Intel-IrriS

# Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture

## Technical Annex for D1.2a

Low-cost sensor generic platforms for connected irrigation system

List of hardware part

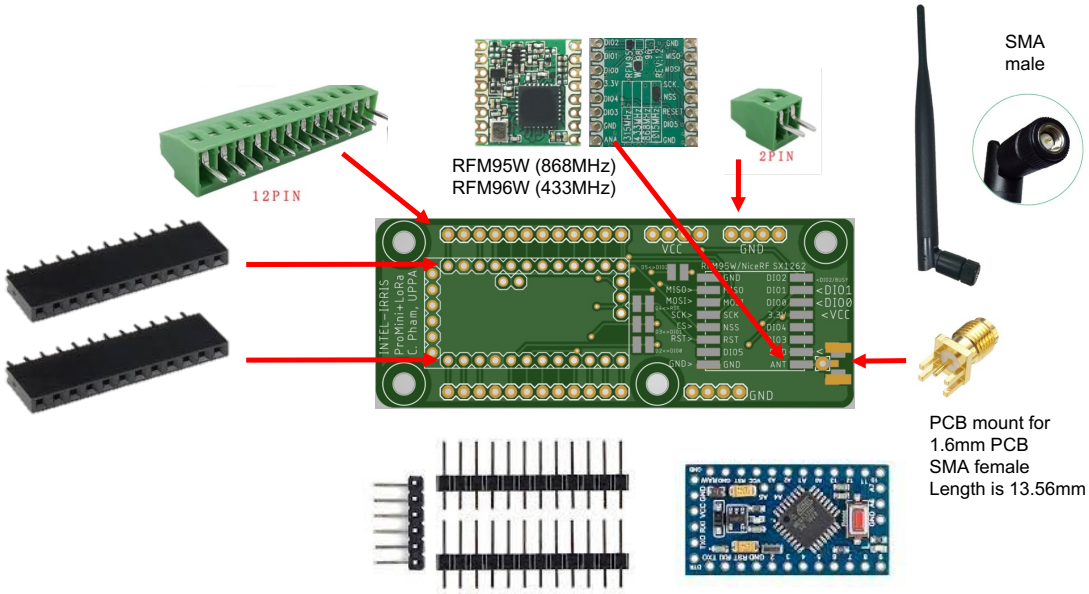
Responsible Editor: UPPA

Version: 1.5

Date: Oct. 13th, 2023

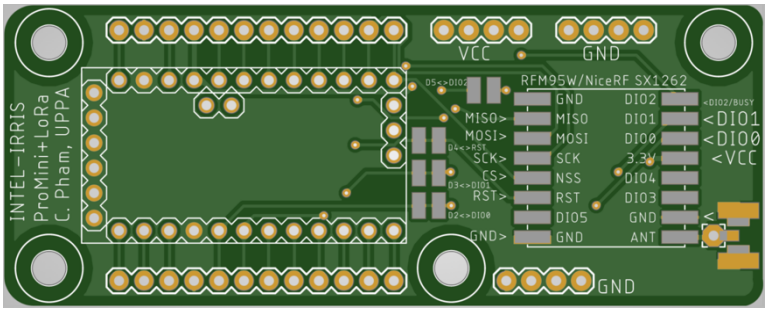
# 1. BOM FOR INTEL-IRRIS STARTER-KIT

## 1.1. DEVICE BASED ON THE SIMPLE PCB V1




Arduino ProMini 3.3V 8MHz

- The UPPA PCB v1




https://github.com/CongducPham/PRIMA-Intel-IrriS/tree/main/PCBs

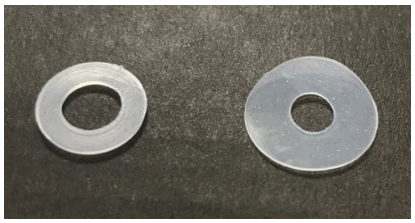
https://github.com/CongducPham/PRIMA-Intel-IrriS/raw/main/PCBs/MySecondProMiniLoRaBreakout_2022-01-20.zip

