

NEARLAB – NES

# TECHNICAL REPORTS



**Title:** Simulink® Real-Time™ on a target computer to implement a master EtherCAT

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## Brief Description

**Brief Description** Integration of the microcontroller ESP32 in ROS through WiFi connection. Microcontroller is programmed in the Arduino IDE

**Title:**



## I. INTRODUCTION

This guide provides an ease-of-use way to connect a wireless sensor to a ROS network, without implementing an ad-hoc communication protocol. In particular, this document walks through the procedure of installing a ROS node on a microcontroller based on **ESP32 WROOM** or **ESP32**, programmed with the **Arduino IDE** in **Ubuntu** environment.

Most of the report was written with the information found on the internet and on ROS documentation site. You can find the links to some of these online pages in the references section.

## II. REQUIREMENTS

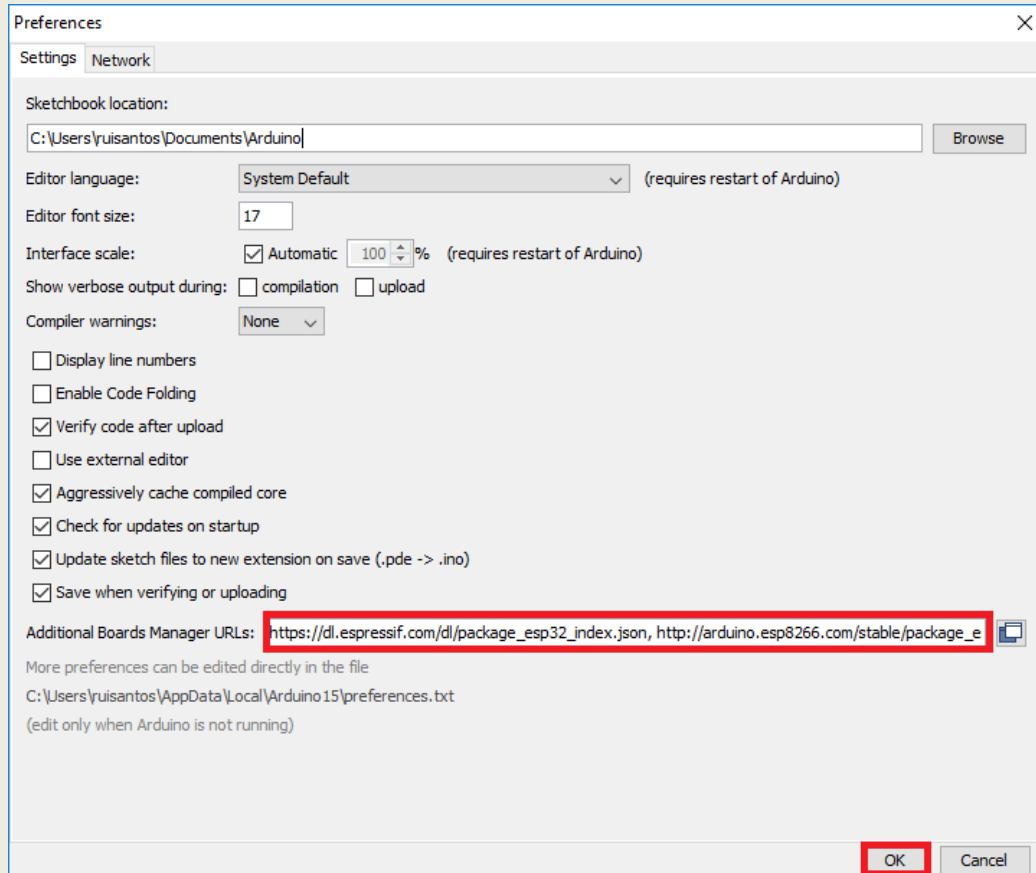
Before starting, please verify you have the following requirements:

1. 1x [ESP32 DevKitC](#) (ESP32 WROOM) or 1x [WiFi Kit 32](#) (ESP32) or NodeMCU (ESP8266-12E)
2. Wi-Fi Network
3. Install Linux [Ubuntu OS](#) (tested on Xenial 16.04 and Bionic 18.04)
4. Install [ROS](#) (tested on Melodic)
5. Install [Arduino IDE](#)

