

 >> METEOROLOGICAL SENSORS



Components

Meteorological Sensors

General Catalog



meteorology



Milano
ITALY



LSI LASTEM s.r.l

40 years of experience in environmental technology

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

► Products

Instrumentation for indoor and outdoor environmental monitoring applications

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



► METEOROLOGICAL SENSORS

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



► INDOORS SENSORS

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



► DATA LOGGERS and SOFTWARE

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



▶ Systems

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

▶ INDOORS APPLICATIONS

▶ Indoor Environmental Quality

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



▶ Heat stress and thermal comfort

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



▶ HVAC

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



▶ Buildings assessment/Wall insulation

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



▶ Controlled Atmosphere Processing Environments

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



▶ Museums and heritage

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



▼ ENVIRONMENT AND POLLUTION

▶ **Air Quality Monitoring**

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



▶ **Landfills and waste plants monitoring**

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



▶ **Compost and biofilters**

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



▼ METEOROLOGICAL APPLICATIONS

▶ **AWS and Synoptic Meteorological systems**

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



▶ **Road and transportation monitoring systems**

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



▶ **Hydrology systems**

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



▶ **Agrometeorology**

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



▶ **Wind energy**

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



▶ **Solar energy**

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



▶ The LSI LASTEM Story

40 years of experience in environmental technology



www.lsi-lastem.com

LSI
LABORATORI
DI STRUMENTAZIONE
INDUSTRIALE S.p.A.



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



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

LASTEM



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



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



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

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



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



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

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



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

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





photo | 3 twin-building structure

LSI LASTEM headquarters in Settala, near Milano, Italy is a 1325 m², 3 twin-building structure that's been home to our company since 1985. Here, a team of 30 professionals is employed in engineering, production, aftersales, marketing and administration departments.

R&D

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



Mechanical Shop

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



Sensors assembly division

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



Data Loggers Assembly division

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





► **Calibration Laboratories**

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



► **Aftersales**

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



► **Training**

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



Note

LSI Lastem - Settala (MI) Italy

Lined area for notes, consisting of multiple horizontal dashed lines.





Parameter	Order numb.	Pag.	
Air temperature	DMA033	10	
	EST033	10	
Radiant temperature	DMA131	11	
Surface temperature	DLE124	12	
	DLE125	12	
	EST124	12	
	DMA672.1	13	
Air temperature RH% and hPa (*)	ESU403.1	13	
	EXP875	14	
	DMA980	14	
	DMA975	14	
	DMA875	14	
	DMA867	14	
	Wind speed&Direction (Cup and vane)	DNA121#C	16
DNA122#C		16	
DNA821		16	
DNA827		16	
DNA921		16	
Wind speed&Direction (Ultrasonic)	DNB104	18	
	DNB106	18	
	DNB105	18	
	DNB107	18	
	DNB146	18	
	Wind speed&direction Temperature & RH Pressure	DNB101	19
DNA202		20	
Wind speed (cup)	DNA301#C	21	
	DNA302#C	21	
	DNA304#C	21	
	DNA801	21	
	DNA802	21	
	DNA805	21	
	DNA806	21	
	DNA807	21	
	Wind direction (vane)	DNA212	23
		DNA310#C	24
DNA311#C		24	
DNA314#C		24	
DNA810		24	
DNA811		24	
DNA814		24	

Parameter	Order numb.	Pag.
Solar radiation (Global irradiance)	DNA815	24
	DNA816	24
Solar radiation (Global irradiance)	DPA252	26
	DPA952	26
	DPA154	27
	DPA855	27
	DPA870	27
	DPA053	28
	DPA863	28
Calibrated Cell	DPA873	28
	DPA048.1	30
	DPA048.2	30
Solar radiation (Net radiation)	DPA048.3	30
	DPA240	31
	DPA840	31
Solar radiation (4-components)	DPA266	32
	DPA817	33
Solar radiation UV-A	DPA822	33
Solar radiation UV-B	DPA008	34
Solar radiation (PAR, Lux)	ESR003.1#C	34
	ESR003#C	34
	DPD504	35
Sunshine duration	DPA257	36
Direct radiation (DNI)	DPA259	36
	DQA130.1#C	37
Rain	DQA131.1#C	37
	DQA950	37
	DQA951	37
	DQA135.1#C	37
	DQA136.1#C	37
	DQA060	38
Rain presence	DQA240.1#C	39
Barometric pressure	DQA250.1	39
	DQA801	39
	DYI010	40
Evaporation	DLE041	41
Soil temperature	DQA340	41
Soil moisture	DPA305	42
Visibility	DPA312	42
Present weather	DPA311	42
	DQL011	43
Snow level		

LSI - LASTEM meteorological sensors range overview

LSI LASTEM produces a wide range of meteorological sensors addressed to their own data acquisition devices as well as to third party data management systems. LSI LASTEM high-quality sensors, the synthesis of almost 40 years of experience in environmental technology instrumentation, have been carefully designed and produced to guarantee reliable and accurate measurements, easy and fast installation and very low maintenance.



Air temperature sensor (Pt100 output)

Pt100 Air temperature sensor for indoor use and, coupled with a radiant screen, for meteorological applications. A 4-wire, Pt100 1/3 DIN B sensing element guarantees very good accuracy over an extended temperature range. This sensor is ideal for virtually any kind of environmental application.

Order numb.

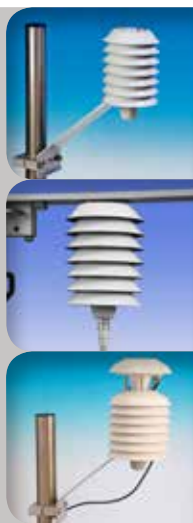
	DMA033	EST033
Connector	Free wires (4-wire)	Mini-Din connector
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)	M-Log (ELO009) R-Log (ELR510)

Common features

Temperature	<i>Principle</i>	Pt100 1/3 DIN B (Class AA)
	<i>Measuring range</i>	-50÷70°C
	<i>Accuracy</i>	0,10°C (@0°C)
	<i>Output</i>	Pt100 DIN-IEC 751 table (EN 60751)
	<i>Resolution</i>	0,01°C (M/R/ELog)
	<i>Response time (T90 air)</i>	30 sec. without protective filter, 6 min. with protective filter
General information	<i>Protection type</i>	IP54
	<i>Power consumption</i>	None
	<i>Operative temperature</i>	-40÷80°C
	<i>Cable</i>	L = 5 m
	<i>Input type on X/E/M/R-Log</i>	Analog

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
	DYA232	Multi plate forced ventilation radiant screen. 24 Vac power supply
	DYA049	Mast-mounting device for ø 45-65 mm pipe
	DZC101.S	ISO9000 type calibration certificate
	CSIT.T.10	ACCREDIA type calibration certificate



Black Globe Thermometer (Pt100 output)

The standard black globe thermometer consists of a black-painted copper sphere with a diameter of 150 mm and a thickness of 0.4 mm. It contains a thermometer with its bulb at the center of the sphere. It measures the radiant temperature as described in the ISO7726 standard.

Main scope of the radiant temperature measurement in meteorological applications is the possibility of estimate the Mean Radiant Temperature (T_{mrt}) which is one of the most important meteorological parameters governing human energy balance and the thermal comfort of man in micrometeorological measurements

Order numb.