- 12-pin and 2-pin screw terminal block, 4-pin can also be ordered https://fr.aliexpress.com/item/4000867583795.html
- 12-pin female header https://fr.aliexpress.com/item/32970948352.html
- RFM95W (868MHz) or RFM96W (433MHz) https://fr.aliexpress.com/item/32844406764.html
- SMA female PCB connector for 1.6mm PCB https://fr.aliexpress.com/item/32948380887.html

- Arduino ProMini, take 3.3v 8MHz version
  https://fr.aliexpress.com/item/1005001621723982.html


- ABS waterproof enclosure
  https://www.gotronic.fr/art-boitier-abs-etanche-g304m-17977.htm
- SEN0308 capacitive soil sensor
  https://www.gotronic.fr/art-capteur-d-humidite-capacitif-gravity-sen0308-32249.htm
- DS18B20 temperature sensor for soil temperature
  https://fr.aliexpress.com/item/32827810300.html
  you will need a 4.7 kOhm resistor
- Irrometer Watermark water tension sensor
  https://www.challenge-agriculture.fr/en/product/makers-space/watermark-sensors-for-makers/
  you will need a resistor from 7kOhm to 14kOhm (we use 10kOhm)

- 2-AA battery holder
  https://fr.aliexpress.com/item/4001008150456.html
- switch with pre-soldered wires
  https://fr.aliexpress.com/item/4000286754686.html
- waterproof cap for the switch (select just the cap)
  https://fr.aliexpress.com/item/33022608497.html
- Cable gland PG7 (select PG7)
  https://fr.aliexpress.com/item/10000132999214.html
- 3dBi 868MHz or 3dBi 433MHz antenna
  868MHz: https://fr.aliexpress.com/item/32964912902.html
  433MHz: https://fr.aliexpress.com/item/32963197821.html
- Flat-face seal for outer antenna junction (6x11x0.8mm), left figure
  https://fr.aliexpress.com/item/4000368310126.html
- Flat-face seal for inner antenna junction (14x5x0.5 mm), right figure
  https://fr.aliexpress.com/item/1005004643934924.html (optional)

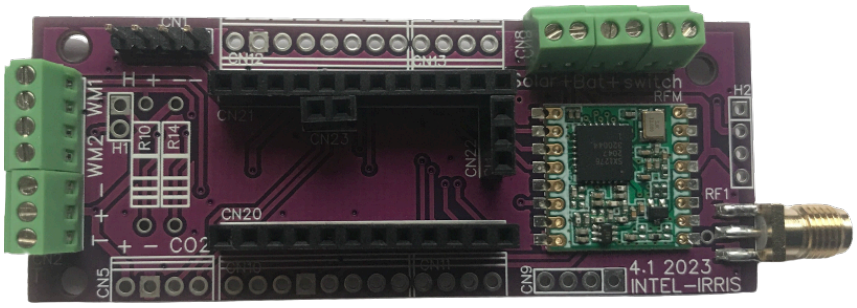


## 1.2. DEVICE BASED ON THE IRD PCB (V4.1)

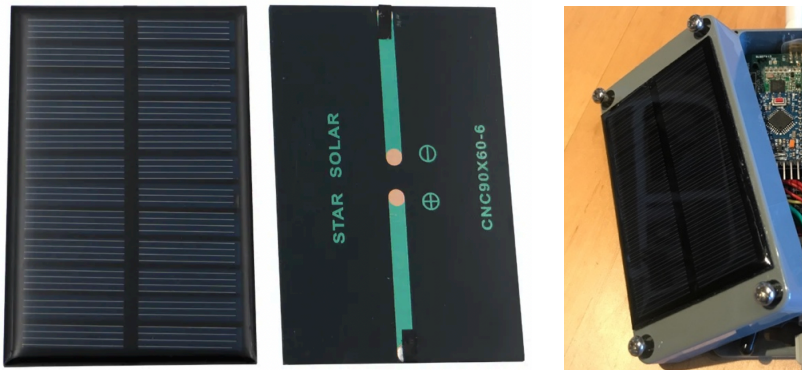
Additional components for the raw PCB version (not fully assembled)

