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|  <p>Long Range IoT Station</p> | <p>Installation and Maintenance Manual</p> | <p>Reference:INSTALL_Long_Range_IoT_Station Version 1.0 Author Lénaïc LOUVEL / Samuel NICOLAS Date..... 08/04/2015</p> |
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Installation and Maintenance Manual Long Range IoT Station (Lora Station) (868MHz version)

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| Date | 02/06/2014 | 08/04/2015 | 08/04/2015 |
| Visa | | | |

Destination List

| Name | Company / Service | Place | Commentry |
|------|-------------------|-------|-----------|
| | | | |
| | | | |

Document history

| Version | Modification | Author | Date |
|---------|--|--------|------------|
| V0.1 | Preliminary version | LLO | 27/01/2014 |
| V0.2 | Adding of some precisions on the following contents: <ul style="list-style-type: none"> • Internet cabling and cable type • Cable gland dimensions • Auxiliary power supply • GPS and GSM considerations | SNI | 06/05/2014 |
| V0.3 | Safety recommendations adding | SNI | 02/06/2014 |
| V0.4 | Safety recommendations adding | SNI | 30/06/2014 |
| V0.5 | Safety recommendations adding | SNI | 23/07/2014 |
| V0.6 | Recommended additional lightning protections | SNI | 29/09/2014 |
| V1.0 | New mounting kit | SNI | 08/04/2015 |

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1 Open Issues

| Reference | Status | Description |
|-----------|--------|-------------|
| [1] | | |
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2 References

| Reference | Document/Link | Description |
|-----------|---------------|-------------|
| [1] | | |
| [2] | | |
| [3] | | |

3 Glossary

| Keyword | Description |
|---------|---|
| ADC | Analog to Digital Converter |
| AMR | Automatic Meter Reading |
| AP | Access Point |
| APC | Automated Power Control |
| API | Application Programming Interface |
| CAN | Control Area Network |
| CPU | Central Processing Unit |
| DAC | Digital to Analog Converter |
| DDRAM | Double Data Rate RAM |
| DHCP | Dynamic Host Configuration Protocol |
| DOTA | Download Over The Air |
| FTP | File Transfer Protocol |
| GPRS | General Packet Radio Service |
| GPS | Global Positioning System |
| GSM | Global System for Mobile communication |
| HTTP | HyperText Transfer Protocol |
| IK | Mechanical Impact |
| IO | In / Out |
| IP | Internet Protocol or Ingress Protection |
| KLK | Kerlink |
| KNET | Kerlink M2M network |
| LoRa | Long Range |

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| | |
|-------------|--|
| M2M | Machine to Machine |
| MIPS | Millions of Instructions Per Second |
| NFS | Network File System |
| NMEA | National Marine Electronics Association |
| PCB | Printed Circuit Board |
| PU | Polyurethane |
| RAM | Random Access Memory |
| RF | Radio Frequency |
| RSSI | Received Signal Strength Indicator |
| SI | Système d'Information |
| SIM | Subscriber Identity Module |
| SMA | SubMiniature version A |
| SSH | Secure Shell |
| TBD | To Be Defined |
| TCP | Transmission Control Protocol |
| USB | Universal Serial Bus |
| UV | UltraViolet |
| WAN | Wide Area Network |
| WLAN | Wireless Local Area Network |
| VHF | Very High Frequency |

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4 Introduction

The LoRa IoT Station is part of the global Long Range Radio fix network to provide M2M connectivity link between low power end-point and Internet Access.

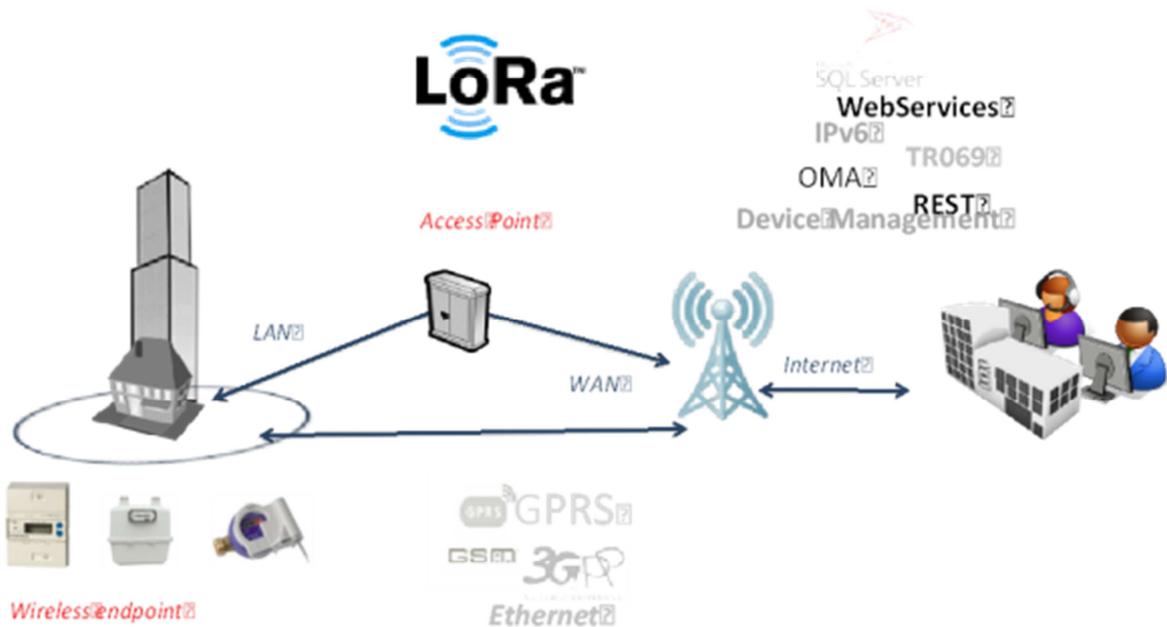


Figure 1: LoRa Network topology

The product is based on LoRa technology provided by Semtech Company.

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5 Description of the Long Range IoT Station

5.1 Block Diagram

The following figure describes the functional architecture:

