

Raspberry Pi to
Radio Shack HTX-100
Push-To-Talk (PTT) Adapter Kit

Model: HTX-PTT2-KIT (Rev A)

Assembly and Reference Manual

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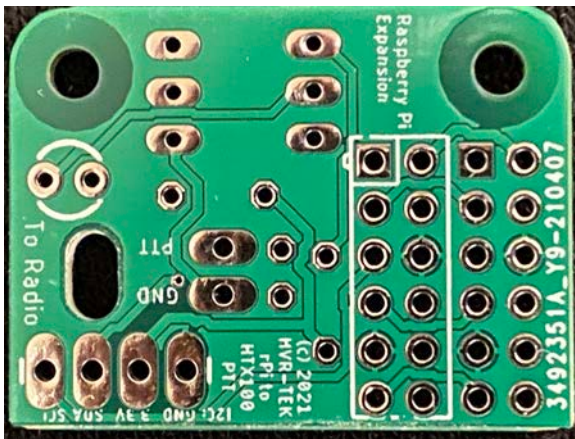
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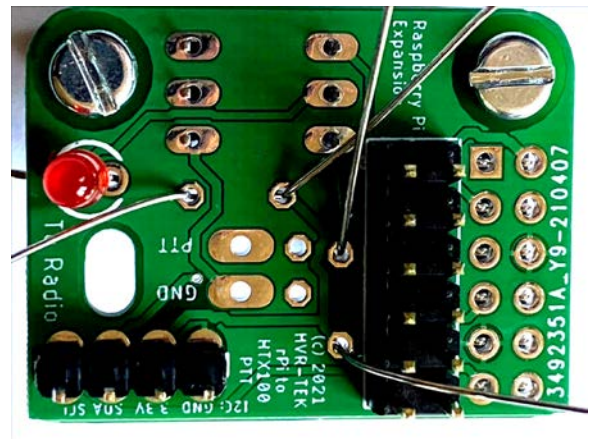
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OVERVIEW

- Please read all the instructions first, to ensure you are familiar with the entire process before starting. These instructions are intended for someone who has soldered kits before and has general knowledge of DC Circuits. Please review the Parts List and Schematic, also, before beginning.
- The **TOP** of the HTX-PTT2 board is the side which has the white outline around the Raspberry Pi Expansion Header near the middle of the board, and does *not* have the GND_BRIDGE (SJ1). The top side will be up when the board is connected to your Raspberry Pi.

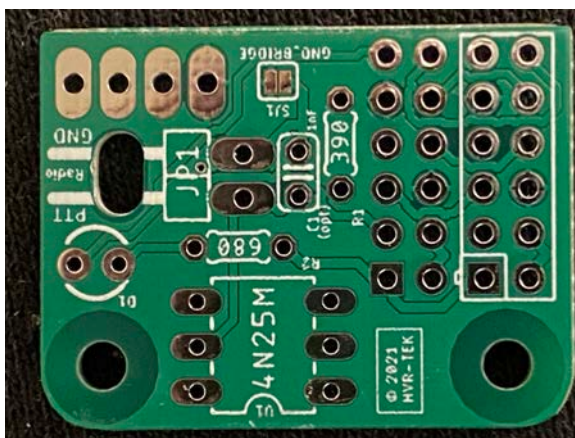


TOP of the HTX-PTT2 Board

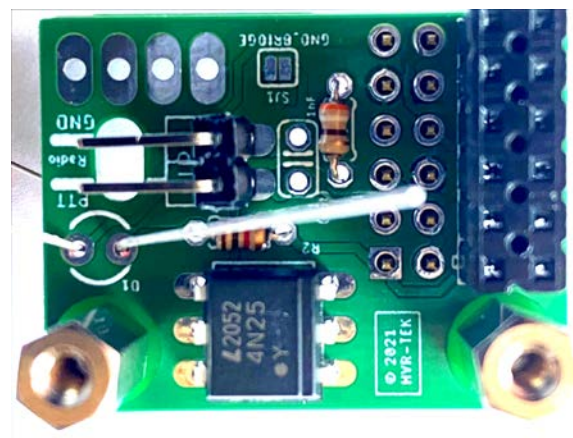


TOP of HTX-PTT2 Board during assembly

- The **BOTTOM** of the HTX-PTT2 board is the side which has the white outline around the Raspberry Pi Socket near the edge of the board. It also has the "4N25M" marking for the large Optocoupler, which will hang down when the board is connected to your Raspberry Pi.



