Instructions for Seagull Bluetooth Speaker Retrofit

Rev A3, Jan 2025

https://seagullelectronickits.com/

Congratulations on the purchase of the Seagull Bluetooth Speaker PCB. This is the only Bluetooth retrofit designed specifically for retrofitting antique radios. Your retrofit radio will provide outstanding audio while maintaining the look, feel, and user experience of the original. These notes provide guidance so you can take maximum advantage of the Seagull PCB's features, and create a retrofit that will be enjoyed for many years. You'll also get tips for minimizing the radio modifications so it could easily be reverted to its original condition.

You can download these instructions at https://seagullelectronickits.com/. You'll also find valuable information in the instructions for the Potentiometer and Wiring Kit.

These notes are divided into five sections:

Features and Configuration – This section describes available features, connections between the Seagull PCB and radio, and how to configure the PCB via configuration shunts and jumpers. Two wiring diagrams are shown: Figure 1 shows the wiring for all Seagull PCB features. The diagram in Figure 2 shows the wiring for minimal features. There is a simpler wiring diagram in the instructions for the Potentiometer and Wiring Kit. Your retrofit will use some or all of the features shown in these diagrams.

Reference Material – This section describes all the connections and programming shunts/jumpers on the PCB.

Retrofit Tips – This section provides tips for minimizing the impact to the radio so that it can be returned to its original condition.

Specifications – This section shows performance specifications and mechanical dimensions.

Resources – This section shows sources that provide parts to help with your retrofit.

Features and Configuration

Terminology Used for Connectors, Jumpers, and Shunts

In this document, connector screw terminal connections are referenced as JX-Y where X is

the connector number, and Y is the number of the screw terminal. Connector locations and pin numbers are shown in Figure 3.

Solderable jumpers and removable shunts are used for configuring the PCB. Solderable jumpers are referred to as JPX where X is the number of the jumper. Locations of the solderable jumpers and shunts are shown in Figure 3.

Wiring to the Terminal Blocks J1 and J3

When connecting stranded wire to terminal blocks, do NOT tin the wire with solder – tinned connections can loosen over time. Tighten the screws to 3.1 – 3.5 in-lb.

Speaker

If your radio is pre-WWII, it likely has a field coil speaker, and you will have to replace the speaker with a modern 4Ω, 6Ω, or 8Ω speaker. See the Resources section for speaker suggestions. To maintain the radio's collectability, do NOT discard the original speaker. If your radio has a large cabinet, secure the original speaker somewhere in the cabinet to prevent it from getting separated from the radio.

Do NOT connect either speaker connection (SPK+ or SPK-) to ground.

Bluetooth Antenna and Range

The Bluetooth antenna is located on the Seagull PCB as shown in Figure 3. Do not install the PCB in a metal enclosure (such as the chassis), or the RF signal will be blocked. For best Bluetooth connectivity, mount the PCB in the upper part of the cabinet and at least a few inches from any large metal parts. You should be able to play the powered speaker from about 30 feet if the path is not blocked. The distance decreases if there are walls between your phone and the powered speaker.

Power Connections

An 18 VDC power supply was included with the Seagull PCB. It connects to connector J2. If you wish to shorten the power cable, cut it and connect the positive (center) wire to J1-7 (18V) and the shield to GND RET (J1-8). If you cut the cable, do NOT connect the power supply shield to the radio chassis. Connect it to GND RET (J1-8), otherwise the amplifier noise may increase.

On/Off Switch

The Seagull PCB is always powered by the 18 VDC power supply. The on/off switch causes the powered speaker to exit the standby mode and turn on. When turned on, the dial lights illuminate, and you can play audio. The Seagull PCB is turned on by grounding J3-6 (/PWR SW). To use the radio's on/off/vol control knob, disconnect it from the radio's circuitry and connect the switch terminals between J3-6 (/PWR SW) and ground as shown in Figure 2.

The PCB is shipped with solderable jumper JP1 closed which causes 10 mA to flow through the power switch when the speaker is on. This current will prolong the life of the on/off switch.

If you use a different switch, connect it as shown in Figure 1

Dial Lights

The Seagull PCB will drive the dial (pilot) lights on the radio when it is turned on by the power switch. For a traditional look, use a Type 47 (6.3V) bulb. If you don't want to change dial lights when they wear out, use Type 47 LED replacements. See Resources for an LED supplier.

