Armmite F4 Hydra

Armmite F4 to SSD1963 Piggyback Adapter

Document revision 1.0

Hydra is designed to fit entirely behind a SSD1963 display and a Armmite F4 in such a manner that the IO pins of the Armmite are still easily available for connections. The complete assembly can be mounted behind a front panel using the display's fixing points. If you have used this combination previously you'll already be familiar with the fact that the display and FMSC connector pins run in opposite directions. Hydra takes care of this problem.

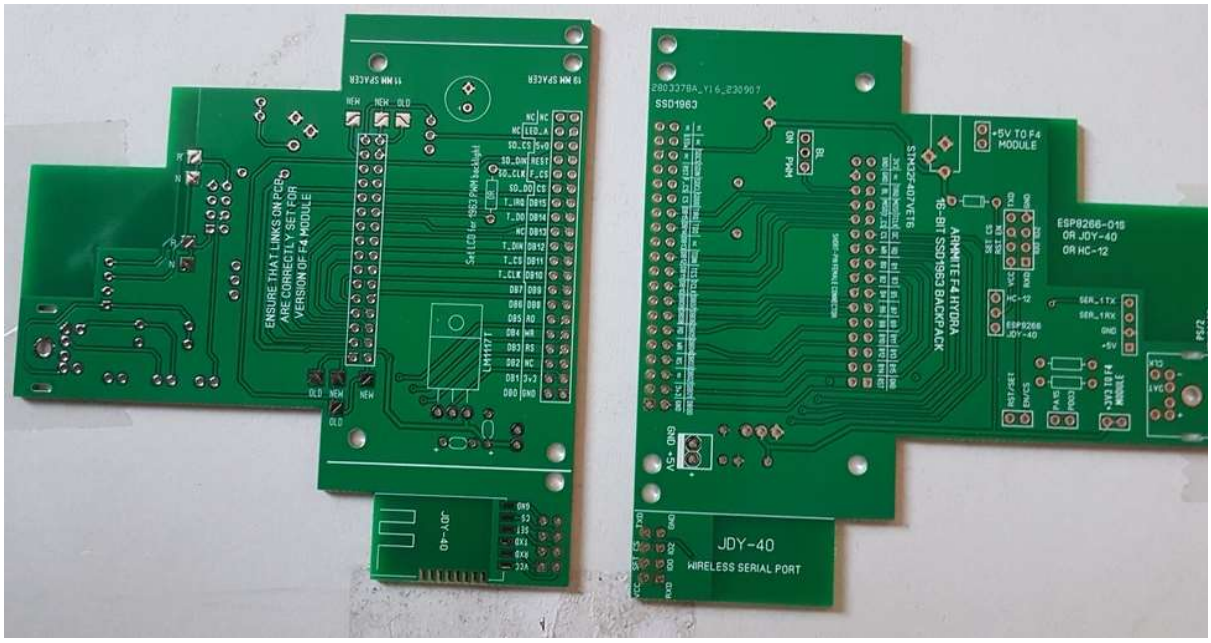
Hydra has the following facilities:

- Can be fitted to 4.3, 5 or 7 inch displays .
- Can be used with both the "New" and "Old" FMSC connector pin layout.
- Has space to install a PS/2 keyboard connector and pullup resistors.
- 5V input can be from a 3.5mm barrel jack, a 2-pin JYK connector or the USB supply to the Armmite.
- Can power the larger displays at 5V.
- Has a built-in regulator to power the display backlight.
- Can provide 3V3 from the above to power the Armmite.
- Has space for an 8-pin female connector which is directly compatible with the ESP8366-01S.
- An adapter PCB is attached which allows a JDY-40 to be used in the above.
- VCC for the above can be selected as 5V (via a 1N400x diode) or 3V3.

Having said all that, please be aware that this board is a *prototype* and does have its problems (that's why you make prototypes, to sort out the problems. :)). I've done this as a prototype because I didn't want to put anyone else's Armmite or SSD11963 at risk.