BOTTOM of the HTX-PTT2 Board



BOTTOM of HTX-PTT2 Board during assembly

- The Radio Header (J2/JP1), Filtering Capacitor (C1) and LED (D1, optional) may be mounted together or independently on *either side* of the HTX-PTT2 board.

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OPTIONS

- **RF Filtering:** Installing the optional 1nF 50V ceramic disc capacitor (C1) on either side of the HTX-PTT2 board will block RF signals which may travel back along the PTT lines from the HTX-100 to the HTX-PTT2 board. The HTX-100 does a great job of doing this already and we have found that this capacitor is likely unnecessary, but you may want to install it to add some more filtering to protect your Raspberry Pi.
- **LED with Different Brightness Levels:** If you would like an indicator showing you when your Raspberry Pi is enabling PTT on your HTX-100, you can install the optional 2mA 1.7V LED (D1) and resistor (R2). For a bright (2.2mA) light, use the 680Ω resistor for R2. For a dimmer (1.6mA) light, use the 1kΩ resistor for R2.
- **Raspberry Pi Expansion Header:** If you would like to access the Raspberry Pi's 12 GPIO pins which feed the HTX-PTT2 board, you can install the optional Raspberry Pi Expansion Header (J3) on the TOP of the board (solder on the BOTTOM). DO NOT INSTALL THIS HEADER ON THE BOTTOM OF THE BOARD. These 12 pins are passed straight through in their identical configuration. This way, you don't lose access to any of these important GPIO pins which you may want to use for other projects. Pin 1 is marked with a SQUARE solder pad, while the other pins have circular solder pads.
- **I²C Header:** The Raspberry Pi's I²C pins (GND, 3.3V, SDA, and SCL) are passed through to an optional I²C header, which you can install on the TOP of the HTX-PTT2 board. DO NOT INSTALL THIS HEADER ON THE BOTTOM OF THE BOARD. The pins are ordered: **GND, 3.3V, SDA, and SCL**, from the inside of the board to the corner of the board.

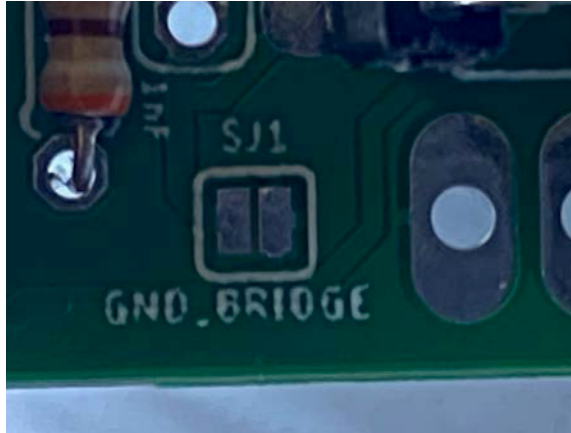
Note: the 3.3V line on this connector is fed from the Raspberry Pi's 3V3 GPIO line, which has a current limitation of 50mA on the early Raspberry Pi and 500mA since the Model B+. If you're looking to attach more than one I²C device or are using an I²C device with anything other than a minimal current requirement, you should instead use the 5V supply (from the Pi Expansion pins 2 & 4) with a 3v3 regulator. The other I²C pins can be picked up from the Expansion Header also: GND =Pins 6 & 9, SDA=Pin3 and SCL=Pin5.