- 4-pin and 3-pin screw terminal
  https://fr.aliexpress.com/item/4000867583795.html

Additional components for fully assembled PCB version, for solar panel



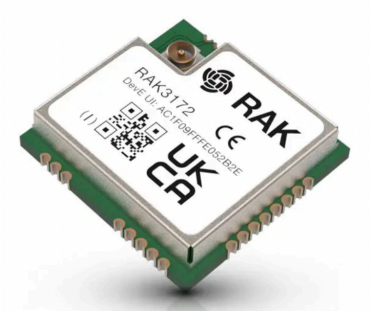

- Mini solar panel 6 V 0.6 W 100 mA 60x90mm
  https://fr.aliexpress.com/item/32881044659.html



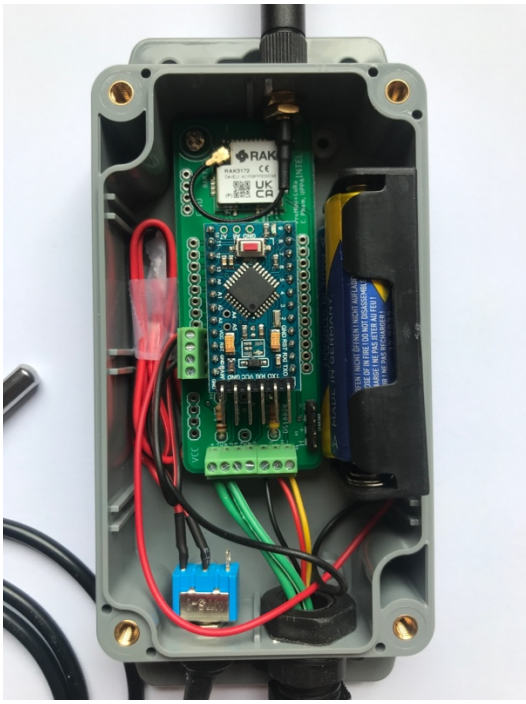

- NiMh rechargeable batteries (do not take Li-Ion batteries)
  https://fr.aliexpress.com/item/1005003197882188.html

## 1.3. DEVICE BASED ON THE RAK3172 PCB

- RAK3172 radio module, chose your frequency band, take the version with the IPEX connector for the antenna https://store.rakwireless.com/products/wisduo-lpwan-module-rak3172?variant=40014759329990



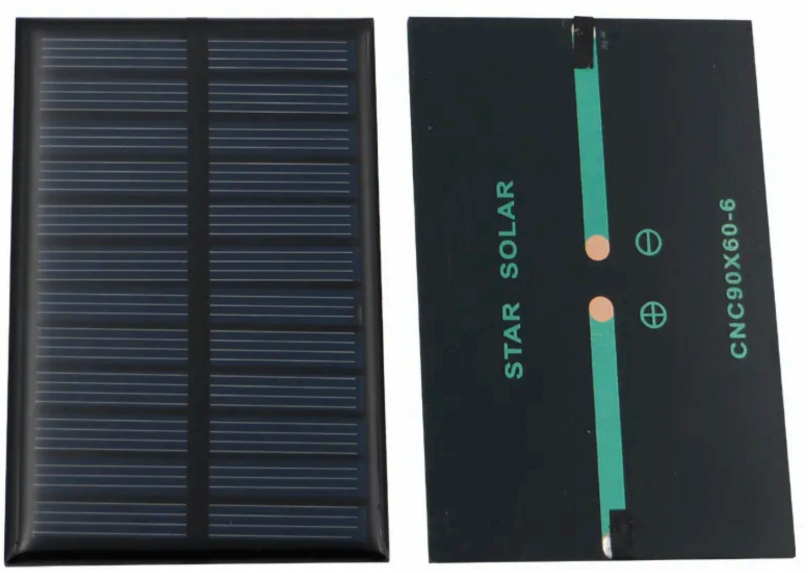

- UFL/ u.FL/ IPX/IPEX to SMA female, take 5cm is enough https://fr.aliexpress.com/item/4000848776660.html

