LSI LASTEM

Environmental Monitoring Solutions

Pluvi-ONE Data Logger

- ▶ Linux operating system for data processing and communications. Open architecture based on integrated Linux PC

- ▶ Smart rain analysis: totals, intensity, mobile total, current total

- ▶ Integrated web server for real-time data, diagnostic information and data download to Excel files via Internet browser

- ▶ Alarms: use of instant messaging system MQTT, SMS, Email and local digital outputs

- ▶ 400 Mb large multi-level data memory. Removable 8 Gb external memory

- ▶ 3G/4G communication, Wireless Router, Ethernet, WiFi, Satellite. Redundant dual system with automatic switch from one mode to another

- ▶ Data communication protocols: Modbus TCP data, FTP (client/server), SFTP, SMTP, SAP, MQTT, http

- ▶ Setup of the correction formula for Class A rain gauges. Management of double rain gauge with redundancy logics and data quality

- ▶ Additional inputs for optional sensors: Temperature, RH%, Water levels, Storm front distance

- ▶ Remote system configuration also via modem, without the need of fixed IP SIM Card with or VPN. Data logger configuration saved on FTP server ready for its upload on a remote Alpha-Log system. Local upload using USB flash drive or connected PC

- ▶ Remote firmware update

Pluvi-ONE is a data logger dedicated to rain monitoring plus other related quantities for hydrological applications where early warnings activities are required. Pluvi-ONE has a series of unique features currently available in a single device and represents the current "state of the art" for rain measurement systems and early warnings activity in hydrometric monitoring networks.

▶ *Pluvi-ONE is an optimized system for measuring and sending data and alarm messages concerning Rain (accumulations and intensity), Water Level, Storm front distance correlated with air Temperature and Relative Humidity measurements. Pluvi-ONE can be completely autonomous as regards the energy part and telemetry. Pluvi-ONE is optimized in size and energy consumption, as well as being extremely easy to transport and install.*

▶ Inputs for analog and digital sensors

- N.2 digital inputs for two independent rain gauges, or one rain gauge with double reed relay.

- N.1 UART input for Storm Distance sensor (DQA601.3)

- N.1 PT100 input for Temperature sensor

- N.1 0÷2 V input.

- Integrated Absolute Pressure sensor
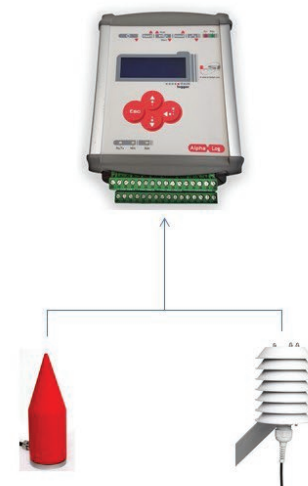
- Integrated internal Temperature sensor
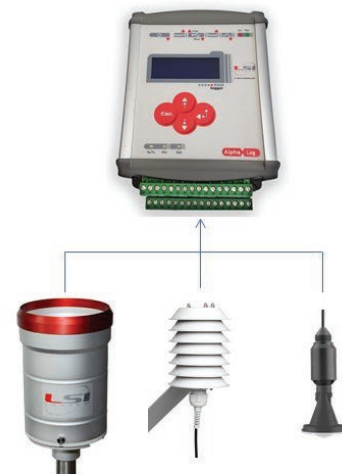
- • N.2 Pulse inputs for Rain gauges
- • N.1 Pt100 input for Temperature sensor
- • N.1 0÷1 V input for Water level sensor

▶ Inputs for Serial sensors

N.1 UART input for:

- Storm Distance sensor (DQA601.3)