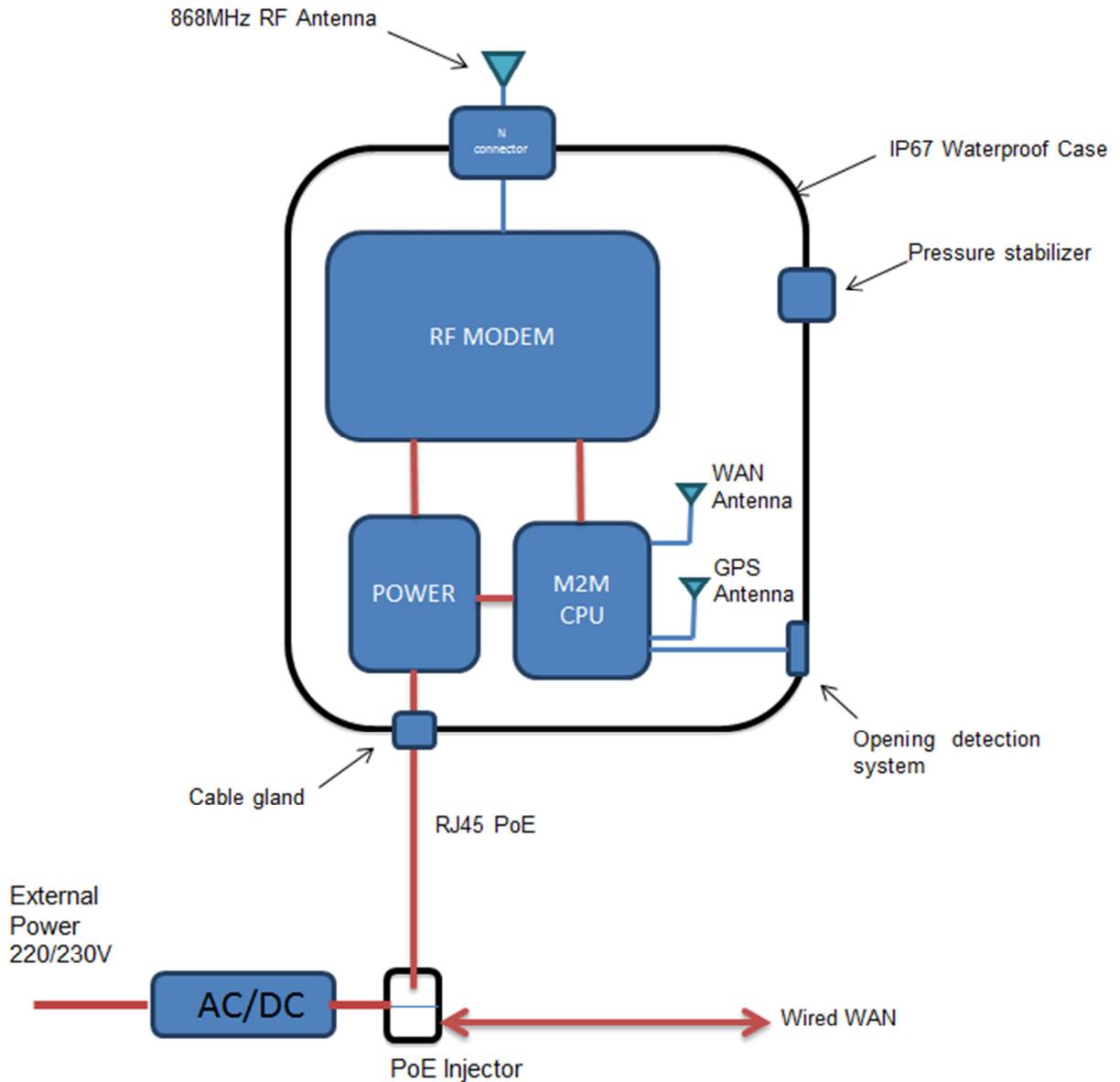


Figure 2: LoRa IoT Station Block diagram

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5.2 Mechanical implementation

The LoRa IoT Station is based on a high impact resistant polycarbonate wall mounting cabinet that withstand harsh industrial and outdoor environments.

It offers excellent flammability rating, good UV resistance and also good chemical resistance.

The dimensions are 231 mm x 125 mm x 60 mm. It is rated IP67.

The opening system is simple: clipping (screwing is optional)

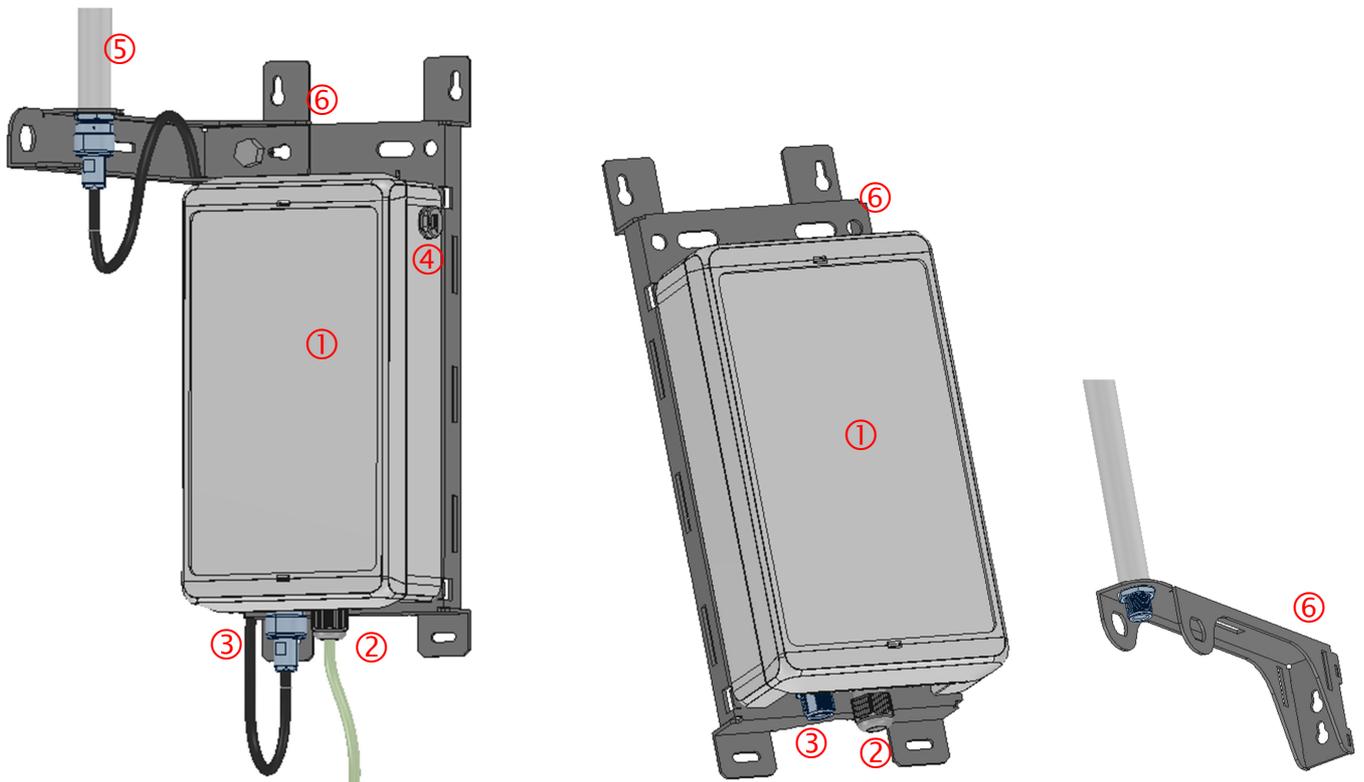


Figure 3 : LoRa IoT Station casing - external view

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Figure 4 : POE injector (example)



Figure 5 : LoRa IoT Station casing - internal view

The LoRa IoT Station is composed of:

- The enclosure itself including:
 - The casing (item 1)
 - 1 cable gland for RJ45 POE (item 2). The LoRa IoT Station is delivered without RJ45 POE cable (Ethernet cable).
 - 1 N connector (item 3) to connect LoRa antenna
 - 1 pressure stabilizer for protection against condensation (item 4)
- LoRa RF antenna connection with N connector (item 5) and its cable
- A POE injector (item 7) and its power supply cable.
- The internal shielding (item 8)
- A mounting kit (item 6) designed to answer different installation configurations:
 - Pole mounting by U-bolt (delivered by default)
 - Wall mounting

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- o Metallic strapping mounting (tube, pipe, flue...)

The mounting kit owns a full independent universal antenna support that could be mounted on the enclosure support (by default) or directly on a pole, a wall ...

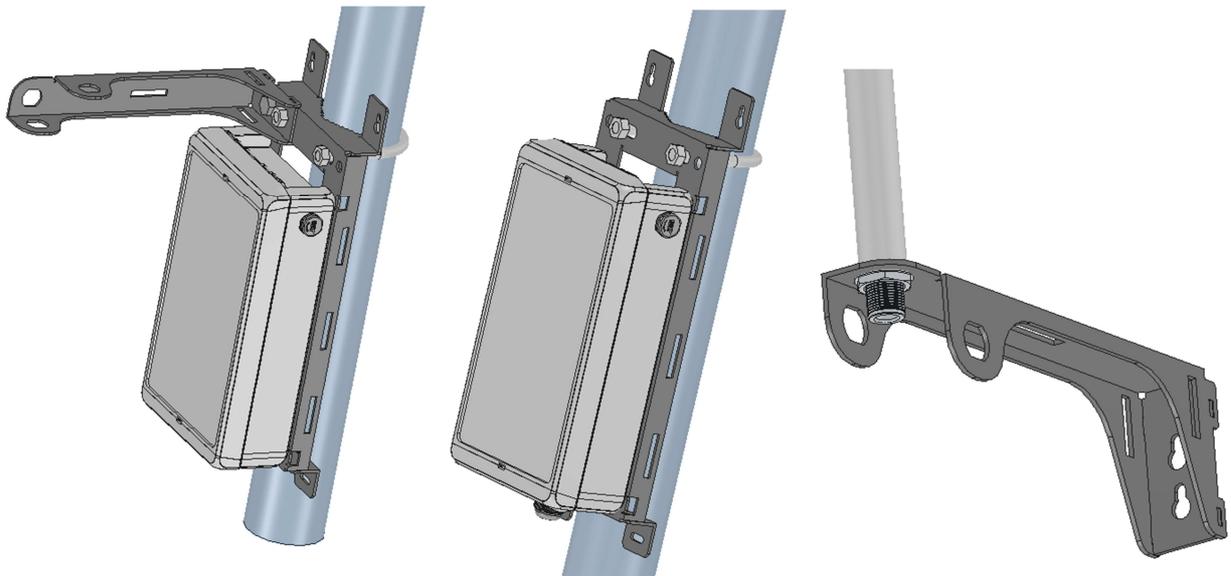


Figure 6 : Mounting kit

5.3 Stickers

The LoRa IoT Station has stickers placed inside the casing:

- A sticker on the door including LoRa IoT Station serial number, regulatory markings and electrical information (item 9)
- A sticker explaining the LEDs behaviour (item 10)

6 Installation procedure

6.1 Installation topology

6.1.1 Single station installation

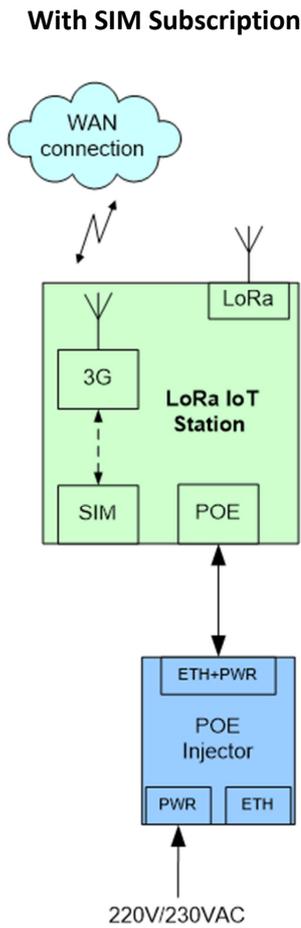


Figure 7 : Single station installation (with SIM)

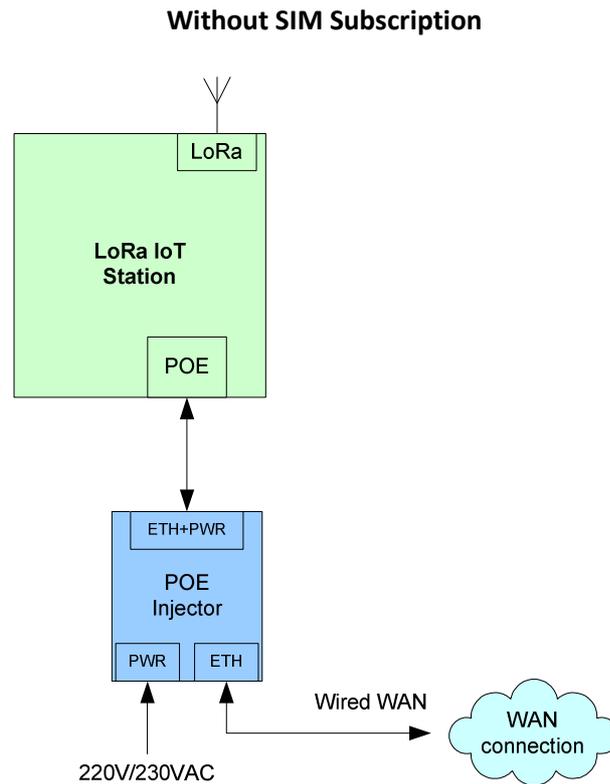


Figure 8 : Single station installation (No SIM)

6.1.2 Multi-station installation

6.1.2.1 With SIM Subscription

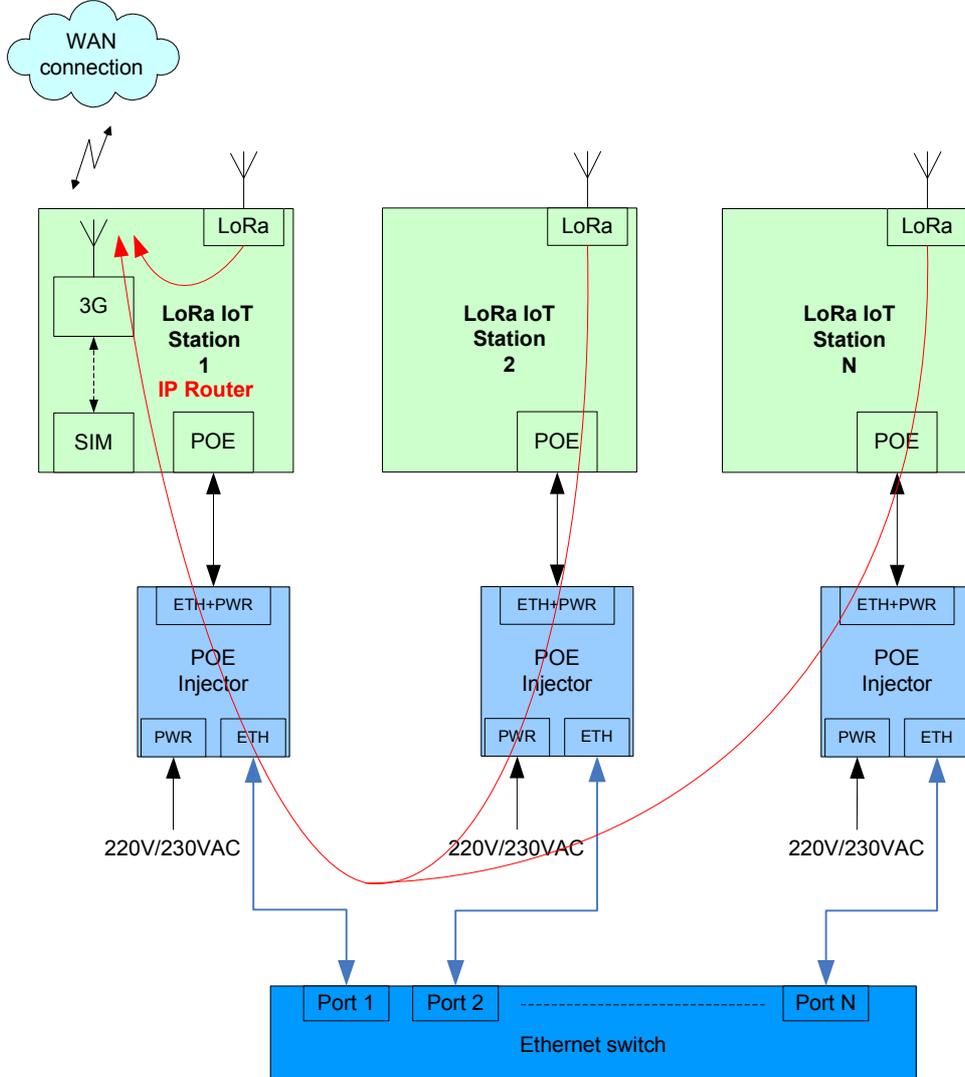


Figure 9 : Multi-station installation (with SIM)

