WLRD12-4DI

User Manual

Pulse counter

Capetti
ELETTRONICA

WineCap LoRa

General warnings.

- The following information must be read and understood before proceeding with the installation, commissioning and maintenance of the devices described in this document.
- **ATTENTION!** Any omission or failure to follow these instructions scrupulously can cause danger.
- **ATTENTION!** Explosion hazard. In case of batteries substitution, make sure that the type is compatible and complies with the specifications indicated by the manufacturer.
- In case of batteries substitution, **DO NOT** disconnect the flat cable which connect the electronic boards without removing batteries before
- ALWAYS substitute all the batteries, also in case of one single battery exhausted.
- If the device is powered by a fixed network, make sure you have disconnected the power supply before carrying out any type of intervention. Failure to comply with this indication can cause damage to people and/or property.
- Follow the manufacturer's suggested warm‑up time (*time required to obtain a reliable measurement*) of the transducer.
- Follow the manufacturer's suggested electric wiring of the transducer to measure (*ground shields at a single point, cable length and section*); voltage measures on distances exceed 15/20 meters are subjected to electromagnetic disturbances. 0÷25mA inputs have a superior electromagnetic compatibility (*EMC*).
- Avoid passage in cavities with power or high voltage cables.
- The protection and safety measures and the warranty provided by the Manufacturer with the equipment may be compromised if it's used in a manner that does not comply with this user manual.
- This equipment complies with CE regulations.
- Modifications or tampering not expressly approved by the Manufacturer could void the user's authorization to operate the equipment.
- This equipment must be installed by qualified personnel and in accordance with national regulations and/or related local requirements.
- Make sure that the object is properly fixed to supports/infrastructures capable of withstanding this load. Make sure proper methods and materials are used when fixing the equipment to a wall.
- Only personnel expressly authorized by the manufacturer can open the container. There are no user serviceable parts inside.

1. Description.

The WLRD12-4DI is a datalogger with four input channels to acquire pulses from clean contacts or open-collector, from energy meters, fluid meters, etc. inputs, with storage functionality of samples acquired.

Counting is continuously performed on input channels and is partially considered on the configurable sampling period. In case, counting can be set as aggregate and scalable.

Data are wireless transmitted and internally stored.

2. Sampling

In normal mode, the measure acquired is related to pulses counted in the programmed sampling interval.

At the end of each interval, the counted value, multiplied by the energy weight, is transmitted to the gateway, and internally saved.

After which, the counter is reset, and a new integration cycle starts.

In cumulative mode, count is maintained and is automatically updated to new value at each measure interval.

Value can reach overflow; in case, counter resets and automatically starts again when reaches the maximum value of 65,535 pulses.

Sampling time is selectable and adjustable by radio but is recommended to set a time and maintain it fixed for the complete measure harvest to guarantee values and intervals homogeneity.

Picture 1 - Product image

To perform an analysis in an established period, a summation of whole contributions coming from each interval is needed.

In normal mode, performing a graphical analysis of samples, is easily possible to compare higher impact pulse periods with lower impact ones, obtaining the measure timing profile, locating peaks and lowest periods.

To obtain the total amount in a period, a sum of samples acquired in the period can be performed.

NOTE: if the gateway analog output is coupled to the datalogger's meter channels, the expected output signal will be a tier where each level represents the recorded energy in the previous period

A punctual evaluation of *weight/pulse/sampling interval/maximum output signal amplitude* parameters is necessary to obtain best dynamic results and avoid signal saturation.

With the same sampling interval, and consider the in-use amplitude scale, a wave integral calculation is possible, obtaining the energy counted on a longer period.

3. Configuration.

The datalogger can be configured to sample:

- Active energy [*KWh*], Reactive energy [*Kvarh*] and Apparent energy [*Kvah*]
- Thermal energy [*KWh*]
- Fluid volume [*l*]
- Generic pulses
- Cumulative generic pulses

The pulse weight is adjustable to align the channel's measure to connected measurer's features to obtain correct reads.

Generic pulse hasn't measure unit so, in case of cumulative mode configuration, weight is used as de-multiplier capable to scale value represented by measure and reduce the overflow frequency.

Each channel can be configured independently to adapts to different pulse sources.

To perform the configuration, the datalogger must be connected to a PC using a *USB* connection; if necessary, *DRIVERS* (*downloadable from the Service Centre www.winecap.it*) must be installed.

