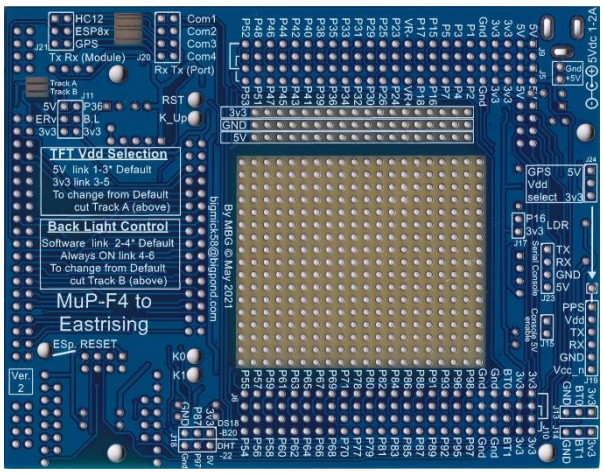
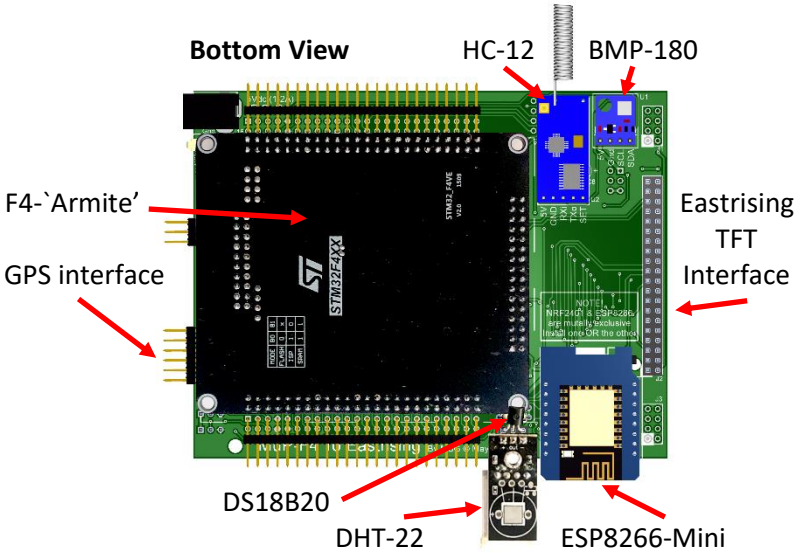
MuP-F4-EastRising TFT Display (F4-ER)

By Mick Gulovsen 5th June 2021 Ver 1.2

TOP View



Bottom View



MuP-F4-EastRising (Herein Called F4-ER)

The F4-ER board is an `All-in-One' board that was designed to fill a niche that I felt was not being met, there were several different adapters to interface to the amazing 9" and 7" Eastrising TFT panels, with resistive touch screen, but I saw almost nothing that had support for other useful modules and these had to be self-made from Vero or another suitable breadboarding platform. This is where F4-ER was born.

The F4-ER has the following features:

- Support for *Eastrising TFT with resistive touchscreen 9", 7" & 5" (5" and 7" not yet tested)*
- Support for *HC-12 Wireless Serial Transceiver module*
- Support for *ESP8266-Mini WiFi communications module*
- Support for *BMP-180 Barometric pressure and temperature module*
- Support for *DHT-22* (and possibly DHT-11) *Temperature and Humidity module*
- Support for *DS18B20 Temperature sensor*
- Support for a GPS module
- All F4 GPIO brought out the duplicate headers for external access to all pins
- Decent `Sea of Holes' Prototyping area (20 x 17 holes on 0.1" spacing)

The individual modules and sensors are designed to be mounted on the underside of the board to minimise the thickness of the `stack' but they can, possibly, be mounted on the top side if the modules are flipped from the orientation I have opted for (take care with pin positionings if you use this approach).
As most of these modules come with the header pins loose, the side to solder them to depends on which side of the F4-ER you wish to mount them to, for this document I will only address mounting on the underside of the board.

In all practicality, some of the modules may be better suited mounted externally, away from the F4-ER PCB via `DuPont' style wire leads.

F4

The STM32F407VET6 Development board (Herein called F4) is a powerful 32Bit ARM based processor that has many built in features that are useful as a platform to build a complete microcontroller-based system.

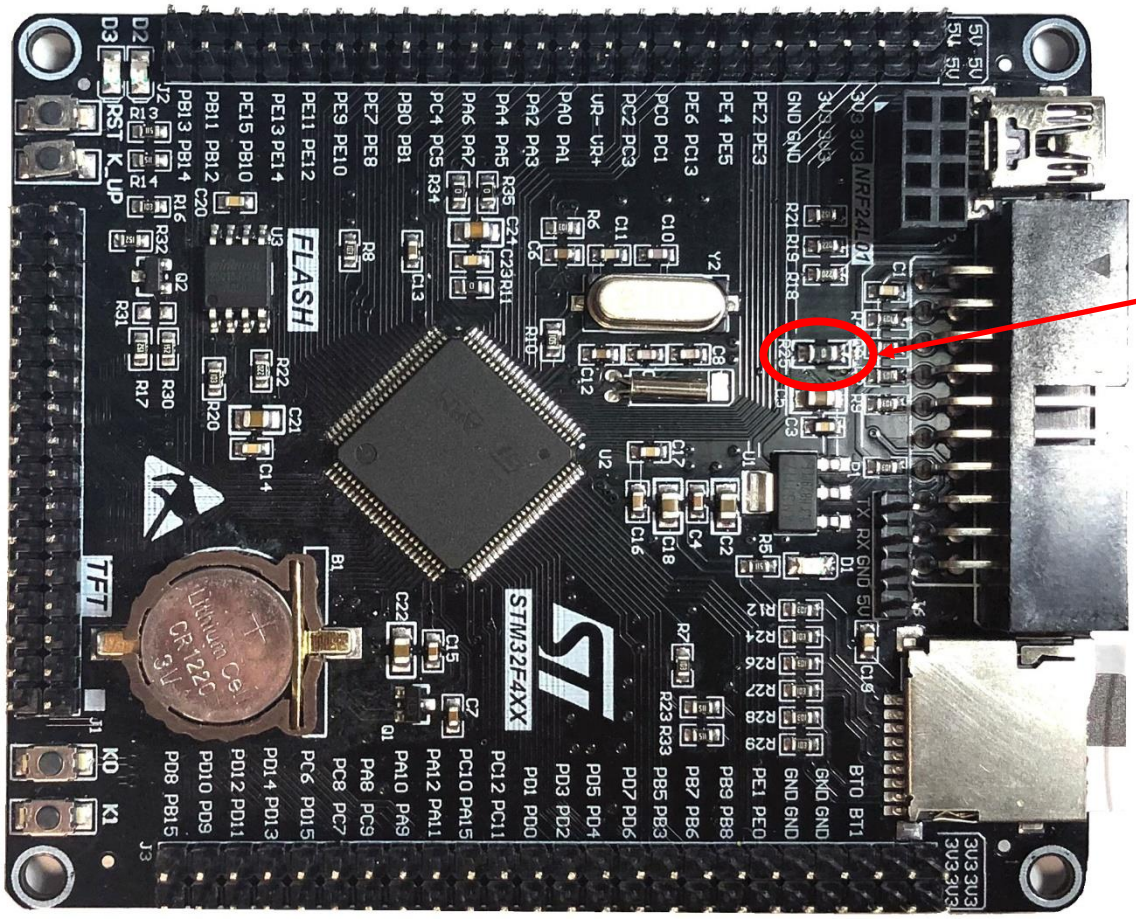
The F4 has preinstalled, many of the system ports needed for a complete system, such as, USB console, 4 x serial TTL ports, RTC with battery backup, SPI, TFT interface, uSD card and other useful interfaces.