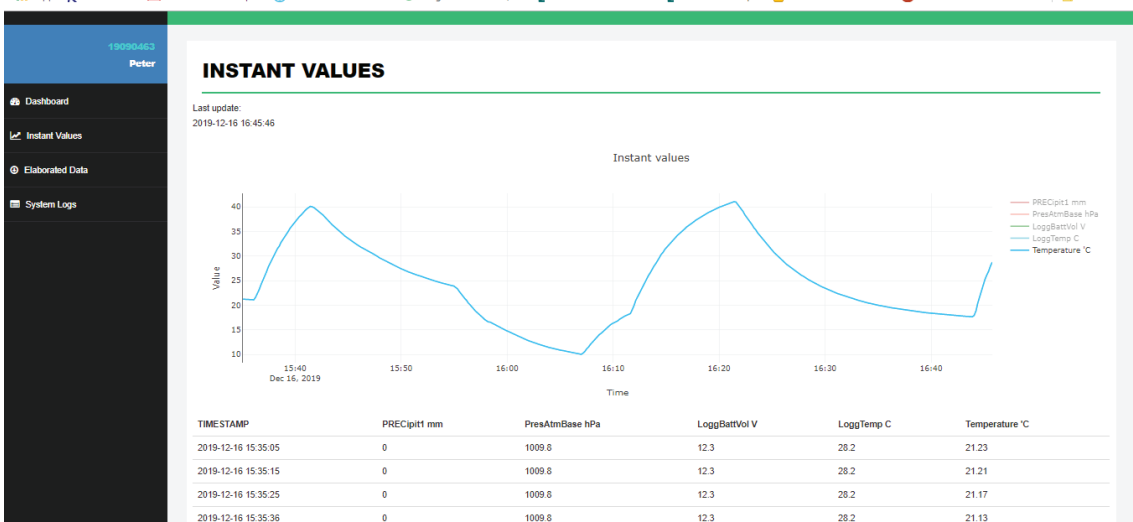- Temperature and RH sensor (DMA672.1/.4)

N.1 UART digital sensor for:
- • Storm front distance sensor
OR
- • Temperature and RH% sensor

▶ Internal web-server

Alpha-Log has an internal web-server.
Using any Internet browser, the following information are available:

- Diagnostic information (system date/hr, IP address, battery status, events/alarms log, output status, etc.

- Instant values

- Data downloading from memory (ASCII, CSV, Excel, ZIP)

- *Real-time chart of the selected parameter*

- *Numeric values of all instant values*

INSTANT VALUES

Last update:
2019-12-16 16:45:46

Instant values

TIMESTAMP	PRECipit1 mm	PresAtmBase hPa	LoggBattVol V	LoggTemp C	Temperature °C
2019-12-16 15:35:05	0	1009.8	12.3	28.2	21.23
2019-12-16 15:35:15	0	1009.8	12.3	28.2	21.21
2019-12-16 15:35:25	0	1009.8	12.3	28.2	21.17
2019-12-16 15:35:36	0	1009.8	12.3	28.2	21.13

▶ Sensors acquisition rate

Acquisition rate is programmable for each input (from 1 sec to 12 hours). To limit energy consumption from sensors requiring power supply, it is possible to set an advanced power supply from the acquisition event, (warm-up) that is interrupted immediately after the acquisition itself.

▶ Data elaboration

Statistical elaboration of the raw data within one or more time basis (from 1 sec to 24 hrs):

- Average/Minimum/Maximum/Standard Deviation;
- Wind elaborations;
- Totals, Current Totals (useful for rain totals (*)
- Current (*) and Mobile (**) Average/Minimum/ Maximum/Standard Deviation;

*Currents are values in which the statistical basis corresponds to the time elapsed since the last reset up to the current time. The reset time is programmable. Example: total rainfall of the current day (from midnight to the current time).

** Mobile values are whose statistical basis corresponds to the last observation period. Example: moving average of temperature over 10 minutes (every minute the value is updated always considering the average value of the last 10 minutes).

▶ Rain intensity calculation

Pluvi-ONE produces rain intensity (mm/hr) elaborations. This parameter is based on the time elapsed between two tilts of the rain gauge. For a correct calculation, it is possible to set the time from the las tilt of the bucket, above which, Pluvi-ONE resets the rain intensity calculation.

