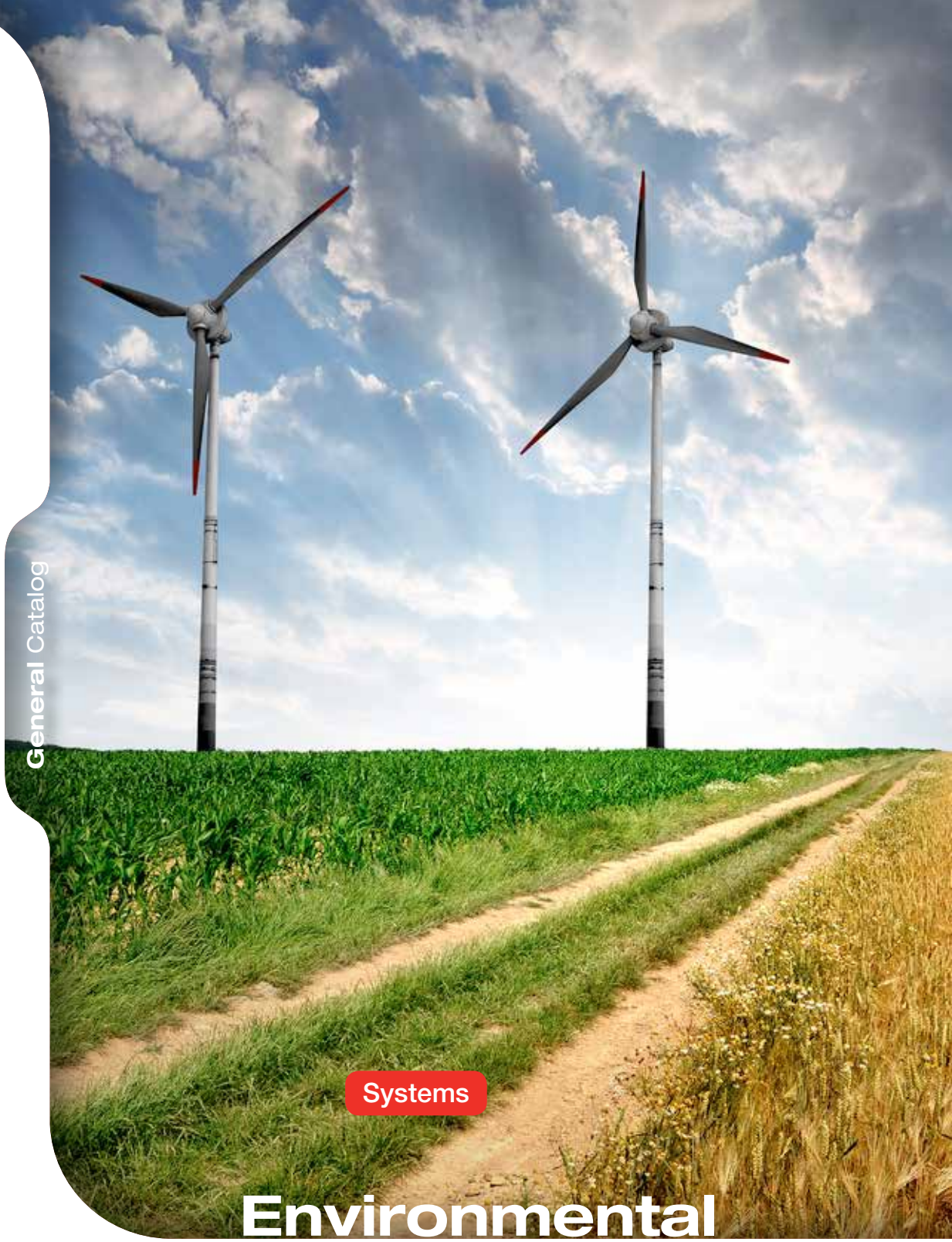
outdoor

General Catalog



Systems

Environmental monitoring systems for wind energy applications

LSI LASTEM

Milano
ITALIY

|||| MW9043-ENG 11/2013

> environmental monitorig

Environmental monitoring systems for wind energy applications

The use of renewable energy sources, including wind energy, represents an actual response to the necessities of environment preservation and sustainable development. But design of wind farms is clearly subject to a complete knowledge of the wind characteristics of the project site. A precise wind assessment campaign is the necessary first step, not only for plant dimensioning and turbine selection, but more often than not to obtain financial coverage for the project.

LSI LASTEM offers the measuring equipment to perform a wind assessment campaign supplying the necessary sensors, data-logger, mast and accessories.

Wind Tower

The backbone of any wind assessment system is the tower, where one or more wind sensors are mounted. The height of the tower (that can be tubular or lattice type) can vary from 10 to 120 meters, depending on the power, and thus hub height, of the generator it is intended to install. According to this, the following classification for wind systems applies:

- Micro wind systems: power (nominal) between 3 Kw and 20 K
- 100KW Mini wind systems: power between 20 Kw and 100 Kw
- Megawatt systems: power between 100 Kw and 1,5 Mw
- Multi-megawatt systems: power over 1,5 Mw

LSI LASTEM supplies towers up to 120 meters and partners with installers over the whole Italian territory to supply turn-key systems.

Sensors

To understand wind conditions and the expected energy yeld of a site, high-quality measurements of wind speed and direction are a are an absolute must. The number of measurement points along the tower (in some case it is better if they are redundant) depends on how important is wind vertical profiling. This increases with the size and power of the turbine you want to install.
Other useful sensors are **temperature** and **pressure**, necessary to calculate the **air density**, essential parameter for the evaluation of the **wind kinetic energy**. Moreover, a couple of thermometers placed at different heights allow an evaluation of the stability of the atmosphere defining the degree of turbulence. Usually it is required that all the sensors are supplied with a specific **calibration certificate**.

Data-Loggers

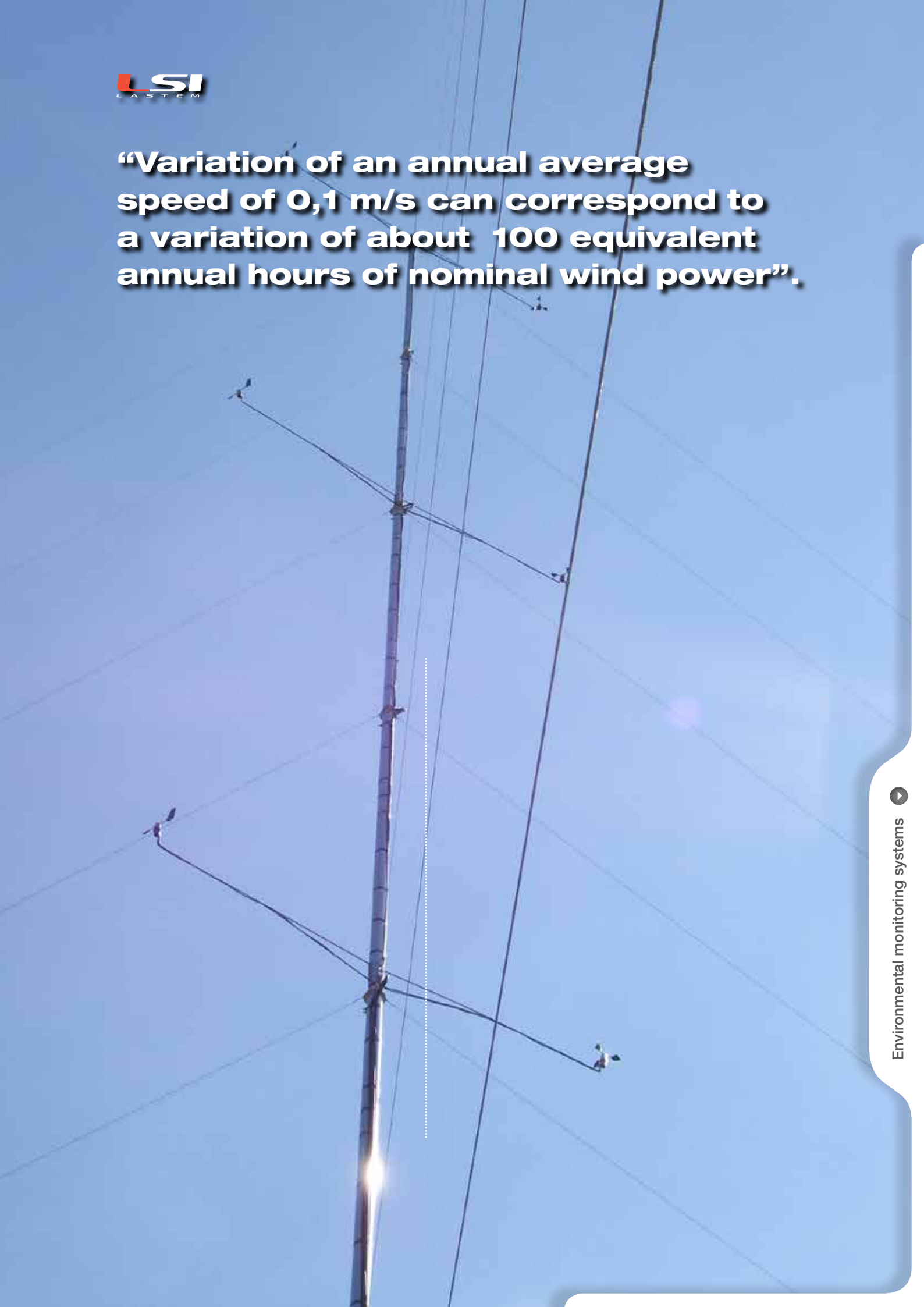
For data storing, pre-processing and transmission, field sensors are connected to a reliable data-logger. The main features making LSI Lastem E-Log suitable for this application are: 1 Hz sampling rate (according to IEC61400-12), inputs for anemometer signals , low consumption, strength in critical situations, data pre-processing capability, sensor error detection, remote and real-time communication. Another essential feature is that the data-logger must be able to calculate the prevailing wind sector in order to generate charts of wind occurrence and wind-roses. LSI LASTEM data-loggers collect and elaborate data according to the standard **IEC1400-12** (Wind turbine power performance testing).

