

# **How to use Sensoterra sensors over the Inmarsat IsatData Pro satellite network with the MinFarm MF-400 IoT Satellite Bridge**

**Version 1.3 March 2021**

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## Table of Contents

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• Section 1 - Introduction	4
• Section 2 - Components Required	9
• 2.1 - Device(s) with sensor(s) attached	9
• 2.2 - MF-400 Gateway	11
• 2.2.1 - MF-400 Technical Overview	12
• 2.2.2 - MF-400 Contents	12
• 2.2.3 - Required Tools for Installation	12
• 2.2.4 - Safety Instructions	13
• 2.2.5 - MF-400 Installation	14
• 2.3 - Inmarsat IsatData Pro Satellite Terminal	30
• Section 3 - Software Staging Preparation Required Before Field Installation	31
• 3.1 - Sensoterra application software	31
• 3.2 - MinFarm Bridge Server	33
• Section 4 - Total System Test before Field Installation	33
• Section 5 - Field Installation	34
• Section 6 - Terminology and Abbreviations	35
• Section 7 - Contact Details	36

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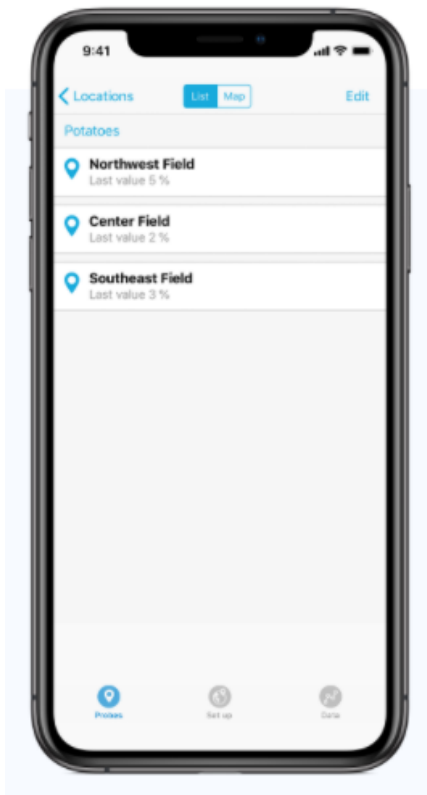
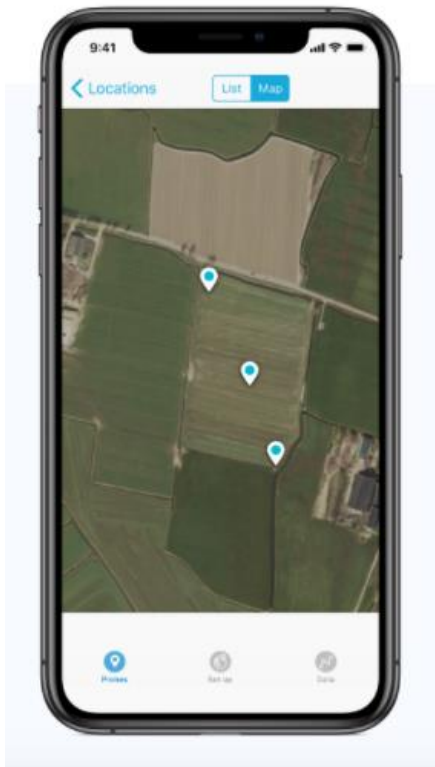
## Section 1

### Introduction

Are you a farmer with a medium or large sized land area in a location of little or no cellular data coverage and electrical power? Would you like to have access to your soil moisture levels on an easy to use interface on your mobile phone or laptop? Remote monitoring of your farm and lands 24 hours, from anywhere.

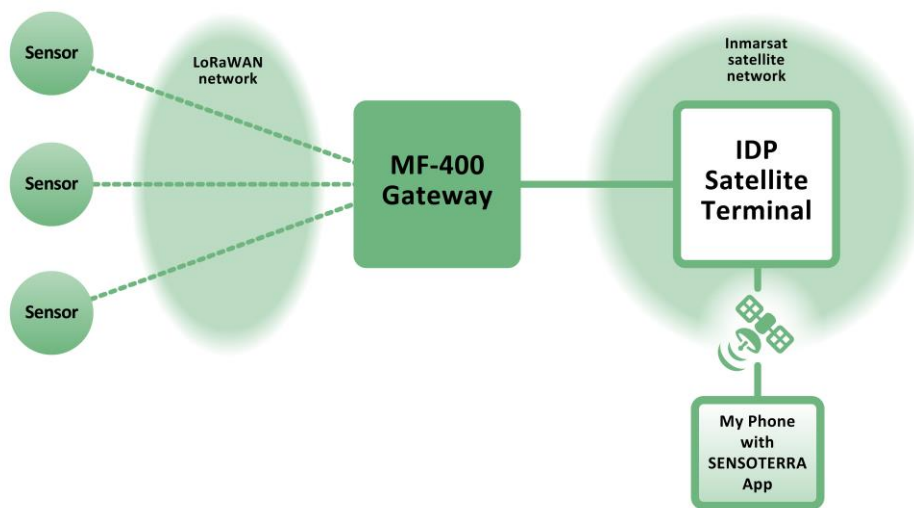


All data is displayed on your mobile phone or laptop.





So what do you need? Have a look at Schematic 1.

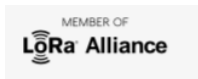


Schematic 1

You will need:

1. Sensoterra Single Depth soil moisture sensor
2. MF-400 Gateway
3. Inmarsat IsatData Pro (IDP) Satellite Terminal
4. Sensoterra application software on your mobile phone or laptop

The technical part in simple terms! How does it all work? There are two main **networks** involved. One is called **LoRaWAN™**, and the other is the **Inmarsat satellite network**.