A special thank you to Geoff Graham and Peter Mather, for MMBasic and for porting it to the F4 (Armite F4).
Also, thanks to Gerry Allardice for his work on the F4 manual and to members of `The Back Shed Forum' for their ongoing interest, contributions and support.

A complete description of the Armite F4 can be found by reading the F4 User manual linked to in Appendix A later in this document.

Warnings and cautions:

There are several very similar F4 development boards out in the market, some look identical to others but have female headers instead of male in some positions (and maybe vice versa). The image below is the model I chose for this design. If you happen to have one that has a connector with the opposite gender to mine simply install a header of the correct gender to suit your board.



It is ***essential*** to remove R25 from your F4 board before you install the F4 to the F4-ER PCB. Removing R25 removes 5V from the USB connector. The F4-ER will provide 5V to the F4 board and still allow the F4 USB console to work as well as allow firmware to be successfully flashed as required.

If you do not remove R25 you will have two sources of 5V connected together when you connect the USB to a PC or other device.

East Rising LCD

The F4-ER interfaces with the 40pin interface used on the 9” (and possibly 5” and 7” variants but these are not yet tested) TFT display panels with resistive touch screens.

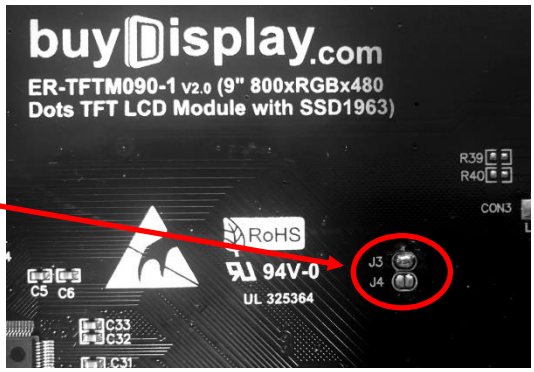
These panels may be purchased from buydisplay.com *(click link embedded in the name)*

Ordering criteria (these pertain to the 9” variant but will most likely be similar for 5” and 7”)

- Model No. ER-TFTM090-1, SSD1963 Controller (9” 800 x 480)
- Pin Header 8080 parallel interface
- Power Supply Vdd, 5.0V
- Resistive touch panel with controller
- Micro SD card not required so you may leave this field blank
- Font chip not required so you may leave this field blank

If you are going to control the backlight via software, Pin(36), you will first need to change the solder short jumpers J3 and J4 that are located roughly, top centre of the ER TFT board as shown.

- J3 Shorted
- J4 Open



The Modules

As mentioned, F4-ER supports several plug-in modules and sensors, I will go through each one here.
I have opted to use the convention of male pins to the module and female sockets for the F4-ER board. I am also opting to mount all modules to the underside of the F4-ER.
If you opt to mount these modules to the top side of the F4-ER (not recommended as this increases the overall `stack’ thickness by around 13mm), please be careful with the pin orientation and ensure that the module(s) will be oriented to connect to the correct pads on the F4-ER.

BMP-180

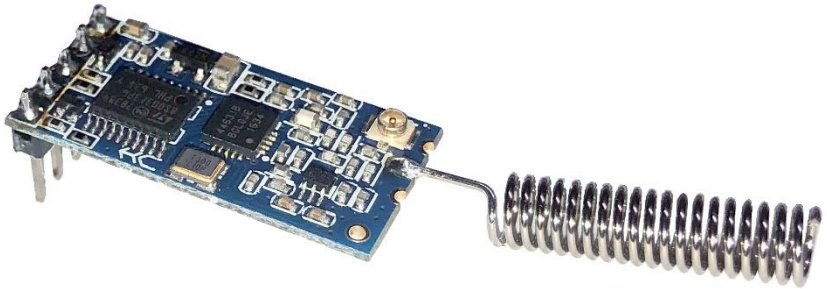
The BMP-180 is a cheap ($3US) sensor for measuring barometric pressure and temperature. *(up to +/- 1.5deg, typically +/- 0.5 deg)*
This module mounted in U1 position.

The module is very small at only 13mm x 10mm in size.

*Note Pins **DOWN** for mounting on the **underside** of the F4-ER board.*

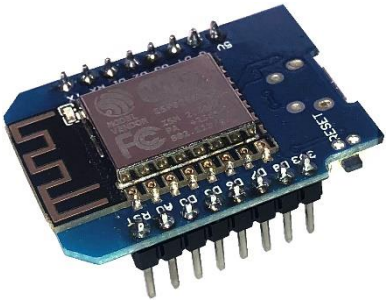
HC-12

The HC-12 is a cheap (sub $5US) wireless transceiver module that is often used for wireless board to board communication. With good line of sight, a pair can achieve successful communication over distances of up to 1000m. There is also a SET pin that whilst not implemented in the F4-ER has been brought out to convenient a pad for user access if so desired.
This module is mounted in U2 position.