Data Transmission system

The acquisition system should allow the data transmission to remote operative centers (by GSM/ GPRS modem or radio), not only to avoid costly trips to sites for periodical data download, but mainly to real-time monitor data consistency and to quickly assess failure or malfunctionings.

Power supply system

The system must be autonomous during the entire course of the wind campaign, often performed in isolated areas. The low consumption of our systems guarantee stand alone operation with small solar panels and rechargeable batteries.



“Variation of an annual average speed of 0,1 m/s can correspond to a variation of about 100 equivalent annual hours of nominal wind power”.

Environmental monitoring systems for wind energy applications

www.lsi-lastem.com

Highlights

- Ready to use systems;
- Installation services for towers from 10 to 120 mt High quality sensors designed according to WMO (World Meteorological Organization) directions;
- Available MEASNET certificates for anemometers Specific elaborations for wind assessment of the site;
- Operative limits suitable for any climatic conditions;
- Low power consumption;
- Remote access.

LSI LASTEM has more than 40 years of experience in the design and production of meteorological instruments. We produce anemometers since 1980. Nowadays, our range of sensors is the synthesis of years of experience in designing and delivering specific solutions, reliability and accuracy of measurement, combined with ease of installation and low levels of maintenance. Along with the sensors, LSI LASTEM proposes data-loggers and anemometric towers to supply turn-key systems able to satisfy the more complex wind assess campaigns.

Main Features

Anemometric Towers

LSI LASTEM supplies anemometric towers, both of tubular or lattice type, and partners with installers over the whole Italian territory to supply turn-key solutions.

- Galvanized steel **tubular towers** with variable height from **10 to 60 metres**, in accordance with the international standard IEC 61400 (SMEA Towers®).
- **Lattice type towers with steel tie rods** with height from **30 to 120 meters** in accordance with the international standard IEC 61400 and EUROCODICE (TV95)
- **Self-supporting lattice type towers** for wind farm control, with height from **30 to 120 meters**, in accordance with the international standard IEC 61400 and EUROCODICE (TV95).
- Self-installing, anodized aluminium **telescopic towers** (compressed air), with height from **5 to 40 meters**.
- Arms and booms in accordance with **IEC 61400** for **LSI LASTEM** sensors.

Types
SERIES 1:
For winds up to 180km/h (50m/s)
SERIES 2:
For winds up to 150km/h (42m/s)
SERIES 3:
For winds up to 120km/h (33m/s)

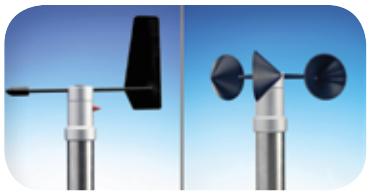
All the **tubular towers** are designed to resist to **Class 1 winds**; they are built with high quality anodized steel according to DIN standards. Hot galvanization guarantees a resistance to corrosion for over 20 years.
The poles are installed without any foundation work but simply fixed to the ground with pickets and appropriate steel cable.
The towers are installed without using cement but simply anchored to the ground, thanks to the use of underground steel plates, to simplify and reduce to the minimum the bureaucratic procedure.
The towers are built to resist high wind speed and ice loads, and can thus be installed in very cold climates and in strong wind mountain areas. The towers are supplied with **certificates of origin and quality of the materials** and with all the documents necessary to the installation.

Wind speed sensors

LSI LASTEM produces a great range of cup anemometers (Standard series), either with direct output, to be connected to its own data-loggers and with analogue output, suitable to be connected to third party systems. The models of this series have superior dynamic characteristics and can be used for any wind assessment campaign. They are supplied with ISO and MEASNET Calibration Certificate (if required). This series includes also models with low consumption and with heaters.

continued

LSI LASTEM also integrates First Class anemometers in accordance with MEASNET and IEC 61400-12 specifications.
Small and very robust, our compact series (DNA202) is ideal for turbine control. This model can be installed on the hub of aero-generators of existing wind farms, along with our compact wind vane (DNA212), to command safety and orienting systems.



In addition, LSI LASTEM produces **combined** wind speed and direction sensors. They can be placed on the top of the towers to avoid the need of arms/supports (boom) and reduce the cabling with the data-logger.

Moreover, LSI LASTEM integrates **sonic anemometers** - a perfect solution for their reliability, low wear and tear and subsequent low maintenance.

Wind direction sensors

Wind direction is a critical factor in wind campaigns because it determines the wake effect and is thus critical to determine location of turbines in a wind farm (micrositing).
LSI LASTEM proposes flag anemometers for either the standard and compact series.

Temperature and pressure sensors

They are useful to evaluate the air density, essential parameter on which depends the wind kinetic energy. If a wind tower remains installed during the operation of a wind farm, this becomes a critical factor in evaluating aero-generators performances.
The temperature sensors are mounted inside reflective radiant shield, while the barometers are mounted into the data-logger box.

Data-logger

LSI LASTEM E-Log model is particularly indicated for wind campaigns. It is equipped with 4 dedicated anemometer inputs (expandable, if necessary, to 8). E-Log is indicated both for wind assessment campaigns, sampling and computing data according to **IEC61400-12** (Wind turbine power performance testing), and for wind farm operation, when his Modbus RTU output grants an easy connection to SCADA systems.
With 1 Hz sampling rate, advanced wind calculations, error detection, high number of inputs and remote operation, E-Log guarantees complete, accurate and reliable wind campaigns.

Data transmission system

The remote data transmission system can be a GSM/GPRS modem or VHF/UHF radio. Use of modems is the most simple and effective approach, but clearly depends on GSM network availability. When this is not the case, our “licence free” radio solutions have a working range up to 10-15 km. An interesting solution is to cover the first few kilometres by radio, up to a place reached by the GSM net, where it is possible to place a second data-logger (with or without sensors), equipped with a GSM/GPRS modem.

Power supply

Given the general low consumption of the system, it is possible to run a complete station with a 50 W solar panel and batteries from 15 to 40 Ah. In these cases, the use heated sensors it is not possible.

