

# ESPIR Crypto Ticker Instruction Manual and Device Details

*Powered by CoinGecko API*

August 23, 2022

## Contents

<b>1</b>	<b>Keyboard Instructions</b>	<b>2</b>
1.1	Input Modes . . . . .	2
1.2	Interaction . . . . .	2
1.3	Button Actions . . . . .	2
<b>2</b>	<b>Initial Setup/Configuration</b>	<b>2</b>
<b>3</b>	<b>Initialisation Screen</b>	<b>2</b>
3.1	Interaction . . . . .	2
<b>4</b>	<b>Mode Details</b>	<b>2</b>
4.1	Single Coin . . . . .	2
4.1.1	Interaction . . . . .	3
4.2	Multiple Coin . . . . .	3
4.2.1	Interaction . . . . .	3
4.3	Portfolio . . . . .	3
4.3.1	Representations . . . . .	3
4.3.2	Interaction . . . . .	3
<b>5</b>	<b>Menu</b>	<b>3</b>
5.1	Accessing Menu . . . . .	4
5.2	Interaction . . . . .	4
5.3	Submenus/Buttons . . . . .	4
5.4	Connection Status . . . . .	4
<b>6</b>	<b>Changing Displayed Coins</b>	<b>4</b>
6.1	Steps . . . . .	4
6.2	Notes . . . . .	4
<b>7</b>	<b>Modifying Portfolio</b>	<b>4</b>
7.1	Steps . . . . .	5
7.2	Notes . . . . .	5
<b>8</b>	<b>Changing Coin Display Settings</b>	<b>5</b>
8.1	Options . . . . .	5
<b>9</b>	<b>Changing Portfolio Display Settings</b>	<b>5</b>
9.1	Options . . . . .	5
<b>10</b>	<b>Adding New Coin</b>	<b>5</b>
10.1	Obtaining CoinGecko ID . . . . .	6
10.2	Steps . . . . .	6
10.3	Notes . . . . .	7

<b>11 Firmware Update/Modification (Technical)</b>	<b>7</b>
11.1 Configure Environment . . . . .	7
11.1.1 Installing Arduino . . . . .	7
11.1.2 Installing ESP8266 for Arduino . . . . .	7
11.1.3 Adding Necessary Libraries . . . . .	8
11.2 Obtain and Upload Most Recent Firmware . . . . .	8
11.2.1 Downloading Latest Firmware . . . . .	8
11.2.2 Uploading Sketch . . . . .	8
11.3 Changing Default Coins Manually . . . . .	8
11.3.1 Obtaining Bitmap . . . . .	9
11.3.2 Obtaining Colour Codes . . . . .	9
11.3.3 Modifying <i>colours.h</i> . . . . .	9
11.3.4 Modifying <i>bitmaps.c</i> . . . . .	9
11.3.5 Modifying <i>ESPIR_Sketch.ino</i> . . . . .	9

<b>12 Changing Coins with Icons using ESPIR Assist</b>	<b>10</b>
--	-----------

## 1 Keyboard Instructions

The keyboard is used to enter information into the device; for WiFi configuration, and adding new coins to the device.



### 1.1 Input Modes

- Lower case (a–z) : Default, activate with **1**
- Upper case (A–Z) : Activate with **2**
- Numerical (0–9) : Activate with **3**
- Special Characters : Activate with **4**

### 1.2 Interaction

- **1** : Select lower case mode
- **2** : Select upper case mode
- **3** : Select numerical mode
- **4** : Select special character mode
- → : Select key to the right
- ← : Select key to the left
- ↑ : Select key above
- ↓ : Select key below
- **OK** : Press current button

### 1.3 Button Actions

- **Key** : Append corresponding value to current input
- <-- : Backspace
- **Space** : Append space to input

- **Enter** : Submit current input
- **Help** : Display instructions for 5 seconds

## 2 Initial Setup/Configuration

The keyboard is used to enter the SSID and password of the network. Once the password has been entered, attempts to establish WiFi connection with provided credentials.

## 3 Initialisation Screen

This screen displays the logo, and gives the user the opportunity to clear the existing configuration.

### 3.1 Interaction

- \* : Clear existing WiFi credentials from the device, this option should be used if incorrect credentials are provided, or the saved network is no longer available.
- # : Clear all configuration and restore to default settings. This erases WiFi credentials, saved settings, selected coins, and portfolio.