DMA131

Temperature	<i>Sensitive element</i>	Pt100 DIN-A (Class A)
	<i>Range</i>	-50÷80°C
	<i>Accuracy</i>	0,15°C (@0°C) DIN-IEC751 EN60751
	<i>Response time</i>	20 min
	<i>Operative temperature</i>	-50+80°C
	<i>Material</i>	Copper
	<i>Cable</i>	L = 10 m
	<i>Power consumption</i>	None
	<i>Standard</i>	ISO7726
	<i>Data logger compatibility</i>	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)

Accessories

Order numb.

	DYA060	Arm for fixing DMA131 sensor on DYA049 collar
	DYA049	Mast-mounting collar for ø 45-65 mm pipe





Contact temperature sensor (Pt100 output)

Plate-made sensor for surface temperature measurements. Its compact dimensions facilitate installation even in small spaces. It can be easily fixed using sylicon, adhesive band or thermoconductive paste.

Order numb.	DLE124 (1)	DLE125 (1)	EST124 (2)
Connector	Free wires (4-wire)	Connector for DPA870-873 pyranometers	Mini-Din connector
Cable	L = 20 m		L = 10 m (flat)
Use	Indoor e outdoor		Indoor
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)	DPA870 (pyranometer) DPA873 (pyranometer)	M-Log (ELO009) R-Log (ELR510)

Common features

Temperature	<i>Principle</i>	Pt100 1/3 DIN B (Class AA)
	<i>Measuring range</i>	-50÷70°C
	<i>Accuracy</i>	0,15°C (@0°C)
	<i>Output</i>	Pt100 DIN-IEC 751 table (EN 6075)
	<i>Resolution</i>	0,01°C (M/R/ELog)
	<i>Response time (T90)</i>	35 sec.
General information	<i>Dimension</i>	30 x 20 mm Thickness 2,5 mm
	<i>Power consumption</i>	None
	<i>Operative temperature</i>	-40÷80°C
	<i>Input type on E/X/M/R-Log</i>	Analog

Accessories	Order numb.	
	DZC101.S	ISO9000 type calibration certificate
	CSIT.T.10	ACCREDIA type calibration certificate
	MM7500	Thermo conductive paste for sensor installation on surfaces



Air temperature and Relative humidity

Technical features - MODELS



www.lsi-lastem.com



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 and n.2 Mini-Din connectors
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515), E/X-Log (all models)	M-Log (ELO009) R-Log (ELR510)

Common features

Temperature	<i>Principle</i>	Pt100 1/3 DIN B (Class AA)
	<i>Measuring range</i>	-50÷70°C
	<i>Accuracy</i>	0,1°C (@0°C)
	<i>Output</i>	Pt100 DIN-IEC 751 table (EN 60751)
	<i>Resolution</i>	0,01°C (X/M/R/ELog)
	<i>Response time (T90)</i>	3 min. with filter, 20 sec. without filter (0,2 m/s air speed)
Relative humidity	<i>Principle</i>	Thin film capacitive sensor
	<i>Measuring range</i>	0÷100%
	<i>Accuracy</i>	±1,5% RH (@5÷95%)
	<i>Output</i>	0÷1 Vdc
	<i>Sensitivity</i>	0,1%
	<i>Response time (T90)</i>	10 min. with filter, 30 s. without filter (0,2 m/s air speed)
General information	<i>Cable</i>	L = 3 m
	<i>Protection type</i>	IP54
	<i>Operative temperature</i>	-50÷+80°C
	<i>Power consumption</i>	2 mA

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



**Thermohygrometer
(analog, RS485, Radio output)**

Instruments for accurate measurement of air temperature and relative humidity in severe outdoor environments.

On models DMA980-975-875, an high efficiency natural ventilation radiant screen (with special black painting on the lower surface of the plates) ensures that the sensing element is protected by sun rays for accurate air temperature readings. For even better results in low wind and high solar radiation conditions, models DMA867 are equipped with a forced ventilation screen. DMA980 model measures temperature and relative humidity and barometric pressure. Output of the models DMA980-975 is RS485 using Modbus RTU® or TTY-ASCII protocols.

EXP815 model is equipped with an internal radio to send measurement up to 600 m far to data logger equipped with radio receiver.

Order numb.	EXP875 (1)	DMA980 (2)	DMA975 (2)	DMA875 (3)	DMA867 (3)
-------------	------------	------------	------------	------------	------------

Measurements	°C/RH%	°C/RH%/hPa		°C/RH%	
Output	Radio	RS485		2x4÷20 mA	
Frequency	869,450 MHz	-		-	
Radio transmission power	25 ± 3 mW	-		-	
Radio transmission distance (line-of-sight)	600 m	-		-	
Transmission rate	10'	-		-	
Battery life	>2 years	-		-	
Protocol	-	Modbus RTU®, TTY-ASCII		-	
Programmable output	-	Instant, max., min., ave. (1÷3600 s)		-	
Configuration	-	Hyperterminal		-	
RS485 protection	-	Galvanic insulation (3 kV, UL1577)		-	
RS485 speed	-	1200÷115 kbps		-	
hPa measurement range	869,450 MHz	800÷1100 hPa	-	-	
hPa accuracy	25 ± 3 mW	0,5 hPa	-	-	
hPa thermal drift	600 m	0,25 hPa/10°C	-	-	
Power supply	Battery (AA 3,6 V)	10÷30 Vac/dc			
Power consumption	<10 µW stand-by 250 mW in transmission	1 W		1 W	3 W
Electric protections	NO (electrically insulated system)	Tranzorb and Emifilter			
Ventilation		Natural		Forced	

Response time (T90)



**Common features**

Temperature	<i>Principle</i>	Pt100 1/3 DIN B (Class AA)
	<i>Measuring range</i>	Programmable: -30÷70°C, -50÷50°C, -50÷100°C
	<i>Accuracy</i>	0,2°C (@ 0°C)
	<i>Resolution</i>	0,04°C
	<i>Response time (T90)</i>	3 min. with filter 20 s without filter (0,2 m/s air speed)
Relative humidity	<i>Principle</i>	Capacitive
	<i>Measuring range</i>	0-100%
	<i>Accuracy</i>	±1,5% RH (@5-95%)
	<i>Response time (T90)</i>	10 min with filter 1 min without filter (0,2 m/s air speed)
General information	<i>Connector</i>	7 pin IP65 watertight connector
	<i>Protection type</i>	IP65
	<i>Operative temperature</i>	-40÷80°C

Accessories**Order numb.**

DZC301.S	Calibration certificate
DYA049	Mast-mounting device for ø 45-65 mm pipe
DWA505	Cable L = 5 m
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
DMA672.1	Sensitive element (spare part)
EXP301	Radio signal receiver from EXP815 radio sensors Output compatible with data loggers (M/E-Log) Maximum number of receivable sensors: 200 Battery: NiCd 9 V Power supply: 12 Vdc Connection cable to data logger: DWA601



Wind speed & direction (wind cup and vane)

Technical features - MODELS



www.lsi-lastem.com



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 speed measuring range	0÷75 m/s (damage limit)		0÷60 m/s		
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 k Ω potentiom.	Hall effect system		
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) X/E-Log (all models)		-	-	-