- open *WineCapManager* software
- select the connection type: choose "*Local Connection*"
- select the support database and click on "*Open*"
- select "*Properties*" from "*Sensor*" drop down menu then choose "*Tools*" tab (*Picture 2 - Datalogger configuration*)
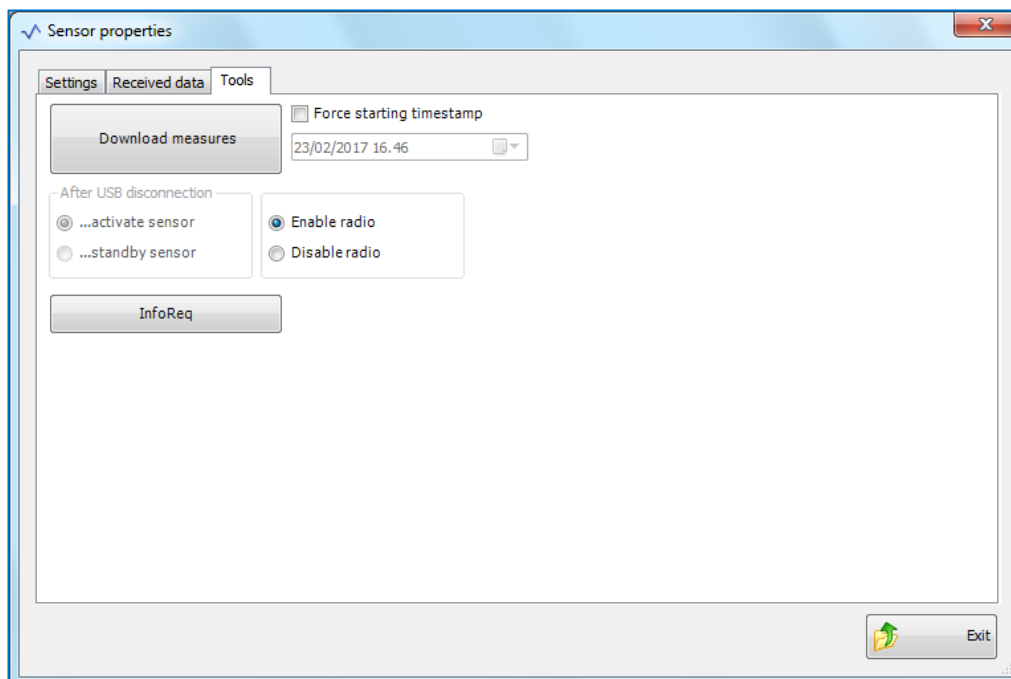
Picture 2 - Datalogger configuration

click on "*InfoReq*" button to enter in the "*Advanced sensor properties*" tab

Picture 3- Datalogger configuration

In this section following options can be selected:

- - channel TYPE from those available.
- - SCALE FACTOR corresponding to single pulse weight.

The unit of measurement is declared referring to measurement type, so, consequently, the pulse weight must be expressed in that unit of measurement.

Example: setting a channel for active electric energy reading, the unit of measurement is [*KWh*]. If a single pulse counts as 50Wh, a SCALE FACTOR of 0.05KWh must be set.

In case of "cumulated pulse" channel, the unit of measurement IS NOT set.

Pulses are summed in growing mode and the SCALE FACTOR can be used both to define the pulse weight value and a DE-MULTIPLIER value capable to scale the reported value, to correct the maximum allowed value dynamic.

In example (*Picture 3- Datalogger configuration*), 0.001 value corresponds to a division by 1,000 of the pulse count reported by datalogger related to those really counted on input wires. If the pulse's weight is 10Wh, defines that the reported count grows by one unit every 10KWh of counted energy.

At the end, click on "*Write*" button to confirm modifications and wait for operation ending message.

ATTENTION: writing a new configuration will delete **ALL** previous data, because potentially incompatible with new configuration. **BE SURE** to download and save previous data before proceeding.

> ➢ Check for proper configuration of WLRD12-4DI datalogger.

The maximum possible value in a measure interval is 65,535 multiplied by the pulse weight [*Wh or KWh*]. Reached this value the count stops, and, during the transmission, the invalid status of the measure is notified.

In this case, a new evaluation of the sampling interval is necessary because may be too high or, vice versa, the energy meter and his pulse frequency may be wrong dimensioned.

