Allstar Radio Interface, ARA-1, ARA-1+ Instruction Manual

Two new models of USB FOB's the ARA-1 and the ARA-1+ are now being produced for Allstar interfacing. They both offer easy to interface radio ports. The ARA-1+ extended GPIO model has all unused GPIO bits available. The boards also have a COS indicator which can be configured to show receive signal. Here are the key features.

- Boards use genuine CM119B crystal-less chips with 8 bit GPIO
- Excellent audio quality and stability
- Option for COS inversion via on-board jumpers
- Heartbeat, PTT, and COS indicators.
- Quality thru-hole boards are easy to modify if necessary
- All I/O is RFI filtered
- Short USB cable and leaded radio cable, GPIO cable for ARA-1+ are supplied
- Rev 2 – X7 gain output audio to drive more rigs

The board ARA-1 has all the connections you will need to interface a radio to your Allstar computer. If you need additional GPIO the ARA-1+ has connection pads for GPIO bits 1,2,5,6,7,8 plus ground and 5V. GPIO can be used for many things including channel steering, fans, AC control, etc.

The ARA-1+ can be compared to the present DMK-URI board. The primary difference is the ARA boards use a CM119B instead of a CM119A and are without the optional stage of additional audio gain which is not often used. They also are considerably less expensive.

These ARA-1 board will be offered for $40 US shipped and the ARA-1+ for $50 US shipped. Both boards are completely assembled with all cables making them one of the least expensive US manufactured radio interface boards available. Payment by check or Paypal. Contact George, WB3DZZ – ggianios@verizon.net to order.
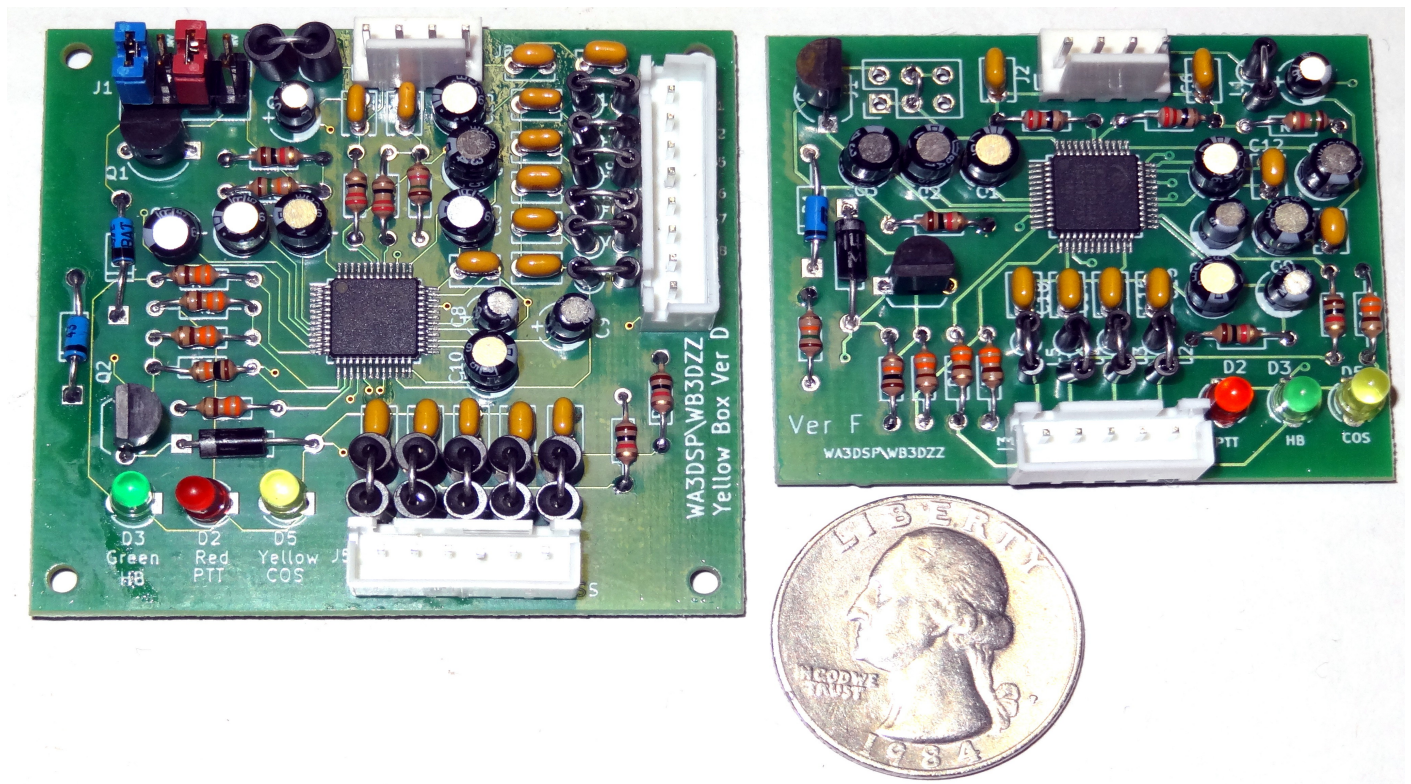

