

1. HHI Radio Pro, User's Guide

Thank you for purchasing the Halibut Electronics **HHI Radio Pro** adapter.



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3. Introduction

The HHI Radio Pro is an adapter that enables you to connect your radio to any headset that's compliant with the Open Headset Interconnect Standard (OHIS).

This User Guide will:

- Provide an overview of the HHI Radio Pro
- Explain how the HHI Radio Pro fits into a larger OHIS ecosystem.
- Explain how to configure the HHI Radio Pro for your radio.
- Help you troubleshoot any problems you might experience.
- Provide known configurations for some common radios.
- Explain how to submit a new configuration to help the next person with your radio.

4. Document History

- 2023-04-27, v0.1: Initial draft.
- 2023-05-25, v0.9: Release Candidate.
- 2023-10-11, v1.0: Update for Production hardware.

5. About the HHI Radio Pro

The HHI Radio Pro is an adapter that enables you to connect your radio to any headset that's compliant with the Open Headset Interconnect Standard (OHIS). The HHI Radio Pro maintains a passthrough to the radio's stock microphone, PTT, and headphone/speaker.

Note: For the purpose of this user guide, "headset" is defined as a single device or a collection of devices that include a PTT, microphone, and headphones or speaker. For example, it can be a literal headset, or a separate mic, speaker, and foot switch.

You can configure the HHI Radio Pro to work with nearly any radio. It includes connectors for:

- Microphones
- Headphones/speakers
- Dedicated PTTs

See [FAQ 9.3](#) for a list of supported connectors.

Any signal can be routed to any pin using a jumper matrix, allowing for literally any pin-out on those connectors. All signals are galvanically isolated to prevent ground loops, and audio signals are trimmable to match levels with your radio.

The HHI Radio Pro adapts your radio's unique electrical and physical properties to an OHIS-compliant radio device socket, allowing any OHIS-compliant headset to connect to it. The OHIS-compliant headset can then hear the output of the radio. When the OHIS-compliant headset's PTT is engaged, its microphone audio is routed to the radio and the radio's PTT is engaged.

5.1. About OHIS and HHI

OHIS is an open standard ("Free Like Speech") that defines the physical and electrical characteristics of the connections between a radio and headset. It does *not* specify the design or function of the devices themselves.

By working with OHIS-compliant radios and headsets (or radios and headsets connected to OHIS-compliant adapters), you can easily connect devices and immediately start operating without needing to build or buy an adapter that's specific to the pairing of those two devices.

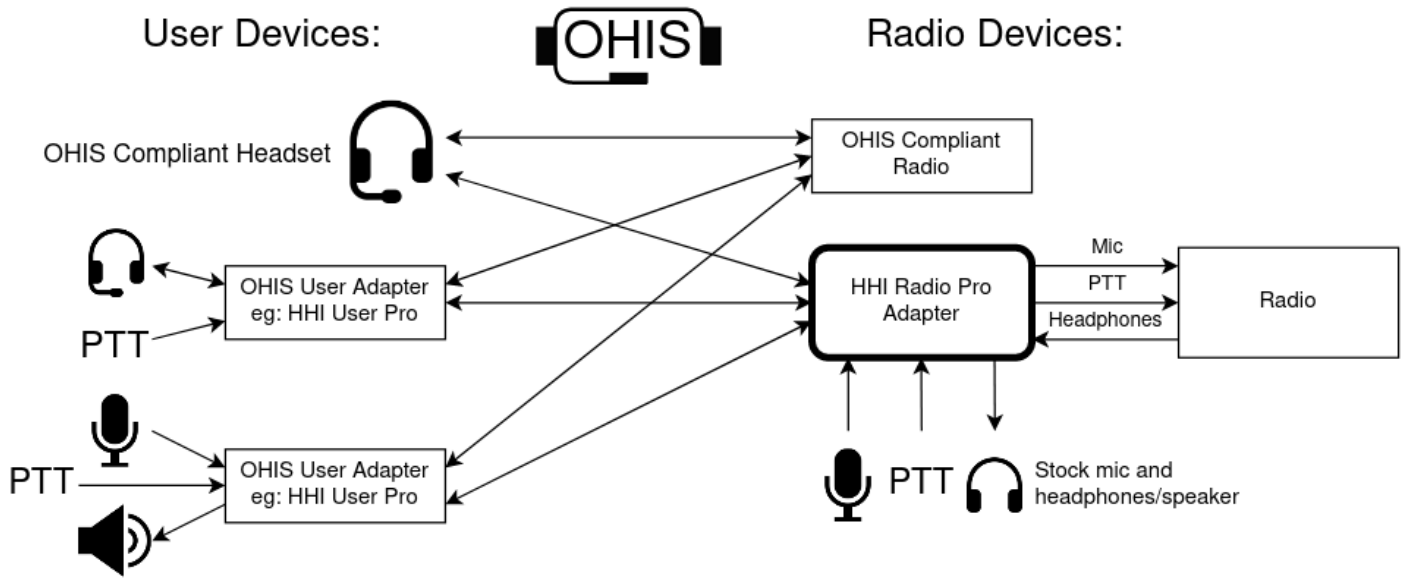
This is especially useful in a multi-user environment, such as a club shack, emergency operation center (EOC), or contest event like Field Day.

