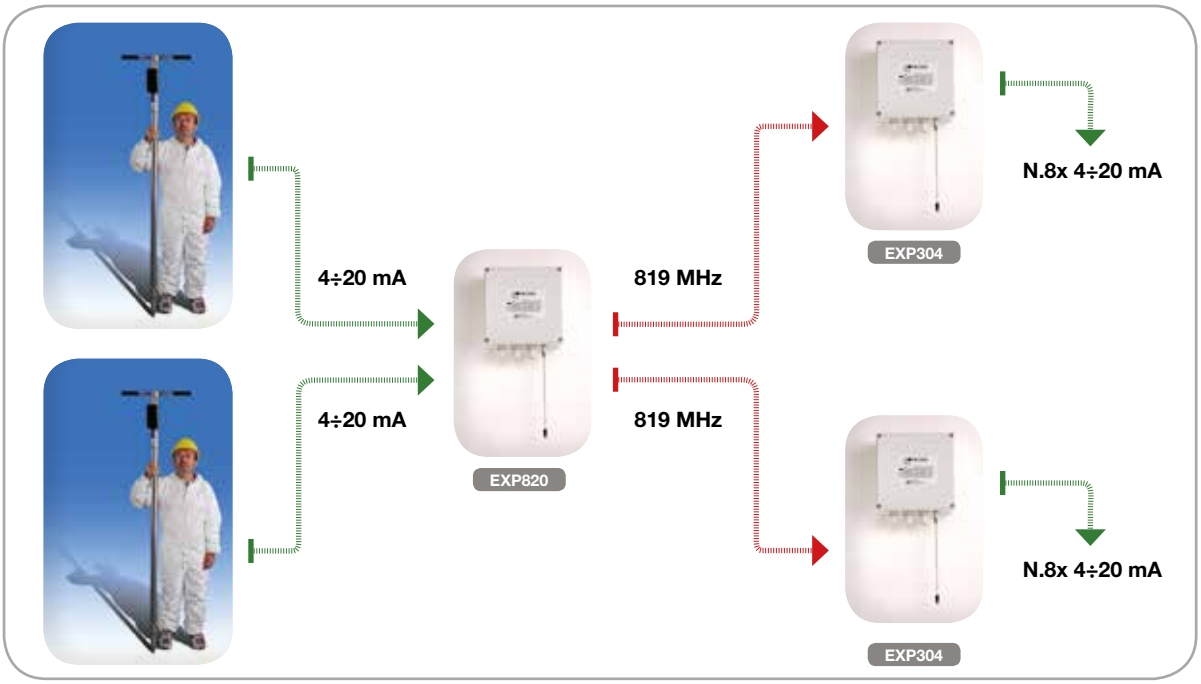


Sensors with 4÷20 mA and RS485 (Modbus-RTU) analog output

When there is no need to mix the compost, like in covered composting plants or biofilters, it is possible to put cabled fixed sensors with 4÷20 mA or RS485 (Modbus-RTU) outputs to allow direct connections to PLC and control systems. Cables are armoured, particularly solid and suitable for these hostile environments.