Common features

Wind speed	<i>Principle</i>	N.32 step optoelectronic disk
	<i>Accuracy</i>	0÷3 m/s=1,5%, >3 m/s= 1%
	<i>Threshold</i>	0,26 m/s
	<i>Delay distance</i>	4,8 m (@ 10 m/s) According to VDI3786 and ASTM 5096-96
	<i>Resolution</i>	0,07 m/s

continued





Wind direction	<i>Principle</i>	See table above
	<i>Measuring range</i>	0÷360° (0÷355° DNA122#C)
	<i>Accuracy</i>	1%
	<i>Threshold</i>	0,15 m/s
	<i>Resolution</i>	0,3°
	<i>Delay distance</i>	1,2 m (@ 10 m/s) According to VDI3786 and ASTM 5366-96
	<i>Damping coeff.</i>	0,21 (@ 10 m/s) According to VDI3786 and ASTM 5096-96
General information	<i>Operative damage limit</i>	75 m/s
	<i>Connector</i>	7 pin IP65 watertight connector
	<i>Housing</i>	Anodized aluminum
	<i>Cup</i>	PA6 plastic and fiberglass
	<i>Vane</i>	Aluminum
	<i>Mounting</i>	Mast \varnothing 48 ÷ 50 mm
	<i>Electric protections</i>	Tranzorb and Emifilters
	<i>Operative temperature</i>	>-30°C (without ice)
<i>Mounting</i>	Mast \varnothing 48÷50 mm	

Accessories**Order numb.**

DZC405	Calibration certificate Includes in DNA121#C and DNA122#C
DWA505	Cable L = 5 m
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)



Wind speed and direction (ultra-sonic)

Technical features - MODELS



www.lsi-lastem.com



Ultrasonic anemometer

2-axis ultrasonic anemometer without moving-parts. It is ideal for general meteorological applications requiring very low-maintenance or measurements with fast response even in low-range wind speed conditions. Model DNB104-106-146 (RS232 output) can be connected to COM2 of LSI LASTEM data logger using Modbus protocol.

Order numb.	DNB104 (1)	DNB106 (1)	DNB105 (1)	DNB107 (1)	DNB146 (2)
Output	RS232, RS485, RS422, SDI-12	RS232, RS485, RS422, SDI-12	2x4-20 mA	2x4-20 mA	RS232, RS485, RS422, SDI-12
Type	Sonic 2-Axis (U-V)	Sonic 2-Axis (U-V)	Sonic 2-Axis (U-V)	Sonic 2-Axis (U-V)	Sonic 3-Axis
Heater	NO	YES	NO	YES	NO
Protocol	NMEA, Modbus-RTU, SD-12	NMEA, Modbus-RTU, SD-12	-	-	NMEA, Modbus-RTU, SD-12
Power consumption	26 mA @ 12 Vdc	6 W	26 mA @ 12 Vdc	6 W	26 mA @ 12 Vdc

Common features

Wind speed	<i>Measuring range</i>	0÷60 m/s
	<i>Accuracy</i>	0÷35 m/s: ±2% or ± 0.2 m/s >35 m/s: ±3%
	<i>Threshold</i>	0,01 m/s
	<i>Resolution</i>	0,01 m/s
Wind direction	<i>Measuring range</i>	0÷360°
	<i>Accuracy</i>	±2°
	<i>WS threshold for WD calculation</i>	0,01÷1,00 m/s (default: 0,02 m/s)
	<i>Resolution</i>	1°
Compass	<i>Principle</i>	Magnetic
	<i>Measuring range</i>	0÷360°
	<i>Resolution</i>	0,1°
	<i>Accuracy</i>	±1°
General information	<i>Power supply</i>	10÷30 Vdc
	<i>Protection</i>	IP66
	<i>Connector</i>	IP65 watertight connector male connector M23, n.19 wires
	<i>Housing</i>	Luran, AISI316
	<i>Mounting</i>	Mast ø 40 mm
	<i>Operative temperature</i>	-40÷+60°C

Accessories

Order numb.

DWA810	Cable L = 10 m for DNB105-107 anemometer
DWA811	Cable L = 10 m for DNB104-106 anemometer
DWA825	Cable L = 25 m for DNB105-107 anemometer
DWA826	Cable L = 50 m for DNB105-107 anemometer
MG2272	Watertight connector for making DNB10X cable
DNB191	Adapter for DNB sensors to pole ø 50 mm



Wind speed & direction, temperature & RH%, pressure

Technical features - MODELS



www.lsi-lastem.com



All-in one weather sensor

This Sensor integrates a unique folded-path sonic anemometer with a multi-element temperature sensor, fast-response capacitive relative humidity sensor, state-of-the-art barometric pressure sensor and an internal flux-gate compass for automatic alignment of wind direction to magnetic north for quick deployment (true/magnetic North offset is adjustable by the user through software command). The result is a professional grade All-In-One Weather Sensor designed for reliability, longevity, and ease of installation. DNB101 can be connected to any LSI LASTEM data logger on serial port COM2 using its Modbus output protocol.

Order numb.	DNB101	
Wind speed	Type	Ultrasonic
	Range	0÷60 m/s
	Accuracy	±0,3 m/s or ±2% (0÷35 m/s), ±3% (>35 m/s)
	Threshold	0,01 m/s
	Resolution	0,01 m/s
Wind direction	Type	Ultrasonic
	Range	0÷360°
	Accuracy	±2° @ wind speed > 1 m/s
	WS threshold for WD calculation	0,01÷1,00 m/s (default: 0,02 m/s)
	Resolution	0,1°
Temperature	Type	Pt100
	Range	-40÷60 °C
	Accuracy	±0.15°C, ±0,1% of the measure
	Resolution	0,1°C
RH%	Type	Capacitive
	Range	0÷100%
	Accuracy	@T=15÷35°C: ±1,5% @T=-40÷60°C: ±1,5%+1,5% reading
	Resolution	0,1%
Pressure	Range	600÷1100 hPa
	Accuracy	±0.5 hPa @ 20°C
	Resolution	0,1 hPa
General information	Power supply	10÷30 VDC
	Output	RS232, RS485, SD-12
	Protocols	NMEA, Modbus-RTU, SD-12
	Power consumption	26 mA @12 Vdc, 6W with heater
	Compass	Resolution: 0,1°, Accuracy: ±1°
	Mounting	Mast ø 40 mm
	Environmental limit	-50÷70 °C
	Data logger compatibility	RS232 port on: M-Log (all models) X/E-Log (all models)
Accessories	Order numb.	
	DWA811	Cable L = 10 m for DNB101
	MG2272	Watertight connector for making DNB101 cable
	DNB191	Adapter for DNB sensors to pole Ø 50 mm

Wind speed and direction (ultra-sonic) | Wind speed & direction, temperature & RH%, pressure

MW9000-ENG



Wind speed (wind cup)

Technical features - MODELS



www.lsi-lastem.com



Compact anemometer

With compact size and high mechanical strength, these sensors are particularly suited 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	<i>Principle</i>	Relay Reed
	<i>Measuring range</i>	0÷75 m/s (damage limit)
	<i>Accuracy</i>	2,5% (calibration tested to 63 m/s)
	<i>Threshold</i>	0,5 m/s
General information	<i>Output</i>	2,65 Hz x m/s
	<i>Connector</i>	4 pin IP65 watertight connector
	<i>Housing</i>	Anodized aluminum
	<i>Operative temperature</i>	-35÷70°C (without ice)
	<i>Mounting</i>	Mast ø 48 ÷ 50 mm
	<i>Data logger compatibility</i>	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)

Accessories

Order numb.