For more details on OHIS, see <https://ohis.org/>.

Halibut Electronics offers the Halibut Headset Interconnect (HHI) line of products. All HHI products implement the OHIS standard in some way. For example, the HHI Radio Pro adapts radios to the OHIS standard.

5.2. About Using the HHI Radio Pro in an OHIS-Compliant Environment

The following diagram illustrates how the HHI Radio Pro fits in an OHIS-compliant environment of multiple types of user devices (such as headsets or separate microphone and speaker) and radio devices:



The left side displays various user devices and the right side displays various radios devices.

All devices have different electrical and physical characteristics. Some support OHIS natively, and some require OHIS-compliant adapters. In this diagram, the non-compliant user devices use the HHI User Pro (a separate product) and the non-compliant radio devices use the HHI Radio Pro (this product) to become OHIS-compliant.

OHIS is the standard in the middle that enables any OHIS-compliant user device to connect to any OHIS-compliant radio device, regardless of any different underlying electrical and physical properties.

5.3. Usage Overview

5.3.1. Radio's Stock Devices

The HHI Radio Pro also allows your radio's stock devices to still connect to the radio, through the "Passthru" sockets on the front of the HHI Radio Pro. The stock headphones or speaker will hear the same output of the radio that the OHIS User Device hears. When the stock microphone's PTT is engaged, the stock microphone audio is routed to the radio, and the radio's PTT is engaged.

The stock devices are just connected straight through to the radio, so HHI Radio Pro doesn't need to "support" any special features your radio may have. The only signal that is NOT connected directly through is the microphone, which runs through a relay to switch in the OHIS microphone signal. But when the OHIS PTT is not pressed, the stock microphone is connected straight through the relay.

In short, the radio's stock devices also work as normal.

5.3.2. Radio's Electrical Property Requirements

HHI Radio Pro works with radios that have the properties listed in [FAQ 9.3](#). If you have a radio who's requirements are not met by HHI Radio Pro, please [contact Halibut Electronics](#) with details of your radio; we'd

like to know what we missed.

In short, it works with nearly any radio.

6. Getting Started

This section will walk you through assembling, connecting, and tuning your HHI Radio Pro for use.

If you haven't already, go through your OHIS User Device's User Guide first. The section [Adjust HHI Radio Pro Levels](#) below will require a properly adjusted OHIS User Device, such as the HHI Radio Pro.

The high-level steps to get your Radio Pro operational are:

1. Verify your Config Board is correct for your Radio.
2. Assemble, and connect HHI Radio Pro to your Radio, and Passthru devices to HHI Radio Pro.
3. Adjust HHI Radio Pro levels for your Radio.

The tools required for this are:

- PH2 Philips screwdriver for panel screws. (PH1 for Early Access Program, or EAP, units.)
- 3/4" socket driver, or box wrench, for the nut on the GX16 "8 pin round" socket.
- Soldering iron and solder, to remove (but not save) surface mount resistors, and add solder blobs over jumper pads.
- Small flat-head "jewelers" screwdriver to adjust trim-pots.
- DC volt meter

6.1. Verify Config Board

HHI Radio Pro uses a removable "Config Board" internally to specify which signals are on which pins. One comes with your Radio Pro.

Halibut Electronics has Config Boards pre-configured for many common radios. However, all Config Boards (even the pre-configured ones) can be re-configured to support any radio. If your radio is NOT supported by one of the pre-configured options, or if you are changing to a radio that requires a different configuration than what your Config Board currently supports, then see the next section on [Configuring the Config Board for your radio](#).

Note: Even if you have a pre-configured Config board for a supported radio, there is one configuration option to consider: Whether the radio's audio output is stereo or mono.

6.1.1. Headphone/Speaker Output From Radio: Mono or Stereo

The pre-configured Config Boards are designed to be always-safe; they come configured for mono output from the radio. If your radio has a stereo output that you would like to take advantage of, now is a good time to make that change.

You will have to remove a connection, and add a new connection in a different spot. Connections are made at the factory using 0 ohm 0603 surface mount "resistors." The user (read: you) makes connections with solder

blobs across the two pads at the intersection. When removing a surface mount jumper, you do not have to save the SMT component. It can be thrown out, or, more likely, lost in the smallest gust of wind.

Look in the lower left corner of the Config board and find the 4 rows labeled "Headphone/Speaker", each row labeled "T" for Tip, "R1" for Ring 1, "R2" for Ring 2, and "S" for Sleeve. Similarly, note the columns labeled "HP:L" for Headphone Left, "HP:R" for Headphone Right, and "HP:G" for Headphone Ground.