## 1.4. DEVICE BASED ON THE WAZISENSE V2

Additional components for the solar panel version:

- Mini solar panel 6 V 0.6 W 100 mA 60x90mm
  https://fr.aliexpress.com/item/32881044659.html

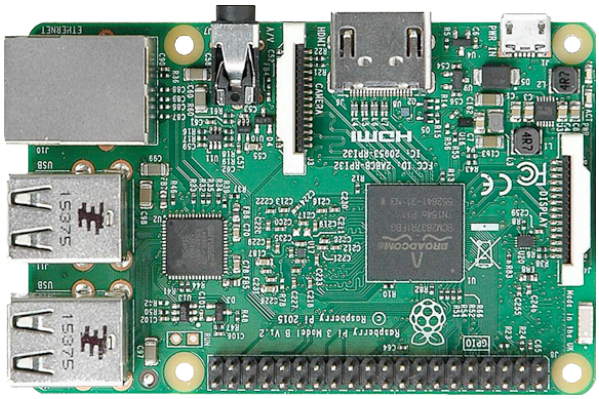



- Li-ion or Li-Po 3.7v battery (from 1200mAh)
  https://fr.aliexpress.com/item/1005002919536938.html


- UFL/ u.FL/ IPX/IPEX to SMA female, take 5cm is enough
  https://fr.aliexpress.com/item/4000848776660.html
  same as for the RAK3172 PCB

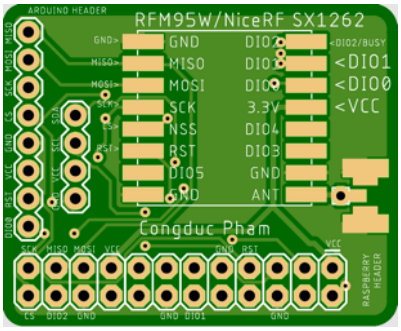
## 1.5. FOR THE INTEL-IRRIS WAZIGATE

- Raspberry: we recommend RPI3B. RPI3B+/4B could also be used.



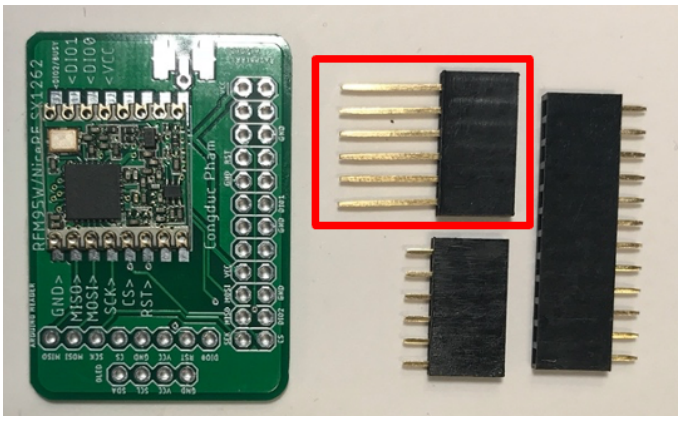
You also need an 8GB or 16GB or 32GB SD card **class 10** RPI3B/3B+/4B have built-in WiFi

