Drinkworks Model-B Appliance
ESP32 Firmware Programming

V:1.0 8/5/2021

Assumptions

- Programming Station is running Windows 10
- ESP32 programming adapter is attached to the Programming Station
- Serial Port assigned to programming adapter is ***COMx***

Prerequisites

- Python 3.7 or greater. Recommended 3.8.2 (32-bit), or newer.
  - **Make sure to check "Add Python 3.8 to PATH" during install**
- ESP Tool Package
  - "pip install esptool"

Procedure

1. Unzip contents of this distribution package to a folder (e.g. ***c:\dw_esp_fw***)
2. Open ***a Command Prompt*** window
3. Navigate to folder containing unzipped distribution package (e.g. cd ***c:\dw_esp_fw***)
4. Connect ESP programming adapter to Target system ***J12,*** labeled ***BOOT***
5. Apply power to target system
6. If PIC18F has been previously programmed, it must be held in reset, or not executing code:
   a. MPLAB IDE has ***Hold in Reset*** command
   b. MPLAB IPE ***Erase Device***
   c. MPLAB IPE has a ***Hold in Reset*** option on the ***Settings*** menu (unclear how reliable this is)
7. Start ESP programming script
   - ***modb_program.py COMx***
8. Wait for ***Bootloader Encryption Completed*** message
9. Power down target system

Typical time for the programming and self-encryption process is approximately 2 minutes.