- A Mono output from the radio should have both the "HP:L" and "HP:R" columns connected to the "T" row, only using the Tip of the connection from the radio, leaving Ring 1 disconnected.
- A Stereo output from the radio should have the "HP:L" column connected to the "T" row, and the "HP:R" column connected to the "R1" row, taking Left audio from Tip, and Right audio from Ring 1.
- In both cases, the "HP:G" column should connect to both the "R2" and "S" rows.
- Ensure the Config board is jumpered the way you need, removing or adding connections as necessary.

6.2. Assemble, Connect HHI Radio Pro

6.2.1. Remove The Top Of The Case

The next steps require HHI Radio Pro to be connected to the radio and powered, but for you to still have access to the trim pots on the Config board. The aluminum case has one slide that can be slid out and removed.

Note: This documentation refers to the slide-out part as the "Top" of the case, though it may have been assembled on the bottom side and have the rubber feet attached to it. For the purposes of making the adjustments here, leave the opening "on top" of the board so you can access the adjustment points. When you're done with tuning and reassemble the Radio Pro, make sure the rubber feet are on the bottom.

To get access to the Config board for adjustment:

- Disconnect all cables from the HHI Radio Pro.
- Remove the 3/4" nut and washer from the GX16 connector on the **Radio side** of the HHI Radio Pro.
- Remove the four PH2 Philips screws holding the **Passthru side** panel of HHI Radio Pro.
- Carefully slide HHI Radio Pro's board out of its case.
- Remove only the top two screws from the **Radio Side** of the case.
 - These screws can sometimes hold the top in place preventing it from sliding out.
- Slide the top of the case out. It might require a little force, it's a pretty tight fit.
- Carefully insert the circuit board back into the case.
 - It slides into the bottom most slot of the case.
 - The connectors might need a little gentle wiggling to fit through the panel on the radio side, but it shouldn't require any force. The circuit board should be almost perfectly flush with the panel when its all the way in, less than 1mm of gap.
 - Remember: "Top" here means the part of the case that has been slid-out. If this is the side of the case with the rubber feet, you'll swap it back to the bottom when we're done making

adjustments.

- Reinsert all side panel screws, and the GX16 washer and nut.

When you're done making adjustments, reinserting the top into the case is the reverse of the above process.

If you can't get the top started sliding into the main body of the case, you might have to pull the sides of the case apart from each other a little bit. It is a very tight fit. But once it's started, it'll slide in with just a little bit of force.

6.2.2. Install Config Board on Main Board

After you've verified your Config Board is ready (see [Section 6.1 above](#)):

- Insert the Config Board onto the Radio Pro main board.
 - Pay attention to the keyed corner: The Config board's upper right corner has been cut off. Note the outline on the Main board has that cut-off corner as well. Make sure the cut-off corners line up correctly when inserting the Config board onto the Main board.
 - Make sure all pins are in the sockets. It's unfortunately easy to insert the board "off-by-one" pin. A correctly inserted Config board will leave no pins exposed.

6.2.3. Connect Radio Pro: Radio Side

- Connect a 13.8v DC source to the Anderson Power Pole.
 - The user provides their own Anderson Power Pole cable for power.
 - The Radio Pro is internally fused for 500mA, but is unlikely to ever pull more than 300mA. You should also fuse the power source to a value no more than what your power leads can handle. .5A or 1A is a safe value.
- Connect a Microphone cable from your radio's microphone port to the matching socket on the Radio Side of Radio Pro.
 - Halibut Electronics provides many common types of microphone cables.
- Connect the Headphones or Speaker output from your radio to the Headphones/Speaker port on the Radio Side of Radio Pro.
 - Halibut Electronics provides common 3.5mm to 3.5mm, and 3.5mm to 1/4" cables.

6.2.4. Connect Radio Pro: Passthru Side

- Connect your radio's stock microphone into the same mic port on the Passthru Side of Radio Pro.
 - It must be connected to the same connector as you used on the Radio Side. There is no Passthru across connectors.
- Connect your headphones or speaker into the Headphones/Speaker port on the Passthru Side of Radio Pro.

6.2.5. Test Passthru Devices

- Power-on your radio, and verify that your radio's stock microphone and headphones/speaker work as before.

- The Radio Pro doesn't require power for Passthru to work.

If the Passthru devices don't work as expected:

- Check all cables between the Radio Side of HHI Radio Pro, and the radio. Make sure they're in the correct sockets, and completely inserted.
- Check all cables between the Passthru Side of HHI Radio Pro, your radio's stock devices. Make sure they're in the correct sockets, and completely inserted.
 - Remember: You must use the same microphone connector on the Radio Side and Passthru Side. HHI Radio Pro cannot convert from one microphone connection to another.
- Make sure the Config board is inserted correctly:
 - The cut-off corner lines up with the outline on the board.
 - There are no exposed pins on the board-to-board connectors.
- Make sure the Config Board is correctly configured for your radio.

6.3. Adjust HHI Radio Pro Levels

There are three adjustments needed:

1. Headphone/Speaker level
2. Microphone level
3. Microphone DC bias current.

Note: These adjustments will require a properly adjusted OHIS User Device, such as the HHI User Pro. If you haven't already, go through it's User Guide and only proceed once it has been properly adjusted.