The PCB has a connection J1-4 (PIL-I) for an incandescent dial light and a separate connection J1-5 (PIL-L) for an LED dial light. Make sure to use the correct connection for the bulb you select.

Connector pin J1-4 (PIL-I) is used to drive up to three Type 47 (6.3V) incandescent bulbs connected in parallel as shown in Figure 2. The bulbs are driven by Pulse Width Modulation (PWM), so if you connect a DC multimeter across the bulbs you will only read about 2.4 VDC, but they will have the same brightness, power consumption, and service life as when they are driven with 6.3 VDC or 6.3 VAC. If you are curious about why the DC meter reads 2.4 VDC, see this article. Output pin J1-4 (PIL-I) has crowbar short circuit protection, so if it is shorted, just cycle the 18 VDC power.

Output pin J1-5 (PIL-L) will drive up to 3 Type 47 LED replacements in parallel as shown in Figure 2. If there is one LED, do not install shunts C5 or C6. If there are two LEDs install configuration shunt C5. If there are three LEDs, install configuration shunts C5 and C6. Output pin J1-5 (PIL-L) is short circuit protected.

Audio Output Power

The Seagull PCB can produce a maximum of 12 Watts continuous output power into an 8Ω speaker (1% THD) or 24 Watts continuous output power into a 4Ω speaker (1% THD.)

Audio power, volume and soft limiting are configured by solderable jumpers JP2, JP3, and JP4. The Seagull PCB is configured from the factory for 12 Watts into an 8Ω speaker or 24 Watts into a 4Ω speaker. 12 Watts is sufficient for most upright consoles and larger tabletop units, so simply connecting the Seagull PCB to an 8Ω speaker will work for many retrofits. If more power is desired, use a 4Ω speaker.

If you like loud music, removing solderable jumper JP2 allows the volume knob to raise the audio level past the point of amplifier distortion. If JP2 is removed, it is recommended that JP4 remain installed to reduce distortion effects.

If you are retrofitting a smaller radio, you can reduce the maximum power to 1.9 Watts (8Ω) or 1.25 Watts (8Ω) by installing jumper JP2. See Table 1.

Installing solderable jumper JP4 enables a soft limiter that will soften distortion if the power amplifier clips, but it increases the THD at high output levels. Experiment with the gain values and soft limiter to get the best sound from your retrofit.

Table 1 below shows the configuration options for output power.

JP3	JP2	Maximum Power (8 Ω)	Notes
Open	Open	12 W	Allows volume to be raised past the clipping point of the amplifier. Recommend installing JP4 to minimize effects of amplifier clipping.
Open	Closed	12 W	Default configuration. Clipping rarely occurs at maximum volume.
Closed	Open	1.9 W	Use for radios with smaller speakers. Amplifier will not clip.
Closed	Closed	1.25 W	Use for radios with smaller speakers. Amplifier will not clip.

Table 1 – Jumper Selections for Audio control with an 8Ω speaker. These power levels double if a 4Ω speaker is used.

Volume Control

Volume can always be controlled by the Bluetooth host device (phone/computer). The Seagull PCB also allows volume to be controlled by a potentiometer. (when you adjust the knob on the radio, you'll see the slider on your phone follow it) To use the radio's on/off/vol control, disconnect it from the radio's circuitry and connect its terminals as shown in Figure 2. If the potentiometer on the radio has an audio taper, connect the programming shunt across C1. If the potentiometer has a linear taper, do not install the shunt. If you are not sure of the taper, rotate the volume control while watching the volume slider on your phone. If the slider moves to the halfway position when the knob is halfway, the shunt across C1 is correct. The Seagull PCB will work with potentiometers between 1 kΩ and about 800 kΩ. Audio is not passed through the volume control potentiometer, so there is no need to shield the wiring between the potentiometer and the Seagull PCB.

If you want to control the volume using your phone only, connect two resistors between J3-8 (POT CW), J3-7 (POT CCW), and J3-10 (VOL WP) as shown in Figure 1. If you want minimum volume when the Seagull PCB turns on, connect J3-10 (VOL WP) to ground. Do NOT leave J3-10 (VOL WP) disconnected.

See the Resources section for sources of replacement potentiometers for antique radios.