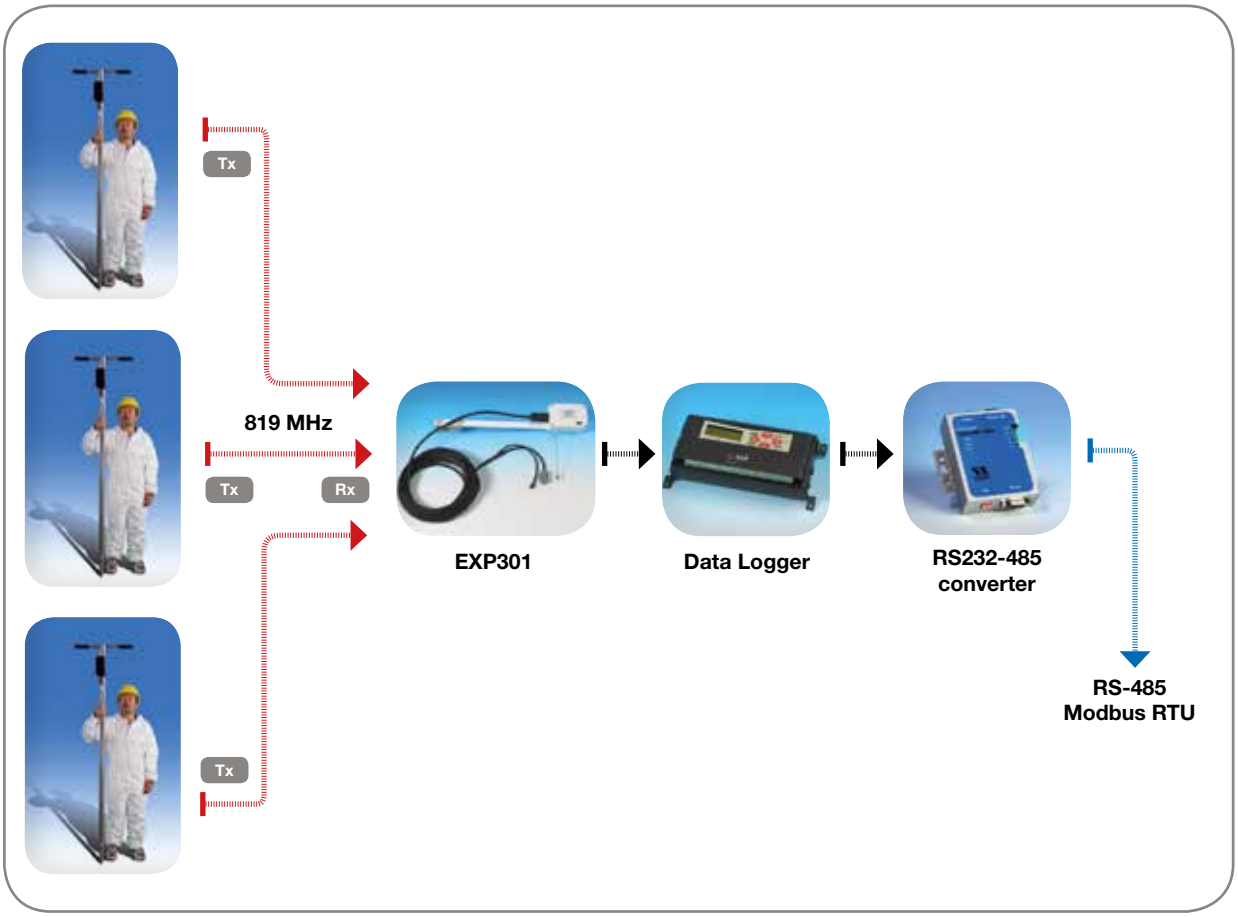
Radio-transmission of 4÷20 mA signals

To radio-transmit signals (max. distance 600m) generated from sensors with 4÷20 mA output, it is necessary to connect sensors to radio-transmitters of 4÷20 mA (EXP820) signals. These signals can radio-transmit data to receivers/converters EXP304 where the 4÷20 mA signal is available.



Modbus-RTU outcoming protocol from data logger connected to networks of radio sensors

Radio sensors can send data to a radio receiver (EXP301) connected to a LSI LASTEM M/E-Log acquisition system in order to obtain a RS485 (Modbus-RTU) output. The acquisition system can re-transmit data via RS485 Modbus-RTU to other systems that handle this kind of signal/protocol.



LSI LASTEM Data Loggers

LSI LASTEM M/E-Log data loggers can receive signals from networks of radio sensors and from sensors with a 4÷20 mA or RS485 Modbus output. The functions of a data logger are the following:

- Data storage;
- Data processing including statistics (average/min/max), also programmable
- Processing of derived quantities, which statistically re-calculate groups of measured quantities
- Data transmission to PC (also remote) via GSM, GPRS, Radio or Ethernet
- Management and real-time view of measurements on a PC
- View of measurements on the local display
- ON/OFF electric outputs
- Interconnected data logger networks via RS485 or radio (ZigBee)
- Connection of other sensors available in the system

ON/OFF outputs from data logger

LSI LASTEM data loggers have electric outputs to locally control external devices. These outputs can become relay outputs (dry contact) through the DEB515 unit.

Programmable parameters:

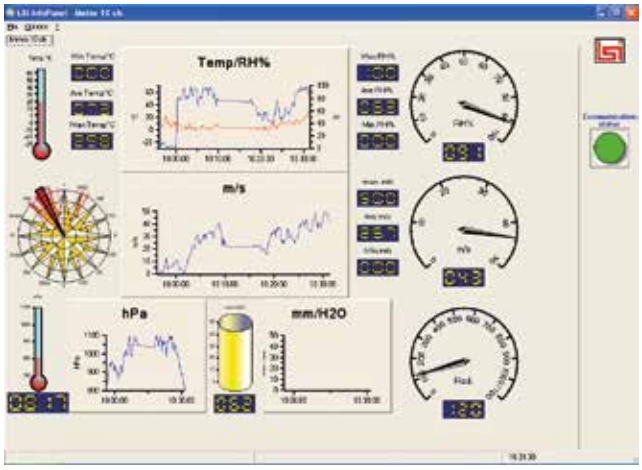
- Less/Greater/within-outside the range
- Thresholds comparison (one or more sensors)
- Timing
- Status error
- Duration

Every output can have logic combinations AND/OR.

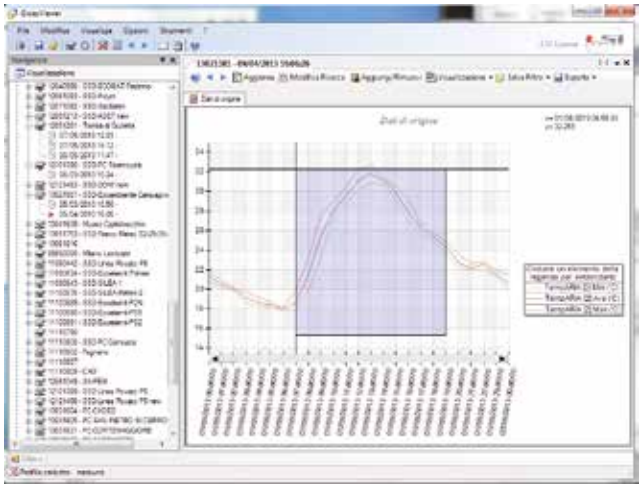
One of the main functions is the outputs management according to measurements coming from many sensors connected to the same data logger. Example: It is possible to set the trigger activation when the average of all temperature sensors overcomes a predetermined threshold.

