MICROSOLAR – METEOROLOGICAL STATIONS FOR PHOTOVOLTAIC SOLAR POWER SYSTEMS (Rev.3 280121)

Description

The **MicroSOLAR** meteorological stations have been designed and constructed to measure the solar radiation and the other climatic conditions which can affect the performance of photovoltaic plants. The monitoring is carried out in compliance with **IEC 61724**, **CEI 82-25 and IEC 60904** standards, using Geoves professional instruments and other main manufacturer sensors in the field of radiometry. MicroSOLAR stations are extremely versatile and, in the basic version, measure the **solar radiation**, the **air and the panel temperatures** and the **wind speed**. In the models more complex MicroSOLAR can interface the following signals:

- 4-20mA signals from inverters or other external devices
- Automatic sun trackers
- Silicon cell or thermopile pyranometers (**ISO9060** Secondary Standard, First or Second Class of accuracy)
- Other meteorological sensors to measure environmental parameters in compliance with **WMO** (World Meteorological Organization) that can affect the performance of photovoltaic plant (eg. rel. humidity, rain, etc…)

The data transmission is performed in two ways: 1) Via **LAN/ethernet** cable, 2) wireless **GPRS** with data sending on a **FTP** area, 3) manually downloading the data from the **SD Card**. Furthermore the istantaneous data of each meteorological measure can be available on a **RS485 ModBus** output to connect the datalogger to external SCADA.

Particular of the meteorological station and of the datalogger enclosure –Jordan installation

Particular of thermopile and silicon cell pyranometers – Jordan Installation

ADVANTAGES and MAIN FEATURES

Conformity

- ✓ Dataloggers and measurement stations: **IEC 61724**, **CEI 82-25 and IEC 60904**
- ✓ Pyranometers and radiometers: **ISO9060, ISO 17025** and **WMO**
- ✓ Meteorological sensors: **WMO Annex 8**

Accuracy, reliability and robustness

- ✓ Measurement sampling time **1 second** with data storage **every 5 (default), 10-15-30 or 60'**
- ✓ Certifiability of all meteorological sensors by accredited laboratories (**Accredia**, **WMO**, **Measnet**, etc…)
- ✓ Instruments, cables, brackets and datalogger enclosures made in **stainless materials** able to resist in any working conditions (direct irradiation, thermal excursions, salinity, sand, wind gusts, hail, etc…)
- ✓ Data protection system against manipulation

Versatility, compatibility and easiness of using

- ✓ Each station can be **fix** with several kind of poles and brackets, or **portable** with carrying case for instruments and foldable tripod for the on-site installation.
- ✓ Data storage in **TXT standard format** with values separated by commas (**CSV format**)
- ✓ **Automatic procedure of GPRS aerial aiming** by datalogger with on-site control of reception GPRS signal
- ✓ On-board **display** for measure reading

Other features

- ✓ Italian technology and Minimum maintenance
- ✓ After-sales technical assistance service for maintenance and calibrations

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Technical Data

DATALOGGER	mSOL3 – Multichannel Datalogger
I/O Channels	**8 analog inputs** (+ 8 option on Expa8 interface): in voltage or current (typ.0…5Vdc or 4…20mA); **2 insulated digital inputs (pulse counter)** for sensors with "high" frequency up to 50KHz (anemometers, flow gauges, ecc…) and with "low" frequency output (rain gauges), sensors that requires the time counting (sunshine duration, leaf wetness,…), on/off signal (free-contacts); **1 diagnostic input** for battery monitor
Power supply	10…14.4Vdc (typical 12Vdc); On-board battery charger, input from photovoltaic panel, with battery monitoring (deactivation of the load <10,5Vdc, restart >12Vdc) or power supplier 220Vac/12Vdc
Average autonomy of a weather station with 7 measures	• **>15days**: with 12Vdc/7Ah battery, 20W photov. panel, storage: 5' transmission: 60' • **>30days**: with 12Vdc/18Ah battery, 30W photov. panel, storage: 5' transmission: 60'
Transmission of elaborated data	Wireless via **GSM/GPRS** on FTP area wired via **RS232/LAN** cable with PC free software for data download
Transmission of istantaneous data	Option: sensor signals duplication on a interface with **RS485 MODBUS RTU** slave / **TCP/IP** output
Alarm transmission	via e-mail using MeteoGraph web (with GPRS data transmission)
Programming	On site: setting of text file in the SD Card memory
Settable parameters	• Date and time with NTP synchronization (network time protocol) • Anemometer and rain gauge constants • Storage rate (5, 10, 15, 30 or 60'); • Transmission rate (5, 10, 15, 30 or 60');
Elaborations	Min, max (gust), arithmetic average, standard deviation, turbulence; trigonometric average; sum; diagnostic measure for battery voltage. Calculable measurements (if the weather sensors that allow the calculation are present): Evapotranspiration Et0, TD Dew point temperature, TWB wet bulb temperature
Data storage	Data backup of 500 days with circular storage
Conformity	Annex 8 – WMO (World Meteorological Organization)
Working temperature	-30…+70°C
IP65 Enclosure (basic version)	Plastic material Dim.(LxHxP): 250x350x160mm, key closure and universal brackets for mounting on the pole.

