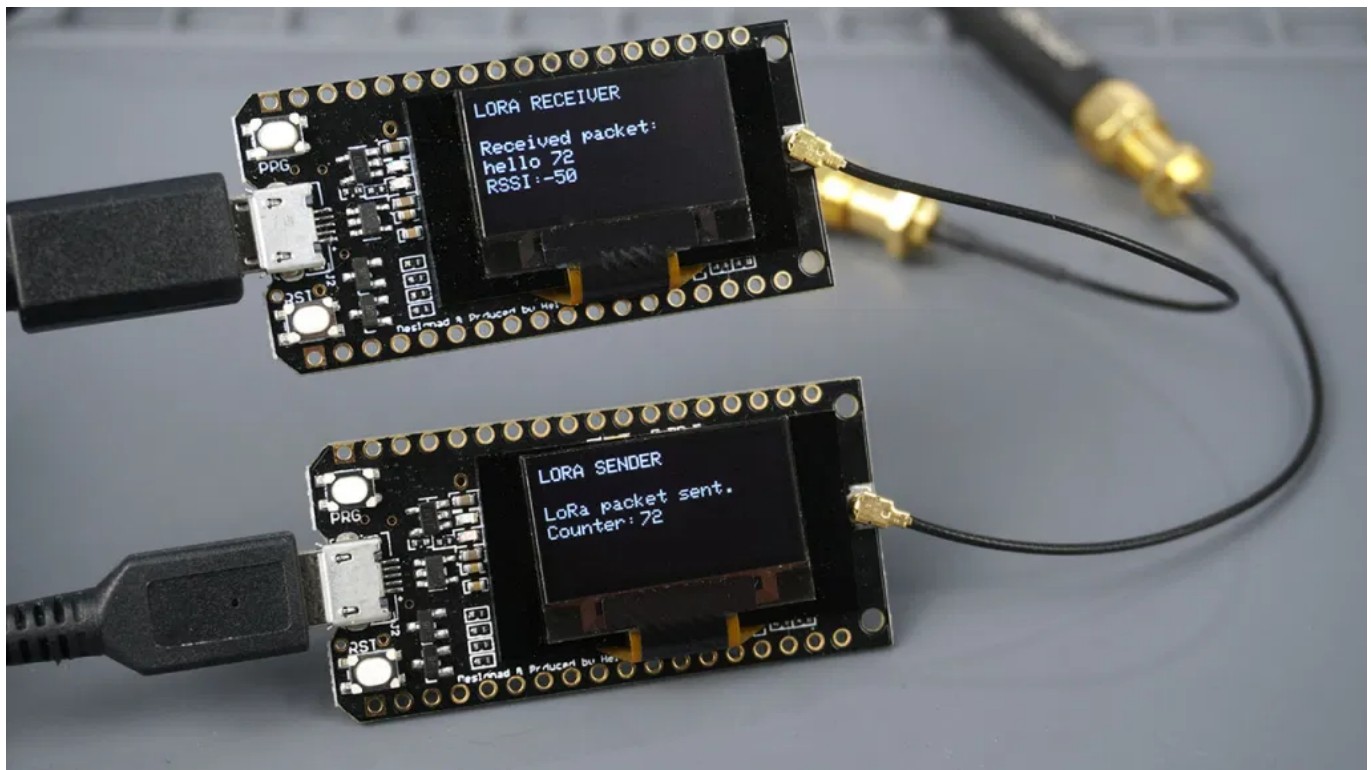


TTGO LoRa32 SX1276 OLED Board: Getting Started with Arduino IDE

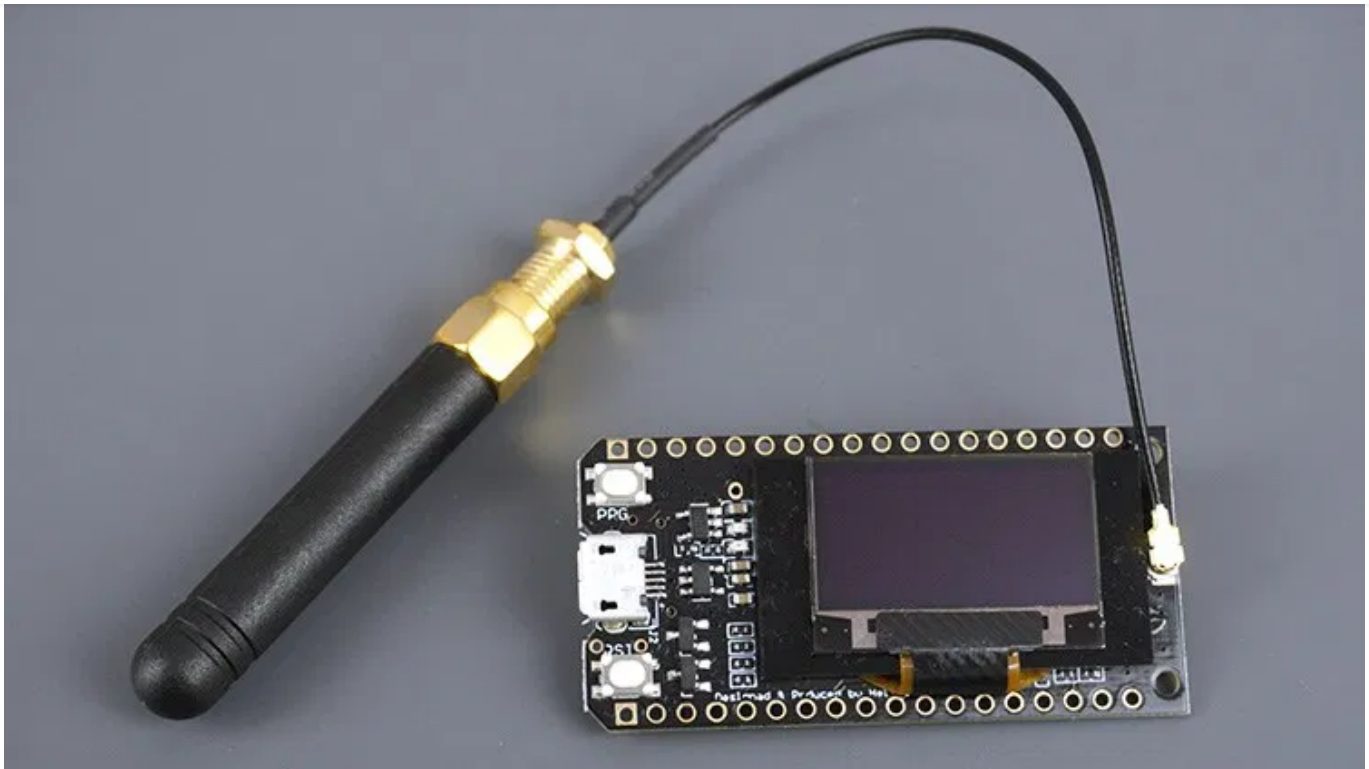
The **TTGO LoRa32 SX1276 OLED** is an ESP32 development board with a built-in LoRa chip and an SSD1306 0.96 inch OLED display. In this guide, we'll show you how to: send and receive LoRa packets (point to point communication) and use the OLED display with Arduino IDE.



For an introduction to LoRa communication, read: [ESP32 with LoRa using Arduino IDE](#).

TTGO LoRa32 SX1276 OLED Overview

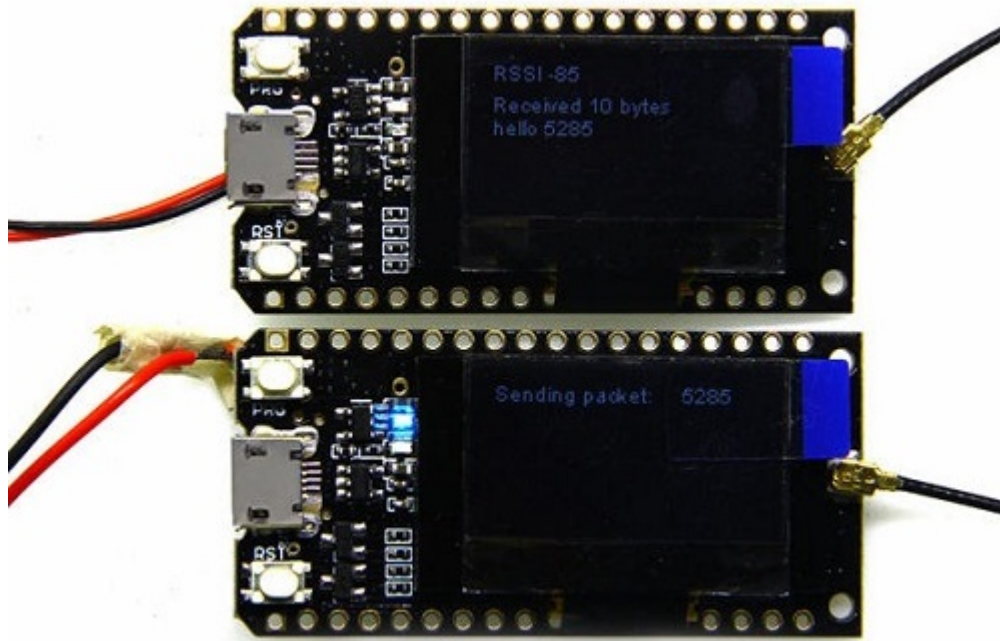
The TTGO LoRa32 SX1276 OLED is a development board with an ESP32, a built-in



The board also features several GPIOs to connect peripherals, PRG (BOOT) and RST buttons, and a lithium battery connector. For a more in-depth overview of this board, read: [TTGO LoRa32 SX1276 OLED Review](#).

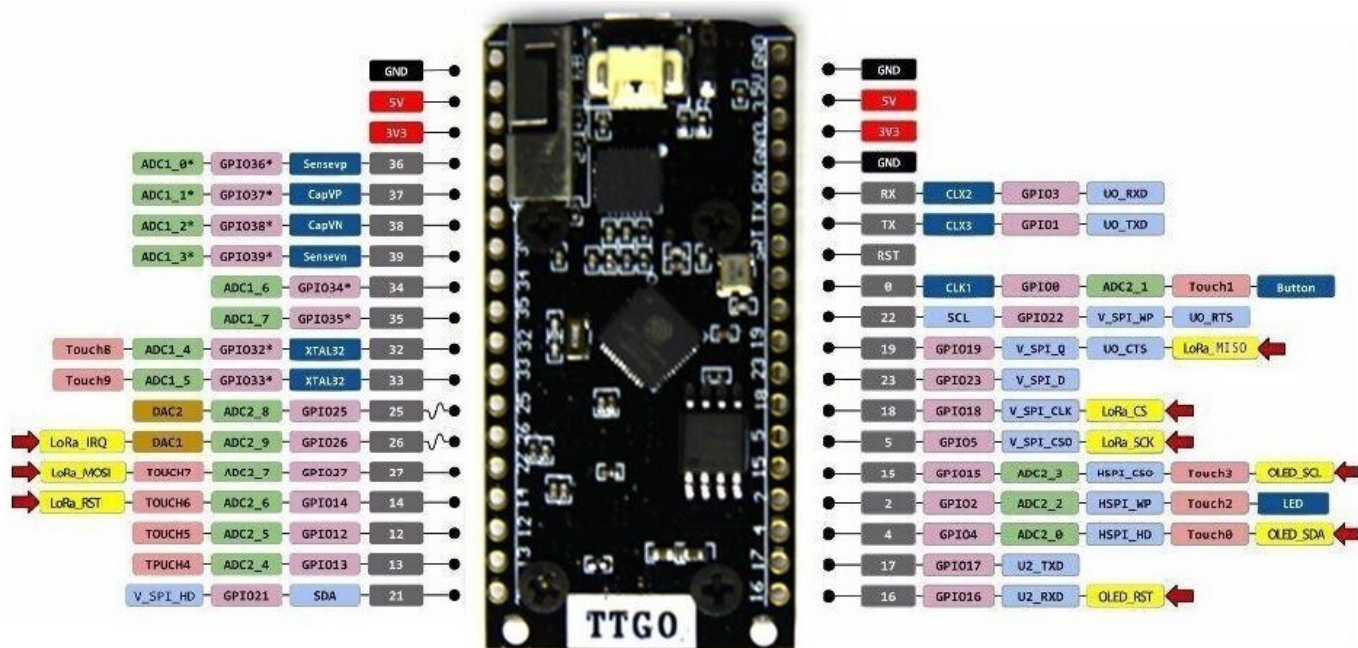
Where to buy?