## 4 Mode Details

There are three display modes on the device: Single Coin, Multiple Coin, and Portfolio.

### 4.1 Single Coin

This mode displays a single coin at a time, the current price, 24 hour % change, candle chart, and bitmap (if available) are displayed.



#### 4.1.1 Interaction

- ↑ : Change to *Portfolio* mode
- ↓ : Change to *Multiple Coin* mode
- → : Navigate to next coin
- ← : Navigate to previous coin
- OK : Open menu

## 4.2 Multiple Coin

This mode displays up to four coins per page, displaying the current price, 24 hour % change, and a line chart.



#### 4.2.1 Interaction

- ↑ : Change to *Single Coin* mode
- ↓ : Change to *Portfolio* mode
- → : Navigate to next set of coins (if more than four coins selected)
- ← : Navigate to previous set of coins (if more than four coins selected)
- OK : Open menu

## 4.3 Portfolio

This mode displays the configured portfolio in various representations, this portfolio is configured in the *Edit Portfolio* submenu.

#### 4.3.1 Representations

- **Decomposition** - Displays all of the assets that comprise users portfolio, displaying the current value of

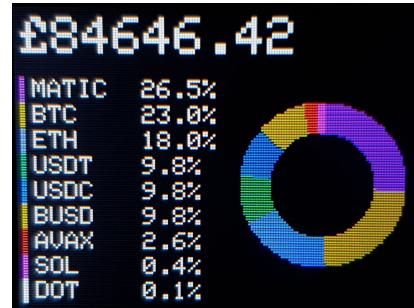
the amount of said asset owned, and its 24 hour % change. As well as a line that shows how each asset contributes to users portfolio.

£84646.42		
MATIC	£22465.65	-4.71%
BTC	£19444.73	-1.85%
ETH	£15231.30	-2.66%
USDT	£8310.31	+0.31%
USDC	£8308.67	+0.22%
BUSD	£8307.45	+0.14%
AVAX	£2174.00	-5.25%
SOL	£341.40	-5.13%
DOT	£62.91	-4.23%

- **Candle Chart** - Displays a candle chart indicating the performance of users portfolio, the time of each candle can be changed in the *Portfolio Settings* submenu.



- **Asset Ratio** - Displays the % of users portfolio value that each asset contributes, these percentages are visually represented with a doughnut chart.



#### 4.3.2 Interaction

- ↑ : Change to *Multi Coin* mode
- ↓ : Change to *Single Coin* mode
- → : Navigate to next portfolio representation
- ← : Navigate to previous portfolio representation
- OK : Open menu

## 5 Menu

The menu allows customisation, namely changing and adding new coins, configuring the portfolio, changing device settings, and clearing saved configuration.



## 5.1 Accessing Menu

To access the menu, press the **OK** key on any of the three modes.

## 5.2 Interaction

- ↑ : Select button above currently selected
- ↓ : Select button below currently selected
- **OK** : Enter selected sub-menu/press selected button
- # : Exit menu

## 5.3 Submenus/Buttons

- **Select Coins** : Change the subset of coins that are displayed on the *Single Coin* and *Multiple Coins* modes.
- **Edit Portfolio** : Used to construct users portfolio by modifying the amount of each coin owned.
- **Add New Coin** : This is used to change one of the existing saved coins (21 available) to some other coin that is not currently saved using the CoinGecko ID.
- **Crypto Display Settings** : This sub-menu allows customisation of the *Single Coin* and *Multiple Coins*, as well as changing the selected currency for all modes.
- **Portfolio Settings** : This sub menu allows customisation of the *Portfolio* mode.
- **Clear WiFi Credentials** : Allows the removal of saved WiFi credentials from the EEPROM, the next time the device is turned on, entry of new credentials will be required.
- **Reset Coins (Restart)** : This removes any added coins from the memory, and restores the default coins (including their bitmaps), the device will restart upon pressing the button.
- **Clear Portfolio** : Resets the amount of all coins to zero, and removes the saved portfolio from memory.

## 5.4 Connection Status

This indicates the status of the connection to the CoinGecko API, and the WiFi connection.

- *Connected* : This indicates that the WiFi connection is working, and the CoinGecko API is responding as expected.

- *WiFi Disconnected* : This indicates that the WiFi connection has failed, the device attempts to reconnect to the network every time data is fetched, so if it is a temporary problem it will fix itself.
- *CoinGecko Not Responding* : This indicates that the WiFi connection is working, but the device is not receiving a response from the CoinGecko API.