Data management software

Our GIDAS software allows complete data management as charts and tables along with superior wind elaborations including Wind Roses and Weibull analysis. The Weibull distribution is used to create different wind speed classes and to assess the frequency of wind speeds at a particular location. The strength of wind varies, and an average value for a given location does not alone indicate the amount of energy a wind turbine could produce. The Weibull model closely mirrors the actual distribution of hourly/ten-minute wind speeds at many locations. The “k Weibull” factor determines if the wind in the area is more or less variable, diminishing or increasing energy potential.

WEB data management

This solution allows real-time access to data from any internet browser. The site where the data stored and are published is managed by LSI LASTEM, which gives this service on subscription basis.
For more information see our catalogue MW9044 “Professional meteorological stations”.

KIT 1.0

Wind acquisition system based on "compact series" anemometric sensors. It includes:
- Wind speed sensors
- Wind direction sensor
- Temperature and humidity sensor
- Atmospheric pressure sensor
- Data-logger powered by solar panel and with GSM/GPRS data transmission.

KIT 1.1

Wind acquisition system based on "standard series" anemometric sensors. It includes:
- Wind speed sensors
- Wind direction sensor
- Temperature and humidity sensor
- Atmospheric pressure sensor
- Data-logger powered by solar panel and with GSM/GPRS data transmission.

KIT 1.2

Analogue output sensors (4-20 mA o 0-5 Vdc). It includes:
- Wind speed sensors
- Wind direction sensor
- Temperature and humidity sensor
- Atmospheric pressure sensor.

Code	Description	KIT 1.0	KIT 1.1	KIT 1.2
	Combined wind speed and direction sensor (direct output)		Note 2	
DNA121#C	CombiSD - Combined wind speed+direction sensor. Direct output (0-460 Hz & 0-1 Vdc). Ranges: : 0.60 m/sec./ 0..360°. Complete with cup rotor and flag. Supplied with Calibration and test certificates.			
DNA122#C	CombiSD - Low consumption combined wind speed+direction sensor. Direct output (0-460 Hz & 0-2 kOhm). Ranges: 0.60 m/sec./ 0..360°. Complete with cup rotor and flag. Supplied with Calibration and test certificates.			
	Combined wind speed and direction sensor (analogue output)			Note 4
DNA821	Combined wind speed+ direction sensor. Output 2x4-20 mA. Power supply . 9-30 Vdc/ca			
DNA827	Combined wind speed+ direction sensor. Output2x0-5 Vdc. Power supply 9-30 Vdc/ca			
	Cables for combined anemometers (direct and analogue output)			
DWA510	Shielded cable l=10 mt. with connector			
DWA525	Shielded cable l=25 mt with connector			
DWA526	Shielded cable l=50 mt. with connector			
DWA527	Shielded cable l=100 mt. with connector			

continued

Code	Description	KIT 1.0	KIT 1.1	KIT 1.2
	Wind speed sensor (Compact series)			
DNA202	3 cups anemometer. Working principle: relay reed. Anodized aluminium. IP65 protection. 4 poles Waterproof IP65 connector. Supplied with calibration certificate.	●		
MN1071	Cable 6x0,5 + shield Polyurethane dia. 8 mm (supplied per metre)	●		
	Wind direction sensor (Compact series)			
DNA202	3 cups anemometer. Working principle: relay reed. Anodized aluminium. IP65 protection. 4 poles Waterproof IP65 connector. Supplied with calibration certificate.	●		
MN1071	Cable 6x0,5 + shield Polyurethane dia. 8 mm (supplied per metre)	●		
DYA046	"T" support for fixing wind speed and direction sensors.	●	Note 7	Note 7
	Wind Speed sensor. Standard Series (direct output)		Note 2	
DNA301#C	3 cups anemometer. Working principle: relay reed. Anodized aluminium. IP65 protection. 4 poles Waterproof IP65 connector. Supplied with calibration certificate.		●	
DNA302#C	3 cups heated anemometer. Working principle: tachometric . Output Hz. Anodized aluminium. IP65 protection. 4 poles Waterproof IP65 connector. Supplied with Calibration Certificate.			
DNA304#C	3 cups low consumption anemometer. Working principle: tachometric . Output Hz. Anodized aluminium. IP65 protection. 4 poles Waterproof IP65 connector. Supplied with Calibration Certificate		Note 5	
	Cables for anemometers standard series (direct output)		Note 3	
DNA110	Shielded cable L = 10 mt. with connector			
DNA125	Shielded cable L = 25 mt with connector		●	
DNA126	Shielded cable L = 50 mt. with connector			
	Wind speed sensor. Standard series (analogue output)			Note 4
DNA801	3 cups anemometer. Working principle: tachometric. Output 4-20 mA. Power supply 9-30 Vca/Vdc. Anodized aluminium. IP65 protection. 4 poles IP65 waterproof connector. Supplied with calibration certificate.			●
DNA807	3 cups anemometer. Working principle: tachometric. Output 0-5 Vdc. Power supply 9-30 Vca/Vdc. Anodized aluminium. IP65 protection. 4 poles IP65 waterproof connector. Supplied with calibration certificate.			
DNA802	3 cups anemometer. Working principle: tachometric. Output 4-20 mA. Power supply 9-30 Vca/Vdc. Anodized aluminium. IP65 protection. 4 poles IP65 waterproof connector. Supplied with calibration certificate.			
	Cables for anemometers standard series (analogue output)			
DWA510	Shielded cable L = 10 mt with connector			
DWA525	Shielded cable L = 25 mt with connector			●
DWA526	Shielded cable L = 50 mt. with connector			
DWA527	Shielded cable L = 100 mt. with connector			
	Wind direction sensors. Standard series (direct output)			
DNA310#C	Flag Anemometer. Working principle: hall effect. Output 0-1 Vdc. Anodized aluminium. IP65 protection. 4 poles waterproof IP65 connector. Supplied with calibration certificate.		●	
DNA314#C	Low consumption Flag Anemometer. Working principle: potentiometer. Output Ohm. Anodized aluminium. IP65 protection. 4 poles waterproof IP65 connector. Supplied with calibration certificate.		Note 5	

continued

Code	Description	KIT 1.0	KIT 1.1	KIT 1.2
	Cables for anemometers standard series (direct output)		Note 3	
DNA110	Shielded cable L =10 mt. with connector			
DNA125	Shielded cable L =25 mt with connector		●	
DNA126	Shielded cable L =50 mt. With connector			
	Wind direction sensors. Standard series (analogue output)			
DNA810	Flag anemometer. Working principle: Hall effect. Output 4-20 mA. Power supply 9-30 Vca/Vdc. Anodized aluminium. IP65 protection. 4 poles IP65 waterproof connector. Supplied with test certificate.			●
	Cables for anemometers standard series (analogue output)		Note 3	Note 3
DWA510	Shielded cable L = 10 mt. with connector			
DWA525	Shielded cable L = 25 mt with connector			●
DWA526	Shielded cable L = 50 mt. with connector			
DWA527	Shielded cable L = 100 mt. with connector			
	Calibration certificates for wind direction sensors	Note 1	Note 1	Note 1
DZZSIT6	MEASNET certificate for wind speed sensor			
DZC403	ISO9001 certificate for wind speed sensor			
DZC404	ISO9001 certificate for wind direction sensor			
	Natural ventilation anti-radiant thermo-hygrometric sensor (output for LSI LASTEM data-loggers)			
DMA672.1	Temperature and humidity sensor to be connected to data-loggers Log series, output Pt100 for temperature, 0-1V for relative humidity. Power supply 12 vdc. Cable L = 5 mt included. Supplied with test certificate.	●	●	
DYA230	Anti-radiant shield for sensor DMA672.x, DMA033 for outdoor and meteorological applications.	●	●	
DYA049	Collar for fixing thermo-hygrometric sensors on pole diam. 45-65 mm.	●	●	●
	Natural ventilation anti-radiant thermo-hygrometric sensor (analogue output)			
DMA875	Temperature and relative humidity sensor. Output 2x0/4-20 mA, power supply 9-30 Vdc/Acc.			●
DWA510	Anti-radiant shield included. Supplied with test certificate.			●
DWA525	Shielded cable L = 10 mt. with connector			
DWA526	Shielded cable L = 25 mt with connector			
DWA527	Shielded cable L = 50 mt. with connector			
	Atmospheric pressure sensor	Note 6	Note 6	Note 6
DQA240.1#C	Barometer- measuring range 800-1100 hPa, output 0-1 Vdc, power supply 12 Vdc	●	●	
DQA201	Barometer- measuring range 800-1100 hPa, output 4-20 mA, power supply 24 Vac			●
DQA208	Barometer-measuring range 800-1100 hPa, output 0-5 Vdc, power supply12 Vdc			
	Data-loggers E-Log series			
ELO305	Data-logger E-Log for environmental measurements. Nr. 12 inputs (nr. 8 analogue, nr. 2 pulse, nr. 2 on-off). Nr. 6 actuation independent outputs. 20 logics of actuation. Converter A/D 16 bit. Memory 2Mb. Power supply 12 Vdc. Display 4x20 char. Nr. 2 Rs232 serial interfaces. Communication protocols: GPRS, GSM and Modbus RTU. Complete with serial cable L = 2 mt. Extractable terminals for sensor connection. Complete with the SW “3DOM” to configure and download data.	●	●	