	MN1071	Cable (per m)
	DYA046	Coupling bar for WS+WD sensors on ø 45 ÷ 65 mm pole
	DNA207	Spare part: rotor
	MM2001	Spare part: Bearings
		





following | Wind speed (wind cup)



www.lsi-lastem.com



Standard anemometer (direct output)

Wind speed sensor with direct signal output (Hz/m/s). These anemometers are ideal for when requirements call 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
Measuring range (damage limit)	0÷75 m/s		
Output	0-883 Hz		
Power supply	5÷12 Vdc	5÷12 Vdc (heater 24 Vac)	5÷12 Vdc
Heater	-	YES (-20°C)	-
Power consumption	Max. 20 mA	20 W	2 mA
Calibration certificate	Included		
Data logger compatibility	M-Log (ELO007-008), R-Log (ELR515), E/X-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		0÷20 mA		0÷5 Vdc
Measuring range	0÷50 m/s				
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	<i>Principle</i>	N.32 step optoelectronic disk, frequency proportional to wind speed
	<i>Threshold</i>	0,3 m/s
	<i>Accuracy</i>	0÷3 m/s=1,5%, >3 m/s= 1%
	<i>Resolution</i>	0,06 m/s
	<i>Delay distance</i>	4,8 m (at 10 m/s) According to VDI3786 and ASTM 5096-96
General information	<i>Operative damage limit</i>	75 m/s
	<i>Connector</i>	7 pin IP65 watertight connector
	<i>Housing</i>	Anodized aluminum
	<i>Operative temperature</i>	-35÷ +70°C (without ice)
	<i>Mounting</i>	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
DNA204	Spare part: rotor
MM2015	Spare part: bearing



DYA046



Wind direction (wind vane)

Technical features - MODELS



www.lsi-lastem.com



Compact wind vane

With compact size and high mechanical strength, this sensors are particularly suited 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 important issues. 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.

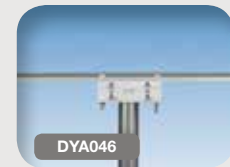
DNA212

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

Accessories

Order numb.

	MN1071	Cable each meter
	DYA046	Coupling bar For WS+WD sensors on ø 45 ÷ 65 mm pole
	DNA218	Spare part: vane
	MM2001	Spare part: bearing



DYA046

Wind speed | Wind direction

MMW9000-ENG





following | Wind direction (wind vane)



www.lsi-lastem.com



Standard wind vane (direct output)

Wind direction sensor with direct signal output. These wind vanes are ideal 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, resistance proportional to wind direction
Output	0÷1 V		0-2000 Ω
Power supply	12 Vdc	24 Vdc/ac (heater) 12 Vdc (direction)	-
Heater	-	YES	-
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), X/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 Vac/dc	24 Vac/dc	10÷30 Vac/dc	24 Vac/dc	10÷30 Vac/dc
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°
	Accuracy	3°
	Threshold	0,15 m/s
	Delay distance	1,2 m (at 10 m/s) According to VDI3786 and ASTM 5366-96
	Damping coeff.	0,21 (at 10 m/s). According 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

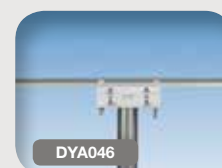


Accessories

Order numb.



DYA046	Coupling bar for WS+WD sensors on \varnothing 45 ÷65 mm pole
DZC404	Calibration certificate Included in DNA310-311-314#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
DWA505	Cable for DNA81x L = 5 m
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



Solar radiation (global irradiance)

Technical features - MODELS



www.lsi-lastem.com



Secondary standard pyranometers

Radiometer for solar irradiance measurement, according to ISO 9060 and WMO No. 8 (Part I, Chapter 7) standards. These sensors are classified as ISO 9060 Secondary Standard. With a total daily uncertainty of only 2%, fast response time, these sensors are ideal for users requiring high-end accuracy and reliability.

Order numb.	DPA252 (1)	DPA952 (2)
Output	μV	RS485-Modbus 4÷20 mA
Power supply	-	7÷35 Vdc
Sensitivity	7÷25 $\mu\text{V}/(\text{W}/\text{m}^2)$	NA
Measuring range	See Irradiance range	0÷1500 W/m^2
Cable	L = 10 m included	See Accessories
Data logger compatibility	M-Log (ELO007-008), R-Log (ELR515), X/E-Log (all models)	

Common features

Secondary Standard pyranometer	ISO 9060 classification	Secondary Standard
	Achievable uncertainty 95% confidential level (daily totals). According to WMO manual, not considering calibration errors, for well maintained instruments on clear sky days, at mid-latitude sites	±2%
	Spectral range	285÷3000 nm
	Temperature response (50 K range)	<± 1% (-10÷40 °C) when compensated: <± 0,4% (-30÷50°C)
	Irradiance range	0÷4000 W/m^2
	Response time 95%	3 s
	Directional (azimuth+cosine) error W/m^2 (@1000 W/m^2) $0 < \theta < 80^\circ$	<± 10 W/m^2
	Zero offset a (response to 200 W/m^2 net thermal radiation)	< 5 W/m^2 (unventilated)
	Zero offset b: Thermal change W/m^2 (5 °C/h)	< ± 2 W/m^2
	Non linearity % (1000 W/m^2)	<± 0.2 %
	Stability (% change/year)	<± 0.5 %
	Standard built-in temperature sensor	Yes
	Standard built-in heater	Yes (12 Vdc, 1,5 W)
	Data provided with each sensor	- Calibration certificate - Temperature dependence data - Directional response data
	Recommended recalibration	Every 2 years
	Mounting (pole \varnothing 45÷65 mm)	Using DYA034 or DYA035 arms + DYA049
	Housing	Anodized aluminum





First class pyranometers

Radiometer for solar irradiance measurement, according to ISO 9060 and WMO No. 8 (Part I, Chapter 7) standards. These sensors are classified as ISO 9060 First Class. With a total daily uncertainty of 5%, flat spectral response (305-2800 nm) and optimal temperature stability, this sensor represents the optimal compromise between costs and quality of irradiance measurement.

Order numb.	DPA154	DPA855	DPA870
Output	$\mu\text{V}/\text{W}/\text{m}^2$	4÷20 mA	RS485
Protocol			Modbus RTU® TTY-ASCII
Programmable output			max., min., ave. (1÷3600 s)
RS485 protection			Galvanic insulation (3 kV, UL1577)
RS485 speed			1200÷115 kbps
Electric Protection		Transorb e Emifilters	
Power supply	None	10÷30 Vac/dc	
Measuring range	See Irradiance range	0÷1500 W/m ²	
Power consumption	None	0,5 W	
Other measures			Air temp. (included) Surface temp. (DLE125 sensor)
Cable	Included L = 10 m (DWA410)	Not included See accessories	
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) X/E-Log (all models)		

Common features

Pyranometer	<i>Principle</i>	Thermopile
	<i>ISO 9060 Classification</i>	First class
	<i>Spectral range</i>	305÷2800 nm
	<i>Sensitivity</i>	30÷45 $\mu\text{V}/\text{W}/\text{m}^2$
	<i>Achievable uncertainty 95% confidential level. (daily totals)</i>	±5%
	<i>Irradiance Range</i>	0÷2000 W/m ²
	<i>Response time (T95%)</i>	23 s
	<i>Zero offset: Thermal change W/m² (5 °C/h)</i>	<± 4 W/m ²
	<i>Directional (azimuth+cosine) error W/m² (@ 1000 W/m²) 0 < θ < 80°</i>	<± 20 W/m ²
	<i>Non linearity % (@ 1000 W/m²)</i>	<± 1 %
	<i>Stability (% change/year)</i>	<± 1,5 %
	<i>Temperature response (50 K range)</i>	<± 4 % (-10÷40 °C)
	<i>Operative temperature</i>	-50÷+80°C
General information	<i>Housing</i>	Anodized aluminum
	<i>Recalibration</i>	Every 2 years
	<i>Mounting (pole \varnothing 45÷65 mm)</i>	Using DYA034 (horizontal) or DYA035 (tilting) arms + DYA049 collar





Second Class Pyranometers

Radiometer for solar irradiance measurement, according to Second class as ISO 9060 and WMO No. 8 standards. This sensor is a good compromise for basic meteorological, agrometeorological and solar energy applications.

