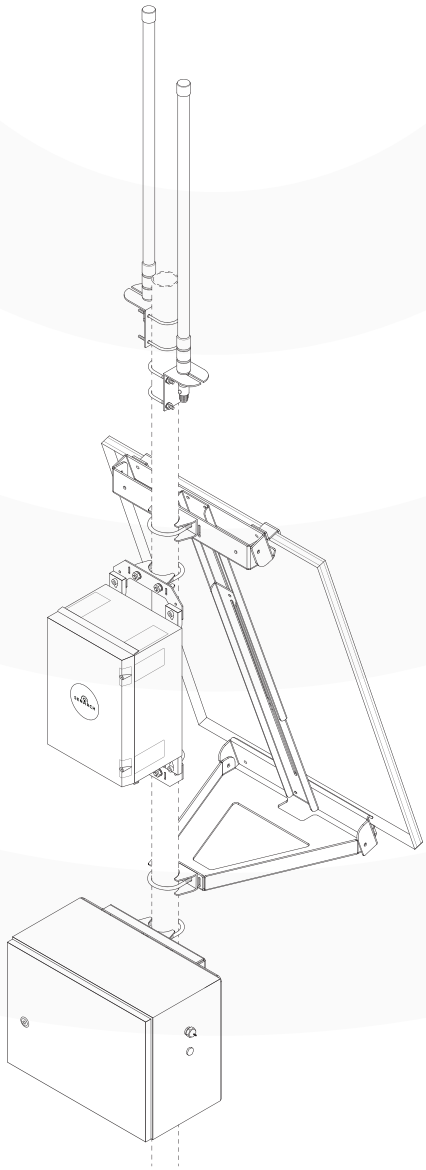
SENARCH



*Mounting pole not included
A tripod is available as an optional accessory

ARCH I

User manual

v.1.3

Safety precautions

SenArch is not liable for any loss or damage caused by failure to follow the instructions in this operating guide.

- The device must not be disassembled or remodeled in any way.
- Do not place the device close to objects with open flames.
- Do not place the device where the temperature is below/above the operating range.
- Do not connect or power the equipment using power cables that have been damaged.
- Do not install the product if you cannot lift and carry weight above 20kg

Declaration of conformity

Arch I is in conformity with the essential requirements and other relevant provisions of the CE and RoHS.

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Revision

Date	Version	Log
28-11-2024	1.0	Initial release
6-12-2024	1.1	Added: - Protecting lightning arrester on antennas (3.5.4) - Mounting with bands guide (3.5.6) - Power supply chapter (2.3) - Tripod mounting guide (3.6)
19-12-2024	1.2	Added: - Tools needed for installation (3.1) - Wall mounting guide (3.7)
16-01-2025	1.3	Expanded the wall mounting example chapter (3.7)

Contents

1.0 Product introduction

1.1 - Congratulations!

SenArch is proud to introduce our flagship product: the Arch I IoT gateway.
This groundbreaking solution is designed to meet the growing demands for reliable and sustainable IoT connectivity in off-grid and remote locations. Our gateway combines the power of LoRaWAN technology with the sustainability of solar energy, creating a self-sustaining, highly efficient network solution that thrives in challenging environments where traditional connectivity and power infrastructure is either limited or unavailable.

The Arch I gateway is a compact, modular system powered by a photovoltaic solar panel, eliminating the need for external power sources or cumbersome cabling. Its energy-efficient design ensures low operational costs while maintaining continuous connectivity for IoT sensors and devices, even in harsh conditions. By harnessing renewable energy, the gateway offers a clean and eco-friendly alternative to conventional IoT network infrastructure, supporting both sustainability and cost-effectiveness.

With its ability to create resilient, off-grid networks, the Arch I gateway enables end-to-end IoT communication in a wide range of applications, from precision agriculture to smart cities, industrial automation, and environmental monitoring. Our solution brings connectivity exactly where it's needed, allowing for easy deployment in remote or hard-to-reach areas, where it can densify existing networks or establish entirely new ones.

Backed by SenArch's core values of innovation, reliability, and sustainability, the Arch I IoT Gateway is the ideal choice for organizations looking to expand their IoT capabilities while minimizing environmental impact.

1.2 - Key features

1 Solar-Powered, Self-Sustaining Operation

- Powered by renewable solar energy, eliminating the need for external power sources or grid connections.
- Ensures continuous operation even in off-grid or remote locations, reducing operational costs.

2 LoRaWAN Connectivity

- Supports long-range, low-power LoRaWAN technology for seamless wireless communication with IoT sensors and devices.
- Ideal for creating or expanding IoT networks in areas lacking conventional connectivity infrastructure.

3 Compact and Modular Design

- Easy to install, allowing for quick deployment in a variety of environments.
- Modular design enables easy maintenance, customization, and scalability based on user needs.

4 Robust and Weather-Resistant

- Built to withstand harsh environmental conditions, including extreme temperatures, humidity, and rough weather, ensuring reliable performance in rugged outdoor settings.

5 Cable-Free Installation

- No need for external cabling or power sources, making installation simple and cost-effective, especially in remote or hard-to-reach areas.

6 Low Power Consumption

- Designed to operate with minimal energy use, making it highly efficient and sustainable for long-term use.
- The key to this solar-powered and autonomous system is the ability to operate at lowest possible power.

7 Real-Time Monitoring and Management

- Provides telco-grade network management tools, including real-time data analytics, monitoring, and performance optimization, ensuring a stable and well-maintained network.

8 Versatile Applications

- Suitable for a wide range of applications, including agriculture, environmental monitoring, smart cities, industrial
- automation, preventive maintenance and construction.

9 Scalable Solution

- Can be deployed as a single unit or scaled up to support larger IoT networks, offering flexibility for small to large-scale projects.

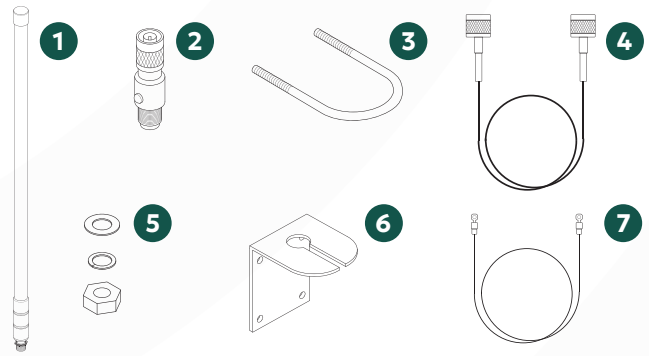
10 Eco-Friendly and Sustainable

- By leveraging solar energy and reducing the need for traditional power sources, the gateway contributes to lowering carbon footprints and supporting green initiatives.

2.0 - Hardware introduction

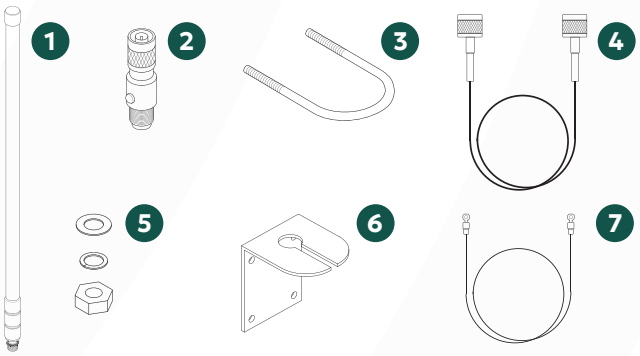
2.1 - Packing list

LoRa antenna kit



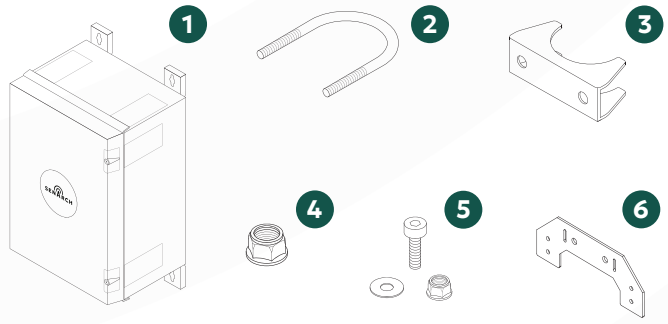
1 - LoRa Antenna 868-915Mhz
2 - Lightning arrester
3 - M6 U-bolt 2x
4 - N-type coaxial cable
5 - Nut, Lock-washer & washer 4x
6 - Mounting bracket
7 - Grounding wire M4 to M6 screws

LTE antenna kit



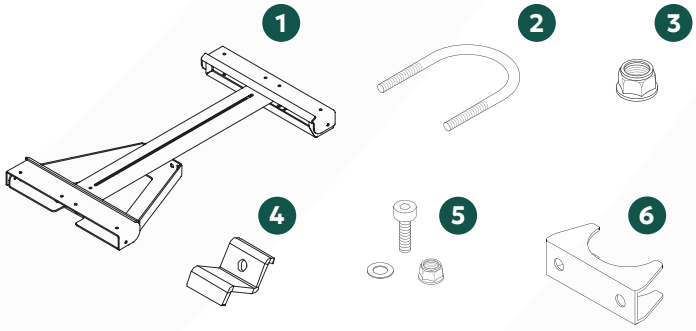
1 - Full-band LTE antenna
2 - Lightning arrester
3 - M6 U-bolt 2x
4 - N-type coaxial cable
5 - Nut, Lock-washer & washer 4x
6 - Mounting bracket
7 - Grounding wire M4 to M6 screws

