



HOW TO UPGRADE ESP8266 BOARDS USING ESP FLASH DOWNLOAD TOOLS

This document applies for the following products:
ESP8266-EVB; ESP8266-EVB-BAT; ESP8266-EVB-BAT-BOX;
MOD-ESP8266-WIFI-DEV; MOD-ESP8266-WIFI;

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All boards produced by Olimex LTD are ROHS compliant

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The hardware designs of the development boards mentioned in this guide (ESP8266-EVB; ESP8266-EVB-BAT; ESP8266-EVB-BAT-BOX; MOD-ESP8266-WIFI-DEV; MOD-ESP8266-WIFI) are considered open source. Anyone can download the original schematics and board design files. The files describing the hardware are made with CadSoft's EAGLE PCB design software – the software has a free version suitable for studying any board schematic or board design.

The part of the software written by Olimex is released under GPL. However, the examples that we distribute are based on the SDK libraries and projects released by Espressif Systems. Make sure that you are acquainted with Espressif Systems' license agreement before using, publishing, or distributing any code based on our software.

It is possible that the pictures in this manual differ from the latest revision of the board.

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CHAPTER 1: PURPOSE OF THIS DOCUMENT

This document aims to assist beginners in restoring or upgrading the firmware of the ESP8266 boards, manufactured by Olimex Ltd.

The guide is suitable for people that have one of the following boards: MOD-ESP8266-WIFI-DEV; MOD-ESP8266-WIFI; ESP8266-EVB; ESP8266-EVB-BAT; ESP8266-EVB-BAT-BOX. This guide uses of the official “ESP FLASH DOWNLOAD TOOLS” distributed by “Espressif Systems”. This means that you would also need a computer capable of running Windows applications.

Experienced ESP8266 users would find this document redundant.

The document structure is as follows:

- All the required hardware and software for a basic setup is listed in “CHAPTER 2: REQUIREMENTS”.
- In “CHAPTER 3: HARDWARE SETUP” there are specific details on how to set the hardware together and then the upgrade procedure.
- The next chapter “CHAPTER 4: FIRMWARE UPDATE” gives the instruction on how to update the firmware
- “CHAPTER 5: SIMPLE AT COMMAND TEST” shows how to setup your terminal program and send basic AT commands to the updated board.
- “CHAPTER 6: FURTHER READING” provides links to more ESP8266-related resources.
- The document's revision and ordering information are available in “CHAPTER 7: ORDERING CODES AND DOCUMENT REVISION”.

CHAPTER 2: REQUIREMENTS

The minimal connection requires several hardware and software prerequisites.

2.1 Hardware requirements

You would need: an ESP8266 board; a way to power the ESP8266 board; a USB < - > serial cable with level shifter; and a personal computer. Each of these is discussed below.

Note that you might already own some of the necessary hardware pieces listed below. For example, as long as you have a fitting 5V power supply unit or USB < - > serial cable there is no need to purchase a new one.

2.1.1 ESP8266 board

The main component of the setup. During your initial research of the ESP8266EX chip, it is **highly recommended** to use one of the following three boards, which are suitable for beginners:

- ESP8266-EVB
- ESP8266-EVB-BAT
- ESP8266-EVB-BAT-BOX

You can also use one of the following two boards, but they are harder to power up and you might need to cut and solder SMT jumpers in order to change boot modes:

- MOD-WIFI-ESP8266
- MOD-WIFI-ESP8266-DEV

MOD-WIFI-ESP8266 and MOD-WIFI-ESP8266-DEV are suitable for people already familiar with ESP8266. They are small, affordable and fit custom designs perfectly. However, their stand-alone usage might provide a challenge for beginners. The main difficulty comes from the hardware adjustments you would need to perform in order to change the boot mode of the board. Entering UART mode would require cutting and soldering of SMT jumpers (hardware revision B of MOD-WIFI-ESP8266-DEV introduces a button for easier access to UART boot mode).

2.1.2 Source of power

The ESP8266-EVB board gets powered via the barrel power jack named “PWR”. You need to apply exactly 5V DC.