continued

Code	Description	KIT 1.0	KIT 1.1	KIT 1.2
	Plastic IP65 box mounting either on wall or on pole for E-Log and accessories. Power supply: solar panel.			
ELF345	Plastic IP65 box 500x400 mm complete with: regulator for solar panel. Possibility of mounting battery 15 and 40 Ah.	●	●	
MG0560	Lead additional battery 40Ah	●	●	
	Telephone modem for E-log			
DEA718.1	GSM/GPRS modem (FTP) dual band complete with antenna	●	●	
ELA110.1	Connection cable to ELO305 for DEA718 modem	●	●	
	Solar panel power supply system			
DYA101	Solar panel 50W	●	●	
DYA064	Support for solar panel	●	●	
	Pole H 2 mt for data-logger and solar panel mounting			
DYA006.1	Pole H. 2 m	●	●	
DYA021	Tripod for fixing the pole to the ground	●	●	
DYA028	Tie rods for pole	●	●	
DYA026	Pickets for fixing tie-rods to the ground	●	●	
	Software			
BSZ311	SW SQL-GIDAS Data management on Microsoft SQL Server 2005 database . E-log data storage (vers.2) on a SQL (GIDAS) database. Visualization and management by the included VIEWER Module.	●	●	
BSZ306	SW CommNET. Automatic download by GSM/GPRS modem	●	●	

Nota 1 Two kinds of Calibration certificates for anemometers are available: ISO9001 made by the LSI LASTEM laboratories and MEASNET, made by the WIND GUARD accredited centre, for calibration according to the standards IEC61400, MEASNET and ISO3966. The models with extension #C are supplied with ISO9001 certificate.

Note 2 Combined wind speed and direction sensors or separate models are available. The separate models are also available with heated versions.

Note 3 Cable length according to the tower chosen.

Note 4 Sensors with output 4-20 mA o 0-5 Vdc are available.

Note 5 Models with low consumption (DNA122#C, DNA304#C, DNA314#C) are available, useful in situations with solar panel power supply.

Note 6 The barometer model DQA240.1#C is suitable for connection to LSI LASTEM data-loggers.

Note 7 The support DYA046 is useful for fixing single sensors to the top of the pole. This accessory is not required in case of combined sensors.

Wind speed&direction (wind cup and vane) | Technical features - MODELS

Combined Wind speed and Direction sensors

Combined wind speed and wind direction sensor. Direct signal output for wind speed (Hz) and wind direction (0÷1 Vdc). This sensor range includes, in a single apparatus, transducers for both wind speed and wind direction measurement. Its use simplifies installation requirements, other than being smaller, lighter and cheaper than the general 2-sensor kit. Model DNA122#S is equipped with a potentiometer and its wind direction output is in Ω, with very low power consumption and it can be used in applications with limited energy availability. Data output of the DNA921 model is RS485 using Modbus RTU® or TTY-ASCII protocols.

Order numb.	DNA121#C	DNA122#C	DNA821	DNA827	DNA921
Wind speed output	0÷833 Hz	4÷20 mA	0÷5 Vdc	RS485	
Wind Direction output	0÷1 Vdc	0÷2000 Ω	4÷20 mA	0÷5 Vdc	RS485
Protocol	-	Modbus RTU®, TTY-ASCII			
WS Programmable output	-	Instant, max., min., ave. (1÷3600 sec)			
WD programmable output	-	Instant, Prevalent sector (1÷3600 sec)			
Configuration	-	Hyperterminal			
Protection	Tranzorb	Tranzorb e Emifilters			
RS485 protection	-				Galvanic insulation (3 kV, UL1577)
RS485 speed	-				1200÷115 kbps
Power supply	12 Vdc		10÷30 Vac/dc		
Power consumption	30 mA	2 mA	0,5 W		
Wind direction principle	Hall effect system	2 kΩ potentiom.	Hall effect system		
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) E-Log (all models)		-		

Common features

Wind speed	*Principle*	N.32 step optoelectronic disk
	Measuring range	0÷60 m/s
	Uncertainty	0÷3 m/s=1,5%, >3 m/s= 1%
	Threshold	0,26 m/s
	Delay distance	4,8 m (@ 10 m/s). According to VDI3786 and ASTM 5096-96
	Resolution	0,07 m/s
Wind direction	*Principle*	See table above
	Measuring range	0÷360° (0÷355° DNA122#C)
	Uncertainty	1%
	Threshold	0,15 m/s
	Resolution	0,3°
	Delay distance	1,2 m (@ 10 m/s). According to VDI3786 and ASTM 5366-96
	Damping coeff.	0,21 (@ 10 m/s). According to VDI3786 and ASTM 5096-96

continued

General information	*Connector*	7 pin IP65 watertight connector
	Housing	Anodized aluminum,
	Cup	PA6 plastic and fiberglass
	Vane	Aluminum
	Mounting	Mast ø 48 ÷ 50 mm
	Electric protections	Tranzorb and Emifilters
	Operative temperature	>-30°C (without ice)
	Mounting	Mast ø 48÷50 mm
Accessories	**Order numb.**	
	DZC405	Calibration certificate Includes in DNA121#C and DNA122#C
	DWA510	Cable L = 10 m
	DWA525	Cable L = 25 m
	DWA526	Cable L = 50 m
	DWA527	Cable L = 100 m
	MG2251	7 pin free female connector
	DNA124	Spare part: rotor
	DNA127	Spare part: vane
	MM2011	Spare part: bearings for Wind direction (QT.2 required)
	MM2020	Spare part: bearing for Wind speed (QT.2 required)

Compact anemometer

With compact size and high mechanical strength, these sensors are particularly suiited for use in strong wind applications, where long term reliability without maintenance is required, as in wind farms and wind turbine surveys. These sensors are compatible with any LSI-LASTEM data loggers, but they can be also easily integrated with third party systems, thanks to a high quality relay-reed-generated linear pulse output.

Order numb.	**DNA202**	
Wind speed	*Principle*	Relay Reed
	Measuring range	0÷75 m/s
	Uncertainty	2,5% (calibration tested to 63 m/s)
	Threshold	0,5 m/s
General information	*Output*	2,65 Hz x m/s
	Connector	4 pin IP65 watertight connector
	Housing	Anodized aluminum,
	Operative temperature	-35÷70°C (without ice)
	Mounting	Mast ø 48÷50 mm
	Operative temperature	-35÷70°C (without ice)
	Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) E-Log (all models)

Accessories	**Order numb.**	
	**MN1071**	Cable each m
	DYA046	Coupling bar for WS+WD sensors on ø 45 ÷65 mm pole
	DNA207	Spare part: rotor
	MM2001	Spare part: Bearings

Standard anemometer (direct output)

Wind speed sensor with direct signal output (Hz/m/s). These anemometers are ideal for when requirements calls for low thresholds and good accuracy even at very low wind speed. The wind speed element is a tachometer with 32 steps ensuring very high resolution. DNA302#C is equipped with heater. DNA304#C, with its extreme-low power consumption, can be used in applications with very low energy availability.