mSOL3

Datalogger mounting in the IP65 container

RADIOMETRIC SENSORS Model	PIRSC – Photovoltaic effect pyranometer for global solar irradiance or direct normal irradiance (DNI) on photovoltaic panel
Measuring range	0…2000 W/m^2
Transducer	Silicon cell
Spectral Range	4…1100nm
Accuracy (typ.)	±3.5%
Typ. Output	4…20mA
Calibration	With ISO9060 First Class pyranometer

Models	PIR2S / PIR01 / PIR02 – Thermopile pyranometers (global solar irradiance)
Measuring range	0…2000 W/m^2
Transducer	Thermopile
Spectral Range	PIR01 and PIR02: 300…2800nm; PIR2S: 283…2800nm
ISO9060 accuracy classes	PIR2S: Secondary standard (high quality) PIR01: First Class (good quality) PIR02: Second class (moderate quality)
Typ. Output	4…20mA
Available certifications	ISO9001 in compliance with ISO9847 norm

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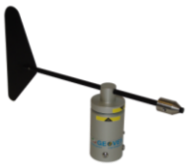
METEOROLOGICAL SENSORS Models	mSTA – Air temperature sensor STC – Contact temperature sensor
Air Temperature - Range	-40…+60 °C (air)
Transducer	Pt100 with screen protection
Accuracy	±0.2°C
Contact temperature - Range	-50…+100 °C
Transducer	Pt100 with stick tape for photovoltaic panel
Accuracy	±0.2°C
Common characteristics	
Power supply	+9…+24 Vdc
Typical Electrical output	Vers. –V: 0…5Vdc or –I: 4…20mA

Model	mWS1 – Wind speed sensor
Range of measurement	0…50 m/s (typical) gusts >70m/s
Transducer	Magnetic with sine signal not AC powered
Mechanical rotation	Over high performance bearings
Typical Electrical output	Vers. –N: sine wave AC (frequency max 200 Hz)
Instrumental constant	4.3 Hz/m/s (typical)
Accuracy	± 0.02 m/s

Models	mWD1 – Wind direction sensors
Range	0…359°
Transducer	Linear Potentiometer with continuous 360°
Rotation	High performance bearings
Anti-icing heater	12Vdc/1W (only for WD2 model)
Accuracy	< ±2°



SUN-TRACKERS STATION TO MEASURE GLOBAL, DIFFUSE AND DIRECT IRRADIANCE Model	**STR21-G** – Sun-tracker with pyrheliometer for automatic measurement of the direct normal radiation (DNI)
	PYRHELIOMETER (DNI measurement)
Measure Range	0…2000 W/m^2
Spectral Range	200…4000nm
Transducer /Typ.Sensibility	Thermopile / 10µV/ W/m^2
Accuracy Class	First Class ISO9060
Time response	<1s
Typical output	Vers. –I: 4…20mA
	PYRANOMETERS (GHI and DHI measurements)
Measure Range	0…2000 W/m^2
Spectral Range	285…3000nm
Transducer /Typ.Sensibility	Thermopile / 10µV/ W/m^2
Accuracy Class	Secondary standard ISO9060
Typical output	Vers. –I: 4…20mA
Model	**SUN-TRACKER** Single arm (Option: double arm) with shadow disk for DHI measurement, and base for pyranometers mounting
Pointing accuracy	<0.01° (solar elevation 0…87°)
Angle Resolution	0.009°
Sun Sensor Field of View	±15°
GPS Sensor positioning start time	About 5 minutes
Power	220Vac/50VA (24Vdc on request)