- **Mounting Hardware:** We recommend using at least one standoff/screws in the corner near the GPIO connector's pins 1 & 2 in order to secure the HTX-PTT2 board to your Raspberry Pi. If you are using a Raspberry Pi Zero, you can use two standoffs. Use a screw for each of the top and bottom of the standoffs, and tighten it comfortably snug.
- **Directly Solder the Radio PTT Wires:** If you would prefer to not use the 2-pin header (J2/JP1) for the Radio PTT Wires, you may choose to solder them directly to the HTX-PTT2 board. If you chose this option, you might prefer to run the wires up/down through the adjacent board hole as a strain relief, and solder them to whichever side of the board you prefer for your configuration.

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- **Ground Bridge Jumper Pads:** By default, the Raspberry Pi's GROUND and the Radio's GROUND are electrically isolated from each other on the HTX-PTT2 board. If you want to bridge them together, just apply a solder drop to GND_BRIDGE (SJ1) on the BOTTOM of the board.



Enlarged photo of the Ground Bridge Solder Jumper (SJ1)

TYPICAL CONFIGURATIONS

- **All Optional Components:** If you would like to include all optional parts, mount the Raspberry Pi Socket (J1), Optocoupler (U1), two resistors (R1 & R2), and capacitor (C1) to the BOTTOM of the HTX-PTT2 board. Mount the Radio Header (J2/JP1), Raspberry Pi Expansion Header (J3), I²C Header (J4), and LED (D1) to the TOP of the board.
- **Minimal Space:** If you would like to minimize the space used for the HTX-PTT2 board (i.e. perhaps you're mounting it in a small case) you may choose to not mount *any* components on the TOP of the board, leaving off the I²C and/or Pi Expansion headers. Just mount the Radio Header (J2/JP1), RF Filter Capacitor (C2, optional) and LED (D1, optional) to the BOTTOM. If you include the LED, it will appear under the board, shining onto the Raspberry Pi.
- **Only LED Protruding:** If you would like the LED (D1, optional) to protrude from your case, you can mount only it to the TOP of the HTX-PTT2 board. Mount the Radio Header (J2/JP1) on the BOTTOM, along with the Optocoupler (U1), two resistors (R1 & R2), capacitor (C1, optional), and Raspberry Pi socket (J1). Do not mount the I²C and/or Pi Expansion headers.

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ASSEMBLY

1. **I²C and/or Pi Expansion Headers on the TOP:** If you're planning to use the optional I²C and/or Pi Expansion headers, we recommend installing them to the TOP of the HTX-PTT2 board prior to installing any other components. This will make soldering the remaining parts easier. Be sure to solder their pins on the BOTTOM of the board, so these headers protrude straight up from the TOP of the board.
2. **Install the Raspberry Pi Socket on the BOTTOM:** Insert the Raspberry Pi Socket into the BOTTOM of the HTX-PTT2 board. While holding it steady to the board, solder in just one corner pin on the TOP first. Then carefully look at the socket and ensure it is perfectly seated on the board, protruding at exactly 90° from the BOTTOM of the board, so it will cause your board to remain horizontal when plugged onto the Raspberry Pi. If it needs adjustment, just heat that single pin and adjust it while it's hot. Then solder the remaining eleven pins. Installing this socket on the wrong side of the board can cause permanent damage to your Raspberry Pi.
3. **Install the Resistors (R1 & R2) and Capacitor (C1, optional) on the BOTTOM:** The resistors and capacitors are not polarized, so they can be installed in either direction. R1 is 390Ω (Orange-White-Brown-Gold). If you would like bright LED light, use 680Ω (Blue-Gray-Brown-Gold) for R2. Alternatively, for a slightly dimmer LED light, use 1kΩ (Brown-Black-Red-Gold) for R2. Both resistors are included in the HTX-PTT2 Kit. The capacitor is an orange disc, with the markings "102" on it.

Slide their leads into the appropriate holes on the BOTTOM of the HTX-PTT2 board, and then bend their leads out so they stay in place. After soldering their leads on the TOP side of the board, snip off their remaining, excess leads.