Order numb.	DNA301#C	DNA302#C	DNA304#C
Output	0-883 Hz		
Power supply	5÷12 Vdc	5÷12 Vdc (heater 24 Vac)	5÷12 Vdc
Heater	-	YES (-20°C)	-
Power consumption	20 mA	20 W	2 mA
Calibration certificate	Included		
Data logger compatibility	M-Log (ELO007-008), R-Log (ELR515), E-Log (all models)		

Standard anemometer (analog output)

Wind speed sensor with analog signal output. All models are based on microprocessor technology: Every sensor has, on the basis of its particular geometry, different response on each point of his measuring range; the microprocessor adjusts the signal linearity at any wind speed value, obtaining a precise and stable output. DNA802 and DNA806 are equipped with heaters.

Order numb.	DNA801	DNA802	DNA805	DNA806	DNA807
Output	4÷20 mA	4÷20 mA	0÷20 mA	0÷20 mA	0÷5 Vdc
Power supply	10÷30 Vac/dc	24 Vac/dc	10÷30 Vac/dc	24 Vac/dc	10÷30 Vac/dc
Heater	-	YES (-20°C)	-	YES (-20°C)	-
Heater operative temperature	-	>-20°C	-	>-20°C	-
Power consumption	0,5 W	20 W	0,5 W	20 W	0,5 W
Microprocessor	PIC 18F2620				

Common features

Wind speed	*Principle*	N.32 step optoelectronic disk
	Measuring range	0-50 m/s
	Threshold	0,36 m/s
	Uncertainty	0÷3 m/s=1,5%, >3 m/s= 1%
	Resolution	0,06 m/s
	Delay distance	4,8 m (at 10 m/s). Acc to VDI3786 and ASTM 5096-96
General information	*Connector*	7 pin IP65 watertight connector
	Housing	Anodized aluminum
	Operative temperature	-35÷ +70°C (without ice)
	Mounting	Mast ø 48 ÷ 50 mm

continued

Accessories	Order numb.	
	**DYA046**	Coupling bar for WS+WD sensors on ø 45 ÷65 mm pole
	DZC405	Calibration certificate. Included in DNA301-302-304#C
	DNA110	Cable for DNA30x#C. L.=10 m
	DNA125	Cable for DNA30x#C. L.=25 m
	DNA126	Cable for DNA30x#C. L.=50 m
	DWA510	Cable for DNA80x. L.= 10 m
	DWA525	Cable for DNA80x. L.= 25 m
	DWA526	Cable for DNA80x. L.= 50 m
	DWA527	Cable for DNA80x. L.= 100 m
	MM2251	Free connector without cable
	MM2025	Spare part: rotor
	DNA204	Spare part: bearing

Compact wind vane

With compact size and high mechanical strength, this sensors are particularly suiited for use in strong wind applications, where long term reliability without maintenance is required, as in wind farms and wind turbine surveys. Ideal also for portable and light AWS and for wind-alarm applications where wind speed and direction are both to be considered. On this regard, LSI LASTEM data loggers can detect specific alarm conditions and open digital outputs when wind speed is over a programmable value and wind direction is coming from a defined angle.

Order numb.	**DNA212**	
Wind speed	*Principle*	Hall effect sensor
	Measuring range	0÷360°
	Threshold	0,25 m/s
	Uncertainty	5°
General information	*Output*	0÷1 V
	Connector	4 pin IP65 watertight connector
	Housing	Anodized aluminum,
	Power supply	10÷14 Vdc
	Power consumption	10 mA
	Mounting	Mast ø 48 ÷ 50 mm
	Operative temperature	-35÷70°C (without ice)
	Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) E-Log (all models)

Accessories	**Order numb.**	
	**MN1071**	Cable each m
	DYA046	Coupling bar For WS+WD sensors on ø 45 ÷65 mm pole
	DNA218	Spare part: vane
	MM2001	Spare part: bearing

Standard wind vane (direct output)

Wind direction sensor with direct signal output. These wind vanes are ideal for when requirements calls for low thresholds and good accuracy even at very low wind speed. DNA310-311#C uses a Hall-effect encoding system. DNA314#C is equipped with a potentiometer to reduce power consumption in very low energy applications. DNA311#C is also equipped with heaters to avoid ice formation on its body in very cold environments.

Order numb.	DNA310#C	DNA311#C	DNA314#C
Principle	Hall effect sensor		Potentiometer
Output	0÷1 V		0-2000 Ω
Power supply	12 Vdc	24 Vdc/ac (heater) 12 Vdc (direction)	-
Heater	-	SI	-
Heater operative temperature		>-20°C	
Power consumption	10 mA	20 W	Max 2 mA
Calibration certificate	Included		
Data logger compatibility	M-Log (ELO007-008), R-Log (ELR515), E-Log (all models)		

Standard wind vane (analog output)

Wind direction sensor with analog signal output. All models use a Hall-effect encoding system. DNA811-815 are equipped with heaters to avoid ice formation on its body in very cold environments.

Order numb.	DNA810	DNA811	DNA814	DNA815	DNA816
Principle	Hall effect sensor				
Output	4÷20 mA		0÷20 mA		0÷5 Vdc
Power supply	10÷30 Vca/cc	24 Vca/cc	10÷30 Vca/Vcc	24 Vca/cc	10÷30 Vca/cc
Heater	-	YES	-	YES	-
Heater operative temperature		>-20°C		>-20°C	
Power consumption	0,5 W	20 W	0,5 W	20 W	0,5 W

Common features

Wind direction	*Measuring range*	0÷360°
	Uncertainty	3°
	Threshold	0,15 m/s
	Delay distance	1,2 m (at 10 m/s). Acc to VDI3786 and ASTM 5366-96
	Damping coeff.	0,21 (at 10 m/s). Acc to VDI3786 and ASTM 5096-96
General information	*Connector*	7 pin IP65 watertight connector
	Housing	Anodized aluminum,
	Operative temperature	-35÷70°C (without ice)
	Mounting	Mast ø 48÷50 mm

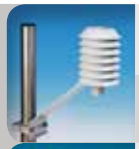
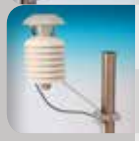
continued

Accessories	Order numb.	
	DYA046	Coupling bar For WS+WD sensors on ø 45÷65 mm pole
	DZC404	Calibration certificate Included in DNA010-011#C
	DNA110	Cable for DNA31x#C L =10 m
	DNA125	Cable for DNA31x#C L =25 m
	DNA126	Cable for DNA31x#C L =50 m
	MG2252	7 pin free male connector for DNA31x#C
	DWA510	Cable for DNA81x L = 10 m
	DWA525	Cable for DNA81x L = 25 m
	DWA526	Cable for DNA81x L = 50 m
	DWA527	Cable for DNA81x L = 100 m
	MG2251	7 pin free female connector for DNA81x sensors
	DNA217	Spare part: rotor
	MM2025	Spare part: bearings

Thermohygrometer (direct output)

Air temperature and RH% sensor. Pt100 output for temperature and 0-1 Vdc output for RH%. For outdoor application it should be coupled with a radiant screen. Precise and reliable, this sensor is suitable for continuous measurements also in severe environments and in presence of steep thermal and hygrometric variations.