You can go to the [TTGO LoRa32 SX1276 OLED page on Maker Advisor](#) to find the best price at different stores. To complete this tutorial, you'll need **two** [TTGO LoRa32 boards](#).



TTGO LoRa32 SX1276 OLED

The following figure shows the TTGO LoRa32 OLED board pinout.



The OLED displays communicates using [I2C communication protocol](#). It is internally connected to the ESP32 on the following pins:

SDA	GPIO 4
SCL	GPIO 15
RST	GPIO 16

The SX1276 LoRa chip communicates via SPI communication protocol, and it is internally connected to the ESP32 on the following GPIOs:

SX1276 LoRa	ESP32
MISO	GPIO 19
MOSI	GPIO 27
SCK	GPIO 5
CS	GPIO 18
IRQ	GPIO 26
RST	GPIO 14

Recommended reading: [ESP32 Pinout Reference Guide](#)

Install ESP32 Boards on Arduino IDE

To program the TTGO LoRa32 board, we'll use Arduino IDE. So, you must have Arduino IDE installed as well as the ESP32 add-on. Follow the next guide to install the ESP32 package on Arduino IDE, if you haven't already:

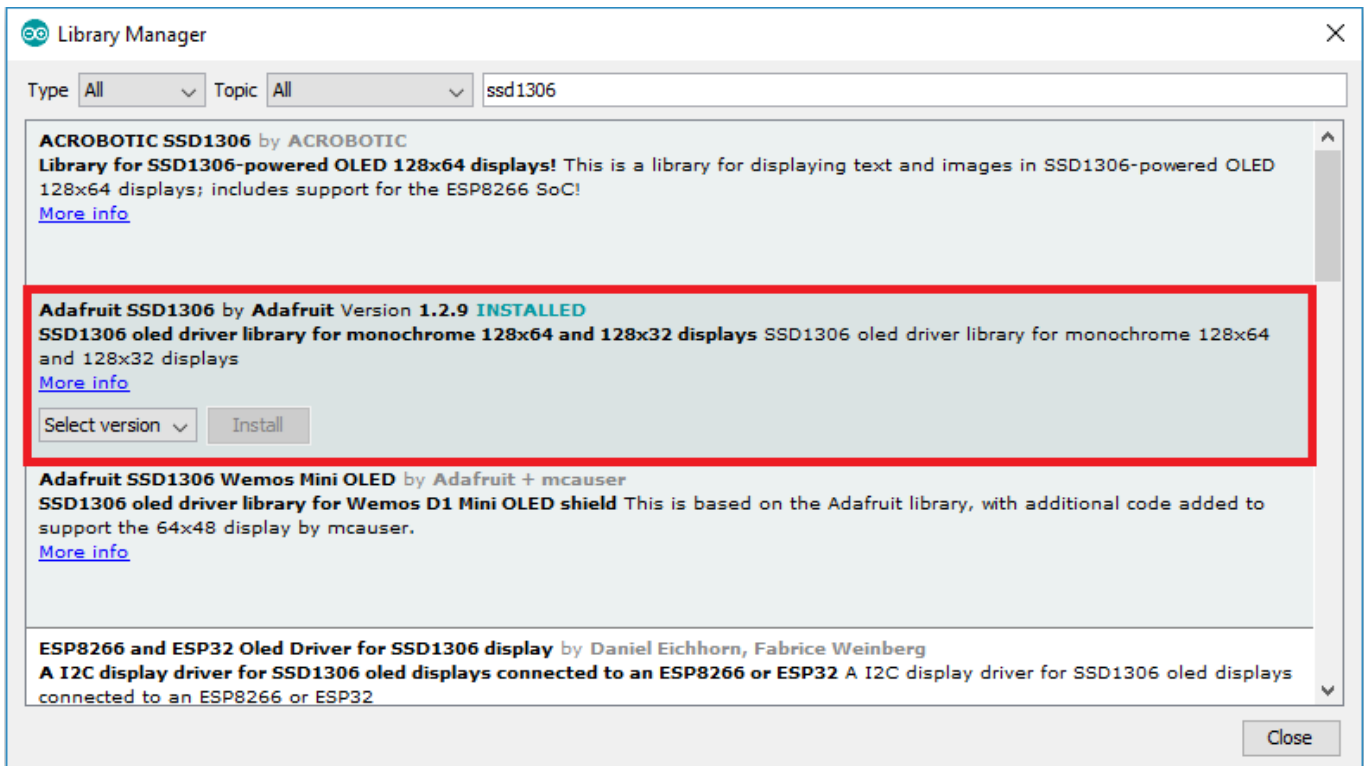
- [Installing the ESP32 Board in Arduino IDE \(Windows, Mac OS X, Linux\)](#)

Installing OLED Libraries

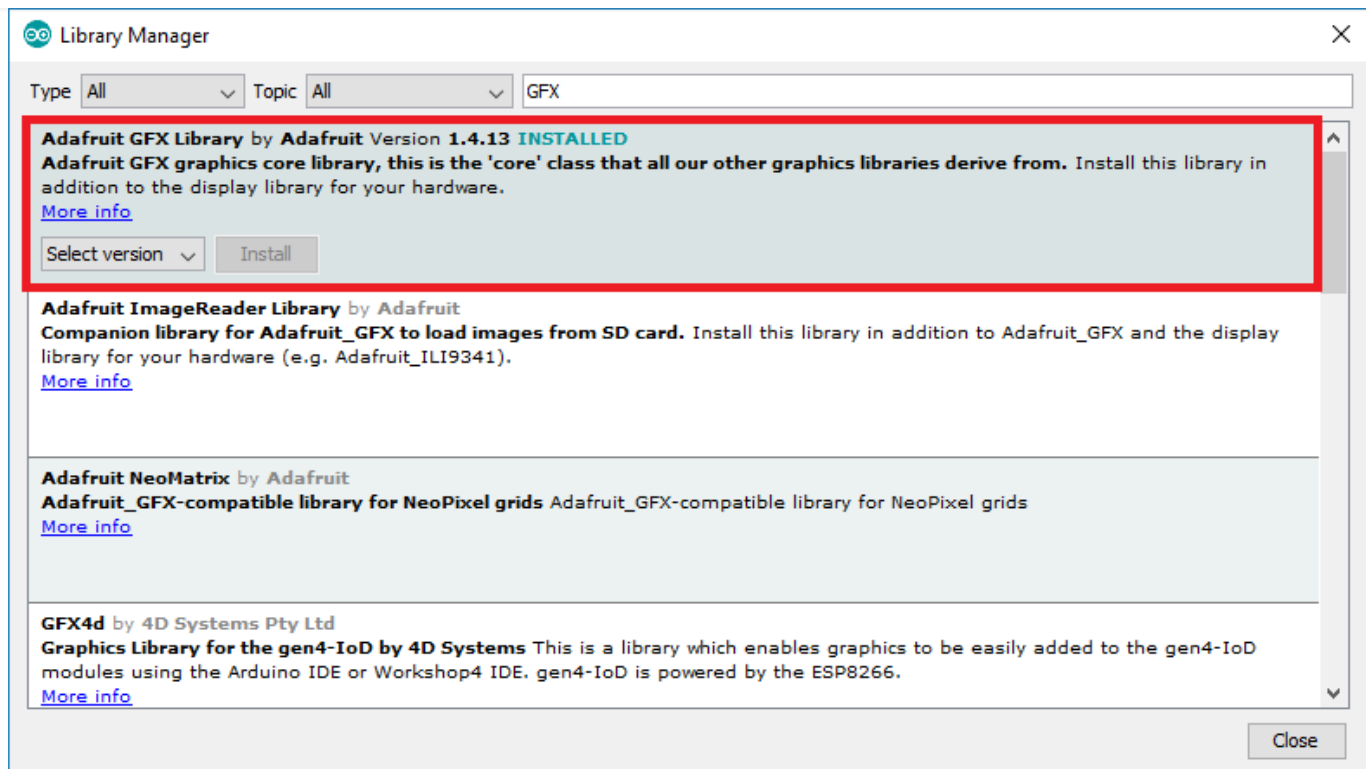
There are several libraries available to control the OLED display with the ESP32. In

Follow the next steps to install those libraries.

1. Open your Arduino IDE and go to **Sketch > Include Library > Manage Libraries**. The Library Manager should open.
2. Type “**SSD1306**” in the search box and install the SSD1306 library from Adafruit.



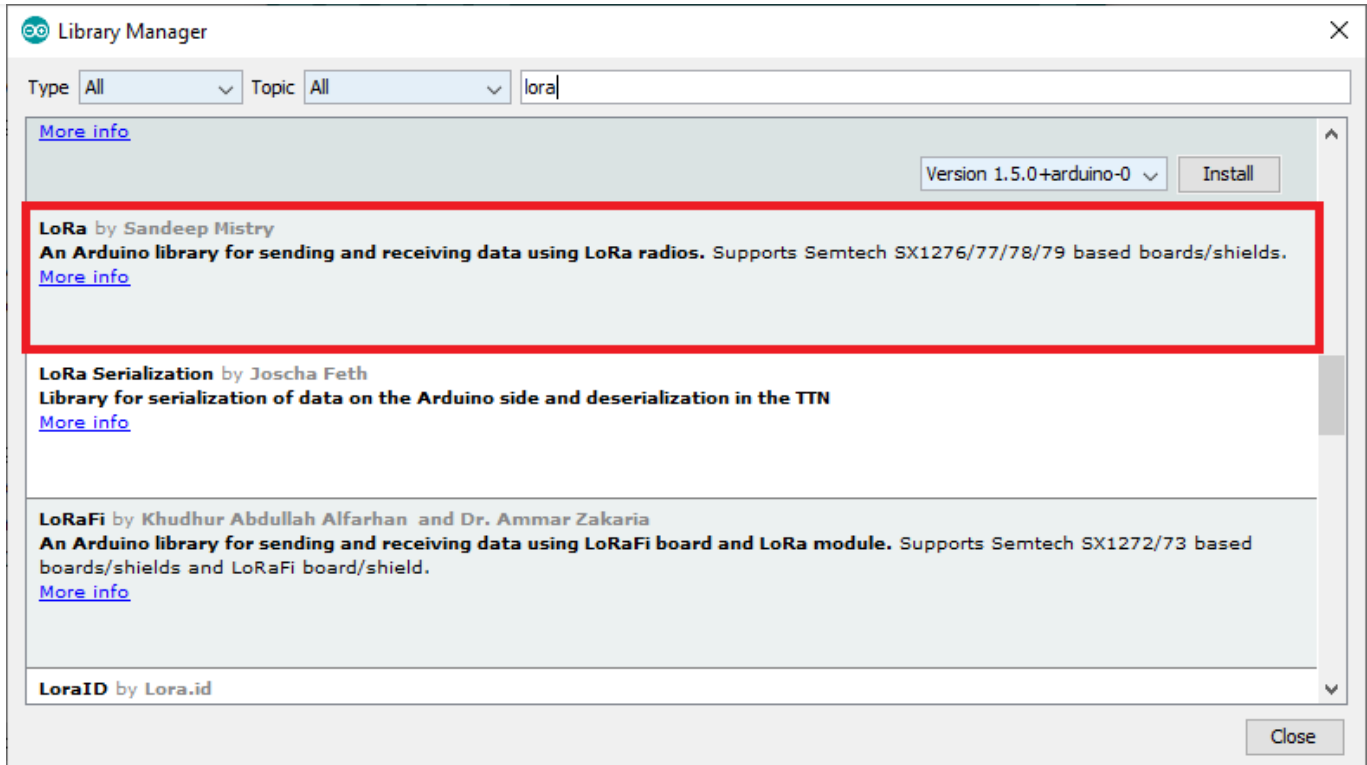
3. After installing the SSD1306 library from Adafruit, type “**GFX**” in the search box and install the library.