▶ Data Memory

Large internal memory (400 MB) plus an extractable USB external memory (capacity up to 32 GB) with FAT32 file system. The external memory can be read directly from a PC. Alpha-Log stores data in ASCII format. The open operating system allows to develop alternative storage formats.
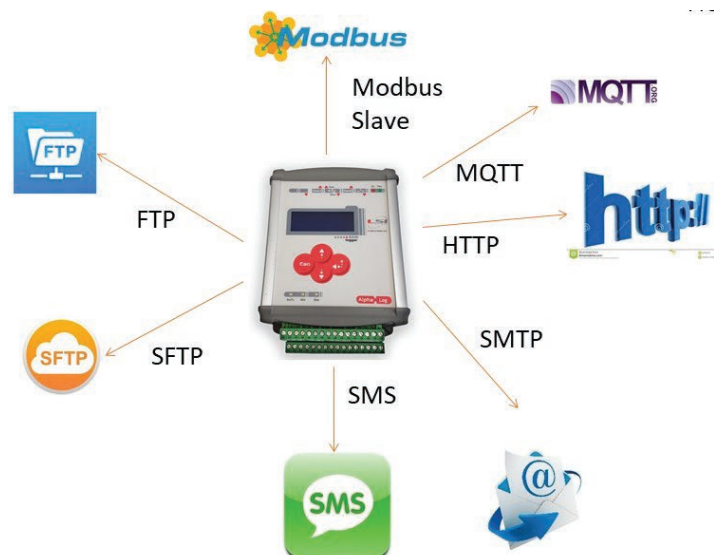
▶ Data communication (devices)

- It is possible to send data to multiple independent remote servers (up to 3 servers) by means of different devices:
- 3G-4G modem
- 3G-4G router
- Ethernet, Wi-Fi
- Satellite

Pluvi-ONE can be connected simultaneously to two communication devices and automatically choose the best option according to the availability of the signal, thus optimizing communication performance and its cost.

▶ Data communication protocols

Available data communication protocols:

- FTP (ASCII format)
- SFTP (ASCII format)
- SAP (Simple ASCII Protocol, property)
- Modbus-TCP
- MQTT (to Broker MQTT)
- SMTP (Email)
- HTTP (see *Internal web-server* part)
- SMS

● Data communication protocols (Modbus)

Data delivery to Modbus Master devices using:

- Modbus TCP on Ethernet

Transmitted data by Modbus protocol can concern instantaneous values, but also mobile statistical values.

Mobile values are whose statistical basis corresponds to the last observation period. Example: moving average of temperature over 10 minutes (every minute the value is updated always considering the average value of the last 10 minutes).

● Communication time rate

Depending by the protocol and the communication device used, it is possible to choose the shortest data communication time base to the remote server:

- Via FTP: minimum 3 minutes
- Via MQTT: minimum 1 s.

It is possible to set different data communication rate according to alarm statuses. For example: increase the communication rate when the rain intensity is greater than a certain programmable threshold.

● ASCII file data format

The main data stream to the server (one or more servers) is made using ASCII (*txt) file by FTP protocol. The content of each colums inside the file is user's configurabe.

1st column: yyyy/mm/dd

2nd column: hh/mm/ss

After the 2nd column it is possible to add following programmable information:

- Meta data: fix values in numeric format
- Data Elaborations. (read Data Elaboration)

The sequnce of the columns after the second column is programmable.

● Switched power supply outputs

N.3 electrical independent and protected outputs. Outputs are useful to power sensors and external devices. They are activated with configurable logics depending by the sensor requirement or event occurrences. These outputs become relay outputs using an external module (MG3023, only when power supply is up to 12 Vdc).

Modbus-TCP - Ethernet

SCADA

● Warnings by SMS, Email and MQTT

Notifications/alarms delivery:

- Email: with editable text, scheduling and distribution lists. Email attachment contains the file with the data that generated the event. Possibility of replicating the Email message via SMS via applicable Web services.
- SMS: with editable text, scheduling and distribution lists, up to 5 users. Active only when the device is working in low-power mode.
- MQTT: Pluvi-ONE can send data to a MQTT Broker server: instant values, elaborations and alarm notifiations.

● Built-in absolute pressure sensor

Alpha-Log has in internal Absolute Pressure sensor, 500÷1100 hPa range, ±0,3 hPa (-20÷85°C) accuracy

▶ Peripherals

Pluvi-ONE is equipped with the following peripherals:

- N.1 RS232-DCE port (EMI, IEC, ESD, EFT filters)
- N.1 RS232-DTE port (EMI, IEC, ESD, EFT filters)
- N.2 USB Host ports, Type-A connector
- N.1 Ethernet port (RJ45)

▶ Firmware update

Pluvi-ONE firmware can be updated remotely, or locally via USB pen-drive.