- It is *very* difficult to access the K0, K1, K_UP and RST buttons on the Armmite with Hydra attached. Some may see this as an advantage. :)
- For a neat job you have to be a little creative in getting 3V3 from the backlight regulator to the Armmite.
- The Armmite / Hydra assembly is a little too long to fit a 4.3 inch display properly. Unfortunately the display and Armmite fixing holes don't quite line up closely enough to be useful.
- How you fix down the free end of the Armmite is up to you. It will vary with the display size and what components are in the way. I would recommend using, as a minimum, some sort of insulated spacer as there is only about 5mm between the two PCBs.
- The 3V3 barrel jack obscures some of the IO pins (it is optional though).
- The SD card socket connections for the display are not brought out for the user.
- All the PCB cuts are in bad places, giving a real risk of breaking through fixing holes, especially if using a 4.3 inch display. There is little I can do to fix this, unfortunately.
- The backlight ON position doesn't work as there is no 3V3 supply to it!
- The PS/2 keyboard gets it's supply from the +5 pin of the serial port connector. If you want to power the Armmite at 3V3 then you should probably link it to the 5V supply on the Hydra.
- The holes for the serial port connector are too small for standard male header pins. DOH!
- I didn't include pads to solder the PS/2 connector shell down. :(

The above problems notwithstanding, I'm more than happy with the way it turned out. A Version 2, should it eventually appear, would take them into account and would probably have more integrated functions.



FRONT VIEW REAR VIEW

For reference purposes the RH view will be referred to as the Rear of the PCB as it is what you see from the rear of the completed assembly.

On receiving the PCB the first task is to cut away the JDY-40 adapter. The cutting line is shown on the Rear of the PCB.

After this, only if you are using a 4.3 inch display you can cut away the two strips marked on the Front of the PCB. If you don't mind the Hydra protruding you can, of course, leave these on. If your display is larger than 4.3 inches then leave them on.

Now you need to investigate the contents of the fixings kit.

2x 18mm M3 MF metal pillars
2x thick metal washer
2x 11mm M3 MF plastic pillars
6x 5mm M3 MF plastic pillars
2x M3 metal screw
6x M3 metal nut
4x M3 shakeproof washer
1x Short pin 2x16 female header for Armmite F4
1x Long pin 2x20 female header for SSD1963

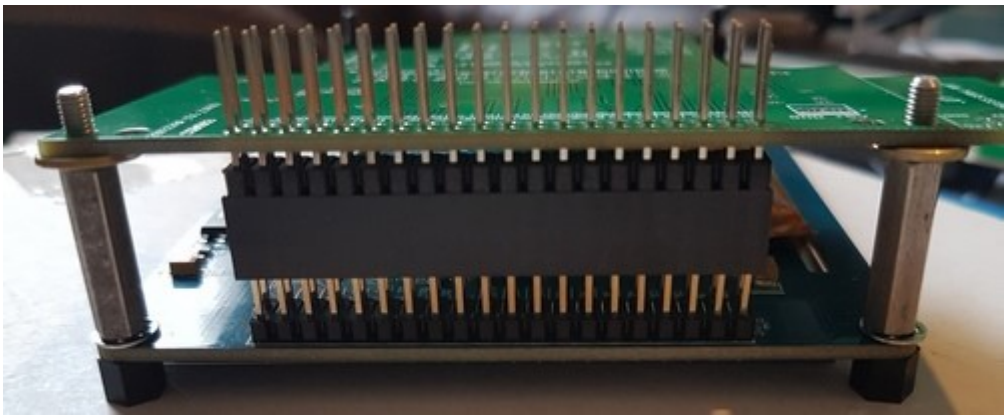
The Armmite F4 header can be soldered in position on the Front of the PCB. Do not solder anything else at this stage. The silkscreen outline is visible from the insertion side.

Thread the pins of the 2x20 female header through from the Front of the PCB.

Asssemble the two 18mm pillars onto the display fixing points, fastening them with a 5mm plastic pillar from the front and a shakeproof washer on the rear of the PCB. Put one of the thick steel washers onto each pillar stud. You can manage without the thick washers, but it's more fiddly trying to fix the other end. 19mm pillars would have been better but I hadn't got those.