Order numb.	DPA053 (1)	DPA863 (2)	DPA873 (2)
Output	$\mu\text{V}/\text{W}/\text{m}^2$	4÷20 mA	RS485
Protocol	-	-	Modbus RTU®, TTY-ASCII
Programmable data output	-	-	max.min.ave. (1÷3600 sec)
RS485 protection	-	-	Galvanic insulation (3 kV, UL1577)
RS485 speed	-	-	1200÷115 kbps
Protection	-	Tranzorb and Emifilters	
Power supply	-	10÷30 Vac/dc	
Power consumption	-	0,5 W	
Measurement range	See "Irradiance range"	0÷1500 W/m ²	
Sensitivity	10÷15 $\mu\text{V}/\text{W}/\text{m}^2$	NA	
Response time (T90%)	16 s	18 s	
Cable	L = 5 m	Not included (see Accessories)	
Installation (on ø 50 mm pole)	DYA032 arm + DYA049 collar (horizontal) DYA048 plate + DYA035 arm + DYA049 collar (tilting)	DYA034 (horizontal) or DYA035 (tilting) arms + DYA049 collar	
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)	-	-

Common features

Pyranometer	<i>Principle</i>	Thermopile
	<i>ISO 9060 Classification</i>	Second class
	<i>Spectral range</i>	305÷2800 nm
	<i>Irradiance range</i>	0÷2000 W/m ²
	<i>Achievable uncertainty 95% confidential level (daily totals)</i>	10%
	<i>Temperature response (50°K range)</i>	<7% (-10÷40 °C) (0,14%/°C)
	<i>Operative temperature</i>	-40÷80°C
General information	<i>Housing</i>	Anodized aluminum
	<i>Recalibration</i>	Every 2 years



Accessories

Accessories	Order numb.	
	DYA032	Horizontal arm for fixing DPA053-053.1 to DYA049 collar
	DYA034	Horizontal arm for fixing DPA252-952-154-855-870-863-873 pyranometers to DYA049 collar
	DYA035	Tilting arm for fixing DPA252-952-154-855-870-863-873 pyranometers to DYA049 collar
	DYA049	Collar for fixing DYA032-034-035 to ø 45-65 mm pipe
	DPA250	Ventilation unit for DPA252 Power supply: 12 Vdc Operative temperature: -40÷70°C
	DWA205	Cable for DPA252-952. L = 5 m
	DWA210	Cable for DPA252-952. L = 10 m
	DWA225	Cable for DPA252-952. L = 25 m
	DWA410	Cable for DPA154-855-870-863-873-053.1 L = 10 m
	DWA425	Cable for DPA154-855-870-863-873-053.1 L = 25 m
	DWA426	Cable for DPA154-855-870-863-873 L = 50 m
	DWA427	Cable for DPA154-855-870-863-873 L = 100 m
	DYA048	Plate for levelling DPA053-053.1 on DYA034 or DYA035 arm
	DYA120	Radiant shield for DPA053-053.1
	DEA420	Signal amplifier for Pyranometers. Output: 4÷20 mA Programmable pyranometer sensitivity ($\mu\text{V}/\text{Wm}^2$) Power supply 10÷30 Vac/dc For more technical information, see MW9008 catalogue
	DEA485	Same features as DEA420 but: Output: Modbus-RTU
	DEA852	Signal amplifier for Pyranometers. Output: 0/4÷20 mA, 0/1÷5 V Power consumption: output + 10 mA Power supply 10÷30 Vac/dc Requires DWA5xx cable. Pyranometer sensitivity not programmable (factory made before delivery)
	DEA854	Same features as DEA852. Connection: free wires terminal
	DPA245	Shadow band for diffuse radiation





following | Solar radiation (global irradiance)



www.lsi-lastem.com



Calibrated Cell

DPA048 is a high-performance calibrated cell. What really sets it apart from the rest of the market is the fact that this sensor is available in different cell technologies (Monocrystalline, polycrystalline, amorphous) – the user can select the technology that fits his own application. Furthermore, the calibration of every sensor is achieved by a reference element (quality grade A, constructed in an identical fashion) from an accredited test laborator in W/m^2 . A calibrating printout similar to EN DIN 17025 documents the product specific parameters.

Order numb.	DPA048.1	DPA048.2	DPA048.3
Technology	Monocrystalline	Polycrystalline	Amorphus
Accuracy	4%		5%
Output	~100 mV /1000 W/m ² @25°C		
Temperature sensor	Pt 1000, laminated or bonded centrally under the cell		

Common features

General information		
<i>Cable</i>		Shielded L = 3m
<i>Housing</i>		Aluminum
<i>Mounting</i>		Bolts M 5 backside
<i>Operative temperature</i>		-25° ÷ 80° C
<i>Mounting</i>		On surfaces
<i>Data logger compatibility</i>		M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)



Solar radiation (Net radiation: incoming and outgoing short-wave)

Technical features - MODELS



www.lsi-lastem.com



Net radiometer

Net radiometers are sensors for measuring net radiation, i.e. the balance between the incoming sun and sky radiation and the ground-reflected short-wave and ground-emitted long-wave radiation. The primary sensitive element is a high sensitivity thermopile.

Order numb.	DPA240 (1)	DPA840 (2)
Output	$\mu\text{V/W/m}^2$	0/4÷20 mA
Power supply	-	10÷30 Vac/dc
Range	-1500÷1500 W/m ²	-150÷1500 W/m ²
Cable	L = 10 m	7 pin IP65 watertight connector
Installation (on \varnothing 50 mm pole)	DYA031 bar + DYA049 collar	Collar DYA049
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)	

Common features

Pyranometer	<i>Principle</i>	Thermopile
	<i>Spectral range</i>	0,3÷60 μm
	<i>Uncertainty</i>	5% daily
General information	<i>Housing</i>	Plated brass and Aluminum
	<i>Operative Temperature</i>	-40÷80 °C
	<i>Recalibration</i>	Every 2 years

Accessories

Order numb.

DYA049	Mast-mounting device for \varnothing 45-65 mm pipe
DYA031	Arm for fixing For DPA240 only (required DYA051)
DWA505	Cable L = 5 m for DPA840
DWA510	Cable L = 10 m for DPA840
DWA525	Cable L = 25 m for DPA840
DWA526	Cable L = 50 m for DPA840
DWA527	Cable L = 100 m for DPA840
MG2251	7 pin free female connector
DPA291	Spare part: domes for net radiometer (n.5 couples)
DPA293	Spare part: salt cartridge



DPA240



DPA840



Solar radiation (4-components net radiation: short and long wave)

Technical features - MODELS



www.lsi-lastem.com



4-component net radiometer

DPA266 is a 4-component net-radiation sensor used for scientific-grade energy balance studies. The instrument has separate measurements of solar (Short Wave or SW) and Far Infra-Red (Long Wave or LW) radiation.

Order numb.