The energy meter pulse frequency must be less than 25Hz.

To calculate the pulse number in the period:

Frequency = (Plant maximum power [W]/pulse weight [Wh])/3,600   *must be less than 25*

*Period pulse = Frequency*Interval [sec]*   *must be less than 65,535*

Regarding the "cumulated pulse" count, must be considered that when the 65,535 value is reached, the count is reset and starts again from zero. When this condition occurs, the new value must be summed to the 65,535 constant.

To avoid this event occurs too often select a SCALE FACTOR sufficiently low.

Example: setting up the system with a value increase every 10 minutes, a count autonomy of approximately 1 year and 3 months can be obtained.

> ➢ Invalid measures.

There are two situations where the measure will be declared invalid:

– the pulse signal lasts more than 3 seconds.

- *CAUSE*: wires are in short circuit with GND, or a prolonged luminous signal beats the photoelectric sensor.
- *EFFECT*: the count reported is "0" until this condition persists.

– pulse number counted in the time interval exceeds the maximum value of 65,535.

- *CAUSE*: pulse frequencies very high and sampling intervals very long.
- *EFFECT*: the reported count is, however, 65,535.

4. Consumption threshold alarms management.

Maximum and minimum consumption threshold alarms may be planned.

The measure is a cumulative value, so the alarm management is performed in differential mode on the threshold interval.

The threshold level is expressed in "last threshold interval counted energy". This calculation expresses the medium power measured in the time interval, allowing the identification of moments where the electric consumption increases, or decreases related to expected thresholds.

<u>NOTE</u>: unless the alarm event is notified in the same moment of the sampled measure, it <u>WILL NOT</u> contains measure data. The energy reported will be ZERO. This situation occurs because of the cumulative measure, the alarm is intended only as a timestamp where the consumption value changes and not its value.

To obtain the thresholds value, starting by the power, is necessary to consider the time interval of thresholds. Therefore, the Kwh value must be multiplied with the threshold interval hours number. If the threshold interval is expressed in minutes, the result must be divided by 60.

Example: *120W maximum threshold setup with threshold interval every 5 minutes*

120Wx5/60=10Wh=0.01KWh ➔ the alarm activates if in 5 minutes more than 10Wh are read

5. Device pre-set and use mode.

a. Wireless Mode:

In this use mode, the datalogger records and transmits each measure sampled to the linked gateway. Typically, the monitoring system is configured in factory, so, if the device is already associated to the system gateway is in **STANDBY** mode (*refer to Picture 7 - Status table – Wireless mode*). In this case, it is necessary to start it with the **TEST** command (*refer to Picture 6 – Wireless devices user interface*). After this operation, the datalogger reactivates, resumes measure activity, and performs the connection to the gateway or to a *enhancer WLRE.* Connection The onboard LED shows the radio signal quality for 2 minutes (*refer to Picture 7 - Status table – Wireless mode*).

Otherwise, in case the device is in **FACTORY RESET** mode (*refer to refer to Picture 7 - Status table – Wireless mode*), that means it's ready for connecting to an existing system, in order to associate it using the **ENROL** command, Refer to the *"WineCap System - User Manual R31"* software manual. It is necessary to use the *WineCapManager* software on the PC connected to the gateway that will be linked with the device.

b. USB Logger Mode:

For this operation mode, the dataloggers works in stand-alone, recording data in its internal memory and without any wireless connection. This is not the factory setup so, to select it, the connection with the PC and the *WineCapManager* running on it is necessary to modify the device 's operation mode. The device must be set in **STAND-ALONE** *(refer to 10 - Stand-alone USB datalogger installation.)* mode and the sample time must be configured; automatically, the device 's clock is aligned with the PC's clock, in order to assure the temporal reference of the sample.

Sampling operations start may be selected disconnecting the USB cable or giving the proper command with the magnetic key (*refer to 10 - Stand-alone USB datalogger installation.*). More details on device 's connection/disconnection through the USB cable are available on the *WineCap System - User Manual R31* manual.

c. On field transition from USB to Wireless datalogger:

This transition is practicable in field, during the sampling period, using the wireless network association command. When the association is done, the datalogger becomes a wireless datalogger and, besides sending new measures to the gateway, starts a download process towards the same gateway of the measures acquired during the stand-alone period (*refer to Picture 8 - Status table - *).