Order numb.		DMA672.1	ESU403.1
Output		RH%: 0÷1 Vdc. °C: Pt100 DIN-IEC 751 table (EN 60751)	
Power supply		6÷18 Vdc	
Connector		L = 3 m free wires (8 wires)	L = 3 m + n. 2 Mini-Din connectors
Data logger compatibility		M-Log (ELO007-008) R-Log (ELR515) E-Log (all models)	M-Log (ELO009) R-Log (ELR510)
Common features			
Temperature	*Principle*	Pt100 1/3 DIN B	
	Measuring range	Depending by the data acquisition system	
	Uncertainty	0,1°C (0°C)	
	Output	Pt100 DIN-IEC 751 table (EN 60751)	
	Resolution	0,01°C (M/R/ELog)	
	Response time (T90)	3 min. with filter, 20 sec. without filter (0,2 m/s air speed)	
Relative humidity	*Principle*	Capacitive	
	Measuring range	0÷100%	
	Uncertainty	±1,5% RH (5-95%)	
	Output	0÷1 Vdc	
	Response time (T90)	10 min. with filter, 1 min. without filter (0,2 m/s air speed)	
General information	*Cable*	L = 3 m	
	Protection type	IP54	
	Operative temperature	-40÷+80°C	

Accessories	Order numb.	
	**DYA230**	Multi plate natural ventilation radiant screen
	DYA233	Multi plate natural ventilation radiant screen for DYA046 arm
	**DYA231**	Multi plate forced ventilation radiant screen. 12 Vdc power supply
	DPA232	Multi plate forced ventilation radiant screen. 24 Vac power supply
	DZC301.S	Temperature and RH% calibration certificate. ISO9000 type
	CSIT.T10	Temperature calibration certificate. ACCREDIA type
	DZZSIT8	RH% calibration certificate. ACCREDIA type
	DYA049	Mast-mounting device for ø 45-65 mm pipe

Barometers
Sensors designed for accurate measurement of barometric pressure. DQA240.1#C is more suitable for LSI-LASTEM data acquisition systems (0-1Vdc output). DQA250 is suitable in applications where very high accuracy (0,3 hPa) is required.

Order numb.	DQA240.1#C (1)	DQA250.1 (2)
Output	0÷1 V	0÷1 V
Power supply	10÷14 Vdc	24 Vac
Power consumption	0,25 W	4 mA
Uncertainty	1 hPa	0,3 hPa (+15÷+25°C)
Thermal drift	0,1 hPa/°C (-10÷+60°C)	< 0,2 hPa
Calibration certificate	Includes	

Sensors designed for accurate measurement of barometric pressure and integration with third party acquisition systems requiring standard analogue output. Calibration is made using trimmers.
DQA223 model uses a thermocompensation system to reduce the thermal effect on the pressure measurement. Furthermore on this model different analogue outputs are locally selectable with dip-switches.

Order numb.	DQA201	DQA202	DQA208	DQA223
Output	4÷20 mA		0÷5 Vdc	0/4÷20 mA, 0/1÷5 V, 0/60÷300 mV
Power supply	24 Vac	12 Vdc		12 Vdc
Power consumption	1 W			40 mA
Uncertainty	1 hPa			1 hPa
Thermal drift	0,1 hPa/°C (-10÷+60°C)			0,01 hPa/°C (-10÷+60°C)

Common features

Barometer	*Principle*	Piezoelectric
	Range	800÷1100 hPa
	Maximum pressure limit	2000 hPa
	Protection	IP43

E-Log – Environmental Data Logger

www.lsi-lastem.com

Highlights

- N.8/16 analog inputs, 4 digital inputs, n.1 RS232 input;
- Inputs extension using MASTER/SLAVE units;
- Available with built-in ZigBee radio;
- Very low power consumption (< 4 mW);
- N. 99 channels for acquisition or calculation;
- 2 MB Flash data memory;
- LSI-LASTEM, Modbus RTU, TTY communication protocols;
- Spontaneous data transmission in ASCII format by TCP protocol;
- N.2 RS232 serial ports
- Built-in calculation library for derived quantities;
- Built-in mathematical calculations library;
- Outputs actuation over programmable events to activate external devices;
- Sampling rate 1 sec. to 12 hrs;
- Elaboration time-base 1 sec. to 24 hrs;
- PC connection via RS232/radio/modem PSTN/GSM/GPRS/Ethernet;
- Display and keyboard;
- Compatibility with CommNET, GIDAS and XPanel programs.

LSI Lastem E-LOG has been explicitly designed for environmental applications. It features specific inputs and calculations for environmental sensors while maintaining an all-time-low power consumption. E-LOG stores data sampled from connected sensors and supports a wide range of communication protocols. Rugged and durable, E-LOG ensures prolonged data-logging in even the most severe environments, while the 16-bit design of the A/D converter ensures data accuracy and reliability of measurements in meteorological and hydrological applications, for air quality and outdoor environmental monitoring

Main Features

Inputs

- N.8 differential (n.16 single-ended) inputs for analog signals (voltage, current and resistance).
- N.4 digital inputs programmable as frequency or on/off digital inputs.
- N.1 RS 232 input for sensors with serial interface.

The number of inputs can be increased using MASTER/SLAVE design. MASTER E-Log can manage up to 99 total channels.

Built-in radio

The ELO515 series is equipped with a built-in ZigBee radio. The Zigbee Radio network allows connecting of several LSI LASTEM devices, including E-Logs, radio sensors (S-Log) and R-Log-SLAVE units.

Derived environmental and mathematical calculations

E-Log has an internal library of derived environmental quantities. These calculated quantities can use inputs from monitoring measures, user-defined constants and other derived quantities This library also includes mathematical calculations. (see *Calculated Quantities*)

Data storage

E-Log stores statistical elaborations with time bases from 1 sec. to 24 hrs:

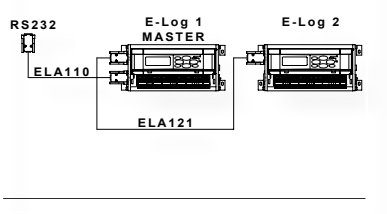
- instant values;
- arithmetical average, minimum, maximum, standard deviation;
- totalization and integration time measurements;
- wind elaborations: resulting/prevailing direction, resulting speed, direction standard deviation (sigma-theta), calm %.

Memory structure is circular.

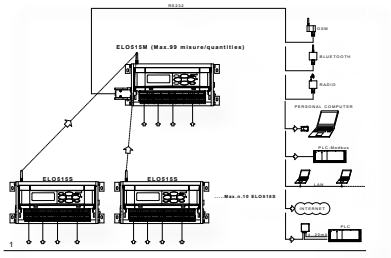
Output actuation at event time

E-Log has seven digital outputs to power up external systems or alarm devices. Outputs are activated according to user-defined actuation logics:

- Greater/less than, within a range;
- Wind alarm;
- Alarm for beginning of precipitations;
- Flood Alarm;
- Scheduled event;
- Snow level alarm;
- Error state of the unit.



Inputs extension: MASTER/SLAVE units by cable



Inputs extension: MASTER/SLAVE units by radio

continued

Sampling rate
Programmable for each sensor (1 sec -12 hrs). E-Log manages up to n.12 channels from sensors and n.8 derived quantities in 1 sec

Sensors power supply actuation
E-Log can feed sensors requiring power supply for their operation, with user-defined warm-up time.

Battery
Batteries are normally included in ELF enclosures (see Accessories). LSI-LASTEM supplies 2-15-40 Ah rechargeable battery packs and 1.5-Volt, D-shaped disposable battery packs. Batteries can be recharged using main power supply or solar panels.
Models ELO310 and ELO515 come with an internal 1.2 Ah battery.

Power supply
E-Log runs at 12 Vdc input voltage power supply. It has an extremely low power consumption (< 4 mW). LSI-LASTEM offers a wide range of power supply systems and battery packs according to the requested power source and autonomy.

Serial ports for data communication
E-Log is equipped with two RS232 serial ports. Both of them can be used for local or remote communication for data download or real-time update of instantan eous and diagnostic values.
COM2 port can also be used to connect sensors with RS232 output.
In models equipped with built-in radio, COM2 port is not available.

Direct connection to PC
E-Log can be directly connected to a PC with the following interfaces:
USB: using included adapter;
RS485: distances up to 1 km, using DEA504 converter;
Ethernet: using DEA550 converter;
Bluetooth: using DEA300 adapter.

Remote connection to PC
E-Log can be remotely connected to a PC with the following interfaces:
- Telephone System: GSM modem;
- GPRS net: GSM/GPRS modem;
- Long distances UHF radio communications.

CommNetEG program can help managing both direct and remote connections with automatic/ scheduled communications.

Data communication in ASCII format using GPRS and TCP/IP protocols
E-Log can send data in ASCII format in spontaneous way at programmable timing. Communication can take place via GPRS modem and FTP protocol or TCP/IP converter (over LAN or WAN).