6.3.1. Adjusting Speaker Level

The trim-pots for adjusting the Speaker Level are in the lower left corner of the Config board, labeled "Left" and "Right." I haven't found a stereo trim-pot, so we're stuck adjusting each side of audio separately. You probably want the Left and Right set to the same level.

The goal here is to match "comfortable listening level" on the stock speaker/headphones, with "comfortable listening level" on OHIS.

Hint: If you're using a headphone or line level output from the radio, then these trim pots will probably end up very close to full volume (fully clockwise). There is a little bit of gain in the headphone chain, so you may want to turn it down a bit, but the levels are very close. If you're using a speaker output from the radio, then these trim pots will probably be much lower, somewhere in the middle, depending on how powerful the speaker amplifier is.

- Apply power to HHI Radio Pro.
- Turn the Left and Right trim pots all the way down (fully counter clockwise).
- Connect a Passthru headphones/speaker, if not already done above.
 - Make sure the "Headphones or Speaker" switch on the front panel of Radio Pro is "On".
- Make your radio make noise: open squelch, tune to an ongoing QSO, etc.
- Adjust the radio's volume to a comfortable listening level on the Passthru headphones/speaker.

- Do this using the radio's normal volume control.
- Connect an OHIS User Device (such as HHI User Pro) to HHI Radio Pro, and listen to its audio.
- Turn up the Left and Right trim pots until the OHIS User device's is also a comfortable listening level, about the same as the stock headphones/speaker.
 - "About the same" is very subjective if you're comparing headphone to a speaker. Adjust them to the way you like it.

Now, the radio's normal volume adjustment will adjust both the OHIS headset and the Passthru speaker/headphones.

6.3.2. Adjusting Microphone Level

Adjusting the Microphone Level involve listening to your transmitted audio. If your radio has a Monitor feature (where you can hear your own microphone audio while transmitting), then you can do this yourself. If not, then you'll need another way to listen to your own transmissions, or a second person to help.

In either case, as we always do as hams *ahem*, make sure you're using the minimum power needed to perform the test. If available, transmit into a dummy load. If not, make sure you're on a clear frequency and use the lowest power setting available.

The goal is to adjust the Mic Level trim pot so that the OHIS microphone is about the same level as the passthrough microphone. Different microphones will sound different, so use your best judgement.

Attention: Before you can do this, make sure you've adjusted your OHIS User Device for proper mic level. With the HHI User Pro, make sure you are getting mostly green LED with maybe a little yellow LED (or yellow and red, for EAP units); full details are in the HHI User Pro User Guide. On another OHIS User device, follow that devices's instructions for correctly setting mic level.

The trim-pot for adjusting the Microphone Level is in the far lower right corner of the Config board. There is also a DC Bias Current adjustment next to it; we'll adjust that in the next section.

- Connect your radio's stock microphone to the Passthru port on the front of HHI Radio Pro, if you haven't already.
- If your radio has an adjustable mic gain, then set your radio's Mic gain appropriately for the stock microphone.
- Connect your (properly adjusted) OHIS headset to HHI Radio Pro.
- Adjust the DC Bias Current trim pot all the way down (counter clockwise).
 - We'll fine tune this in the next section.
- Adjust the Mic Level trim pot on HHI Radio Pro so that the OHIS mic volume is matched with the stock mic.
 - Either use the "Mon" or "Monitor" feature of your radio, listen on a separate receiver, or another person with their own radio to compare the two levels.
 - HHI Radio Pro will use the mic for the PTT that's pressed. That is, key up using the stock mic's PTT and the stock mic's audio will be sent to the radio. Use the OHIS PTT, and the OHIS mic's audio will be sent to the radio. In this way, you can easily go back and forth between the two for comparison.

Warning: If you are experiencing a problem where the first second or two of your transmit audio is quiet or heavily distorted, don't worry: we'll fix that in the next section. Set the Mic level using the level after a few seconds of key-down, after the level has settled down.

6.3.3. Adjusting Microphone DC Bias Current

After adjusting the mic level, if you notice a brief period immediately after pressing the OHIS PTT of no audio, and/or heavily distorted audio, that then becomes normal after half a second to a couple seconds, then you may need to adjust the Microphone's DC Bias Current. Even if you don't notice this problem, take the following measurements to be sure.

I've only seen this on one radio/stock mic so far (Flex, with the FMH-3 stock mic). So hopefully this shouldn't be very common. If you find you need this adjustment on a non-Flex radio, please [contact us](#) and let us know which radio, so we can update our documentation.

Currents? Voltages? We are adjusting a DC current in the OHIS circuit to match a possible DC current being pulled by the stock microphone. We are measuring these currents by the voltages they create through the radio's input impedance. This is why we are measuring *voltages* to adjust *currents*.

Note: If you plan to leave the stock mic *disconnected* from the Passthru port, then jump directly to [Disable DC Bias Current](#) and skip the rest of this section. But if you ever re-connect the stock mic and notice the distortion mentioned above, you may need to go through this process.