6. Sensor positioning.
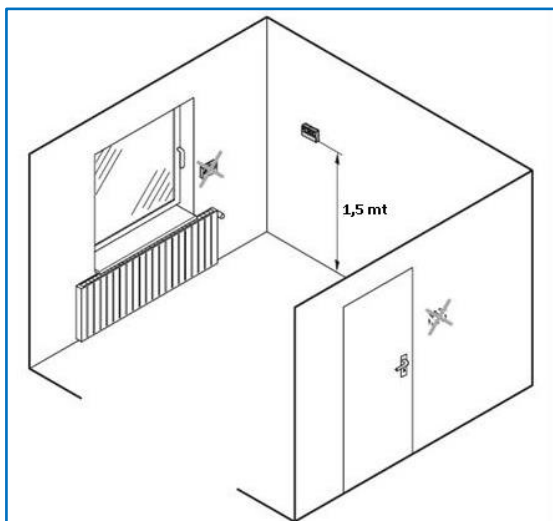
Picture 4 - Sensor positioning

To ensure that the measurements are not affected by external factors, some precautions must be taken into consideration during positioning:

- positioning must take place on a dividing wall, about 1.5 meters from the floor;
- the device must not be placed near doors and windows;
- the device must not be positioned above the radiators;
- the device must not be placed near heat sources;

7. Wireless device user interface.

The user interface consists of a "virtual" button that can be activated using the *WineCapKey* and of a two-colours led.

To give a command, user must approach the *WineCapKey* to the device's sensible area and keep it in that position.; the following picture (*Picture 5 - WineCapKey positioning*) shows device's sensible points.
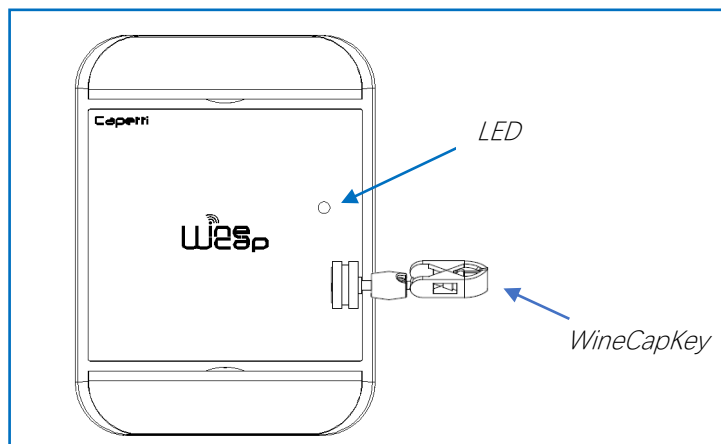
Picture 5 - WineCapKey positioning

The following COMMAND table describes the available commands:

WIRELESS DEVICES USER INTERFACE

Flash count	Command	Description
1 flash	STATUS	Shows the device **STATUS**. As answer the led perform a flash sequence as reported in the **STATUS** table. If the device is performing the **TEST** (*refer to TEST command*) this command stops it.
2 flashes	TEST	Enter in **TEST** mode and transmits status and measurements every 5 seconds. If the device is in **STANDBY** mode or it is out of radio range, this command forces the connection procedure to the WSN and the return to the operative mode. The **TEST** stops after 120 seconds. During **TEST**, the led continuously shows the **STATUS** to monitor the received radio signal quality. CAUTION: Measures acquired during TEST phase are NOT saved.
3 flashes	ENROL	Association to the network: must be used when the device has not yet been included in a network, starts the entry and association procedure to the gateway (*refer to "WineCap System - User Manual R31"*).
4 flashes + 4 flashes	STANDBY	Temporary device deactivation: the device is stopped. The sampling process and the radio are/is. turned off losing the connection to the network. To reactivate, a **TEST** command is necessary. The **STANDBY** command must be given twice to confirm it: at the first sequence the led flashes alternating RED and GREEN lights, waiting for the second confirm sequence within 15 seconds. At the command execution the led flashes as the **STANDBY** status (*refer to "Picture 7 - Status table – Wireless mode"*).
5 flashes + 5 flashes	FACTORY RESET	The device performs the memory deleting procedure and goes in STOP status. All samples, configuration and wireless network data associated are LOST. To reactivate the device a new association and configuration procedure is necessary (**ENROL** *command*). Also in this case, the **FACTORY RESET** command must be given twice to confirm it. At the command execution the led flashes as the "PROBE/DATALOGGER NOT ASSOCIATED" status (*refer to "Picture 7 - Status table – Wireless mode"*).
5 flashes + 3 flashes	LOGGER NO WSN	As the previous command but performs only the WSN deleting procedure and disassociate from the gateway. The device enters in **LOGGER STAND ALONE** mode: data are kept, and the sampling activity **CONTINUES** with previous setup. Command must be given with 2 sequences: 5 flashes and then 3 flashes. At the command execution wait for the device reboot. At the STATUS command, "**LOGGER**" will be the answer (*refer to "Picture 8 - Status table - Stand-alone mode"*). A new association (**ENROL** *command*) is possible to a new gateway.