Tone Control

The Seagull PCB supports a potentiometer for adjusting tone. If your radio has a tone control knob, disconnect it from the radio's circuitry and connect its terminals as shown in Figure 2. If the potentiometer on the radio has an audio taper, connect the programming shunt across C2. If the potentiometer has a linear taper, do not install the shunt. If you are not sure of the taper, try the shunt in both configurations and see what sounds best. The Seagull PCB will work with potentiometers between 1 kΩ and about 800 kΩ. Audio is not passed through the tone control potentiometer, so there is no need to shield the wiring between the potentiometer and the Seagull PCB. See the Resources section for sources of replacement potentiometers.

If your radio does not have a tone control knob, you can configure a fixed tone setting by connecting resistors between J3-8 (POT CW), J3-7 (POT CCW), and J3-9 (TONE WP) as shown in Figure 1. Table 2 below provides resistance values for different levels of bass or treble boost. You can also use a potentiometer instead of the resistors to get a more accurate tone setting. Do NOT leave J3-9 (TONE WP) disconnected.

R_1	R_2	Note
0	4.7k	9.6 dB bass boost
750	3.9k	6 dB bass boost
1.5k	3.3k	3 dB bass boost
2.7k	2.7k	0 dB bass boost (flat audio)
3.3k	1.8k	1 dB treble boost
4.7k	820	2 dB treble boost
4.7k	Short	2.6 dB treble boost

Table 2 – Resistor values for setting tone with programming shunt C2 not installed. See Figure 1 for connection details

Pairing Switch

If you want to control Bluetooth pairing from the front of the radio, disconnect two wires from the rotary band switch and use the band switch to ground /PAIR (J1-2) as shown in Figure 2. Grounding J1-2 causes the Seagull PCB to enter pairing mode for 3 minutes.

A pairing switch is not required. If /PAIR (J1-2) is permanently shorted to ground as shown in Figure 1, the Seagull PCB will enter pairing mode when turned on with the power switch. If

the Seagull PCB pairs with or connects to a device, or if 3 minutes elapses, the Seagull PCB will exit pairing mode. With J1-2 permanently grounded, just turn the Seagull PCB off and on to force it to pairing mode.

Additional information regarding pairing and connecting:

1. Whenever the Seagull PCB is turned on you will have to connect to it. It will not automatically connect back to the last Bluetooth source.
2. Before connecting a device to the Seagull PCB for the first time, the Seagull PCB must be placed in pairing mode, and the Bluetooth source must pair with it.
3. Once a device has paired with the Seagull PCB, it doesn't need to be paired again. A paired device can connect to the Seagull PCB at any time.
4. If shunt C3 is not installed, the dial lights will flash in pairing mode. If C3 is installed, the dial lights will light solidly whenever the radio is on

Aux Audio

The Seagull PCB will accept Aux audio from an analog stereo source such as the headphone output from a phone or computer. Connections are shown in Figure 2. When using the Aux Audio input, speaker volume is adjusted on the audio source instead of from the volume knob on the radio. Grounding J3-4 (/AUX DET) enables the Aux Audio signal path. If you do not use Aux Audio, leave J3-1 (AUX RET), J3-2 (AUX L), J3-3 (AUX R), and J3-4 (\AUX DET) disconnected as shown in Figure 1.

See Specifications for the maximum audio level for Aux In.

Wiring Diagrams

Figure 1 shows the required Seagull PCB connections for minimum functionality. Figure 2 shows connections for full functionality. Connect your Seagull PCB to use the functionality you need. You can find a simpler wiring diagram in the instructions for the Potentiometer and Wiring Kit.