PC Software solutions

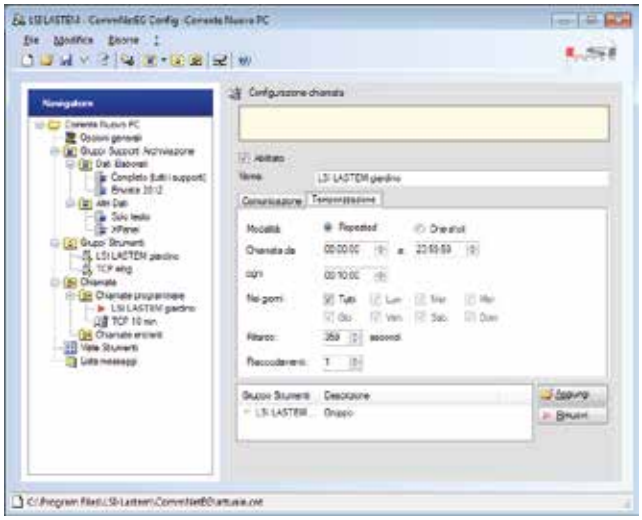
The data recorded by the data logger can be managed with some LSI LASTEM PC software solutions. There are three software products:



XPanel
It allows a real-time view of values acquired from analog/digital controls and charts, which are useful to analyze the dynamics of the fermentation cycle. It also includes alerts when thresholds are exceeded



Gidas
It manages stored data, creates reports and stores them in the SQL database

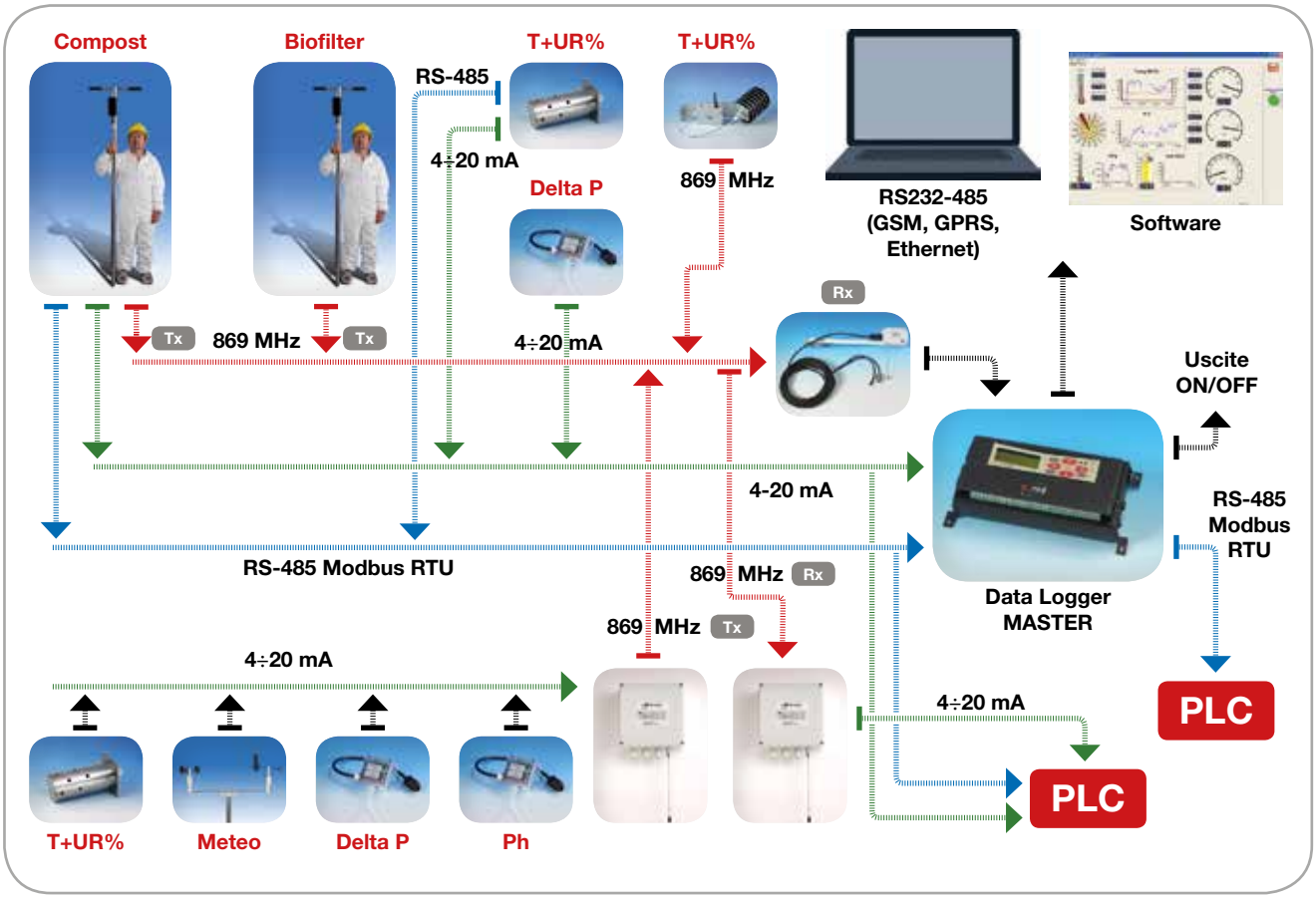


CommNET
It allows to automatically download data from the data logger

Monitoring systems for compost and biofilters

The monitoring of the bio fermentation process: Temperature, oxygen water content, is the key factor for a high quality compost.

Sensors for continuous monitoring of compost and data acquisition systems



Highlights

- Sensors designed to resist to hostile environments typical of compost heaps
- Sensors with radio output (869 MHz), 4÷20 mA or RS-485 (Modbus RTU)
- Data logger to store measurements and ON-OFF outputs to switch on/off external equipment for irrigation, insufflation, etc.
- PC software products for an online view of measurements and data storage
- Management of measurements coming from the biofilter and meteorological measurements from the composting plant

LSI LASTEM produces sensors and systems for measuring the parameters needed to check the status of the bio fermentation process of compost matters, such as temperature, oxygen and water content. LSI LASTEM has been producing this kind of sensors for 10 years. In the latest models, LSI LASTEM has added new electronic and mechanical adaptations to improve the resistance and efficiency of the sensors, considering the adverse conditions that they may undergo during the monitoring process (mechanic shocks, high temperatures, water and corrosive substances) and that may damage the sensor and other delicate parts. Some sensors can be connected to LSI LASTEM data acquisition systems and third parties management systems.