Photo of ARA-1+ FOB on the left and ARA-1 on the right. Shown in comparison to the size of a quarter.

Operation Instructions

COS JUMPER

The photo of the ARA-1+ shows the COS jumpers at the upper left. These jumpers are supplied for unique situations where instead of software USB or USBINVERT you can use hardware inversion on the ARA boards. The ARA1+ has push on jumpers that can be placed for INVERT or NON-INVERT. It is shipped with the jumpers in the NON-INVERT positions. The ARA-1 board is not shipped with jumpers. The NON-INVERT position is soldered in place.

Since COS phase is also programmable in simpleusb-tune-menu generally these jumpers are left in the USB (non-invert) state and setting 'J' in the simpleusb-tune-menu program is used to change COS phase. You can use the V (view) option in simpleusb-tune-menu to confirm the correct phase. When the radio is connected and turned on and NOT receiving any signal COS INPUT in the V option should show CLEAR and when there is signal it should show KEYED.

To change the jumpers move them to the left or right as shown here -

NON-INVERT   INVERT   (dark color indicates jumper inserted)
  DEFAULT

(Note the ARA-1 does not have the left jumper. The ARA1+ left jumper position is just for storage of the extra jumper)

USB CONNECTION

The supplied USB cable plugs into the top center 4 pin connector. This is the connection to the Pi or computer USB port. This is obviously a required connection. The Green HB (Heartbeat) LED should blink at a steady rate when Allstar is running. If you need a longer cable an extension cable can be used. Cables are available from nay sources such as amazon -

https://www.amazon.com/AmazonBasics-Extension-Cable-Male-Female/dp/B00NH11R3I

RADIO CONNECTION

Your radio or repeater connects to the 5 pin (6 pin ARA-1+) connector at the bottom of the board. A plug and cable are supplied for connection. Wire colors and pin positions are shown in drawing below. Pins starting from the left (Yellow LED) are Ground, RX audio, TX audio, COS, PTT, and CTCSS (ARA-1+ only). For the ARA-1+ generally connections are only made to the first five pins. CTCSS is used for special applications.

GPIO CONNECTION - ARA-1+ only

The 8 pin connector on the right side of the board is for GPIO connections to the CM119B. This allows 6 unused input and output bits of the CM119B to be used for any application desired. The CM119B GPIO pin have a 5V maximum voltage and limited current so a buffer device is required to connect to higher current outputs like a relay. LED's, transistors, FET's etc. can be interfaced directly. Bits available are 1,2,5,6,7,8. Bits Reserved for Allstar are Bit 3 which is used for PTT, and bit 4 for the COS indicator.

COS LED

The COS LED can be driven by Allstar to show the presence of a receive signal. This uses bit 4 of the CM119B. Using the COS LED is optional. If you decide to use it you must configure your Allstar to use the bit defined for the COS LED. Current image downloads have the required code already installed in the config files but they must be uncommented to be active. If the lines are not alreay installed you must add them. Check first! Here are the lines required:

In **/etc/asterisk/rpt.conf** in the node stanza you want to activate the COS LED add the following in the mapping section if it is not already there. The xxxxx is the node number for that stanza.

events=eventsxxxxx

Add the event stanza if it is not already there. If it is there it will look like this, where xxxxx is your node number. This can be located anywhere after the node stanzas. Typically between the [schedule] stanza and the [functions] stanza.