### III. ESP32 ADD-ON INSTALLATION IN ARDUINO IDE

To install the ESP32 board in your Arduino IDE, follow these next instructions:

1. In your Arduino IDE, go to **File> Preferences**
2. Enter [https://dl.espressif.com/dl/package\\_esp32\\_index.json](https://dl.espressif.com/dl/package_esp32_index.json) into the “**Additional Board Manager URLs**” field as shown in the figure below. Then, click the “OK” button:



Note: if you already have the ESP8266 boards URL, you can separate the URLs with a comma as follows:

3. Open the **Boards Manager**. Go to **Tools > Board > Boards Manager...**
4. Search for **ESP32** and press **Install** button for the “ESP32 by Espressif Systems”:
5. That's it. It should be installed after a few seconds.

[https://dl.espressif.com/dl/package\\_esp32\\_index.json](https://dl.espressif.com/dl/package_esp32_index.json),  
[http://arduino.esp8266.com/stable/package\\_esp8266com\\_index.json](http://arduino.esp8266.com/stable/package_esp8266com_index.json)

### IV. ALTERNATIVE ESP32 ADD-ON INSTALLATION (NOT RECOMMENDED)

If you have Arduino installed to ~/Arduino, modify the installation as follows:

```
cd ~/Arduino
mkdir -p hardware/espessif
cd hardware/espessif
git clone https://github.com/espessif/arduino-esp32.git esp32
cd esp32
git submodule update --init --recursive
cd tools
python3 get.py
```

## V. ESP32 ADD-ON TEST

Open **Arduino IDE**

**Tools > Board > Select your board**

**File > Examples > ESP32 Arduino > WiFi > WiFi Scan**

Compile and Upload

Open CTRL+MAIUSC+M

If you are using Heltec WiFi Kit 32:

**Sketch > Include Library > Manage Libraries**

Install Heltec ESP32 Library

**File > Examples > Heltec ESP32 Dev-Boards > FactoryTest (according to your board)**

Compile and Upload

Open CTRL+MAIUSC+M

## VI. ROSSERIAL INSTALLATION

You can install roserial for Arduino by running:

```
sudo apt-get install ros-kinetic-rosserial-arduino
sudo apt-get install ros-kinetic-rosserial
cd ~/Arduino/libraries
rm -rf ros_lib
roslaunch rosserial_arduino make_libraries.py ~/Arduino/libraries
```

After restarting your IDE, you should see ros\_lib listed under examples

## VII. INSTALL REPOSITORY

Clone repository in Arduino IDE workspace

```
cd ~Arduino/sketchbook
git clone https://github.com/stex2005/ESP32-ROS-Driver.git
```

Replace all file from repository to ~/Arduino/libraries/ros\_lib

```
cd ~/Arduino/sketchbook/ESP32-ROS-Driver
cp *.h *.cpp ~/Arduino/libraries/ros_lib
```

## VIII. RUN THE CODE

1. Open ESP32HelloWorld with Arduino IDE

2. Open Terminal (CTRL+T) and type

```
ifconfig
```

Take note of the IP address of your computer and modify the sketch with the proper IP address:

```
// Set the roserial socket server IP address (ifconfig on roscore terminal)
IPAddress server(192,168,1,3);
```

Replace 192.168.1.3 with your IP address. (N.B. comma separated).

This is the IP address of the machine where the roscore is running, in the simplest case it is your laptop's IP address

3. Add "WiFicredentials.h" with your WiFi information

```
cd ~/Arduino/sketchbook/ESP32-ROS-Driver/ESP32HelloWorld
gedit WiFicredentials.h
```

Modify the file as follows and save

4. **Tools > Boards > Select your Board**

```
#define UID "YourSSID"
#define PASS "YourPassword"
```

5. Compile, Upload and open Arduino Terminal (CTRL+MAIUSC+M)
6. Open some new Terminals and start **roscore** and **roserial server socket**:

Option 1:

```
roslaunch roserial_server_socket.launch
```

Option 2:

```
roscore
```

```
roslaunch roserial_server_socket.launch
```

7. Check if the ESP32 is publishing at the correct frequency (example is at 20Hz)

```
rostopic list  
rostopic echo chatter  
rostopic hz chatter
```