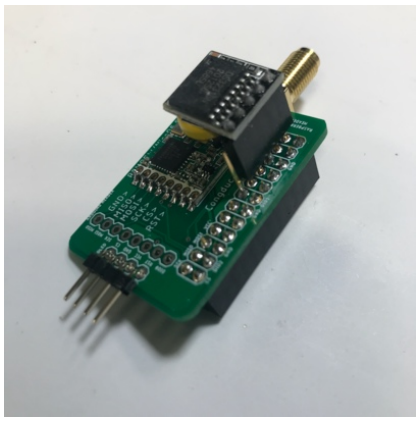
- The UPPA RFM95W breakout to make the LoRa hat




https://github.com/CongducPham/LowCostLoRaGw/blob/master/PCBs/RFM95Breakout_2020-11-14.zip

- RFM95W (868MHz) or RFM96W (433MHz)
  https://fr.aliexpress.com/item/32844406764.html
- Longer SMA female PCB connector for 1.6mm PCB
  https://fr.aliexpress.com/item/32964875181.html
- Longer 6-pin header
  https://fr.aliexpress.com/item/4001351715019.html
- Regular 6-pin and 12-pin female header
  https://fr.aliexpress.com/item/32970948352.html

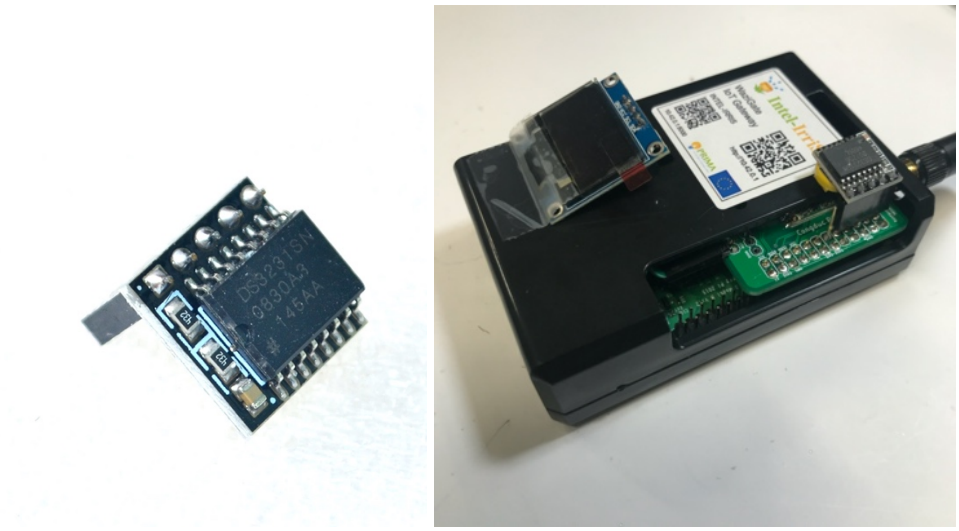


- Male header 90 degree, take R1 B6 type
  https://fr.aliexpress.com/item/32887929634.html


- ABS case for RPI3B/3B+ (take just the case)
  https://fr.aliexpress.com/item/32718435597.html
- ABS case for RPI4B (if you use RPI4, take just the case)
  https://fr.aliexpress.com/item/1005004207618033.html

- 0.96" OLED screen
  https://fr.aliexpress.com/item/32920071528.html
- RTC module for Raspberry gateway
  https://fr.aliexpress.com/item/32317422637.html




- Indoor higher gain antenna base for N-connector antenna
  take SMA male connector to connect to gateway's radio module
  https://fr.aliexpress.com/item/1005004335675189.html
- Higher gain antenna with N-connector male, this is one example
  https://fr.aliexpress.com/item/1005005514194604.html
  there are plenty of models (choose either 433MHz or 868MHz)

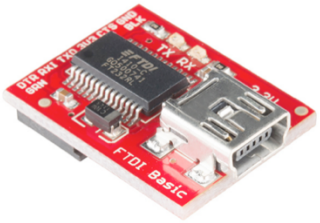
# 2. EXPECTED RESULTS


# 3. ADDITIONAL LIST OF USEFUL COMPONENTS

The following list are the components and part that you may find useful to have in your lab for various projects.

