Loco Controller Firmware Build and Flashing Guide

Introduction

The Loco Controller is designed to be simple to upgrade to encourage experimentation and modification of it's firmware and so the firmware is based around the popular and Arduino framework. In order to be able to modify the supplied examples and download to the hardware it's necessary to install the free and cross platform [Arduino IDE](#).

Prerequisites

    macOS - Version 10.15: "Catalina" or newer, 64 bits
    Linux - 64 bit
   Windows - Win 10 and newer, 64 bit

Step by step guide

The guide below is quick walkthrough of installing the IDE and building and flashing the LocoController's firmware. For more detail see the Random Nerd guide ['Installing an ESP32 Board in Arduino IDE 2 (Windows, Mac OS X, Linux)'](#) and Seed Studio's [Wiki on the ESP32C6](#). Some of the examples require that the ESP32C6's flash based file system se set up for more details on this see Random Nerd's guide ['Install ESP32 LittleFS Uploader (Upload Files to the Filesystem)'](#)

Step1 - Install the Arduino IDE 2

Before proceeding make sure you have the [Arduino IDE 2](#) installed on your computer, this can be obtained from the [Arduino download page](#). The IDE is cross platform and will work with MacOS, Linux and Windows and detailed install instructions for each OS can be found [here](#). At the time of writing the current version is 2.3.6.

Step2 - Install the ESP32 Add-on

Once the IDE is installed the next step is add the ESP32 board packages. Open the Boards Manager by navigating to Tools > Board > Boards Manager… or simply click the Boards Manager icon in the LH sidebar.
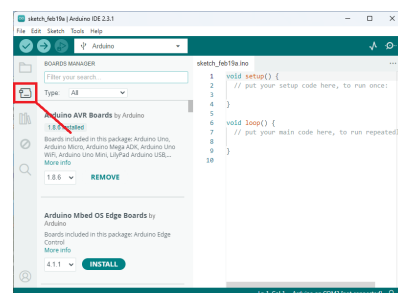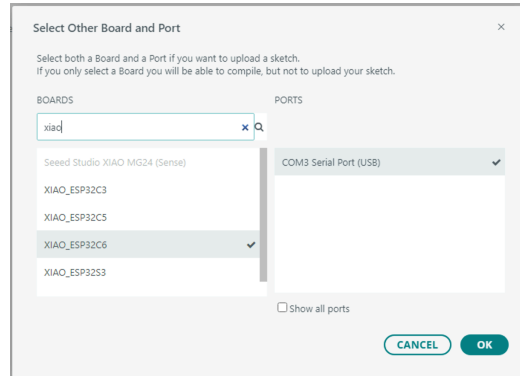
In the search box type 'ESP32' and hit the install button for the package 'esp32 by Espressif Systems' The install should only take a few seconds, when it is finished close and reopen the IDE.
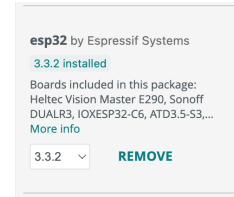
Step3 - Select the XIAO ESP32C6 board

Before the sketch can be compiled the IDE needs to know the type and serial port of the attached board. In the pulldown at the top of the IDE window choose 'Select other board and port…', search for 'XIAO' and select 'ESP32C6'. To the RHS of this dialog will be a list of attached serial devices, one of which will be the Loco Controller. A simple way to determine the correct port is to disconnect the unit and see which entry disappears. Reconnect the board and then select it's entry in the list.

## Step4 - Add the Required Libraries

In order to compile the example sketches additional libraries are required to be installed. Open the Library Manager by navigating to Tools > Manage Libraries… or simply click the Library Manager icon in the left-side bar.
Open the Boards Manager by navigating to Tools > Board > Boards Manager… or simply click the Boards Manager icon in the LH sidebar.
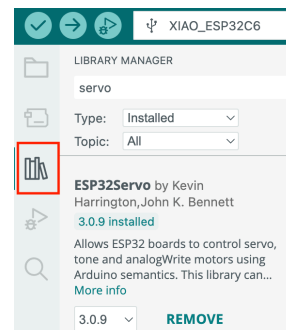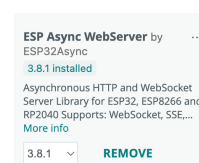
Search for and add the following libraries:-

Async TCP 3.4.9 by ESP32 Async TCP
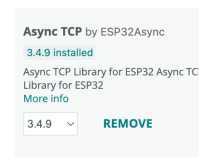
ESP Async WebServer 3.8.1 by ESP32Async

Arduino_JSON 0.2.0 by Arduino

Arduino_JSON by Arduino
0.2.0 installed
[BETA] Process JSON in your Arduino sketches.
More info
0.2.0 ⌄   **REMOVE**

EmbAJAX 0.2.0 by Thomas Friedrichsmeier

EmbAJAX by Thomas Friedrichsmeier…
0.2.0 installed
Framework for displays and controls on a web page Simplistic framework for creating and…
More info
0.2.0 ⌄   **REMOVE**

Step5 - Install the LittleFS Uploader

The default example stores html and other files in it's onboard flash filesystem 'LittleFS'. This uses a LittleFS upload plugin which needs to be installed separately. The instructions for this vary with OS so and Random Nerd has a good description of the process at 'Install ESP32 LittleFS Uploader (Upload Files to the Filesystem)'.
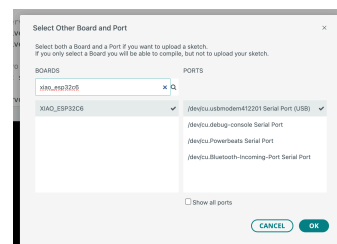
Restart the IDE at this point to ensure all the above changes are registered.