Installing LoRa Library

There are several libraries available to easily send and receive LoRa packets with the ESP32. In this example we'll be using the [arduino-LoRa library by sandeep mistry](#).

Open your Arduino IDE, and go to **Sketch > Include Library > Manage Libraries** and search for “**LoRa**”. Select the LoRa library highlighted in the figure below, and install it.



After installing the libraries, restart your Arduino IDE.

LoRa Sender Sketch

Copy the following code to your Arduino IDE. This code sends a “hello” message followed by a counter via LoRa every 10 seconds. It also displays the counter on the OLED display.

```
/*  
  Rui Santos  
  Complete project details at https://RandomNerdTutorials.com/ttgo-lora32-sx1276-arduino-ide/  
*/  
  
//Libraries for LoRa  
#include <SPI.h>  
#include <LoRa.h>  
  
//Libraries for OLED Display
```

```
#include <Adafruit_SSD1306.h>

//define the pins used by the LoRa transceiver module
#define SCK 5
#define MISO 19
#define MOSI 27
#define SS 18
#define RST 14
#define DI00 26

//433E6 for Asia
//866E6 for Europe
//915E6 for North America
#define BAND 866E6
```

[View raw code](#)

How the code works

Start by including the libraries to interact with the LoRa chip.

```
#include <SPI.h>
#include <LoRa.h>
```

Then, include the libraries to interface with the [I2C OLED display](#).

```
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
```

Define the pins used by the LoRa transceiver module:


```
#define SCK 5
#define MISO 19
#define MOSI 27
#define SS 18
#define RST 14
#define DI00 26
```

Select the LoRa frequency:

```
#define BAND 866E6
```

Define the OLED pins.

```
#define OLED_SDA 4
#define OLED_SCL 15
#define OLED_RST 16
```

Define the OLED size.

```
#define SCREEN_WIDTH 128 // OLED display width, in pixels
#define SCREEN_HEIGHT 64 // OLED display height, in pixels
```

Create a `counter` variable to keep track of the number of LoRa packets sent.

```
int counter = 0;
```

Create an `Adafruit_SSD1306` object called `display`.

setup()

In the `setup()`, to start using the OLED you need to do a manual reset via software using the RST pin. To do this reset, you need to declare the RST pin as an output, set it to `LOW` for a few milliseconds and then, set it to `HIGH` again.

```
pinMode(OLED_RST, OUTPUT);  
digitalWrite(OLED_RST, LOW);  
delay(20);  
digitalWrite(OLED_RST, HIGH);
```

Start an I2C communication using the defined `OLED_SDA` and `OLED_SCL` pins using `Wire.begin()`.

```
Wire.begin(OLED_SDA, OLED_SCL);
```

After that, initialize the display with the following parameters. The parameters set as `false` ensure that the library doesn't use the default I2C pins and use the pins defined in the code (`GPIO 4` and `GPIO 15`).

```
if(!display.begin(SSD1306_SWITCHCAPVCC, 0x3c, false, false)) { // A  
  Serial.println(F("SSD1306 allocation failed"));  
  for(;;); // Don't proceed, loop forever  
}
```

Then, you can use the methods from the Adafruit library to interact with the OLED display. To learn more you can read our [tutorial about the I2C OLED display with the ESP32](#).

```
display.clearDisplay();  
display.setTextColor(WHITE);  
display.setTextSize(1);  
display.setCursor(0,0);  
display.print("LORA SENDER ");  
display.display();
```

Initialize the serial monitor for debugging purposes.

```
Serial.begin(115200);  
Serial.println("LoRa Sender Test");
```

Define the SPI pins used by the LoRa chip.

```
SPI.begin(SCK, MISO, MOSI, SS);
```

And set up the LoRa transceiver module.

```
LoRa.setPins(SS, RST, DIO0);
```

Finally, initialize the LoRa transceiver module using the `begin()` method on the `LoRa` object and pass the frequency as argument.

```
if (!LoRa.begin(BAND)) {  
  Serial.println("Starting LoRa failed!");  
  while (1);  
}
```

```
display.setCursor(0,10);  
display.print("LoRa Initializing OK!");  
display.display();
```

loop()

In the `loop()` is where we'll send the packets. You initialize a packet with the `beginPacket()` method.

```
LoRa.beginPacket();
```

You write data into the packet using the `print()` method. As you can see in the following two lines, we're sending a hello message followed by the counter.

```
LoRa.print("hello ");  
LoRa.print(counter);
```

Then, close the packet with the `endPacket()` method.

```
LoRa.endPacket();
```

Next, write the `counter` on the OLED display

```
display.clearDisplay();  
display.setCursor(0,0);  
display.println("LORA SENDER");  
display.setCursor(0,20);  
display.setTextSize(1);  
display.print("LoRa packet sent.");
```

```
display.print("Counter:");  
display.setCursor(50,30);  
display.print(counter);  
display.display();
```

After this, the `counter` message is incremented by one in every loop, which happens every 10 seconds.

```
counter++;  
delay(10000);
```

Testing the LoRa Sender

Upload the code to your board. You need to select the right board and COM port you're using.

To select the board, in the Arduino IDE, go to **Tools > Board** and select the **TTGO LoRa32-OLED V1** board.

After uploading the code to your board, it should start sending LoRa packets.

LoRa Receiver Sketch

Now, upload the receiver sketch to another TTGO LoRa32 OLED board. This sketch listens for LoRa packets within its range and prints the content of the packets on the OLED, as well as the RSSI (relative received signal strength).

```
/*  
  Rui Santos  
  Complete project details at https://RandomNerdTutorials.com/ttgo-lora32-sx1276-arduino-ide/  
*/  
  
//Libraries for LoRa  
#include <SPI.h>  
#include <LoRa.h>  
  
//Libraries for OLED Display
```



```
#include <Adafruit_SSD1306.h>
```

```
//define the pins used by the LoRa transceiver module
#define SCK 5
#define MISO 19
#define MOSI 27
#define SS 18
#define RST 14
#define DI00 26

//433E6 for Asia
//866E6 for Europe
//915E6 for North America
#define BAND 866E6
```

[View raw code](#)

This sketch is very similar with the previous one. We just need to modify some lines to receive LoRa packets instead of sending.

In the `loop()`, we check if there are new packets to receive using the `parsePacket()` method.

```
int packetSize = LoRa.parsePacket();
```

If there's a new packet, we'll read its content. To read the incoming data, use the `readString()` method. The data received is saved on the `LoRaData` variable.

```
if (packetSize) {
  //received a packet
  Serial.print("Received packet ");
```

```
while (LoRa.available()) {  
  LoRaData = LoRa.readString();  
  Serial.print(LoRaData);  
}
```

We also get the RSSI of the received packet by using the `packetRSSI()` method.

```
int rssi = LoRa.packetRssi();
```

Finally, display the received message, as well as the RSSI.

```
display.clearDisplay();  
display.setCursor(0,0);  
display.print("LORA RECEIVER");  
display.setCursor(0,20);  
display.print("Received packet:");  
display.setCursor(0,30);  
display.print(LoRaData);  
display.setCursor(0,40);  
display.print("RSSI:");  
display.setCursor(30,40);  
display.print(rssi);  
display.display();
```

Testing the LoRa Receiver

Upload the code to your board. Don't forget you need to select the **TTGO LoRa32-OLED V1** in the Boards menu.

After uploading the code, it should start receiving the LoRa packets from the other board.

Wrapping Up

This article was a quick getting started guide for the [TTGO LoRa32 board](#) how to: send LoRa packets in point to point communication and use the OLED display.

Now, the idea is to combine what you've learned here to build IoT projects. LoRa can be specially useful if you want to receive sensor readings that are not covered by your wi-fi network and are several meters apart. Additionally, you can also connect your board to the TTN (The Things Network).

We hope you've found this tutorial useful. Learn more about the ESP32 with our resources:

- [Learn ESP32 with Arduino IDE](#) (eBook + Video Course)
- [MicroPython Programming with ESP32 and ESP8266](#) (eBook)
- [ESP32 with LoRa RFM95 Chip using Arduino IDE – Getting Started](#)
- [More ESP32 projects...](#)

Thanks for reading.

[eBook] Build Web Servers with ESP32 and ESP8266 (2nd Edition)

Build Web Server projects with the ESP32 and ESP8266 boards to control outputs and monitor sensors remotely. Learn HTML, CSS, JavaScript and client-server communication protocols [DOWNLOAD »](#)

Recommended Resources

[Build a Home Automation System from Scratch »](#) With Raspberry Pi, ESP8266, Arduino, and Node-RED.

[Home Automation using ESP8266 eBook and video course »](#) Build IoT and home automation projects.

[Arduino Step-by-Step Projects »](#) Build 25 Arduino projects with our course, even with no prior experience!

What to Read Next...

[\(ESP32/ESP8266 + MySQL + PHP\)](#)

[ESP32 ADC – Read Analog Values with Arduino IDE](#)

[\[SOLVED\] Reconnect ESP32 to Wi-Fi Network After Lost Connection](#)

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126 thoughts on “TTGO LoRa32 SX1276 OLED Board: Getting Started with Arduino IDE”

Hamza

October 19, 2019 at 5:36 pm

I like your tutorials are beautiful work, is there a possibility to add the module sd card

[Reply](#)

Sara Santos

October 20, 2019 at 10:31 am

Hi.

Yes, I think you can.

Follow this tutorial: <https://randomnerdtutorials.com/esp32-data-logging-temperature-to-microsd-card/>

Regards,

Sara

[Reply](#)

Ion Gheorghe

October 19, 2019 at 8:41 pm

How i can transfer from this board using UART the data to a pic18.
I would like to have a Pic18 + Lora+ ESP and be able to send 30 bytes to a second Pic18, or receive from other PIC18 a group of 30 bytes.

[Reply](#)**David Caplin**

October 21, 2019 at 7:07 am

The TTGO series of boards are great, they have loads of really odd ones too, like esp32 + a camera, or SIM card, or GPS, or DHT sensor, just about any project you want, there is a TTGO board for it.
Only thing I've found is the range of the TTGO LoRa is pretty poor, I'm only getting a couple 100m in clear open countryside, rather than the 1000s of m it should really be.

[Reply](#)**Sara Santos**

October 23, 2019 at 6:25 pm

Hi David.

There are many variables that can interfere with range including the board

But there are a few settings you can change to try increasing the communication range: <https://github.com/sandeepmistry/arduino-LoRa/issues/90>

Regards,
Sara

[Reply](#)

Bert

October 26, 2019 at 5:13 pm

Hello Rui and Sara.

I can send and receive text via Lora.

But I would like to send an analog value and an on / or switch command to a receiver. I have not yet succeeded. Have you already done something with it? It seems very nice to be able to read something from a greater distance and to switch than just to transfer text.

I just have no idea how to handle that and I need a hint. The Text distance that I have already covered here is not that great yet. About 1000 Meters, but that is also sufficient for me.

Greetings from bert from (cold) Netherlands.

[Reply](#)

Sara Santos

October 27, 2019 at 11:21 am

Hi Bert.

same message. Note that each reading is separated by a special character. This way, on the receiver side, you know how to split the message.

```
void sendReadings() {
  // Send packet data
  // Send temperature in Celsius
  message = String(readingID) + "/" + String(tempC) + "&" +
    String(soilMoisture) + "#" + String(batteryLevel);
  // Uncomment to send temperature in Fahrenheit
  //message = String(readingID) + "/" + String(tempF) + "&" +
  // String(soilMoisture) + "#" + String(batteryLevel);
  delay(1000);
  LoRa.beginPacket();
  LoRa.print(message);
  LoRa.endPacket();
}
```

This works the same way if you want to send commands to turn something on or off.

On the receiver side, we use the following to read and split the data:

```
void getLoRaData() {
  Serial.print("Lora packet received: ");
  // Read packet
  while (LoRa.available()) {
    String LoRaData = LoRa.readString();
    // LoRaData format: readingID/temperature&soilMoisture#batterylevel
    // String example: 1/27.43&654#95.34
    Serial.print(LoRaData);

    // Get readingID, temperature and soil moisture
    int pos1 = LoRaData.indexOf('/');
    int pos2 = LoRaData.indexOf('&');
    int pos3 = LoRaData.indexOf('#');
```

```
soilMoisture = LoRaData.substring(pos2+1, pos3);  
batteryLevel = LoRaData.substring(pos3+1, LoRaData.length());  
}
```

Now, feel free to modify these functions to use in your project.