6.3.3.1. Measure Your Radio's DC Bias Current

Use a DC volt meter for the following measurements and adjustments. All measurements are made between the "Mic+" and "Mic-" test points along the bottom edge of the Config Board. You don't need to talk into the Mic for these tests, we're only measuring DC values.

You'll take two measurements below:

1. Passthru Voltage: When no PTT is pressed.
 2. OHIS Voltage: When the OHIS PTT is pressed.
- Connect your radio's stock mic to the Passthru port, if it isn't already.
 - Make sure HHI Radio Pro, and your radio, are both powered on.
 - Measure the Passthru Voltage: DC voltage across the Mic+ and Mic- test points with no PTT pressed anywhere.
 - If the Passthru Voltage is 0.0v, proceed directly to [Section 6.3.3.3. Disabling DC Bias Current](#) and skip the rest of this section.
 - Otherwise, if you measure a non-zero voltage, keep going.

6.3.3.2. Match the OHIS DC Bias Current with the stock Mic DC Bias Current

The goal here is to match the DC voltage across the Mic+ and Mic- test points, between the Passthru mic and the OHIS mic.

- Connect an OHIS headset to HHI Radio Pro
- Press the OHIS PTT.
- Measure the OHIS Voltage: DC voltage across the Mic+ and Mic- test points, while pressing the OHIS PTT, and after the measured value has settled down. It might take a second or three to settle down.
- Adjust the DC Bias Current trim pot so that the OHIS Voltage matches the Passthru Voltage. The trim pot changes the OHIS Voltage, the Passthru Voltage will always remain the same. So press OHIS PTT, adjust the trim pot while measuring, get the OHIS voltage as close as you can, then release OHIS PTT to measure the Passthru voltage again.
- If you cannot get the voltages to match, even with the DC Bias Current trim pot **all the way down** (counter clockwise), then proceed directly to [Section 6.3.3.3. Disabling DC Bias Current](#).
 - This means your stock mic probably doesn't have a DC path at all.
- If you cannot get the voltages to match, even with the DC Bias Current trim pot **all the way up** (clockwise), then leave it at max. You're done. But please [contact us](#) and tell us what radio you ran into this situation with.

6.3.3.3. Disabling DC Bias Current

Only do this section if:

- You measured 0.0v on the Passthru mic (no PTT pressed)
- You were unable to get the same measured voltage on the Passthru mic (no PTT pressed) and the OHIS mic (OHIS PTT pressed), even with the DC Bias trim-pot turned all the way down.
- Remove the "DC Bias Current Enable" jumper on the lower right corner of the Config board near the Mic Level trim-pot.
 - Once the Enable jumper is removed, the setting of the DC Bias Current trim-pot doesn't matter.

6.4. Done!

All done! Go back to [Section 6.2.1](#). and follow those steps in reverse to re-assemble your Radio Pro, put the top back. Make sure the rubber feet are on the bottom when you reassemble Radio Pro, even if that puts the slide-out part on the bottom.

7. Configure the Config Board For Your Radio

7.1. Pin Assignments

The Config board included with your HHI Radio Pro was pre-configured for the radio you specified while ordering.

If Halibut Electronics doesn't offer a pre-configured Config Board for your radio, or you chose the "Generic" Config Board, then your config board comes with a few common defaults, but you will need to confirm they're correct, and add the unique bits for your radio. You can also modify a pre-configured Config Board for another radio. In either case, here's how the Config Board works.

TODO Include a picture of the Config board, with the different sections labeled.

The config board is a large matrix of jumpers to connect pins on physical connectors, to logical signals.

Note: For the time being, ignore the trim pots, "Spk Load" and "DC Bias Current, Enable" jumpers, and "+ Test -" test points. You'll address those in [Section 6](#) above once the pin assignments are done.

Note the following vertical sections of the Config board:

1. Radio Side, on the left
2. Passthru, a single column in the center
3. Passthru Side, two columns on the right

Note how all three sections are further split horizontally into the following sections for each physical connector:

1. PTT RCA, top two rows labeled "C" for center, and "S" for shield.
2. Mic 3.5mm, next four rows, labeled "T" for tip, "R1" and "R2" for rings 1 and 2, and "S" for shield.
3. Mic RJ-45, next eight rows, labeled pins 1 through 8.
4. Mic GX16-8P, next eight rows, labeled pins 1 through 8.
5. Headphones, bottom four rows, labeled "T", "R1", "R2", and "S" as above.

The job of the Config board is to assign physical pins (rows) to logical signals (columns), by jumpering across the two. At the factory, this jumper is accomplished with a "0 Ohm Resistor" so it can be done by a surface mount pick-n-place machine. You can do it yourself with just a solder blob jumper between the two adjacent pads.

The horizontal sections are pretty self explanatory, they're the individual pins on the physical connectors on the Radio/back side of the HHI Radio Pro, and on the Passthru/front side of the HHI Radio Pro.