Assemble two 5mm pillars at the other end of the display, the front one being secured by a shakeproof washer and a second 5mm pillar.

Offer the Hydra PCB onto the studs on the rear of the 18mm pillars. You will need to wriggle the female header a little to get it to locate onto the display header. Now push the header fully down onto the display connector. This is not particularly easy but I found it easier than trying to align the Hydra PCB onto the connector pins after plugging it in.



With the Hydra now on the pillars, fit M3 nuts to hold it in position. At this stage you can solder the connector and cut the pins down to length. Hint - don't use your best component lead "nippers" for this as those pins are pretty hard. And sharp! I held each one in position with a bit of sleeving while cutting it. It saves your fingertips and prevents the things from reaching escape velocity.

BEFORE SOLDERING MAKE SURE THAT YOU HAVE THE HYDRA PCB THE RIGHT WAY UP! The silkscreen for the GND / +5V connector must be visible.

You can now remove the nuts and unplug the Hydra assembly from the display. This takes some effort, particularly with a new connector. Just take your time and wriggle the boards slightly.

Now you need to add some components to the Hydra.

There is a 0R link to be fitted on the Front of the PCB. I used a simple wire link.

There are two 4K7 resistors and a socket to be fitted if you want the PS/2 keyboard option.

The regulator won't dissipate much heat so mount it parallel to the PCB and spaced away from it by a couple of mm or so. The two capacitors below it are 10uF tantalum electrolytic types. Anything from 6V upwards in working voltage will do. The capacitor above the regulator position is optional, but may be needed for a 7" display. 47uF-100uF 10V would be suitable.

You will need to prepare the Hydra board for your Armmite F4 before it can be used. Have a look at it and, if it says NEW-TFT on it put solder blobs in all the positions marked NEW on the front of the Hydra PCB. If it says OLD-TFT or makes no mention of new or old then put solder blobs in the OLD positions. The solder blob pads marked N and R should be ignored.

You will also need to configure the backlight control. On the SSD1963 the BACKLIGHT CONTROL link should be set to 1963_PWM. The Hydra board can be linked to PWM to give an adjustable backlight or ON to force it to full brightness.

The Armmite F4, by default, is set to use a ILI9341_16 parallell display. You will need to connect it to a terminal and use OPTION DISPLAY DISABLE to remove it, otherwise the system won't boot when connected to the SSD1963.

POWER SUPPLIES

By a happy stroke of luck, the Armmite F4 exposes its 5V rail on one of the serial port pins. If you link this to one of the Hydra pads marked "+5V TO F4 MODULE it will provide power from the USB connector to the input of the backlight regulator on the Hydra. This works fine for me, but it will depend on the capabilities of the user's USB port.

Another approach is to power the Armmite F4 from the backlight regulator of the Hydra. The simple way to achieve this is to connect one of the pads marked +3V3 TO F4 MODULE to one of the 3V3 pins of the Armmite F4. A slightly more complex, but less visible way, is to connect the centre pin of the regulator to the top (ON) pin of the backlight link using a wire link.

Another approach is to use independent supplies for the display and Armmite F4. This is the only option with the bigger displays as they require a 5V supply and an unmodified Armmite does not isolate the USB supply. This can be got round by either removing R25 from the Armmite (the circuit shows it as a 500mA fuse but it's usually a 0R link) or by replacing it with a Schottky diode. 5V can be fed into the Hydra board via a JYK connector or a 3.5mm barrel jack. Either of these will power the input to the backlight regulator.

OPTIONS

The 8-pin connector for communications boards is connected to PA9 / TXD1 and PA10 / RXD1 and are accessible as COM1. Other signals for this connector are available for connection to any suitable pins by the user.

FINAL ASSEMBLY

Place the display face down on the table.
Place the Armmite F4 face up on the table.
Fit the two 11mm pillars into the Hydra on each side of the Armmite connector and secure with M3 nuts.
Plug the Hydra board down onto the Armmite then fix the bottom ends of the pillars with M3 screws.
Plug the Hydra board down onto the display and secure it onto the pillars with M3 nuts.