Gateway enclosure kit



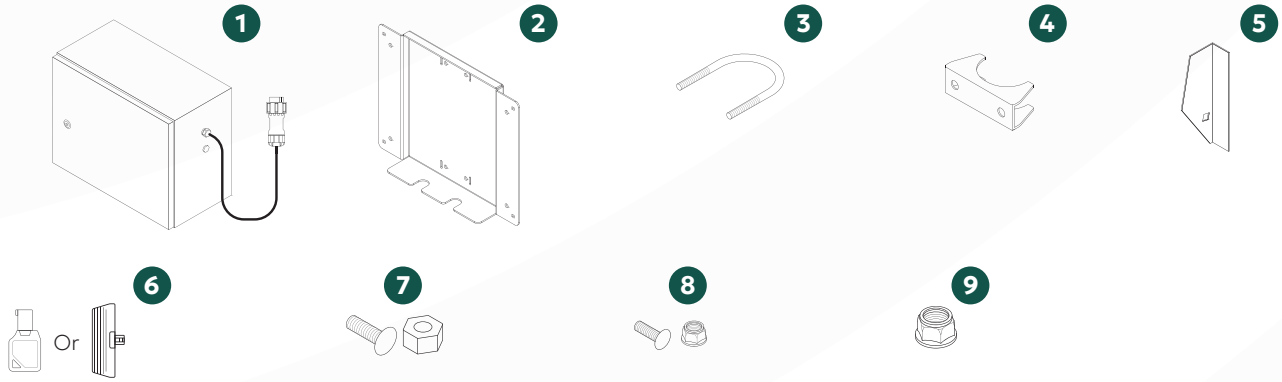
1 - Gateway enclosure
2 - M8 U-bolts 48mm 2x
3 - U-bolts bracket 2x
4 - M8 self-locking nuts 4x
5 - 25mm Socket head cap screws, wide washers & M6 self locking nuts 4x
6 - Gateway enclosure mounting bracket

Solar panel frame pre-assembled kit



1 - Solar panel mounting frame
2 - M8 U-bolts 48mm 2x
3 - M8 self-locking nuts 4x
4 - Solar panel mounting brackets 4x
5 - 25mm Socket head cap screws, washers & self locking nuts 4x
6 - U-bolts bracket 2x

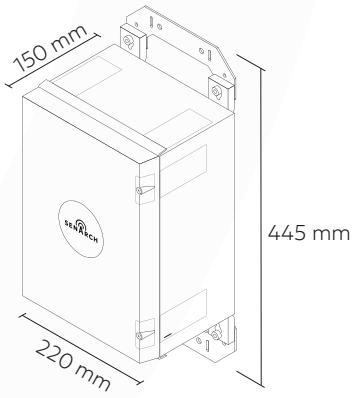
Battery enclosure kit

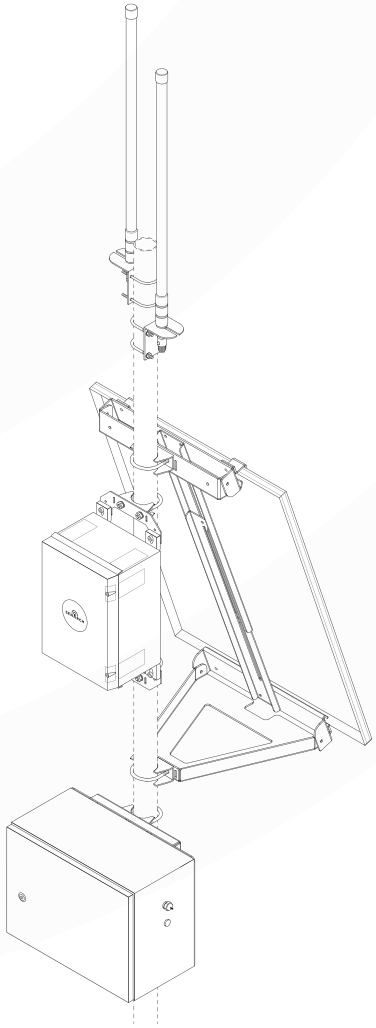


1 - Battery enclosure, including 3m cable
2 - Battery mounting plane
3 - M8 u-bolts 48mm 2x
4 - U-bolts bracket 2x
5 - Battery slider
6 - Battery enclosure key (type depending on lock)
7 - Round head bolt M8x16mm & M8 nuts 4x
8 - Round head bolt M6x12mm & M6 self locking nuts x4
9 - M8 self-locking nuts 4x

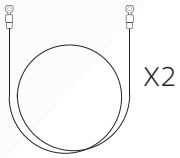
2.2 - Hardware overview

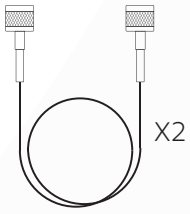
2.2.1 - Product overview & dimensions

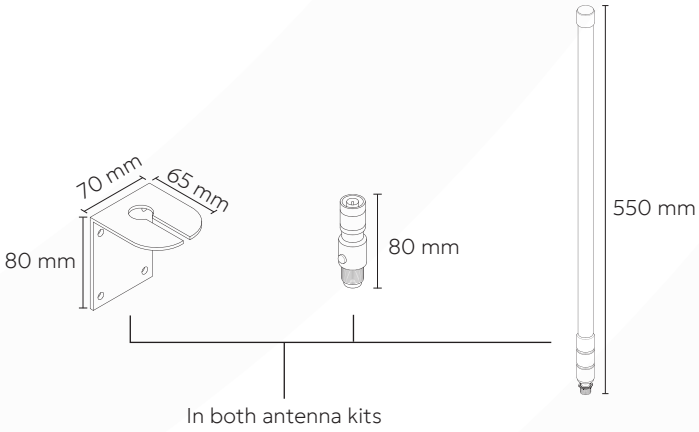


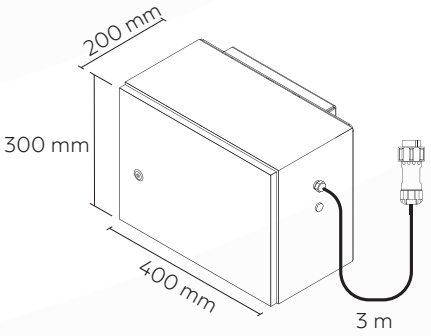


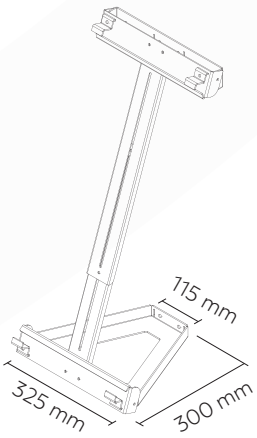
*mounting pole is not included.
Required: 48x2000 mm pole in either galvanized steel or aluminum in a 3mm thickness











2.3 - Power supply

Power requirements

Battery requirements

Type: **Must be AGM**
Voltage: 12V
Capacity: 50Ah or 100Ah

Solar panel requirements

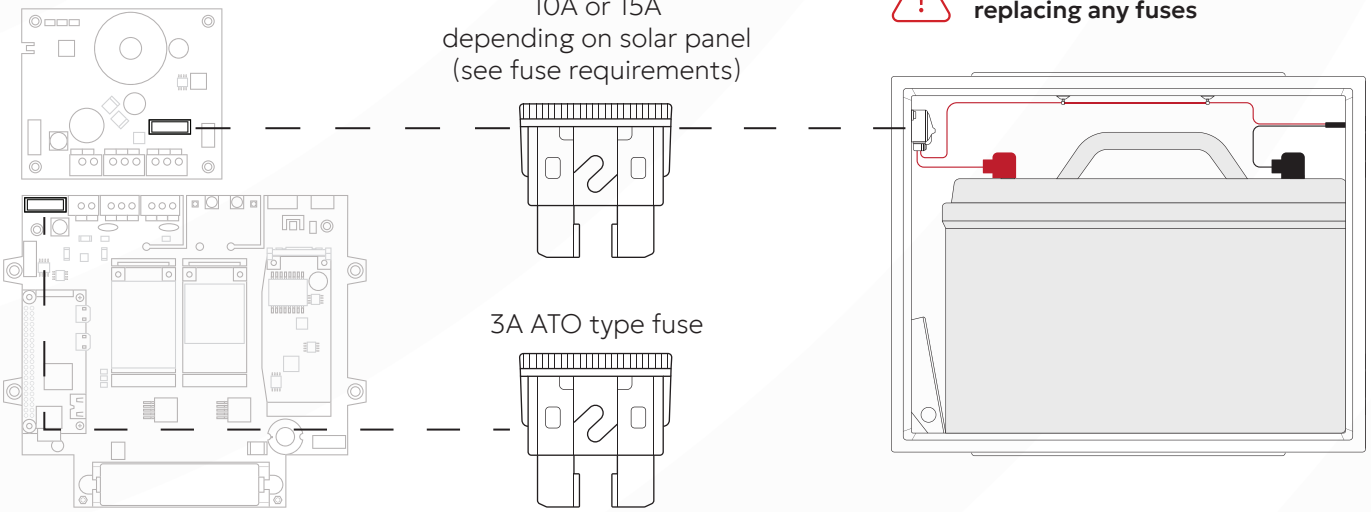
Type: Poly/Mono crystal
Voltage: 12V
Capacity: 50W, 100W or 150W

Fuse requirements

Type: ATO
Voltage: 32 Vdc
Current (solar power):
10A (for 50W & 100W solar panels)
15A (for 150W solar panels)

Failing to meet these requirements might result in product failure.
SenArch is not liable if requirements are not met

Fuse types and locations



Disconnect battery before replacing any fuses

To replace the fuses in the gateway enclosure, simply pull out the fuse and insert the new in its place

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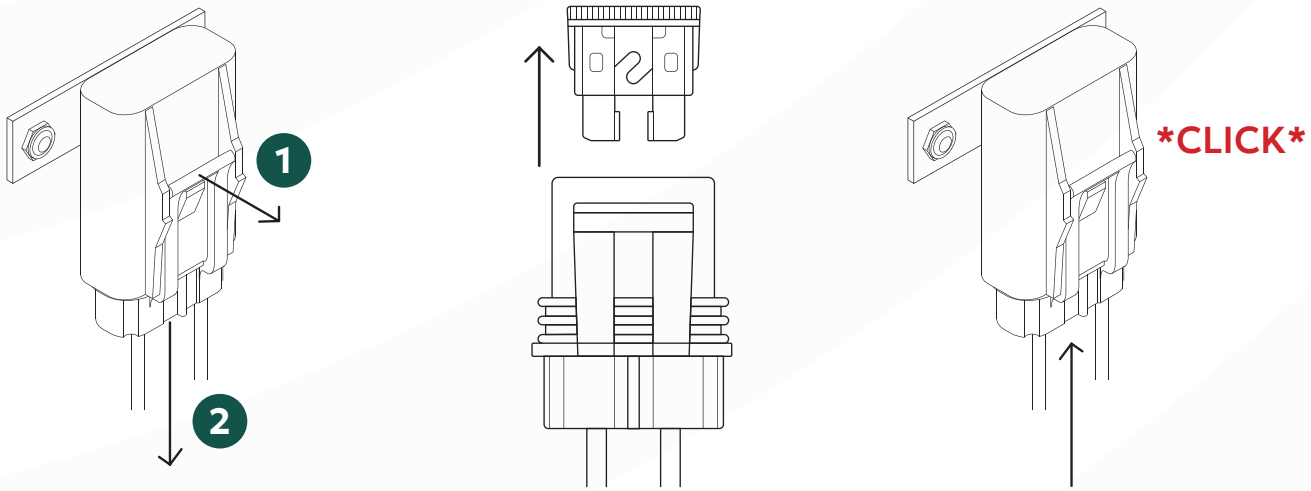
Replacing fuse in the battery enclosure