Let's look at the vertical sections in more detail.

7.1.1. Radio Side Section

The Radio Side section specifies which pins on which connectors have which signals. OHIS needs the following signals specified:

- Headphones left (HP:L), right (HP:R), and ground (HP:G)
- Microphone positive (Mic+), and ground (Mic-)
- Push-to-talk (PTT), and power/common ground (GND)
- Optionally, which pins should be tied to the shield (Shld)

Assign a pin to a signal by jumpering across the intersection of the row (pin) and column (signal) with either an 0603 0 Ohm resistor (done at the factory), or a solder blob (done by you).

The matrix is complete: Any signal can be on any pin on any connector. This makes for a jumper matrix that looks much larger and more complex than it needs to be, but it allows for entirely arbitrary pin-outs. (Yes, this means the labels on the panels are arbitrary and not mandatory. You could put audio on the PTT connector, or speaker on the RJ-45, etc. But, you know, only do that if it makes sense for your setup. 😊)

7.1.2. Passthru, and Passthru Side, Sections

The "Passthru" column down the middle specifies which pins on the Radio Side connectors on the back of the HHI Radio Pro should be routed through to the Passthru Side connectors on the front. All pins should be jumpered through EXCEPT pins assigned to "Mic+" and "Mic-".

Because the microphone signal sent to the radio is switched between the Passthru Side connectors and the OHIS connector, the Mic+ and Mic- signals must *NOT* be hard wired to Passthru. Instead, jumper the Mic+ and Mic- in the "Passthru Side" columns. This sends the mic signal from the Passthru Side connectors, through the relay on the HHI Radio Pro main board, then back up to the "Mic+" and "Mic-" signals on the Radio Side connectors.

All other pins should be Passthru'd to the Passthru side.

7.1.3. Special Considerations

A few things to note.

7.1.3.1. Headphones vs Speaker

If your radio is expecting to drive a loud speaker instead of headphones and only provides a single 2-pin speaker output, then tie both the "HP:L" and "HP:R" signals to Tip, and "HP:G" to Ring 2 and Shield. Leave Ring 1 disconnected to prevent accidental shorting out of the right channel if a stereo signal is ever connected.

If you are instead using a stereo headphone output from the radio, then tie "HP:L" to Tip, "HP:R" to Ring 1, and "HP:G" to Ring 2 and Shield.

7.1.3.2. Multiple Mic Connectors

It's very unlikely you will use more than one Mic connector. However, it's safe to have multiple connectors configured on the Config Board, as long as only one is used at a time. For example, the pre-configured Config

boards as sold by Halibut Electronics have all three physical connectors jumpered to the signal, so the same (for example) "Yaesu HF" Config Board will work on Yaesu radios with either RJ-45 or GX16 mic connections, but only one at a time.

Only ever use the same connectors on the Radio Side and Passthru side. It won't work to, for example, use an RJ-45 on the Radio Side and a GX16-8P on the Passthru side. There is no cross-connection between the connectors for the pins that do not have OHIS relevant signals.

7.1.3.3. Grounds and Shields

There's way more than can be covered here. See [the FAQ below](#) for more information.

Suffice it to say here that OHIS, and therefore HHI Radio Pro, keeps separate connections for mic ground, headphone ground, power ground, *and* shield (which is tied to OHIS power ground at the power input). You have the option to connect any pins to the shield if you know you want to/need to for your specific situation.

7.2. Document Radio Pin-out

You might have to search through a few different places to find the following details. I find it easier to figure all this out first and refer to notes here when actually assembling the Config board.

7.2.1. Microphone

Which connector is the Microphone signal on?

- RJ-45 Mic
- GX16-8P (8 pin "round") Mic
- 3.5mm Mic
- Other: _____

What pin numbers are Mic+ and Mic- (or Mic Ground) on?

- Mic+: _____
- Mic-: _____

7.2.2. Push To Talk

What connector is the PTT signal on?

- RJ-45 Mic
- GX16-8P (8 pin "round") Mic
- 3.5mm Mic
- RCA
- Other: _____

What pin numbers are the PTT signals on?

- PTT: _____

- Power Ground: _____

7.2.3. Headphones or Speaker

What connector is the headphone or speaker signal on?

- 3.5mm Headphone
- Other: _____

What pin numbers are the Left and Right signals on?

- Left: _____ (If mono, put the + signal here)
- Right: _____ (If mono, put the same pin number as Left here)
- Ground: _____

What level is it?

- Headphone
- Speaker
- Line Level (common on "Data port" connections, or when pulling Rx audio from the Microphone connection)

7.3. Solder up the Config Board

Apply the above pin-out information to the Config board.

Note: When removing jumpers, you can safely ignore jumpers on connectors you aren't using. If you have a pre-configured Config board, it will work for several different types of radios, even radios that use different connectors. You don't have to remove those jumpers. Only remove them if they're on the wrong pins of the connector you ARE intending to use.

TODO Include picture of the Config board, with sections labeled, for reference.