## 6 Changing Displayed Coins

This section will explain how to use the *Select Coins* submenu to change the configuration.



### 6.1 Steps

1. Press # to enter menu
2. Navigate to the *Select Coins* option in the menu using ↑ and ↓ buttons
3. Press **OK** button to enter submenu
4. Use the arrow keys to navigate to the coin you would like to add (currently selected coin will flash)
5. Press **OK** to add the coin (it will turn green) (also, pressing **OK** on a green coin will deselect it)
6. Once coins are changed to liking, use # to exit the sub menu
7. Use # to exit menu and return to the main interface

### 6.2 Notes

- Up to 8 coins can be selected at any given time, if more than this are selected, the oldest coin (in terms of selection time) will be deselected.

## 7 Modifying Portfolio

This section will detail how to modify the portfolio using the *Edit Portfolio* submenu.



## 7.1 Steps

1. Press # to enter menu
2. Navigate to the *Edit Portfolio* option in the menu using ↑ and ↓ buttons
3. Press **OK** button to enter submenu
4. Once in the submenu, navigate to the coin that needs to be altered
5. Press **OK** to open the amount editor at the bottom of the screen
6. Use the editor to change the amount of coin owned:
  - **First OK Press** : Add decimal point to input
  - **Second OK Press** : Save amount to coin
  - **Number Keys** : Enter the desired amount (max 10 digits before decimal point and 6 decimal places (limited to 13 digits total inc. decimal point))
  - \* : Clear current value
  - # : Remove the current value and return to coin select screen
7. Enter amount, press **OK** to add decimal point, add digits after decimal point, press **OK** to save value to coin
8. Press # to exit the portfolio editor
9. Use # to exit menu and return to the main interface

## 7.2 Notes

- Up to **9** coins can be in the portfolio at any given time, if an attempt is made to add another coin amount after 9 are selected, the added amount will not be saved.

## 8 Changing Coin Display Settings

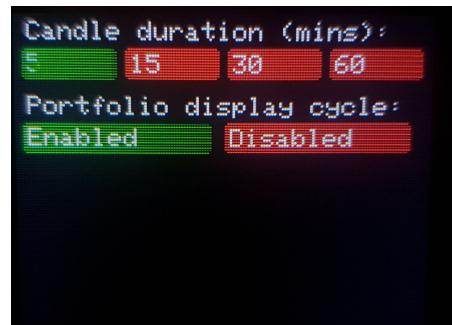
These options are available in the *Crypto Display Settings* submenu, these options impact both the *Single Coin* and *Multiple Coin* modes. Exit this menu and any other submenu with the # key.

## 8.1 Options

- **Cycle duration** : The amount of time the coin/set of coins is displayed on screen in seconds before the next coin/set of coins is shown. If 'Off' is selected, cycle is disabled, and coin/set of coins will refresh when data is updated.
- **Candle duration** : The amount of time that each candle in the displayed candle chart represents in minutes (or point in the line chart).
- **Currency** : The currency that the coins price is shown as (this also impacts *Portfolio* mode).
- **Toggle bitmaps** : The bitmaps are the small icons displayed alongside the coin, they can be disabled with this option (this does not impact the *Multiple Coin* mode).

## 9 Changing Portfolio Display Settings

These options are available in the *Portfolio Settings* submenu. Exit this menu and any other submenu with the # key.



## 9.1 Options

- **Candle duration** : The amount of time that each candle in the portfolio candle chart represents in minutes.
- **Portfolio display cycle** : If enabled, the portfolio representation cycles every time the data is updated.

## 10 Adding New Coin

If a desired coin is not available in the default selection, then the coin will need to be added through the *Add New Coin*

submenu.

## 10.1 Obtaining CoinGecko ID

To add the coin, the API needs to know the ID associated with the asset, this is easily obtained. As an example, I will obtain the ID for STETH (Lido Staked Ether).

1. Navigate to CoinGecko.com

2. Search for the asset

The screenshot shows a search bar at the top with 'STETH'. Below it is a list of results under 'Cryptocurrencies':

- Lido Staked Ether (STETH) #13
- Wrapped stETH (WSTETH)
- Aave Interest Bearing STETH (ASTETH)

Below this is a section for 'Exchanges' and 'Tethys Finance'.