<https://lora-alliance.org>

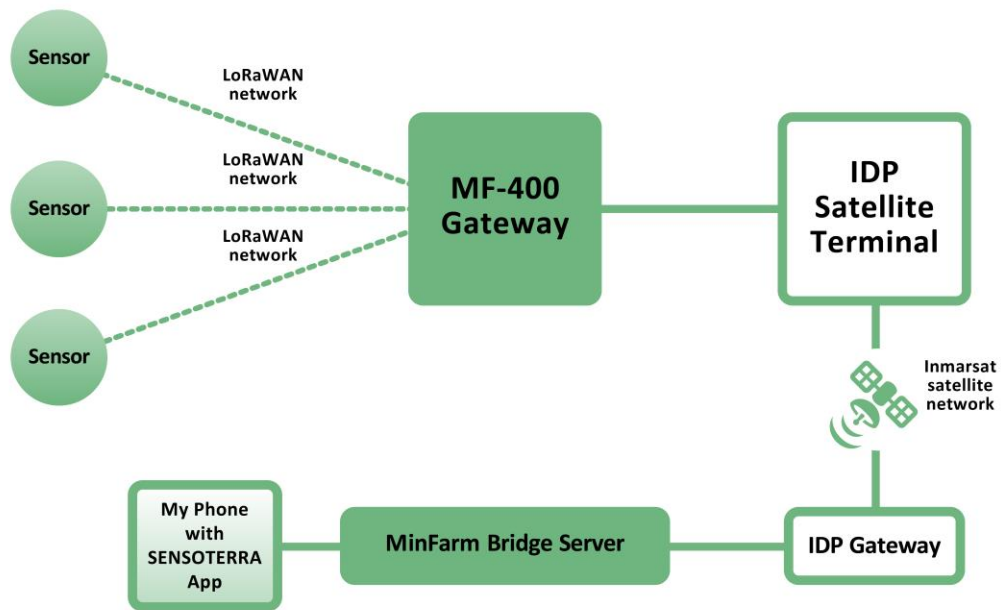
The **LoRaWAN™** ('long range wide area network') is a low power wireless network that allows you connect wireless battery operated devices to a gateway that can be several kilometres away. Through this gateway, the devices can then connect to the Internet. So it is low power, has a good range, and is wireless - these are the important facts to remember about this network.



<https://www.inmarsat.com>

The **Inmarsat satellite network** provides a global, reliable and trusted method of accessing the Internet using low-powered, portable satellite terminals.

Your Sensoterra single depth sensor sits out in a remote area of your land. Every hour your sensor sends information to the MF-400 Gateway. This is sent over the LoRaWAN network that we talked about. It passes the information to the IDP satellite terminal, up to the satellite in the sky, back down to a satellite receiving station, called the IDP gateway, which then passes it on to the MinFarm Bridge Server, and then on to your mobile phone where you can view it using the Sensoterra application software. This flow of information can be seen in Schematic 2, just slightly more detailed than Schematic 1.



Schematic 2

## Section 2

### Components Required

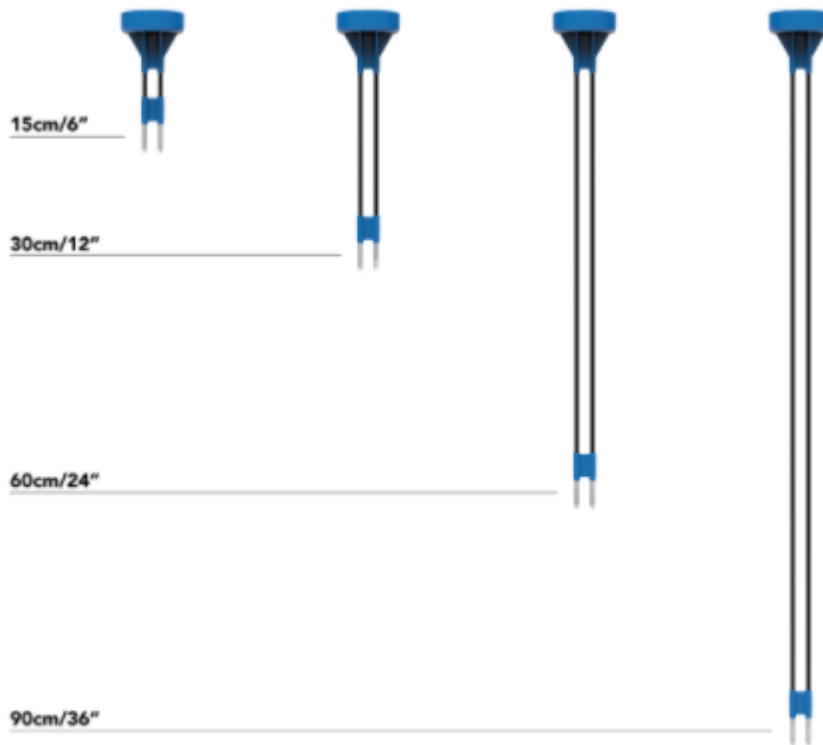
#### 2.1

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#### Single Depth Sensor

The picture below shows a Sensoterra single depth sensor which measures soil moisture levels. Sensoterra also produce a multi depth device which has 6 different sensors attached, but for the purpose of this paper we will talk about the single depth sensor. The MF-400 IoT Satellite solution will work with both sensors in a similar way. You should contact Sensoterra to discuss what sensor best suits your requirements.





Device Installation:

Refer to the Sensoterra Installation Guide

[https://www.sensoterra.com/uploads/documents/Installation/SD\\_Installation\\_guide\\_1.0.pdf](https://www.sensoterra.com/uploads/documents/Installation/SD_Installation_guide_1.0.pdf) for particular installation and set-up instructions for your single depth sensor.

## 2.2

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### MF-400 Gateway

The MF-400 can be seen in the pictures below. You will need to contact CPN Satellite Services to purchase a gateway unit.



## 2.2.1

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### MF-400 Technical Overview

The MF-400 Gateway provides network server connectivity for 100 remote LoRaWAN™ sensors via Inmarsat IsatData Pro (IDP) satellite terminals and can operate continuously from a single 80W solar panel.

The MF-400 runs an optimized protocol to ensure that airtime satellite costs per sensor are kept to a minimum. This makes the MF-400 a standalone, low power, low-cost solution for adding satellite connectivity to your existing COTS LoRaWAN™ sensor devices.

The MF-400 Gateway supports LoRaWAN™ version 1.0.2, and is compatible with a very wide range of commercial off the shelf (COTS) LoRaWAN™ sensors.

Both the communication device and the solar charger are installed in IP67 rated CPN enclosures for harsh environments.