7.3.1. Microphone

Copy configuration from [above](#):

- Connector: RJ-45, GX16-8P, 3.5mm, Other: _____
- Mic+ Pin: _____
- Mic- Pin: _____

Remove existing Mic jumpers if they aren't where you want them. Look down the Mic+ and Mic- columns, **on both the Radio Side and Passthru Sides**, looking for existing jumpers on connectors you're using. If there are currently any jumpers on the connector you're using, and they are NOT on the pins we want them on, remove them. If you removed any jumpers above, add jumpers to those rows in the Passthru column.

Add the following jumpers on the Radio Side:

- Add: Mic+, Radio Side

- Add: Mic-, Radio Side

Add the following jumpers on the Passthru Side (same rows as the Radio Side)

- Add: Mic+, Passthru Side
- Add: Mic-, Passthru Side

Remove the following jumpers on Passthru column (same rows as the Radio Side)

- Remove Mic+, Passthru Column
- Remove Mic-, Passthru Column

7.3.2. PTT

Copy configuration from [above](#):

- Connector: RJ-45, GX16-8P, 3.5mm, RCA, Other: _____
- PTT Pin: _____
- Power Ground Pin: _____

Remove existing PTT and Power Ground jumpers if they aren't where you want them. Look down the PTT and Gnd columns looking for existing jumpers on connector you're using. If there are any current jumpers on the connector you're using, and they are NOT where we want them, remove them. If you removed any jumpers above, add jumpers to those rows in the Passthru column.

Add the following jumpers on the Radio Side:

- Add: PTT
- Add: Power Ground (column labeled: GND)

7.3.3. Headphones or Speaker

Copy configuration from [above](#):

- Connector: 3.5mm Headphone, Other: _____
- Left Pin: _____
- Right Pin: _____
- Headphone Ground Pin: _____
- Level: Headphone, Speaker, Line Level

Remove existing Headphone/Speaker jumpers if they aren't where you want them. Look down the HP:L, HP:R, and HP:G columns looking for existing jumpers on connectors you're using. If there are any current jumpers on the connector you're using, and they are NOT where we want them, remove them. If you removed any jumpers above, add jumpers to those rows in the Passthru column.

Add the following jumpers on the Radio Side:

- Add: Left, or Mono + (column labeled: HP:L)
- Add: Right, or Mono + (column labeled: HP:R)

- Add: Headphone Ground (column labeled: HP:G)

Add or remove the speaker load resistors: Both "Spk Load" jumpers, lower right corner of Config board.

- Add if Level is Speaker, Remove is Level is Headphone or Line.

7.3.4. Passthru Column

- Add jumpers to all positions on the Passthru column, EXCEPT where Mic+ and Mic- are connected.
- Remove jumpers from the rows where Mic+ and Mic- are connected.

8. Troubleshooting

9. FAQ

9.1. "OHIS is Open. Does that mean Halibut Electronics products are Open Source Hardware?"

9.2. "What is the distinction between OHIS and HHI?"

9.3. "What kinds of radios are supported by HHI Radio Pro?"

HHI Radio Pro is designed to work with as many radios as possible. It will work with any radio that meets the following specifications:

- Microphone:
 - Physical Connectors:
 - 8p8c Modular, aka RJ-45. Will also work with a 6p6c (aka RJ-11) or 4p4c (aka RJ-14).
 - GX16-8p, aka "8 pin round mic" connector.
 - 3.5mm, aka 1/8 inch, "phone" connector, 4 pin TRRS. Also works with 2 pin TS, or 3 pin TRS.
 - Signal level: Between -35dBV and -85dBV.
 - Electret mic elements are about -45dBV to -50dBV, dynamic mic elements are about -55dBV to -60dBV.
 - HHI Radio Pro provides 10dB gain over the OHIS standard of -45dBV, has a jumper selectable -20dB pad, and a trim pot with about -30dB of useful resolution.
 - Impedance: 500 ohm or more.
 - Electret mic elements are about 1.5k Ohm, dynamic mic elements are 600 Ohm. But mic input amps are typically 1k to 10k input impedance.
 - HHI Radio Pro provides a very low output impedance, close to 1 Ohm, which can drive nearly any load impedance. But the load impedance is limited by the high-pass frequency of a 1uF DC blocking cap. A 500 Ohm load will high-pass at 318Hz. Higher load impedances (typical) will pass lower frequencies. A lower load impedance (very uncommon) will high-pass at higher frequencies, which will start filtering voice frequencies.
 - Balanced, pseudo-balanced, or single-ended.
 - Electret mic elements are typically pseudo-balanced or single-ended, dynamic mic elements are typically balanced or pseudo-balanced.
 - HHI Radio Pro keeps the microphone return (aka "mic ground") separate from other grounds, and isolates the signal with an audio transformer, which will drive any of these three mic amp types.
 - DC Bias: Either provided or not.
 - Electret mic elements use a DC Bias, dynamic mic elements do not use a DC bias.
 - HHI Radio Pro does not need a DC bias voltage on the mic line, and safely removes it if it is provided.
- Headphones or Speaker:
 - Physical Connector:
 - 3.5mm 4 pin TRRS. Also works with 2 pin TS, or 3 pin TRS.