Installation
E-Log is normally installed in IP65 protection portable or fix box wall or pole mounting (see *ELF series in Accessories part*) for protection against shocks, water, dust and atmospheric agents; the IP65 box normally hosts also power supply systems, communication devices, additional batteries and, when present, barometric sensors.

Data output protocols
Serial port COM1:
- LSI LASTEM native (CISS)

Serial port COM2:
- Reduced native (CISS)
- TTY: instantaneous values (spontaneous or by external request);
- Modbus RTU: instantaneous values and diagnostic information

Data input protocols
E-Log Serial port COM2 can also be used to connect sensors with RS232 interface.
Supported protocols include:

- Gill: Sonic Gill anemometers (Gill format Polar, continuous).
- HYDROLAB water quality probes
- CLIMATRONICS: AIO probe
- AEROQUAL: AQM60 base module

Order numb.	ELO105	ELO305	ELO310	ELO515
Built-in 2.4 GHz radio		NO		YES
RS232 port		N. 2		N.1
LCD 4 x 20 chars. display	NO		YES	
N. 8 keys keyboard	NO		YES	
Tripod use		NO		YES
Internal 1.2 Ah battery		NO		YES

continued

Common features		Range	Resolution	Accuracy (@ 25°C)
Analogue inputs	*Voltage*	-300 ÷ 1200 mV	40 µV	±160 µV
		±78 mV	3 µV	±30 µV
		±39 mV	1.5 µV	±15 µV
	Pt100	-50 ÷ 70 °C	0.003 °C	±0.1°C
		-50 ÷ 600 °C	0.011 °C	±0.3°C
		0 ÷ 6000 Ω	0.1 Ω	±1.5 Ω
	Thermocouples	E-IPTS 68	< 0.1 °C	±0.6 °C
		J-IPTS 68	< 0.1 °C	±0.6 °C
		J - DIN	< 0.1 °C	±0.6 °C
		K-IPTS 68	< 0.1 °C	±0.5 °C
		S-IPTS 68	0.22 °C	±2.0 °C
		T-IPTS 68	< 0.1 °C	±0.5 °C
	Inputs number	n.8 (n.16 single-ended)		
	ESD protections:	±8 kV contact discharge IEC 1000–4-2		
	Max input signal	1.2 V		
	EMC filters	On all inputs		
	Temperature error (@ -10÷30°C)	300 ÷ 1200 mV < ±0.01% FSR; ±39 mV < ±0.01% FSR ±78 mV < ±0.01% FSR		
Digital inputs	*Inputs number*	N. 4		
	Programmable functions	N.2 frequency inputs (optoelectronic sensors, max 10 kHz) N.2 frequency inputs (max 1 kHz) N.4 logic state inputs ON/OFF (0 ÷ 3 Vdc signals)		
	Max error	3 Hz @ 5 kHz		
	Protection	Transient voltage suppressor 600 W, <10 µs		
Digital outputs	*Output number*	n.7 (n.4 sensors power-up, n.3 on events)		
	Max current on each output	150 mA		
	Protection	Thermal and over current (> 0.15 A)		
Power supply	*Power supply*	8 ÷ 14 Vdc		
	Power consumption	Display ON: 60 mA, OFF: 20 mA		
	Power consumption (Stand-by)	Stand-by: 0.2 mA		
	Protections	Transient voltage suppressor: 600 W, t = 10 µs; on polarity inversion		
Radio (see MODELS)	*Type*	ZigBee		
	Frequency	ISM 2.4 GHz direct sequence channels		
	Power	10 mW (+10 dBm)		
Other features	*Internal clock*	Accuracy 30 s/month (T=25°C)		
	Display (see MODELS)	LCD 4 x 20 car		
	Keyboard (see MODELS)	n.8 keys		
	Processor	1 RISC 8 bit, clock 16 MHz		
	ADC resolution	16 bit		
	Sampling time	80 ms (rejection 50 Hz)		
	Environmental limits	-20 ÷ 60 °C, 15 ÷ 100 % RH (not condensing)		
	Protection	IP 40		
	Weight	500 g		
	Dimensions	140 x 120 x 50 mm		
RS232 ports (see MODELS)	*Speed*	1200 ÷ 115200 bps		
	Type	9 pins/Female/Male/DTE/DCE		

Accessories
for E-Log – Environmental Data Logger

Data loggers requires to add some accessories to complete the installation. These components have to be chosen depending by power supply and communciation mode. Depending on these choices, you can opt to add the following accessories.

IP65 boxes for long-term operation

For continuous, long-term or outdoors operation the data loggers are normally installed inside IP65 protection boxes for protection against water, dust and atmospheric agents; each case contains also a specific power supply system. The case has also room for communication devices to be chosen from the above list. Each box can be supplied with an arm for pole or wall installation.

Order numb.		
ELF345		IP65 box. Complete with solar panel regulator. Fitting for 15 or 40 Ah battery.
	Dimension	502x406x555 mm
	Weight	8 Kg (battery not included)
	Compatibility	M-Log, E-Log, R-Log
MG0558	*Battery*	18 Ah
MG0560	*Battery*	44 Ah
DYA074	*Support*	Pole Ø 45÷65 mm ELF345 mounting
DYA101	*Solar panel*	50 Watt
DYA064	*Arm for solar panel*	Pole Ø 45÷65 mm DYA101 mounting

Communication devices

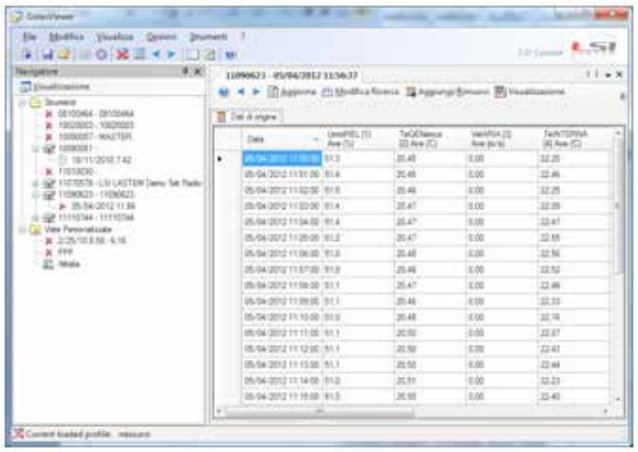
EO-Log weather station comes with a 1,5m RS232 cable and USB converter for local connection to a PC. To upload data on the CMA web site, you can choose other type of communication devices, such as GSPRS modem, UMTS router, TCP/IP converters for LAN. GPRS and UMTS technology require a contract with a local telephone service provider. TCP/IP technology offers a free of charge communication solution, as long as the LAN is connected to the Internet. In the latter case, data logger should be connected to the nearest TCP/IP Ethernet sock.

Order numb.		
DEA718.1		GSM-850 / EGSM-900 / DCS-1800 / PCS-1900 MHz Quad-Band. GPRS class 10
	Operative temperature	-20÷70°C
	Power supply	9÷24 Vcc from data logger
	Power consumption	Sleep: 8 mA During communication: 110 mA
ELA110.1	Connection cable from DEA718.1 to E-Log	

LSI LASTEM offers different solutions about the data management on the PC.

SQL-GIDAS VIEWER

Gidas Viewer is a post-processing solution that allows for data display, management and analysis of the data downloaded by 3DOM and CommNET programs. The user can access data in various tabular and chart form (including Wind Roses), process data using different time bases, joint together data and instruments. Gidas Viewer is based on a powerful SQL Database for better data security and management, including tools for data backup and storage.
Gidas Viewer SQL database can be installed locally or in PC networks and it is also accessible from third-party software for custom-made software applications and web data display.