Picture 6 – Wireless devices user interface

8. Device enrolment.

Not necessary if performed in factory before delivery.

Enrol the device to the wireless network referring to the *"WineCap System - User Manual R31"*. In case the device is already enrolled but in **STANDBY** status, a **TEST** command must be issued (refer to *Picture 6 – Wireless devices user interface*).

9. Installation procedure.

After installing the gateway in appropriate place in charge, (*refer to "WineCap System - User Manual R31"*), be sure that the device is enrolled to the gateway and activated.

Head for the installation point. On the way, to check the quality of the radio coverage, use the "Field Measurer" function.

This function is activated issuing the **TEST** *(refer to Picture 6 – Wireless devices user interface)* command: position the *WineCapKey* in the spot indicated in *Picture 5 - WineCapKey positioning* and wait for two AMBER flashes, then remove the *WineCapKey* from device. The "Field Measurer" function lasts enabled for two minutes.

To issue commands to the device, place the *WineCapKey* where indicated.

Once the *WineCapKey*, is detected, the led periodically emits AMBER flashes with a 2 second cadence.

For each flash, a different command is associated; to confirm the command the *WineCapKey* must be removed from the sensible area immediately after the number of flashes corresponding at the desired command. The **TEST** corresponds to the second pulse and activate the "Field Measurer" function.

The device will give back the radio signal quality through led flashes:

WIRELESS MODE STATUS Table

FLASH COUNT – WIRELESS MODE		STATUS/RADIO SIGNAL QUALITY
●··○··●··○··●··○··●··○··●	5 green flashes	ACTIVE - Radio signal: Excellent
●··○··●··○··●··○··●	4 green flashes	ACTIVE - Radio signal: Good
●··○··●··○··●	3 green flashes	ACTIVE - Radio signal: Fair
●··○··●	2 amber flashes	ACTIVE - Radio signal: Sufficient
●	1 red flash	ACTIVE - Radio signal: Insufficient
▬	1 red flash 2" long	OUT OF RANGE Network searching
▬··○··▬	2 red flashes 2" long	STANDBY Radio off - No Logging
●··○··▬··○··●	Short-long-short red flashes series	FACTORY RESET Device not enrolled – No logging

Picture 7 - Status table – Wireless mode

Optimize reception selecting the best position: small movements can help.
If the signal is absent or insufficient at the install point, a *enhancer WLRE* should be put between (*refer to "WineCap System - User Manual R31"*). The *enhancer WLRE* itself must be in a position where the signal level is at least sufficient.

The network will reconfigure itself automatically; the signal will be good again when the device synchronizes with the *enhancer WLRE*.

The wireless communication will not be reconfigured until completely lost by the device. Because of this, in some cases it could be necessary to force the operation. In such cases, put the device in **STANDBY** mode, then run the **TEST** again (*refer to "WineCap System - User Manual R31"*).

NOTE: The display equipped datalogger *(WLR-TST)* is recommended, to verify the signal quality during devices installation.

10.   Stand-alone USB datalogger installation.

Install the datalogger in appropriate place.

If the sampling process has not yet been activated, you can start it through the *WineCapKey*.

Bring it closer to the sensitive point, wait for 2 flashes (*TEST*) *(refer to Picture 6 – Wireless devices user interface)* and remove. The datalogger begins sampling according to your settings through your PC.

Through the *WineCapKey* is possible to ask for the status, bring it close to the datalogger for 1 flash (*STATUS*) and remove it.

STAND-ALONE DEVICE - STATUS TABLE Table

| FLASH COUNT –STAND ALONE MODE		STATUS
▬	1 green flash 2 seconds long	ACTIVE
▬··○··▬	2 red flashes 2 seconds long	STANDBY
●··○··▬··○··●	Sequence of red flashes: short, 2 seconds long, short	FACTORY RESET INVALID datalogger clock! PC connection required.