[enventsxxxxxx]

Add the following after the above line. If the lines are already there but commented, remove the ';' semicolon from the beginning of the line.

cop,62,GPIO4:1 = c|t|RPT_RXKEYED
cop,62,GPIO4:0 = c|f|RPT_RXKEYED

If you are typing this in please pay attention to the exact syntax including case or better yet cut and paste from here to the file.

Save the rpt.conf file. Now you will need to edit the **/etc/asterisk/simpleusb.conf** file.

In the stanza for the node you want to indicate the COS add the following. Again if the line is already there and commented then remove the leading ';' semicolon from the line.

gpio4=out0

Save the simpleusb.conf file. For these changes to take effect you must restart asterisk.

FINAL SETUP

The hamvoip simpleusb-tune-menu program available from the main menu has all the settings you will need to configure your ARA board to your radio. Most important is level settings. First we start with receive levels. This is item 2 on the simpleusb-tune-menu list of options. This is the level that is coming FROM your radio that is talking to your node. When you select this item you should see some indication on the bar graph when you speak into the microphone.
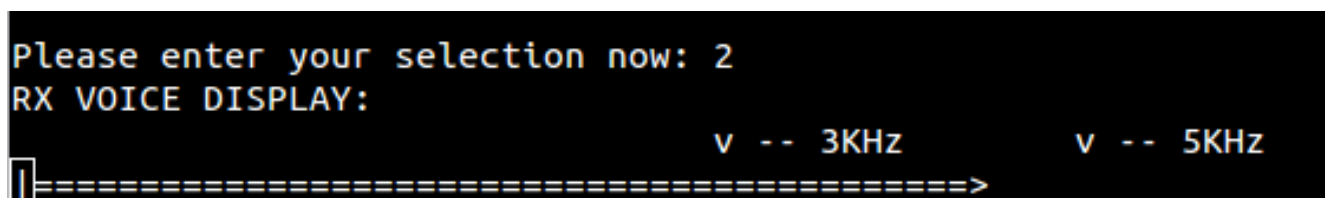
This is what it should look like. The bottom double line with the right arrow indicates your maximum level and it should go up to the 5Khz mark on peaks and occasionally just a little above but not much above. Note that this is radio dependent and also how you speak into your microphone. If you are using more than one radio to talk to your node check them all and make sure none excessively exceed the 5Khz mark. Overdrive and thus distortion are to be avoided!

If you see no audio indication on the display make sure your COS is working – see the COS jumper section above. The 'v' simpleusb-tune-menu option should show KEYED for COS INPUT when you are transmitting to your node. If that is working and you still do not have audio make sure you can hear yourself from on the node radio with its volume turned up when you transmit to it and check your radio connections to the FOB. People often confuse the transmit (TX) and receive (RX) connections. TX is audio OUT of the FOB to your node radio (to is mic input) and is what you hear from your node. RX is audio into the FOB from your node radio (audio output of the node radio) and is what others hear when you talk on the radio you are using to transmit to your node.

If the display bar graph indication is low hit return and set a new value and hit return again to try the new value. Values are from 1 to 999 and keeping it centered around the 500 value would be the goal but not absolutely necessary. If the result is consistently low even with the number set high then you may need to turn on boost. If it is consistently high even with very low numbers then you should turn boost off. To turn boost off or on select the 'B' option at the simpleusb-tune-menu screen. It toggles between on and off. When you change RX boost you need to reset the levels with item 2. Once you get this set correctly we can go on the the transmit audio settings.

The transmit audio levels is somewhat subjective assuming you do not have a service monitor. For a simplex node this is not too critical. You can listen to a local repeater on the radio you using to talk to your node and set the receive volume to a comfortable level. Then using *81 on the DTMF pad listen to the level of the time message. If it is distorted or higher than the level you would hear from a local repeater use item 3, TX level to turn it down. If it is to low go to higher numbers. The range is 1-999. Once you have it at an acceptable level then you should save the settings with the 'w' command before exiting. If the settings are not saved they will go back to default at the next boot.