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Model	SPN1 –Automatic pyranometer system for measuring of global and diffuse solar radiations and sunshine duration without any manual regulation.
Measuring Range (typ.)	0…2000 W/m^2
Spectral Range (typ.)	400…2700 nm
Transducer	Thermopile
Accuracy class	1st class ISO9060, ±5% daily expected uncertainty
Typical Electrical output	Vers. –I: 4…20mA

POLES and BRACKETS Models	PF2-55	PF3-55
Heights (m)	2	3
Type	Fix	telescopic
Wind load	130km/h	130km/h
Diameters (mm)	Base: 55 Top: 55	Base: 55 Top: 50
Weight (kg) guy-wires and accessories excluded	6kg	11kg
N. of guy-wires	None	None
N. of elements	1	2
Housing	Galvanized steel	Galvanized steel
Required workers x installation	1	1

Installations on a mover plant and on inverters shelter

MicroSOL1 – Portable Station for control of meteorological parameters on photovoltaic plants

The portable station is provided by a datalogger mod. MicroMET2-LP for data acquisition and storage; the datalogger is powered from batteries and can interface a pyranometer and several meteorological sensors such as *air temperature, panel temperature and wind speed* in answering of guidelines pointed out in the **IEC 61724**, **CEI 82-25** and **IEC 60904** norms**.**

The station is extremely easy to mount thanks to a foldable tripod that is suitable for every kind of flooring; furthermore it's simple to connect thanks to cables with fast plug and double heading (datalogger and sensor side).

The station is provided also by a carrying case, shock and water proof, that contains all instruments and the *Geodesk software* for the management of data stored in the SD card and the data export in Excel.

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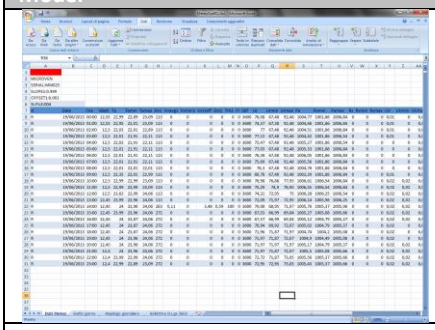
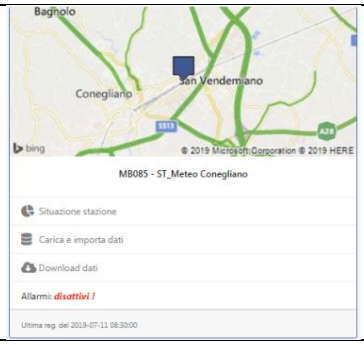
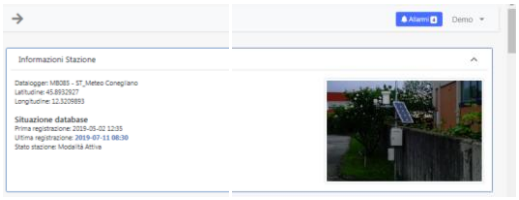
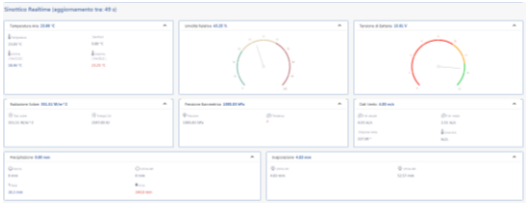
SOFTWARE **Model**	**Geodesk & MeteoGraph – Web software for environmental data management**
	**Geodesk** is a basic service software, free supplied with all Geoves datalogger, that can import data recorded (on SD card or sent via GPRS or transmitted by cable from the datalogger) and generate a single data file in Excel format. In this way it's possible to create data aggregation of desired period (eg. Monthly) and then derive the tabular and graphical reports. Besides Geodesk creates the setup configuration for the functioning of Butterfly, Micro3 and LPDL Geoves dataloggers
	**MeteoGraph** is a web application for the numerical and graphic display of data transmitted via GPRS on FTP area from environmental monitoring stations with Geoves datalogger. The software relies on an FTP Geoves area where data is sent autonomously by the control units at fixed times and are available in **standard text format** with fields separated by commas (**CSV format**). The data is therefore **always usable** without the need to use proprietary communication protocols or specific programs for data decoding; furthermore, the software **does not require any installation** as Internet access is sufficient and a username and password must be entered to enter the dedicated web page and display the measurements from a PC, tablet or smartphone. The data in text format are processed by MeteoGraph to obtain on the web page both the measurement in numeric format (eg average minimum maximum trend, etc.) and in graphic format that can be downloaded in jpg bitmap format.
	**Station dashboard** The available functions are: • *Station situation*: access to the graphic processing page and to the station's synoptic • *Load and import data*: the data saved on the datalogger SD card are imported, or on a PC folder (or other support) • *Data download*: data are downloaded in text format with fields separated by commas for simple backups or subsequent processing with other applications (eg Excel, Access, external databases or other commercially available software) • *Alarms*: access to the station alarm management menu (optional on request)