3. Find the *Info* section (below the search bar) and locate the *API id* (second from last, *staked-ether* in the example)

The screenshot shows the 'Info' section for STETH. It includes fields for Contract, Website, Explorers, Community, Search on, and Tags. The 'API id' field is highlighted with a red oval and contains the value 'staked-ether'.

## 10.2 Steps

1. Obtain the CoinGecko ID as seen in the previous section
2. Press # to enter menu
3. Navigate to the *Add New Coin* option in the menu using ↑ and ↓ buttons
4. Press **OK** button to enter the coin adding functionality
5. Use the keyboard to enter the retrieved coin ID, this will be checked to ensure it is a valid ID (if not, you will be able to retry)



6. Once ID has been successfully verified, enter the associated code (e.g. BTC for Bitcoin, and ETH for Ethereum)



7. Now to select the colour to be associated with the added coin, colours are entered using RGB (Red, Green, Blue) values, so use some RGB Colour Picker to get this

- ← : Select component on the left
- → : Select component on the right
- Number Keys : Enter RGB values (0–255)
- \* : Clear value in selected component
- OK : Save the colour and complete

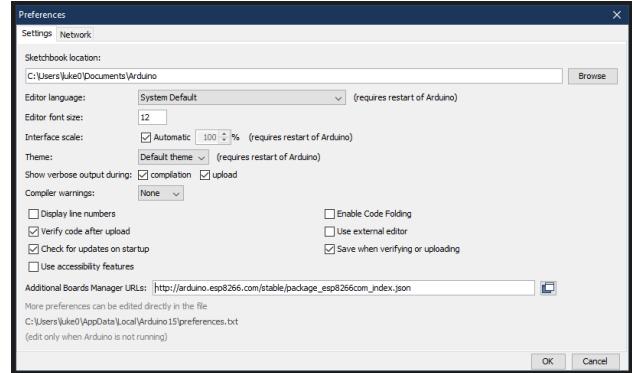


8. The new coin is now available



## 10.3 Notes

- Up to **5** added coins can be stored in memory, if more than this are changed from their default, the first added coin will be overwritten in memory.
- Can be aborted at any stage by pressing **#**, data is only overwritten once the colour is input
- ID's are limited to **30** characters
- Codes are limited to **7** characters



## 11 Firmware Update/Modification (Technical)

This tutorial is for Windows users.

### 11.1 Configure Environment

#### 11.1.1 Installing Arduino

Arduino is a program that is used to interact with microcontrollers and upload code, to install it, simply visit Arduino to obtain the latest software.

#### Downloads



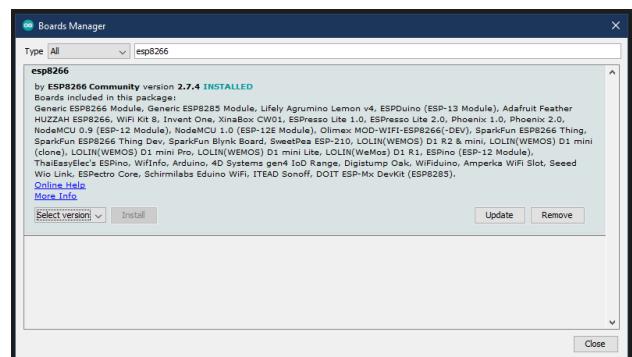
If using the top option (recommended), execute the downloaded .exe file to install the Arduino software.

#### 11.1.2 Installing ESP8266 for Arduino

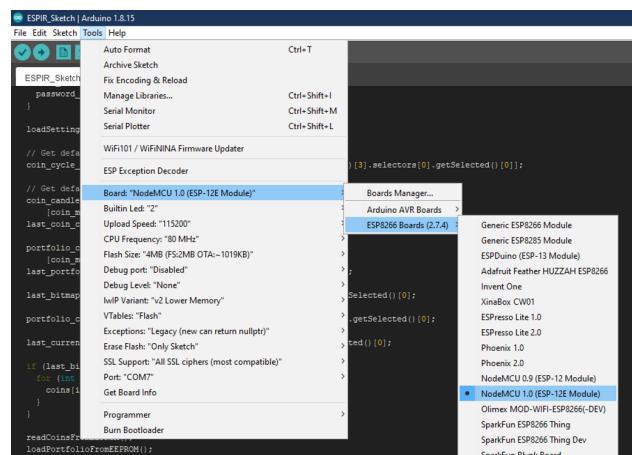
Now that Arduino is installed, the esp8266 drivers/core firmware is needed. This is obtained through Arduino's *Board Manager*:

1. Open Arduino Software, you should be presented with a new sketch
2. At the top left corner, press *File*, then *Preferences*, this will open a new dialogue box
3. Locate the *Additional Board Manager URLs* input box, and paste the following URL:  
[http://arduino.esp8266.com/stable/package\\_esp8266com\\_index.json](http://arduino.esp8266.com/stable/package_esp8266com_index.json)

4. Press *OK* to close the dialogue box
5. Restart the Arduino software to refresh the Board Manager
6. With Arduino opened, navigate to *Tools*, hover the cursor over the button labelled *Board*, and the Board Manager button will appear, click this
7. Now in the Board Manager, enter *esp8266* into the search bar, this should return a result
8. Hover over the result, in the *Select Version* drop down menu, select version **2.7.4**, and then hit *Install*



9. Close the Boards Manager
10. Click *Tools*, and hover over *Board* again
11. There should now be an *ESP8266 Board (2.7.4)* option, hover over this
12. Now find the option labelled *NodeMCU 1.0 (ESP-12E Module)*, and click it



- Now you are ready to install all of the necessary libraries

### 11.1.3 Adding Necessary Libraries

The following libraries need to be installed to upload the sketch, updated versions may be available, but use them at your own risk:

- ArduinoJSON* : Version **6.19.4**
- Adafruit ST7735 & ST7789 Library* : Version **1.9.3**
- IRremote* : Version **3.3.0**
- Adafruit GFX Library* : Version **1.11.3**

The following steps are required to add these libraries to Arduino:

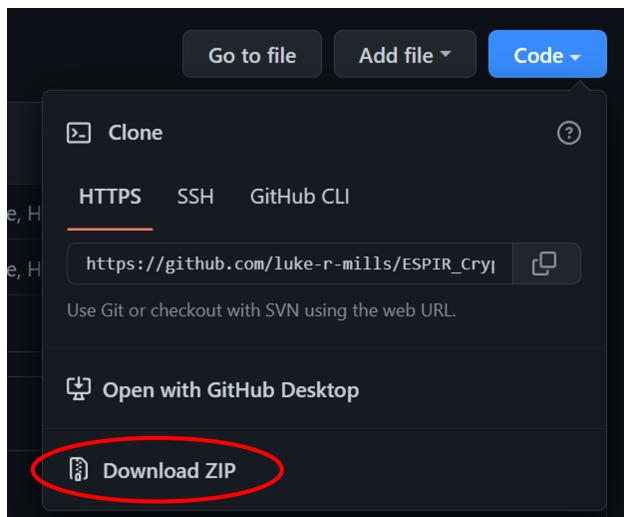
- Press *Tools*, then press *Manage Libraries*, this will open the *Library Manager*
- Now search for the title of the desired library in the search box
- If the title of the result is the same as one of the libraries from above, hover over the result, and use the *Select Version* drop down to select the correct version
- Now press the *Install* button to install the library
- Repeat from step 2 for all of the libraries listed above, once all installed, close the library manager

## 11.2 Obtain and Upload Most Recent Firmware

This project is open-source, so the firmware is easily obtained through GitHub (to access the files, you may need to create an account).

### 11.2.1 Downloading Latest Firmware

- Navigate to the ESPIR Crypto Ticker Repository on Github
- Download the code as a *.zip* file using the *Download ZIP* button