Main

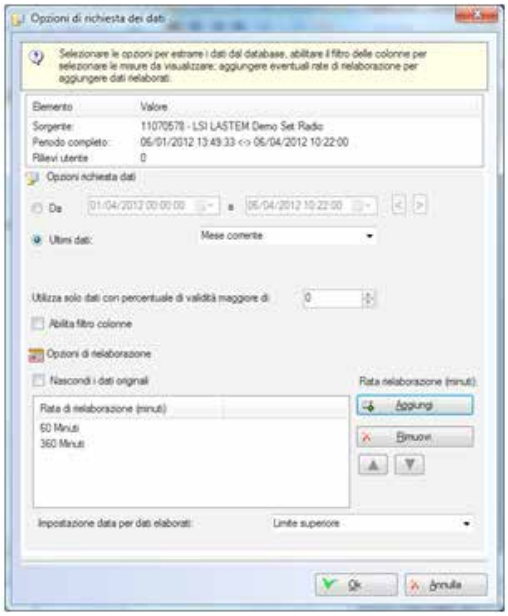
- Instrument browser, including all data loggers and surveys for easy data selection;
- Selection of one or more time base for displaying statistical data;
- Reports (table and charts) with measurement selection;
- Export data to ASCII table and Excel;
- Fast data query recall for easy reports update using fresh data.

interface - **Gidas viewer**

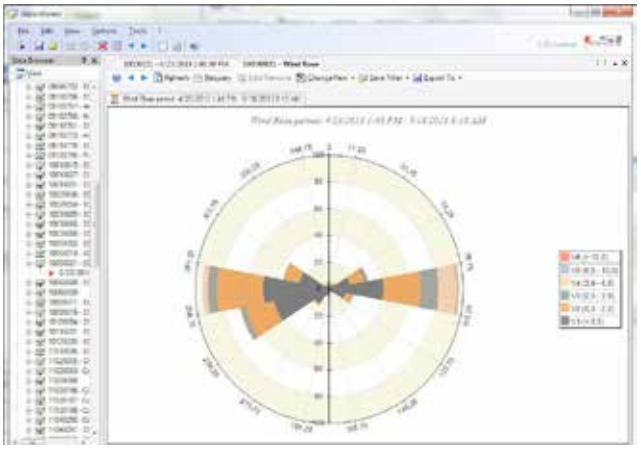
Data selection

- Data selection by date;
- Selection of one or more elaboration time base;
- Selection of measurements to be placed inside the report.

interface - **Data selection**



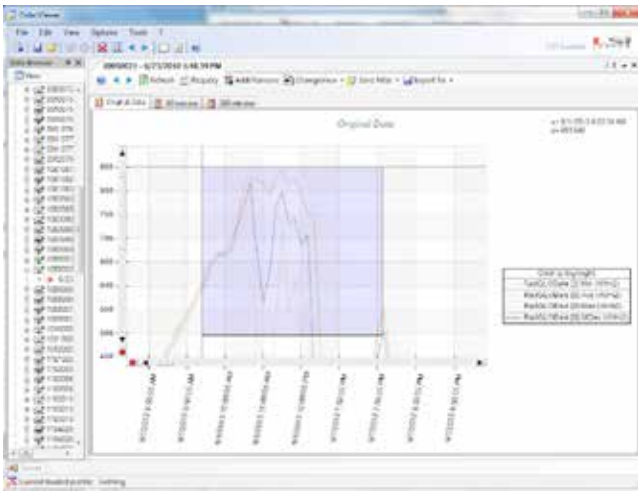
interface - **Data selection**



Data reports

- Table;
- Charts: zoom scroll;
- Export: ASCII ed Excel;
- Wind rose;
- Weibull analysis.

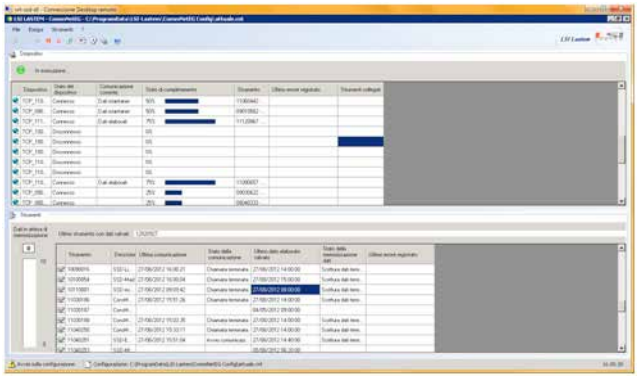
interface - **Data report**



interface - **Data report**

CommNET-EG

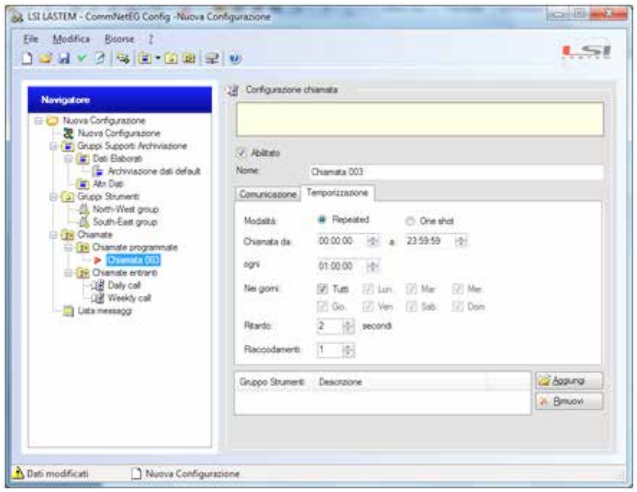
CommNetEG is the solution for automatic data download from LSI LASTEM data loggers to PCs and Servers. CommNetEG can manage several simultaneous communication channels and protocols, including parallel serial COM, PSTN, GSM and GPRS modem, VHF/UHF radio and TCP/IP.



Main

- Data downloading from one or more data loggers in automatic mode;
- Simultaneous use of different communication devices (VHF/UHF radio, GSM, GPRS, LAN, USB, RS232 cable) using different communication channels;
- Data storing in several formats, including ASCII files, SQL databases and Binary for successive data management with SQL-GIDAS Viewer, XPanel, SYNOP, Evapotranspiration, TEA Thermal Environment Application, InfoFlux programs;
- Cyclical data download at programmed times or on operator's request, from one or more instruments (or groups of them)

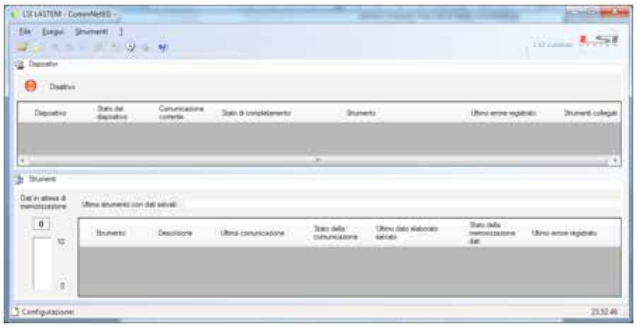
interface - **CommNET-EG**



Configuration module

- Setup module to program all the communication parameters;
- Wizard tool for procedure configuration;
- Group of stations each using its own communication parameter: device, day/ time starts, repetitions;
- Communication devices setup;
- Data storing formats setup: ASCII, SQL-GIDAS, SQL-ENVIEW, Binary, formats;
- PC and data logger clock synchronization;
- Switch-off data logger communication device after data communication;
- Save one or more configurations.

interface - **CommNET-EG config**



interface - **CommNET-EG config**

Operative service

- Communication statistical analysis;
- Selection of the configuration to be used;
- Events log book;
- Start/Stop communication;
- Manual calls.

GPRS Module

- Entry calls from data logger by GPRS modem in “push” mode

Reference List

Environmental monitoring systems for wind energy applications

Some of the customers who choose our systems for Wind energy applications:

Italy:

-**Running Energy** - Arezzo
-**Eneco** - Firenze
-**RAM S.n.c.** - Macerata
-**Sorel** - Milano
-**GiEffe Impianti** - Potenza
-**Prima Luce Impianti** - Pistoia
-**Energetica Soc. Coop.** - Roma
-**GREEN ENGINEERING SRL** - Polla Salerno
-**Consorzio ABN** - Salerno
-**Studio di Ingegneria Di Silvestro** - Teramo
-**Alted** - Trieste

>> ENVIRONMENTAL SYSTEMS FOR **WIND ENERGY**

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