	**Station situation - *Station information***
	The parameters displayed are:
	• Station unique identifier (ID)
	• Name of the station
	• Geographic coordinates (Latitude and Longitude)
	• Data base status:
	  ○ Date and time of Start data storage
	  ○ Date and time Last data storage
	  ○ Operation status of the station
	• Photos of the station

	**Real-time synoptic of the station** The synoptic is a very useful tool for assessing the situation of the latest measurements taken by the monitoring station and assessing the meteorological or environmental situation of the site. For each measurement it is possible to associate one or more dedicated processes. For example, for the temperature it is possible to indicate the minimum and maximum value and the time in which it occurred in addition to other calculated measures such as the dew point. The synoptic also shows: • calculated measures • Diagnostic data (eg battery voltage) • Significant data for the interpretation of the measure (eg barometric tendency, wind chill, monthly precipitation, etc.)

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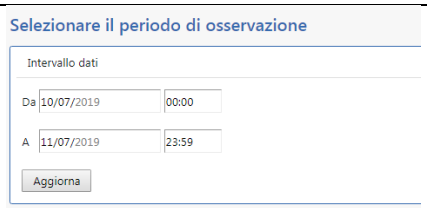
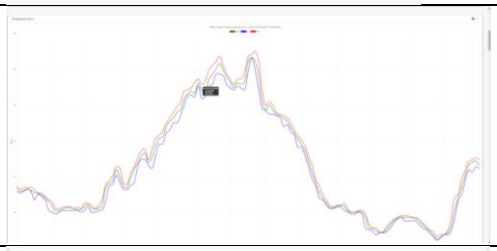
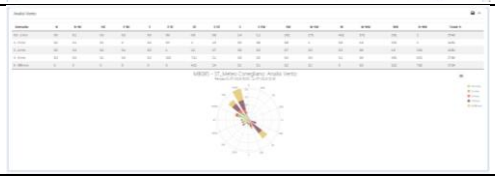


Observation period
It is possible to select the observation period in which to carry out all the elaborations that are displayed by MeteoGraph



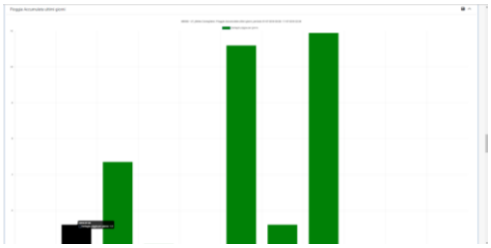
Graphic elaborations

- **Linear multi-line** for measurements where the arithmetic average is applied (eg temperature, humidity, pressure, etc.) with representation of the minimum and maximum value



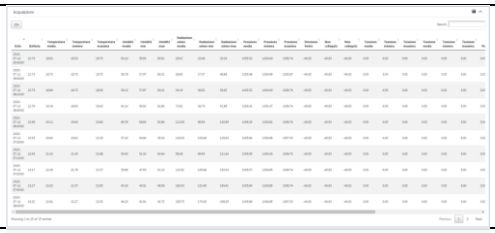
Graphic elaborations

- **Wind-rose** for the anemometer measurements

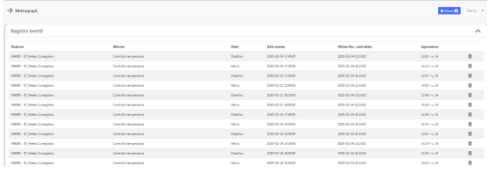


Graphic elaborations for precipitation

- Graph with hourly summation
- Monthly or annual precipitation histogram
- Other graphs are available on request or can be customized with simple filters



Tabular elaborations
Daily data table can be downloaded both in text and in .png image format



Alarm management
To manage alarms, the software allows you to set upward (> value) or downward (<value) intervention thresholds, after which alert emails are sent to the personnel in charge.
The alarms are then represented on the screen with adequate effects and colors to attract the attention of the operator

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