Example Output

```
C:\Users\user\dw_ModelB\releases\v1.021>modb_program.py COM17
COM port: COM17
Checking espfuse to see if board already programmed
Board not encrypted. Proceed with programming.
-----Programming Board-----
Erasing Flash...
esptool.py v2.8
Serial port COM17
Connecting....
Detecting chip type... ESP32
Chip is ESP32D0WDQ5 (revision 3)
Features: WiFi, BT, Dual Core, 240MHz, VRef calibration in efuse, Coding Scheme None
Crystal is 40MHz
MAC: a8:03:2a:e2:4d:78
Uploading stub...
Running stub...
Stub running...
Changing baud rate to 460800
Changed.
Erasing flash (this may take a while)...
Chip erase completed successfully in 12.9s
Hard resetting via RTS pin...
Programming Flash...
Esptool.py -p COM17 -b 460800 --after no_reset write_flash --flash_mode dio --flash_size 16MB --
flash_freq 40m 0x1000 bootloader.bin 0xE000 partition-table.bin 0x10000 ota_data_initial.bin
0x70000 MODB_v1.01_b145.aws 0x200000 dw_ModelB.bin 0x800000 dw_MfgTest.bin
esptool.py v2.8
Serial port COM17
Connecting....
Detecting chip type... ESP32
Chip is ESP32D0WDQ5 (revision 3)
Features: WiFi, BT, Dual Core, 240MHz, VRef calibration in efuse, Coding Scheme None
Crystal is 40MHz
MAC: a8:03:2a:e2:4d:78
Uploading stub...
Running stub...
Stub running...
Changing baud rate to 460800
Changed.
Configuring flash size...
Compressed 42432 bytes to 23933...
Wrote 42432 bytes (23933 compressed) at 0x00001000 in 0.5 seconds (effective 623.7 kbit/s)...
Hash of data verified.
Compressed 3140 bytes to 298...
Wrote 3140 bytes (298 compressed) at 0x0000e000 in 0.0 seconds (effective 1574.1 kbit/s)...
Hash of data verified.
Compressed 8192 bytes to 31...
Wrote 8192 bytes (31 compressed) at 0x00010000 in 0.0 seconds (effective 4106.7 kbit/s)...
Hash of data verified.
Compressed 127488 bytes to 32922...
Wrote 127488 bytes (32922 compressed) at 0x00070000 in 0.9 seconds (effective 1138.2 kbit/s)...
Hash of data verified.
Compressed 1507316 bytes to 866622...
Wrote 1507316 bytes (866622 compressed) at 0x00200000 in 19.5 seconds (effective 618.8 kbit/s)...
Hash of data verified.
Compressed 1310708 bytes to 766221...
Wrote 1310708 bytes (766221 compressed) at 0x00800000 in 17.2 seconds (effective 609.1 kbit/s)...
Hash of data verified.

Leaving...
Staying in bootloader.
ets Jul 29 2019 12:21:46
```

```
rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:2
load:0x3fff0018,len:4
load:0x3fff001c,len:11904
ho 0 tail 12 room 4
load:0x40078000,len:23128
ho 0 tail 12 room 4
load:0x40080400,len:7300
entry 0x40080830
I (96) boot: Chip Revision: 3
I (97) boot_comm: chip revision: 3, min. bootloader chip revision: 0
I (46) boot: ESP-IDF release-PVT 2nd stage bootloader
I (46) boot: Enabling RNG early entropy source...
I (46) boot: SPI Speed      : 40MHz
I (51) boot: SPI Mode       : DIO
I (55) boot: SPI Flash Size : 16MB
I (59) boot: Partition Table:
I (63) boot: ## Label            Usage          Type ST Offset   Length
I (70) boot:  0 nvs_keys         NVS keys         01 04 0000f000 00001000
I (77) boot:  1 otadata          OTA data         01 00 00010000 00002000
I (85) boot:  2 phy_init         RF data          01 01 00012000 00001000
I (92) boot:  3 nvs              WiFi data        01 02 00013000 00007000
I (100) boot:  4 storage          WiFi data        01 02 0001a000 00010000
I (107) boot:  5 pdata            WiFi data        01 02 0002a000 00023000
I (115) boot:  6 xdata            WiFi data        01 02 0004d000 00023000
I (123) boot:  7 picFactory       unknown          44 56 00070000 00030000
I (130) boot:  8 pic_ota0         Unknown data     01 57 000a0000 00030000
I (138) boot:  9 pic_ota1         Unknown data     01 58 000d0000 00030000
I (145) boot: 10 edata            WiFi data        01 02 00100000 00100000
I (153) boot: 11 factory          factory app      00 00 00200000 00200000
I (160) boot: 12 ota_0            OTA app          00 10 00400000 00200000
I (168) boot: 13 ota_1            OTA app          00 11 00600000 00200000
I (175) boot: 14 test_fw          test app         00 20 00800000 00200000
I (183) boot: End of partition table
I (187) boot: Defaulting to factory image
I (192) boot_comm: chip revision: 3, min. application chip revision: 0
I (199) esp_image: segment 0: paddr=0x00200020 vaddr=0x3f400020 size=0x3b44c (242764) map
I (293) esp_image: segment 1: paddr=0x0023b474 vaddr=0x3ffbdb60 size=0x04b9c ( 19356) load