Disconnect battery before replacing any fuses



Pull out on the lock tab and pull down on the bottom to open the fuse case

Pull out the fuse and insert a new one, see fuse requirements for the type

Click the fuse case back together again

3.0 - Gateway installation

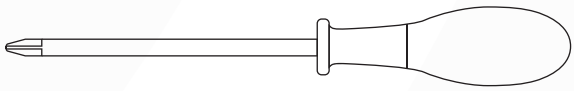
3.1 - Tools needed for installation

Tools are not included

All tool sizes are metric

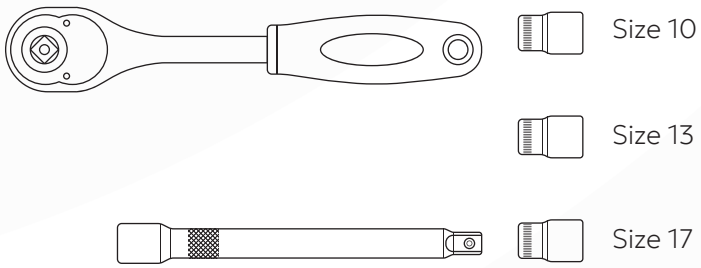
M6 allen key

Phillips screwdriver

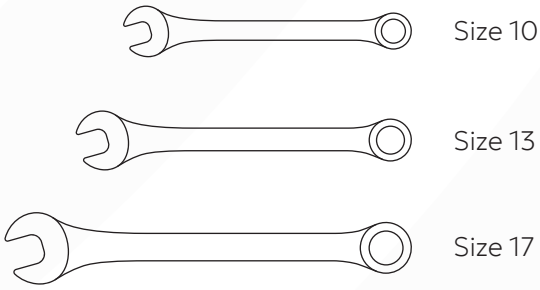


At least one of the following options:

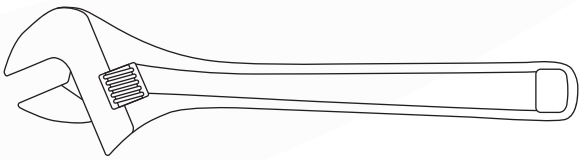
Ratchet wrench set



Combination wrenches in the following sizes:



Adjustable wrench

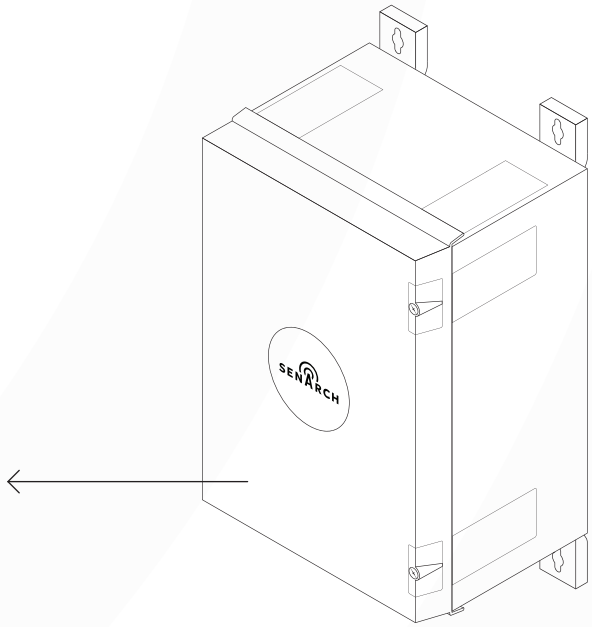


3.2 - Co-host keys

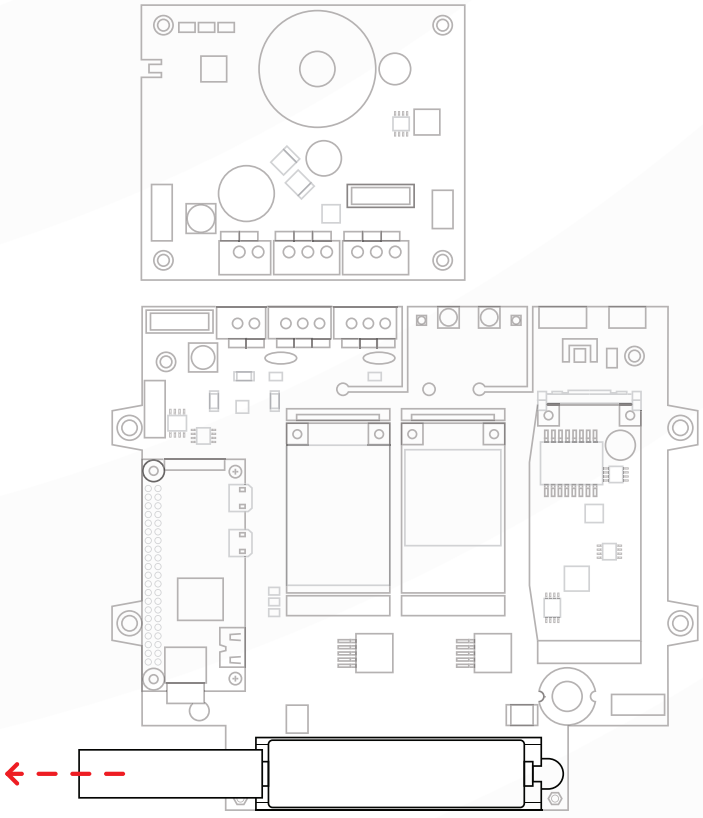
Attached to the gateway enclosure you will find the co-host keys for the unit

Remove this label and store it in a safe place

Co-host keys: ARCH-0000
DevEUI: 0000000000000000 AppEUI: 0000000000000000 AppKey: 00000000000000000000000000000000



3.3 - Main board battery strip removal

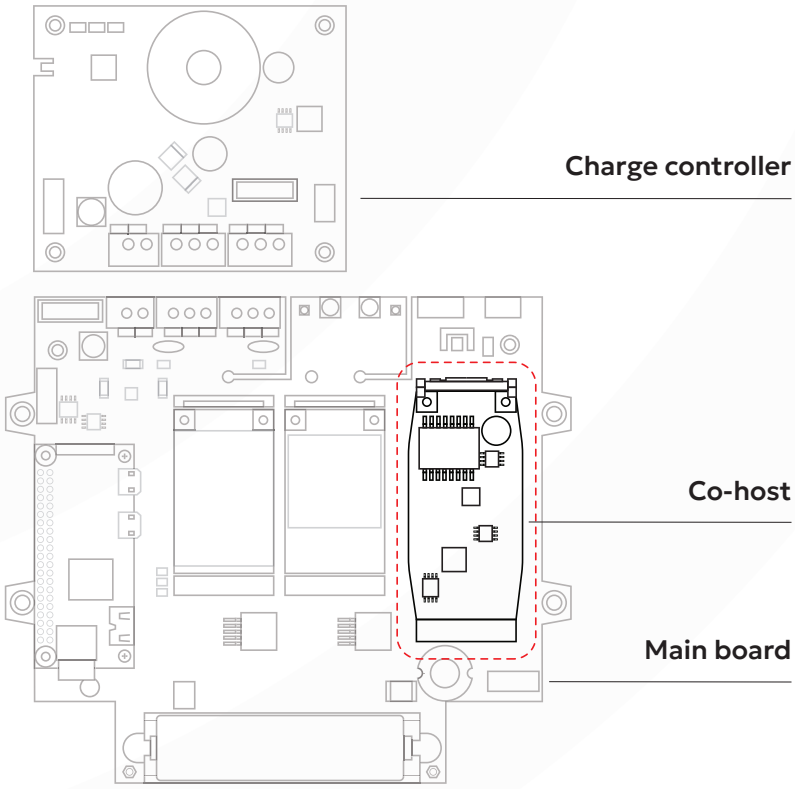


Open the gateway enclosure using a Phillips screwdriver

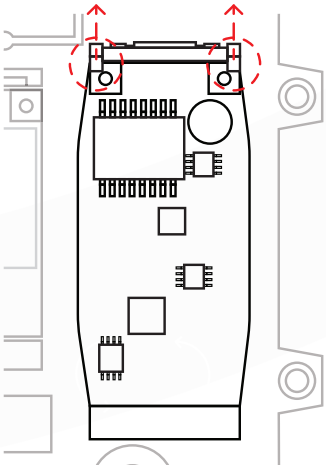
Locate the Li-ion battery on the main board inside the gateway enclosure

Pull out the battery strip as illustrated

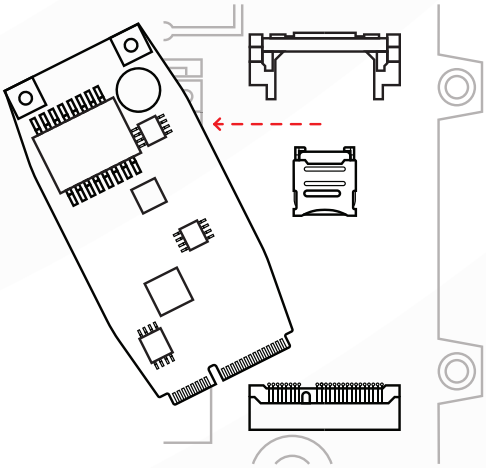
3.4 - SIM card installation



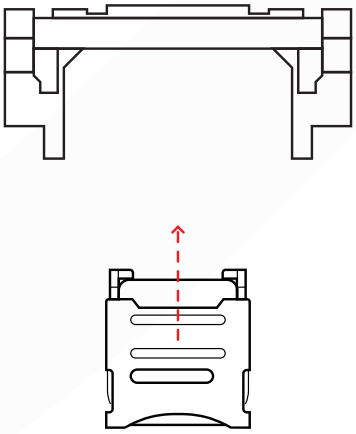
1 Locate the co-host board inside of the gateway enclosure