The corresponding power supply plug (or female jack) that fits the DC barrel has 2.1mm inner diameter and 5.5mm outer diameter. The length of the male plug should be between 10mm and 14mm.

ESP8266-EVB-BAT and ESP8266-EVB-BAT also have a similar barrel jack named “PWR”, which can be used for powering the board. These two boards also have a Li-Po battery circuitry – you can also power them using the Li-Po battery connector.

We distribute affordable 220V<->5V adapters that fit the board's barrel jack. Search our web-shop for SY0605E and SY0605E-CHINA.

You would need to power MOD-WIFI-ESP8266 or MOD-WIFI-ESP8266-DEV from a 3.3V source. They don't have a voltage convertor – do not try to power these boards with 5V! Refer to the schematic of each of the boards to find the location of the “3.3V” and “GND” pins.

2.1.3 USB < - > serial cable

The USB < - > serial cable establishes a physical connection between the board and a personal computer. It is important that the cable has a built-in level shifter.

You might already have such a cable. In case you don't, you would need to get such an adapter cable due to a couple of reasons:

- the voltage levels of board's RXD and TXD are lower than the voltage levels of computer's TXD and RXD (even if your computer has a native serial port). The adapter takes care of the level adjustment;
- most modern computers lack serial port.

The are two very important considerations to make, when selecting the cable that would work for you:

- the cable needs to fit the UART pins of the boards;
- the cable has the proper driver support for the operating system of your personal computer.

We distribute affordable USB to serial adapter cables with either female or male leads. Search our web-shop for USB-SERIAL-CABLE-F (suitable for ESP8266-EVB, ESP8266-EVB-BAT, ESP8266-EVB-BAT-BOX) or USB-SERIAL-CABLE-M (suitable for MOD-WIFI-ESP8266 and MOD-WIFI-ESP8266-DEV).

2.1.4 Personal computer

In order to install the “ESP FLASH DOWNLOAD TOOLS” you need a computer which is able to:

- run Windows applications;
- work properly with your serial cable;
- access the Internet.

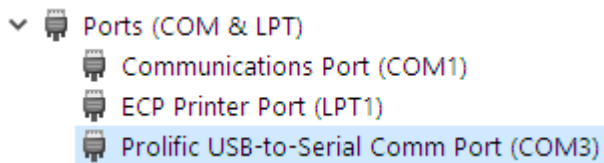
2.2 Software requirements

2.2.1 Driver for the USB < - > serial cable

Contact the supplier of your USB to serial adapter cable for such drivers. After the drivers are installed make sure the cable is properly recognized by the operating system.

A properly installed serial cable should be listed as a COM port by the operating system.

For example, under Windows, in “Windows Device Manager” a properly installed cable gets listed like this:



2.2.2 ESP FLASH DOWNLOAD TOOLS

This is the official tool for updating the firmware of ESP8266EX. The tool is maintained by “Espressif Systems”.

Download and extract the latest version of “FLASH DOWNLOAD TOOLS” from the official Espressif web-site. The archive is usually located under “Tools” sub-group at the web-page with the ESP8266EX resources. By the time of writing this document, the page with resources can be found at:

<http://espressif.com/en/products/hardware/esp8266ex/resources>

We used “FLASH DOWNLOAD TOOLS v2.3” during the preparation of this document. If you want to have the exact same behavior as us, use “FLASH DOWNLOAD TOOLS v2.3”. You can download them from here:

https://www.olimex.com/Products/IoT/_resources/flash_download_tools_v2.4_150924.rar

There are a lot of tools that can accomplish the same (including tools which work fine under Linux OS and Mac OS). Feel free to use other tools if you wish. However, this guide aims to assist beginners with ESP8266EX and it focuses only on the “FLASH DOWNLOAD TOOLS” released by “Espressif Systems”.

2.2.3 SUITABLE FIRMWARE

We would also need to download (or prepare) firmware compatible with the ESP8266 board.