REgards,

Sara

[Reply](#)

Antoine

February 27, 2020 at 6:36 pm

Hi Sara,

thank you for this piece of code. It's very interesting since I try to send temperature and soil moisture sensor values with these boards.

I was wondering if I can still use I2C to connect a BME280.

I2C is already used by the oled display, but I think it is possible to have both device on the same "line" with different I2C adresses.

Am I right ?

Many thanks to you and Ruis for your work and nice tutos ^^

[Reply](#)

Sara Santos

March 2, 2020 at 11:41 am

Hi Antoine.

Yes, it is possible.

[i2c-communication-arduino-ide/](#)

Regards,
Sara

[Reply](#)

Mike Allard

February 26, 2021 at 3:32 pm

Hi Antoine and Sarah.

I tried this on the same I2C bus with bad results. I was using the GY-21P dual sensor. BMP280 and Si7021. I just could not get this working on GPIO 4 and GPIO 15 sharing with the Oled bus.

My solution was to initialise the display using IO 4 and 15, set it up and display welcome message etc. Then initialise the BMP280 on IO 22 and 23. If left like this it breaks the display.

To work around this I then use `Wire.begin(4,15);` which reassigns the I2C to the Oled.

When reading from BMP280, start the function with `Wire.begin(22,23);` do the reading and end the function with `Wire.begin(4,15);`

In other words, programmatically switch the I2C bus pin configuration when needed. Not sure if this is the best way, but was a simple solution for me.

Regards,

Mike.

Sara Santos

February 27, 2021 at 11:50 am

Hi Mike.

You can also use TwoWire to creates two I2C instances.

Read this tutorial about I2C: <https://randomnerdtutorials.com/esp32-i2c-communication-arduino-ide/>

Regards,

Sara

Nor Aiman Farhan bin Mohamad Razali

May 25, 2021 at 4:22 pm

Hi Sara, i was using this command to transfer multiple sensor data through LoRa. I'm using Arduino Nano but there is always give me an error for this piece of command.

```
message = String(readingID) + "/" + String(tempC) + "&" +  
String(soilMoisture) + "#" + String(batteryLevel);
```

when i delete this command, i can compile succesfully without error. do i need to install any library to be able to use this command

[Reply](#)

Sara Santos

May 28, 2021 at 5:35 pm

Hi.
What is the error?
Regards,
Sara

[Reply](#)

Bert

October 27, 2019 at 5:00 pm

I do my best, thank you

Greetings Bert.

[Reply](#)

Aage Rasmussen

November 4, 2019 at 2:40 pm

Hi
I have used these boards to control my outdoor light etc.
i have connected them with solar cells and 18650 battery with charger module as instructed in Learn ESP32 for Arduino.

everything has been working perfectly for a month until the battery runs out of power.
after that I cannot contact the board over USB

the first time it happened I thought it was a bad board
but today it happened again with two boards running out of power
no sun in Danmark 😞

it may be a problem that they get power through the lithium battery.
Connecting even if they write is ok?

Regards
Aage

[Reply](#)

Clyde Cox

November 22, 2019 at 3:13 am

Fantastic tutorial as Usual.

[Reply](#)

Sara Santos

November 22, 2019 at 11:24 am

Thanks 😊

[Reply](#)

Martin

November 26, 2019 at 9:52 pm

Hi,

Great article. I got myself a pair of these to see what I could do.

They came already programmed as a pair but did not have the signal strength displayed so I re-programmed them using the code in the article which worked flawlessly, thank you.

I do have a problem though, the range is extremely poor. Although I am only using the antennas that were supplied, I expected much more range. I am getting barely 10m away and the signal is lost.

I tried disconnecting the antennas on both transmit and receive ends to see if there was a drop in signal which would indicate the antennas were working, (no drop in signal would show one or both antennas were faulty in some way).

For example, with about 50cm between the two units I get an RSSI of -85 and just moving to the next room (5m away and through just a stud wall) the RSSI drops to -104.

Is there something wrong do you think?

Thanks

Martin

[Reply](#)

Konrad

February 2, 2020 at 10:43 am

frequencies of the LoRa transceivers. So I changed “LoRa.begin(866E6)” to “LoRa.begin(433E6)” and the range grew up to more than 1 kilometer.

[Reply](#)

Nuno

October 24, 2020 at 10:14 am

How can we check that? I bought two units as the ones on the tutorial, and I'm also getting too short of a range. Is there any problem in setting the frequency to 443MHz?

[Reply](#)

Bob Rader

November 28, 2019 at 3:18 pm

November 28, 2019 —

Now that we have this board working, I would like to know if the TTGO Model LoRa32 V2.1_1.6 T3 can be programmed using the Arduino IDE? If Yes, Under the tools tab of the IDE, what board do I select, what upload speed do I select, what programmer do I select, etc.? Also, do I need to do other things to the board during the upload process (for instance, as with the TTGO LoRa32-OLED V1 it was required to push and hold the “prog” button)? Bob Rader

[Reply](#)

Sara Santos

December 2, 2019 at 2:26 pm

Hi Bob.

I've answered your question on the forum.

Regards,

Sara

[Reply](#)

Joseph Tannenbaum

December 12, 2019 at 8:38 pm

This is cool. Great tutorial! I have a problem, using the TTGO devices. The sender goes forever, but the webserver stops after 50- 250 packets. I switched the sender and receiver and the same thing happens. The webserver/receiver stops responding. No idea why. Was going to put the sender in my observatory to keep track of conditions, but it it quits, won't be of use. Ideas?

Thanks,

Joe

[Reply](#)

Joseph Tannenbaum

December 12, 2019 at 10:14 pm

Sorry, I put this in the wrong tutorial. Should be:

<https://randomnerdtutorials.com/esp32-lora-sensor-web-server/#more-90811>

Joe

I guess I have too many of your tutorials bookmarked? 😊

[Reply](#)

Sara Santos

December 14, 2019 at 11:59 am

Hi Joseph.

What do you mean by the web server stops?

Do you get any errors?

Regards,

Sara

[Reply](#)

Joseph T Tannenbaum

December 14, 2019 at 3:06 pm

No errors, (I have both on a com port with a screen open to it) Tried changing the frequency of reading on the sender, and the longer between sendings, the quicker it dies. I believe the loop just dies.

Scott

December 20, 2019 at 3:06 am

Thank you for these examples. The pin assignments for the SPI interface to the SX1276 chip were what I needed to get things working. You've provided more information than LilyGo about their own TTGO product. Please note that your code also works with the version that does NOT have the built-in display, just by taking out the OLED code.

[Reply](#)

Alain

January 9, 2020 at 2:48 pm

Hello

A great tuto as usual !

I have implemented this LoRa send and LoRa receive codes on ESP LoRa OLED from TTGO.

I have combined this tuto with the tuto on BM280 data so that LoRa can relay weather data to a host site for display over the web.

This can work for hours (some 8000 packets) and suddenly the receiver stops receiving packets without any reasons. I need to reset the ESP to restart. When it sticks all Serial.prints are stopped on the serial console, no more IRQ signal are available on IRQ/DIO0 pin.

I am investigating the following problems: CRC error on reception, unexpected LoRa chip reset on RST pin, LoRa chip losing LoRa Begin

[Reply](#)**Sara Santos**

January 10, 2020 at 12:08 pm

Hi Alain.

You can check for that in your code and when something wrong happens like: fail to init LoRa, drop internet connection or something, restart the board with: `ESP.restart();`

I hope this helps.

Regards,

Sara

[Reply](#)**Alain BERTOUT**

January 10, 2020 at 4:11 pm

Hi Sara

Thank you for your prompt answer.

Today, my workaround was to include a `LoRa.begin(BAND)` command after each successfully received packet .

This looks to solve the problem for now more than 23 000 packets received.

I hope this could also help other members in the ESP/LoRa community.

Besr regards

[Reply](#)**Sara Santos**

January 12, 2020 at 10:30 pm

Hi Alain.

Thank you so much for sharing this with us.

It will definitely be useful for our followers.

Regards,

Sara

[Reply](#)**Joseph Tannenbaum**

January 15, 2020 at 10:24 pm

I tried this and it's the receiver that quits. Restarting the receiver gets it going again??? Dies at somewhere around 70 packets.

[Reply](#)**alain**

January 15, 2020 at 10:57 pm

Instead of restarting the receiver I have schedule the receiver to go in

Longer test period is necessary to conclude.

Note : the idea of reprogramming with LoRa begin after reception was not 100% satisfactory for me. The receiver still stuck after some 12000 packets.

Joseph T Tannenbaum

January 16, 2020 at 12:02 am

I wonder if it is related to the frequency. I'm in the US so am using the 915 band. I am sampling every 60 sec.

Joe Snyder

June 16, 2020 at 10:45 pm

After experiencing the receiver stall problem mentioned several times in these comments, and trying all the mentioned fixes with no satisfaction, I checked the API and found the following: `LoRa.receive()`; which according to the docs sets the chip to continuous receive. Has worked well for several days now with 100ms updates of the received data (a counter). so I'm guessing the chip goes to sleep on its own for some reason. I will dig into the 1276 data sheet for more info as time permits. For now the following code works:

```
void initLora() {  
  //SPI LoRa pins  
  SPI.begin(SCK, MISO, MOSI, SS);  
  //setup LoRa transceiver module
```

```
LoRa.begin(BAND);  
LoRa.receive(); // Sets continuous receive
```

[Reply](#)**Alain BERTOUT**

January 10, 2020 at 10:06 am

Hello

I have successfully implemented this brilliant tutorial to deliver BME 280 data to a web server accessible over WiFi.

I am periodically experiencing the LoRa receiver that stops delivering packets after some 1000's of perfect data transmission.

No more IRQ signals are visible from the LoRa chip. The ESP is still looping correctly.

With full ESP restart, the receiver resumes its task. Also with a single LoRa.begin(BAND) command (without ESP reset) the receiver also resumes its task.

Can we suspect conflicts between functions/librairies : OLED, LoRa, WiFi, http?

[Reply](#)**Bob Rader**

January 13, 2020 at 12:01 am

The TTGO LoRa project is going well for me and thanks a million for all your tutorials, posts and the E-Books.

Using a pair of TTGO V2.1 – 1.6 T3 modules I have been able to transmit & receive the transmitted signal more than 5km. I like Using this module because it allows me to connect the module directly to a vertically polarized dipole antenna at both the Tx & Rx ends. For this distance test the signal path was line-of-sight with no interfering obstructions.

Now, my next project will be to see how far I can actually transmit the LoRa signal. To do this I will need to play with some of the LoRa SX1276 parameters which effect the range such as coding factor, bandwidth, Tx power, etc...

One issue I have NOT been able to successfully resolve is changing these LoRa RF parameters on the SX1276 using the LoRa library. For instance, I recently attempted to adjust the transmit power parameter without success. Note, I am using a spectrum analyzer to view and characterize the short burst of RF output signal from the TTGO module.

I also would like to play with some of the other LoRa parameters like coding factor, bandwidth, spreading factor and other such parameters. However, I am unable to find the correct syntax nor any documentation as to how to set and use such parameters.

Can you help???

Regards,
Bob Rader

[Reply](#)

Sara Santos

January 13, 2020 at 10:49 am

Hi Bob.

5km is a very good result for these boards 😊

To play with those settings, you can take a look at the Lora library file. See functions in lines 66 to 71 : <https://github.com/sandeepmistry/arduino-LoRa/blob/master/src/LoRa.h>

I think it is exactly what you want.

Regards,

Sara 😊

[Reply](#)

Harry

January 26, 2020 at 7:05 pm

I'm using the heltec board and my program pauses within this if statement. What would the issue be with this?

```
if (!LoRa.begin(BAND)) {  
  Serial.println("Starting LoRa failed!");  
  while (1);  
}
```

[Reply](#)

Sara Santos

January 27, 2020 at 6:35 pm

What LoRa boards are you using? Your board might be using a different pinout than ours.