DPA266

4 components
Net radiometer

Output 4 x $\mu\text{V/W/m}^2$

Principle Thermopile

Measurements Incoming&outgoing short wave (pyranometer)
Incoming&outgoing long wave (pyrgeometer)

Range 0 ÷ 2000 W/m²

Pyranometer

Type Second class WMO (ISO9060)

Spectral range 285 ÷ 3000 nm

Pyrgeometer general

Spectral range 4500 ÷ 50.000 nm

Temperature sensor Pt100

Heating 1,6 Watt; 12 Vdc

Cable L = 5 m

Data logger compatibility M-Log (ELO007-008)
R-Log (ELR515)
X/E-Log (all models)



Solar radiation (UV-A and UV-B)

Technical features - MODELS



www.lsi-lastem.com



UV-A and UV-B radiometers

Radiometer with broad spectral response for measuring of atmospheric irradiance in the UV-A and UV-B spectrum. The sensing element is a photodiode with optical filter with interferential deposition in order to improve spectral transmission. A High-quality dome and diffuser improves cosine response for radiations coming from lower angles.

Order numb.	DPA817	DPA822
Measurement	UV-A	UV-B
Principle	Photodiode	
Spectral range	315÷400 nm	280÷315 nm
Accuracy	12% daily	15% daily
Measuring range	0÷70 W/m ²	0÷5 W/m ²
General information	<i>Output</i>	4÷20 mA
	<i>Power supply</i>	10÷30 Vac/dc
	<i>Power consumption</i>	0,7 W
	<i>Recalibration</i>	Every 2 years
	<i>Housing</i>	Anodized aluminum
	<i>Cable</i>	Not included See accessories
	<i>Installation (on ø 45÷65 mm pole)</i>	DYA034 arm + DYA049 collar
	<i>Data logger compatibility</i>	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)

Accessories	Order numb.	
	DYA049	Mast-mounting device for ø 45-65 mm pipe
	DYA034	Arm for fixing DPA817 to DYA049 collar
	DWA410	Cable L = 10 m
	DWA425	Cable L = 25 m
	DWA426	Cable L = 50 m
	DWA427	Cable L = 100 m





Luxmeter and PAR radiation sensor

Luxmeter probes to measure illuminance in long term outdoor applications according to the response of the human eye (Vlambda CIE curve). The sensing element is a photodiode with optical filter with interferential deposition in order to improve spectral transmission. DPA808 radiometer with broad spectral response measures the atmospheric irradiance in the PAR (Photosynthetic active radiation) spectral range. It has an optical-quality glass dome optimizing the cosine response. To convert the signal output to 4÷20 mA or Modbus, it is possible to use DEA420 or DEA485 converters.

Order numb.	DPA008 (1)	ESR003.1#C (2)	ESR003#C (2)
Measurement	PAR	Lux	
Principle	Photodiode		
Spectral range	Photosynthetically Photon Flux Density 40÷700nm	Vlambda CIE curve	
Accuracy	7,7% spectral error	±3%	
Measuring range	0÷3000 $\mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$	0÷100 KLux	0÷150 KLux
Response time	<1ms	0,1 sec	
Linearity	<0,2%	< 1%	
Recalibration	Every 2 years		
Output	0÷10 mV	0÷300 mV	
Power supply	-	7÷15 Vdc	
Consumption	-	5 mA	
Connector	Free wires (4-wire)	Mini-Din connector	
Housing	Anodized aluminum		
Protection	IP65		
Cable	L = 5 m	L = 10 m	
Installation (on \varnothing 45÷65 mm pole)	DYA032+DYA049		
Data logger compatibility	M-Log (ELO007-008) R-Log (ELR515) X/E-Log (all models)	M-Log (ELO009) R-Log (ELR510)	
Calibration certificate	Na	DZC201.S included	

Accessories

Order numb.



DYA032	Horizontal arm for fixing PAR or Lux sensors to DYA049 collar
DYA049	Mast-mounting collar for \varnothing 45÷65 mm pipe
DEA420	Signal amplifier for Pyranometers Output: 4÷20 mA Programmable pyranometer sensitivity ($\mu\text{V}/\text{Wm}^2$) Power supply 10÷30 Vac/dc For more technical information, see MW9008 catalogue
DEA485	Same features as DEA420 but: Output: Modbus-RTU



Sunshine duration meter

The sensor measures sunshine duration and direct radiation from the sun. Measurement is made in the visible range and near infrared, to second class WMO pyranometer specifications. Once set up for the latitude and location, the sensor does not require seasonal positioning unless greater precision is needed, accomplished by two annual adjustments. For each rotation, the instrument determines the two radiation levels of the beam, with and without the direct action of the sun disc, and calculates the difference, which gives a good approximation to the direct radiation level. The instrument also supplies the sunshine duration, defined by World Meteorological Organization (WMO, 1981) as the time during which the direct solar radiation exceeds the level of 120 W/m², and is normally measured in hours. The sensor has two actionable heaters: a continuous anti-condensation heater and a thermostatic one for defrosting. In conditions of darkness, the band is stopped and the sunshine status is set to "no".

Order numb.

DPD504

Direct radiation	<i>Output</i>	Direct radiation/Sunshine status
	<i>Principle</i>	Non-tracking sensor
	<i>Sensitive element</i>	Photodiode
	<i>Spectral range</i>	300÷1100 nm
	<i>Accuracy</i>	15% (daily totals)
	<i>Measuring range</i>	0÷1500 W/m ²
	<i>Output</i>	60÷300 mV
Sunshine duration	<i>Threshold</i>	120 W/m ² of direct radiation
	<i>Output</i>	On/off TTL 0÷5 V
	<i>Accuracy</i>	<0.1h (in clear sky)
	<i>Power supply</i>	10÷14 Vdc
General information	<i>Power consumption</i>	Sensor: 0,7 W Anti-condensation heater :1 W Defrosting heater: 20 W
	<i>Mast-mounting</i>	For ø 50 mm pipe
	<i>Recalibration</i>	Every 2 years
	<i>Data logger compatibility</i>	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)

Accessories

Order numb.

DYA041	Lateral arm for DPD504 mounting
DYA049	Collar for DYA041 mounting on pole ø 45÷65 mm
DWA510	Cable L = 10 m
DWA525	Cable L = 25 m
DWA526	Cable L = 50 m
DWA527	Cable L = 100 m



Direct radiation (DNI)

Technical features - MODELS



www.lsi-lastem.com



Pyrheliometer

Research grade normal incidence direct solar irradiance sensor (DNI), also known as pyrheliometer for short wave direct solar radiation. It complies with 'First Class' classification, from ISO 9060 and WMO standards.

A unique product feature is the heated window, eliminating the formation of dew on the sensor window, making early morning measurements more accurate. DPA259 is the first pyrheliometer to include a fast detector, making it ideal for high grade research or CPV applications.

Order numb.

DPA257

DPA259

Response time (95%)

18 s

1 s

Common features

Direct radiation	<i>ISO classification</i>	ISO 9060 First Class
	<i>Spectral range</i>	200 ÷ 4000 nm
	<i>Irradiance range</i>	0 ÷ 2000 W/m ²
	<i>Sensitivity</i>	7 ÷ 15 μV/(Wm ⁻²)
	<i>Full opening view angle</i>	5°
	<i>Non stability (drift)</i>	< 1% per year
	<i>Temperature dependence</i>	< ±1% (over 50 K range)
General information	<i>Cable length</i>	5 m
	<i>Calibration traceability</i>	WRR (World Radiometric Reference)
	<i>Temperature range</i>	-40 ÷ +80°C
	<i>Window heating</i>	0,5 W (12Vdc)

Accessories

Order numb.