The module is only 27.4mm x 13.2mm in size. *Note Pins **DOWN** for mounting on the **underside** of the F4-ER board.*

ESP8266-Mini (see also NRF2401 below)



The ESP8266-Mini is a cheap ($5US) ESP12 WeMos WiFi module that is excellent at enabling access to WiFi networks for embedded IoT applications. It also has 10 general IO pins that, whilst not implemented in the F4-ER have been brought out to convenient pads for user access if so desired.
There is a hole in the F4-ER to allow a non-conducting, implement access to the 'Reset' button on the module. It can also be reset by software, *via Pin(18)*.
This module is mounted in U3 position.

The module is only 34mm x 25.5mm in size.

*Note Pins **DOWN** for mounting on the **underside** of the F4-ER board.*

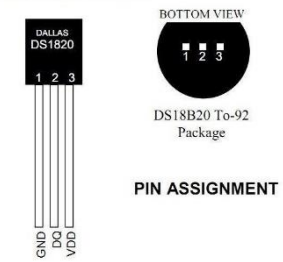
NRF2401 (see also ESP8266-Mini above)

The NRF2401 is a very cheap ($1-2US) wireless communication GFSK transceiver module. This module is natively supported by the F4 board. As it would not be possible to plug into the F4 once it is mounted to the F4-ER I have provided a `pass-through' so that it can be mounted where the ESP8266-Mini is. As a consequence, it is not possible to have both mounted on the underside at the same time. You could, possibly, mount the ESP8266-Mini on the top layer by soldering the ESP8266-Mini's pins on the opposite side to those shown above but this would make the entire assembly thicker by approximately 13mm.
This module is plugged into J22.

The module is only 34mm x 17mm in size.

Note Pins **DOWN** for mounting on the **underside** of the F4-ER board.

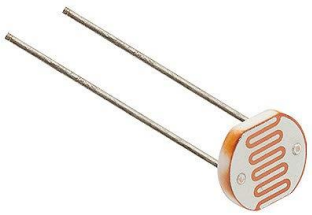
DS18B20



The DS18B20 is a cheap ($4US for Genuine, a few cents for clones) sensor for measuring temperature to a reasonable accuracy.

The chip is a standard TO-92 style package and its pinout is shown in the image to the right. In the F4-ER, Pin(87) is used for this device, it can be connected directly to J18 (if you wish to measure the temperature inside the case) or via leads to a convenient location of your choice.
This sensor is plugged into the inner pins of J18 on the underside of the board (Flat face towards the F4). The DQ pin is pulled high via R1 (4k7) on the F4-ER board.

LDR



The LDR, Light Dependant Resistor, is used to automatically DIM the ER display if you have the backlight configuration set for software control (see the description for J11 later in the document.)
The LDR is configured as a voltage divider with R3 (10K), depending on the type of LDR you have it may be necessary to change the value of R3 to get the range you require.

This device is plugged into J17 via wires to a suitable location to detect light level.

DHT-22 (also possibly DHT-11)

The DHT-22 is a cheap ($6-7US) sensor for measuring humidity and temperature

The module is quite small at only 41mm x 16mm in size (I had to remove the mounting tab to avoid fouling with the case that I chose).

*Note Pins **UP** for mounting on the **underside** of the F4-ER board.*

NOTE! There are at least two pinout options for this device that I have found. The one that plugs directly into the F4-ER board has a pinout as follows:

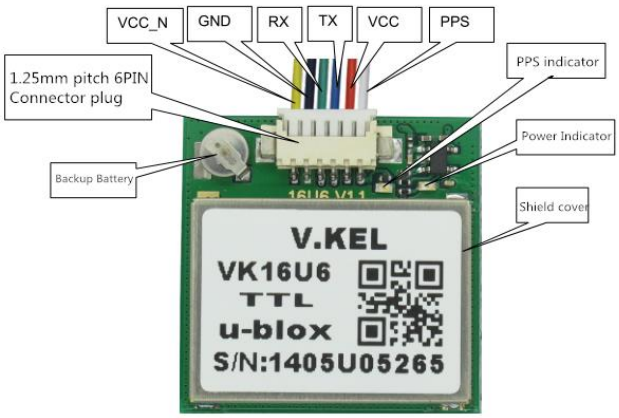
(L-R as shown)

1 Vcc (5V)
2 Signal --- Pin(97)
3 GND

Pin 2, is pulled high via R2 (4k7) on the F4-ER board.
This module is plugged into the outer pins of J18 on the underside of the F4-ER, however, it is most likely that this sensor will be mounted away from the project so any module pinout style can be used by connecting via a cable, obviously ensuring that the correct wire goes to the correct pin for your module.

GPS

The GPS module we used to test the F4-ER was a VK16U6 model, which appears to be superseded, but most modules should work. This particular module is 28mm x 28mm and most likely will be mounted off the board to optimise orientation and to provide as clear a view of the sky as possible. The modules generally come with attached leads (on a 1.25mm pitch) that need to be terminated.



One caveat I have with the GPS is it appears that some use the naming convention of TX/RX as pertaining to the MPU UART terms. On my first prototype I had Com4-TX going to GPS-RX and vice-versa. Requiring a swap of these wires to get the module to work. I have elected to keep their naming convention for this module ONLY, so Com4-TX will go to GPS-TX. **Confused?** **I know I am.**

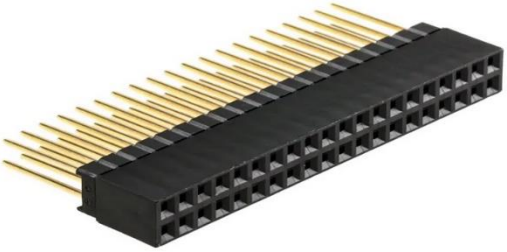
The Connectors

J1

J1 is designed to mate with JP1 on the Eastrising TFT panel, this is to access the ER onboard font/flash chip and is not used by the F4-ER board.
By using an 8pin 'Extended Leg' header similar to that mentioned in STEP 6 in the construction section of this manual J1 can be used to provide access to the font chip, if desired, and wires can be soldered on the top side of the F4-ER to access the chip.

J2

J2 is the main TFT connection to JP2 on the Eastrising panel, and is described in STEP 6 in the construction section of the manual.
J2 is an `Extended Leg' 40pin Female header (Element14 P/N 156923002)



J2 is on the underside of the board.

J3

J3 is designed to mate with JP3 on the Eastrising TFT panel, this is to access the ER onboard SD card and is not used by the F4-ER board.

By using an 8pin `Extended Leg' header similar to that mentioned in STEP 6 in the construction section of this manual J3 can be used to provide access to this SD, if desired, and wires can be soldered on the top side of the F4-ER to access the chip.

NOTE! The Eastrising's onboard SD card is not supported by MMBasic, so custom software will be required to use it.