Regards,
Sara

[Reply](#)

Harry

January 27, 2020 at 7:56 pm

Hi Sara, I'm just using the heltec board at the moment. I double checked the pins so hopefully it's not that.

[Reply](#)

Sara Santos

January 27, 2020 at 10:06 pm

Hi again.

I just checked and the Heltec LoRa boards with oled have the same pinout as the TTGO LoRa32. So, the code should work straight away (unless you have a "weird" version of an heltec board).

So, without more information, it is very difficult to find out what might be wrong :/

Regards,
Sara

[Reply](#)

Cassio Lucas

February 2, 2020 at 2:09 pm

Hello Sara Santos, how are you? I hope fine.

I have two modules TTGO LORA_V1_0_OLED and they working normally, however I using the standard Send/Receive LoRa examples, I would like to know if its possible to improve the RSSI value by adjusting some parameters on the code like for an example the TxPower on the Sender? Have you tried this and could you share the part of your code?

Thank you!

[Reply](#)**Sara Santos**

February 2, 2020 at 5:37 pm

Hi Cassio.

I haven't tested changing the parameters to improve the communication range.

But you can read about that here:

<https://github.com/sandeepmistry/arduino-LoRa/issues/90>

I hope this helps.

Regards,

Sara

[Reply](#)

Hi Sara,

I am responding to Cassio Lucas' post of February 2, 2020 and your reply to him. I am providing a copy of my Sender & Receiver sketches allowing for and utilizing the LoRa RF & Modulation parameters.

I have also done distance testing and have so far been able to send a LoRa message more than 5 km. To do this I am using the TTGO V2.1 -1.6 T3 with a home made ground plane antenna at each end. My signal path also is "line-of-sight" with NO intervening obstructions. I have found that the external antennas are very very important to get good range.

Further please note that this testing was done on the 433 Mhz band here in the US running under amateur radio authorization. I have also used the same sketches on 915 Mhz making the appropriate frequency changes in the sketches, LoRa module & antenna.

I also would like to suggest 2 articles I found very helpful to help understand the LoRa Modulation parameters.

Two very good articles explaining the LoRa RF parameters are:

"A Study of LoRa: Long Range & Low Power Networks for the Internet of Things"

explaining the LoRa parameters can be found at

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5038744/>

&

Decoding Lora <https://revspace.nl/DecodingLora>

Here are my two sketches (please note it appears that the copy did not preserve the exact/ correct formatting):

//

//

/*****

Rui Santos

Complete original project details at <https://RandomNerdTutorials.com/ttgo-lora32-sx1276-arduino-ide/>

TTGO V2.1_1.6 T3 — Receiver Sketch —

Version 1-30-20

Notes: ** LoRa RF parameters for the receiver MUST BE set the same as the SENDER **

Modified by Bob Rader 1-22-20 added LoRa RF Parameters, internal green

LED and an external output for an LED on pin 12 to verify receipt of packet.

Added to the display the analog reading & digital status sent from sender
Mod of 1-30-20 — added call sign

2-2-20 modified for signal range test without the Digital or Analog,
Removed Call Sign

Two very good articles explaining the LoRa RF parameters:

“A Study of LoRa: Long Range & Low Power Networks for the Internet of Things”

explaining the LoRa parameters can be found at

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5038744/>

&

Decoding Lora <https://revspace.nl/DecodingLora>

*****/

//433E6 for Asia

//866E6 for Europe

//915E6 for North America

/***** SET LoRa RF & Modulation Parameters

*****/

*

Define parameters to be used by LoRa module

Band Band or Freq — 433E6 for Asia 866E6 Europe 915E6 North

ie: 915E6 or 922350000 or any specific frequency

Power Tx Power 2 to 20 default 17

SF Spreading Factor 6 to 12 default 7

BW Bandwidth 7.8E3, 10.4E3, 15.6E3, 20.8E3, 31.25E3,
41.7E3, 62.5E3, 125E3, & 250E3 default 125E3

CR Coding Rate 5 or 8 default 5

Preamble Preamble 6 to 65535 default 8

SyncWd Sync Word byte val to use as sync word default 0x12

*/

#define Band 433E6 // Set Band or Frequency in Hz

#define SF 10 // Set Spreading Factor

#define BW 125E3 // Set Bandwidth

#define CR 5 // Set Coding Rate

#define Preamble 255 // Set Preamble

#define SyncWd 0x12 // Set Sync Word

//***** Libraries for LoRa

#include

#include

//***** Libraries for OLED Display

#include

#include

#include

//***** Define pins used by LoRa

module

#define SCK 5

```

#define MOSI 27
#define SS 18
#define RST 23
#define DIO0 26

//***** .....Define pins & Parameters
used by OLED Display
// and variables

#define OLED_SDA 21
#define OLED_SCL 22
#define OLED_RST 16
#define SCREEN_WIDTH 128 // OLED display width, in pixels
#define SCREEN_HEIGHT 64 // OLED display height, in pixels

Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire,
OLED_RST);

String LoRaData;
const int ledPin = 25; //Use pin 25 for Led
const int ledPin1 = 12; //Use pin 12 for External Led

void setup() {

pinMode(ledPin, OUTPUT); //Define ledPin as output
pinMode(ledPin1, OUTPUT); //Define ledPin as output
//reset OLED display via software
pinMode(OLED_RST, OUTPUT);
digitalWrite(OLED_RST, LOW);
delay(20);
digitalWrite(OLED_RST, HIGH);

digitalWrite(ledPin, HIGH);

//***** Initialize OLED Address 0x3C

```

```
Wire.begin(OLED_SDA, OLED_SCL);
if(!display.begin(SSD1306_SWITCHCAPVCC, 0x3c, false, false)) { //
Address 0x3C
Serial.println(F("SSD1306 allocation failed"));
for(;;); // Don't proceed, loop forever
}
//***** .....Set-Up Display

display.clearDisplay();
display.setTextColor(WHITE);
display.setTextSize(1);
display.setCursor(0,0);
display.print("LORA RECEIVER ");
display.display();

// initialize Serial Monitor
Serial.begin(115200);

Serial.println("LoRa Receiver Test");

//***** LoRa SPI pins

SPI.begin(SCK, MISO, MOSI, SS);
//***** setup LoRa transceiver module &
Frequency

LoRa.setPins(SS, RST, DIO0);

if (!LoRa.begin(Band)) { // Please Set Correct Frequency/ Band above
Serial.println("Starting LoRa failed!");
while (1);
}

//***** Setup LoRa Transmission Parameters
LoRa.setSpreadingFactor(SE); // 6-12
```

```
31.25E3,
// 41.7E3, 62.5E3, 125E3, & 250E3
LoRa.setCodingRate4(CR); // 5 or 8
LoRa.setPreambleLength(Preamble); // 5 to 65535
LoRa.setSyncWord(SyncWd); // byte val to use as sync word

Serial.println("LoRa Initializing OK!");
display.setCursor(0,10);
display.println("LoRa Initializing OK!");
display.display();
}
//***** START LOOP *****
//*****

void loop() {

//***** ..... parse data from packet
int packetSize = LoRa.parsePacket();
if (packetSize) { // when no more data in packet — end
//received a packet
Serial.print("Received packet ");

//***** .....read packet data
while (LoRa.available()) { // while data is in packet
LoRaData = LoRa.readString(); // read data
Serial.print(LoRaData); // continue until all packet
} // data has been read

//***** .....print RSSI
int rssi = LoRa.packetRssi(); // read the transceiver RSSI value
Serial.print(" with RSSI ");
Serial.println(rssi);

//***** .....display information on Oled Display
display.clearDisplay();
```



```
display.setTextSize(2);
display.print("LoRa 433Rx"); // Send "LORA RECEIVER" to top line of
display
display.setCursor(10,18); // Set cursor to col 10 line 18
display.print(LoRaData);
display.setCursor(0,54); // Set cursor to col 0 line 54
display.setTextSize(1);
display.print("RSSI = ");
display.setTextSize(2);
display.setCursor(48,50); // Set cursor to col 48 line 50
display.print(rssi);
display.display();

if (LoRaData == "Test 123") // test to see if data received is
{ // same as data sent — if yes,
for (int i = 0; i < 3; i++) // blink ledPin 3 times
{
digitalWrite(ledPin, HIGH);
digitalWrite(ledPin1, HIGH);
delay(200);
digitalWrite(ledPin, LOW);
digitalWrite(ledPin1, LOW);
delay(200);
}
}

//***** .....blink external & internal green LED
// 3 times to verify receipt of packets
/* for (int i = 0; i < 3; i++){
digitalWrite(ledPin, HIGH);
digitalWrite(ledPin1, HIGH);
delay(300);
digitalWrite(ledPin, LOW);
digitalWrite(ledPin1, LOW);
```

```
*/  
}  
}  
  
//***** END *****/  
//  
//  
  
/*  
***** ..... TTGO V2.1-1.6 T3 Transmit/ Sender  
Sketch.....  
Original sketch from  
Rui Santos  
Complete original project details at https://RandomNerdTutorials.com/ttgo-lora32-sx1276-arduino-ide/  
  
Set for transmission on 433 Mhz  
  
Sketch 2-2-20 Used to send test text "Testing 123" to TTGO Receiver  
Module  
  
Modified 12-9-19 By Adolfo Mondragon added both an Analog Input &  
digital Input  
  
***** Sender/ Transmit Unit set For 433 Mhz  
Band *****  
  
TTGO V2.1_1.6 T3 — Sender Sketch —  
Version 2-2-20  
  
Notes: ** LoRa RF parameters for the receiver MUST BE set the same as  
the SENDER **  
  
Modified by Bob Rader 1-22-20 added LoRa RF Parameters, internal  
green Led
```

Added to the display the analog reading & digital status sent from sender
 Mod of 1-30-20 — added call sign
 modified for signal range test without the Digital or Analog, Removed Call Sign

Two very good articles explaining the LoRa RF parameters:

"A Study of LoRa: Long Range & Low Power Networks for the Internet of Things"

explaining the LoRa parameters can be found at

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5038744/>

&

Decoding Lora <https://revspace.nl/DecodingLora>

***** SET LoRa Modulation & RF Parameters

Band Band or exact Freq 433E6 for Asia, 866E6 Europe, 915E6 America
 ie: 915E6 or 922350000 or another specific frequency

Power Tx Power 2 to 20 default 17

SF Spreading Factor 6 to 12 default 7

BW Bandwidth 7.8E3, 10.4E3, 15.6E3, 20.8E3, 31.25E3,
 41.7E3, 62.5E3, 125E3, & 250E3 default 125E3

CR Coding Rate 5 or 8 default 5

Preamble Preamble 6 to 65535 default 8

SyncWd Sync Word byte val default 0x12

*/

#define Band 433E6 // Set Module Frequency

#define Power 17 // Set Power (2 to 20)

#define SF 10 // Set Spreading Factor (6 to 12)

#define BW 125E3 // Set Bandwidth (see above)