Main features

Temperature sensors

Temperature is a very important parameter in the bio fermentation process. Too high temperatures may stop the process, while too low temperatures may not trigger it.

LSI LASTEM produces models of sensors that measure parameters at a depth of 1 or 2 m.

Temperature and oxygen sensors

Oxygen is the most important parameter in order to define the status of the bio fermentation process, which must take place in an aerobic environment in order to be carried out effectively. In fact, little oxygen stops the process. Sensors are equipped with an electro-chemical cell. This allows to easily replace and recalibrate the cell when it completes the active cycle (every 2-3 months).

Temperature sensors on two levels

Temperature and oxygen sensors

Sensors for measuring temperature and water content in the material

Too much water in the matter stops the bio fermentation process. The water content measurement (% of water in relation to the volume) is only possible when the material is firm and doesn't contain air. Sensors can measure the water content up to a maximum temperature of 60°C. Above this temperature the sensor may be damaged.

Temperature and water content sensors

Sales Kit

Sensors for continuous monitoring of compost and data acquisition systems

KIT 1.0

Sensors radio-connected to a data logger connected to a PC

They measure the following parameters in the compost heaps:
- Temperature and oxygen
- Temperature

Radio-transmission of signals to an acquisition system connected to a PC connection through different types of connections PC software for online view and storage of measurements Acquisition of ON/OFF signals trough relay outputs for switching on/off external devices.

KIT 1.1

Sensors radio-connected to a 4÷20 mA signal receiver/converter

They measure the following parameters in the compost heaps:
- Temperature and oxygen
- Temperature

Radio-transmission of signals to a receiver/converter in order to convert radio-signals into 4÷20 mA signals in a remote station.

KIT 1.2
Sensors with analog output (4÷20 mA)
They measure the following parameters in the compost heaps:
- Temperature and oxygen
- Temperature
- Temperature and water content

Radio-transmission of signals and reception in a remote station.

KIT 1.3
Sensors with serial output RS485 (Modbus-RTU)
They measure the following parameters in the compost heaps:
- Temperature and oxygen
- Temperature
- Temperature and water content

KIT 1.4
Sensors with serial output 4÷20 mA connected to a M-Log acquisition system for portable devices
They measure the following parameters in the compost heaps:
- Temperature and oxygen
- Temperature
- Temperature and water content

Connection to a portable acquisition system (with case) for short term measurements.

	Code	Description	1.0	1.1	1.2	1.3	1.4
		Sensors with 4÷20 mA cable output					
	**EXP420**	Two-level temperature sensor with 4÷20 mA output			●		●
	EXP421	Temperature and oxygen sensors with 4÷20 mA output			●		●
	EXP427	Temperature and water content sensors with 4÷20 mA output			●		●
		Sensors with radio output					
	**EXP830**	Two-level temperature sensor with radio output	●	●			
	EXP831	Temperature and oxygen sensors with radio output	●	●			
		Repeater for radio signals	Note 1	Note 1			
	**EXP401**	"Store and forward" repeater for wireless sensors, version IP65 Power supply 12 Vdc with DWA3xx cable					
	DWA310	Armoured cable (10m)					
	**DEA251**	Charger/converter 220 Vac÷12 Vdc					

continued

	Code	Description	1.0	1.1	1.2	1.3	1.4
		Sensors with RS-485 (Modbus-RTU) cable output					
	**EXP485**	Two-level temperature sensor with RS485 output				●	
	EXP486	Temperature and oxygen sensors with RS485 output				●	
	**EXP487**	Temperature and water content sensors with RS485 output				●	
		Cables for sensors with 4-20 mA and RS485 output			Note 7	Note 7	Note 7
	**DWA310**	Armoured cable (10m)					
	DWA325	Armoured cable (25m)					
	DWA326	Armoured cable (50m)					
	DWA327	Armoured cable (100m)					
	**DWA301**	Cable (2m) to connect sensors to the portable acquisition system ELO009					●
	DWA301.1	Cable (5m) to connect sensors to the portable acquisition system ELO009					●
		Fittings for probes EXP420-EXP421-EXP830-EXP831-EXP485-EXP486					
	**DEA251**	Handle for sensor inserting					
		Fittings for probes EXP487-EXP427					
	**DEA251**	Stainless steel pipe for heaps pre-forming and inserting probes EXP427-487 into the material					
		Fittings for 4÷20 mA signals radio- transmission/reception			Note 8		
	**EXP820**	4÷20 mA signals radio-transmitter N. 8 inputs			●		
	EXP304	Receiver/converter of radio signals coming from sensors or EXP820. N. 8 outputs (4÷20 mA)		●	●		
	DEC252	Antenna for EXP820-304		●	●		
	**DEA251**	Charger/converter 220 Vac÷12 Vdc IP65 for EXP820-302-304		●	●		
		Portable data acquisition system					Note 9
	**ELO009**	Portable data logger with 4 analog inputs for portable devices using sensors with 4÷20 mA output					●