6.1.2.2 Without SIM Subscription

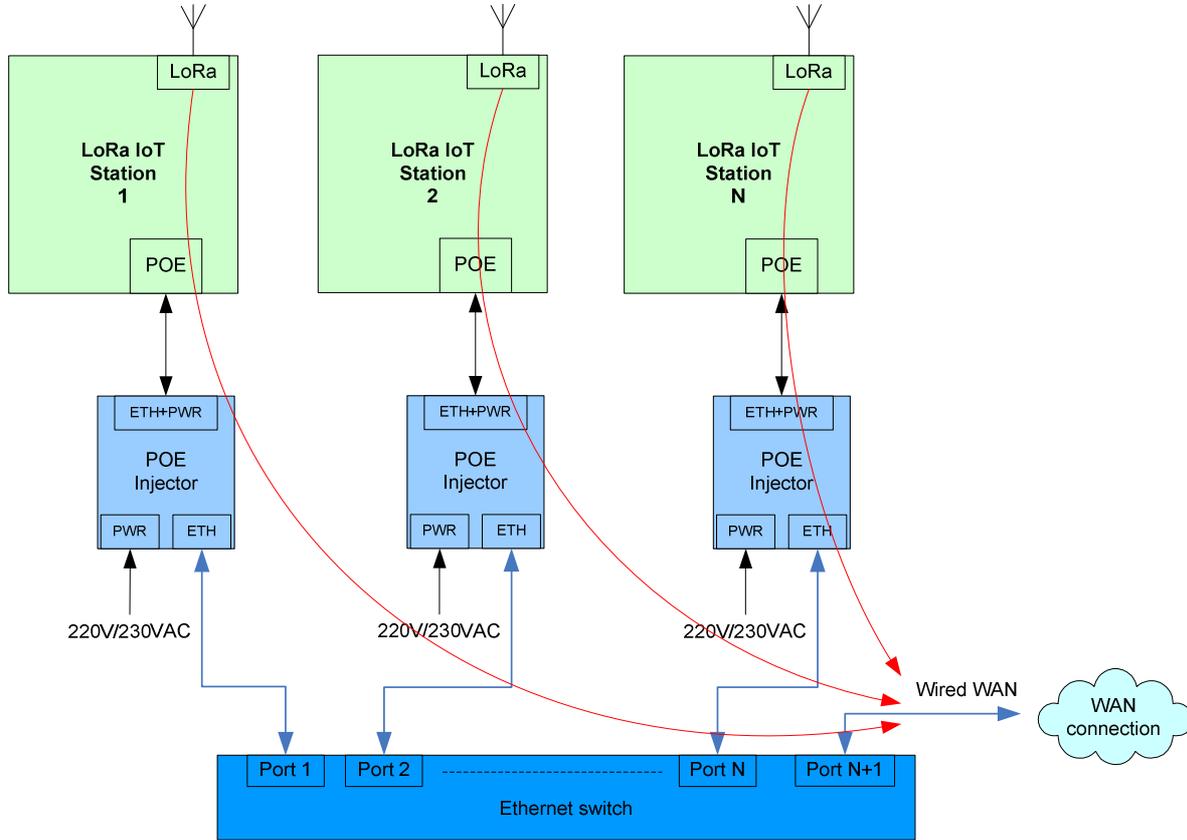


Figure 10 : Multi-station installation (No SIM)

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6.2 Electric distribution to the LoRa IoT Station

6.2.1 Safety standard

The installation must conformed to EN 60728-11 (Cabled distribution systems standard).

6.2.2 Power-Over-Ethernet (POE) power supply

The LoRa IoT Station is supplied through Ethernet cable: POE 48V class 0(Max: 15Watts)
The nominal current is about 70mA in Lora Rx mode with the GSM in a network attached mode.

Kerlink recommends a CAT6 SSTP standard Ethernet cable.
The maximum cable length is 100m.

On LoRa IoT Station side, the Ethernet cable must be firstly inserted through the cable gland. Then, the shield of the cable must be clamp like in the following picture to get a good earth shielding.
The internal wires have to be connected to the terminal block as described on the picture below:

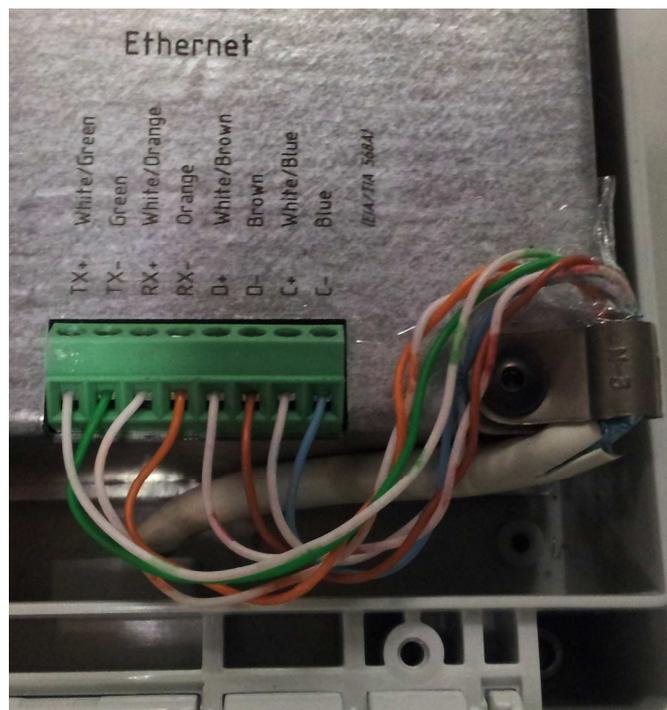


Figure 11 : Ethernet connection

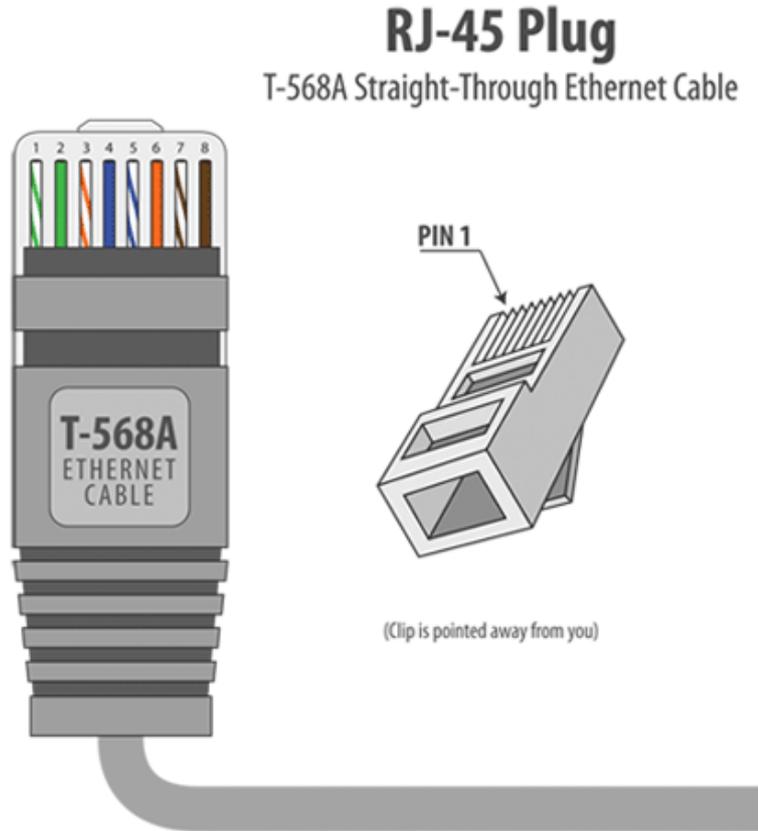
The cable gland allows external cable diameter from 4mm to 8 mm.

On the other side of the POE cable, RJ45 connector must be inserted into POE injector. This POE injector is connected to 230VAC.

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The POE injector must be installed in accordance to its own specifications.



6.2.3 Solar power supply

The LoRa IoT Station can be also supply with a DC power supply as a solar panel. The input voltage range is 11 to 30VDC.

The power supply must be qualified as a limited power source.

The maximum power is 13W.

The nominal current for a 12V power supply is about 250mA in Lora Rx Mode with the GSM in a network attached mode.

After insertion through the cable gland, a 2-wire cable can be connected to the dedicated terminal block as described on the figure below:

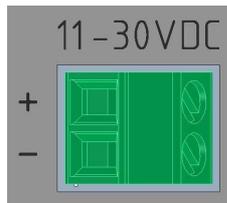


Figure 12 : DC power supply connection (temporary image)

The cable gland allows external cable diameter from 4mm to 8 mm.

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6.3 Mounting of the enclosure

6.3.1 GPS and GSM considerations

The Wirgrid Station owns a GPS and a GSM integrated solutions. Those both technologies need to install the product in an open environment to get acceptable performances.