## 2.2.2

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### MF-400 Contents

- 1 x IP67 Enclosure (400 x 405 x 160mm)
- 1 x 12V battery
- 1 x STECA PR 1010 Solar Charger
- 1 x 80W 12V Solar Panel (670 x 770 x 30mm)
- 1 x LoRa Omnidirectional Antenna (8dBi, 0.8m)
- 1 x Enclosure Pole Mount
- 1 x LoRa Antenna Pole Mount
- 1 x IDP Satellite Terminal Power & Data Cable (5m)
- 1 x Solar Panel to Enclosure Cable
- 1 x LoRa Antenna Cable (5m)

## 2.2.3

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### Required Tools for Installation

- Phillips screwdriver - PH3
  - Enclosure lid
- Phillips screwdriver - PH2
  - Battery

- Slotted screwdriver - 0.6x3.5mm
  - Terminal blocks
- Wrench - #8
  - Pole mount Enclosure & IDP terminal
- Wrench - #10
  - LoRaWAN antenna
- Wrench - #13
  - Solar panel
- Zip ties
- Wire cutter

#### 2.2.4

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#### Safety Instructions

An external fuse or circuit breaker (max. 20A) must be provided in the onsite installation as an interrupt facility for the enclosure system – Only applicable to AC powered systems!. **WARNING** Risk of electrical shock, fire, personal injury, or death.

- Do not use a power supply without proper grounding (Protective Earth). Use the terminal on the input block for earth connection. Make sure that protective earth is connected according to all local and national codes and regulations!
- Turn the power off before working on the device. Protect against inadvertent re-powering.
- Make sure that the wiring is correct by following all local and national codes.
- Do not modify or repair the unit.
- Do not open the electronic units, e.g. power supply, as high voltages are present inside.
- Use caution to prevent any foreign objects from entering the housing.
- Do not use in wet locations or in areas where moisture or condensation can be expected while the cover is not mounted.
- Do not touch during power-on, and immediately after power-off. The hot surface may cause burns.

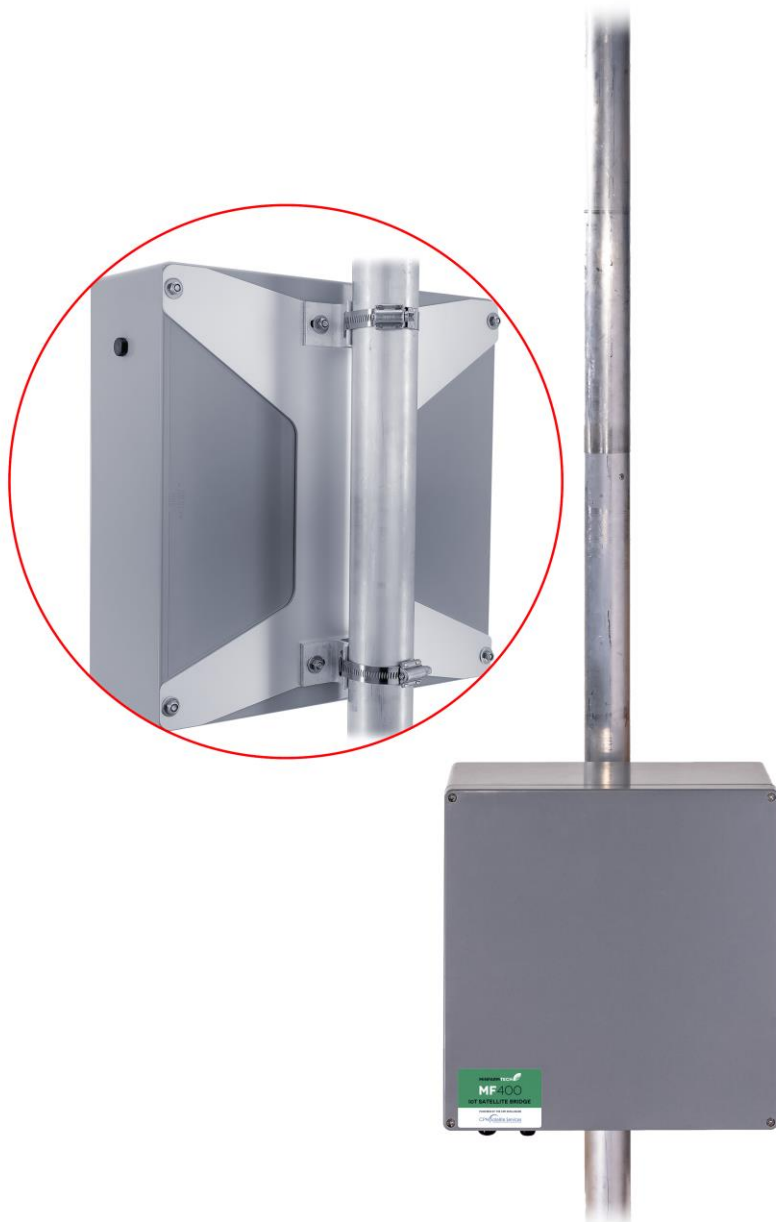
## 2.2.5

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### MF-400 Installation

Step 1 - Mount the enclosure to the pole.

Mount the enclosure to the pole by using the pole mount located at the backside of the enclosure.



Step 2 - Mount the solar panel to the pole.

Mount the solar panel to the pole by using the pole mount located on the backside of the solar panel.



Step 3 - Mount the antenna to the pole.

Plug the antenna cable into the antenna and use its pole mount to secure it onto the top of the pole.

Please make sure that your installation matches antenna cable requirements!



Step 4 - Mount the IDP Terminal to the pole.

Plug the IDP cable into the IDP terminal and use its pole mount to secure it onto the pole. We recommend using zip ties to fix the cables to the pole.

Please make sure that your installation matches cable requirements!



Step 5 - Open the enclosure.

Loosen the 4 marked screws of the cover and remove it from the enclosure.