2 Pull the two lock pins up to release the top of the co-host board

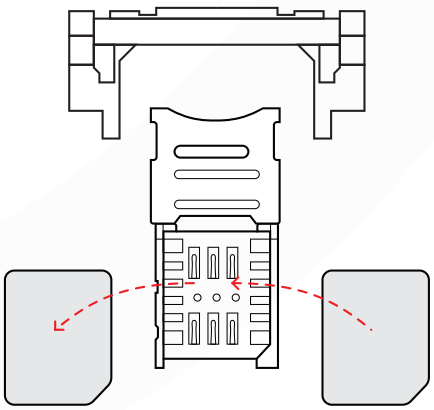


3 Put the co-host board aside in a non static location to reveal the SIM card slot

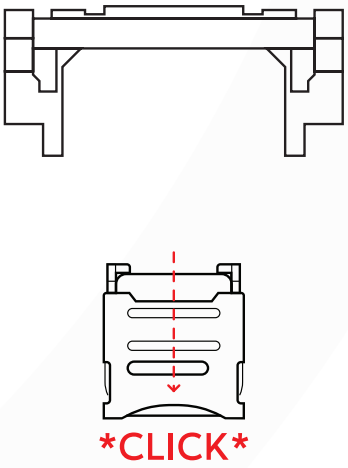


4 push the SIM card slot shield upwards to unlock and open it

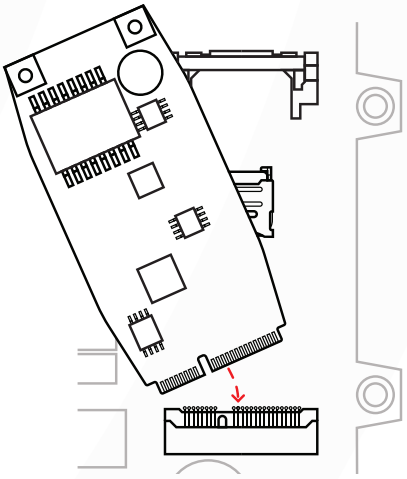
3.4 - Sim card installation (continued)



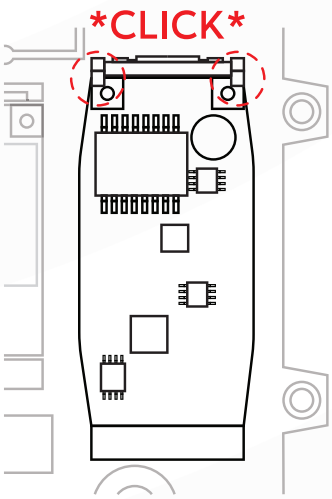
5 Insert or exchange the SIM card



6 Close the shield and lock it by pushing it downwards until it clicks



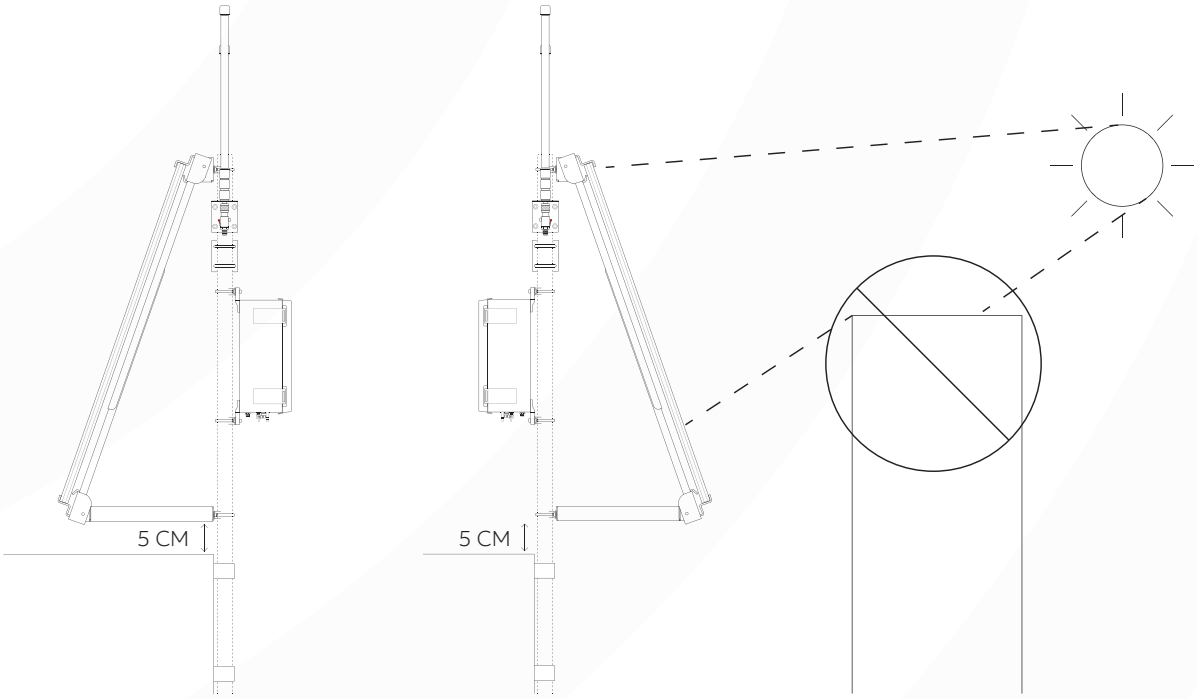
7 Reinsert the co-host board into the bottom slot



8 Click the top of the co-host board back into the lock

3.5 - Pole mounting

3.5.1 - Solar panel clearance and angle



When attaching the solar panel, (**see 3.5.4**) make sure the bottom of the solar panel frame is cleared by at least 5 cm of any obstacle

Make sure the solar panel is unobstructed for as many hours a day as possible

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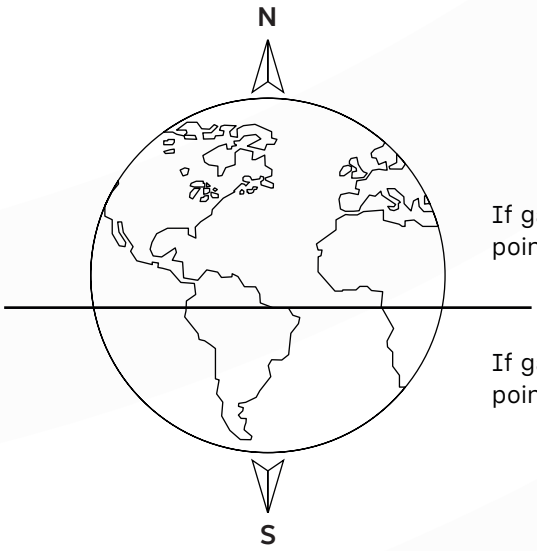
3.5.2 - Solar panel orientation

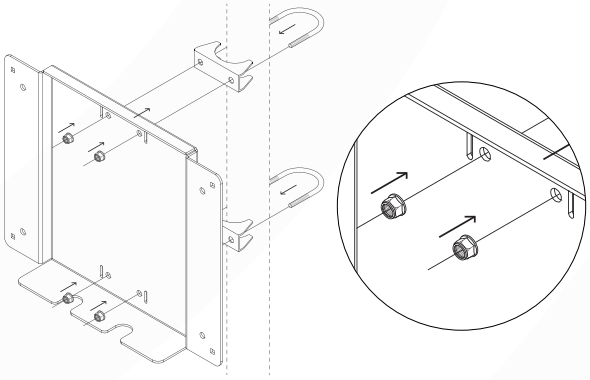


If gateway is placed on the **northern hemisphere**, point the solar panel towards **south**

If gateway is placed on the **southern hemisphere**, point the solar panel towards **north**

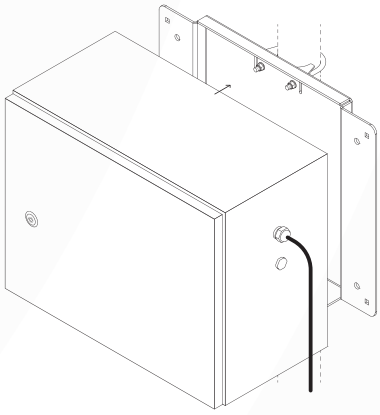
3.5.3 - Battery cabinet installation

1



Attach the battery enclosure mounting plate to the pole, using the U-bolts, U-bolt brackets and the M8 self-locking nuts as illustrated

2



Place the battery cabinet onto the mounting plate rest so that the holes on the mounting plate and the back of the cabinet line up

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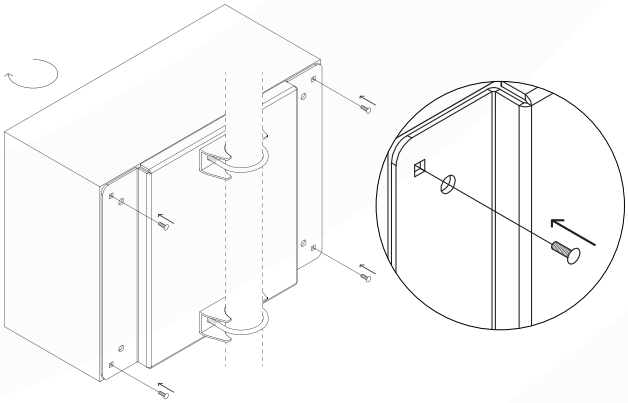
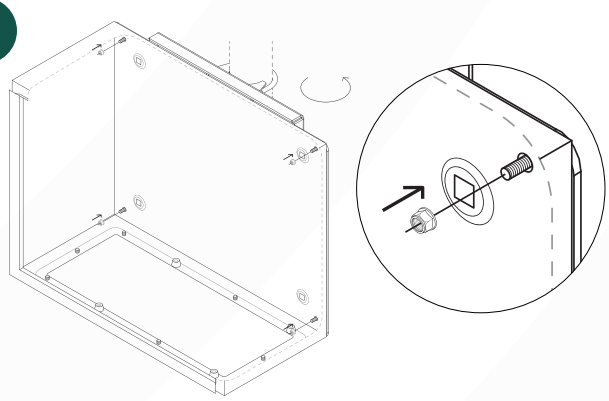
3