OTHER SETTINGS

Depending on your radio there are other settings in simpleusb-tune-menu that you can set. If the location you are getting audio from your node radio is not already DE-emphasised then you would want to set item 'G' DE-emphasis to enabled. If the audio input of your radio is not internally PRE-emphasised then you will want to turn PRE-emphasis to enabled with item 'F'. These items toggle. When changing these settings you should re-check the levels as described above.

It you are using a radio designed for amateur radio with an accessory connector like the Alinco DB9 or the popular DIN 6 pin used by many manufacturers you would typically use the 1200 baud pin for audio and no PRE or DE-emphasis would be needed. On many commercial radios this is programmable so it could differ widely.

Normally the PL or DCS filter is enabled when using a radio to reduce the level of frequencies below 300Hz. The DCS filter item 'Q' is preferred because it has better filter characteristics.

You can use item 'C' echo mode to record your voice and play it back for testing. This is a good way to hear how you sound back to your radio. Be sure to disable this option when you are done testing.

Again be sure to save your settings with the 'W' command before exiting with the '0' (zero) option. Once saved all settings will remain the same through subsequent boots.

Note that as of the V1.5.3-53 3/27/2019 HAMVOIP update a long standing bug has been fixed in the CM119B OUPUT level settings. The CM119B is used in all of the ARA boards. This may change the audio level you hear FROM your node. This change does not effect how others would hear you. If you set your nodes OUPUT level (item 3 in simpleusb-tune-menu) before this update you may need to a one time adjustment of this level after performing this or any update after which would fix this SW bug.

ARA-1

The ARA-1 has connections for USB to the Pi, and a 5 pin Radio connector. This is a basic board that would work for most all applications except those needing GPIO and/or CTCSS. The radio connector supplies Audio in (RX), Audio out (TX), COS, PTT, and Ground. A jumper position for COS is available and default jumpered to NON-INVERT. Users would normally select COS phase in software, either USB or USBINVERT. All radio lines are RF filtered. This board uses a genuine CM119B.
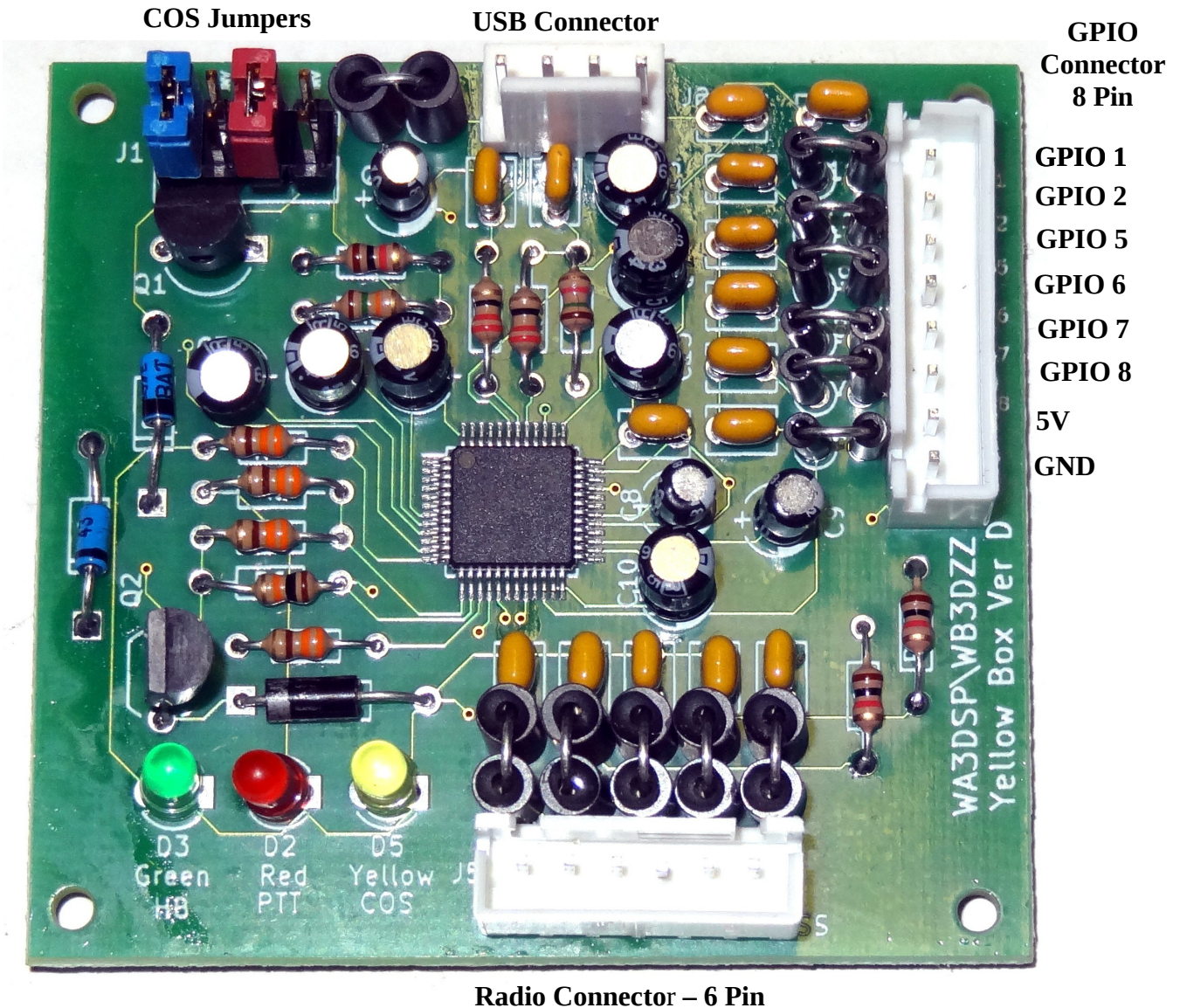