#define CR 5 // Set Coding Rate (5 or 8)

```
#define Preamble 8 // Set Preamble (6 to 65535)
#define SyncWd 0x12 // Set Sync Word ( default 0x12)

//***** ..... Libraries for LoRa..... *****

#include
#include

//***** ..... Libraries for OLED Display
*****
.....

#include
#include
#include

//***** ..... Define pins used by LoRa SX1276
module..... ***

#define SCK 5
#define MISO 19
#define MOSI 27
#define SS 18
#define RST 23
#define DIO0 26

const int ledPin = 25; // Uses Pin 25 for internal Grn LED to indicate
transmission made

//***** ..... Define pins & Parameters used by OLED
Display.....
#define OLED_SDA 21
#define OLED_SCL 22
#define OLED_RST 16
#define SCREEN_WIDTH 128 // OLED display width, in pixels
#define SCREEN_HEIGHT 64 // OLED display height, in pixels
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, & Wire,
OLED_RST);
```

```

byte sensor_D ; // This will be the Digital I/O Input on pin 14
int sensor_A ; // This will be the Analog Input on pin 12

//***** ..... initialize and set-up ESp32 Pins & Serial
Monitor .....

void setup() {
  Serial.begin(9600); // set baud rate for serial monitor

  pinMode(14, INPUT_PULLUP); // Use pin 14 for Digital Input SENSOR
  with pull-up
  pinMode(12, INPUT); // Use pin 12 for Analog Input SENSOR, see below
  pinMode(ledPin, OUTPUT); // Use pin 25 For internal Led — On when in
  Tx mode

  //***** ..... Reset OLED
  display.....*****
  pinMode(OLED_RST, OUTPUT);
  digitalWrite(OLED_RST, LOW);
  delay(20);
  digitalWrite(OLED_RST, HIGH);

  //***** ..... Initialize OLED at address
  0x3C.....
  Wire.begin(OLED_SDA, OLED_SCL);
  if(!display.begin(SSD1306_SWITCHCAPVCC, 0x3c, false, false)) {
    for(;;); // ..... Don't proceed, loop forever.....
  }
  //***** .....Set-Up & Write To
  Display.....*****
  display.clearDisplay();
  display.setTextColor(WHITE);
  display.setTextSize(1);
  display.setCursor(10,0);
  display.print("LoRa Sender Module");

```

```

display.print("initalized OK!");
display.display();

//***** LoRa SPI pins*****
SPI.begin(SCK, MISO, MOSI, SS);

//***** .....Set & test LoRa transmit
frequency.....
LoRa.setPins(SS, RST, DIO0);
if (!LoRa.begin(Band)) {
while (1);
}

//***** .....Setup LoRa Transmission & Modulation
Parameters.....

LoRa.setTxPower(Power); // 2 to 20
LoRa.setSpreadingFactor(SF); // 6-12
LoRa.setSignalBandwidth(BW); // 7.8E3, 10.4E3, 15.6E3, 20.8E3,
31.25E3,
// 41.7E3, 62.5E3, 125E3, & 250E3
LoRa.setCodingRate4(CR); // 5 or 8
LoRa.setPreambleLength(Preamble); // 5 to 65535
LoRa.setSyncWord(SyncWd); // byte val to use as sync word 0x12
delay(2000);
}

//***** START LOOPING *****
//*****
//***** Start Looping *****

void loop() {
//***** ..... Read Sensors.....

sensor_A = analogRead(12); // Analog Data Attached To Pin 12

```

```

sensor_D = digitalRead(14); // Digital Input Attached To Pin 14, Hi or Low

digitalWrite(ledPin, HIGH); // Turn ESP 32 on-board green LED (attached
to pin 25) on
// to indicate a transmission in progress
Serial.print(sensor_A); // Print Analog value to serial monitor
Serial.print(" "); //
Serial.println(sensor_D); // Print Digital value to serial monitor

//***** .... Send the LoRa packets.....*****

LoRa.beginPacket();
LoRa.print("Test 123");
/*
LoRa.print(sensor_D);
LoRa.println("");
LoRa.print("A = ");
LoRa.print(sensor_A);
*/
LoRa.endPacket();

// ***** ..... Write to local Display On ESP
32.....
display.setTextSize(2);
display.clearDisplay();
display.setCursor(0,0);
display.println("LORA 433TX");
display.setCursor(0,40);
display.print("");
//display.setCursor(55,20);
//display.print(sensor_D);
//display.setCursor(0,40);
display.print("Test 123");
//display.setCursor(55,40);
//display.print(sensor_A);

```

```
digitalWrite(ledPin, LOW); // turn ESP green LED off
```

```
delay(3000);  
}
```

```
// ***** END *****
```

```
//
```

```
//
```

[Reply](#)

Sara Santos

February 3, 2020 at 11:00 am

Hi Bob.

Thank you so much for sharing this valuable information.

Can you please share your codes using pastebin? When you paste the code here, some sections are automatically cut and it doesn't preserve formatting.

Regards,

Sara

[Reply](#)

Bob Rader

February 3, 2020 at 2:18 pm

Sara,

process and as such don't know how to start or do it. Also, I would like to share some pictures of the, simple to make, home made antennas and perhaps a spectrum analyzer output of the RF signal. How to do this?

Just need the details & specifics how to proceed...

Bob Rader

Sara Santos

February 3, 2020 at 4:21 pm

Hi again Bob.

You can read this that explains how to share code using

pastebin: <https://rntlab.com/question/need-help-using-pastebin/>

To share images, you can read this: <https://rntlab.com/question/how-to-send-image-files/>

Regards,

Sara

Bob Rader

February 4, 2020 at 3:50 pm

Feb 4, 2020

Sara,

hope all went OK.

Upon your conformation that all is OK, I will work to upload the Transmit/ Sender sketch...

The title is: TTGO_V2_1-

1_6_T3_Receiver_Sketch_From_Bob_Rader_Feb4_2020

Please confirm if you are able to get it...

Regards,
Bob Rader

Sara Santos

February 4, 2020 at 6:25 pm

Hi Bob.

I did not get it. Where is the link?

Regards,
Sara

Bob Rader

February 4, 2020 at 9:03 pm

Sara,

Perhaps try this: <https://pastebin.com/5feAAf4A>

If not, I have sent it to my engineers in Mexico via dropbox. Dropbox is

Regards,
Bob

Sara Santos

February 5, 2020 at 10:09 am

Great!
I got it now.
Thank you so much for sharing. 😊
Regards,
Sara

Bob Rader

February 5, 2020 at 2:28 pm

Sara,

GREAT! Now that I know how pastebin works I will soon send off the sender/ transmit sketch.

Regards,

Bob

Sara Santos

Thanks 😊

Bob Rader

February 6, 2020 at 4:34 pm

Sara,

Here is the link to the sender sketch: <https://pastebin.com/qVqJbQYt>

I am also planning in the future to do some fotos of the homemade antennas & a spectrum analyzer screen capture of the RF output. Hope you find these sketches helpful...

Regards,

Bob

Sara Santos

February 6, 2020 at 4:41 pm

Thank you for sharing.

What was the communication range that you get with these new LoRa parameters?

Regards,

Sara

Bob Rader

February 7, 2020 at 2:40 pm

Feb. 6, 2020

Sara,

Yes! The communications range is effected by the the modulation parameters, however, there are some other factors that more SIGNIFICANTLY effect the communications range and they have little to do with the modulation parameters. Specifically, the antenna, coax and an unobstructed line-of-sight path between sender & receiver.

I am getting more than 6 km here in southern New Mexico and feel I can get even longer range by looking at the system from an RF standpoint.

First let me give you the theoretical stuff:

The TTGO V2.1 – 1.6 T3 ESP32 LoRa system with modulation parameters of, SF=10; BW=125 KHz and a coding rate of 5. Semtech says that the SX1276 with these parameters should have a receiver sensitivity of -132 dBm. With a transmitter power setting of 17 (+17dBm) yields a total 'link budget' of (132 + 17) or 149 dB.

Now calculating the link losses in free air, (37 dB + 20* (log of freq MHz) + 20* (log of distance miles)), 37dB + 20(log915)=59.2 +20 (log40)=32 (0 dB of antenna gain and 0 dB of coax losses are assumed) or a total link loss of 129 dB. If one wanted to have a 20dB signal margin then these numbers work for a theoretical distance of 65 km. Looking at these numbers, it can be seen that a 3 dB increase in the link budget yields a theoretical distance of almost 90 km.

My testing to date was only to verify that I could communicate 6 km to a farm field. The distance was line-of-sight with no intervening

both ends, with the receive system (antenna & TTGO) about 7 meters above ground and the sender system about 1.5 meters above ground. The TTGO systems and antennas were connected directly to the SMA connector provided on the TTGO (this was the main reason for selecting this ESP32 module). The receiving TTGO said the RSSI was -117 for this test and it should be noted here that the RSSI number does not directly relate to dBm.

Pictures of this set-up, I hope, will be forth coming in the near future.

It is hoped this helps you and others working with the LoRa technology. I find the LoRa quite fascinating and functional for battery powered low speed data transfers with very long expected battery life.

Also, I wish to thank you and Rui for all your help with the ESP32 programming end of things. Your help and assistance was invaluable in getting this project up and running.

Regards,

Bob Rader

AuLeeFor

March 1, 2020 at 8:57 pm

#Bob Rader

I'm trying to change Signal BandWidth.
But no matter what I set. SBW stays at 125khz.
I've tried these methods:

```
#define BW 62.5E3 // Set Bandwidth
```

```
LoRa.setSignalBandwidth(62.5E3);
```

Can anyone please clarify !

[Reply](#)

Bob Rader

March 2, 2020 at 6:45 pm

March 2, 2020

Hi AuLeeFor,

A few things come to mind in trying to help with your issue:

First, I use the TTGO LoRa32 V2.1_1.6 T3 module due to the SMA connector attached directly on the board. For me it makes the antenna mounting easier and less signal loss in the antenna feed line circuit.

Second, I am using the Sandeepmistry LoRa Library with the `#include LoRa.h` statement at the beginning of my sketch.

Third, The sender and receiver NEED TO HAVE the exact same parameters, ie, BW, etc defined for both unit's sketches.

Forth, If you are wanting to set the BW at 62.5 KHz I would do it as: `#define BW 62500` Then later in your sketch (I did it at in the void setup() {) using the statement `LoRa.setSignalBandwidth(BW);`

Please note that the LoRa.h library requires statements like `LoRa.setxxxxxxxxxx(xx);` to be used if you intend to modify the modulation parameters beyond the defaults. I have played with many of these

Hope this helps...

Regards,
Bob Rader

[Reply](#)

ecc

March 13, 2020 at 10:20 pm

I'm also seeing the sender failing with the "Starting LoRa failed!" message.
(TTGO LoRa OLED version 1 module.

I have other code that uses this radio, and it has also stopped working when I rebuild it with the current ESP-IDF / arduino-esp32 environment. I've traced it to the low-level SPI communication with the radio chip failing. I wonder if something in the development environment has changed recently?

Can anyone who has this working with a current build please post the versions of the tools you're using? Thanks.

[Reply](#)

Sara Santos

March 15, 2020 at 5:03 pm

Hi.

Are you sure that your board is the same as ours?

won't be able to initialize LoRa.

Make sure you define the right pins on the next lines:

//define the pins used by the LoRa transceiver module

```
#define SCK 5
```

```
#define MISO 19
```

```
#define MOSI 27
```

```
#define SS 18
```

```
#define RST 14
```

```
#define DIO0 26
```

Regards,

Sara

[Reply](#)

Chandrasekhar Dhulipala

March 22, 2020 at 12:06 pm

Hi everyone,

I m trying to use TTGO LoRa 32 OLED V1 and NodeMCU (ESP-12E) modules for my work. I want to send data via UART, from ESP-12E to TTGO LoRa module. However I am unable to implement the receive part on the TTGO LoRa module.

Can someone suggest how this can be done?

Thanks in advance,

-Chandrasekhar DVS

Sara Santos

March 23, 2020 at 11:27 am

Hi.

Basically, you need to instantiate an hardware serial communication – this uses GPIO 17(TX) and GPIO 16 (RX):

```
HardwareSerial ss(2);
```

in the setup():

```
ss.begin(115200); //or change for another baud rate
```

```
Serial.begin(115200); //Serial monitor
```

than, to read the information:

```
if (ss.available() > 0) {
```

```
// read the incoming byte:
```

```
incomingByte = ss.read();
```

```
// say what you got:
```

```
Serial.print("I received: ");
```

```
Serial.println(incomingByte, DEC);
```

```
}
```

```
}
```

As shown in this example:

<https://www.arduino.cc/reference/en/language/functions/communication/serial/read/>

I hope this helps.

Regards,

Sara

Chandrasekhar Dhulipala

March 23, 2020 at 3:08 pm

Hi Sara,

Thanks for the quick response, I think the default 16 and 17 pins weren't working right on my board. Referring to the code snippet of yours and some others, I was able to solve the problem. Also I remapped the UART pins. Following is the code snippet I used.

```
HardwareSerial ss(2);
```

```
#define RXD2 23
```

```
#define TXD2 18
```

```
String inputString = "";  
char inChar;
```

```
void setup() {  
  // put your setup code here, to run once:  
  Serial.begin(9600);  
  ss.begin(9600,SERIAL_8N1, RXD2, TXD2);
```

```
  inputString.reserve(50);  
}
```

```
void loop() {  
  while(ss.available()>0)  
  {  
    inChar = (char)ss.read();  
    inputString+=inChar;
```

```
Serial.println(inputString);  
inputString = "";  
}  
}  
}
```

Thanks for your reply.