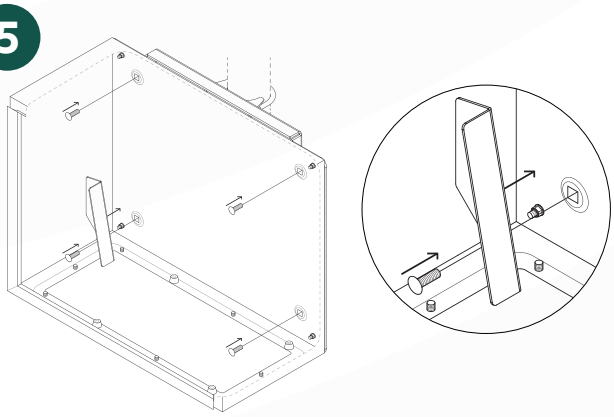
Insert the M6 round head bolts into the outer most corner holes in the mounting plate so that they enter the battery enclosure

4



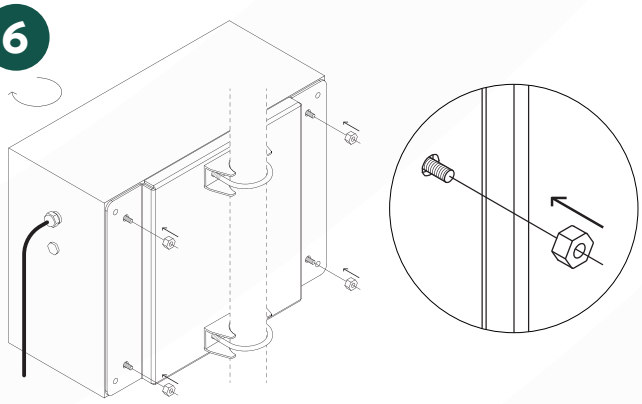
On the inside of the battery enclosure, fasten the M6 round head bolts with M6 self-locking nust as illustrated.

5



Place the battery slider in the bottom left corner inside the battery enclosure as illustrated.
Insert the M8 round head bolts into the inner most holes inside the battery enclosure so that they go through the mounting plate

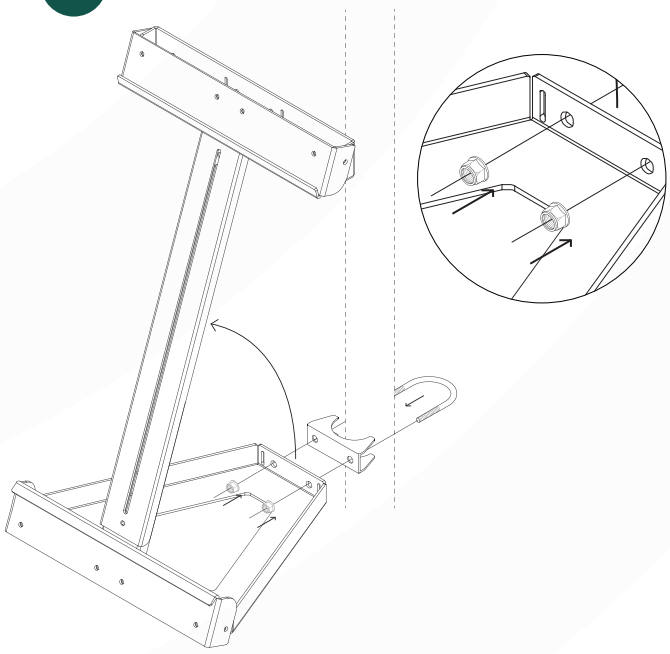
6



Fasten the M8 round head bolts with each a M8 nut for battery enclosure on the back of the mounting plate as illustrated

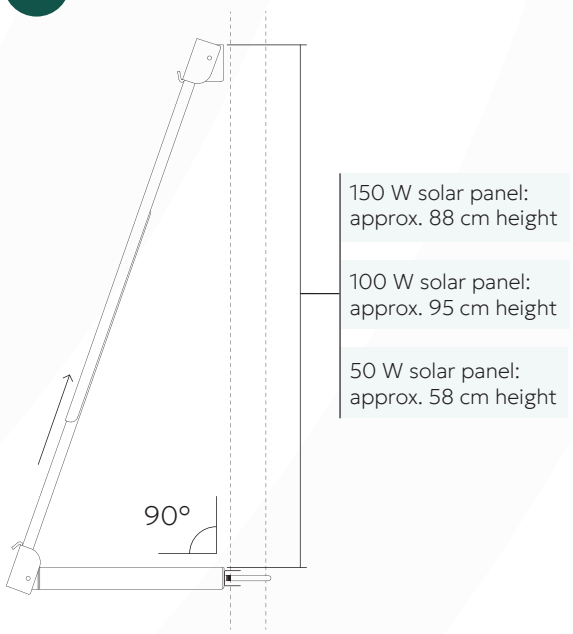
3.5.4 - Solar panel installation

1



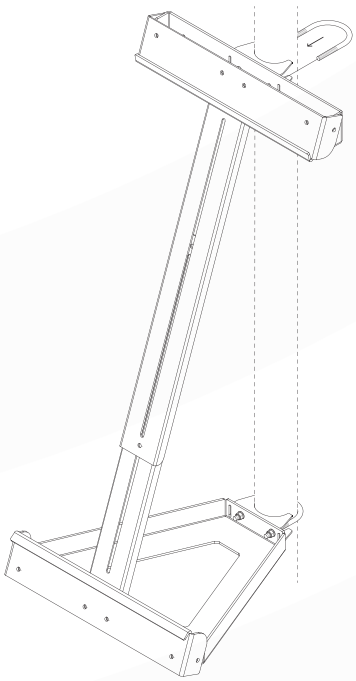
Lift up the solar panel frame arm and fasten the bottom to the pole, using a U-bolt, U-bolt bracket and two M8 self-locking nuts. Fasten tightly

2



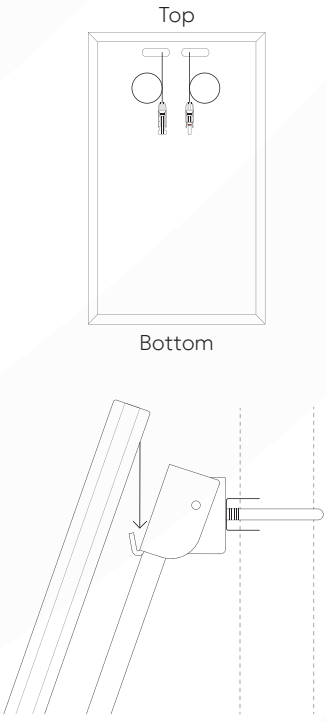
Extend the arm according to the solar panel used. Make sure the bottom plate of the frame is fastened to the pole at a 90 degree angle

3



Fasten the top of the frame to the pole using the same method as step 1. Fasten tightly

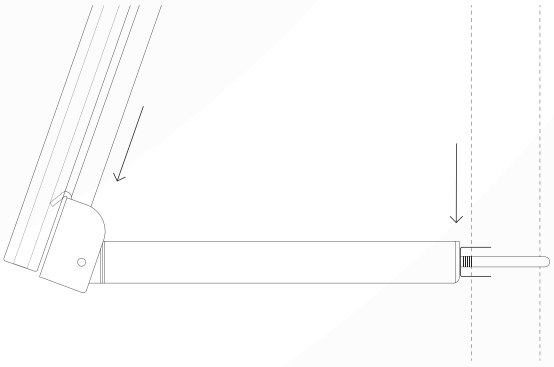
4



Lower the top of the solar panel down onto the hook ledge so that the solar panel is hanging safely
The top of the solar panel needs to be the end with the wires.
Make sure the solar panel is centered with the pole

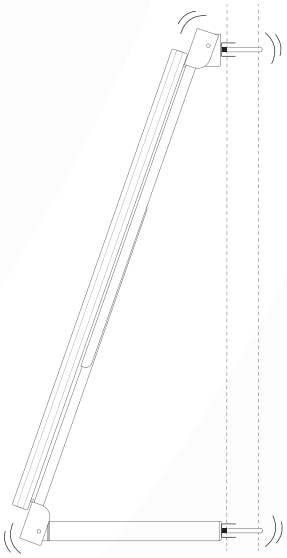
3.5.4 - Solar panel installation (continued)

5



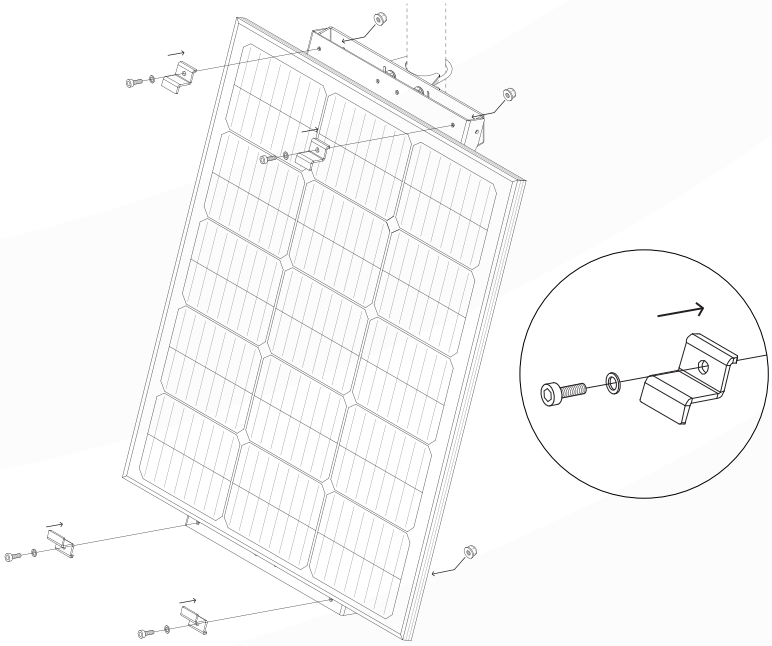
Loosen the the bottom U-bolt so that the bottom of the frame can be extended downwards.
Extend until the hook ledge is locking the bottom edge of the solar panel.
Tighten the U-bolt tightly again.

6



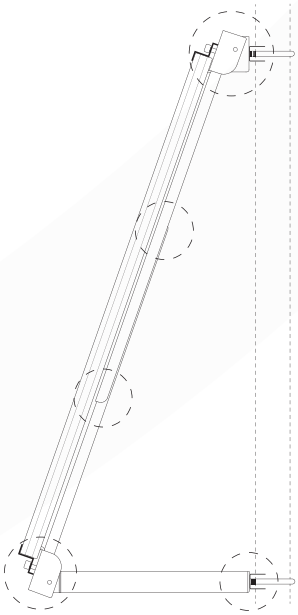
Test if the solar panel frame is securely fastened to the pole and that the solar panel cannot be moved vertically. You should not be able to move the solar panel frame out of place.