J4

J4 is the TFT connection to the F4 board, this is on the underside of the board and is a 32pin header (usually female, to suit the F4 board you have)

J5

J5 is one of the main connections to the F4 board and picks up half of the GPIO pins as well as the power rails.

J5 is on the underside of the board and is a 48pin header (usually female, to suit the F4 board you have)

J6

J6 is the other one of the main connections to the F4 board and picks up half of the GPIO pins as well as the power rails.

J6 is on the underside of the board and is a 48pin header (usually female, to suit the F4 board you have)

J7

J7 is a `pass through' for the serial console connections (J6 on the F4 board) and picks up RX and TX and transfers them to J23 on the top of the board for access to the serial console if required. J7 is a 4pin header (usually female, to suit the F4 board you have)

J8

J8 is a pass through for the NRF2401 in case the user wishes to use it. All signals are passed through to J22 on the underside of the F4-ER board. J8 is an 8pin header (usually male, to suit the F4 board you have) mounted on the underside of the board.

J9

J9 is one of the 2 main connections to the GPIO. J9 is a 48pin header in parallel to J5 and can be either R/A male pins mounted on the underside of the board (to keep thickness to a minimum) or if thickness of the assembly is not an issue it can be mounted to the top side of the board and be straight or R/A at user's preference.

J10

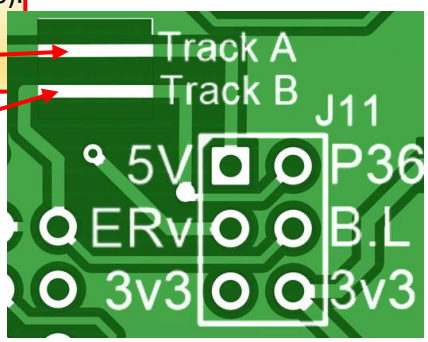
J10 is the other one of the 2 main connections to the GPIO. J10 is a 48pin header in parallel to J6 and can be either R/A male pins mounted on the underside of the board (to keep thickness to a minimum) or if thickness of the assembly is not an issue it can be mounted to the top side of the board and be straight or R/A at user's preference.

J11

J11 Allows the Power selection for the Eastrising panel to be selected (5V or 3v3) as well as the Backlight selection Permanently ON 3v3 or Software control via Pin(36).

NOTE! I have linked J11 to be defaulted to a 5V display and software controlled via Pin(36). As I have defaulted the 2 options, if you desire to change the display to operate from 3v3 then you will have to cut Track A (arrowed) and link ERv to 3v3.

If you wish to have the backlight permanently ON instead of controlled via software then you will have to cut Track B (arrowed) and link B.L. to 3v3.



These track locations have been left exposed and not covered by the solder mask to facilitate cutting if needed.

J12

J12 is a power source input from a 5Vdc power supply, this is an alternative to using the J16 (2.1mm) barrel jack.
Be aware of polarity when using this header as reverse connection could damage modules and the expensive ER panel.

J13

J13 is a duplication of the F4's BT0 to enable BT0 to be changed for flashing new firmware (bootloader mode) or setting to Run Mode.
BT0 to 3v3 is Bootloader mode, BT0 to GND is Run Mode. Refer to the Armite F4 manual linked to in Appendix A
I have spaced J13 & J14 apart so a small 0.1" mini switch may be used for BT0 if required (Do not fit a switch to J14).

J14

J14 is a duplication of the F4's BT1 to enable BT1 to be changed for flashing new firmware (bootloader mode) or setting to Run Mode.
BT1 to GND is Bootloader mode, BT1 Removed is Run Mode. Refer to the Armite F4 manual linked to in Appendix A

NOTE! *BT1 is normally pulled low so it isn't really required, I have allowed for it as a matter of completeness, do not fit a mini switch to J14 as by doing so will not allow BT1 to be left OPEN* ***--- just omit J14.***

J15

J15 is to isolate 5V from the 'pass through' of the serial console to J23.
As the F4-ER is normally powered from a 5Vdc supply there is no need to supply 5V when connected to the serial console so I removed 5V from J23. If, however you wish to use the serial console and 5V isn't being supplied to the F4-ER by any other means, linking J15 allows 5V to be connected using J23 to power the F4 for communications.

WARNING! Do not have 2 separate 5V supplies connected at the same time.

J16

J16 is the recommended method to supply power to the F4-ER board. The power source should be a 5Vdc centre +ve 1A-2A plug pack or similar with a 2.1mm connector.

J17

J17 is the connector for the LDR, mentioned above. I recommend a 2pin R/A male header, mounted on the top side of the F4-ER board, and DuPont wires to the LDR mounted, looking through a hole in the case, where it can `see' the level of ambient light so the backlight can be adjusted automatically.

J18

J18 is a 2x3 header generally female on the underside of the board (labelling is actually on the top) that the DHT-22 and DS18B20 sensors can attach to.

J19

J19 is the GPS header, this would generally be a R/A 6pin header that the GPS module would attach to. This is in conjunction with J24 for power selection for the GPS module (5v or 3v3). I have provided an extra pad to access the PPS pin if this is required for the user's application.

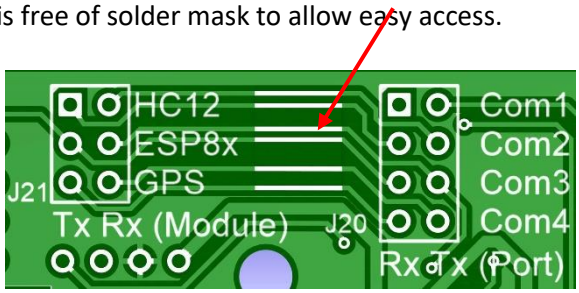
J20

J20 is a convenient header to locate all 4 Com ports RX and TX connections. RX and TX directions refer to the Com port. i.e., TX is Transmit OUT of the Com port and RX is Receive IN to the Com port.
I have linked these to defaults for the modules that use them. See the Com port assignment later in this manual as well as J21.

J21

J21 is a convenient location to locate the 3 modules that require a Com port to operate (HC12, ESP8266-Mini & GPS). RX and TX are directions as applicable to the Module. i.e., TX is Transmit OUT of the Module port and RX is Receive IN to the Module port. In a normal situation RX of the Module should connect to the TX of the Com port and vice-versa.

The 3 modules are pre-linked to Com2-Com4. If the user wishes to change these assignments, I have provided an easy area between J20 and J21 where the tracks can be cut allowing the modules to be relinked to ports the user prefers. This area is free of solder mask to allow easy access.