## USB-SERIAL

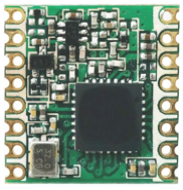
You will also need the FTDI breakout (3.3v version) to program the board. You need only one to program all your boards. Original product from Sparkfun is here: https://www.sparkfun.com/products/9873




We tested a Chinese one (on the right) that can be set either at 5v or 3.3v. Much cheaper! https://fr.aliexpress.com/item/32648254875.html

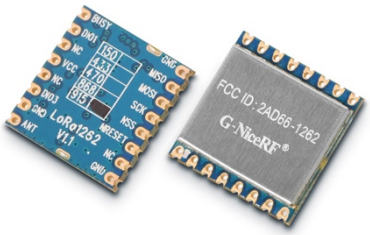
## LORA RADIO MODULES

- The RFM95W (868MHz) and RFM96W (433MHz) LoRa module from HopeRF are very popular modules that you can buy from many Chinese manufacturers. It requires a breakout board as it is very small. Its advantage is to be easily integrated on a PCB board



https://fr.aliexpress.com/item/32844406764.html
(chose frequency for the correct model)

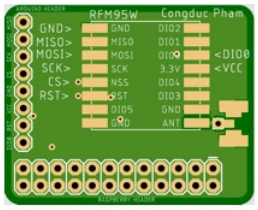
- The NiceRF SX1262, NiceRF SX1268 and NiceRF SX1280 LoRa modules from NiceRF embed the newest LoRa SX1262 (868MHz), SX1268 (433MHz) and SX1280 (2.4GHz) chips from Semtech. They have the same footprint than the RFM95W so same PCB breakout can be used with little modifications



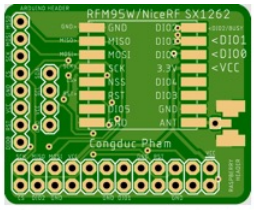
NiceRF SX1262

SX1262: https://fr.aliexpress.com/item/32959012033.html
SX1280: https://fr.aliexpress.com/item/32946774361.html

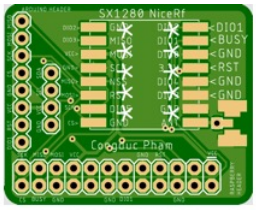
## UPPA PCBs



Old RFM95W breakout



RFM95W/NiceRF SX1262 breakout



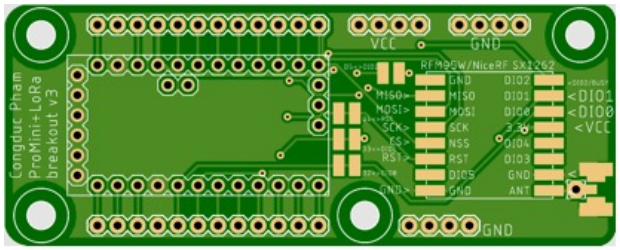
NiceRF SX1280 breakout

Radio module back view

RFM95W, SX1276

NiceRF SX1262

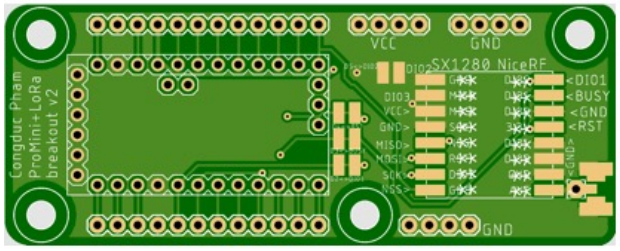
NiceRF SX1280
LoRa 2.4GHz



ProMini LoRa RFM95W
can work with NiceRF SX1262

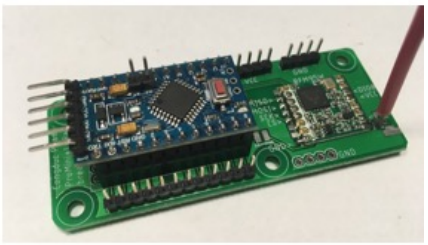
RFM95W, SX1276

NiceRF SX1262



ProMini LoRa NiceRF SX1280

NiceRF SX1280
LoRa 2.4GHz



PCBs from UPPA:
https://github.com/CongducPham/LowCostLoRaGw/tree/master/PCBs
https://github.com/CongducPham/PRIMA-Intel-IrriS/tree/main/PCBs