I (302) esp_image: segment 2: paddr=0x00240018 vaddr=0x400d0018 size=0x10751c (1078556) map
I (681) esp_image: segment 3: paddr=0x0034753c vaddr=0x3ffc26fc size=0x01154 (  4436) load
I (683) esp_image: segment 4: paddr=0x00348698 vaddr=0x40080000 size=0x00400 (  1024) load
I (688) esp_image: segment 5: paddr=0x00348aa0 vaddr=0x40080400 size=0x1ab6c (109420) load
I (743) esp_image: segment 6: paddr=0x00363614 vaddr=0x00000000 size=0x0c96c ( 51564)
I (762) esp_image: Verifying image signature...
I (1210) boot: Loaded app from partition at offset 0x200000
I (1210) boot_comm: chip revision: 3, min. application chip revision: 0
I (1212) esp_image: segment 0: paddr=0x00001020 vaddr=0x3fff0018 size=0x00004 (     4)
I (1221) esp_image: segment 1: paddr=0x0000102c vaddr=0x3fff001c size=0x02e80 ( 11904)
I (1234) esp_image: segment 2: paddr=0x00003eb4 vaddr=0x40078000 size=0x05a58 ( 23128)
I (1246) esp_image: segment 3: paddr=0x00009914 vaddr=0x40080400 size=0x01c84 (  7300)
I (1250) secure_boot: Generating new secure boot key...
I (1265) secure_boot: Generating secure boot digest...
I (1289) secure_boot: Digest generation complete.
I (1289) boot: Checking flash encryption...
I (1290) flash_encrypt: Generating new flash encryption key...
I (1307) flash_encrypt: Read & write protecting new key...
I (1318) flash_encrypt: Setting CRYPT_CONFIG efuse to 0xF
I (1329) flash_encrypt: Disable UART bootloader encryption...
I (1330) flash_encrypt: Disable UART bootloader decryption...
I (1331) flash_encrypt: Disable UART bootloader MMU cache...
I (1337) flash_encrypt: Disable JTAG...
I (1342) flash_encrypt: Disable ROM BASIC interpreter fallback...
I (1360) boot_comm: chip revision: 3, min. application chip revision: 0
I (1360) esp_image: segment 0: paddr=0x00001020 vaddr=0x3fff0018 size=0x00004 (     4)
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I (1367) esp_image: segment 1: paddr=0x0000102c vaddr=0x3fff001c size=0x02e80 ( 11904)
I (1380) esp_image: segment 2: paddr=0x00003eb4 vaddr=0x40078000 size=0x05a58 ( 23128)
I (1392) esp_image: segment 3: paddr=0x00009914 vaddr=0x40080400 size=0x01c84 (  7300)
I (2062) flash_encrypt: Encrypting partition 0 at offset 0xf000...
I (2091) flash_encrypt: Encrypting partition 1 at offset 0x10000...
I (2148) flash_encrypt: Encrypting partition 4 at offset 0x1a000...
I (2605) flash_encrypt: Encrypting partition 6 at offset 0x4d000...
I (3607) flash_encrypt: Encrypting partition 7 at offset 0x70000...
I (5344) flash_encrypt: Encrypting partition 8 at offset 0xa0000...
I (6751) flash_encrypt: Encrypting partition 9 at offset 0xd0000...
I (8156) boot_comm: chip revision: 3, min. application chip revision: 0
I (8156) esp_image: segment 0: paddr=0x00200020 vaddr=0x3f400020 size=0x3b44c (242764) map
I (8246) esp_image: segment 1: paddr=0x0023b474 vaddr=0x3ffbdb60 size=0x04b9c ( 19356)
I (8253) esp_image: segment 2: paddr=0x00240018 vaddr=0x400d0018 size=0x10751c (1078556) map
I (8633) esp_image: segment 3: paddr=0x0034753c vaddr=0x3ffc26fc size=0x01154 (  4436)
I (8634) esp_image: segment 4: paddr=0x00348698 vaddr=0x40080000 size=0x00400 (  1024)
I (8639) esp_image: segment 5: paddr=0x00348aa0 vaddr=0x40080400 size=0x1ab6c (109420)
I (8686) esp_image: segment 6: paddr=0x00363614 vaddr=0x00000000 size=0x0c96c ( 51564)
I (8704) esp_image: Verifying image signature...
I (9135) flash_encrypt: Encrypting partition 11 at offset 0x200000...
E (32161) esp_image: image at 0x400000 has invalid magic byte
E (32161) boot_comm: mismatch chip ID, expected 0, found 65535
E (32163) boot_comm: can't run on lower chip revision, expected 3, found 255
W (32171) esp_image: image at 0x400000 has invalid SPI mode 255
W (32177) esp_image: image at 0x400000 has invalid SPI size 15
E (32184) esp_image: image at 0x600000 has invalid magic byte
E (32190) boot_comm: mismatch chip ID, expected 0, found 65535
E (32197) boot_comm: can't run on lower chip revision, expected 3, found 255
W (32204) esp_image: image at 0x600000 has invalid SPI mode 255
W (32211) esp_image: image at 0x600000 has invalid SPI size 15
I (32217) boot_comm: chip revision: 3, min. application chip revision: 0
I (32225) esp_image: segment 0: paddr=0x00800020 vaddr=0x3f400020 size=0x2ead0 (191184) map
I (32301) esp_image: segment 1: paddr=0x0082eaf8 vaddr=0x3ffbdb60 size=0x01518 (  5400)
I (32303) esp_image: segment 2: paddr=0x00830018 vaddr=0x400d0018 size=0xe9040 (954432) map