6.3.2 General considerations

The LoRa IoT Station must be mounted on any concrete pedestal, concrete wall or any non-flammable surface (UL94-V0).

It must not be mounted on a flammable surface.

The mounting kit delivered with the LoRa IoT Station allows fixing the product in different ways.

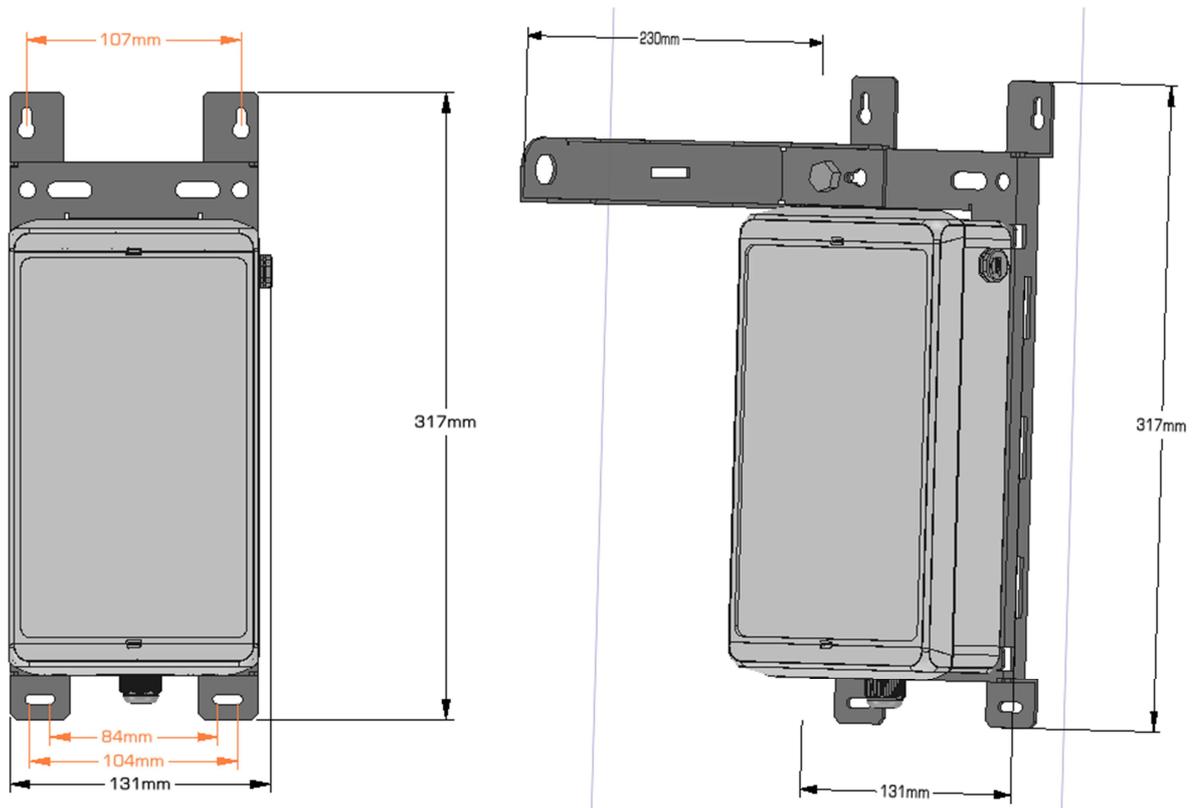


Figure 13 : mounting kit dimensions

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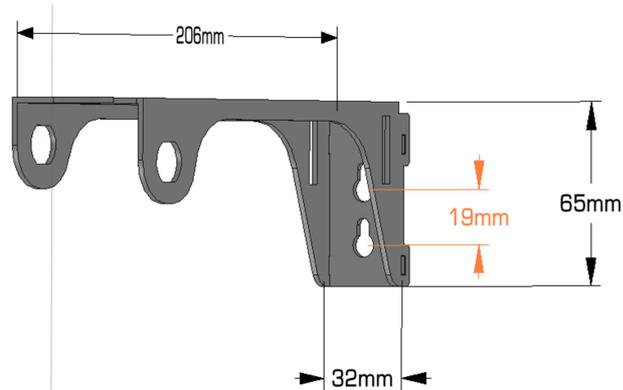


Figure 14 : Universal antenna support dimensions

6.3.3 Pole mounting by U-bolt

By default, the LoRa IoT Station is delivered with a U-bolt to be mounted on a pole of a maximum diameter of 60mm.

To fix the U-bolt, it is recommended to use nuts provided in the mounting kit.

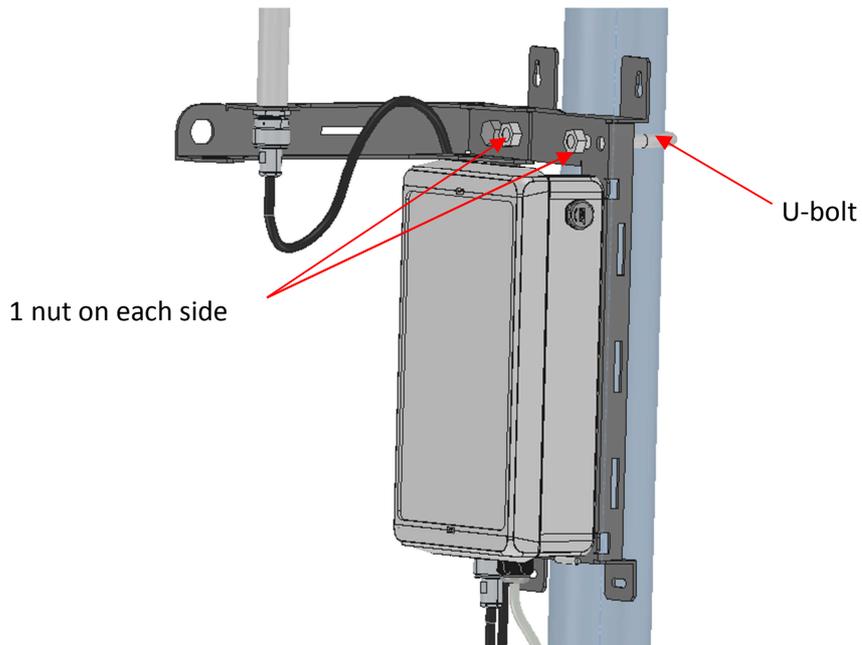


Figure 15 : Pole mount set on the enclosure

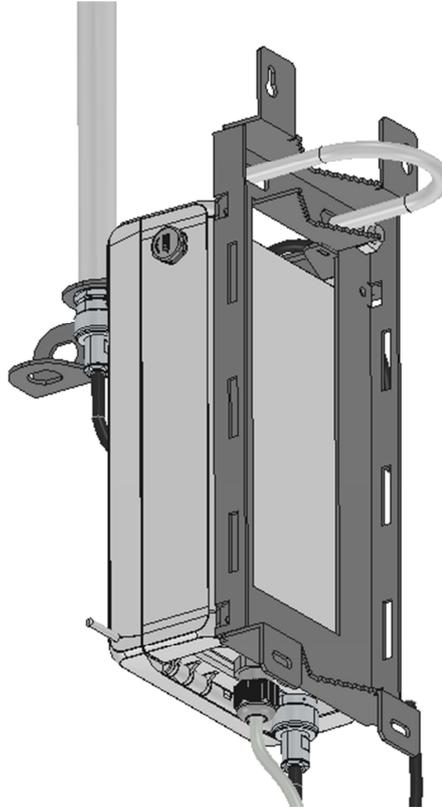


Figure 16 : Another view of the pole mounting using U-bolt (no pole represented)

For safety reason, the metallic mounting kit must own a good earth connection. This may be ensured by a good earth connection on the metallic pole since the U-bolt is conductive.

6.3.4 Wall mounting

The LoRa IoT Station can be also mounted on a wall with M4 screws (not delivered with the mounting kit).