The best idea is to download the latest NONOS SDK from the official web-site of “Espressif Systems” - it contains a folder with pre-built binaries. Download and extract the latest version of “ESP8266 NONOS SDK” from the official Espressif web-site. The archive is usually located under the “SDKs & Demos” sub-group at the web-page with the ESP8266EX resources. By the time of writing this document, the location is:

<http://espressif.com/en/products/hardware/esp8266ex/resources>

We used “ESP8266 NONOS SDK v1.5.0” during the preparation of this document. If you want to have the exact same behavior as us, use “ESP8266 NONOS SDK v1.5.0”. You can download it from here:

https://www.olimex.com/Products/IoT/_resources/esp8266_nonos_sdk_v1.5.1_16_01_08_0.rar

You can also use our custom IoT firmware files that are available at GitHub:

<https://github.com/OLIMEX/ESP8266/tree/master/IoT%20Firmware>

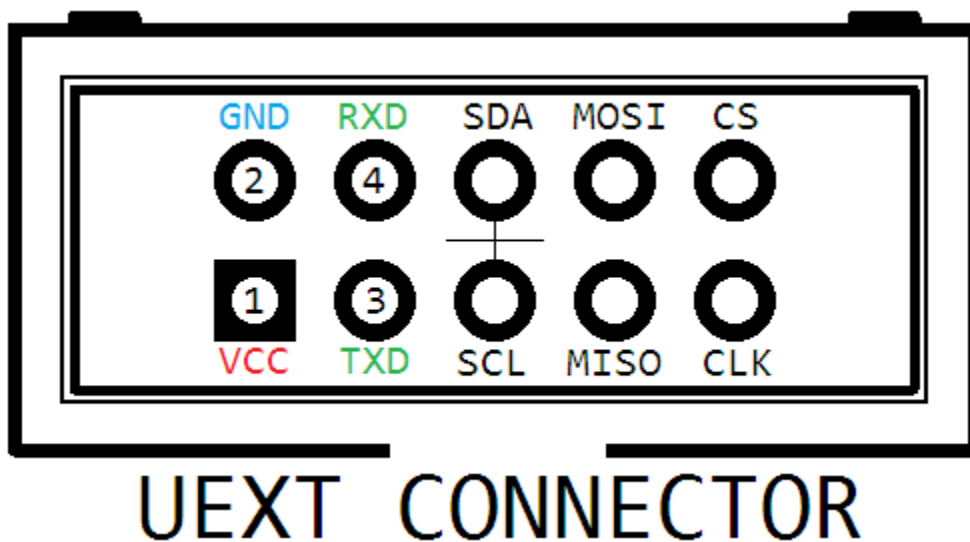
CHAPTER 3: HARDWARE SETUP

The hardware setup consists of a powered ESP8266 board with a properly established connection between the board and the personal computer via the serial cable.

The layout of the hardware connections can be found on the next page.

The hardest part of the hardware setup is probably connecting the USB < - > serial cable to the TX, RX, and GND pins.

The important part here is to connect the GND of the cable to the GND pin (#2) of the UEXT connector. Then TXD of the cable to RXD of the UEXT (#4). Finally, RXD of the cable to TXD of the UEXT (#3).



For connecting the USB < - > serial cable we are interested only in pins #2, #3 and #4.

The connections are easier if the slave board has module you'd like to connected has male UEXT connector.

Follow the same idea when you use MOD-WIFI-ESP8266 and MOD-WIFI-ESP8266-DEV – **but keep in mind that those boards are meant for male connector (instead of female). They are supposed to serve as slaves and the RX and TX lines are swapped.** Refer to the schematic of your board to find the pins where signals RX, TX, and GND are available. The idea is to connect the cable to the RX, TX and GND signals.