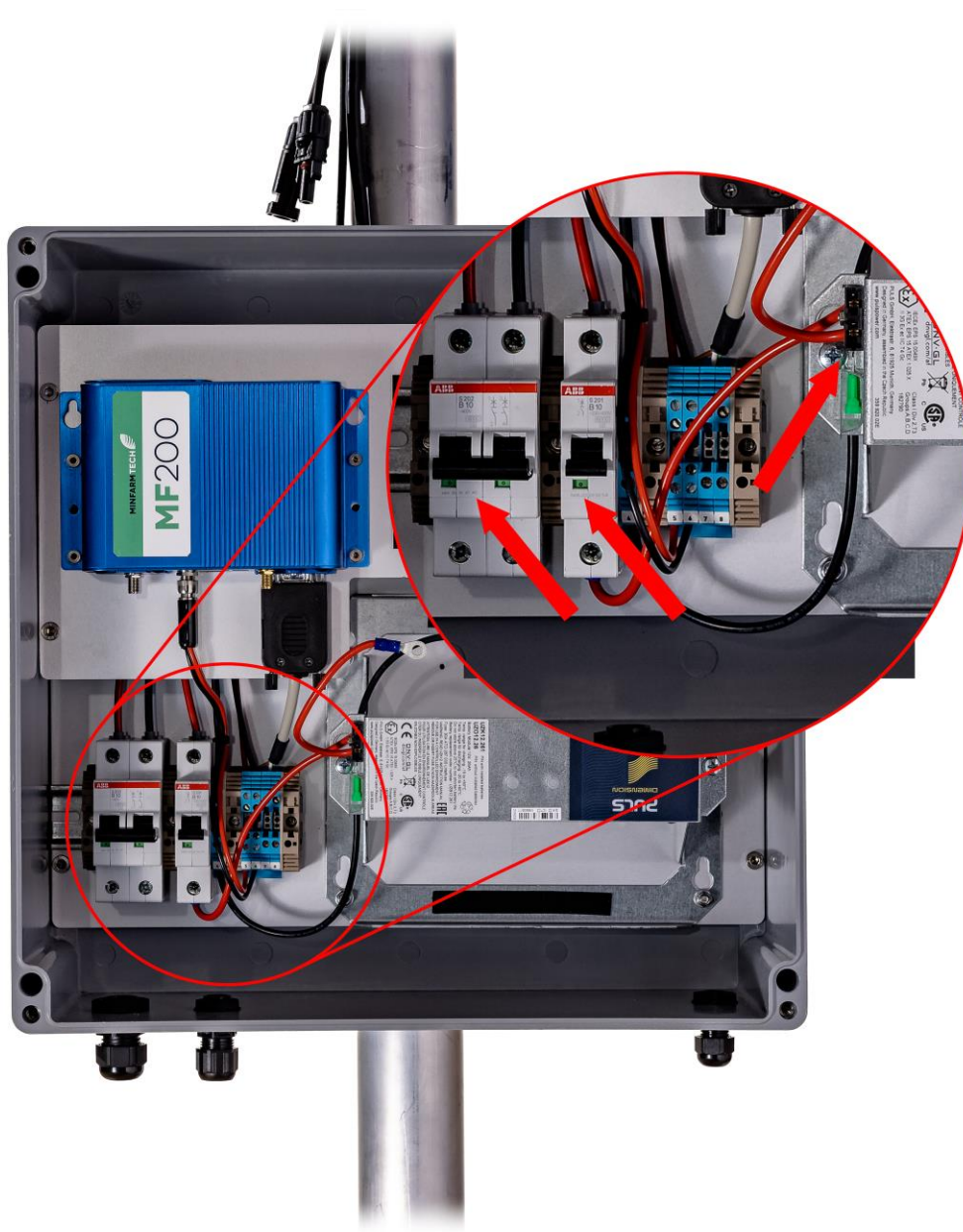


Step 6 - Ensure all circuit breakers are switched off / not plugged in.

Make sure all circuit breakers are switched off and pointing down. Ensure that there is no fuse plugged into the battery mount.

**Red** = ON

**Green** = OFF



Step 7 - Remove the top of the battery mount.

Remove the top cover of the battery mount by loosening the 2 marked screws.

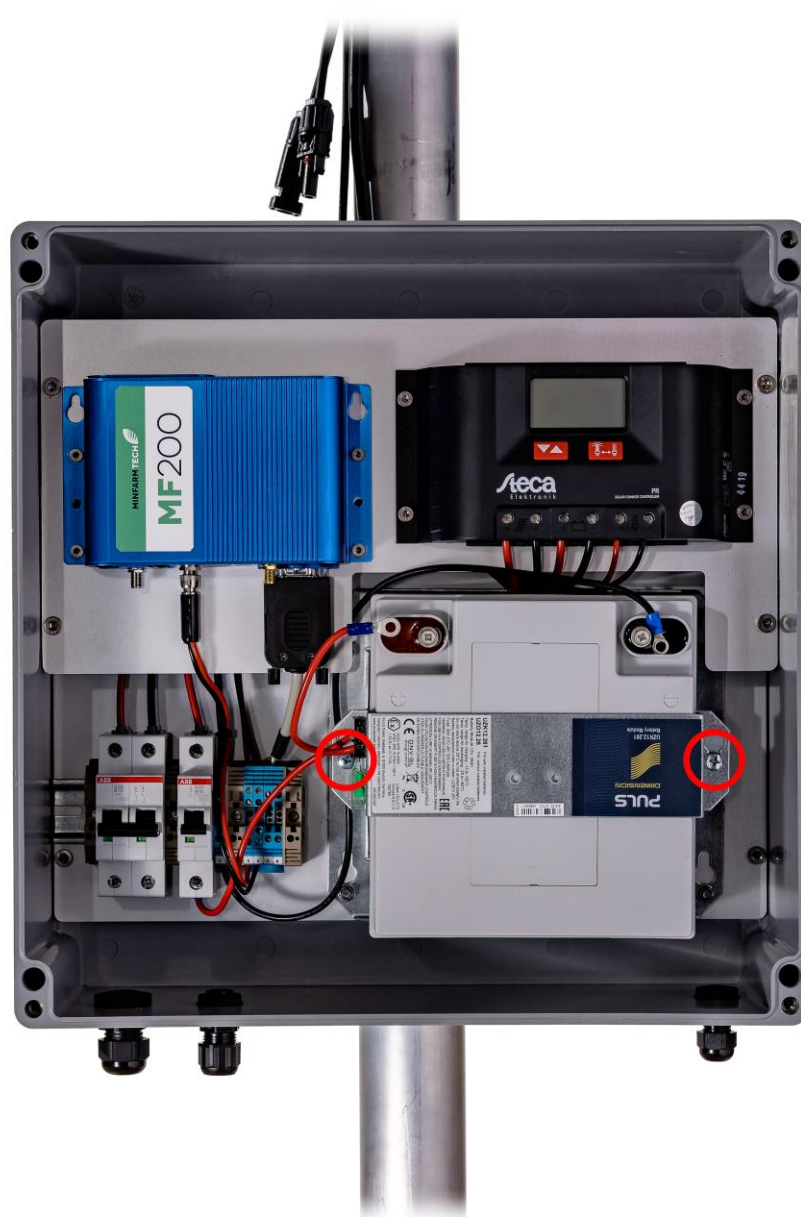
Make sure that all circuit breakers are switched to OFF during installation!