▶ Configuration

Pluvi-ONE's configuration is carried out by means of the 3DOM program on PC. The configuration file is sent to the LSI-LASTEM (or others) FTP server. Pluvi-ONE is programmed to import the configuration file directly from this FTP server.
The file can also be sent by Ethernet port or saved on a pen drive and loaded, via the USB port, into the instrument.

Pluvi-ONE firmware can be updated remotely, or locally via USB pen-drive.

▶ Local Display

Pluvi-ONE is equipped with a backlit LCD display (4x20 chrs). The following information are listed:

- Real-time measurements list
- Last 20 alarms list
- Communication statistical information
- System date/time start /actual
- Operative mode
- Battery status
- IP address
- Servers list
- Internal/external memory status
- Electrical output status
- Etc.

▶ Camera

Pluvi-ONE can manage an external independent IP camera switching on/off rules using programmable logics related to the measurement and alarms status. In this way, it is possible to increase/decrease the number of images according to the programmed events in order to reduce the system's power consumption and communication costs.
The IP camera can be connected to the same Router used by Pluvi-ONE for data communication.

▶ Clock synchronization

The internal clock (accuracy 1 min / month) is updated through NTP (Network Time Protocol) whenever Pluvi-ONE activates an Internet connection - The time zone is defined by the configuration.

● Power supply

Pluvi-ONE runs at 9÷30 Vdc. The internal regulator allows to charge an external Pb battery (up to 5 Ah), through solar panel or main power supply.

● Power consumption and battery duration

Pluvi-ONE average electrical consumption is 0.03 W during stand-by and measurements; 2,4 W with active communication. This power consumptions do not include the external communication device.

Comm.rate	Consumption Pluvi-ONE (average)
1 com/day	60 mW
1 com/hr	600 mW

Using 3G modem. Display off. Sensors without own power consumption

Comm Rate	Battery capacity battery life (days)		
Battery type	9 Ah	15 Ah	40 Ah
1 com/day	100	150	400
1 com/hr	7	10	30

Power autonomy in days. Pluvi-ONE only. Using 3G modem, no powered sensores, starting from fully charged battery and without sun

● Software
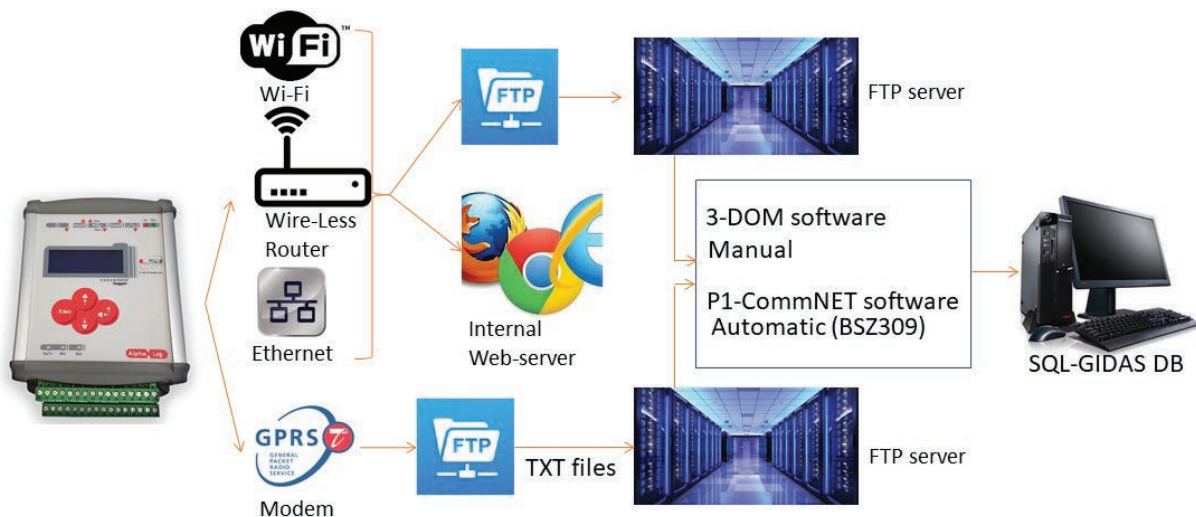
Pluvi-ONE pushes data to the server for their further management without any specific LSI LASTEM software applications. However, from the server, it is possible to upload the same data on a PC, where it is possible to use any LSI LASTEM's application that uses the SQL-Gidas database (see the LSI LASTEM's software catalogue); to do this, there are two possibilities:

- Using 3DOM program: data downloading (in manual mode) from a specific FTP area (where Pluvi-ONE has sent its data) and saving them on a local SQL-GIDAS database (or TXT file).