Step6 - Load and Compile an Example Sketch

There are several example sketches in the distribution located in the 'firmware' folder. Each sketch has the extension .ino. and opening this file will load the sketch into the IDE. Any modifications made can be tested with the 'verify' button in the top bar.

Step7 - Download to the Hardware

Check that the correct board and serial port are selected, search for 'XIAO_ESP32C6' and select this board. To the RHS of this dialog will be a list of attached serial devices, one of which will be the Loco Controller. A simple way to determine the correct one is to disconnect the unit and see which entry disappears. Reconnect the board and then select it's entry in the list.

Select Other Board and Port   ✕
Select both a Board and a Port if you want to upload a sketch.
If you only select a Board you will be able to compile, but not to upload your sketch.
BOARDS   PORTS
xiao_esp32c6   ✕ Q
XIAO_ESP32C6   ✓   /dev/cu.usbmodem412201 Serial Port (USB) ✓
                                 /dev/cu.debug-console Serial Port
                                 /dev/cu.Powerbeats Serial Port
                                 /dev/cu.Bluetooth-Incoming-Port Serial Port
                                 ☐ Show all ports
                                      CANCEL   OK

Once the board is selected close the dialog and hit the 'upload' button (right facing arrow). The firmware will compile and begin to download to the device ending with the message 'Hard resetting via RTS pin…'.

```
  53
  54    Servo gearboxServo;
Output

Sketch uses 1018980 bytes (77%) of program storage space. Maximum is 1310720 bytes.
Global variables use 43084 bytes (13%) of dynamic memory, leaving 284596 bytes for local variables. Maximum is 327680 bytes.
esptool v5.1.0
Serial port /dev/cu.usbmodem412201:
Connecting...
Connected to ESP32-C6 on /dev/cu.usbmodem412201:
Chip type:       ESP32-C6FH4 (QFN32) (revision v0.2)
Features:        Wi-Fi 6, BT 5 (LE), IEEE802.15.4, Single Core + LP Core, 160MHz
Crystal frequency: 40MHz
USB mode:        USB-Serial/JTAG
MAC:             b4:3a:45:ff:fe:8a:20:78
BASE MAC:        b4:3a:45:8a:20:78
MAC_EXT:         ff:fe

Uploading stub flasher...
Running stub flasher...
Stub flasher running.
Changing baud rate to 921600...
Changed.

Wrote 1019120 bytes (628055 compressed) at 0x00010000 in 3.8 seconds (2149.3 kbit/s).
Hash of data verified.

Hard resetting via RTS pin...

                                                                              XIAO_ESP32C6 on /dev/cu.u
```

The example sketches will flash the 'it's alive' yellow LED next to the USB-C connector indicating that the firmware has downloaded correctly and is running.

Some examples require loading files into the LittleFS filesystem which is part of the onboard flash memory. These reside in a folder named 'data' inside the same folder as the sketch and only need to loaded before the first load of the sketch or whenever the files are changed.

To upload the files to the Loco Controller check that the serial monitor is closed (icon on the RH end of top bar) then hold '⌘' + 'shift' + 'P' on MacOS or 'ctrl' + 'shift' + 'P' on Windows to open the command line, search for 'littleFS' and select 'LittleFS to Pico/ESP8266/ESP32'. The command takes a few seconds and ends with the message 'completed upload'. If the upload fails with the error message 'ERROR: No port specified, check IDE menus' restart the IDE and try again.
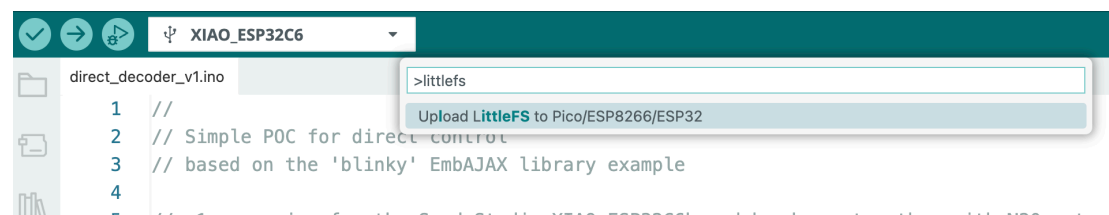
Download Troubleshooting

If the ESP32C6's boot loader is inactive the IDE won't be able to connect to the device during flashing. If this happens press and hold the 'BOOT' button on the ESP32C6 module whilst applying power, then release. The 'BOOT' button is located next to the USB-C connector opposite pin 1.