-Chandrasekhar DVS

[Reply](#)

Sara Santos

March 23, 2020 at 4:33 pm

Hi again.

I'm glad it is working 😊

Thanks for sharing your solution. It might be helpful for others.

Regards,

Sara

[Reply](#)

ulco

March 28, 2020 at 1:48 pm

Hi, thank you for this great tutorial. At first I didn't see anything on the oled screen. I did not have any errors during uploading the sketch. In Serial

turns out that with the TTGO LoRa V2.1_1.6, oled SDA = 21 and oled SCL = 22. after changing that it works great!

[Reply](#)

Sara Santos

March 28, 2020 at 6:16 pm

Great!

You should always look at your board pinout, so that you have the right pin assignment on the code.

Regards,

Sara

[Reply](#)

GERMAN

April 5, 2020 at 10:16 am

Hi Sara, great 'TTGO LoRa32 SX1276 OLED' tutorial.

I'm working with your code on a TTGO LoRa 32 OLED V1, but I didn't see anything on the oled screen (like 'ulco' said), ...any idea?, could you share a sketch/code in order to check only the oled screen?

I suspect that my oled is damaged because the code uploaed is the exactaly same as yours in this tutorial.

Thanks so much in advance !!

Sara Santos

April 6, 2020 at 9:53 am

Hi.

To test the OLED, you can use the code in this tutorial:

<https://randomnerdtutorials.com/esp32-built-in-oled-ssd1306/>

But change the following line with the pins used by the OLED in your board:

So, instead of

```
Wire.begin(5, 4);
```

You should have

```
Wire.begin(4, 15);
```

You also need to add the following lines right after the setup()

```
pinMode(OLED_RST, OUTPUT);
```

```
digitalWrite(16, LOW);
```

```
delay(20);
```

```
digitalWrite(16, HIGH);
```

I hope this helps.

Regards,

Sara

[Reply](#)

Tiziano

April 28, 2020 at 8:40 am

platform, the LoRa protocol has also fascinated me a lot. I'm trying to get my 11-year-old son Gabriel interested. By doing various searches on several sites to find out about LoRa I landed here. I was wondering if you were going to do some tutorials also on LoRaWan, because the literature on the web is very poor and I think the need to be able to read multiple sensors in different positions becomes more and more interesting. Alternatively if you can recommend me some tutorials on LoRaWan and how to connect the same sensors as your tutorial.

Thanks

Tiziano

[Reply](#)

Sara Santos

April 28, 2020 at 5:18 pm

Hi.

Thank you for following our work.

Yes, I intend to do some tutorials about LoraWan and connecting the board to The Things Network (TTN).

However, I don't think I'll be doing it soon. I have other projects on the "waiting list".

One of our followers built a very interesting project in which he connects the ESP32 to TTN.

Here's a link for his project: <https://marcoroda.com/2020/04/12/TTGO-LORA-TTN.html>

I hope this is helpful.

Regards,

Sara

[Reply](#)

Carl Rajack

August 25, 2020 at 8:18 pm

Hi Sara and team,

I completed this project and it worked very well. Thanks for all the work you have done.

However, I hooked up a accelerometer (MPU6050) using the I2C bus (Using the default pins 21, 22) . The MPU6050 works okay on its own but when I integrate the code into the sketch with the Lora/Oled I get a debug or exception error on the monitor.

If I comment out the following lines from the setup , the 6050 works okay. Any ideas you may have which could help me in this regard ? I am trying to have the Accel/Gyro data transmitted via LOra.

Thanks,
Carl

```
//reset OLED display via software
pinMode(OLED_RST, OUTPUT);
digitalWrite(OLED_RST, LOW);
delay(20);
digitalWrite(OLED_RST, HIGH);
```

```
//initialize OLED
Wire.begin(OLED_SDA, OLED_SCL);
if(!display.begin(SSD1306_SWITCHCAPVCC, 0x3c, false, false)) { // Address
0x3C for 128x32
Serial.println(F("SSD1306 allocation failed"));
for(;;); // Don't proceed, loop forever
}
```

```
display.clearDisplay();
```



```
display.setTextSize(1);  
display.setCursor(0,0);  
display.print("LORA SENDER ");  
display.display();  
  
//SPI LoRa pins  
  
SPI.begin(SCK, MISO, MOSI, SS);  
//setup LoRa transceiver module  
LoRa.setPins(SS, RST, DIO0);  
  
if (!LoRa.begin(BAND)) {  
  Serial.println("Starting LoRa failed!");  
  while (1);  
}  
Serial.println("LoRa Initializing OK!");  
display.setCursor(0,10);  
display.print("LoRa Initializing OK!");  
display.display();  
delay(2000);
```

[Reply](#)

Sara Santos

August 26, 2020 at 4:57 pm

Hi.

Maybe the two I2C buses are conflicting with each other (acelerometer and OLED display).

Take a look at this tutorial about I2C and see if you can figure something out: <https://randomnerdtutorials.com/esp32-i2c-communication-arduino-ide/>

Regards,

[Reply](#)**Carl Rajack**

August 27, 2020 at 2:05 am

Thanks for your prompt response. I am trying to figure out the I2C communications but in the meantime I disconnected the 6050 and did a I2C port scan and it did not show the integrated OLED device. It is not faulty because it works with test sketches.

Could you explain the reason why this device does not show up on the port scan ? Btw, when I reconnect the 6050, it's I2C address shows up with the scan.

[Reply](#)**Hans**

September 2, 2020 at 9:09 pm

Hello and thanks for this article!

I have some questions about this kind of ESP32 and LoRa board:

- is it possible to set the ESP & LoRa module to sleep and only wake up the ESP at some kind of interval for some measuring and then activate the LoRa module if the value changed (for example the temperature) to send the data?
- what is the current consumption of the whole board when all components are active or in sleep mode?
- is it possible with the LoRaWAN protocol on this chip to use the adaptive

Last question is, why does all the LoRa chips on the market use the older Semtech SX127x and not the newer SX126x versions?

[Reply](#)

Nikolay Sorokin

October 17, 2020 at 1:49 pm

Hello guys, can I choose a particular receiver to send my data, if I have more than one?

[Reply](#)

Joakim Lundin

November 2, 2020 at 8:34 pm

Many thanks for a great tutorial! I tested it and made it work directly with my new devices. Unfortunately, I can no longer load new code, not on any of the devices. Would be very happy if you could help me 😊

: fatal error: when writing output to
preproc\ctags_target_for_gcc_minus_e.cpp: No space left on device
compilation terminated.

exit status 1

Error compiling for board TTGO LoRa32-OLED V1.

Thanks!

[Reply](#)**Sara Santos**

November 3, 2020 at 10:52 am

That's weird.

I would suggest that you erase the flash of your board.

You can follow this discussion: <https://rntlab.com/question/how-perform-reset-factory-esp32/>

Regards,

Sara

[Reply](#)**van**

November 25, 2020 at 2:39 pm

hi

thanks for the tuto

im just wondering if there is any similar board based on lora that can send data in a range of 10km? if so please tell me

thank you in advance!

[Reply](#)**Sara Santos**

November 26, 2020 at 11:02 am

Hi.

I'm not sure. It depends on the board antenna, several configuration parameters and also on the environment – on open field the range is better. But, I don't think that you'll find an ESP32 lora board with 10Km range.

Regards,
Sara

[Reply](#)

van

November 26, 2020 at 12:41 pm

hi

thanks for the fast reply!

what board can reach the highest range? what about lora module alone?
10km is just an example

do you have any tuto or something that can help me sending data for long ranges? since im new in this domain

Regards,

[Reply](#)

Sara Santos

November 26, 2020 at 4:39 pm

Hi.

To have more range, you may need to use LoRaWan and a LoRa Gateway.

At the moment, we don't have any tutorials about that

<https://www.thethingsnetwork.org/>

Regards.

Sara

[Reply](#)

SILKANNI FORRER

December 10, 2020 at 8:22 am

Dear Rui, dear Sara.

Your work with tutorials is impressive and very helpful, I am thrilled.

I am new to programming but have learned a lot from your and other tutorials.

Thank you.

I once dared to load your sketch from the TTGO LoRa transmitter and receiver onto my ESP's. The transmitted data is displayed in the serial monitor, my sensor is also output correctly, but in both cases, be it receiver or transmitter, the display does not light up, it is simply black, I then indicate that it has to do with an OLED library, me I tried several without success, I put a display test program on it with the library, and the display works perfectly.

I use TTGO, T3, V1.6 as a transmitter and

TTGO T-Beam LiLYGO as a receiver.

I thank you in advance for your valuable support.

Sincerely yours,

Forrer

[Reply](#)

Sara Santos

December 10, 2020 at 10:15 am

Hi.

Your boards might have a different pinout than ours.

You need to search for the pinout of your board and see which pins are being used to connect to the OLED.

Then, modify the following lines to include the right pins.

```
//OLED pins
```

```
#define OLED_SDA 4
```

```
#define OLED_SCL 15
```

```
#define OLED_RST 16
```

I hope this helps.

Regards,

Sara

[Reply](#)

SILKANNI FORRER

December 10, 2020 at 5:35 pm

Hi Sara.

In my case, I have the OLED pins

on:

```
#define OLED_SDA 21
```

```
#define OLED_SCL 22
```

```
#define OLED_RST 4
```

Need to define it so that it works properly.

In any case, thank you very much.

Kind regards

Silkanni

[Reply](#)

Sara Santos

December 10, 2020 at 6:54 pm

That's great!

Regards,

Sara

[Reply](#)

SILKANNI FORRER

December 10, 2020 at 5:30 pm

Halo Rui

Thank you very much for your valuable support, I have solved the problem with the display, because it had to be something similar with both ESP32s. With your help, I found out that the OLED pins did not align, my boards do not have to:

/ OLED pins

```
#define OLED_SDA 4
```

```
#define OLED_SCL 15
```

```
#define OLED_RST 16
```

```
#define SCREEN_WIDTH 128 // OLED display width, in pixels
```

```
#define SCREEN_HEIGHT 64 // OLED display height, in pixels
```

rather:

```
// OLED pins
```

```
#define OLED_SDA 21
```

```
#define OLED_SCL 22
```

```
#define OLED_RST 4
```


[Reply](#)**Scot Jones**

December 20, 2020 at 9:40 am

Hi, great tutorial.

I seem to have an issue with the code as copied from the webpage. The sender works for ever and a day, the reciever however stops displaying the recived packet count after a while of running.

I swapped the code out on both my units to make sure it wasnt the hardware that was at fault.

Any ideas or anyone else seen this?

[Reply](#)**BERTOUT Alain**

December 20, 2020 at 2:12 pm

Hi Scot

I also encounter similar issue with this Esp lora chip as I used it for periodic temperature transmission. After a random number of pool the transmission drops. The only workaround I found was to put the Esp in sleep mode between pools...

Alain

[Reply](#)

Scot Jones

December 21, 2020 at 11:08 am

Thanks for the reply Alan. Yes that's exactly what I'm seeing.

[Reply](#)**Mark Strauch**

December 21, 2020 at 11:44 pm

Thank you so much for this tutorial. I really appreciate the clear explanations for each part of the code. Very well done: I had my boards talking to each other within 15 minutes.

I have struggled with other LoRa board approaches, mostly because they want to jump to LoRaWAN implementation, which is much more complicated. This is just what I needed for my local control and monitoring needs.

[Reply](#)**Olivier**

January 15, 2021 at 10:43 am

Bonjour. J'ai pour projet de réaliser un site web capable de récupérer les informations d'un réseau LoRaWAN. Je suis intéressé par les solutions existantes.

l'information de sa position sur l'interface Web. Pensez-vous cela réalisable avec cette carte (TTGO LoRa32). Merci d'avance de votre réponse.