continued

	Code	Description	1.0	1.1	1.2	1.3	1.4
	**ELF432**	Case IP65 impact resistant for ELO009. Charger and battery 15 Ah included					●
		Data acquisition system	Note 2				
	**ELO305**	Data logger, 12 inputs, 99 radio channel No. 2 serial ports No. 7 outputs for activation Power supply 12 Vdc	●				
	**ELF340**	Box for data logger, charger 220 Vac/12 Vdc and battery 2 Ah	●				
	**ELA100**	Serial cable (15m) for data logger connection to a PC	●				
	**DYA084**	Wall mount for box ELF340	●				
	**EXP301**	Receiver of radio signals coming from sensors or transmitter EXP820. RS-232 output	●		●		
	MC4322	Support for mounting EXP301 to a pole or through band DYA049	Opt				
	DYA049	Band for mounting MC4322 to poles of 45-65 mm in diameter	Opt				
	DEC254	Omnidirectional antenna for EXP301	●				
	DWA601	Serial cable and charger (10m) to connect EXP301 to the data logger	●				
	**MG3023**	Auxiliary relay output for activation	Note 3				
		Converter RS485 - Alternative data logger/PC communication systems with serial cable ELA100	Note 4				
	**DEA504**	Converter RS232-485					
	MN1510	Cable 4x2xAWG24/I-S/FTP-CMX Cat.5 connection DEA504					
		Ethernet converter - Alternative data logger/PC communication systems with serial cable ELA100	Note 5				
	**DEA553**	Converter for data logger connection on the Ethernet network Power supply 9-30 Vdc					

continued

Code	Description	1.0	1.1	1.2	1.3	1.4
	PC Software	Note 6				
BSZ411	Xpanel: Software for real-time view of acquired data					
BSZ311	GIDAS: Software for storage and management of acquired data					

Note 1 The repeater is useful in case of problems concerning the radio signal reception. The signal has a range of 600 m (line of sight) but it can decrease in case of obstacles during the transmission. The repeater must be powered (12 Vdc) continuously through a charger connected with a cable DWA3xx (please choose the cable according to the length needed) and it must be equipped with an antenna DEC254.

Note 2 The data logger ELO305 can be simultaneously connected to cable sensors and to radio sensors through the receiver EXP301.

Note 3 The data logger ELO305 has no. 7 independent digital outputs that can be connected to relay DGD010 to obtain an ON/OFF contact. The number of relays is established according to the number of outputs to activate.

Note 4 It is possible to connect the data logger to a remote PC through a line RS485 by using two converters DEA504. One converter must be positioned in the box ELF340, the other must be connected to a PC. The cable MN1510 is supplied by the meter.

Note 5 It is possible to connect the data logger to a WAN (Internet) or LAN (Intranet) network by connecting the device DEA550 to the nearest LAN socket. This device can also receive RS485 signals transformed through converters DEA504.

Note 6 The data logger sends the acquired data to a PC. According to the different needs, at least one software must be installed on that PC. X-Panel is a software for real-time dynamic view of data, while GIDAS is a software for displaying all recorded data in charts.

Note 7 Please, choose the length of the cables according to your needs. Each sensor must be equipped with its own cable.

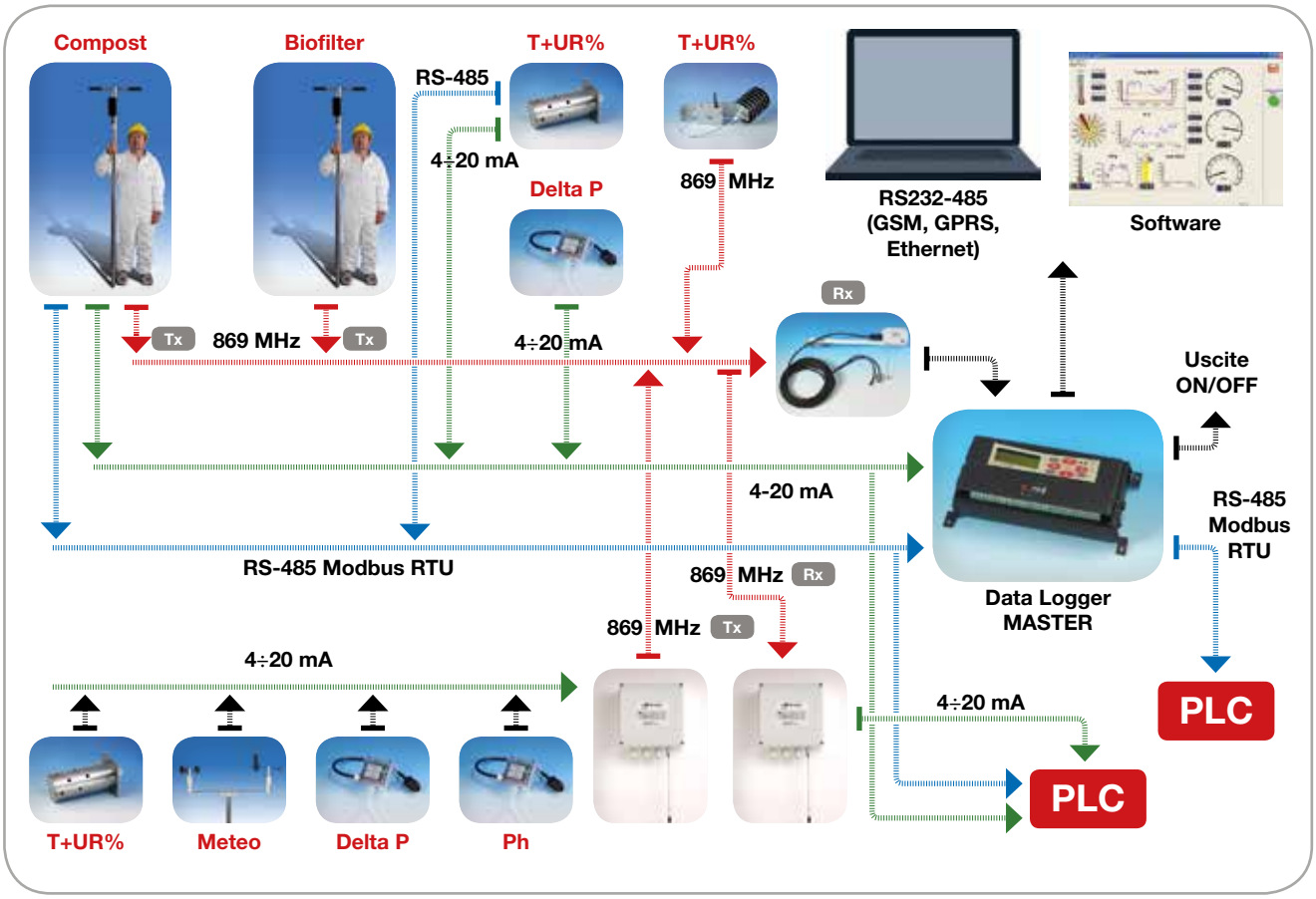
Note 8 The transmitter is connected to the 4÷20 mA output of the sensors to radio-transmit signals to a remote station that will re-convert them into 4÷20 mA signals.