**Displays**


- 0.96" small OLED displays

  https://fr.aliexpress.com/item/32920071528.html

**Antenna and related components**

- Simple whip (monopole) antenna for both devices and gateway

  433MHz -
  5dBi https://fr.aliexpress.com/item/32806809309.html
  3dBi https://fr.aliexpress.com/item/32963197821.html
  868MHz -
  5dBi https://fr.aliexpress.com/item/32921480326.html
  3dBi https://fr.aliexpress.com/item/32964912902.html



- Specific antennas for gateway

  Ground plane, ½ wave dipole (e.g. sleeve dipole, center-fed), or fiberglass antennas are best choice for the gateway if you need a cable extension to put the antenna outdoor.

https://fr.aliexpress.com/item/32801738509.html

https://www.lextronic.fr/antennes/507-antenne-868-mhz-ground-plane-pour-base.html

- If the antenna must be placed on a higher position, you would need an extension coaxial cable. Take an RG58 cable, SMA male to SMA female.


https://www.aliexpress.com/item/1005002733346503.html

at the end of an extension cable, the simple 1/4 whip (~ monopole) antenna is not really suitable. A dipole antenna, or a compact sleeve dipole antenna is necessary (see https://www.youtube.com/watch?v=wcho1gJ2xEQ).

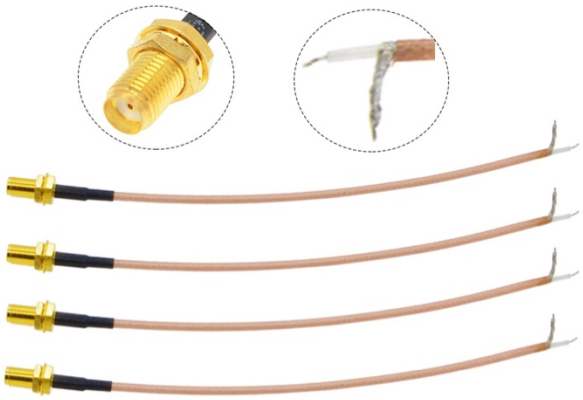
- SMA female PCB connector for 1.6mm PCB

https://fr.aliexpress.com/item/32955045280.html

- Pigtail RG316 SMA male to SMA female


https://fr.aliexpress.com/item/1005002462162713.html

- or this one to solder directly on the PCB board without the SMA female PCB connector



https://fr.aliexpress.com/item/1005001475479079.html

If you want to build your own antenna or adjust the length of the antenna cable, then you will need the following items.

- SMA connectors (for cable model RG58) for custom antenna cable.

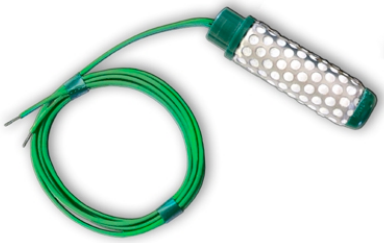
SMA Female

SMA Male

- Coax crimping tool (with RG58 format) and RG58 coax cable

## SIMPLE PHYSICAL SENSOR FOR TEST AND DEMONSTRATION

- Soil moisture sensors: Capacitive Gravity SEN0193 (left) & Gravity SEN0308 (middle), water tension Irrometer Watermark (right)

## WIRES, CASING, AND VARIOUS ADDITIONAL PARTS

- Breadboard/Dupont cables: need both M-F and F-F

M-F

F-F

take those that are about 10cm to 20cm maximum.