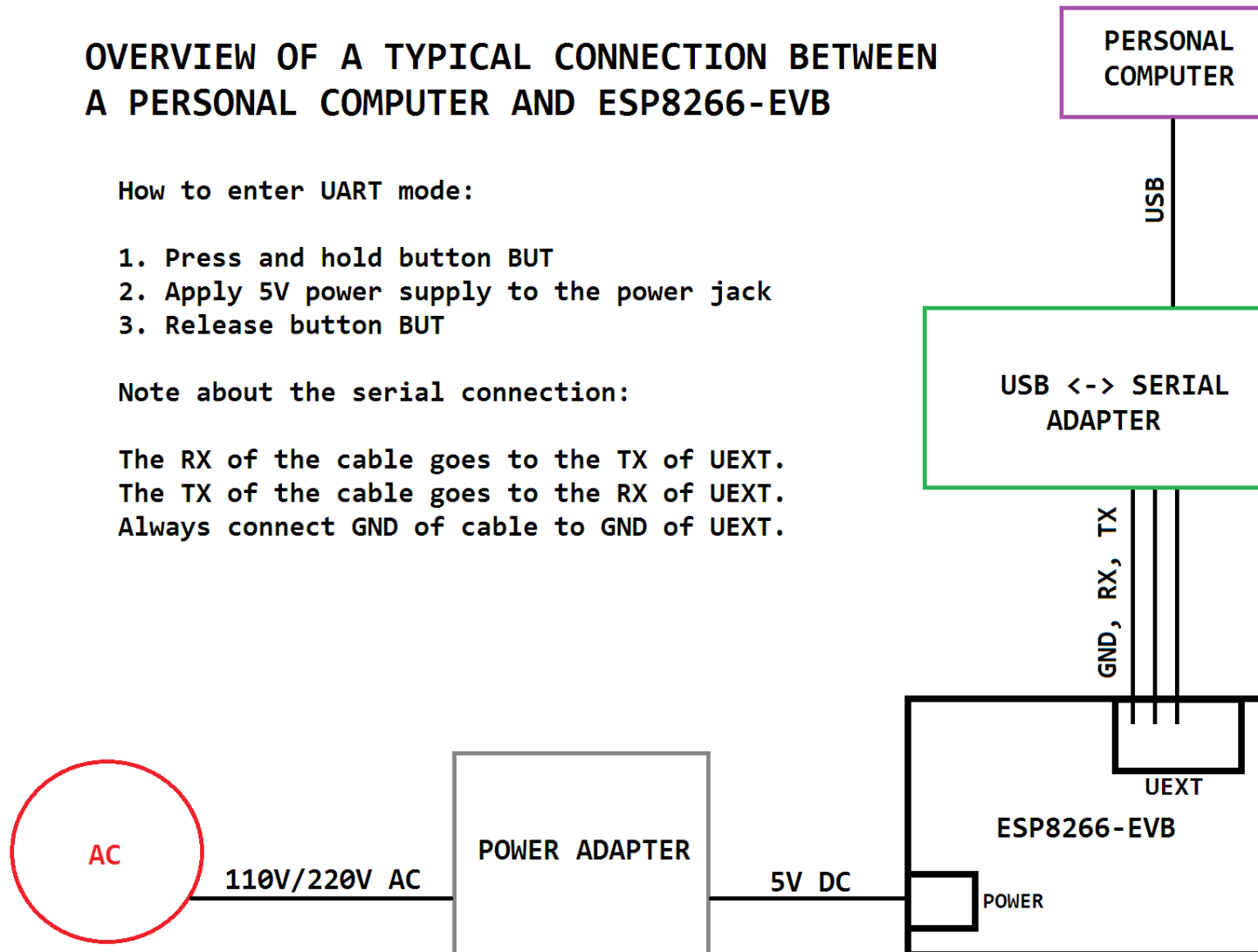
OVERVIEW OF A TYPICAL CONNECTION BETWEEN A PERSONAL COMPUTER AND ESP8266-EVB

How to enter UART mode:

1. Press and hold button BUT
2. Apply 5V power supply to the power jack
3. Release button BUT

Note about the serial connection:

The RX of the cable goes to the TX of UEXT.
The TX of the cable goes to the RX of UEXT.
Always connect GND of cable to GND of UEXT.



CHAPTER 4: FIRMWARE UPDATE

At this point we have all the hardware and software prerequisites ready. Now we have to set everything together.

1. Start the ESP8266 board in UART (bootloader) mode.

If you are using ESP8266-EVB, ESP8266-EVB-BAT or ESP8266-EVB-BAT-BOX – disconnect the ESP8266 board from any power supply; press and hold button BUT; apply power supply.