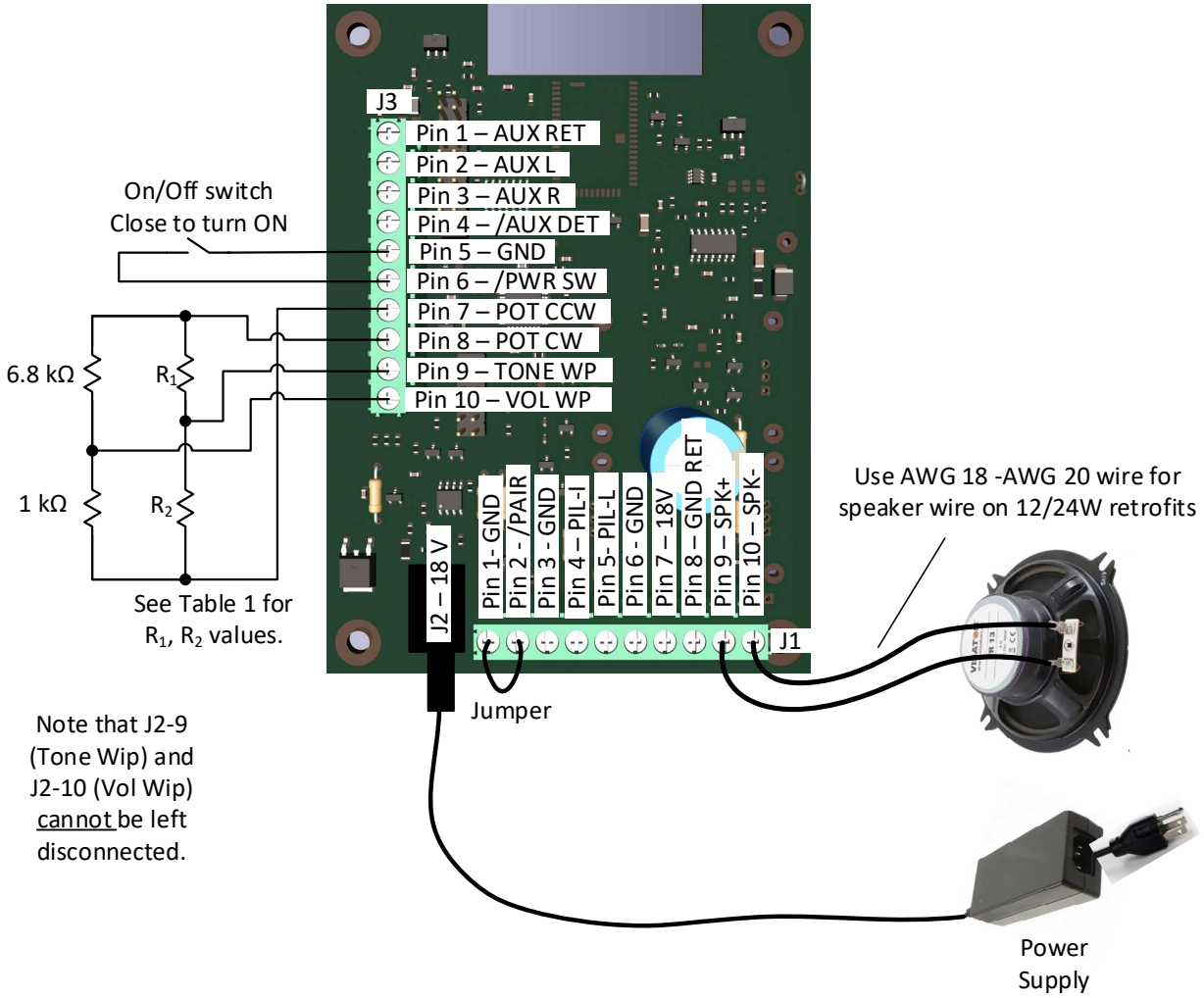

Figure 1 – Wiring diagram – Minimal functionality

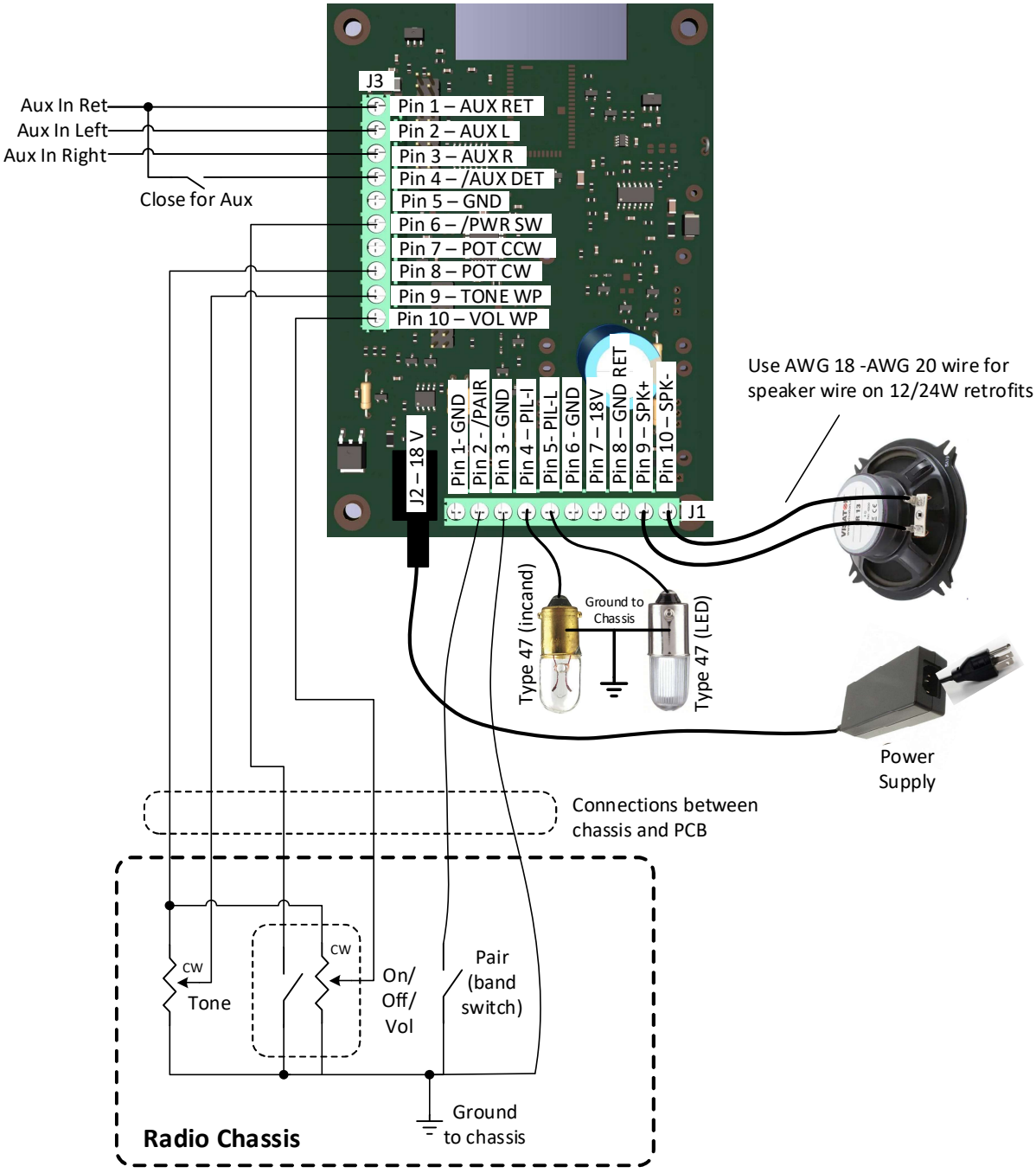

Figure 2 - Wiring Diagram - Full Functionality

Reference Material

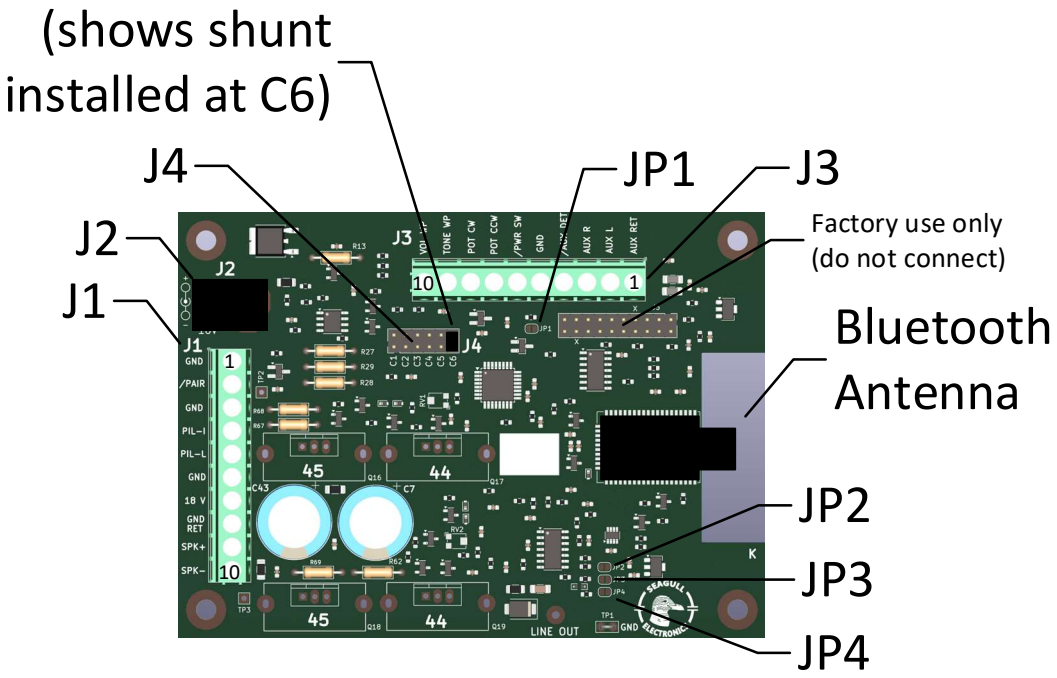

Figure 3 - Connector and Configuration Jumper Locations

Connector J1

Pin	Label	Description	Comments
1	GND	Ground	
2	/PAIR	Connect to ground to enter pairing mode. Ground permanently if you want the radio to enter pairing mode for 5 minutes when the speaker is turned on.	See Pairing Switch
3	GND	Ground	
4	PIL I	Drives type 47 (6.3V) pilot light. Up to 3 bulbs can be connected in parallel.	See Dial Lights
5	PIL L	Drives up to 3 Type 47 LED replacements in parallel.	See Dial Lights
6	GND	Ground	
7	18V	Connects to 18 VDC Power Source	See Power Connections

8	GND RET	Connect to the ground return of the 18 VDC Power Source	See Power Connections
9	SPK+	Connect to one terminal of 4Ω, 6Ω, or 8Ω speaker. Do NOT connect either speaker pin to ground!	See Speaker
10	SPK-	Connect to one terminal of 4Ω, 6Ω, or 8Ω speaker. Do NOT connect either speaker pin to ground!	See Speaker

Connections J3

Pin	Label	Description	
1	AUX RET	Return for AUX Audio (GND on Seagull PCB).	See Aux Audio
2	AUX L	Left channel Aux input	See Aux Audio
3	AUX R	Right channel Aux input	See Aux Audio
4	/AUX DET	Connect to ground to select Aux input	See Aux Audio