- Water-proof cases: electric out-door cases for instance

from https://www.polycase.com/ or https://www.gotronic.fr/art-boitier-abs-etanche-g304m-17977.htm or any water-proof casing you can find suitable from your local hardware/electric stores.

- You may need your own cable gland to have a real customized case

we take PG7 size for device case

https://fr.aliexpress.com/item/10000132999214.html

- Some standoffs/spacer and associated screws for the gateway

take 10mm to 20mm maximum

2-AA battery couplers for the IoT device, or 1-AA slot one for 3.6V

2xAA: https://fr.aliexpress.com/item/4001008150456.html

- Small waterproof toggle switch

MTS-102, ON-ON switch

https://fr.aliexpress.com/item/33022608497.html

**however, it more convenient to get those with the wired already attached.**

https://fr.aliexpress.com/item/4000286754686.html and buy the waterproof cap separately:
https://fr.aliexpress.com/item/33022608497.html

There is another provider of pre-wired waterproof small switch but it is a bit more expensive.

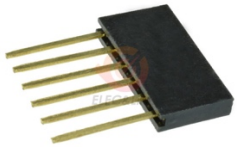
https://www.superbrightleds.com/moreinfo/rocker-pushbutton-remote-switches/mini-onoff-toggle-switch-wired/1356/3109/

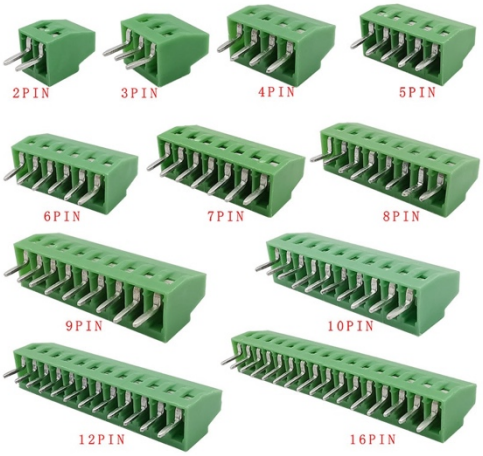
Various 2.54mm pin headers (male, female), 2.54mm screw terminal, screw block connection strips

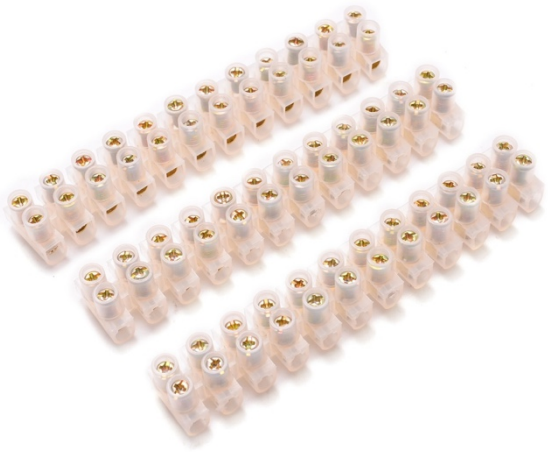
Female header pin: https://fr.aliexpress.com/item/32970948352.html

The most used female header is the 12-pins.

It is also useful to have female header with longer pins such as these ones: https://fr.aliexpress.com/item/4001351715019.html





Screw terminal: https://fr.aliexpress.com/item/4000867583795.html

## SOLDERING MATERIALS THAT ARE NOT MANDATORY BUT ARE ALWAYS GOOD TO HAVE!

- A simple soldering iron with thin solder wire


- or a good soldering station if you want to invest, much recommended

https://fr.aliexpress.com/item/4000845052069.html

- A set of heat-shrink tubes to isolate wires / silicon for joints

(*) provided web links to some vendors are only given as example. You can search from other vendor to optimize cost.

# 4. ANNEX

- https://pc-industriel.anteor.com/pc-durcis/575-pc-modulaire-compact-mb1-10ap.html
- https://www.giga-concept.fr/produit/antenne-868-mhz-iot-lpwa-ism-omnidirectionnelle-mat-murale-3dbi/