J22

J22 is a pass through for the NRF2401 in case the user wishes to use it. All signals are passed through to J8 on the underside of the F4-ER board. J22 is an 8pin header (usually female, to suit the NRF2401 board you have) mounted on the underside of the board.

J23

J23 is a `pass through' to J7 for the serial console. NOTE that 5V does not connect through to the F4 unless J15 is connected. See J15 for more information.

J24

J24 is a voltage selection for the GPS module. Select either 5V or 3v3 operation to use the GPS module.

Construction of the F4-ER

Construction of the F4-ER is very straight forward, the main selections are the gender of the headers to suit the particular F4 and the gender of your particular plug-in modules. The GPIO headers, J9 & J10, can be mounted either on the top or the bottom of the board, these are in parallel with the headers that plug into the F4 board (J5 & J6). In my case I opted to use R/A headers mounted on the bottom as I wanted the `sandwich' to be as thin as possible to fit into the case I chose, this also allows the pin numbers on the top of the board to not be obscured by J9 or J10. If mounting any module or header on the opposite side than suggested, take care with the pinout orientation.

In the following description I have used my defaults of F4 headers to suit the above image and all plug-in modules will have MALE pins so the F4-ER board will need FEMALES to suit.

Step 1:
Start by installing R1-R4 on the UNDERSIDE of the board, along with C1-C8 (mind polarity of C4 & C8) on the underside of the board. The Caps that are under the modules may need to lay flat, especially if using low profile headers.

Step 2:
Assemble the headers, that will mate with the F4 development board. I found it easier to insert the headers into the F4 and then fit to the F4-ER and solder each pin, this facilitates vertical alignment of the headers so you know the two boards will mate together perfectly.

The headers for this section are:

J4 2x16 Female J5 2x24 Female J6 2x24 Female J7 1x4 Female J8 2x4 Male (not required if not using NRF2401)

Step 3:
Decide whether you wish to use a 2.1mm Barrel Jack (recommended) or 2pin R/A header for your power input source, or fit both if that is your preference. Solder to the underside of the board.

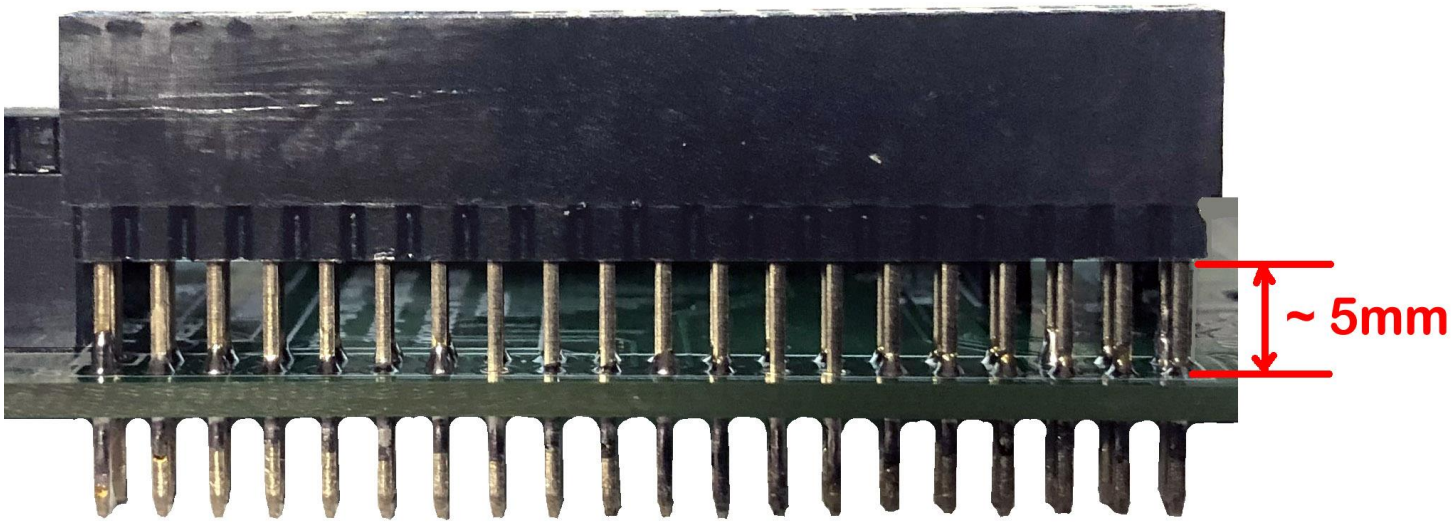
Step 4:
Fit headers for each of the modules to the underside of the board.

The headers for this section are:

U1 1x4 Female U2 1x5 Female U3 1x8 Female (x2) ***ignore if installing NRF2401*** **J18 2x3 Female**

Step 5:
If using the NRF2401 fit a **2x4 Female** to J22. You may ignore this header if not using the NRF2401.

Step 6:
Install your modules so that you can see how much you need to extend header J2 so that the modules clear the rear of the Eastrising TFT panel, in my case I had to extend the header by 5mm.
I used standard Male and Female headers, if you chose to use low profile headers you may only need to extend J2 by a couple of mm.



Step 7:
Remove all modules and your F4 from the F4-ER and using a meter check that you have no shorts between GND and 5V (or 3v3). If all looks OK and the build looks fine, plug in your F4 module and apply 5Vdc to the F4-ER board and check the 5V and 3v3 rails.
If all of the above looks great then connect your PC to the F4 via the USB console and you should be able to communicate with the F4 using TeraTerm or your favourite terminal program (See the F4 manual for details on how to flash the F4 and using the console)

If you are happy, disconnect the power and plug in your modules and the ER display.
Once again apply 5Vdc power and check the voltages for 5V and 3v3, if all looks good it is time to start programming your F4 and having some fun.

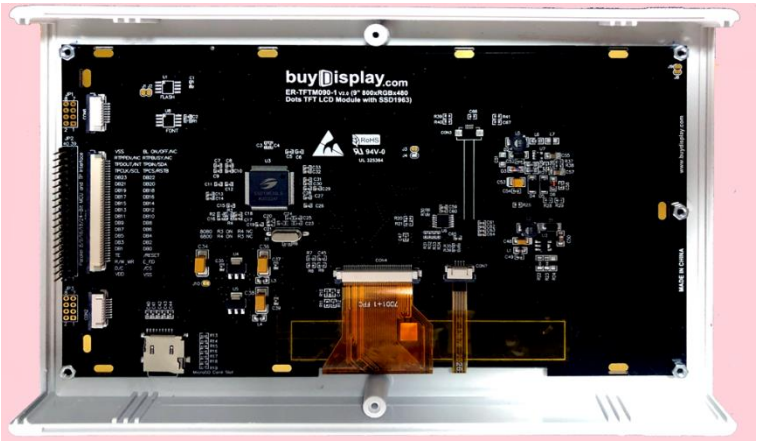
Andrew_G has written some pretty cool test code to put the F4-ER through its paces.
See the link to his work in APPENDIX A of the document.