Note 9 Sometimes it is useful to carry out quick measurements by using sensors with 4÷20 mA output that are connected to the acquisition system ELO009 closed in its impact-resistant portable case.

Monitoring systems for biofilters

An improved monitoring of the biofilter means an improved efficiency of the whole plant

Continuous monitoring systems for biofilters



Highlights

- Sensors for measuring temperature and water content in the biofilter material
- Sensors for monitoring temperature, humidity, differential pressure and air velocity in the inlet ducts of the biofilter
- Connection to a local data logger or to a radio system sending 4÷20 mA signals
- Data logger to store measurements and ON-OFF outputs to switch on/off external equipment
- RS232, RS485, Ethernet and radio connection between data logger and PC
- PC software products for an online view of measurements and data storage
- Management of meteorological measurement

Sensors for inside-compost measurements can also be used to measure the same parameters (a part from oxygen) in the biofilter and check the status of the biofilter material. Moreover, LSI LASTEM produces other types of sensors for measuring temperature, relative humidity and air velocity in the biofilter inlet duct. Besides ensuring storage and real-time view of measurements, the data logger can manage ON-OFF for switching on/off external devices such as automatic sprinklers with a programmable activation. It is possible to control the irrigation of the biofilter by setting the min/max humidity threshold (water content), the starting/ending time or the irrigation time.

Main features

Sensors for measuring the temperature of the material in the biofilter

These sensors can be inserted into the biofilter material. They can have a radio, 4÷20 mA or RS485 (Modbus-RTU) output and can be connected to a LSI LASTEM data logger or others management system.

Sensors for measuring temperature and water content in the biofilter

These sensors can measure the water content of the biofilter material. They can have a 4÷20 mA or RS485 (Modbus-RTU) output.

Sensor for measuring temperature and air humidity in the biofilter inlet duct

This sensor measures temperature and relative humidity in the inlet ducts of the biofilter. It can be inserted into a filter system (DYA225) in order to protect it from the aggressive substances contained in the duct. According to each model, the sensor can have a radio, 4÷20 mA or RS485 (Modbus-RTU) output.

Sensor for measuring differential pressure

Measuring the differential pressure is useful to determine the air velocity in the biofilter inlet duct. LSI LASTEM data logger can convert the pressure into air velocity and calculate the flow with the volume of the duct. The differential pressure sensor must be connected to a Pitot tube to be used in the duct.

Sales Kit

Continuous monitoring systems for biofilters

KIT 2.0

Radio sensors connected to a data logger connected to a PC

Measurement of the following parameters in the biofilter and radio-transmission to a data logger:
- Two-levels temperature
- Temperature and water content

Measurement of the following parameters in the inlet duct of the biofilter through 4÷20 mA sensors and radio-transmission to a data logger:
- Temperature and relative air humidity
- Differential pressure (air flow calculation on data logger)

PC connection through different types of connections PC software for online view and storage of measurements. Acquisition of ON/OFF signals trough relay outputs for switching on/off external devices.

KIT 2.1

Sensors with 4÷20 mA output

Measurement of the following parameters in the biofilter:
- Two-levels temperature
- Temperature and water content

Measurement of the following parameters in the inlet duct of the biofilter:
- Temperature and relative air humidity
- Differential pressure

Optional:
Connection of the sensors to a radio-transmitter that sends the signals to a 4÷20 mA receiver/converter

KIT 2.2

Sensors with RS485 (Modbus-RTU) output

Measurement of the following parameters in the biofilter:
- Two-levels temperature
- Temperature and water content

Measurement of the following parameters in the inlet duct of the biofilter:
- Temperature and relative air humidity

Measurement of the following parameters in the duct and in the biofilter, with sensors connected to a data logger (Modbus-SLAVE) for signals conversion into RS485.

	Code	Description	2.1	2.2	2.3
		Sensors with 4÷20 mA cable output			
	**EXP420**	Two-level temperature sensor with 4÷20 mA output		●	
	**EXP427**	Temperature and water content sensors with 4÷20 mA output		●	
	**DMA875.1**	Sensor for measuring temperature and relative air humidity of the inlet duct 4÷20 mA output	●	●	
	**DYA225**	Protection filter for DMA875.1	●	●	
	**DQE521**	Sensor for measuring differential pressure Field of 0-3 hPa 4÷20 mA output	●	●	●
	BSE004	Pitot tube for air velocity measurement in the duct	●	●	●
		Sensors with radio output			
	**EXP830**	Two-level temperature sensor with radio output	●		
	EXP831	Temperature and oxygen sensors with radio output	●		
		Repeater for radio signals	Note 2	Note 2	
	**EXP401**	"Store and forward" repeater for wireless sensors, version IP65 Power supply 12 Vdc with DWA3xx cable			
	DWA310	Armoured cable (10m) for power supply			
	DEC252	Antenna for EXP401			
	**DEA251**	Charger/converter 220 Vac÷12 Vdc			