If your board doesn't have a button (“MOD-WIFI-ESP8266” or “MOD-WIFI-ESP8266-DEV”) you need to change the SMT jumpers to the UART (bootloader) mode and then power the board. By default the boards are configured for “execute from flash” mode.

2. Connect the serial cable to the board's RX, TX and GND. Make sure that the cable is properly recognized by Windows.
3. Extract the archive with the NONOS SDK. The archive here is named “esp8266_nonos_sdk_v1.5.1_16_01_08_0.rar”.
4. Extract the archive with “FLASH DOWNLOAD TOOLS”. The archive we use here is named “flash_download_tools_v2.4_150924.rar”.
5. Navigate inside the extracted folder and start the executable. The one here is “ESP_DOWNLOAD_TOOL_V2.4.exe”. The graphical interface of the tool would launch. In case of a problem with the start of the application consider updating your Python installation.
6. Now we have to point the tool to the firmware binaries. We have to change a few options also. Use the ellipsis (...) in the “Download Path Config” box to point to the firmware binaries from the NONOS SDK (the archive that we extracted in point 3). We need four prebuilt binaries named: “**boot_v1.5.bin**”; “**esp_init_data_default.bin**”; “**blank.bin**”; “**user1.2048.new.5**”. These files are located in folder “**.../bin/**” and its sub-folder “**.../bin/at/1024+1024/**”.

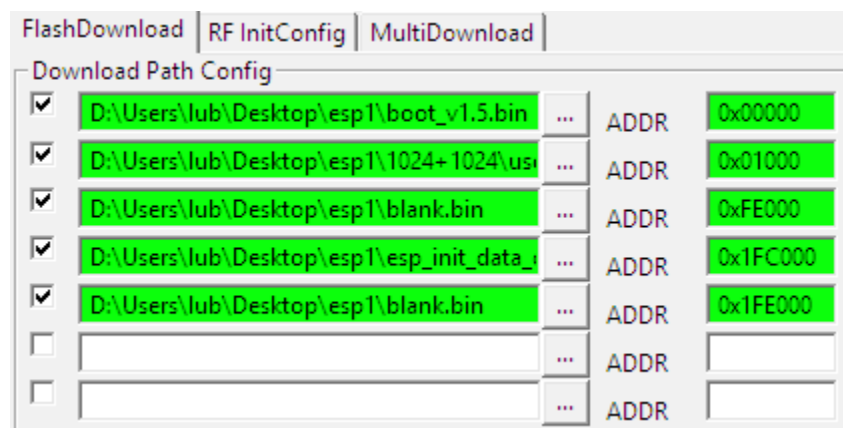
The corresponding write addresses and description of each file can be found in the table below (the table is taken from the official AT instruction set):