- Using P1-CommNET program (BSZ309): data downloading (in automatic and continuous mode) from a specific FTP area (where Pluvi-ONE has sent its data) and saving them on a local SQL-GIDAS database (or TXT file).

● Installation

Pluvi-ONE can be placed inside IP66 enclosure (ELF series). LSI-LASTEM offers a selection of ELF enclosures (see Accessories) against shock, water, dust and atmospheric agents. Depending on the ELF's models, the enclosure can also accommodate power systems, communication devices and batteries.


IP66 enclosure are available for both fix or portable applications.

● ELU001-002 enclosures

Depending by the installation requirements, Pluvi-ONE can be also placed inside ELU001-002 IP66 enclosure. ELU001-002 are special enclosures including the following parts.

ELU001:

- IP66 enclosure with transparent window. Room for Pluvi-ONE data logger and Modem (not included),

- Tiltable 20 W solar panel (included),

- 9 Ah battery (included),

- Bar for sensors mounting (included).

- IP67 connectors (included) for Rain gauge's cable (DWA505.1) and T+RH% (DMA672.4) sensor
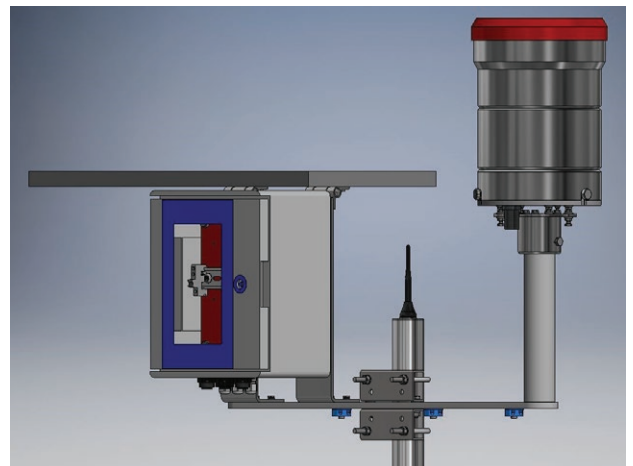
ELU002:

- IP66 enclosure with transparent window. Room for Pluvi-ONE data logger and Modem (not included),

- 85-264 Vac power unit

- 9 Ah battery (included),

- Bar for sensor mounting (included).

- IP67 connectors (included) for Rain gauge's cable (DWA505.1) and T+RH% (DMA672.4) sensor.

Models Pluvi-ONE

Code	ELP001.1
Description	Pluvi-ONE data logger.
Inputs type	Terminal block
Analog inputs	N. 1 0÷2 Vdc input
Digital inputs	N.2 pulse inputs
RS232 ports	N.2
USB ports	N.2
RS485 port	NO
SDI-12 port	NO
Integrated Absolute Pressure sensor	YES
Integrated Temperature sensor	YES
On/off outputs	YES
Backlit display	YES
Threaded slot for tripod fixing	NO
Internal battery	NO
Plug for power battery charger	NO
Included accessories	Ethernet cable, DIN-bar mounting.