COS Jumpers   **USB Connector**

Radio Connector – 5 Pin

Pins from left – Ground, Audio in (RX), Audio out (TX), COS, PTT

Cables are supplied to connect the USB and leads to the radio or a DB25 wired with DMK/URI pinout. It is the users responsibility to supply the radio end connector.

ARA-1+

The ARA-1+ has all of the added connections you might need in a repeater application. It has the same USB connector as the ARA-1. The radio connector is 6 pin which includes Audio in (RX), Audio out (TX), COS, PTT, Ground and CTCSS. There is an 8 pin connector which has 6 bits of GPIO, ground and +5V. Note the +5 is for low current applications like pull-ups. This board also uses a genuine CM119B. COS jumpers shown in NON-INVERT position.

COS Jumpers   **USB Connector**

GPIO Connector 8 Pin

GPIO 1
GPIO 2
GPIO 5
GPIO 6
GPIO 7
GPIO 8
5V
GND

Radio Connector – 6 Pin

Pins from left – Ground, Audio in (RX), Audio out (TX), COS, PTT, CTCSS

Connectors

ARA-1+
GPIO – 8 pin

Radio Connector
ARA-1   - 5 pin
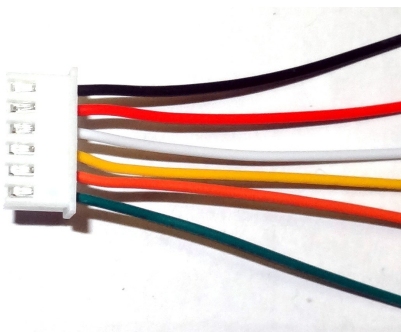ARA-1+ - 6 pin