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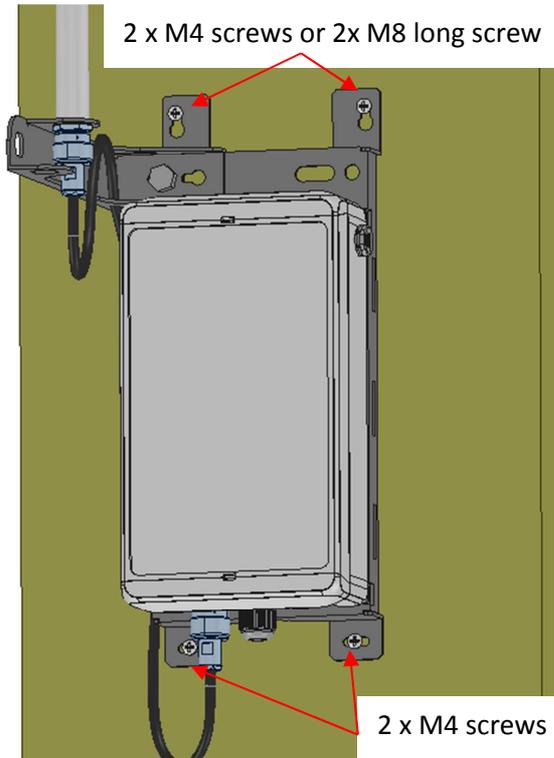


Figure 17 : Wall mount of the enclosure (front side)

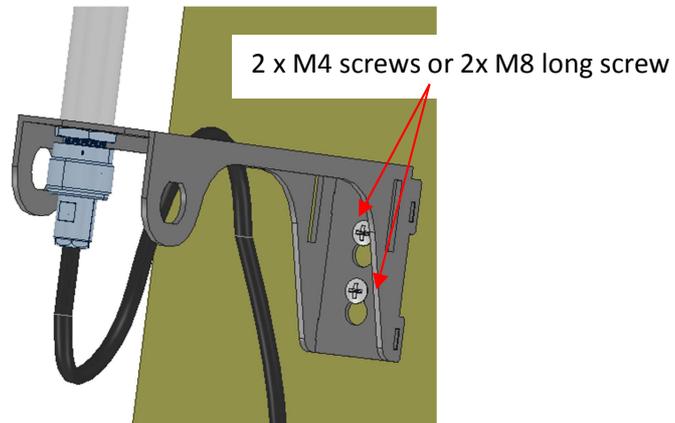


Figure 18 : Wall mount of the universal antenna support (front side)

For safety reason, the metallic mounting kit must own a good earth connection. This may be ensured by adding an earth connection on one of the four screws (fastening not delivered by default).

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6.3.5 Metallic strapping mounting

The LoRa IoT Station can be also mounted on a pole by strapping. The maximum acceptable width of the strapping is 25mm. It is recommended to use 2 metallic strappings as described on the figure below:

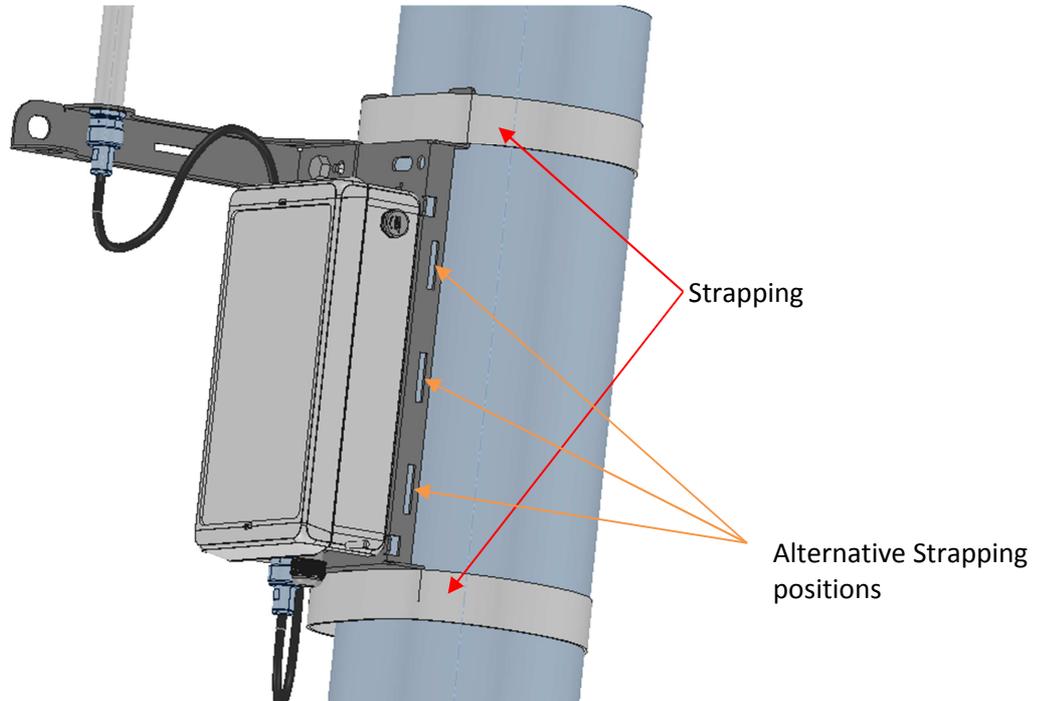


Figure 19 : Pole mount set using strapping

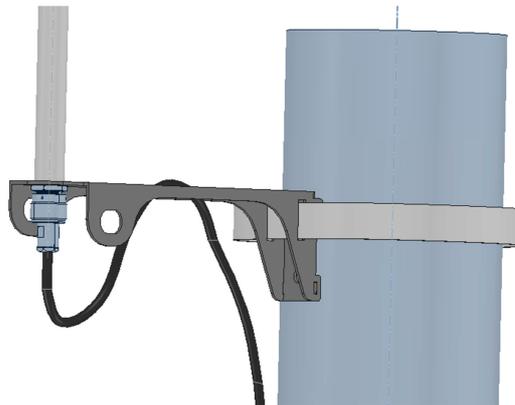


Figure 20 : Pole mounting of the universal antenna support using strapping

For safety reason, the metallic mounting kit must own a good earth connection. This may be ensured by a good earth connection on the metallic pole if strappings are conductive.

6.4 Setting connections

6.4.1 Ethernet connection

Before connecting the Ethernet wires, ensure that the POE injector is not connected to 230VAC.

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The Ethernet wires must be connected as described in §6.2.1.

6.4.2 LoRa RF Antenna connection

LoRa IoT Station is delivered with a 868MHz antenna.

| | |
|-------------------|------------|
| Frequency | 868 MHz |
| Impedance | 50 ohm |
| Electrical length | 1/2 λ |
| V.S.W.R. | < 1,3:1 |
| Polarization | Vertical |
| Gain | 3 dBi |
| Max power in | 50 watt |
| DC Ground | Yes |
| Whip material | Fiberglass |
| Connector | N Female |
| Length | 0,3 m |
| Weight | 75 g |
| IP Code | IP66K |

Figure 21 : Technical antenna specifications

First, fix the universal antenna support on the enclosure support using provided screw and nut.
Next, fix the antenna on the mounting set:

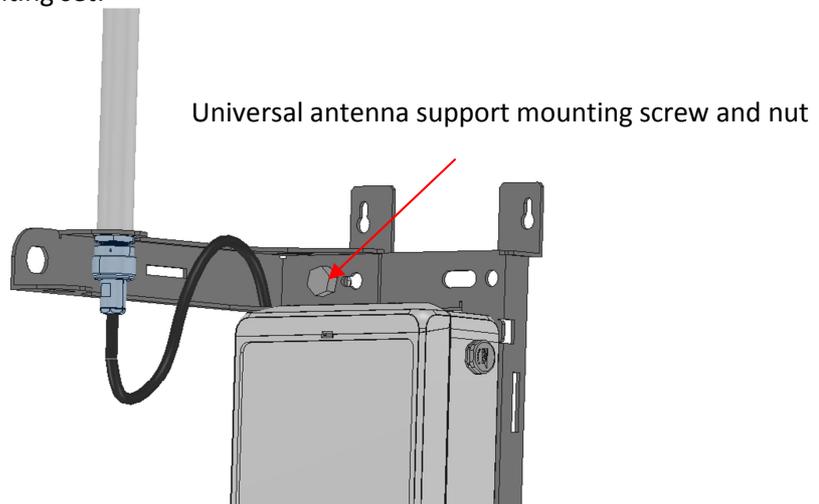


Figure 22 : attachment of the antenna on the mounting set

Once the RF antenna is fixed, connect the N connector of the antenna cable on the connector based on the bottom of the casing as described on the figure below.