I (32643) esp_image: segment 3: paddr=0x00919060 vaddr=0x3ffbf078 size=0x02fc4 ( 12228)
I (32648) esp_image: segment 4: paddr=0x0091c02c vaddr=0x40080000 size=0x00400 (  1024)
I (32650) esp_image: segment 5: paddr=0x0091c434 vaddr=0x40080400 size=0x1a9e8 (109032)
I (32696) esp_image: segment 6: paddr=0x00936e24 vaddr=0x00000000 size=0x0915c ( 37212)
I (32710) esp_image: Verifying image signature...
I (33127) flash_encrypt: Encrypting partition 14 at offset 0x800000...
W (1349) flash_encrypt: Not disabling FLASH_CRYPT_CNT - plaintext flashing is still possible
I (1361) flash_encrypt: Flash encryption completed
I (1361) boot: Checking secure boot...
I (1361) secure_boot: Read & write protecting new key...
I (1377) secure_boot: blowing secure boot efuse...
I (1377) secure_boot: Disable JTAG...
I (1377) secure_boot: Disable ROM BASIC interpreter fallback...
I (1395) secure_boot: secure boot is now enabled for bootloader image
I (1396) boot: Resetting with flash encryption enabled...
ets Jul 29 2019 12:21:46

rst:0x3 (SW_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:2
load:0x3fff0018,len:4
load:0x3fff001c,len:11904
ho 0 tail 12 room 4
load:0x40078000,len:23128
ho 0 tail 12 room 4
load:0x40080400,len:7300
entry 0x40080830
I (155) boot: Chip Revision: 3
I (155) boot_comm: chip revision: 3, min. bootloader chip revision: 0
I (86) boot: ESP-IDF release-PVT 2nd stage bootloader
I (86) boot: Enabling RNG early entropy source...
```

```
I (86) boot: SPI Speed      : 40MHz
I (91) boot: SPI Mode       : DIO
I (95) boot: SPI Flash Size : 16MB
I (100) boot: Partition Table:
I (103) boot: ## Label            Usage          Type ST Offset   Length
I (111) boot:  0 nvs_keys         NVS keys         01 04 0000f000 00001000
I (118) boot:  1 otadata          OTA data         01 00 00010000 00002000
I (126) boot:  2 phy_init         RF data          01 01 00012000 00001000
I (133) boot:  3 nvs              WiFi data        01 02 00013000 00007000
I (141) boot:  4 storage          WiFi data        01 02 0001a000 00010000
I (148) boot:  5 pdata            WiFi data        01 02 0002a000 00023000
I (156) boot:  6 xdata            WiFi data        01 02 0004d000 00023000
I (163) boot:  7 picFactory       unknown          44 56 00070000 00030000
I (171) boot:  8 pic_ota0         Unknown data     01 57 000a0000 00030000
I (179) boot:  9 pic_ota1         Unknown data     01 58 000d0000 00030000
I (186) boot: 10 edata            WiFi data        01 02 00100000 00100000
I (194) boot: 11 factory          factory app      00 00 00200000 00200000
I (201) boot: 12 ota_0            OTA app          00 10 00400000 00200000
I (209) boot: 13 ota_1            OTA app          00 11 00600000 00200000
I (216) boot: 14 test_fw          test app         00 20 00800000 00200000
I (224) boot: End of partition table
I (228) boot: Defaulting to factory image
I (233) boot_comm: chip revision: 3, min. application chip revision: 0
I (240) esp_image: segment 0: paddr=0x00200020 vaddr=0x3f400020 size=0x3b44c (242764) map
I (337) esp_image: segment 1: paddr=0x0023b474 vaddr=0x3ffbdb60 size=0x04b9c ( 19356) load
I (346) esp_image: segment 2: paddr=0x00240018 vaddr=0x400d0018 size=0x10751c (1078556) map
I (738) esp_image: segment 3: paddr=0x0034753c vaddr=0x3ffc26fc size=0x01154 (  4436) load
I (740) esp_image: segment 4: paddr=0x00348698 vaddr=0x40080000 size=0x00400 (  1024) load
I (745) esp_image: segment 5: paddr=0x00348aa0 vaddr=0x40080400 size=0x1ab6c (109420) load
I (802) esp_image: segment 6: paddr=0x00363614 vaddr=0x00000000 size=0x0c96c ( 51564)
I (821) esp_image: Verifying image signature...
I (1269) boot: Loaded app from partition at offset 0x200000
I (1269) secure_boot: bootloader secure boot is already enabled. No need to generate digest.
continuing..
I (1274) boot: Checking flash encryption...
I (1279) flash_encrypt: flash encryption is enabled (3 plaintext flashes left)
I (1287) boot: Checking secure boot...
I (1291) secure_boot: bootloader secure boot is already enabled, continuing..
I (1299) boot: Disabling RNG early entropy source...
Drinkworks
Drinkworks String Found
Bootloader Encryption Completed
Exiting Program

C:\Users\user\dw_ModelB\releases\v1.021>
```

[i] Two instances of “invalid magic byte” are related to the ESP ota flash partitions that are blank. The Red/Orange indications can be ignored.