16Mbit Flash, map: 1024KB + 1024KB

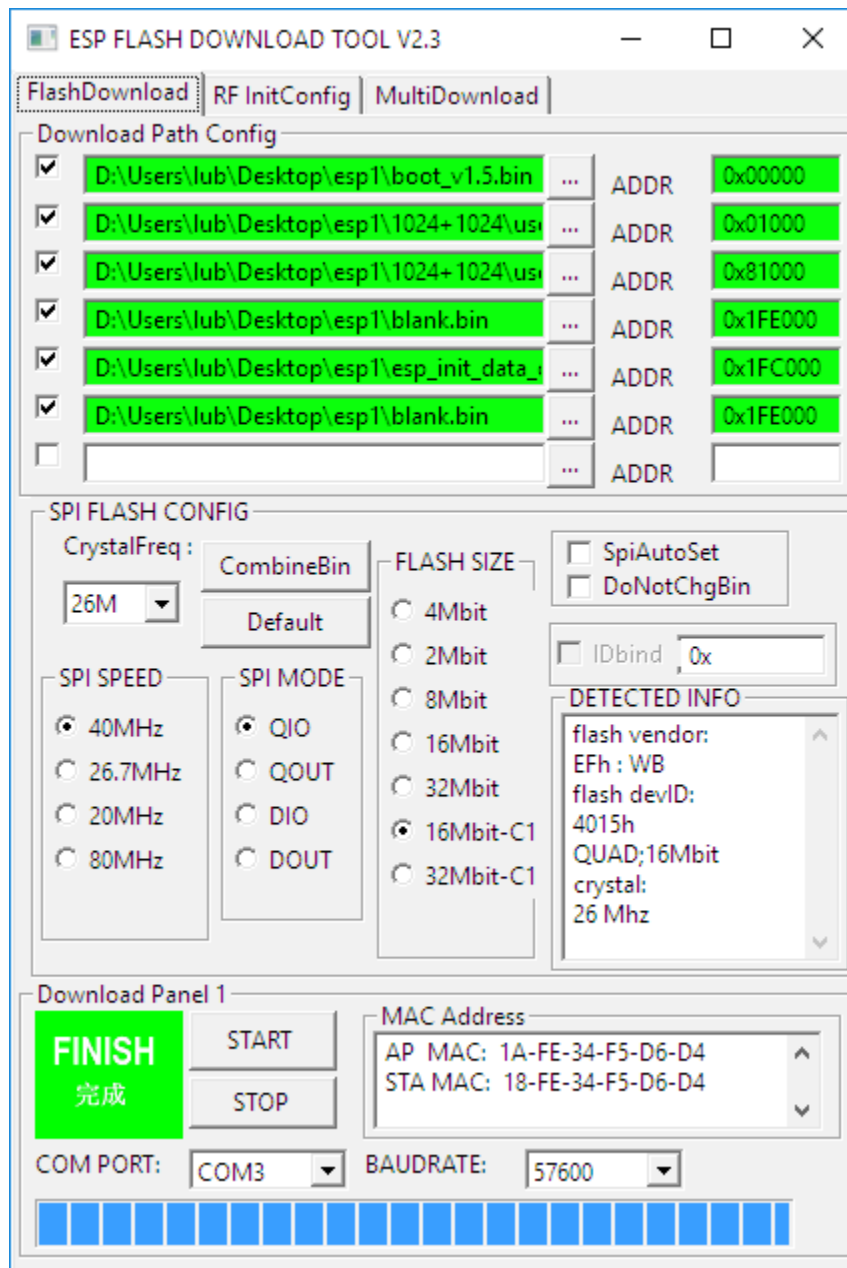
Use Espressif Flash download tool and select Flash size : 16Mbit-C1.

bin	Address	Description
esp_init_data_default.bin	0x1FC000	Optional. Stores default RF parameter values.
blank.bin	0xFE000	Initialize Flash user parameter area, more details in Appendix.
blank.bin	0x1FE000	Initialize Flash system parameter area, more details in Appendix.
boot.bin	0x00000	In \bin\at
user1.2048.new.5.bin	0x01000	In \bin\at\1024+1024

Notice that the same blank.bin file is used two times at different addresses. When everything is set remember to enable the write of each of the binaries by using the tick before the field with the path to each file. The “Download Path Config” should look this way:



- The other three fields that we have to edit are the “FLASH SIZE” of the ESP8266 board, the “COM PORT” of the serial cable and the communication’s “BAUDRATE”. The flash size of Olimex boards is 2MB = 16Mbit and it is suggested to use the 16Mbit-C1 option. The “BAUDRATE” is 57600. The “COM PORT” is different depending on the system. The serial cable here gets assigned COM3 so that is what we would assign. Refer to the “Windows Device Manager” to find the COM port number of the cable of your system.
- At this point make sure that the ESP8266 board is in UART (bootloader) mode as suggested in point 1. We also need to have the serial cable connected to the RX, TX and GND signals of the board.
- Click button “START” at the bottom of the graphical interface of FLASH DOWNLOAD TOOLS and wait till upgrade succeeds. A successful upload looks like this:



10. (conditional) If your board doesn't have a button to enter UART mode – you would need to revert the jumpers back to default “FLASH” mode. Else the firmware will not execute upon powering the board (it would boot in UART bootloader mode).
11. Voila. The firmware and the AT command set are now updated. We can head to the next chapter where we would test the firmware.