Picture 8 - Status table - Stand-alone mode

11. Shutting off/Reactivating the device.

If the device is shut off and left unused for a long time, you can issue the **STANDBY** command *(refer to Picture 6 – Wireless devices user interface)*. It corresponds to the command number 4 and must be issued twice to confirm the operation.

Position the *WineCapKey* in the spot indicated in (*Picture 5 - WineCapKey positioning*), and wait for four AMBER flashes, then remove the *WineCapKey* from device. Verify that the device asks for confirmation of **STANDBY** command with alternate GREEN/RED flashing, then position again the *WineCapKey* and wait for four flashes again. The device will confirm the **STANDBY** status lighting the RED led for 2 seconds twice. To reactivate the device the **TEST** command must be issued.

12. Transducer's connection layout.
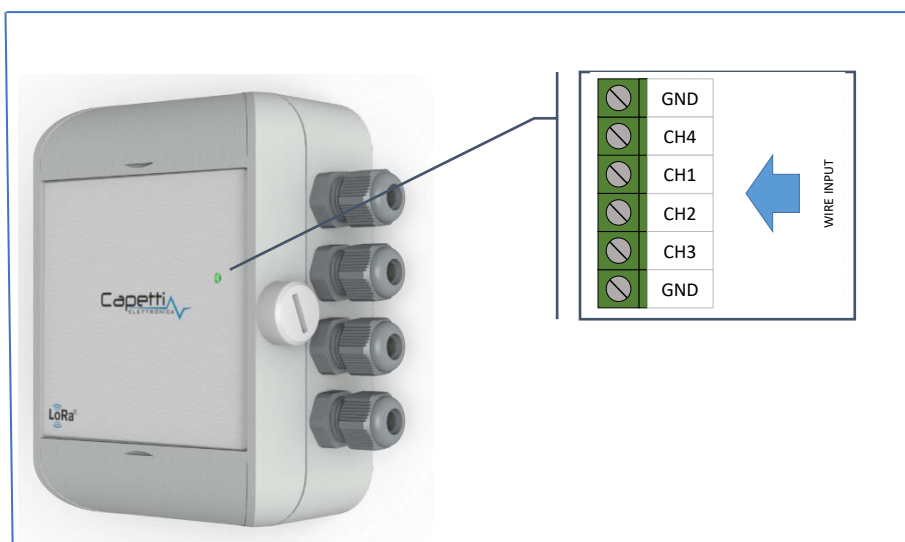
Picture 9 - Connections layout

13. Connections.

➢ **Connection with POD energy meter.**

The EXP2PUL expansion may be connected to the WLRD12-4DI datalogger input, to acquire led flashes coming from POD energy meters provided by the energy supplier.

This operation requires the proper wires connection (*respecting colour code*):

➢ brown: RA (*active*) higher LED
➢ blue: RR (*reactive*) lower LED
➢ black: GND (*common*)

The pulse weight is declared on energy meter serigraphy, set up the DIP switch in proper mode. For small and medium dimension plants, normally corresponds, respectively, to 1 Wh and 1 var for each pulse. For larger plants a correction factor may be present because of current transformers.

Use the two strips of double-sided adhesive located on the back, to paste the expansion to the meter's plastic front cover, taking care to clean the dust or liquids that may be present on the surface.

During the positioning, pay attention to the proper photosensors alignment with meter led. Flashes may be useful to obtain the best position.

WARNING: the POD energy meter, if the power sampled is "0", lights the RA LED continuously until this condition persist. The WLRD12-4DI enter in error mode so measures sent will be declared invalid. When this condition is solved, the POD meter and the datalogger starts to count again automatically.

➢ Connection with energy meter.

Direct insertion or current transformers type multifunction energy meters can be connected to the WLRD12-4DI datalogger inputs.

The weight of pulse generated by the energy meter must be set equal to the one set on the datalogger.