Step 8 - Insert the battery into the enclosure.

Insert the battery into the enclosure and reinstall the top cover of the battery mount using the 2 marked screws.

Make sure that all circuit breakers are switched to OFF during installation!



Step 9 - Connect the battery to the enclosure.

Connect the battery to the enclosure by connecting the **Red** and **Black** wires as shown below.

Make sure that all circuit breakers are switched to OFF during installation!



Step 10 - Connect the solar panel cables to the enclosure.

Insert the solar panel cable into the enclosure and connect them to the double circuit breakers inside the enclosure.

The **Red** marked cable (positive pole (+)) has to be connected to the left side of the double circuit breaker (+),

the **Black** marked cable (negative pole (-)) to the right side of the double circuit breaker (-).

Make sure that all circuit breakers are switched to OFF during installation!



Step 11 - Connect both sides of the solar panel.

Plug both sides of the solar panel cable together. **Red to Red** and **Blue to Blue**.

Make sure that all circuit breakers are switched to OFF during installation!



Step 12 - Insert the cable of the IDP and connect it.

Insert the cable coming from the IDP terminal (DCE) into the enclosure and connect it to the terminal blocks marked from #5 to #8. Connect the wires as follows:

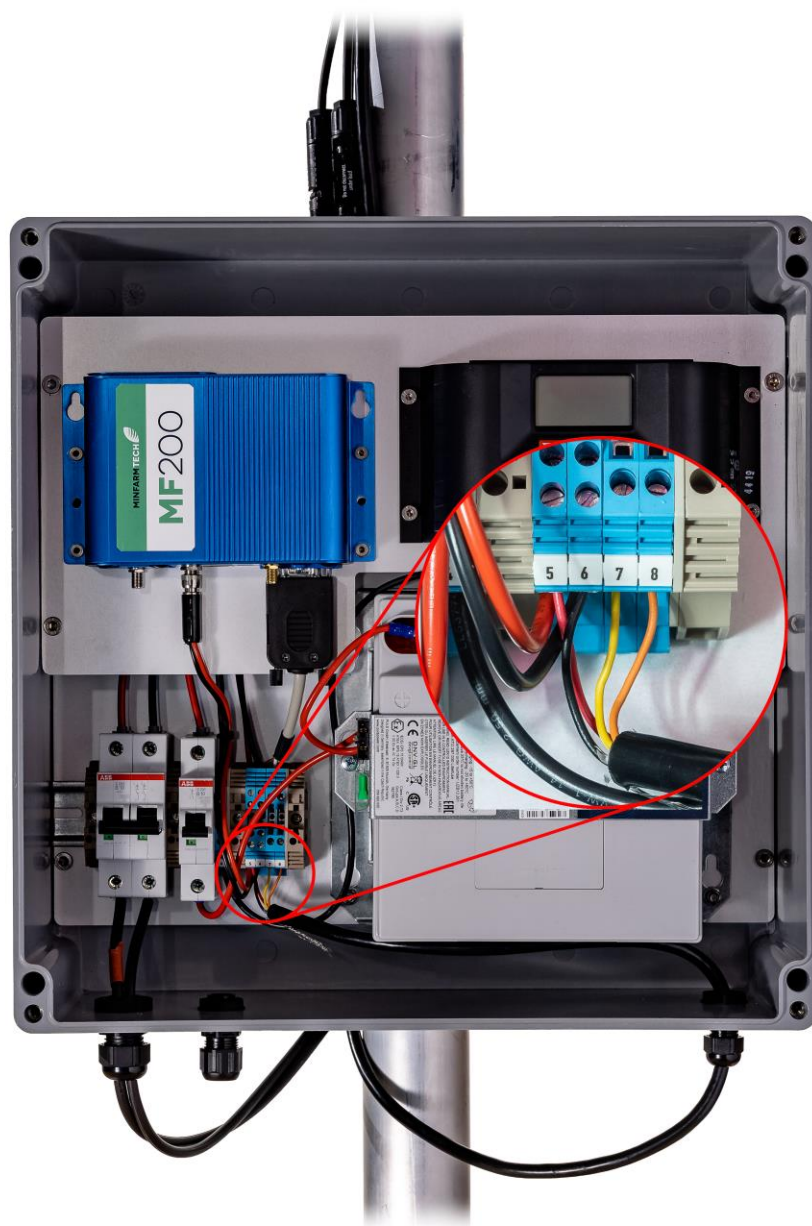
**Red (+ PWR)** – #5

**Black (- GND)** – #6

**Yellow (RX)** – #7

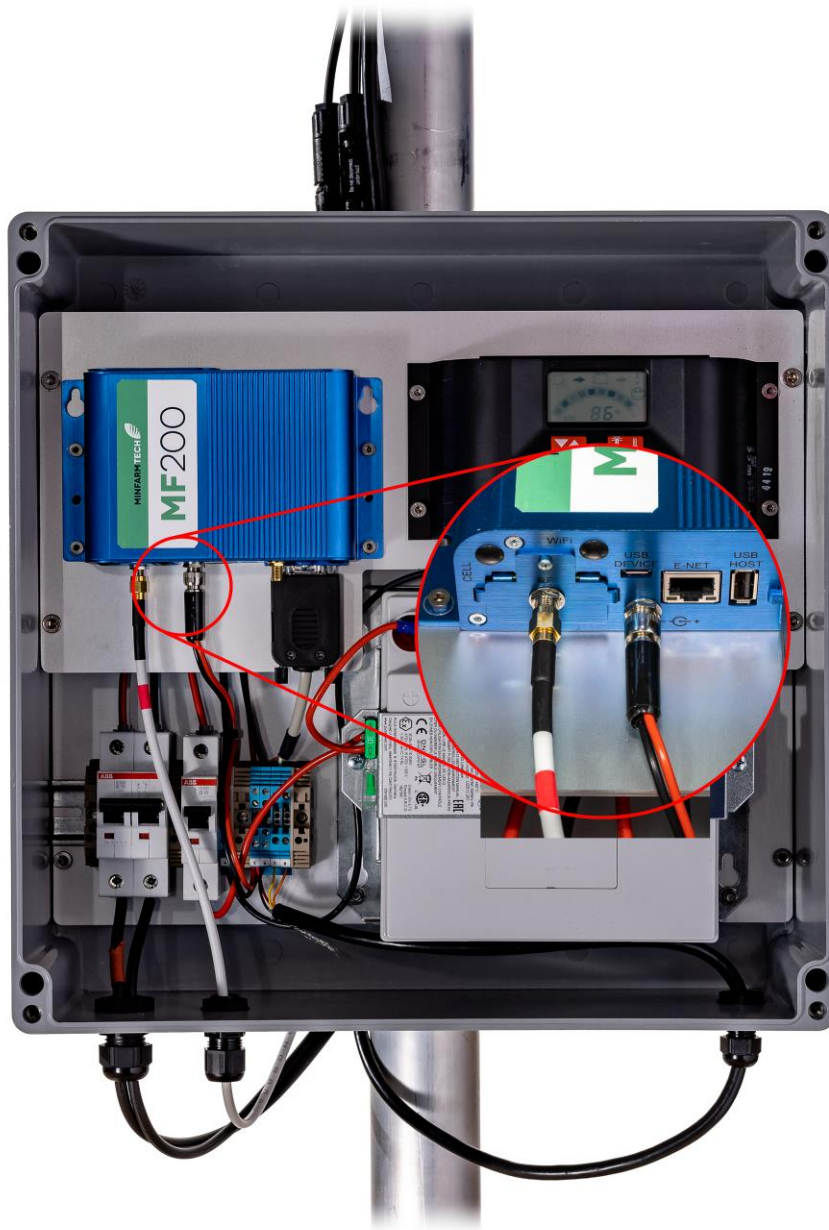
**Orange (TX)** – #8

Make sure that all circuit breakers are switched to OFF during installation!



Step 13 - Insert the antenna cable and connect it.

Insert the antenna cable into the enclosure and connect to the connector located on the bottom left of the MF-200 (RF) (depending on the cable you might need to use an SMA adapter).



Step 14 - Switch on / plug in all circuit breakers inside the enclosure.

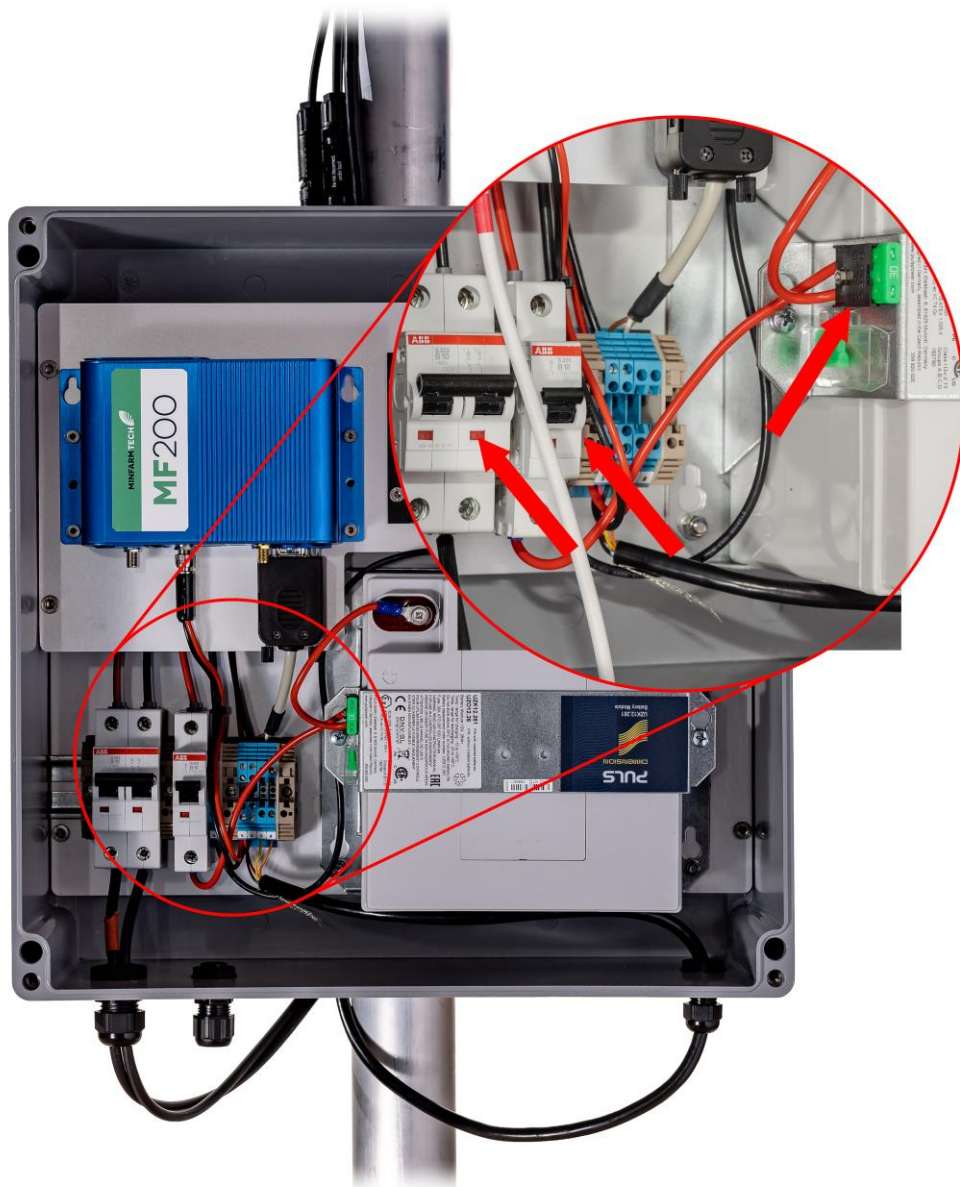
Switch on all circuit breakers and plug in the fuse that goes into the battery mount.



Step 15 - Check if the system is operating properly.

Make sure that the solar panel is connected and the batteries are charging.

Please ensure that all cable glands are tightened to get the IP67 rating and strain relief for the cables.