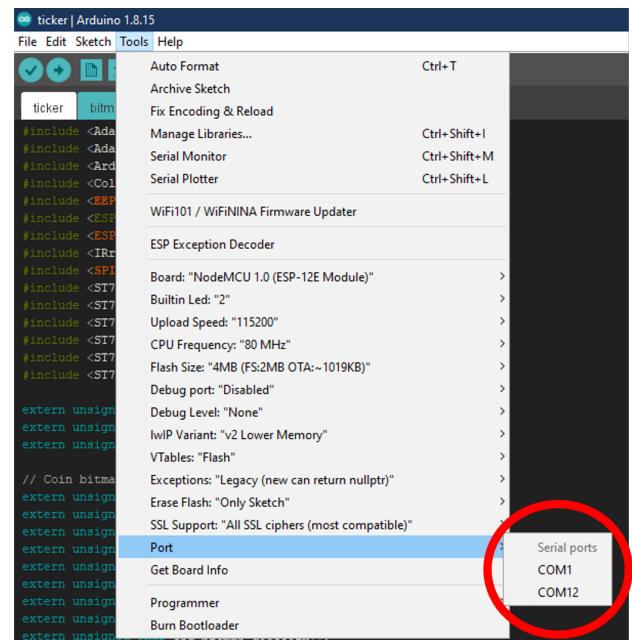


- Extract the downloaded *.zip* file, note the location of this file

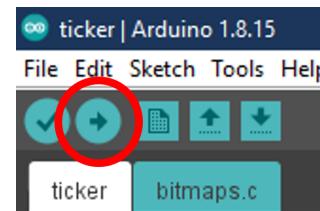
### 11.2.2 Uploading Sketch

With the firmware downloaded, the files need to be moved to the correct locations.

- The *ESPIR\_Library* directory/folder in the extracted file needs to be moved to your Arduino library folder, this is usually located in *Documents* → *Arduino* → *libraries*
- With this moved, enter the *ESPIR\_Sketch* folder (back in the originally extracted *ESPIR\_Library* folder), and open the *ESPIR\_Sketch.ino* file in Arduino
- Now connect the Ticker to the computer via the micro USB cable
- Check that Arduino is detecting the device, there should be a port available called COM and then some number, make sure this port is selected. If there are multiple, disconnect the Ticker, and check which port disappeared. This is the port that needs to be selected.



- If all of the steps have been completed properly, you should be able to upload the sketch using the *Upload* button



- The firmware has now been updated to the latest version

## 11.3 Changing Default Coins Manually

If you want to add a new coin with a bitmap without using ESPIR Assist, then you will need to create the bitmap and modify the code to use this bitmap.

### 11.3.1 Obtaining Bitmap

The icon is composed of 2 sections, the background, and the logo itself. The logo is limited to a single colour.

1. Obtain the image that will be used to create the logo, make sure the logo is not too detailed, as this does not translate well to the small resolution of the icon. Also crop the image so that it is a square (to avoid weird scaling issues later).
2. Navigate to the image2cpp website to generate the code for the corresponding bitmap from the initial image
3. Upload the logo image to the website using *Select image*
4. Set the image resolution to **40x40** (this cannot be different or it will not work)
5. Make sure the background colour is set to **White**
6. Set the *Scaling* property to **scale to fit, keeping proportions**
7. Adjust the *Brightness / alpha threshold* value until the logo is fully visible in the preview, it should look similar to the preview below (with different logo):

### 3. Preview



8. If the logo preview has a white background, and the logo is black, select the *Invert image colours* option
9. Set the *Code output format* property to **Arduino code**
10. Set the *Draw mode* property to **Horizontal - 1 bit per pixel**
11. Press the *Generate Code* button to get your bitmap code, save this for later

### 11.3.2 Obtaining Colour Codes

1. Pick the colours that will be used, one of which is used for the background, and the other is used for the logo itself (one is also used for the other elements such as the pie chart). RGB values are needed, so use RGB Colour Picker to get the RGB values for the two colours
2. The display uses 5:6:5 RGB values, so the obtained 8:8:8 RGB values need to be converted to this representation. This can be done on GreekGeeks Colour Convert Tool, simply enter the RGB values to get the 5:6:5 Packed representation for both the colours

### 11.3.3 Modifying *colours.h*

1. Open *colours.h*, it is located in the *ESPIR\_Library* directory downloaded earlier (should be placed in Arduino library folder)
2. Get the 5:6:5 RGB values generated earlier, they should be format as *0xCCCC* where *C* are numbers and letters
3. Below the *// PASTE NEW COLOURS HERE* comment in *colours.h*, add the following:

```
#define *CODE*_BACKGROUND_COLOUR 0xBBB  
#define *CODE*_LOGO_COLOUR 0xFFFF
```

where *\*CODE\** is the code of the new coin, *OxB*BBB is the 5:6:5 RGB code of the background colour, and *OxL*LLL is the 5:6:5 RGB code of the logo colour

4. Note down the names of these definitions for later

### 11.3.4 Modifying *bitmaps.c*

1. Select a default coin that you would like to overwrite, note down its code (e.g. BTC)
2. Open *bitmaps.c*, it is located in the *ESPIR\_Sketch* directory downloaded earlier
3. Find the bitmap associated with the value you would like to overwrite, it should be called *CODE\_logo*, e.g. *BTC\_logo*
4. Note down the name, as this makes the modification of *ESPIR\_Sketch.ino* much easier
5. Delete this bitmap from the file
6. Go back to your generated bitmap code, copy it, and paste it below the *// PASTE NEW BITMAPS HERE* comment in the file

