Rain Gauge

Mod. PL400 and PL1000
Mod. PL400R and PL1000R
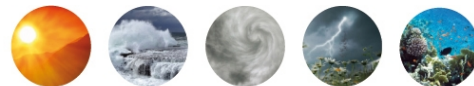

Manual

Summary

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1.1   *Packaging and mounting*

The sensor is placed in its original packaging already mounted.

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1.2 Functioning and features

PL400 or PL1000 rain gauge is made of a rain gathering system funnel shaped, which carries the rain in the measuring system mounted inside. Such system is made of a transductor with **knife blade receiver with double bowl**, which gathers and measures the rain. It's made according to **WMO** (World Meteorological Organization) norms and to UNI 11552:2012 classification. A special device (reed contact) detects the receiver switching, filtering any noise due to fake rebounds thanks to specific mechanical and electrical solutions (anti-rebound).

The **gathering mouth** is defined by **very thin edge** to minimize the possibility that raindrops fall on the edge and then slip outside.

The **funnel shape**, first cylindrical and then conical, with different angles in accordance to WMO norms, **holds splashes of raindrops** falling inside the funnel, within it. The cone slope and it's particular finishing minimize the superficial retention of the drops.
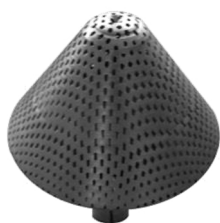
A **perforated filter** inverted cone shape (graspo) and **removable**, placed on the funnel bottom, **retains impurities and other dirt**, allowing more water to pass through it. The **nozzle**, placed under the funnel, is **dimensioned** in such a way as to ensure a constant water flux regulation **in case of sudden rainfall of high intensity**, decreasing the reason of a typical error of the rain gauges in this condition.

The particular **form of the receiver support system**, **reduces to a minimum friction** and thereby the measure uncertainty during the tilting.

The **cylindrical body is easily removable** thanks to a hinge, to do **maintenance and cleaning** and any on site inspection.

Finally, specific adjustment screws allow a perfect levelling of the detection system.

Sensor type	Wind speed
Type	PL400 and PL1000 Class A UNI 11552:2012 only A,B,C type
Compliance	WMO – CE
Measuring range:	Unlimited
Security range:	Unlimited (max measurable intensity 0 ÷ 300 mm/h)
Transducer type	Tilting Bucket
Electrical output carachteristic:	Pulses, 4÷20mA, 0÷2Vdc or RS485/Modbus serial
Expected ideal electrical output	0.2 mm/imp. (reed clean contact) (0.1mm on demand)
Output impedance	1Ω/1MΩ
Protections	Electrical Discharger and debounce circuit
Accuracy	0.2 mm/h at 60 mm/h, ±2% over 60mm
Sensibility and Resolution	0.2 mm
Linearity	<|2%|
Repeatability	max 0.2 mm/h at 60 mm/h
Operation intervals	temperature -40 ÷ +70°C (heated type); relative humidity. 0÷100%; wind speed 50m/s with gusts 60m/s
Made of	aluminum alloy, Teflon inserts and stainless steel receiver
Weight	1,4 Kg
Size	ømax230 mm; h345 mm; **S=400cm² PL400** ømax360 mm; h600 mm; **S=1000cm² PL1000**

Features written in the table can be modified. For updating always see the latest version of the datasheet.

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1.3 Available electrical outputs and interfacing

2. The sensor is usually available with 4 different outputs (pre-configured in factory), that correspond to 4 order codes, respectively (named XXX the sensor code):

XXX – **N** : Sensor with natural output, that is pulses [**0.2mm/impulso**]

XXX – **A** : Sensor with voltage output 0-2Vdc = 0-100mm [**mm = (V• 100)/2**]

XXX – **B** : Sensor with current output 4-20mA = 0-100mm not self-powered [**mm = 100•(mA - 4)/16**]

XXX – **C** : Sensor with digital output RS485 o ModBus- see below.

For connections to IP68 connector, see the sensor datasheet.
The supply includes the solder connector or a cable with ends for terminal block.

In case of sensors with digital output, the output measure represents always the rain accumulation since last reset. The reset is automatic at 100mm. There are two cases:

- *RS845 Interface (Half duplex)*
  - Standard communication settings are:

baudrate:	**9600**
parity:	**N**
data bit:	**8**
stop bit:	**1**

  - Data request command is: **010CR** (xxx represents the sensor ID always expressed in 3 digits by putting 0 for numbers less than 100, or 10, example 010;
    CR = Carriage Return; if set at 000 answer all sensors on the same line 485, example 000CR). See § 1.8

  - The response to any sensor request is the measure value in the programmed engineering unit (es. °C o %Rh), so isn't necessary calculate the value again.