4. **Install the Optocoupler (U1) on the BOTTOM:** When inserting the 6-pin 4N25/4N25M Optocoupler into the BOTTOM of the HTX-PTT2 board, ensure its pin 1 (which has a small dot) is aligned towards the *outside* of the board and the "4N25" writing on the chip is not upside-down when compared to the writing on the board. Insert three pins on one side. Then while holding the component at an angle, *gently* slide the other three pins into their holes one at a time. Once it's inserted it will tend to hold itself in well, because the leads spread out slightly from the component. Solder its six leads on the TOP of the board. Be careful not to overheat it while soldering it.
5. **Install the LED (D1, optional):** This component can be installed on *either* side of the HTX-PTT2 board. Regardless of which side you install it on, be certain that the **shorter** (negative, cathode) lead of the LED goes towards the *OUTSIDE* of the board and the **longer** (positive, anode) lead of the LED goes toward the *INSIDE* of the board. After you insert it, bend the leads out so it remains in place. Solder it on the other side of the board and snip off its remaining, excess leads. If you accidentally install it backwards, the radio will still enable the PTT circuit, but the LED will never light – just remove it and reinstall it the opposite way.

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CONNECTING TO YOUR RASPBERRY PI AND RADIO SHACK HTX-100 RADIO

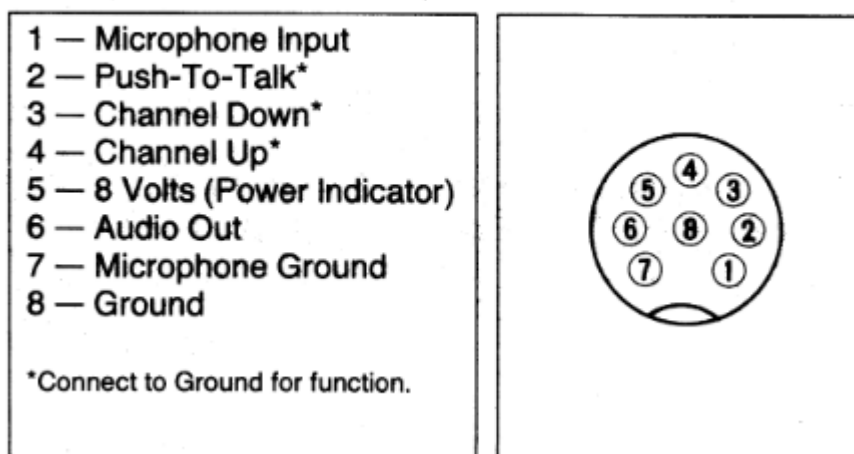
- IF YOU INCORRECTLY INSTALL THE PTT BOARD, IT CAN CAUSE PERMANENT DAMAGE TO YOUR RASPBERRY PI!!!

When installing the HTX-PTT2 board to your Raspberry Pi, properly shut-down and **TURN OFF** your Raspberry Pi first! Then, install the board onto your Raspberry Pi's GPIO header pins, properly aligning the corner screw hole between the PTT board and your Pi.

Only after you are 100% certain you have installed the board so that only GPIO pins 1 through 12 exactly match the HTX-PTT2 Raspberry Pi Socket (J1), power up your Raspberry Pi.

- Connect the HTX-PTT2's Radio PTT Header (J2/JP1) pins to the HTX-100 Radio's Front 8-Pin Microphone Jack. You may use the 2-pin header with a 2-pin cable, or you may solder your wires directly to the board (use the strain-relief hole). The GND pin should go to the HTX-100 Radio's pin 8 (Ground) and the PTT pins should go to the HTX-100 Radio's pin 2 (Push-To-Talk), as indicated by this chart from the HTX-100 Radio manual:

MICROPHONE JACK PIN FUNCTIONS



Note: When connecting to the PTT Radio Header/Pads (J2/JP1) on the HTX-PTT2 board, be certain to connect the GND and PTT leads as indicated. The GND lead goes right next to the four-pin I²C connector and the PTT lead goes on the side towards the Optocoupler (U1). This is important because forward current from the radio is required to flow through the Optocoupler's internal transistor from collector to emitter. If you accidentally switch these, it should not damage anything, but PTT will not work, even though the LED light will light.