USB Connector – 4 pin

Cables supplied with the ARA boards. Shown is radio to DB25 Female wired as DMK/URI pinout. USB Cable and 8 Pin GPIO supplied with ARA-1+ board.
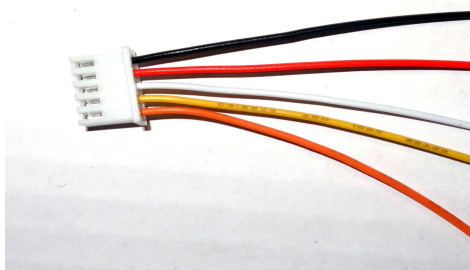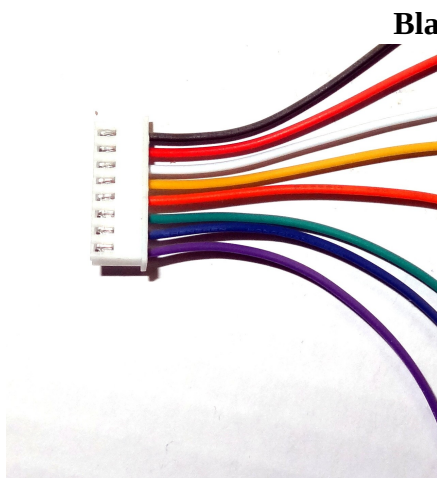

Black - Ground

Red - Audio in (RX)

White – Audio out (TX)
Yellow - COS

Orange - PTT

ARA-1 Radio Connector
5 Pin - Color Codes

Black - Ground

Red - Audio in (RX)

White – Audio out (TX)
Yellow - COS
Orange - PTT

Green - CTCSS

ARA-1+ Radio Connector
6 Pin – Color Codes

Black - Ground
Red - +5V

White - GPIO8
Yellow - GPIO7

Orange - GPIO6

Green - GPIO5

Blue - GPIO2

Purple - GPIO1

ARA-1+ GPIO Connector
8 pin – Color Codes

Connection Details

There are so many different radio connection schemes it would be hard to document them all. Here are a few of the most popular in a chart. The ARA-1 and ARA-1+ come wire to a DB25 female wired as the DMK/URI.

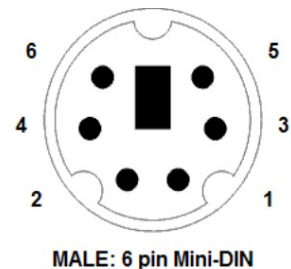| ARA-1	ARA-1+	DMK-URI – DB25 Female ARA end	DIN 6 pin Male to Radio	Alinco/TYT DB9 Male to Radio
Ground - Black	Ground - Black	19,20	2	5
Audio in (RX) - Red	Audio in (RX) - Red	21	5	4
Audio out (TX) White	Audio out (TX) - White	22	1	9
COS - Yellow	COS - Yellow	8	6	1
PTT - Orange	PTT - Orange	1	3	7
N/A	CTCSS - Green	7	N/A	N/A

We generally wire to the 1200 baud labeled connections which are shown here and with no PRE or DE-emphasis allowing the radio to do that. If what you hear from the radio you are using to connect to your node sounds mushy and lacks highs you may need to enable PRE-emphasis. If what others hear when you speak sounds tinny or lacks lows you may need to enable DE-emphasis.

Users have the option of using a mating DB25 male wired as shown above for the DMK/URI or you can remove the DB25 and connect wires directly to your radio. The advantage of using the DB25 is that you would have compatibility between the DMK/URI and these boards in being able to swithc between them.