Step 16 - Close the enclosure.

Screw in the 4 marked screws of the cover to reinstall it to the enclosure.



## 2.3

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### Inmarsat IsatData Pro Satellite Terminal

The IDP satellite terminal can be seen in the picture below. You can purchase a unit from CPN Satellite Services.



IDP Satellite Terminal Contents:

1 x IDP ST 2100 Satellite Terminal

1 x IDP Pole Mount

IDP Satellite Terminal Installation:

Refer to the satellite terminal user guide for particular installation and set-up instructions.

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## Section 3

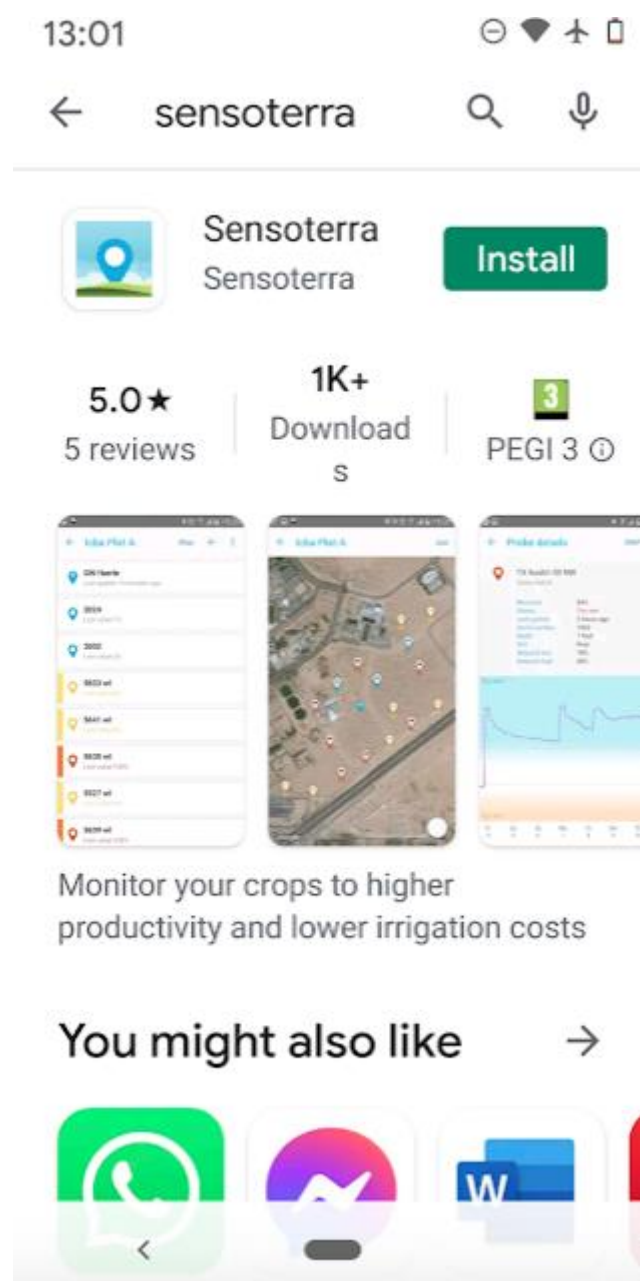
### Software Staging Preparation Required Before Field Installation

#### 3.1

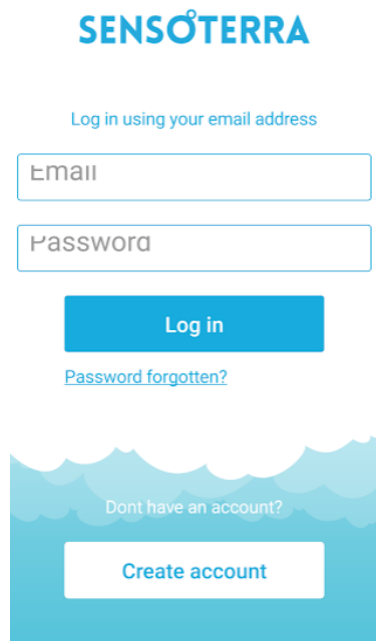
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#### Sensoterra Application Software

All information from your sensor can be viewed on the Sensoterra software on your mobile phone or laptop. The App can be downloaded from the App Store or Google Play on your smartphone.

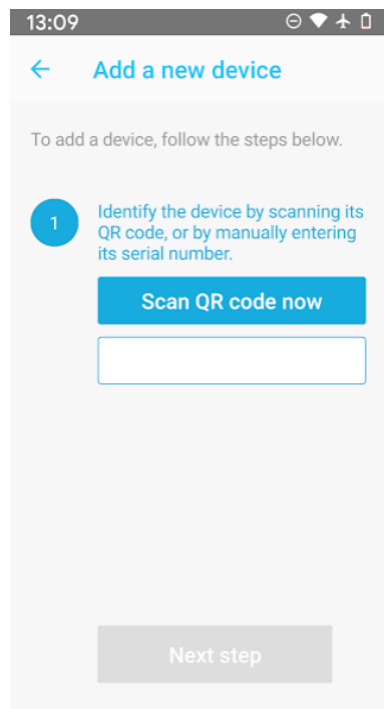


To start using the service you will first need to create an account.



The image shows the Sensoterra web interface for login and registration. At the top is the 'SENSOTERRA' logo in blue. Below it is a link 'Log in using your email address'. There are two input fields: 'Email' and 'Password'. A blue 'Log in' button is positioned below the password field. A link 'Password forgotten?' is located below the 'Log in' button. At the bottom, there is a blue wavy graphic with the text 'Dont have an account?' and a white 'Create account' button.

When you have completed this stage, you can add your sensor(s) to the App. This is a very straightforward process, either by scanning the QR code on the sensor or manually inserting the serial number.