Case

What case and how you want to mount your new ER panel and its attached boards is entirely up to individual choice.

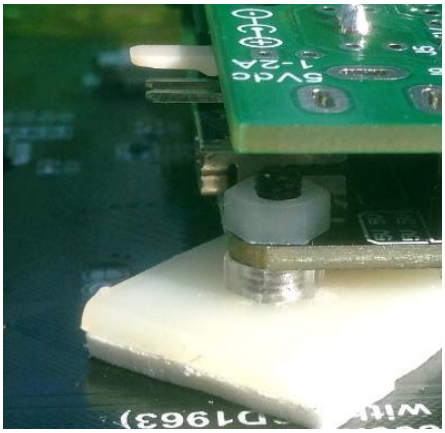
I chose to use a Hammond 250mm x 160mm x 40mm case (model 1598FS) that I thought was quite attractive both visually and price wise. These are available from Element14/Farnell part # 1426558 and no doubt from other places. The ER Panel just fits between the binding posts of this case and is probably the smallest case available to suit the 9” screen, the F4-ER board and all modules.

I cut the opening to suit the screen and then made a fascia out of a thin black opaque cover from a `loose leaf sleeve binder' that is very cheap and available at just about all stationary stores. This actually made the front look quite professional.



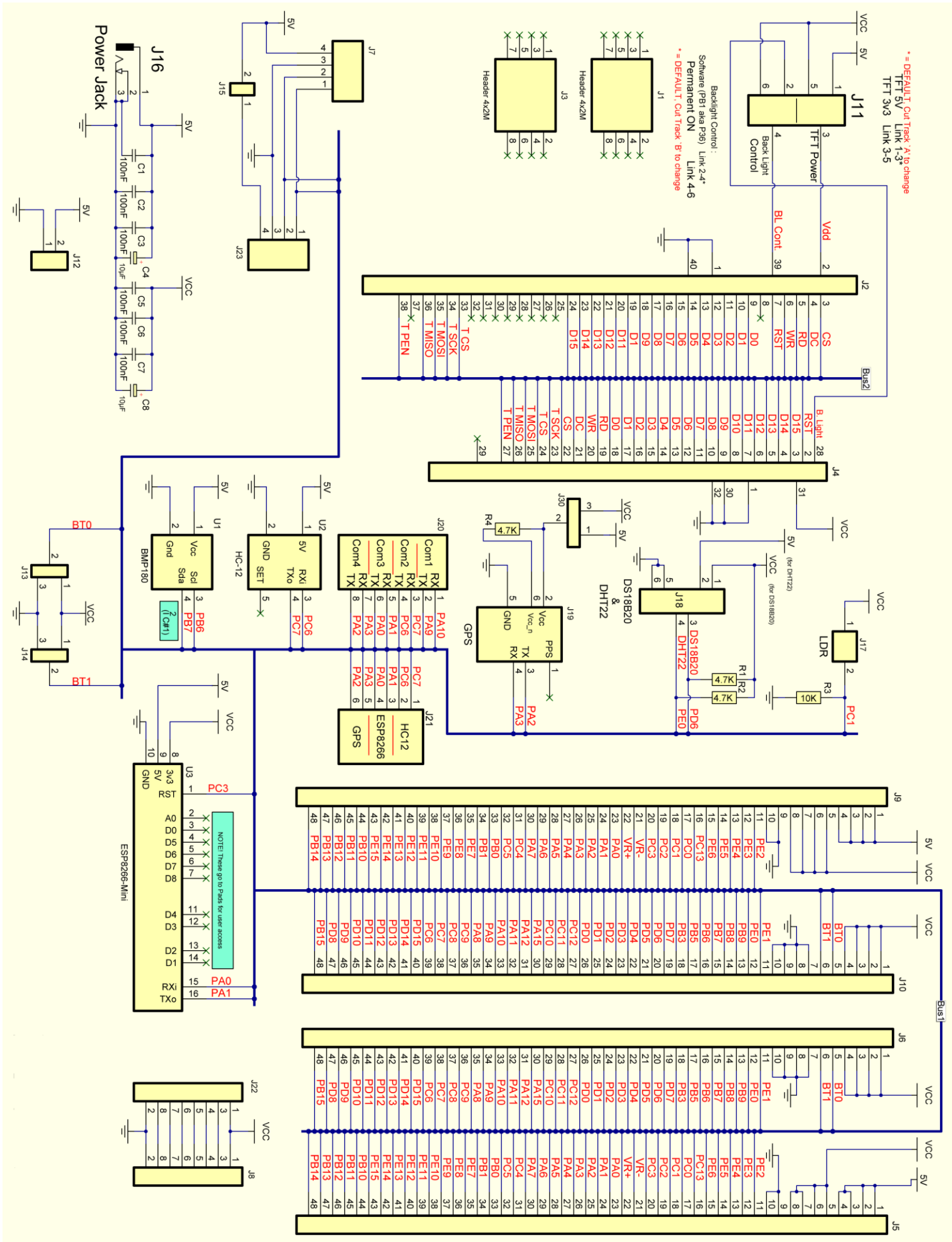
You can drill mounting holes for the ER display and counter sink them so that the screws stay below the surface and are covered by the fascia after it is glued into place.

In my case I opted to use some screws I had on hand that had large and very flat heads that I super glued in place. I don't really recommend this but it actually holds extremely well.



The 40pin header holds one end of the F4-ER quite well to the ER panel and a small modified `sticky standoff' with a screw and nut attached to the F4 mounting hole, near the USB connector, and stuck to the rear of the ER panel seems to hold the assembly quite well.