continued

	Code	Description	2.1	2.2	2.3
		Sensors with RS485 (Modbus-RTU) cable output			
	**EXP485**	Two-level temperature sensor with RS485 output			●
	**EXP487**	Temperature and water content sensors with RS485 output			●
	**DMA975.1**	Sensor for measuring temperature and relative air humidity of the inlet duct RS485 (Modbus-RTU) output			●
	**DYA225**	Protection filter for DMA975.1			●
		Cables for sensors with 4-20 mA and RS485 output	Note 1	Note 1	Note 1
	**DWA310**	Armoured cable (10m)			
	DWA325	Armoured cable (25m)			
	DWA326	Armoured cable (50m)			
	DWA327	Armoured cable (100m)			
		Fittings for 4÷20 mA signals radio-transmission/ reception	Note 3	Note 8	
	**EXP820**	4÷20 mA signals radio-transmitter N. 8 inputs	●	●	
	EXP304	Receiver/converter of radio signals coming from sensors or EXP820. N. 8 outputs (4÷20 mA)	●	●	
	**DEA251**	Charger/converter 220 Vac÷12 Vdc IP65 for EXP820-302-304	●	●	
		Data acquisition system			
	**ELO305**	Data logger, 12 inputs, 99 radio channels. No. 2 serial ports No. 7 outputs for activation Power supply 12 Vdc	●	●	
	**ELF340**	Box for data logger charger 220 Vac/12 Vdc and battery 2 Ah	●	●	

continued

	Code	Description	2.1	2.2	2.3
	**ELA100**	Serial cable (15m) for data logger connection to a PC	●		
	**DYA084**	Wall mount for box ELF222	●		
	**EXP301**	Receiver of radio signals coming from sensors or transmitter EXP820. RS-232 output	●		
	MC4322	Support for mounting EXP301 to a pole or through band DYA049	Opt		
	DYA049	Band for mounting MC4322 to poles of 45-65 mm in diameter	Opt		
	DEC254	Omnidirectional antenna for EXP301	●		
	DWA601	Serial cable and charger (10m) to connect EXP301 to the data logger	●		
	**MG3023**	Auxiliary relay output for activation	Note 4		
		Converter RS485 - Alternative data logger/PC communication systems with serial cable ELA100	Note 5		
	**DEA504**	Converter RS232-485			●
	MN1510	Cable 4x2xAWG24/I-S/FTP-CMX Cat.5 connection DEA504			●
		Ethernet converter - Alternative data logger/PC communication systems with serial cable ELA100	Note 6		
	**DEA553**	Converter for data logger connection on the Ethernet network Power supply 9-30 Vdc			
		PC Software	Note 7		
	BSZ411	Xpanel: Software for real-time view of acquired data			
	BSZ311	GIDAS: Software for storage and management of acquired data			

Nota 1 Please, choose the length of the cables according to your needs. Each sensor must be equipped with its own cable.

Note 2 The repeater is useful in case of problems concerning the radio signal reception. The signal has a range of 600 m (line of sight) but it can decrease in case of obstacles during the transmission. The repeater must be powered (12 Vdc) continuously through a charger connected with a cable DWA3xx (please choose the cable according to the length needed) and it must be equipped with an antenna DEC254.

Note 3 Radio sensors can send data directly to a receiver/converter that converts them into 4÷20 mA signals.

Note 4 The data logger ELO305 has no. 7 independent digital outputs that can be connected to relay DGD010 to obtain an ON/OFF contact. The number of relays is established according to the number of outputs to activate.

Note 5 It is possible to connect the data logger to a remote PC through a line RS485 by using two converters DEA504. One converter must be positioned in the box ELF340, the other must be connected to a PC. The cable MN1510 is supplied by the meter.

Note 6 It is possible to connect the data logger to a WAN (Internet) or LAN (Intranet) network by connecting the device DEA550 to the nearest LAN socket.

Note 7 The data logger sends the acquired data to a PC. According to the different needs, at least one software must be installed on that PC. X-Panel is a software for real-time dynamic view of data, while GIDAS is a software for displaying all recorded data in charts.

Note 8 The transmitter is connected to the 4÷20 mA output of the sensors to radio-transmit signals to a remote station that will re-convert them into 4÷20 mA signals.

Portable systems

Easy-to-use portable systems for quick analysis of water content and temperature of materials

Portable systems

Highlights

- Measurement of temperature and water content of the materials
- Systems for real-time measurement inside compost heaps, waste and other granular materials
- Real-time data view
- Easy-to-insert sensors

LSI LASTEM produces real-time measurement systems for temperature, water content and relative air humidity inside compost material, waste and other granular materials. As regards measuring the water content, the material must be homogeneous and firm in order to avoid the presence of air inside the material.

Main features

Water content and temperature measurement system
The reading device is connected to a probe with electrodes that is inserted in the firm material. Should the material not be firm, it is necessary to mince it further and put it into a container in order to carry out the measurement. The reading device displays the % of water in the material, expressed both in volume (% of water compared to the volume of the material) and weight (weight of water in 1m3 of material).

Sales Kit
Portable systems

KIT 3.0
System for measuring water content and temperature
Measurement of water content and temperature through a portable system.