- *RS845-MODBUS Interface (Half duplex)*
  - Standard communication settings are:

baudrate:	**9600**
parity:	**N**
data bit:	**8**
stop bit:	**1**

  - The sensor answers to MODBUS RTU command only with **FUNCTION CODE 0x03** (Read Holding Register), on the same ID of the RS485; the protocol allows the reading of the measure value, which is stored in two MODBUS registers with the **IEE754 representation.** The floating point value is represented with 32 bit, occupying two MODBUS registers of 16 bit.
  - Modbus addresses to be used are:

    40002 - 40003 (2 registers required with a single command)

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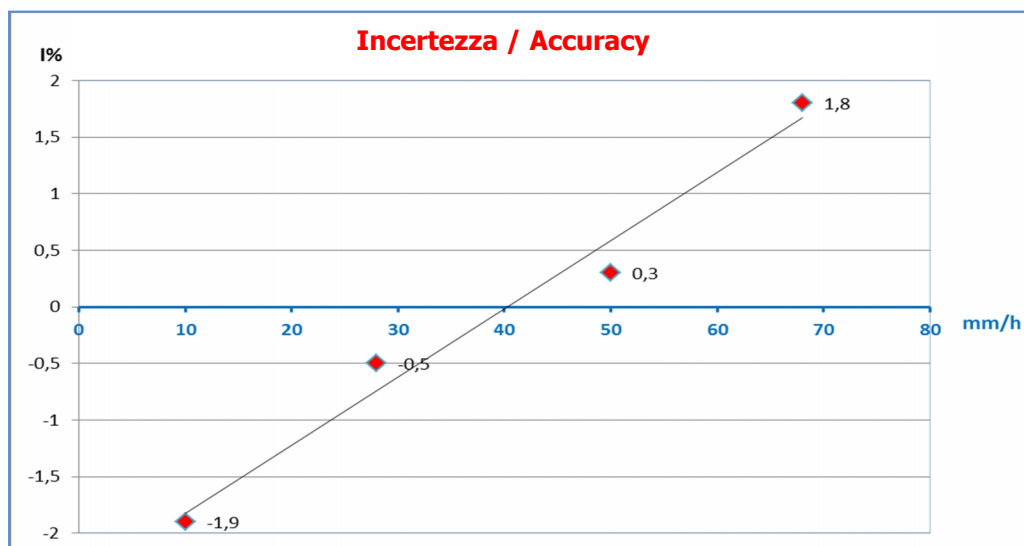
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1.4 Calibration

After having assembled the sensor, it is functionally tested, by sliding a flow of distilled water (about 25l/h) into the gathering funnel.
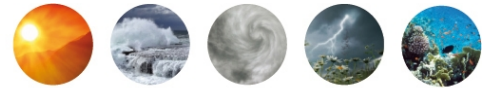
A special system (Rain gauge certification mobile laboratory: LAB-CERT) counts switchings made by the rain gauge and, via a specific bin for the gathering, the water is weighted with a precision balance certified by DKD. This automatic analysis system calculates the difference between measured switchings and expected switchings in a fix time interval, if the difference is less or equal to one switching, the device has been successfully tested, otherwise it's calibrated again. The automatic system, when the testing is positive, releases a printed data report with all the device characteristics (tilting capacity, speed of commutation, measured precision at known flow).

Repeating the test at different flux intensity, according to UNI 11552:2012 norm for **rain gauge classification**, it's possible to define the characteristic curve, and for A, B, C output type

Theorical quantity of precipitated H_2O	Detected quantity at the end of measurement	Produced intensity	Accuracy %
200g	196,2g	10 mm/h	-1,9%
200g	199,1g	28 mm/h	-0,5%
200g	200,7g	50 mm/h	0,3%
200g	203,6g	68 mm/h	1,8%