Schematic


Power Jack
J16
J11
TFT Power
Back Light Control
Backlight Control : Software (PB1 aka P36) Link 2-4* Permanent ON Link 4-6
* = DEFAULT, Cut Track 'B' to change
* = DEFAULT, Cut Track 'A' to change
TFT 5V Link 1-3*
TFT 3v3 Link 3-5
Header 4x2M
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
J12
J13
J14
J15
J17
J18
J19
J20
J21
J22
J23
J30
Bus1
Bus2
BL Cont.
Vdd
CS
DC
RD
WR
RST
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
T PEN
T MISO
T MOSI
T SCK
T CS
B_Light
C1
C2
C3
C4
C5
C6
C7
C8
100nF
10µF
BMP180
HC-12
GPS
ESP8266
ESP8266-Mini
DS18B20 & DHT22
LDR
R1
R2
R3
R4
4.7K
10K
BT0
BT1
U1
U2
U3
PC1
PC3
PA0
PA1
PA2
PA3
PA9
PA10
PB6
PB7
PC6
PC7
NOTE! These go to Pads for user access

Default Com Port Assignments

Port #	Assigned to
Com 1	Serial Console
Com 2	HC-12
Com 3	ESP8266-Mini
Com 4	GPS

IO Used on F4-ER

Pin(x)	F4 Name	ER-F4 Connector	MMBASIC Function	Goes to
16	PC1	J5-18	PIN(16)	LDR
18	PC3	J5-20	PIN(18)	ESP8266-RST
23	PA0	J5-23	COM3-TX	ESP8266-RX
24	PA1	J5-24	COM3-RX	ESP8266-TX
25	PA2	J5-25	COM4-TX	GPS-TX (pin3) * See Manual
26	PA3	J5-26	COM4-RX	GPS-RX (pin4) * See Manual
36	PB1	J5-34	LCD_BL	ER PANEL
63	PC6	J6-39	COM2-TX	HC-12-RX
64	PC7	J6-38	COM2-RX	HC12-TX
68	PA9	J6-34	COM1-TX	SERIAL CONSOLE
69	PA10	J6-33	COM1-RX	SERIAL CONSOLE
87	PD6	J6-20	PIN(86)	DS18B20
92	PB6	J6-16	1^2C-SCL	BMP-180
93	PB7	J6-15	1^2C-SDA	BMP-180
97	PE0	J6-12	PIN(97)	DHT-22

Pin(x) Number to Pin Name Look-Up Table

NOTE! Missing numbers are not accessible from MMBasic (ie GND, 3v3 or Vcap etc.)

Pin(x)	F4-Name	Pin(x)	F4-Name	Pin(x)	F4-Name
1	PE2	39	PE8	68	PA9
2	PE3	40	PE9	69	PA10
3	PE4	41	PE10	70	PA11
4	PE5	42	PE11	71	PA12
5	PE6	43	PE12	72	PA13
6	Vbat	44	PE13	76	PA14
7	PC13	45	PE14	77	PA15
8	PC14	46	PE15	78	PC10
9	PC15	47	PB10	79	PC11
15	PC0	48	PB11	80	PC12
16	PC1	51	PB12	81	PD0
17	PC2	52	PB13	82	PD1
18	PC3	53	PB14	83	PD2
23	PA0	54	PB15	84	PD3
24	PA1	55	PD8	85	PD4
25	PA2	56	PD9	86	PD5
26	PA3	57	PD10	87	PD6
29	PA4	58	PD11	88	PD7
30	PA5	59	PD12	89	PB3
31	PA6	60	PD13	90	PB4
32	PA7	61	PD14	91	PB5
33	PC4	62	PD15	92	PB6
34	PC5	63	PC6	93	PB7
35	PB0	64	PC7	95	PB8
36	PB1	65	PC8	96	PB9
37	PB2	66	PC9	97	PE0
38	PE7	67	PA8	98	PE1

Bill of Materials

Part No.	Description	Layer (suggested)	Comments
C1	100nF	Bottom	small monolythic 0.1" spacing
C2	100nF	Bottom	small monolythic 0.1" spacing
C3	100nF	Bottom	small monolythic 0.1" spacing
C4	10µF	Bottom	Tantalum 10-16v 0.1" spacing
C5	100nF	Bottom	small monolythic 0.1" spacing
C6	100nF	Bottom	small monolythic 0.1" spacing
C7	100nF	Bottom	small monolythic 0.1" spacing
C8	10µF	Bottom	Tantalum 10-16v 0.1" spacing
J1	Header 4x2	Bottom	0.1" spacing NOT REQUIRED
J2	Header 20x2 Female - EXTENDED LEGS	Bottom	0.1" spacing
J3	Header 4x2	Bottom	0.1" spacing NOT REQUIRED
J4	Header 16x2 Female	Bottom	0.1" spacing
J5	Header 24x2 Female	Bottom	0.1" spacing
J6	Header 24x2 Female	Bottom	0.1" spacing
J7	Header Header 4x1 Female	Bottom	0.1" spacing
J8	Header Header 4x2 Male	Bottom	0.1" spacing NOT REQUIRED if no NRF2401
J9	Header 24x2 Male R/A	Bottom	0.1" spacing
J10	Header 24x2 Male R/A	Bottom	0.1" spacing
J11	3x2	Top	0.1" spacing NOT REQUIRED
J12	Header 2way Male R/A Latching Header	Bottom	0.1" spacing
J13	Header 3x1 Male (or mini switch)	Top	0.1" spacing
J14	3x1		0.1" spacing NOT REQUIRED
J15	Header 2x1 Male	Top	0.1" spacing
J16	2.1mm Power Jack	Bottom	0.1" spacing
J17	Header 2x1 Male R/A	Top	0.1" spacing
J18	Header 3x2 Male	Bottom	0.1" spacing
J19	Header 6x1 Male R/A	Top	0.1" spacing
J20	4x2		0.1" spacing NOT REQUIRED
J21	3x2		0.1" spacing NOT REQUIRED
J22	Header 4x2 Male	Bottom	0.1" spacing NOT REQUIRED if no NRF2401
J23	Header 4x1 Male R/A	Top	0.1" spacing
J24	Header 3x1 Male R/A	Top	0.1" spacing
R1	4.7K 250mw	Bottom	
R2	4.7K 250mw	Bottom	
R3	10K 250mw	Bottom	
R4	4.7K 250mw	Bottom	
U1	Header 4x1 Female (For BMP-180)	Bottom	Pressure/Temperature Sensor
U2	Header 5x1 Female (For HC-12)	Bottom	Serial Wireless Transceiver
U3	Header 8x1 (x2) Female (For ESP8266-Mini)	Bottom	WiFi module