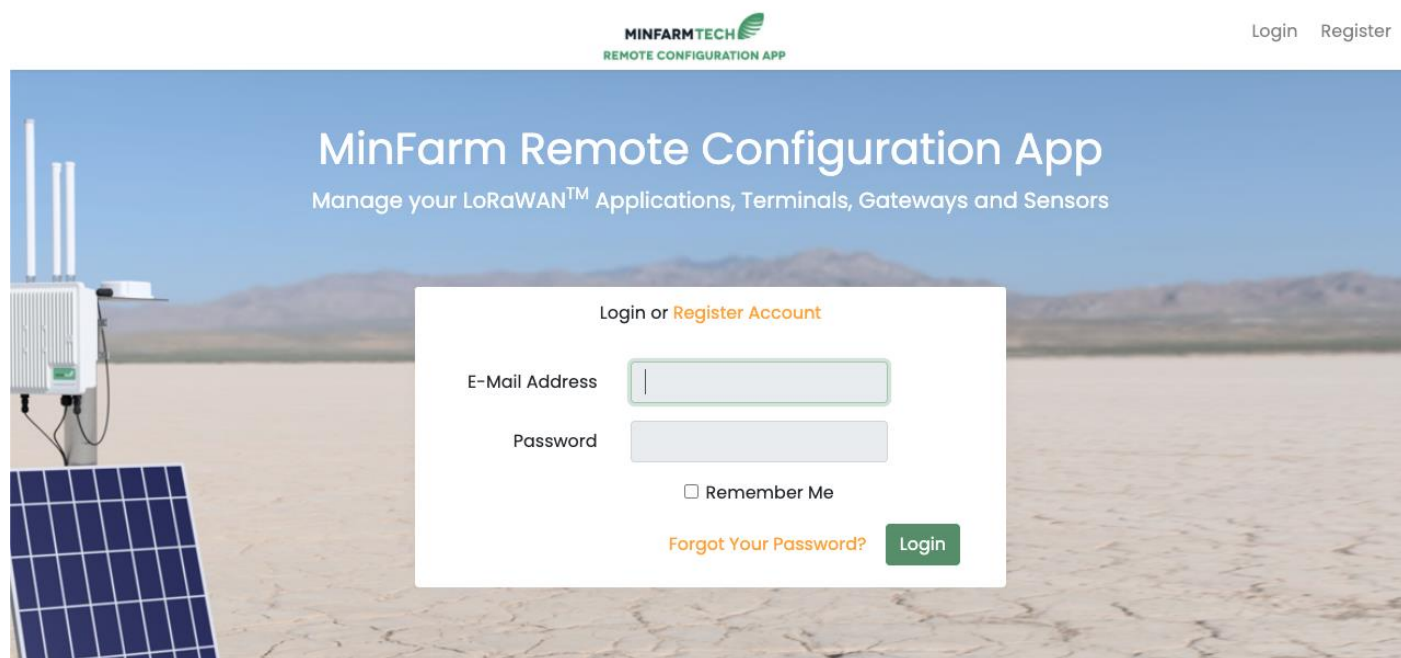
The image shows a mobile app screen titled 'Add a new device'. At the top, the status bar shows the time '13:09' and various icons. Below the title bar, there is a back arrow and the title 'Add a new device'. A subtitle reads 'To add a device, follow the steps below.' Step 1 is highlighted with a blue circle containing the number '1'. The instruction for step 1 is 'Identify the device by scanning its QR code, or by manually entering its serial number.' Below this instruction is a blue button labeled 'Scan QR code now' and an empty white input field. At the bottom of the screen is a grey button labeled 'Next step'.

Refer to the Sensoterra Installation Guide for more information.

## 3.2

### MinFarm Bridge Server

To start using the MinFarm Bridge Server you will first need to register and set up an account. Contact MinFarm Tech for a link to login. Click 'Register Account', add your name, email, and password. You will create a Deployment.



## Section 4

### Total System Test before Field Installation

Each component of your setup will first need to be activated, and then everything added together to create the network. This is best done at a facility that has good internet access, and any troubleshooting can be easily carried out.

So this is what needs to be done:

- Build out the entire MF-400 Gateway and attach to a pole outside with the solar panel and IDP satellite terminal. Select a location that has line of site to the Inmarsat satellite.
- Verify that the solar panel is charging the battery. Refer to the Solar Charger User Guide.  
<https://www.steca.com/index.php?Steca-PR-en#productproperty>

- Verify that the MF-200 (blue box) is powered on and ready. Look at the status LEDs at the front. It is in the ready state when - PWR should be solid green and STATUS should blink twice every second. Note that it takes about 5 minutes from power-on for the MF-200 to enter the ready state.
- Place the sensor(s) close by (but at least 5 metres from the MF-400 Gateway).
- Confirm that uplinks are appearing on the Sensoterra application on your phone or laptop.
- If problems occur, contact MinFarm Tech.

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## Section 5

### Field Installation

Ensure everything is working properly before you visit the site. You will need some standard tools for installing a pole-mounted device, and also bring a BGAN satellite terminal for Internet access.

- Install the MF-400 Gateway with the solar panel on a pole. Set up the IDP satellite terminal.
  - Install the sensor(s) according to the Sensoterra Installation Guide.  
[https://www.sensoterra.com/uploads/documents/Installation/SD\\_Installation\\_guide\\_1.0.pdf](https://www.sensoterra.com/uploads/documents/Installation/SD_Installation_guide_1.0.pdf)
  - Verify that the solar panel is charging the battery. Refer to the Solar Charger User Guide.  
<https://www.steca.com/index.php?Steca-PR-en#productproperty>
  - Verify that the MF-200 (blue box) is powered on and ready. Look at the status LEDs at the front. It is in the ready state when - PWR should be solid green and STATUS should blink twice every second. Note that it takes about 5 minutes from power-on for the MF-200 to enter the ready state.
  - Verify that uplinks are appearing on the Sensoterra application. If problems occur, contact MinFarm Tech.
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## Section 6

### Terminology and Abbreviations

- PE:
  - PE is the abbreviation for Protective Earth and has the same meaning as the symbol.
- Earth, Ground:
  - This document uses the term “earth” which is the same as the U.S. term “ground”.
- T.B.D.:
  - To be defined, value or description will follow later.
- AC 230V:
  - A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually  $\pm 15\%$ ) included. E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V).
- 230Vac:
  - A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.
- 50Hz vs. 60Hz:
  - As long as not otherwise stated, AC 100V and AC 230V parameters are valid at 50Hz and AC 120V parameters are valid at 60Hz mains frequency.
- may:
  - A keyword indicating the flexibility of choice with no implied preference.
- shall:
  - A keyword indicating a mandatory requirement.
- should:
  - A keyword indicating the flexibility of choice with a strongly preferred implementation.
- DCE:
  - data communication equipment.
- DTE:
  - data terminal equipment.

## Section 7

### Contact Details



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