DPA271

Sun tracker with integrated GPS system. Single arm, only one Pyrheliometer mount, GPS receiver, 3 m RS-232 cable, 10 m power cable.
 Motor: stepping motor
 Pointing accuracy: <0,01° (solar elevation 0 to 87°)
 Angle resolution: 0,009°
 Rotation angles: -15° to +95° elevation-angle, 0° to 180° azimuth-angle
 GPS accuracy: 15 m
 LED indicators: Power and GPS status
 Communication for setup: RS232
 Environmental protection: IP65
 Temperature range: -40÷50°C
 Power supply: 100÷240 Vac (50/60 Hz), 20 W consumption, optional: 21÷32 Vdc, 10W consumption
 Dimensions: 430(W)x380(D)x440(H) mm
 Weight: 14.5 Kg



DPA271.1

Sun tracker with integrated GPS system. Same features as DPA271, but double arms, one Pyrheliometer mount, GPS receiver, 3 m RS-232 cable, 10 m power cable. It can receive DPA271.2/3/4 accessories for additional diffuse and global radiation measurements.

DPA271.2

Shading ball assembly for one pyranometer (diffuse radiation). It must be combined with DPA271.3 or DPA271.4 depending by the number of pyranometers used.

DPA271.3

Mounting plate assembly for one pyranometer (diffuse or global radiation). For diffuse radiation measurement it must be combined with DPA271.2 shading assembly.

DPA271.4

Large mounting plate assembly for two pyranometers. For one diffuse radiation measurement it must be combined with DPA271.2 shading assembly.





Rain

Technical features - MODELS



www.lsi-lastem.com



Rain gauge

Rain gauge is the instrument for the measuring of rain quantity. The device is composed of a collector cone and a double-chamber tipping bucket connected to a magnet that operates one reed switch, which generates impulses that can be counted by external meters: each impulse is equal to 0.2 mm of rainfall. Models are equipped with a siphone placed on the cone's nozzle; it has function during heavy rain, to regulate the flow into the bascule permitting all the water to fall inside. Models are equipped with a siphon placed on the cone's nozzle; it has function during heavy rain, to regulate the flow into the bascule permitting all the water to fall inside. The external body is made of anodized aluminum. For sites with sub-zero temperatures, the thermostatic heated models (DQA131.1-951-136.1), ensure the complete melting of snow, even at extreme temperatures, and avoid ice formation on its body. Data output of the models DQA950-951 is RS485 using Modbus RTU® and TTY-ASCII protocols.

Order numb.

DQA130.1#C
(1)

DQA131.1#C
(1)

DQA950
(1)

DQA951
(1)

DQA135.1#C
(2)

DQA136.1#C
(2)

	DQA130.1#C (1)		DQA131.1#C (1)		DQA950 (1)		DQA951 (1)		DQA135.1#C (2)		DQA136.1#C (2)	
Diameter	200 mm				357 mm							
Collector surface	324 cm ²				1000 cm ²							
Heater	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES		
Heater power supply	-	24 Vac	9÷30 Vac/dc	24 Vac	-	24 Vac	-	24 Vac	-	24 Vac		
Heater power consumption	-	60 W	0,5 W	60 W	-	60 W	-	60 W	-	60 W		
Operative temperature	>0°C	>-20°C	>0°C	>-20°C	>0°C	>-20°C	>0°C	>-20°C	>0°C	>-20°C		
Weight	2,8 kg	-	-	-	-	-	-	-	-	-		
Output	Pulses. Max load 20 mA/24V non inductive		RS485		Pulses. Max load 20 mA/24V non inductive							
Protocols	-	-	Modbus RTU®, TTY-ASCII		-	-						
Programmable data output	-	-	Pulse date/time, Tot. (1÷3600 s)		-	-						
RS485 protection	-	-	Galvanic insulation (3 kV, UL1577)		-	-						
RS485 speed	-	-	1200÷115 kbps		-	-						
Data logger compatibility	M-Log (ELO007-008), R-Log (ELR515), E-Log (all models)		-		-		M-Log (ELO007-008), R-Log (ELR515), E-Log (all models)					

Common features

Rain gauge	<i>Principle</i>	Tipping bucket with syphone
	<i>Design</i>	WMO accordance
	<i>Resolution</i>	0,2 mm (opt. 0,1 mm)
	<i>Accuracy</i>	Rain intensity 0÷1 mm/min: ± 0,2 mm Rain intensity 1÷4 mm/min: 1%
	<i>Operative temperature</i>	<70°C
	<i>Housing</i>	Aluminum
	<i>Calibration certificate</i>	Included
	<i>Data logger compatibility</i>	M-Log (ELO007-008) R-Log (ELR515) E/X-Log (all models)

Direct radiation (DNI) | Rain

MW9000-ENG



Accessories

Order numb.



DYA039	Base plate for ground installation
DYA040	Mast-mounting device for ø 50 mm pipe
DYA058	Lateral support. Requires DYA040
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
DEA280	Integrator for DQA130#C/131#C Range: 0-20 mm. Output: 4-20 mA Power supply: 24 Vac
DEA285	Integrator for DQA130#C/131#C Range: 0-20 mm. Output: 4-20 mA Power supply: 12 Vdc
DEA282	Integrator for DQA130#C/131#C Range: 0-20 mm. Output: 0-5 Vdc Power supply: 24 Vac

Rain presence

Technical features - MODELS



Rain presence sensor

Rain presence sensors are used when it is necessary to discriminate between rainfall and condensation. The measurement principle employed is that of conductivity between two electrodes; these are kept above environmental temperature by heaters in order to prevent condensation.

Order numb.

DQA060

<i>Principle</i>	Capacitive
<i>Power supply</i>	10÷14 Vdc
<i>Measure</i>	Presence of rain
<i>Output</i>	Relay contact (1A-40V)
<i>Operative temperature</i>	0÷50°C

Accessories

Order numb.

DYA049	Mast-mounting device for ø 45-65 mm pipe
DWA510	Cable L = 10 m
DWA525	Cable L = 25 m
DWA526	Cable L = 50 m
DWA527	Cable L = 100 m





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	10÷30 Vdc
Power consumption	0,25 W	4 mA
Accuracy	0,5 hPa	0,3 hPa (15÷25°C)
Thermal drift	Compensated into the range: 10÷60°C. Drift in the range-20÷10°C: -0,025 hPa/°C	< 0,2 hPa
Calibration certificate	Includes	
Principle	Piezometric	
Range	800÷1100 hPa	
Maximum pressure limit	2000 hPa	
Protection	IP43	IP32



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. On DQA801 the pressure range is selectable by dip-switches.

Order numb.	DQA801	
	Output	0/4÷20 mA
	Power supply	10÷30 Vdc/ac
	Power consumption	0,5 W
	Accuracy	0,5 hPa
	Thermal drift	Compensated into the range: 10÷60°C Drift in the range-20÷10°C: -0,025 hPa/°C
	Principle	Piezometric
	Range	Default: 800÷1100 hPa (selectable 600÷1100 hPa, 700÷1100 hPa)
	Maximum pressure limit	2000 hPa
	Protection	IP65
	Operative temperature	-40 85°C

Accessories	Order numb.	
	DWA505	Cable L = 5 m for DQA801
	DWA510	Cable L = 10 m for DQA801
	DWA525	Cable L = 25 m for DQA801
	DWA526	Cable L = 50 m for DQA801
	DWA527	Cable L = 100 m for DQA801
	MG2251	7 pin free female connector
	DYA078	Support for DQA801 with radiant shield Connection to DYA049 collar
	DYA049	Mast-mounting device for ø 45÷65 mm pipe





Evaporimeter

LSI LASTEM evaporimeter pan and plastic platform are built to WMO standards for class "A" evaporimeters.