E%= 0,0603[mm/h]-2,4284 R^2=0,9774

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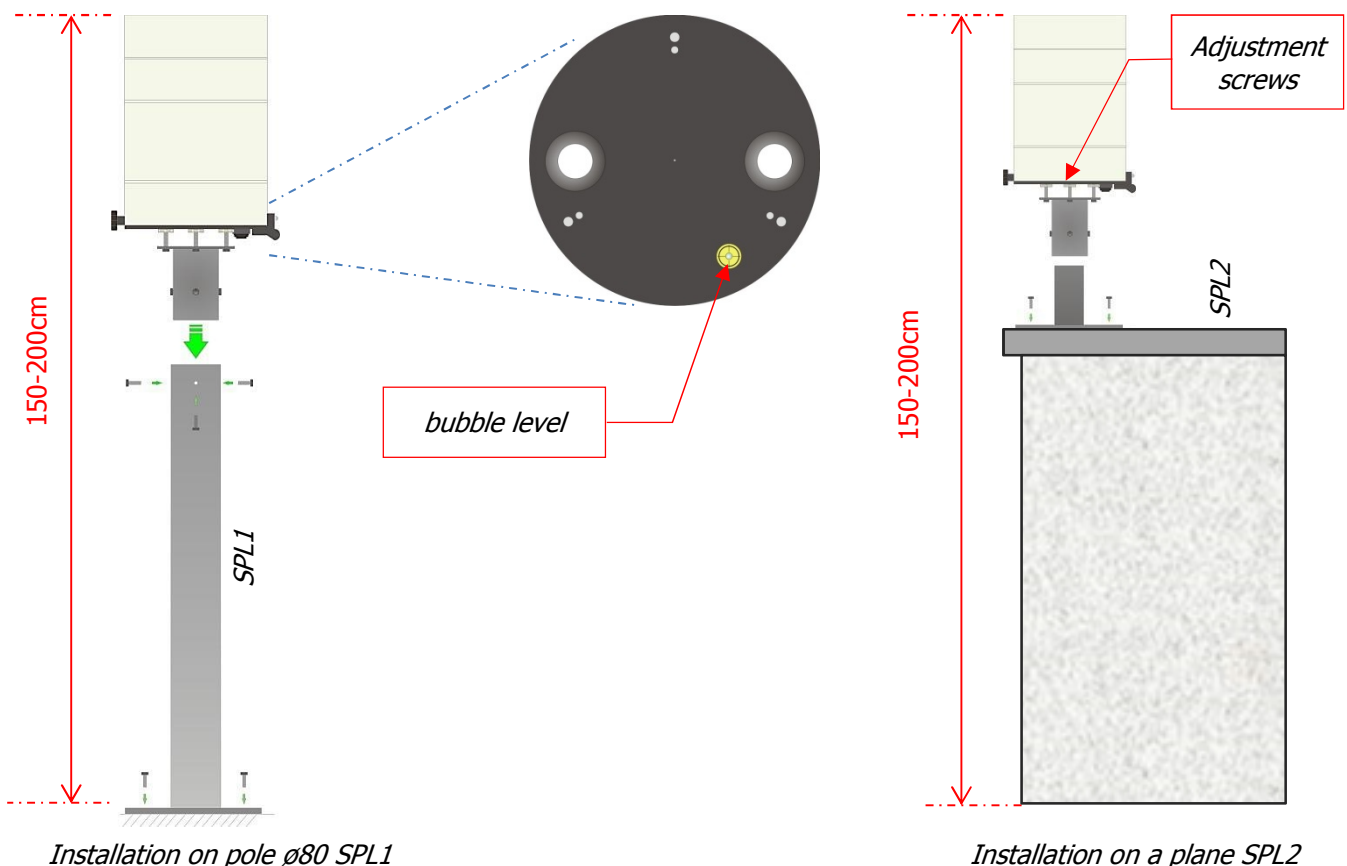
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1.5   Cleaning and maintenance

Every 1÷6 months, depending on where the sensor is placed and on wheater conditions in the period, it's necessary to check the filter cleaning, removing any debris, leaves or anything else that may obstruct normal water flow. The rain gauge should be opened using the proper screw handle with hinge on the side opposite to the hinge, and check that in the tilting bucket there aren't soil residue, sand or other blocking debris.
If necessary, surfaces can be cleaned with mild detergent (soap), or with clean water and a little nylon brush.
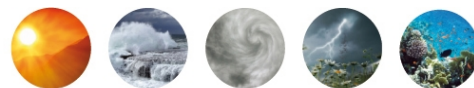
1.6   Installation

The sensor must be installed **far from obstacles** (houses, trees, constructions, etc ...), ensuring that the space above it is free from any object which can interfere with the rainfall mensuration and in a position easily accessible for periodic cleaning. According WMO norms, the **optimal distance from the nearest obstacle is about 3.5m**. A proper installation can be made **on a plane** or **on a pole at a height of at least 150cm** (height of the collecting mouth).
The rain gauge is already calibrated at 0.2mm (0.1 on demand) rain for each bucket commutation, any other calibration during the installation isn't necessary.
For proper working of the tilting device and a correct measurements, it's necessary that the rain gauge is placed perfectly level, using a bubble level on the rain gauge base. For a perfect positioning, that base has three adjustment screws with millimeter steps, to allow the perfect levelling by little adjustments.

Installation on pole ø80 SPL1

Installation on a plane SPL2

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1.7   Validity of certificates

Unless otherwise indicated, the sensor warranty is 24 months from the manufacturing date, while the validity of the certification is 12 months from first use if stored in a depot suitably to the characteristics written on the datasheet.

1.8   ID's sensor for serial communication

ID for RS485*	Measure
1	Temperature
2	Humidity
3	Global Solar adiation
4	Wind Direction
5	Evaporation
6	Hydrometic Level
7	Phreatic Level
8	Battery Voltage
9	Wind Speed
10	Rain Fall
11	Net Solar Radiation
12	Snow Level
13	Pressure
14	Voltage
15	Evapotranspiration
16	Leaf wetness
17	pH
18	Conductivity
19	Counter (digital)
20	Cracks measure
21	Inclinometer
22	Load Cell
23	Redox
24	Oxygen Solution
25	Torbidity
26	Extensimeter
27	Linear Moving
28	Frequency
29	CH4
30	THC
31	NMHC
32	Current
33	Flow
34	CO
35	NO
36	NO_X
37	NO_2
38	O_3
39	SO_2
40	Energy

* Check if it is the latest table

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