For safety reason, the power supply of the product must be disconnected before plugging the N connector.

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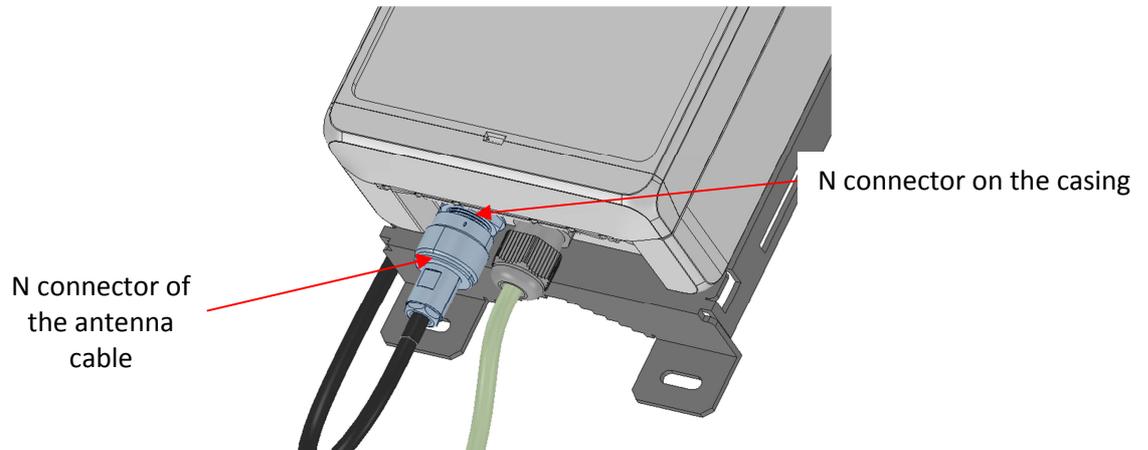


Figure 23 : connection of LoRa RF antenna (bottom view)

To improve the durability of the RF connections against environmental aggression (moisture, pollution, ...), Kerlink recommends to recover connectors with an insulating tape like the reference 130C from 3M.

To fix the antenna cable, it is possible to fix it with cable clamp, using spaces provided for this purpose:

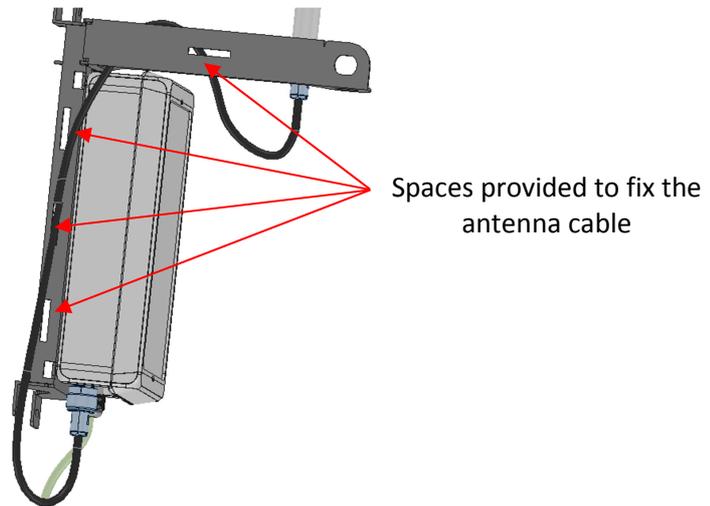


Figure 24 : attachment of the RF antenna cable

It is possible to order other antennas as an option. Kerlink proposes antennas with gain from 3dBi to 16dBi. For more details, contact Kerlink at support@kerlink.fr.

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6.5 Commissioning

6.5.1 SIM card

The SIM card is mandatory to establish the 3G/GPRS communications.

Before inserting the SIM card, pay attention that the LoRa IoT Station is unpowered by checking the 2 LEDs PWR are OFF.

Then, to insert a SIM card in the Access Point:

- Open the LoRa IoT Station casing
- Open the internal door of the cabinet
- Then, you can remove the SIM card holder of the Lora IoT Station by pressing with a little screwdriver, the extraction button (as shown below)
- Place the SIM card in the SIM card holder
- Insert carefully the SIM card holder with the SIM card in the LoRa IoT Station

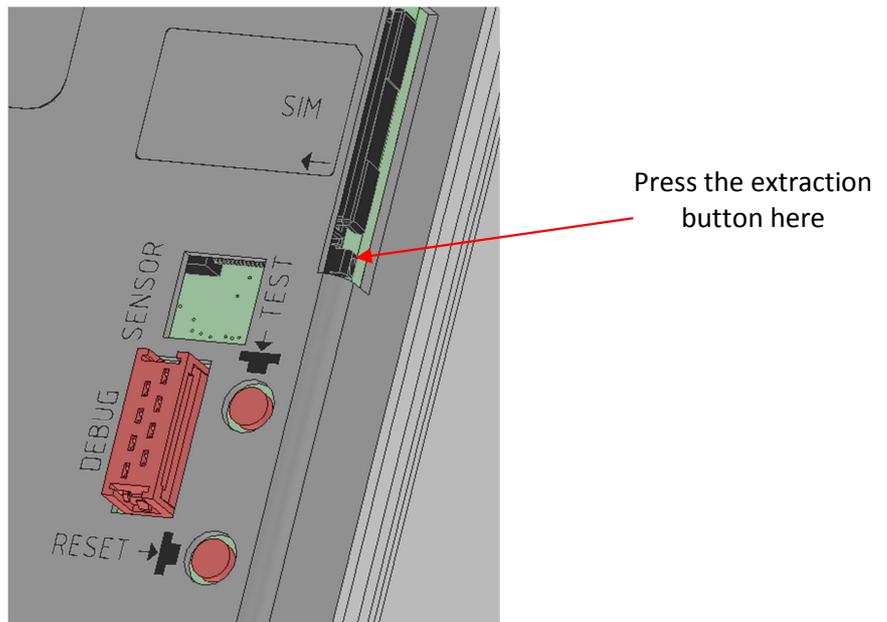


Figure 25 : SIM Card

In case of replacement of the SIM card, the power supply must be firstly switched off by disconnecting Ethernet wires or disconnecting the POE injector. For few seconds, the LoRa IoT Station is still powered-on due to the internal backup battery. Wait and check the 2 LEDs PWR are switched off before extract the SIM card.

After inserting the new SIM card as described above, the Lora IoT Station can be re-powered on.

In case of change of mobile operator, APN and login/password must be updated. For more details, contact Kerlink at support@kerlink.fr.

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6.5.2 Power on

Once the RF antenna and the Ethernet wires are connected and the SIM card is inserted, the Lora IoT Station can be powered on.

To POWER ON the LoRa IoT Station, connect the POE injector on the 230VAC main power supply.

6.5.3 Functional check

To ensure the LoRa IoT Station is started up, check the 2 PWR LEDs: they should be switched ON. After some seconds, the LEDs switch off.

Then, to check and analyse the status of the Lora IoT Station, the TEST button must be pressed briefly in order to activate the LEDs functionality during 1 minute. This operation can be repeated indefinitely.