[Reply](#)

Bert

January 26, 2021 at 5:38 pm

Hallo,

Thanks for this shared information.

I do have a couple of questions... :

- can I receive the sender information on my TTN gateway ?
- how does the identification between sender and receiver works, is there a handshake ?
- where can I find other projects like this, like them very much !!!

regards,

Bert.

[Reply](#)

Jeevakumaran

February 15, 2021 at 6:28 am

Hi Sara and team

it show like this.

esptool.py v2.6

Serial port COM5

Connecting.....

____An error occurred while uploading the sketch

—

A fatal error occurred: Failed to connect to ESP32: Timed out waiting for packet header

the detail of the board: <https://github.com/LilyGO/TTGO-LORA32>

Before that i can upload code normally. After several test, i got that issue.
do you guys have any solution regarding this issue?

[Reply](#)

Sara Santos

February 15, 2021 at 10:42 am

Hi.

Press the on-board RST button when you start seeing the dots.

Additionally, disconnect any peripherals when uploading the code.

Regards,

Sara

[Reply](#)

Izzy

Hi Sara.

Both of my OLED display are in good condition.

As for my project, this tutorial works except for the OLED display.

In the Serial Monitor in arduino, I can see that the packets are being sent and received perfectly, its just that both of my OLED display didn't show the details (ie, RSSI, packets sent, received packets, counter etc) mentioned in the coding.

Kind regards,

Izzy

[Reply](#)

Sara Santos

March 6, 2021 at 12:10 am

Hi.

Are you sure your board is the same as ours?

If it is a different version, it may use different OLED pins. So, the OLED won't work if you don't change the pins on the code.

Regards,

Sara

[Reply](#)

Martin Weissenboeck

March 21, 2021 at 1:21 pm

initialization, otherwise no error message is displayed.

[Reply](#)

Sara Santos

March 23, 2021 at 11:42 am

Hi Martin.
Thanks for letting me know about that typo.
It is fixed now.
Regards,
Sara

[Reply](#)

Martin Weissenboeck

March 21, 2021 at 2:13 pm

TTGO-LoRa V2.1.6 uses pin 21 for SDA and pin 22 for SCL

```
//OLED pins
#define OLED_SDA 21 // was 4!
#define OLED_SCL 22 // was 15!
```

```
=====
```

```
//reset OLED display via software
pinMode(OLED_RST, OUTPUT);
```

```
delay(20);  
digitalWrite(OLED_RST, HIGH);
```

Is not necessary, because Adafruit does the same if the 4th parameter is not equal to -1 and equal to OLED_RST.

[Reply](#)

Sara Santos

March 23, 2021 at 11:43 am

Thanks for sharing.
It might be useful for anyone who has that version.
Regards,
Sara

[Reply](#)

Danny

March 25, 2021 at 7:53 pm

Estimados Sara y Rui,

Necesito de su ayuda para implementar un gateway Lora por medio de placas, tengo un nodo Lora que transmite datos en ISM 915Mhz con la placa TTGO LoRa32 SX1276 OLED pro no se como configurar este nodo a modo gateway. Tambien cueto con la placa SPARKFUN SAMD21PRO RF , por favor me podria guiar cual de estas placas es la optima para implementar un gateway lora considerando que resulte un gateway

Saludos cordiales.

[Reply](#)

Danny

March 30, 2021 at 6:38 pm

Dear Sara and Rui,

I need your help to implement a Lora gateway through boards, I have a Lora node that transmits data in ISM 915Mhz with the TTGO LoRa32 SX1276 OLED pro board, I don't know how to configure this node as gateway. I also have the SPARKFUN SAMD21PRO RF board, please could you guide me which of these boards is the optimal one to implement a lora gateway considering that it is an efficient and robust gateway considering the boards that I have available or which board you recommend for the implementation.

Kind regards.

[Reply](#)

Steve Mann

April 25, 2021 at 2:02 am

How can I determine which version of TTGO board I have?

[Reply](#)

Kamaruzzaman Seman

April 28, 2021 at 4:54 pm

Hi Sara,

A very interesting project. I have compiled the codes, but produced this error. Appreciate your advice. thanks.

Arduino: 1.8.5 (Windows 10), Board: "TTGO LoRa32-OLED V1, 80MHz, 921600, None"

C:\Users\kzaman\Documents\Arduino\testLORA\testLORA.ino:13:30: fatal error: Adafruit_SSD1306.h: No such file or directory

compilation terminated.

exit status 1

Error compiling for board TTGO LoRa32-OLED V1.

This report would have more information with "Show verbose output during compilation" option enabled in File -> Preferences.

[Reply](#)

Sara Santos

April 29, 2021 at 1:39 pm

Hi.

That means that you don't have the Adafruit SSD1306 library installed.

for ssd1306. Install the library by Adafruit.

Regards,
Sara

[Reply](#)

Michal

June 1, 2021 at 2:08 pm

Hi, I am trying to use this boards as a transmitter receiver of correction data for the GNSS base.

The RTCM data is about 2KB and the transmission will be done in 9.2KB/s.

I am quite new to Arduino IDE but can you tell me what would be the best code for this kind of project?

I think in Lora module the Air Rate speed can be configure, but I do not know if that is possible.

[Reply](#)

Michal

June 1, 2021 at 3:41 pm

Hi,

What would be the code to send/receive UART data of the base GNSS correction via the Lora.

The packets are send every second and are about 2KB.

[Reply](#)**Ariq**

June 23, 2021 at 9:33 am

Hello, i have ttgo lora esp32. The problem is i cant upload the code because eror wait packet header, i've already read another article abaout that but in this case there isnt the boot button on v1.6, what should i do?

[Reply](#)**thermike**

July 1, 2021 at 3:44 pm

hello everybody,

I am playing around with two ttgo lora sx1276 esp32 modules that one sends and the other receives characters. They are on

```
#define BAND 868E6
```

They do it successfully. However, for time to time, the receiver receives a packet of characters that includes seemingly garbage or not readable characters. Here are some examples:

01.07.2021 11:29:28 Home/Lora/inbound WEMOS Receiver Received:

```
[TJAzy!#[
)h>07D(&9$"%Fj.nm
X^] with RSSI -120
```

01.07.2021 13:52:19 uX] with RSSI -119

01.07.2021 14:51:53 Home/Lora/inbound WEMOS Receiver Received:

[T8;

n

Y0p>&W

01.07.2021 14:51:54 ,F

Iu=4D1*ي0;-v

I guess this could be a parasite or some interference from the environment(?). Or could it be some lora emission (?) How can i go around and decode/decrypt this or search its origin?

[Reply](#)

Lindsay

August 5, 2021 at 9:11 am

Hi Rui and Sara

I was trying to use the TTGO info for these boards to setup a lora tx and rx and what a total failure. TTGO need to fix their poor information for their weird and wonderful series of boards. Then I thought to search RNT. Job done.

Keep up the great work

[Reply](#)

Sara Santos

August 5, 2021 at 11:00

Thanks 😊

[Reply](#)

Aage Rasmussen

August 7, 2021 at 11:08 am

Hi Rui and Sara

can I assume that RTC Pins on Esp32 wroom and ADC pins on TTGO LoRa32 SX1276 OLED are the same regarding wakeup pins

Regards

Aage

[Reply](#)

Sara Santos

August 7, 2021 at 2:09 pm

Hi.

Yes.

They should be the same.

Regards,

Sara

[Reply](#)

Aage Rasmussen

August 7, 2021 at 11:12 am

hi again Sara and Santos
sorry it was rude of me not to write Sara first

/ Aage

[Reply](#)

Roy Shearer

August 27, 2021 at 10:34 am

Hi Sara, thanks for a great tutorial which has been a valuable resource for me as a newbie to these boards.

I am having some signal strength issues however – any ideas would gratefully received.

I am in Glasgow, Scotland, using the 868E6 (I've also tried 868E6) band and ~ 200mm antennae (<https://www.ebay.co.uk/itm/274640551855>). I am sending simple single integer messages from one board to another, and it is repeating the message back to the first board. The best range I can get without failures is 100m through buildings and 200mm in line of sight. I was expecting much larger ranges

Is this range reasonable for LoRa?
What steps if any can I take to improve it?

Sara Santos

August 27, 2021 at 4:26 pm

Hi Roy.

That range is normal with these boards.

We got a better communication range with a regular ESP32 with the SX1276, as shown in this tutorial: <https://randomnerdtutorials.com/esp32-lora-rfm95-transceiver-arduino-ide/>

There are other configuration parameters you can try to optimize to get better results. There are some issues related to that subject here:

<https://github.com/sandeepmistry/arduino-LoRa/issues>

Regards,

Sara

[Reply](#)

slim

September 1, 2021 at 1:36 pm

hi sara

i have a problem in my project with lora

when i send a message from emitter to receiver it work good

but when i communicated the emiiter to arduino to receive data from it

i can see the data in the emiiter but it doesnt show anything in the receiver

[Reply](#)

Sara Santos

September 1, 2021 at 4:03 pm

Hi.

How does the emitter communicate with the arduino? Do you mean the Arduino IDE or an Arduino board?

Regards,

Sara

[Reply](#)

slim

September 2, 2021 at 7:15 am

hi.

arduino board communicate with the emitter with tx rx and it work well but i cant see the data in the receiver

[Reply](#)

Sara Santos

September 2, 2021 at 6:21 pm

Have you checked only the receiver without the Arduino?

[Reply](#)

Slim

September 2, 2021 at 6:26 pm

Yes it work well

sstap

September 4, 2021 at 4:05 pm

Hey, can I also supply the board over the pin headers? I have a 5V power line in my circuit.

[Reply](#)**Sara Santos**

September 6, 2021 at 9:15 am

Hi.

Yes. You can power the board through the 5V pin.

Regards,

Sara

[Reply](#)

Hi Rui and Sara. I have purchased few copies of your and have trying to program TTGO lora esp32 oled based on your tutorial. Successfully uploaded but got error Lora starting failed. I have read your comment in the tutorial page where you suggested to change the pin number for specific module. I have realised that my lora module is slightly different from yours. Ours has a imprinted antenna on pcb. I suspected it has different pin assignment. I tried to search on internet the pin out of my module, but unsuccessful. I am seeking your your help if you know the type or the pinout of our module. Thanks in advance.

[Reply](#)

Sara Santos

September 15, 2021 at 4:55 pm

Hi.

Can you provide more details about your module?

What's the exact model?

Regards,

Sara

[Reply](#)

Leave a Comment

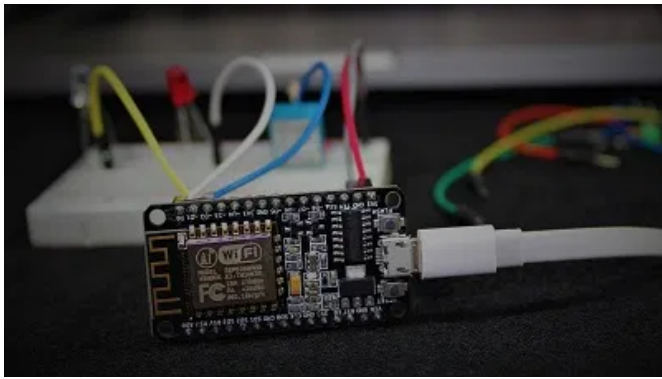
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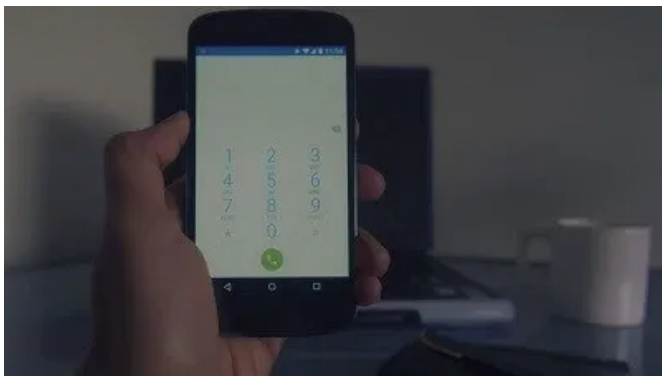
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