### 11.3.5 Modifying *ESPIR\_Sketch.ino*

1. In Arduino, use *ctrl + f* to open the find menu, and locate all references to the deleted bitmap (using the name from earlier)
2. Use find to locate the reference at the start of the file, on the line beginning with *extern unsigned char*
3. Replace this deleted name with the new name given to the variable added in *bitmap.c*
4. Once this deleted bitmap name has been replaced with the name of the new bitmap, locate the next reference, this should be in a *COIN* constructor, this is the constructor we will modify to fill with the new coins information and bitmap
5. The parameters of the constructor are as follows:
  - (a) *Coin code* : e.g. BTC (replace with code of new coin)

- (b) *Coin ID* : e.g. bitcoin (replace with id of new coin, if unknown, look at 10.1 Obtaining CoinGecko ID)
  - (c) *Bitmap* : Name of the bitmap drawn by coin (replace with name of new bitmap)
  - (d) *Background Colour* : Icon background colour (change to *\*CODE\*\_BACKGROUND\_COLOUR*)
  - (e) *Bitmap Colour* : Colour of the logo (replace with *\*CODE\*\_LOGO\_COLOUR*)
  - (f) *External Colour* : Portfolio, pie chart, etc colour (replace with preferred colour of the two added)

6. Upload sketch to the device (see 11.2.2 Uploading Sketch if unfamiliar)

  - 3. With this logo saved, follow the steps in section 10.1 to obtain the API id of the coin
  - 4. Enter the code of the coin in the ‘Enter Coin Code to Add’ entry (e.g. BTC)
  - 5. Enter the API id of the coin in the ‘Enter CoinGecko ID’ entry (e.g. bitcoin)
  - 6. Press the ‘Select Logo’ button and locate the downloaded logo using the dialogue box
  - 7. Select the logo colour (this is the colour of the bitmap) using the button to spawn a colour select dialogue box
  - 8. Select the background colour (this is the colour of the circle) using the button to spawn a colour select dialogue box

## 12 Changing Coins with Icons using ESPIR Assist

Rather than generating colours, getting bitmaps, manually editing code, etc, I created a tool that does all of the hard work for you. A prerequisite for this is of course to have the Arduino environment configured with all of the necessary boards and libraries installed, and also have the firmware downloaded (sections 11.1 & 11.2).

The software is coded using the tkinter library in Python, there are some prerequisites you will need to run the code:

- Python 3
  - Pillow (9.2.0)

With these installed, you should be able to run the script by either clicking it or using terminal.

The program is very intuitive, but for completeness, here is a step-by-step guide to make things extra clear:

1. Open the program using terminal or clicking it
  2. Download the logo of the coin you would like to add, for the best result, the logo should either be light on a dark background, or dark on a light background

3. With this logo saved, follow the steps in section 10.1 to obtain the API id of the coin
  4. Enter the code of the coin in the '*Enter Coin Code to Add*' entry (e.g. BTC)
  5. Enter the API id of the coin in the '*Enter CoinGecko ID*' entry (e.g. bitcoin)
  6. Press the '*Select Logo*' button and locate the downloaded logo using the dialogue box
  7. Select the logo colour (this is the colour of the bitmap) using the button to spawn a colour select dialogue box
  8. Select the background colour (this is the colour of the circle) using the button to spawn a colour select dialogue box
  9. Select which colour you would like the accent colour to be from the logo and background colours, this is the colour used in places such as the portfolio doughnut chart
  10. Next, adjust the '*Brightness Cut Off*' slider until the logo you have added is clearly visible
  11. **IMPORTANT:** If at this stage the '*Bitmap*' image is black on a white background, you need to press the '*Invert Output Colours*' tick box
  12. You can go back and change the brightness cut off sliders and change the colours until you are happy with the '*Preview*' bitmap, this is what it will look like on the ticker
  13. Once happy, enter the code of the coin you no longer want on the ticker (e.g. ETC)
  14. Finally, use the dialogue windows spawned by pressing the '*Select \_\_ Directory/Folder*' buttons to select the locations of the respective directories
  15. Once happy, press the '*REPLACE*' button, and you should hopefully see a green '*Success*' appear
  16. Now upload the sketch to the ticker, see section 11.2.2