Note 1

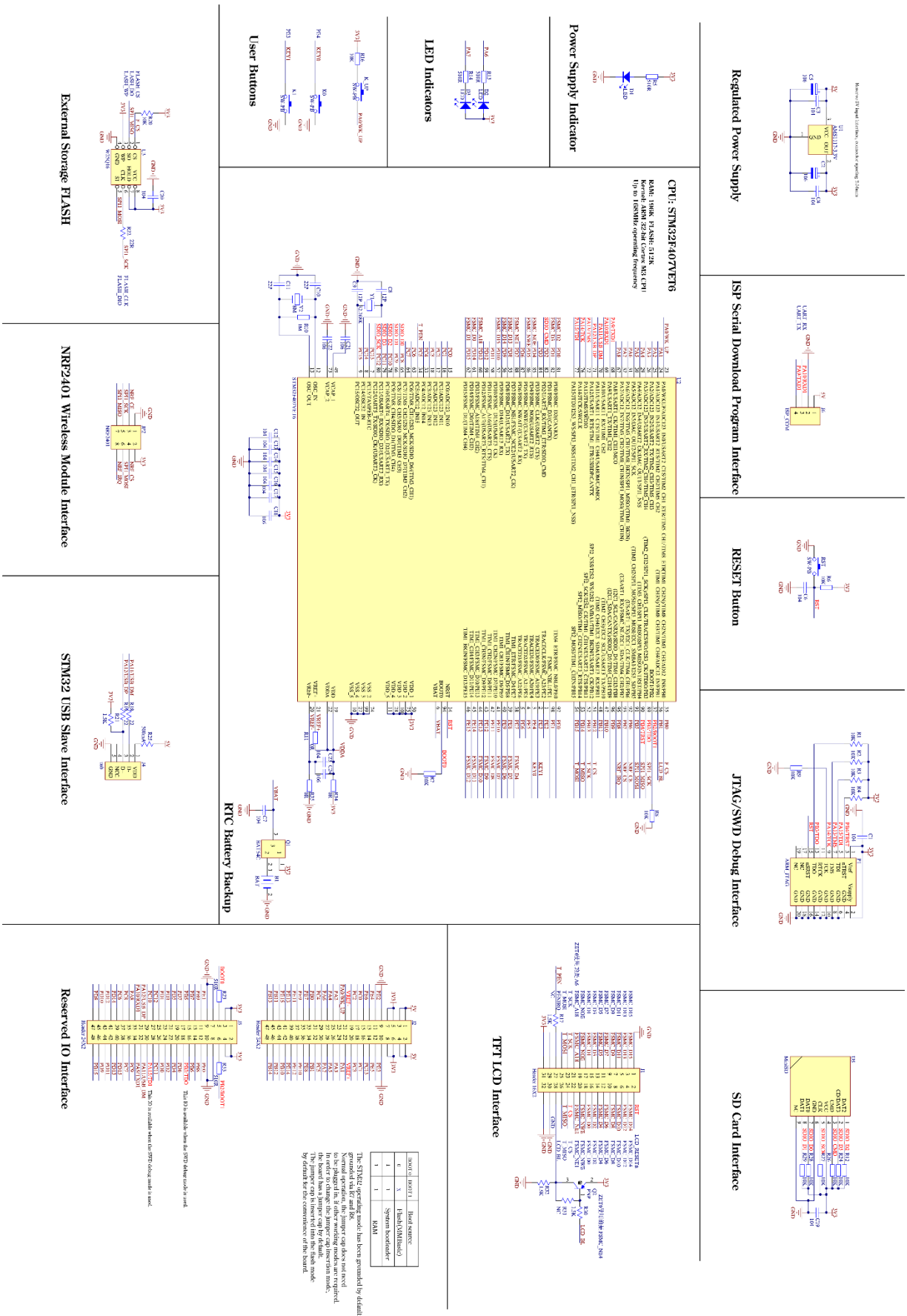
Several parts are not needed in the standard build. Consult the Connectors section of the manual for more information.

Note 2

Some (uncommon) F4's may have different sex headers. Consult the F4 section of the manual for more information.

APPENDIX A

English Schematic for STMF407VET6 (F4)



APPENDIX B

Useful Links and information pertaining to The Armite-F4 and MMBasic

My repository of files related to the F4-ER

https://www.dontronics.com/micks-mite/files/17%20MuP-F4-EastRising/

Andrew_G's test and evaluation software for the F4-ER

https://www.dontronics.com/micks-mite/files/17%20MuP-F4-EastRising/F4-ER%20Test.zip

Andrew_G's test and evaluation software User Manual

https://www.dontronics.com/micks-mite/files/17%20MuP-F4-EastRising/F4-ER%20Test%20Manual.pdf

Manual for the ARMITE F4: (Draft 3)

http://www.thebackshed.com/forum/uploads/disco4now/2021-03-02_204557_Armmite%20F4%20Manual.pdf

Thread on TBS forum relating to the Manual for the ARMITE F4

http://www.thebackshed.com/forum/ViewTopic.php?TID=13542&P=1

Firmware for the F4 released by Peter Mather for the F4: (latest towards the Rear of Thread)

http://www.thebackshed.com/forum/ViewTopic.php?FID=16&TID=13523

Geoff Graham's site containing all things MMBasic related (except the F4 apparently).

https://geoffg.net/

The Back Shed Forum, Microcontroller sub group

http://www.thebackshed.com/forum/ViewForum.php?FID=16

A shameless plug for my repository of files showing my repertoire of PCB offerings.

https://www.dontronics.com/micks-mite/files/

Acknowledgements

I wish to acknowledge and thank the following people for their work and support, without which the MuP F4-EastRising would never have existed.

Geoff Graham.	For his creation of MMBasic and tireless efforts supporting it for the last 10 years.
Peter Mather.	Peter has picked up from Geoff and ported MMBasic to many devices, F4 is just one of them.
Andrew Garrett.	For pointing me at the F4 and his constant haranguing of me to add more and more features to the F4-ER and for writing a very professional demonstration program to test it.
Gerry Allardice.	For his efforts in writing and maintaining the Manual for the F4 `Armite'
Glenn Littleford.	For running and maintaining `The Back Shed' Forum
Don McKenzie.	For his many years of slapping the back of my head and teaching me all that I know about electronics and micro-chips, whilst blowing smoke in my face and forcing me to drink his beer (which was ALWAYS ICE cold).
Dontronics.	Sadly, no longer running as a viable business but still continues, in name, to allow me to have a point of presence on the internet by hosting all of my files.
Sue Gulovsen.	My darling Wife, who puts up with me spending our retirement money on silly little green fibreglass boards and tiny black things with little, sharp legs sticking out of them that constantly find their way onto the floor to be stepped on by our bare feet.