- Connect a *shielded* cable to carry your Transmit Audio from your Raspberry Pi's USB Sounds Card Headphone-Out jack to the HTX-100 Radio's Front 8-Pin Microphone Jack, also. Ground from the

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sound card should also go to the HTX-100 Radio's pin 8 (Ground, along with PTT ground from above) and the Audio-Out from the sound card should go to the HTX-100 Radio's pin 1 (Microphone Input), as indicated by the above chart.

- Alternatively, you may choose to use a 3-conductor *shielded* cable to run *both* the Transmit Audio and PTT signal together. If you chose to do this, use the outer-jacket of the cable as ground for both the HTX-PTT2 board and the USB sound card to the HTX-100 Radio's pin 8 (Ground). Then use one inner-wire for the PTT signal from the board's Radio Header (J2/JP1)'s PTT pin to HTX-100 Radio's pin 2 (Push-To-Talk). Use the other inner-wire for the sound card's Audio-Out signal to the HTX-100 Radio's pin 1 (Microphone Input).
- In addition, use a standard 1/8" male-to-male cable to carry the Receive Audio from the HTX-100 Radio to your Raspberry Pi's USB Sound Card. Connect it from the HTX-100 Radio's front (head)Phones Jack to your USB sound card's microphone input. Stereo cables seem to work fine here, too. If you want to try simply monitoring for some digital signals, such as FT8, just connect this up first and see what you can decode on your Raspberry Pi.

USING WSJT-X

Following is a basic primer for installing and configuring the WSJT-X application on a Raspberry Pi, using the newest currently-available software as of the creation date of this manual (Raspbian AKA "Raspberry Pi OS" which is Debian 10 AKA "Buster" & Linux Kernel 5.10.17 and WSJT-X 2.3.1). This procedure is subject to change as Debian and WSJT-X make changes/updates.

1. Install the newest Raspbian using the procedure at <https://www.raspberrypi.org/software/>
2. SSH to your Pi
3. Update packages and install some basic utilities:

```
apt update -y; apt upgrade -y
```

```
apt install -y joe raspi-gpio
```

4. Test manually triggering the HTX-PTT2 board's PTT line from Raspberry Pi's GPIO17 (pin 11):

```
raspi-gpio set 17 op pn dl
```

Your HTX-PTT2 should now enable PTT and turn on the LED

```
raspi-gpio set 17 op pn dh
```

Your HTX-PTT2 should now disable PTT and turn off the LED

5. Configure GPIO17 (pin 11) to NOT be enabled on boot:

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```
sudo joe /boot/config.txt
```

Add this line to the end:

```
gpio=17=a3
```

Exit and save by typing Ctrl-K, Ctrl-X

```
mkdir ham; cd ham
```

```
getconf LONG_BIT
```

If you see "32", enter this line:

```
wget http://www.htx-100.com/resources/clearAMA0RTS.txt -O clearAMA0RTS
```

OR, if you see "64", enter this line:

```
wget http://www.htx-100.com/resources/clearAMA0RTS_64.txt -O clearAMA0RTS
```

```
chmod 755 clearAMA0RTS
```

```
crontab -eu pi
```

(choose Joe Editor, if prompted) Add to bottom:

```
@reboot /home/pi/ham/./clearAMA0RTS
```

Save and Exit by pressing Ctrl-K, Ctrl-X

```
sudo reboot
```

6. Enable Serial Port (required for WSJT-X to work):

```
sudo raspi-config > Interface Options > Serial Port
```

```
> login shell: NO > enable serial port: Yes
```

```
> Ok > Finish > Reboot?: Yes
```

7. Enable VNC for remote operation of Raspberry Pi:

```
sudo raspi-config > Interface Options > VNC > Yes > Ok > Finish > Reboot?: Yes
```

8. On your other/local PC, run VNC Viewer/VNCConnect (by RealVNC): Connect to the local IP of Pi

9. Upon first VNC login:

```
Ok > Next >
```


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United States, American English, New York, Use English Language, Use US Keyboard > Next

new password > Next > Desktop fill screen? don't check > next

network: Next > Update software: (yes) Next > Done

Start > Preferences > Raspberry Pi Configuration > Display

> Set Resolution > 1280x1024 > Ok > Close window > reboot? Yes

10. To Install wsjtx 2.3.1 & configure it: In SSH:

```
cd ham
wget https://physics.princeton.edu/pulsar/k1jt/wsjtx_2.3.1_armhf.deb
dpkg -i wsjtx_2.3.1_armhf.deb
apt-get -f -y install
```

11. Back in VNC: Start > Sound & Video > wsjtx > File > Settings

> Radio: PTT Method: RTS (/dev/ttyAMA0)

Clicking "Test PTT" should now toggle your HTX-100 "TX" mode and light the LED on the HTX-PTT2 card.

> Audio: Input: plughw:CARD=Device,Dev=0 Output: plughw:CARD=Device,Dev=0
(Possible alternative card: alsa_output.platform-bcm2835_audio.analog-stereo)

> Frequencies > right-click in the Working Frequencies list, and select Reset > Yes > Ok

Wide Graph: Bins/pixel: 5, start: 100hz, N Avg: 2, Flatten, Cumulative, Spec: 25%.

12. For further instructions using WSJT-X, see <https://physics.princeton.edu/pulsar/k1jt/wsjtx.html>

NOTE: When booting your rPi, the PTT line will pulse for approx. 500ms between the OS' enabling of AMA0's RTS and our script clearing it. As such, it is recommended to keep your rig off/disconnected during boot.

LEGAL

- ***We assume no liability whatsoever for any damage incurred in your endeavor to build and use this kit. If you don't agree to this, send your kit back immediately for a full refund.***
- Raspberry and Raspberry Pi is a Trademark of The Raspberry Pi Foundation.