14. Technical Information.

Power supply	8.5Ah - 3.6V type "C" lithium internal battery (*BAT2*)
Battery life (*)	Up to 7 years *(samples every 60 minutes and radio signal quality at least sufficient)*
Measures acquired *(2 input channels)*	Pulses from clean contact or open collector configurable as: • Active electric energy [*KWh*] • Reactive electric energy [*Kvarh*] • Apparent electric energy [*Kvah*] • Thermal energy [*KWh*] • Fluid volume [*l*] • Generic pulses • Generic pulses with scalable aggregate count *Compatible with any digital energy meter with pulse output.*
Sampling interval *(*)*	Selectable from one minute to 24 hours *(60 minutes default)*
Datalogger capacity	64,000 samples (*for each channel*)
Working temperature	• Operative: -30°C ÷ +60°C • Warehousing: -40°C ÷ +70°C
Radio frequency	ISM 868MHz
Radio coverage	Up to 15Km in line of sight *(can be extended using WLRE battery powered enhancers)*
Sealing	IP65
Dimensions	90x120x50mm
Weight	350g
Case material	ABS
Mounting	Fix on 4 points
Connections	Wireless, USB
Cable external diameter	4.7mm maximum
Copper wire section	0.05 ÷ 2.5mm² / ÷ 14 AWG
Optional accessories	• Energy meters • Rogowski coils • Open/closed TA (*current transformers*) • POD counter pulse acquisition interface (*EXP2PUL*)
Pulse input - Connection	Internal clamping screw terminal block
Pulse input - Transducer input	From 0 to 4.5mm Ø gland
Pulse input - Count maximum frequency	40Hz with pulse time set to 10msec
Pulse input - Count weight	Selectable using management software

* battery life may be influenced by fieldwork conditions, sampling/measuring interval and system configuration.
** radio coverage can be extended using up to 32 enhancers WLRE (maximum 16 for each path) between the device and the gateway.

15. Mechanical dimensions.
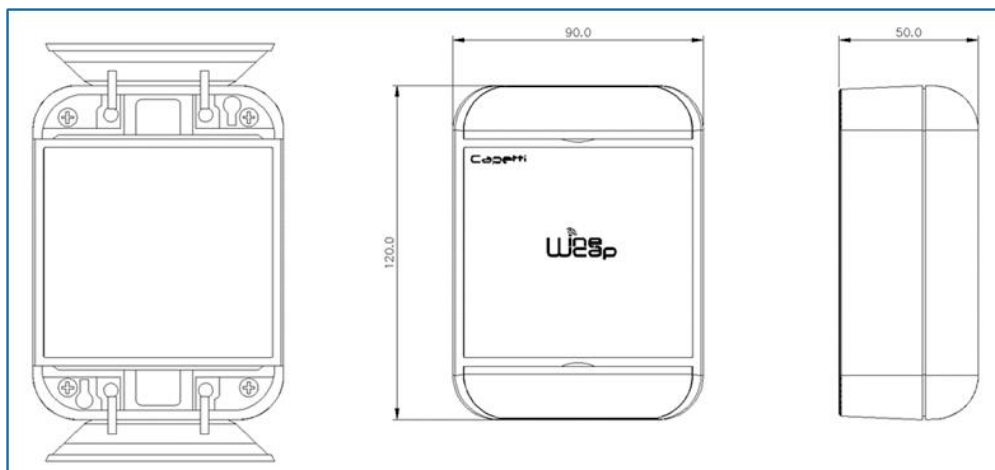
Picture 10 - Mechanical dimensions

16. Disclaimer.

- Specifications are subject to change without notice and should not be interpreted as a commitment on the part of Capetti Elettronica S.r.l.

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- The product is not intended for use in applications where safety is critical, such as life-security systems or medical-related applications.

- If a channel is saturated or disrupted "Frequency hopping" transmitting method allows data integrity and security, but correct functioning of the product in environments with high radio activity is not guaranteed.

17.   Reference standards.

EN 61010 -1

For electromagnetic compatibility

EN 61000 - 3 - 2
EN 61000 - 3 - 3
EN 300 220 -2
EN 301 489 - 03
EN 61000 - 6 -1

This symbol indicates that this product is compliant with the European Directive 2011/65/CE that restricts the use of substances in the manufacturing of electronic devices.

The "WEEE" logo on the label indicates that this product is compliant with the "WEEE" EC Directive. This symbol (valid only in the European Union countries) indicates that the product it is applied to, MUST NOT be discarded with ordinary household or industrial waste, but must be sent to an authorized reception point. The end user should contact the device provider, either the manufacturer or the reseller, to agree a collection and disposal process, after having checked the terms and conditions of sale.

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