Code	Description	3.0
	System for measuring water content and temperature inside the material	
DQA345	Measurement system: indicator and probe with 1m extension cable	●

Meteorological systems

The plant management is also related to the wind analysis and the knowledge of air dynamics and odors

Sensors and meteorological systems

Highlights

- Sensors for measuring temperature and relative air humidity 4÷20 mA and RS485 (Modbus-RTU) outputs
- Sensors for measuring wind speed and direction 4÷20 mA and RS485 (Modbus-RTU) outputs
- Complete weather monitoring stations
- Software for wind analysis and odors dynamics

Together with sensors for managing the biofilter and the composting plant, LSI LASTEM also produces sensors and systems to measure meteorological parameters useful for carrying out wind analysis and odor dynamics controls. LSI LASTEM only produces sensors with analog or digital outputs (RS485 Modbus-RTU) that can be connected to third-parties systems or LSI LASTEM data acquisition systems, which are already set for managing the biofilter and the composting plant. LSI LASTEM also produces weather stations, which are unrelated to the composting equipment but that use the same PC software solutions and therefore ensure an integrated management of data.

Main features

Complete weather stations

LSI LASTEM weather stations are professional and complete equipment to measure basic meteorological parameters such as temperature, relative air humidity, wind speed and direction, barometric pressure, solar radiation and rain. The weather station includes a basic kit of different sensors, a 12-inputs data logger and a PC software for programming and data transfer. It is possible to expand the basic kit with more sensors, exchange systems, power supply equipment, mounting elements and other PC software solutions. LSI LASTEM offers a wide range of products to expand your basic kit. For further information about meteorological stations, please refer to “professional meteorological stations” cod. MW9044.

Sensor for measuring wind speed and direction

Sensore combinato per la Combined sensor for measuring wind speed and direction with weather vane and cup anemometer. Available with 4÷20 mA or RS485 (Modbus-RTU) output. Speed and direction are essential to calculate the atmospheric dynamics.

Sensor for measuring temperature and air humidity

Available with 4÷20 mA or RS485 (Modbus-RTU) output.

Software for odor analysis

The software GidasADM can calculate and display the odor concentration. This parameter can be expressed as odor units or as a percentage compared to the maximum value recorded in a specific area.
This software uses an easier version of the Gaussian model, WinDimula, developed by Maind Srl and ENEA (National Agency for New Technologies, Energy and Sustainable Economic Development). This model is also recommended by ARPA Agency. GidasADM also allows a pre-analysis of the odor concentration, which can be useful to understand the impact of odors produced by the composting plant on the nearby areas.
For further information about GidasADM, please refer to “Software” cod. MW9006.

Sales Kit

Sensors and meteorological systems

KIT 4.0

Meteorological sensors with 4-20 mA output

Sensors for measuring wind speed and direction, temperature and relative humidity, with 4-20 mA output and power supply 9-30 Vdc/ac

KIT 4.1

Meteorological sensors with RS485 (Modbus-RTU) output

Sensors for measuring wind speed and direction, temperature and relative humidity, with RS485 (Modbus-RTU) output and power supply 9-30 Vdc/ac

	Code	Description	4.0	4.1
		Sensor for measuring wind speed and direction		
	**DNA821**	Sensors for measuring wind speed and direction, with 2x4-20 mA output and power supply 10-30 Vdc/ac.	●	
	DNA921	Sensors for measuring wind speed and direction, with RS485 (Modbus-RTU) output and power supply 10-30 Vdc/ac.		●
		Sensor for measuring temperature and relative air humidity with anti-radiation screen		
	**DMA875**	Sensor for measuring temperature and relative air humidity with 2x4-20 mA output and power supply 10-30 Vdc/ac.	●	
	DMA975	Sensor for measuring temperature and relative air humidity with RS485 (Modbus-RTU) output and power supply 10-30 Vdc/ac.		●
		Cables	Note 1	Note 1
	**DWA505**	Cable (5 m)		
	DWA510	Cable (10 m)		
	DWA525	Cable (25 m)		
	DWA526	Cable (50 m)		
	DWA527	Cable (100 m)		

Nota 1 Please, choose the length of the cables according to your needs. Each sensor must be equipped with its own cable.

Reference List

Monitoring systems for compost and biofilters

Some of the customers who choose our systems:

-Agrienergia
Bologna
-Aimag
Modena
-Amiat
Torino
-ASECO
Società dell'acquedotto Pugliese, Taranto
-Akron
Imola
-Calabra Maceri
Cosenza
-CDU
Torino
-CIPNES
Olbia Tempio
-Consorzio Civeta
Chieti
-Consorzio Comuni della Gallura
Olbia Tempio
-Cosmari
Macerata
-CPL Concordia
Bologna
-Daneco impianti
Bari
-Dolomite Ambiente
Belluno
-Eal Compost
Lodi
-Ecoambiente Salerno
Salerno
-Ecoeternit Srl
Montichiari, Brescia
-Ecoimpianti
Perugia
-EDEN94
Manduria, Taranto
-Fermo Asite
Fermo
-FL srl
Alessandria
-Fomet
Verona
-Galatero
Cuneo
-Green Tech
Milano
-Grena
Verona
-IREN
Reggio nell'Emilia
-IRGESA SS – Scala ERRE
Porto Torres, Sassari
-Ladurner
Milano - La Spezia
-Mantova Ambiente
Mantova
-Merlino
Milano
-Mirr
Macerata
-Montello
Bergamo
-OMAR Srl
Spresiano, Treviso
-Raco
Catania
-REA IMPIANTI
impianto Scapigliato, Livorno
-Rio Marsiglia
Genova
-SEA Risorse SpA
Viareggio, Lucca
-Sicula Trasporti
Catania
-STR
Cascina del Mago - Sommariva Perno - Torino
-Tersan Puglia
Bari
-Tossilo
Sassari
-Trasimeno Servizi
Magione, Perugia
-Unieco
Reggio nell'Emilia
-Versilia Ambiente
Massarosa, Lucca

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