- Radio shack and HTX-100 are Trademarks of Retail Ecommerce Ventures
- HVR-TEK, HTX-PTT2, HTX-PTT2-PCB, HTX-PTT2-KIT and HTX-100.com are trademarks of Ken Reiss (KA1HVR). Thank you to Dale NY2DS for his 64-bit assistance!

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PARTS LIST

Qty	Side	Ref #	Description		Mouser #	Comments
1		PCB	PC Board	HTX-PTT2-PCB		Order at www.HTX-100.com
1	B	U1	Optocoupler	4N25/4N25M	859-4N25	Optical switching transistor
1	B	R1	Resistor	390Ω 5% 1/8W	299-390-RC	Current-limits Optocoupler
1	B	J1	Socket	2x6 2.54mm	517-929975-01-06-RK	Plugs into Pi
1	T/B	J2	Header	1x2 2.54mm 90°	649-1012937990201BLF	To Radio ("JP1" on board)
1		WH1	Wire Harness	2cond 35cm 2.54mm	N/A	To connect to HTX-100

RF Filtering Option:

1	T/B	C1	Capacitor	Ceramic 1nF 50V 10%	594-D102K20Y5PH63L2R	(optional)
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LED Options:

1	T/B	D1	LED	Red 2mA 1.7V 2.5mcd	859-LTL-4221NLC	(optional)
1	T/B	R2	Resistor	680Ω 5% 1/8W	588-OJ6815E-R52	(optional) for Bright LED
1	T/B	R2	Resistor	1kΩ 5% 1/8W	299-1K-RC	(optional) for Dim LED

Additional Header Options:

1	T	J3	Header	2x6 2.54mm	649-1012938191201BLF	(optional) for Pi Expansion
1	T	J4	Header	1x4 2.54mm	649-1012937890401BLF	(optional) for I ² C

Mounting Options:

2	B	SO1	Standoff	M2.5x11mm	855-R25-1001102	(optional)
4		SC1	Screws	M2.5 6.0mm	534-29301	(optional)

Side:

T=TOP

B=BOTTOM

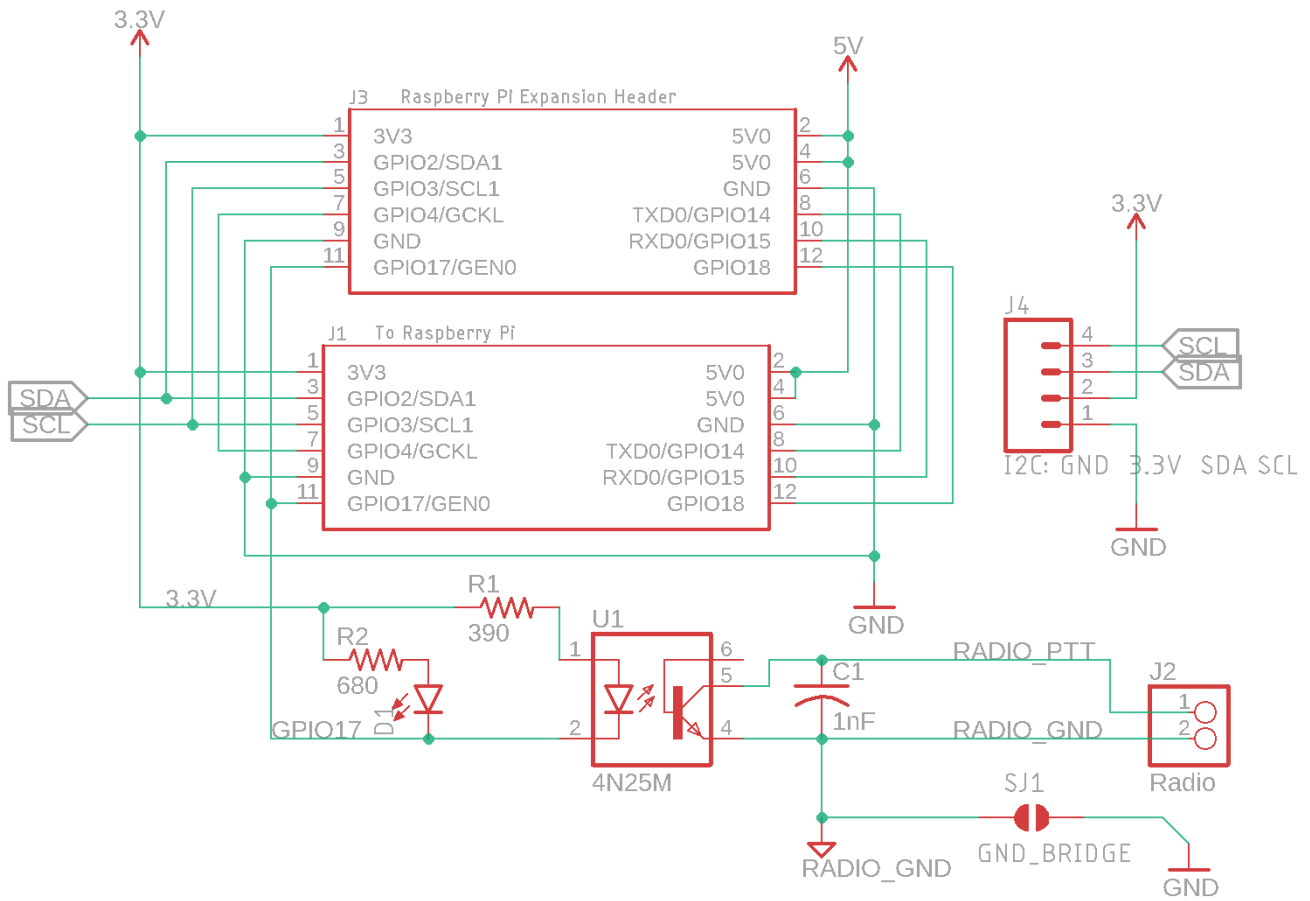
T/B=TOP OR BOTTOM (Your choice)

Note: All parts listed above are included in HTX-PTT2-KIT.

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SCHEMATIC DIAGRAM



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PHOTOS OF COMPLETED HTX-PTT2-KIT INSTALLED ON A RASPBERRY PI ZERO W