7



Screw on the solar panel mounting brackets as illustrated using the socket head cap screws, washers and self-locking nuts to secure the solar panel to the solar panel frame

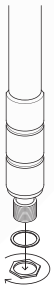
8



Finish solar frame installation by tightening all screws on the frame

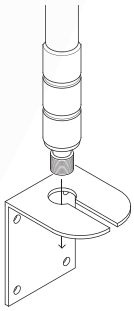
3.5.5 - Antenna installation

1



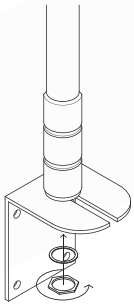
Unscrew and put aside the bolt and washer from the bottom of the antenna

2



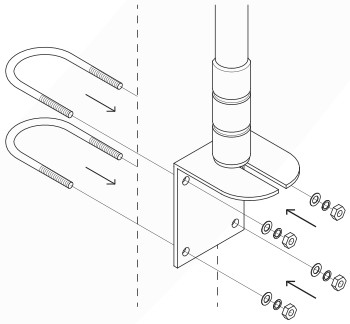
Place the bottom of the antenna into the hole in the mounting bracket

3



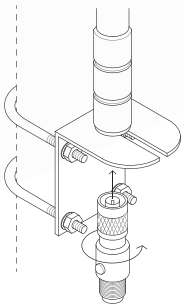
Fasten the antenna to the mounting bracket with the washer and bolt put aside in step 1.
Make sure it is fastened tightly

4



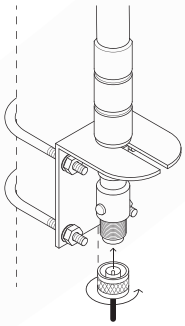
Attach the mounting bracket with the antenna to the pole, using the U-bolts, washers, lock-washers and bolts as illustrated

5



Tightly screw in the lightning arrester to the bottom of the antenna

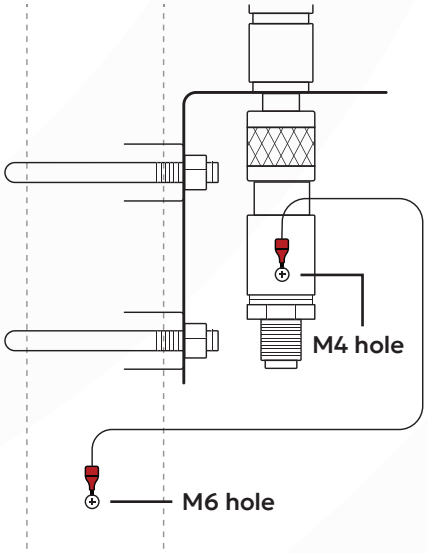
6



Tightly screw in the N-type coaxial cable to the bottom of the lightning arrester

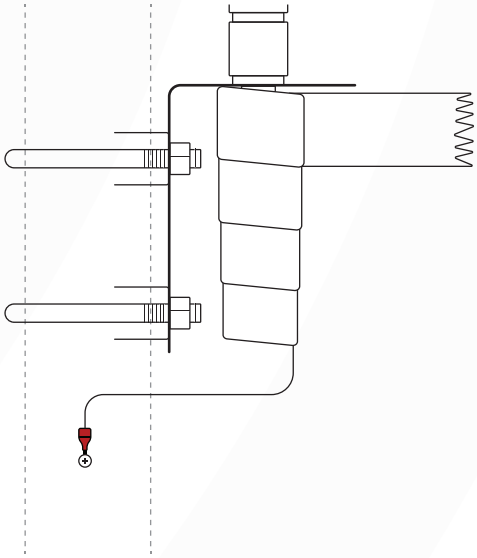
3.5.5 - Antenna installation (continued)

7



For safety, screw the M4 end of the ground plane wire to the lightning arrester on the antennas and the M6 end to a metal surface, for example the mounting pole

8

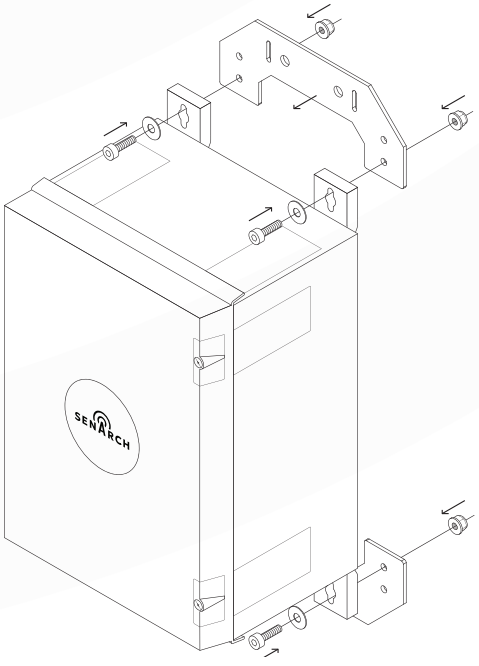


We strongly recommend wrapping the lightning arrestor in vulcanising tape for weather protection

Vulcanising tape not included

3.5.6 - Gateway enclosure installation

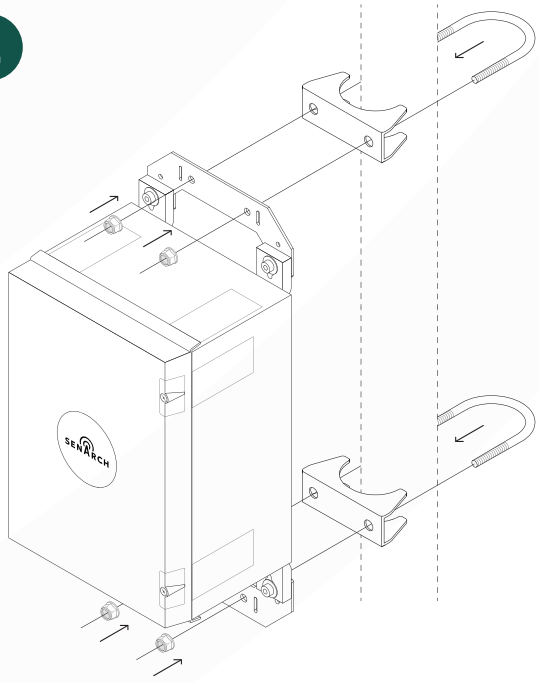
1



To prepare the gateway enclosure for mounting, screw on the gateway enclosure mounting brackets using the socket head cap screws, big washers, small washers and self-locking nuts as illustrated.

It is recommended to do this step right out of the box

2



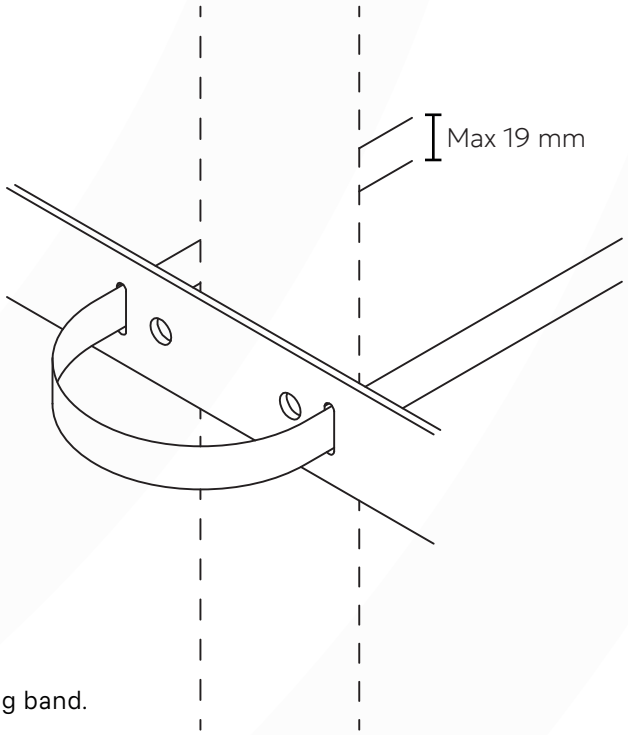
Attach the gateway enclosure mounting brackets to the pole, using the U-bolts, U-bolt brackets and the M8 self-locking nuts as illustrated

It is recommended to install the gateway enclosure behind the solar panel mount

3.5.7 - Mounting with metal bands

It is possible to fasten the gateway enclosure, solar panel frame and battery enclosure to a pole using metal bands instead of u-bolts.

This works as illustrated:



Use any kind of high strength and durability fastening band.
SenArch recommend using Band-It bands.
Fastening band can have a max width of 19mm

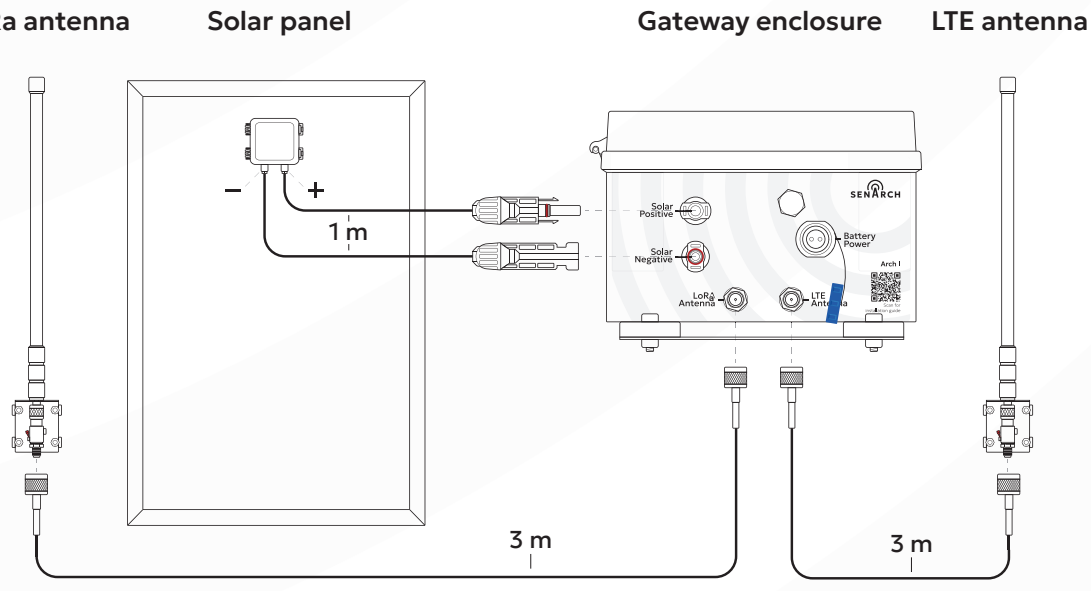
Tightening the band is dependent on the type of band used. Refer to the instructions of the type of band used