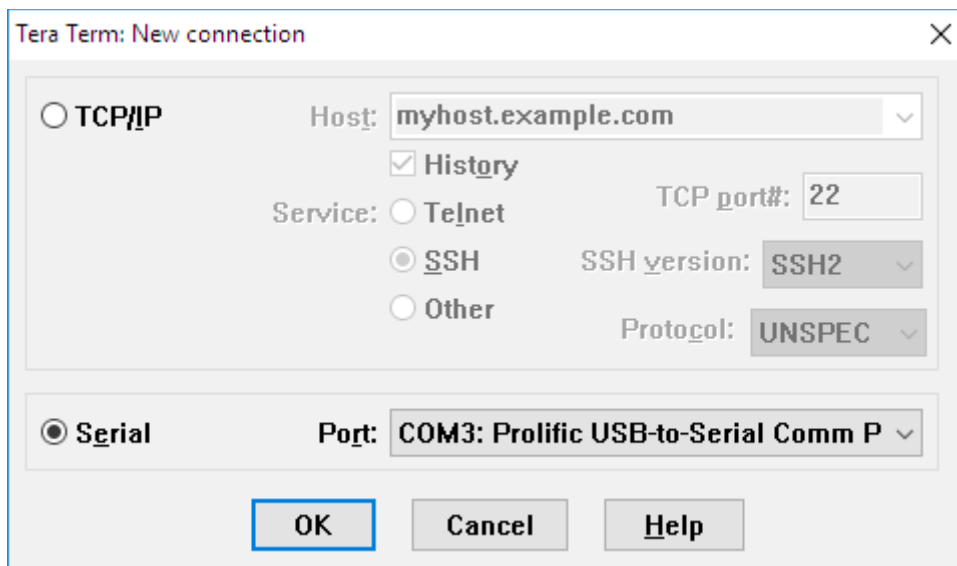
CHAPTER 5: SIMPLE AT COMMAND TEST

Again we need the serial cable to be able to send and receive AT commands over the UART of the ESP8266 board.

For this test we power the board in the default state (no button pressed; if the board doesn't have a button the jumpers need to be in “execute from flash” mode).

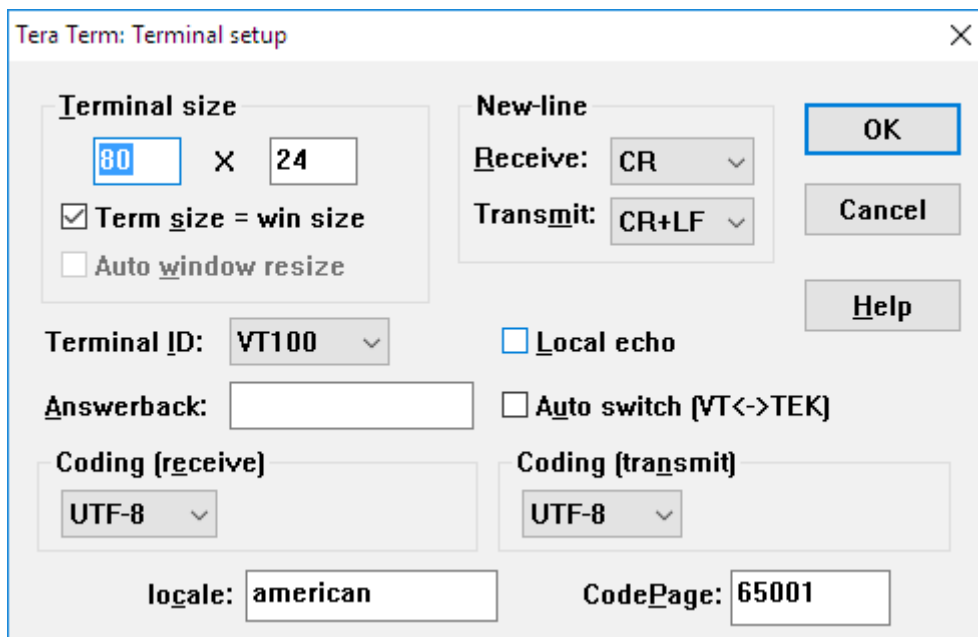
We also need a properly configured terminal software program. The terminal program should have an option to add automatically carriage return and line feed after each command. By default most terminal programs add only carriage return when you send a string by pressing the keyboard button “Enter”. In this document we would use TeraTerm.