The pan is made in stainless steel. The platform is made of white plastic. The pan features a stainless steel still well fit to contain the evaporimeter level sensor. The sensor consists of a piezometric water level sensor with analogue output for easy connection to any data acquisition systems. LSI LASTEM data loggers can manage the switching of a solenoid valve for the automatic refill of water (when the measured level is below 25 cm).

Order numb.

DYI010

Evaporation pan

Design

WMO Class A

Housing

Stainless steel AISI 304

Evaporation surface

1,143 m²

Steel well

Included

Weight

22 Kg

Dimensions

Ø 1207 mm, H. 254

Accessories

Order numb

DYI013

Plastic made platform

DQC102

Piezometric type water level sensor

Range: 0÷200 mm/H₂O

Output: 4÷20 mA

Accuracy:

Linearity: 0,1 % FS

Stability: 0,1% FS

Hysteresis: 0,03% FS

Temp. Coeff Zero: typical: 0,015%FS/K,

Max: 0,02% FS/K

Temp. Coeff sensitivity: typical:

0,01%/K Max: 0,02% FS/K

Material: Stainless steel

Operative temperature: 0÷+50°C

Power supply: 12 Vdc

DWA510

Cable L = 10 m

DWA525

Cable L = 25 m

DWA526

Cable L = 50 m

DWA527

Cable L = 100 m





Soil temperature sensors

DLE041 is used for temperature measurement on soil surface or buried at the required depth. It is made of a tightly waterproof shank and it can be also used for water temperature measurements.

Order numb.	DLE041	
	<i>Principle</i>	Pt100 1/2 DIN B (Class AA)
	<i>Measuring range</i>	-20÷70°C
	<i>Accuracy</i>	0,15°C (0°C)
	<i>Output</i>	Pt100 DIN-IEC 751 table (EN 60751)
	<i>Cable</i>	L = 10 m
	<i>Housing</i>	Stainless steel AISI 304
	<i>Operative temperature</i>	-20÷70°C



Soil moisture sensor

DQA340 is the ideal solution for the measurement of volumetric moisture in soils and other porous materials. The sensor is based on TDR technology (Time Domain Reflectometry), ensuring good accuracy even in very wet soils, and without special calibration for mineral soils. Using its rods, the sensor can be inserted in the material for 11 cm. It measures both soil moisture (0-100% range) and temperature.

Order numb.	DQA340	
Moisture	<i>Principle</i>	TDR (Time domain reflectometry)
	<i>Measuring range</i>	0÷100% volumetric moisture
	<i>Accuracy</i>	0÷40%: ± 1% 40÷70%: ± 2%
Temperature	<i>Principle</i>	Pt100 1/2 DIN B
	<i>Accuracy</i>	± 0,2°C
General information	<i>Power supply</i>	6÷24 Vdc
	<i>Power consumption</i>	Sleep: 5 mA Measuring: 120 mA
	<i>Cable</i>	L = 5 m
	<i>Output</i>	2x0÷1 V





Visibility sensor and Present weather

DPA305 and DPA312 visibility sensors with a measuring range up to 2 km is designed to detect fog and haze on roads and in tunnels. DPA305 with both digital and analogue outputs as well as relays for switching external equipment; it can be integrated into Intelligent Transport Systems and used for automatically switching warning signs in changing visibility conditions.

DPA311 analyses water particles of different forms in the air as fog, rain or snow or mix form. It can measure visibility, type of precipitation including its intensity and accumulation.

Order numb.	DPA305 (1)		DPA312 (2)		DPA311 (2)	
	Type	Visibility meter			Visibility meter and Present weather	
Visibility	<i>Principle</i>	Forward-scattering a 45°		Optical backscatter		
	<i>Range</i>	<10 m÷2 km visibility (MOR)		10 m÷2 km visibility (MOR)		
	<i>Accuracy</i>	<= 10%		<100 m: ± 10 m >100 m: 10%		
	<i>Resolution</i>	NA		1 m		1 m
Precipitation	<i>Type</i>				WMO codes Tab.4680: Rain, snow, mixed rain/snow, fog, drizzle, clear	
	<i>Measures</i>				Intensity: 0÷60 mm/h (±20%) Accumulation (mm/h)	
	<i>Resolution</i>				Intensity: 0,1 mm/h Particle : >0,16 mm	
	<i>Measurement rate</i>				60 s	
Informazioni generali	<i>Output</i>	4÷20 mA		RS485 Half duplex, 1200 bauds, ASCII		
	<i>Relays (n.3)</i>	1) Fault 2) Visibility threshold YES/NO precipita- tion or 2 nd visibility threshold				
	<i>Power supply</i>	9÷36 Vcc		11÷15 Vdc		
	<i>Consumption</i>	6 W normal running (no dew, heater ON) 2,5 W no dew heater OFF		60 mA + 200 mA for lens heating		
	<i>Operative temperature</i>	-30÷50°C		-30÷60°C		





Snow level sensor

The robust design of DQL011 makes it the ideal solution for reliable measurement of snow-depth in extreme conditions. The additional air-temperature detection feature guarantees precise readings over a wide temperature range. The powerful ultrasonic impulses emitted by this sensor deliver reliable readings even when there is a difficult reflection ratio, as is the case with powdery or fresh snow. The sensor is characterized by a high level of operating reliability, low energy consumption and ease of use in the field.

Order numb.

DQL011

Snow level	<i>Principle</i>	Ultra-sonic (frequency 50 kHz)
	<i>Range</i>	0÷8 m
	<i>Resolution</i>	1 mm
	<i>Accuracy</i>	< 0,1% Full scale
	<i>Beamwidth</i>	12°
Air temperature	<i>Principle</i>	Semiconductor in radiant shield
	<i>Range</i>	-40÷+60°C
	<i>Resolution</i>	0,1°C
	<i>Accuracy</i>	< 0,15%
General information	<i>Power supply</i>	10,5÷15 Vdc
	<i>Power consumption</i>	Max 200 mA, 5 mA (stand-by)
	<i>Energy consumption</i>	0,5 Ah/day (1 min. measuring interv.)
	<i>Output 1</i>	2x0/4-20 mA
	<i>Output 2</i>	RS232
	<i>Operative temperature</i>	-40÷+60°C
	<i>Material</i>	Aluminum
	<i>Installation</i>	Mast-mounting for 61 mm pipe
<i>Connector</i>	12 pin-connector (cable not included)	

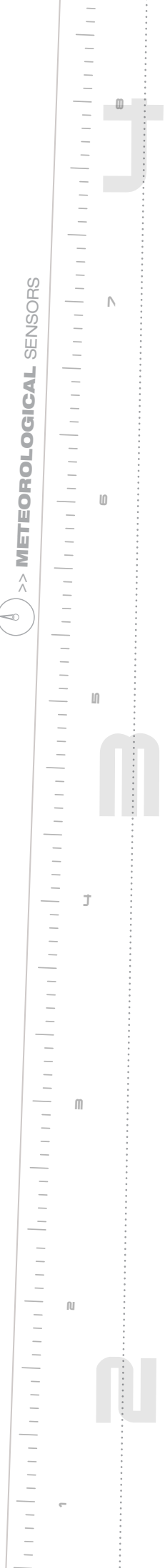
Accessories

Order numb.

	DYA047	Support for DQL011 on meteo pole Ø 50 mm (maximum height: 4m)
	MN1072	Cable each meter



 >> METEOROLOGICAL SENSORS



Milano
ITALY

via Ex SP. 161 Dosso, 9
20090 Settala (MI) Italy

tel: +39 02 95 41 41

fax: +39 02 95 77 05 94

web site: www.lsi-lastem.com