Technical features

Inputs Pulses (Rain gauge)	Inputs number	N.2
	Features	Redundancy modes: • N.2 single relay reeds from two rain gauges • One rain gauge with double reed relay system
	Power supply	Limited to 1 mA per reed relay
	Input type	Open collector with 3.3 V pullup resistance (positive input)
	Max input frequency	480 KHz
	Linearization	Yes (using correction formula for Class A rain gauges according to - UNI11452-2012)
	Protections	• From reed relay rebounds • From over-tension (> 5V) • 400 W peak pulse power capability at 10/1000 μs waveform Repetition rate (duty cycle): 0.01 % • IEC-61000-4-2 ESD 30 kV (air), 30 kV (contact) • ESD protection of data lines in accordance with IEC 61000-4-2 • EFT protection of data lines in accordance with IEC 61000-4-4
Input (Temperature RH%)	Input	UART-TTL (DMA672.1 sensor), (DMA672/.4 sensor when ELUxxx box is used)
	Range	Temperature: -40÷70°C RH%: 0÷100% DewPoint: -40÷70°C
	Resolution	Temperature: 0,1°C RH%: 0÷100% Dew Point: 0,1°C
Input Pt100 (Temperature sensor)	Input	Pt100 (3 wires)
	Range	-40÷70°C
	Resolution	0,1°C
	Accuracy	±0,25 °C
Input Voltage	Range	0÷2 V
	Resolution	NA
	Accuracy	NA
Internal Measurement (Absolute Pressure)	Range	500÷1100 hPa 500÷1050 hPa range, ±0,3 hPa (-20÷85°C) accuracy
	Resolution	Typically 0,084 hPa
	Accuracy	±0,3 hPa (-20÷85°C)
	Long term stability	±1 hPa/year
Internal Measurement (Power)	Mode	Battery or power supply level
	Type	Voltage
RS232 Ingresso/uscita	Inputs numb.	N.2
	Mode	• Connection to Input Extension Module (MDMMA1110) • Connection to communication devices (modem 2G/3G, radio). • Connection to SCADA/PLC devives (Modbus RTU - Slave protocol) • Connection (Com.2) to Storm Distance sensor (DQA601.1)

USB Input/output	Number	N.2
	Type	Host, connector type A
	Mode	• Connection to pen-driver • Connection to Wi-Fi antenna (optiona)
Switched power supply outputs	Outputs numb.	N.3 (programmable triggering)
	Type	Solid-state output V Out = V In
	Max tension	1,1 A for eac output
	Mode	• External sensors power supply • Communication system power supply • Alarm • Timer (date/time or cycles)
	Protections	400 W peak pulse at 10/1000 μs waveform. Repetition rate (duty cycle): 0.01%
Memory	Type	Three levels storage system for greater reliability: • 8/16 MB on Flash chip LSI LASTEM file system • 400 MB on Flash chip with UBIFS file system • Up to 32 GB on USB memory stick with FAT32 file system
User interface	Display	57x19 mm. 4 lines x 20 char.
	Keyboard	N.4 buttons
	Leds	Diagnostic about:: • Data transmission activity • System status • Battery charge status • Internal Linux computer status (ready/error)
Clock	Accuracy	1 minute/month accuracy.
	Synchronization	Automatic from internet time (NTP).
ADC	Resolution	12 bit oversampled to 14 bit; 16 bit optional.
	Filter	Noise filtering for 50/60 Hz.
Data transmission	Modem	External 2G/3G modem (connection to RS232 port)
	Router	3G/4G router (connection to Ethernet port)
	Wi-Fi	External antenna connected to USB port
Linux Computer	Type	Linux based internal computer with open and end-user extensible architecture.
	Processor	32 Bit
	ADC converter	16 Bit
	Power modes	• Always ON (always connected to Internet) • Automatic power ON (awake for data transmission only, best energy performance)
	Linux kernel	V. 2.6.35, Debian Wheezy distribution
	Ethernet	Ethernet 10/100 Mbps

	USB ports	Nr. 2 USB ports, Host, Type-A connector
	Flash memory	2 GB Flash with UBIFS file system
	RAM	128 MB
Watch dog	Type	Dual/redundant watch dog system
Power supply	Power supply	6÷30 Vdc
	Inputs	Separate inputs from 6÷30 Vdc power supply: • From solar panel (17 Vmin), Max current: 5 A. Recharge voltage: 13,8 V • From battery/main power supply, Max current: 5 A
	Peak pulse power capability	400 W peak pulse at 10/1000 µs waveform, Repetition rate (duty cycle): 0.01 %.
	Battery charge	17 V
	Protections	• IEC-61000-4-2 ESD 30 kV (air), 30 kV (contact) • Over-current protection by self-replacing PTC fuse • Polarity inversion protection • Over current protection by input power supply(>33V) • 400 W peak pulse power capability at 10/1000 µs waveform
Environmental limits	Operating temperature	-30÷60°C
	Operating humidity	10÷99 % RH, not condensing (conformal coating option)
	Storage temperature	-40÷80 °C
Physics	Weight	600 gr
	Dimensions	160x125x50 mm.
	Mounting	DIN mounting rail 35 mm
EMC	Protections	EN61326-1 2013