- Restart or power cycle the ESP8266 board (in case it is still in UART mode). We want the board to be in FLASH mode.
- Connect the USB < - > serial cable between the board and the personal computer. Remember the COM port that the operating system assigns to the cable.
- Download and install TeraTerm.
- Start TeraTerm. Select the “Serial” radio button and from the drop-down menu select the COM port of the serial cable. It should look like this:

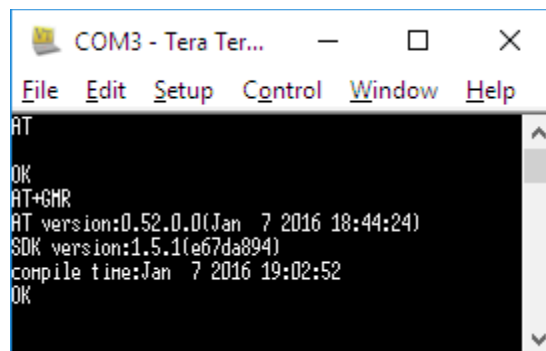


- Click “OK”
- Navigate to “Terminal” → “Serial Port...” and set the “Baud Rate” field to “115200”. Click “OK”.
- Navigate to “Setup” → “Terminal...”

- In the “New-line” box change the value for the “Transmit” field to “CR+LF”. It should look like this:



- Now the terminal is set properly. We can send AT commands to the board now. It is important to notice that the AT commands should be capitalized!
- For example, type “AT” and press “Enter”. Then type “AT+GMR” and press “Enter”. You should receive the following response:



For the full AT command set – it is always the best idea to refer to the official documentation released by Espressif Systems!

CHAPTER 6: FURTHER READING

In this chapter you would find links to places with useful information.

- The best location for ESP8266-related documentation, news and general information is the official Espressif Systems' forum here:

<http://bbs.espressif.com/>

- The latest official resources and documentation for ESP8266EX can also be found here:

<http://espressif.com/en/products/hardware/esp8266ex/resources>

- The best place to read more about the ESP8266 support for Arduino IDE is this one:

<https://github.com/esp8266/Arduino>

- The custom ESP8266 firmware and examples provided by Olimex can be found here:

<https://github.com/OLIMEX/ESP8266>

- The link to the official web-site of Olimex is here:

<https://www.olimex.com>

CHAPTER 7: ORDERING CODES AND DOCUMENT REVISION

7.1 Ordering codes

The exact names of some products mentioned in this guide can be found below. The products can be found in our web-shop with these specific product names:

ESP8266-EVB – evaluation board for ESP8266EX with relay, button, UEXT, all GPIOs available on 0.1" header

ESP8266-EVB-BAT – evaluation board for ESP8266EX with relay, button, UEXT, Li-Po battery connector with charger and all GPIOs available on boxed connector

ESP8266-EVB-BAT-BOX – evaluation board for ESP8266EX with relay, button, UEXT, Li-Po battery connector with charger; all GPIOs available on boxed connector and Hammond box

MOD-WIFI-ESP8266 – extension module with ESP8266EX with male UEXT connector – can be directly attached to existing Olimex boards with female UEXT

MOD-WIFI-ESP8266-DEV – the smallest ESP8266EX Olimex module – perfect for embedding in own designs

USB-Serial-Cable-F – affordable serial to USB cable with female leads

SY0605E – affordable power supply adapter 5V/1A 50Hz/220V(suitable for most European countries)

You can also find a big number of extension boards that can be connected to the UEXT of the board and also some of the components (if damage occurs and you want to replace the part yourself). Make sure to use the search box.

You can purchase directly from our online shop or from any of our distributors. List of confirmed Olimex Ltd distributors and resellers: <https://www.olimex.com/Distributors>.

Please visit <https://www.olimex.com/> for more info.

7.2 Document revision

Document revision	Changes	Modified page
A, 10.03.16	Initial document release	All
B, 15.08.16	Added a note about the different pinout between male and female UEXT connectors	9