If using a 5" display you can make some very nice supports for the free end of the Armmite from bits of PCB. Cut two pieces 12mm x 20mm. Drill 3mm holes at two opposite corners. they should ideally be on 14mm centres. Fix one corner underneath the Armmite and the other goes over the 5mm spacer stud. No doubt something similar could be done for a 7" display.

COMMENTS

For those wondering about the name Hydra: It comes from two things, it's ability to be expanded to many IO via the ESP8266 connector and the fact that it's a bit of a beast. :) I now have designs for adapters for JDY-40 and HC-12, with a preliminary design for RS485 simplex. All fitting the same connector. RS485 duplex is a possibility and could run extremely fast on the Armmite F4.

Note that the NRF24L01 module can still be fitted with the Hydra PCB attached.

JDY-40 OPERATION

This is simple in use but a little more difficult to configure. I recommend that you download the JDY-40 manual from the internet as it's very useful.

First, what is it? It's a microcontroller with a built-in 2.4GHz transceiver intended to be used for low power operation on the part of the band that doesn't require licencing. This part of the band is where ordinary 2.4GHz wireless mice and keyboards live, and garage door openers and a host of other low power devices. The JDY-40 is actually fairly crude in that it's operation is unencrypted and there is no automatic message acknowledgement or error checking. There are better devices available if these are required. However, it's insanely cheap, easy to interface and you needn't feel bad about blowing a couple up!

When configuring it you connect t it via a COM port and send it AT commands (just like an old modem) to which it makes various responses. You have to force it into configuration mode by connecting its SET pin to GND. This can be done manually or via a GP pin.

The intention is to provide a configuration program which can be used to make the process easy, but this has not yet been written. :)

Output power is a bit confusing with the JDY-40. The specification for the chip used only lists four power levels: -10dBm, -5dBm, 0dBm and +5dBm yet the spec lists ten possibilities! However, there is no RF power stage so the maximum output is *probably* only about 3.2mW which is well within legal limits. By default the power is set to maximum. I tried setting it to minimum and still got a range of over 8m in digital mode. By running at the lowest usable power you can run more devices on adjacent (or close) channels without them interfering with each other.

This device covers the range 2400MHz to 2483.5MHz using 128 channels. Unfortunately there are only 14 agreed channels in the world for this use. They also overlap, just to make life more difficult! (Technical bit: The channels are on 5MHz centres and are 22MHz wide with a 5MHz guard band between them.)

The legal channels are as follows:

Channel	Frequency(MHz)	JDY-40_channel (estimated)
1	2412	12
2	2417	17
3	2422	22
4	2427	27
5	2432	32
6	2437	37
7	2442	42
8	2447	47
9	2452	52
10	2457	57
11	2462	62
12	2467	67
13	2472	72
14	2484	84

Note: Channels 12,13 & 14 (JDY-40 67, 72 & 84) should not be used in North America as output power exceeds the legal maximum above 2483.5MHz. Only Channel 14 is actually banned in law, 12 and 13 can be used if power is very low. In Canada Channels 1 to 11 are full power and channel 12 has restricted power. Channels 13 and 14 are not available.

If using several devices in the same area their frequencies overlap, so ideally you should use them in non-overlapping frequency groups (JDY-40 RF channel numbers in brackets):

1, 6, 11, 14	(12, 37, 62, 84)
2, 7, 12	(17, 42, 67)
3, 8, 13	(22, 47, 72)
4, 9, 14	(27, 52, 84)
5, 10, 14	(32, 57, 84)

However, Channel 6 is usually used for Wi-Fi installations ...

There are further restrictions in some other countries such as Spain and France.

By default the JDY-40 is in wireless serial port mode . You can then connect to it via COM1 at 9600 baud. It is a simplex device so you can't transmit and receive at the same time. The serial modem mode is:

A0 Serial port transparent transmit / receive. This is the default for a new device and is the only useful mode here.

It is possible to use these modules with several transmitters or receivers as the Device ID can be set to be unique for each. All receive devices on the same frequency and with the same Device ID will respond to the same transmission. Likewise, by using the SET pin you can dynamically reprogram them to be either transmitter or receiver.

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