Fastening bands not included

3.5.8 - Cable connections

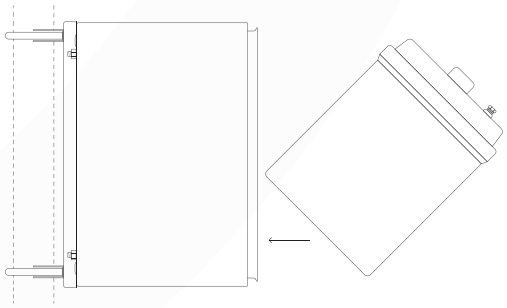
Connect the cables of the LoRa antenna, LTE antenna and solar panel into the gateway as illustrated

Do not connect the battery power yet



3.5.9 - Powering up the system

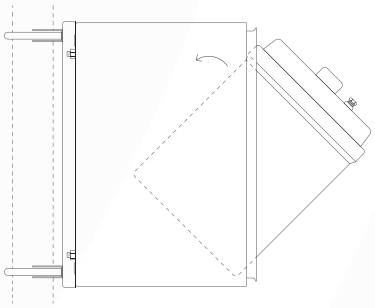
1



Tilt the battery towards yourself with the terminal side of the battery closest to you

Be careful to not touch the battery terminals while handling the battery

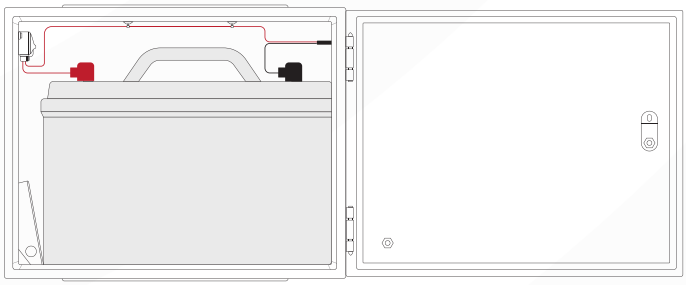
2



Lift the battery into the battery enclosure so that the bottom corner closest to you is resting just inside the enclosure. Then let the battery fall into an upright position. The battery slider will make sure the battery is positioned correctly

---

3



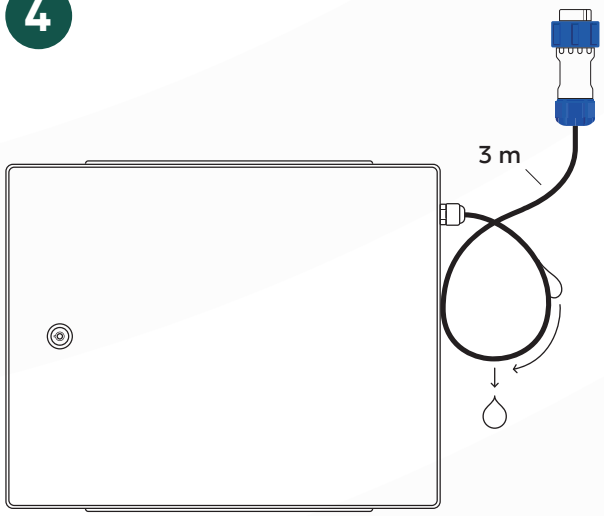
Connect the eye connectors in the battery enclosure to the correct terminals on the battery and cover them with the rubber hoods

CAUTION:

it is critical that the positive connector **(red wire)** is connected to the positive terminal **(red)**

The negative connector **(black wire)** has to be connected to the negative terminal **(black)**

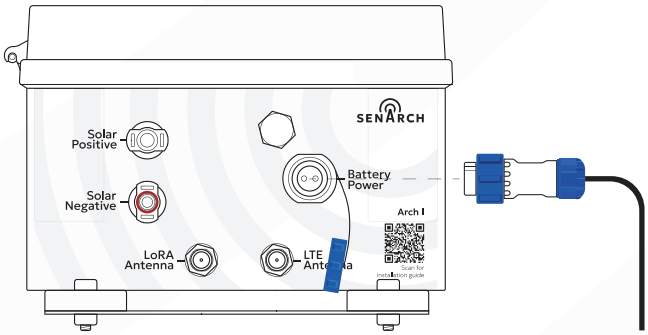
4



As a safeguard, make a downwards loop with the battery cable and lock it with a tie wrap to direct the rain water away preventing it from entering into the enclosure through the port.

See illustration.

5



Plug in the battery cabinet to the gateway enclosure as illustrated

The gateway is now powered on :)

3.6 - Tripod mounting

The SenArch tripod is an optional accessory and not included unless ordered seperately

When installing the Arch I on the SenArch optional tripod, refer to chapter **3.5 - Pole mounting**

It is recommended to install the gateway on the tripod in the order and setup illustrated here:

3 - LoRa & LTE antennas

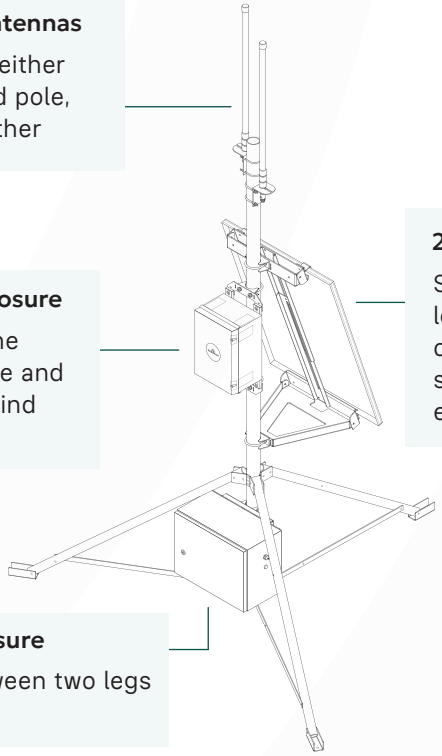
One antenna on either side of the tripod pole, one above the other

2 - Solar panel

Straight above a leg of the tripod on the opposite side of the battery enclosure

4 - Gateway enclosure

Directly above the battery enclosure and in the space behind the solar panel



1 - Battery enclosure

Centered in between two legs of the tripod

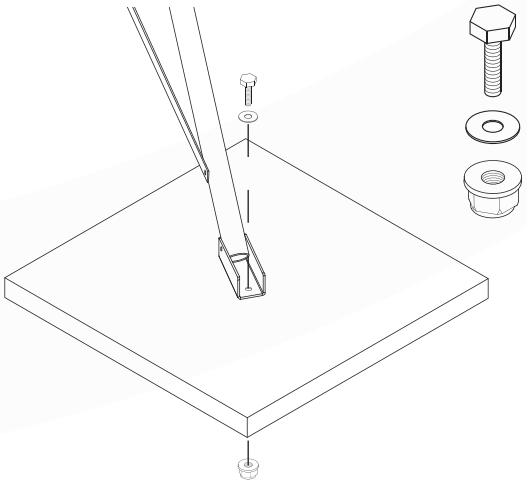
3.6.1 - Securing to ground

When setting up the SenArch tripod it is important to secure it to the ground to prevent it tipping over and damaging the gateway or preventing the gateway from functioning.

Securing the tripod can be done in any way fitting for the deployment setting and does not have to follow a ruleset.

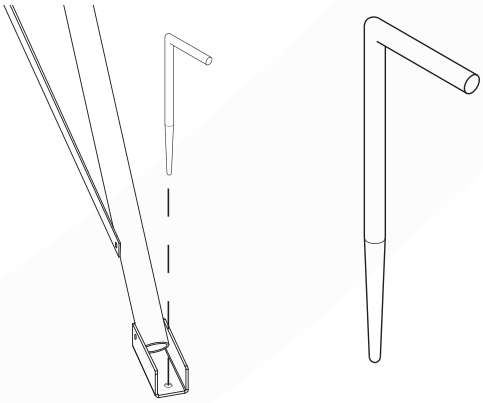
However, we recommend securing the tripod in one of the following ways:

Bolted to tiles (for hard surfaces):



Bolt each foot of the tripod by drilling a hole through a heavy pavement tile and fastening with a bolt with a fitting washer and a self locking nut. The bolt can not exceed a diameter of 10 mm

Pegs (for deployment on soil surface):



Use any type of long and strong peg to secure each foot of the tripod to the ground.
The diameter of the peg should optimally be 10 mm

Parts for securing the tripod are not included

3.7 - Wall mounting

Wall mounting is an optional method of installing the Arch I.

When installing the Arch I on a wall, refer to chapter **3.5 - Pole mounting** for the steps beyond wall mounting.

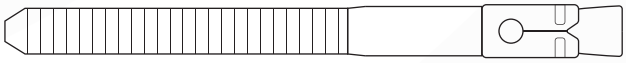
This chapter is only an example and not a step by step guide

Depending on the type of wall to which the Arch I is installed, other methods or tools might be needed.

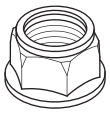
Research the best way of fastening equipment to the type of wall in question before starting the wall mounting process.

Example of wall mounting bolts and nuts:

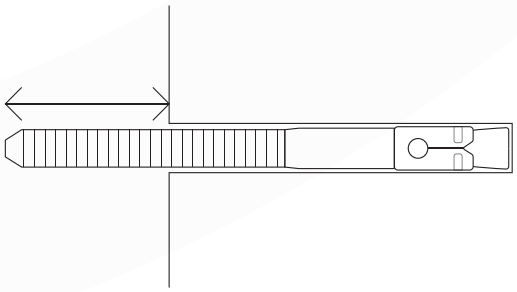
Carbon steel expansion bolts M8 (M6 for antennas) (Not included)



Self locking nuts M8



Installing the wall mounting bolts:



Refer to the installation instructions of the bolt you have acquired on how to install them into your surface.