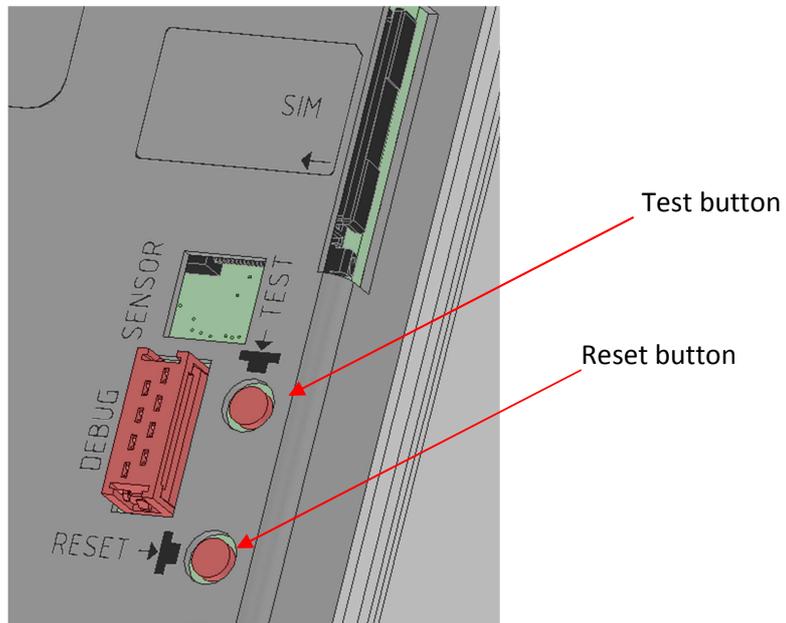


Figure 26 : Test and Reset buttons

Status of the Lora IoT Station:

| Name | Color | Mode | Details |
|----------------------|-------|------------|---|
| PWR (Station) | Green | Continuous | Station power indicator |
| PWR (Modem) | Green | Continuous | Modem power indicator |
| GSM1 | Green | Continuous | GSM quality level Most Significant Bit |
| GSM2 | Green | Continuous | GSM quality level Least Significant Bit |

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WAN quality level :

| GSM1 | GSM2 | Status |
|------|------|-----------------------|
| 0 | 0 | SIM Card error |
| 0 | 1 | No network connection |
| 1 | 0 | RSSI Level < 17 |
| 1 | 1 | RSSI Level >18 |

The behaviour of the other LEDs depends on the application software downloaded in the LoRa IoT Station. Only Station LEDs (WAN, MOD1 and MOD2) can be controlled by the application.

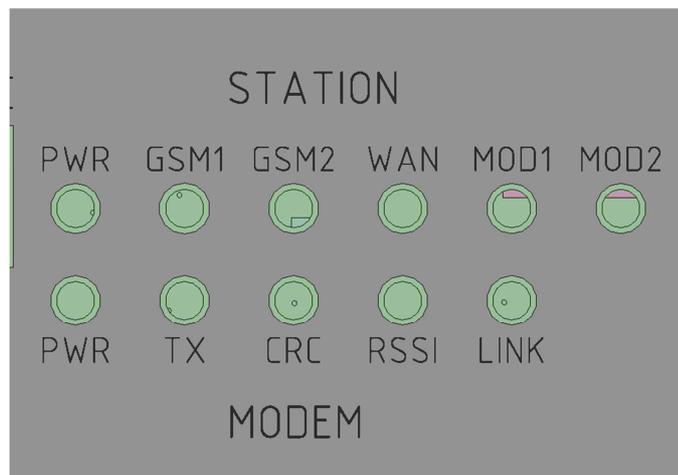


Figure 27 : LEDs indicators

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6.6 Lightning protections

In harsh environment, additional protections may be used to improve lightning immunity.

6.6.1 Antenna link

For the antenna link, Kerlink recommends the P8AX series from CITEL. Protections must be installed in accordance to its own specifications.



6.6.2 Ethernet link

For the Ethernet link, Kerlink recommends the CITEL MJ8-POE-B reference from CITEL. Protections must be installed in accordance to its own specifications.



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7 Maintenance of the Access point

7.1 Simple checks

7.1.1 LoRa IoT Station enclosure

Check the robustness of the installation:

- Screwing of the LoRa IoT Station on the mounting set
- Screwing of the mounting set (depends on the configuration)

Check the Ingress Protection of the enclosure:

- No trace of water inside the enclosure
- Tightening of the cable gland
- Tightening of the pressure stabiliser
- PU gasket on the door

7.1.2 Cables

Check:

- The LoRa RF antenna N connectors are well fixed on the casing and on the mounting set.
- Screwing of Ethernet wires
- Ensure that the POE injector is correctly installed (RJ45 and power supply cable).

7.1.3 LED

Make sure the LoRa IoT Station is working properly according to LEDs indications
See §6.5.3.

7.2 Interfaces for debug or maintenance purposes

7.2.1 Proprietary debug interface

The LoRa IOT Station has a proprietary debug interface:

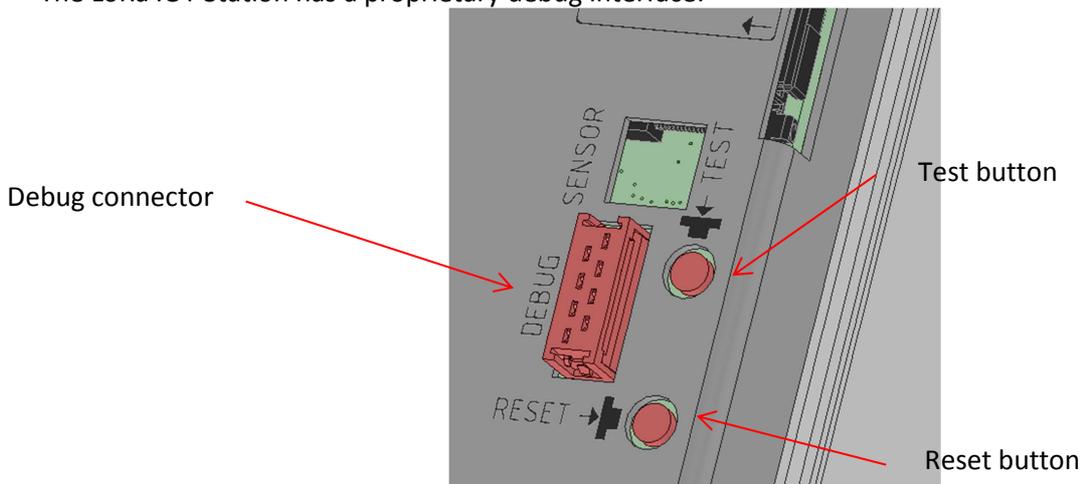


Figure 28 : Proprietary debug interface of the LoRa IoT Station

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This debug interface is intended to be used by authorized and qualified personnel only.
Be careful: Only specific equipment developed by Kerlink must be connected to this interface.

It is also possible to access to the debug interface by Ethernet connection by connecting directly to the POE injector or the Ethernet switch (depending on the installation topology).

7.2.2 USB and Ethernet interface

Firmware update can be performed with a USB key via the USB type A connector below:

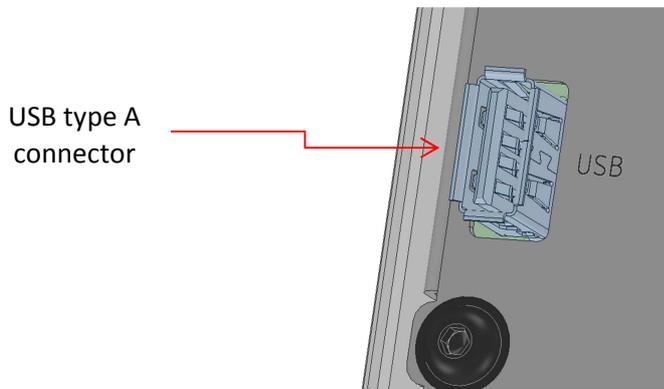


Figure 29 : USB connector of the LoRa IoT Station

7.2.3 TEST and RESET buttons

Test and reset button are small buttons present on the top side as shown in Figure 28.

RESET button is intended to reinitialize the LoRa IOT Station.

TEST button has 2 functions:

- Short Press : LEDs functionality is activated during 1 minute
- Long Press : Activation of an auto-test sequence defined by the application software

8 Kerlink support

The LoRa IoT Station must be installed and maintained by authorized and qualified personnel only. In case of defect or breakdown, make sure the above recommendations detailed in this document are met. If an issue is not addressed in this document, contact Kerlink at support@kerlink.fr.

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