- A 3.5mm to 1/4" cable or adapter can also be used to connect to a radio with 1/4" headphone connection.
 - Signal level: Between -10dBV and +20dBV.
 - Line level is about 0dBV into 600 Ohm, headphone level is about 0dBV into 8 Ohm (similar voltage to line level, but more current), and +10dBV into an 8 Ohm speaker would be 12.5W, much more than most radios provide.
 - HHI Radio Pro provides a trim pot with about 30dB of useful resolution, and provides 10dB of gain, to match to the OHIS standard of 0dBV.
 - Output Impedance: Between 4 Ohm and 10k.
 - Line level is 600 Ohm, headphones are typically between 8 and 300 Ohm, and speakers are typically 8 or 16 Ohm.
 - HHI Radio Pro presents either a 50 Ohm, or 10k, load impedance. A lower impedance source can drive a higher impedance load.
 - Ground Referenced, or Push Pull: Either.
 - Line level and headphones are ground referenced, speakers can be either ground referenced or push-pull.
 - HHI Radio Pro keeps the headphone/speaker return (aka "ground") separate from other grounds, and isolates the signal with an audio transformer which allows for either.
- Push To Talk, PTT:
 - Physical Connector:
 - Any pin on a Microphone connector.
 - Dedicated RCA 2 pin.
 - Contact closure to ground.
 - HHI Radio Pro uses an opto-isolator to tie the PTT line to the radio's power ground. It can sink up to 50mA of current, and V_{ce} up to 80v. (Note: NOT suitable to switch plate voltage of tube amps.)

9.4. "Grounds and Shielding: How do they even...?"

Entire books have been written on the subjects of grounding and shielding. There's no way to cover it all here. Instead, we will discuss what options HHI Radio Pro provides, what Halibut Electronics recommends, and let you choose how to handle your grounds and shields.

9.4.1. Ground vs Shield

OHIS, and therefore HHI Radio Pro, specifies separate return paths (ie: grounds) for a) Microphones, b) Headphones, and c) PTT/Power. In addition to the three separate return grounds, the shield is its own separate connection.

HHI Radio Pro ties the Shield to power ground on the OHIS side of the circuit, its own metal chassis, and copper shields on the circuit board with signal traces run on inner layers. None of the grounds from the radio are inherently connected to the shield, unless they are explicitly done so on the Config board.

Ideally, the various return grounds are treated as separate signals in their own right: the microphone being a balanced pair, headphones being two single ended signals with a shared reference and return ground, and the

PTT just being a contact closure between two arbitrary pins. For example, an XLR microphone cable does this: separate pins for Mic+, Mic-, and Ground/Shield.

Unfortunately, this is not always possible. For example, most 3.5mm, 1/4", and RCA cables assume shield IS the return path/ground. A 3 pin TRS headphone connector puts Left audio on the tip, Right audio on the Ring, and the return ground on the Sleeve. The cable has two center conductors tied to Tip and Ring, and one shield tied to the Sleeve.

In this case, do you connect the Sleeve to the a) Headphone Ground, b) Shield, or c) both? If both, what is the impact of tying the headphone ground to the shield at that point in the circuit?

9.4.2. Ground Loops

Why not just connect all the grounds and shields together? It's all "ground", right?

Well, sort of. This is one possible philosophy: Connect everything together with as solid and direct a connection as possible, make your ground reference as low impedance as possible, and common to all uses of ground.

The problem here is, if you have multiple ground paths from Point A (eg: your radio) to Point B (eg: HHI Radio Pro), that creates a loop antenna, which will pick up stray magnetic fields and induce currents in your ground that are not the intentional result of return currents.

This can be mitigated by keeping the physical area of that loop as small as possible: Running the multiple ground paths physically near each other in a split-loom, for example. Also, shielding the multiple paths in a single shield, like a grounded conduit, will work similarly. When doing this, remember to consider *ALL* ground paths, including DC power, ground lug, USB cables to a computer, etc.

The other option is to minimize the number of loops in the ground, by making it a tree. Only connect the shields at one end of your cable, closest to the earth ground.

In the case of HHI Radio Pro, you have the option of connecting, or disconnecting, the shield of each connector to address this. Unfortunately, there's no way for Halibut Electronics to know your whole setup to know the best way to do this before shipping you a Config board.

10. Known Radio Configurations

10.1. Flex

10.2. Kenwood

10.2.1. Kenwood Station Radios (mostly HF)

10.2.2. Kenwood Mobile Radios (mostly VHF/UHF)

10.3. Yaesu

10.3.1. Yaesu Station Radios (mostly HF)

10.3.2. Yaesu Mobile Radios (mostly VHF/UHF)

10.4. Icom

10.4.1. Icom Station Radios (mostly HF)

10.4.2. Icom Mobile Radios (mostly VHF/UHF)