For commercial radios, Motorola, etc. either use the DB25 Female to Male or remove the DB25 and wire directly to the radio.
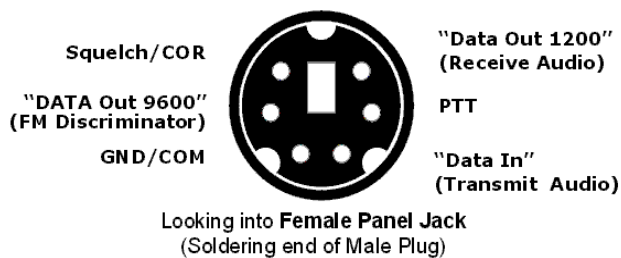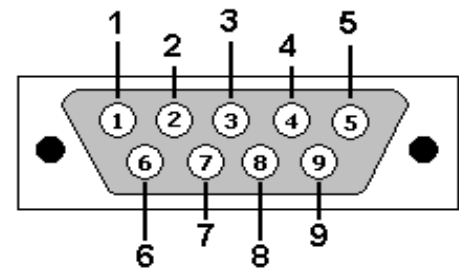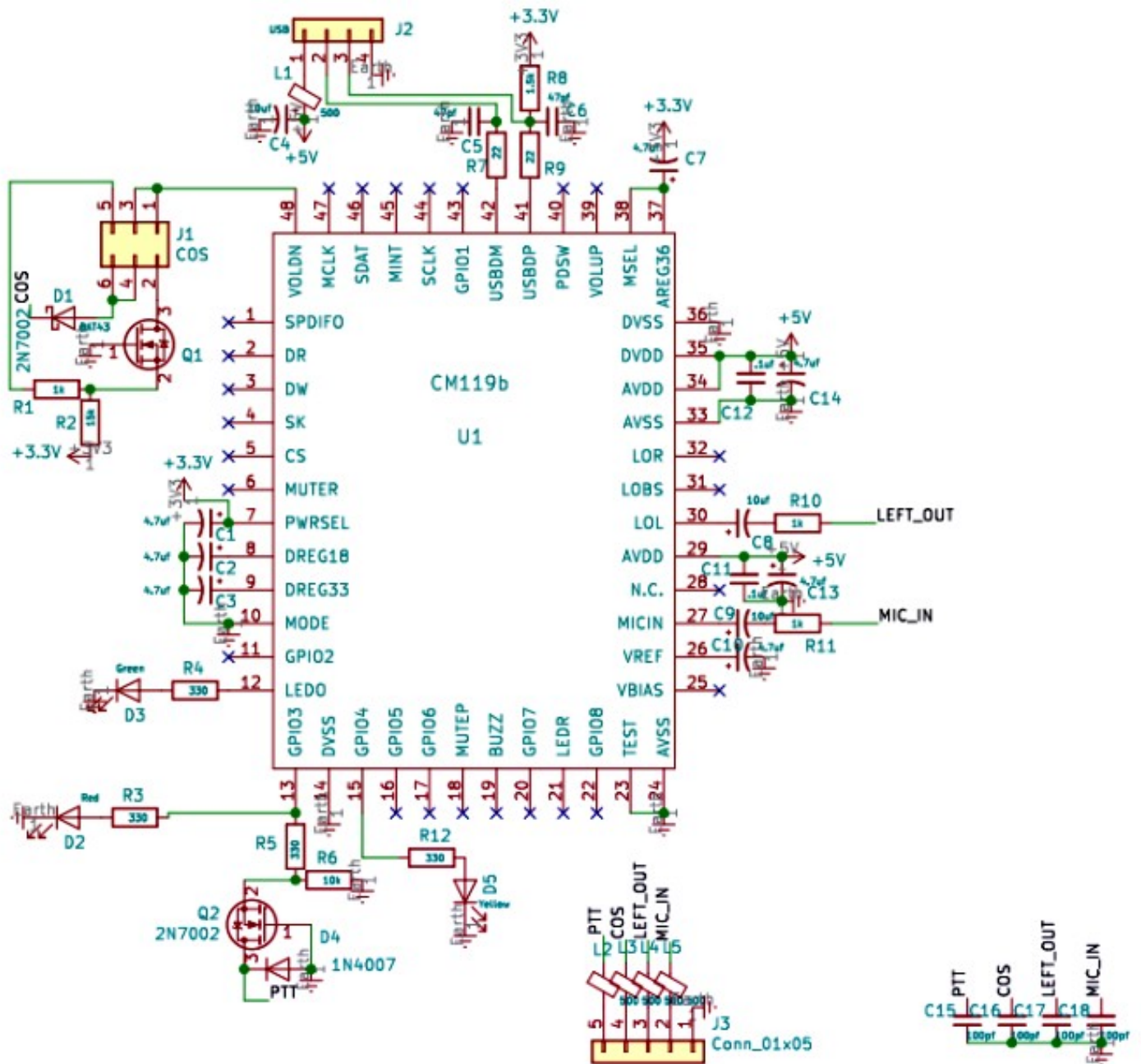

