**Flashing an ESP-01 board with new firmware**

The process for changing the ESP8266 firmware is a little involved, but straightforward. There is a plethora of information available on the web[[1]](#endnote-1), but none will show exactly what we need to do. I upgraded the firmware on several ESP 01 boards and never “bricked” one, but I thought I had on more than one occasion. The process is unforgiving so be sure that all the binaries are being set up as instructed and the sequence of operations is followed. If at the end the ESP won’t say “OK”, then go back and repeat the operation with special care that the details are all correct.

Here is the step by step process I went through:

1. The interface to the ESP-01 ESP8266 board requires a serial connection to the computer. I used a USB Serial adapter CH340G which I purchased on eBay. The ESP board requires a 3.3-volt supply. The circuit I used to make the connection was first constructed on breadboard and then a wired breadboard. The schematic is shown in Fig A1.
2. To understand what firmware is currently loaded in the ESP 8266, I used the Termite 3.4 RS232 terminal program. It can be downloaded from <https://www.compuphase.com/software_termite.htm>
3. The settings for Termite are shown in Fig A2.
4. Connect power to the flashing breadboard and then interface to the computer.

Find the correct COM port for the serial adapter and type AT in the command line on the bottom of the Termite. If everything is hooked up correctly and the baud rate is correct, an “OK” will be viewed in the terminal interface window. If “ERROR” is returned instead of “OK”, type AT+RST to reset the ESP 8266 and then it should respond “OK” to AT command. Getting the baud rate matched is important because until that happens only garbage information is received by the computer.

1. All the ESP-01 I’ve purchased have arrived with the baud rate set to 115600. If the flashing breadboard is set up correctly and you don’t get “OK”, then you have to trial and error different baud rates on Termite until the ESP-01 returns with OK. The baud rate needs to be set to 115600; if it isn’t, instructions for changing baud rate are shown below. Otherwise skip to #7.
2. If you need to change the baud rate: type in the terminal interface window: AT+UART\_DEF=115200,8,1,0,0. Check to see that this has worked by changing the baud rate of the terminal to 115200 and typing AT in the interface window. The response should be “OK”
3. Now type AT+GMR. The response should be something like:

AT version:0.30.0.0(Jul 3 2015 19:35:49)

SDK version:1.2.0

compile time:Jul 3 2015 20:52:32

OK

After the SDK version information there may be other characters, but this isn’t important.

This example is a very early firmware version of the ESP 8266. I found that ESP-01 modules purchased from different eBay vendor were often of various versions, but it didn’t matter. All could be brought up to the desired 1.7.4 needed for the Arduino WiFi driver.

1. Close the Termite program.
2. To set up the flash process, load ESP8266 Download tool V3.8.8 (or later) found at

<https://www.espressif.com/en/support/download/other-tools>

and the flash information and unzip it into a file on the local machine such as C:\Users\Name\Desktop\ESP8266\_Flash\_Tool. Windows Defender may not trust the download, but I’ve found my regular security suite not to have any issues with it and I’ve used it several times without issue.

1. The target firmware can be found at <https://www.espressif.com/en/support/download/at>

On this page are several choices for ESP 8266 firmware. The one that we want for the WIFI Clock/Weather Display is ESP8266 NonOS AT Bin V1.7.4. This site can be confusing so I’ve loaded the necessary binary files in the folder ESP firmware which is included in the file ESP 8266 firmware which I’m including. Put these files into a new folder such as C:\User\Name\Desktop\Firmware.

1. The files which will be needed for the firmware flashing are:
   * 1. blank.bin
     2. boot\_v1.7.bin
     3. esp\_init\_data\_default\_v08.bin
     4. user1.1024.new.2.bin

For convenience be sure that all of these files are in the folder you just corrected.

1. Launch the ESP8266 Download tool downloaded in #9 and follow the following steps:
   1. Double click on .exe file and wait for Download Tool Mode box to load. (*Note: it takes a while for the tool to load and this window to appear especially on a slower PC*)
   2. Select “8266” as chip type and “developer” as Work Mode.
   3. On the SPIDownload tab configure firmware upload as shown in figure Fig A3 All the entries should be in file we set up in #11. This is done by using the select tab next to the file name and choosing the appropriate binaries in file identified in #10 and #11. Note that the blank.bin will be loaded more than once.
   4. In the right hand column of this SPIDownload tab insert that addresses for the files shown in Fig A.3. Be sure that these addresses are correct.
   5. Be sure that the boxes on the left hand side are checked for all 6 binaries loaded.
   6. Set the Com port to the USB port that is connected to the ESP 8266 flash board. (It will be the same as used for Termite.)
   7. Set the CrystalFreq to 40Hhz, FLASH SIZE to 8Mbit and SPI Mode to QIO. Don’t check SpiAutoSet or DoNotChgBin.

*The ESP 8266 is put into flash mode by holding the flashbutton (that is pulling the GPIO0 pin to ground) while the ESP 8266 is being reset. I found the easiest and most reliable way to do this was to jumper the GPIO0 pin to ground and cycle the 3.3v power to the ESP 8266. )*

* 1. Power off the 3.3v to the ESP 8266
  2. Jumper GPIO0 to ground to force ESP into flash mode
  3. Apply power to the ESP 8266.
  4. Click start button on the download tool.
  5. The green progress bar on the bottom of the app will progress and the will indication completion. The Finish button will light when complete.

*If instead of the green progress bar moving, you only see dots on the flasher console, then you know the flasher isn’t talking to the chip. I found that this was caused by:*

* *Power not being applied to the ESP 8266 or the serial connection not made*
* *The Com port wasn’t configured correctly*
* *Or the information configured into the tool wasn’t correct. Note that you need to check the information in the binaries every time you load the program. I found that changes occurred that I didn’t observe and caused me no end of trouble.*

1. Close the ESP8266 download tool.
2. Disconnect the jumper to ground the GPIO0 pin and power cycle the ESP 8266.
3. Open Termite program. Type AT+GMR. The response now should be:

AT version:1.7.4.0(May 11 2020 19:13:04)

SDK version:3.0.4(9532ceb)

compile time:May 27 2020 10:12:17

Bin version(Wroom 02):1.7.4

OK

*You now know that the new firmware is loaded into the ESP 8266. The baud rate of the part needs to be slowed down to work with Arduino software serial interface.*

1. Now type AT+UART\_DEF=9600,8,1,0,1 to change the baud rate of the ESP8266 to 9600 to be compatible with the virtual serial ports of the Arduino
2. Change Termite baud rate to 9600. Type AT. OK should be the response
3. The ESP-01 module is now ready to go.

1. Two very useful website are:

   <https://www.allaboutcircuits.com/projects/flashing-the-ESP-01-firmware-to-SDK-v2.0.0-is-easier-now/>

   https://www.allaboutcircuits.com/projects/update-the-firmware-in-your-esp8266-wi-fi-module/ [↑](#endnote-ref-1)