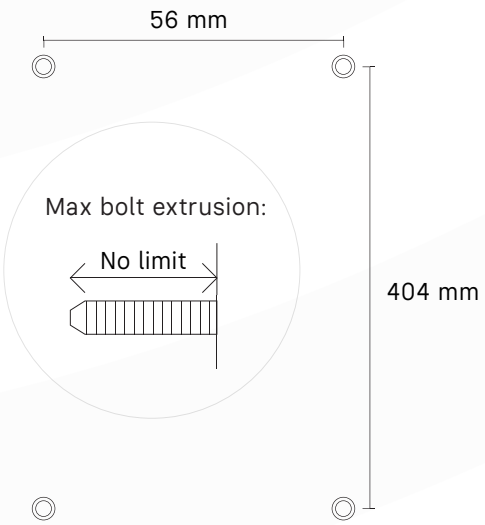
Check the following diagrams for the maximum extrusion the bolt can have from the wall

Bolt measurements for each module:

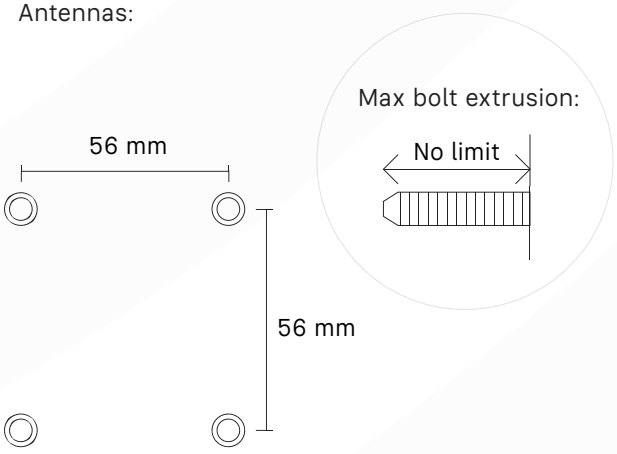
On these diagrams you can see the distance needed between the wall bolts, and the maximum allowed extrusion of the bolt from the wall, for each module of the Arch I

It is recommended that you measure these distances yourself before starting the wall mounting installation to lower the chances of errors.

Gateway enclosure:

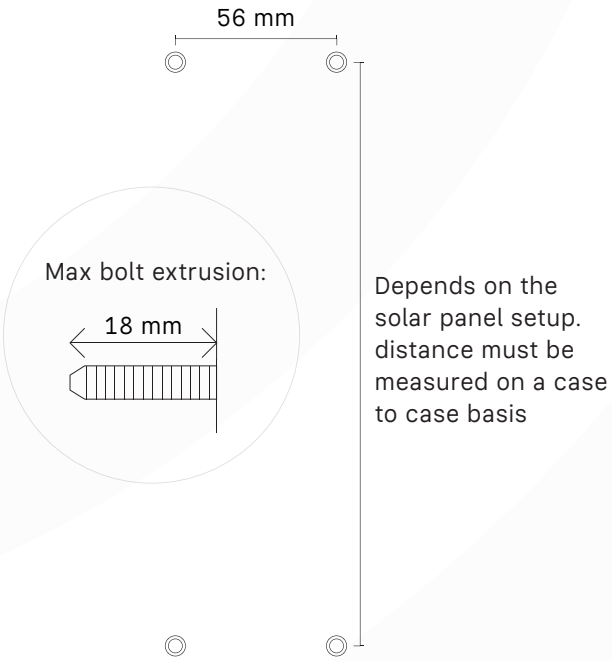


Antennas:

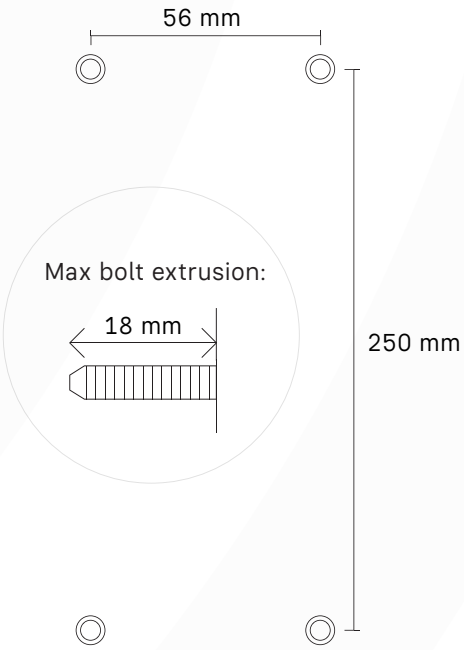


3.7 - Wall mounting (continued)

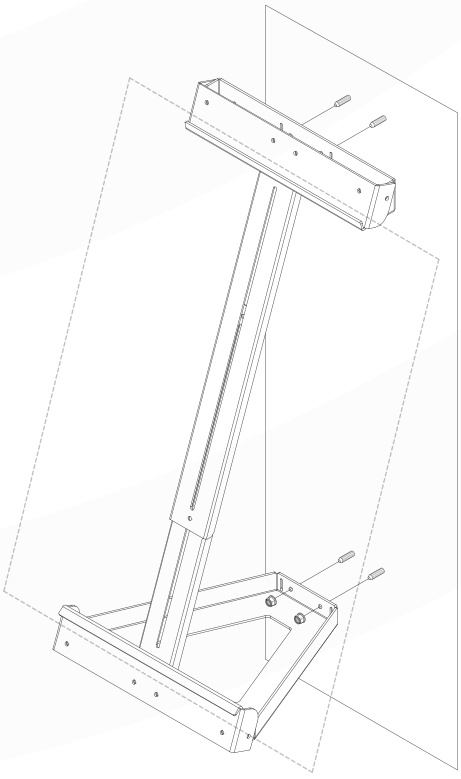
Solar panel frame:



Battery back plate:



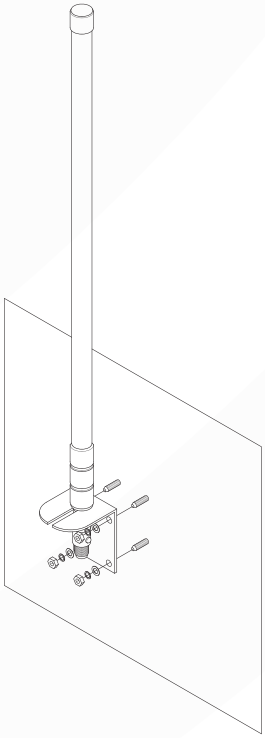
Solar panel frame



You can fasten the solar panel frame to the wall using M8 self locking nuts onto M8 Expansion bolts in the wall

Install the solar panel onto the solar panel frame before starting the wall mounting process to make sure you have the correct measurements

Antennas



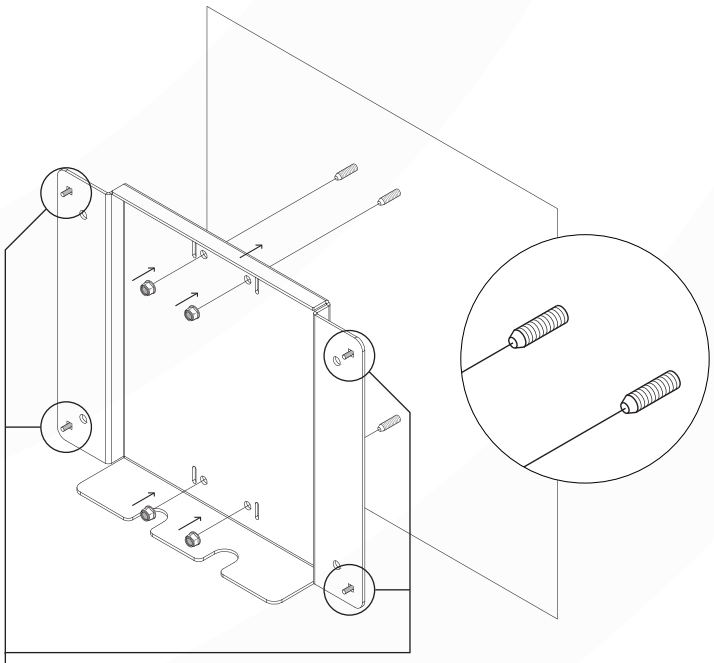
You can fasten the solar panel frame to the wall using the nuts and washers included onto M6 Expansion bolts in the wall

Alternatively a short pole (max 48mm width) can be attached to the wall on which the antennas can be installed with U-bolts

To prevent loss of efficiency do not install the antennas too close to any metal plating

3.7 - Wall mounting (continued)

Battery back plate

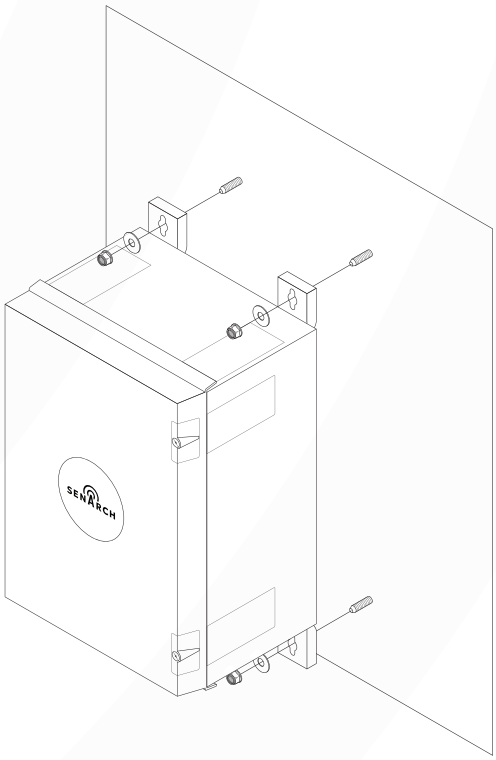


You can fasten the solar panel frame to the wall using M8 self locking nuts onto M8 Expansion bolts in the wall

Before putting the back plate on the wall, make sure to insert the M6 round head bolts into the outer most corner holes in the mounting plate as illustrated

Continue installing the battery enclosure by following the steps in **3.5.3**

Gateway enclosure



You can attach the gateway enclosure directly on the wall without the included mounting brackets, using M8 self locking nuts onto M8 Expansion bolts in the wall

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Depending on how far apart the gateway parts are installed, extension cables may be needed