Common 6 Pin DIN
Radio Data Connector
Yaesu, Kennwood, Icom

Here is an excellent site for checking radio connections -

http://packetradio.com/pdfzips/BUXmic-acc-wiring-index.pdf

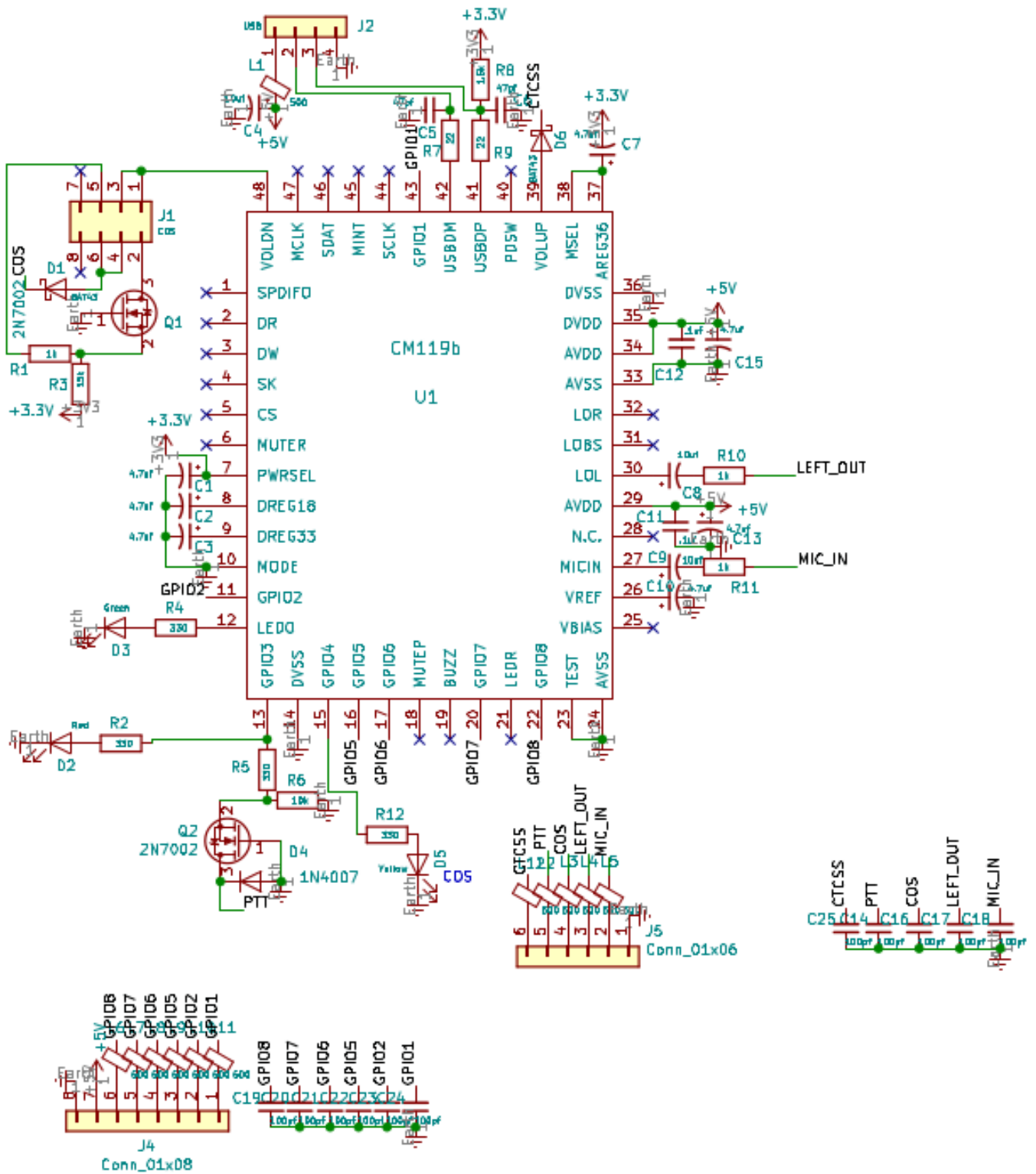**DB9 Male looking into the connecto**r

ARA-1 Schematic

* Note that R8 (1.5K) is omitted from the final design

ARA-1+ Schematic

* Note that R8 (1.5K) is omitted from the final design