5	GND	Ground	
6	/PWR SW	Connect to ground to turn powered speaker on	See On/Off Switch
7	POT CCW	Connect to ground (CCW of volume and tone pots)	
8	POT CW	Output – Connect to CW terminal of volume pot on radio.	
9	TONE WP	Connect to wiper of tone pot on radio	See Tone Control
10	VOL WP	Connect to wiper of volume pot on radio	See Volume Control

Configuration Shunts

Configuration shunts are provided with the kit. They are used to short pins on Connector J4 as shown below.

Position	Shunt Installed	Shunt Removed
C1	Audio taper pot used for volume.	Linear pot used for volume. See Volume Control.
C2	Audio taper pot used for tone.	Linear pot used for tone. See Tone Control.
C3	Dial lights solid when speaker is on.	Dial lights flash in pairing mode. See Pairing.
C4	Unused	Unused
C5	Additional LED	See Dial Lights
C6	Additional LED	See Dial Lights

Solderable Jumpers

Functionality for JP1 is shown below. See Audio Output Power for functionality of JP2, JP3, and JP4.

See this video for instructions for working with solderable jumpers.

Jumper	Shorted	Open	Note
JP1	10 mA switch current when radio is on. (default)	20 uA switch current when radio is on.	10 mA through an old switch keeps the contacts cleaner and prolongs switch life.

Retrofit Tips

This section contains tips that will help you make the best retrofit while ensuring the radio can be returned to its original condition someday. Following these tips will ensure that your radio maintains the highest value and be enjoyed by generations to come. You can find more tips in the instructions for the Potentiometer and Wiring Kit. If you have tips that belong here, please let us know!

1. A retrofit speaker likely won't be a perfect match for the original speaker. Cut a mounting adapter using 3/8" plywood so you can use the original mounting screw locations.

2. If you replaced the speaker, mount the old speaker to the inside of the case so it doesn't get lost.

3. If your radio is a table model from the late 1940's, 1950's, or early 1960's, it will usually have a small speaker that mounts to the dial scaffolding. For best results, have the speaker refurbished. Then limit the maximum output power as shown in Audio Output Power so the speaker doesn't get stressed.

4. If you replace a potentiometer, leave the old one in the bottom of the chassis. Even if it is bad, it can probably be repaired by a dedicated craftsman. Secure it with zip ties so it won't rattle.

5. When disconnecting wires for repurposing potentiometers and switches, make sure to leave the wire ends near the location they came from.

6. If the radio has a thin case, cut a piece of plywood and mount it between the edge rails. Secure the Seagull PCB to the plywood.

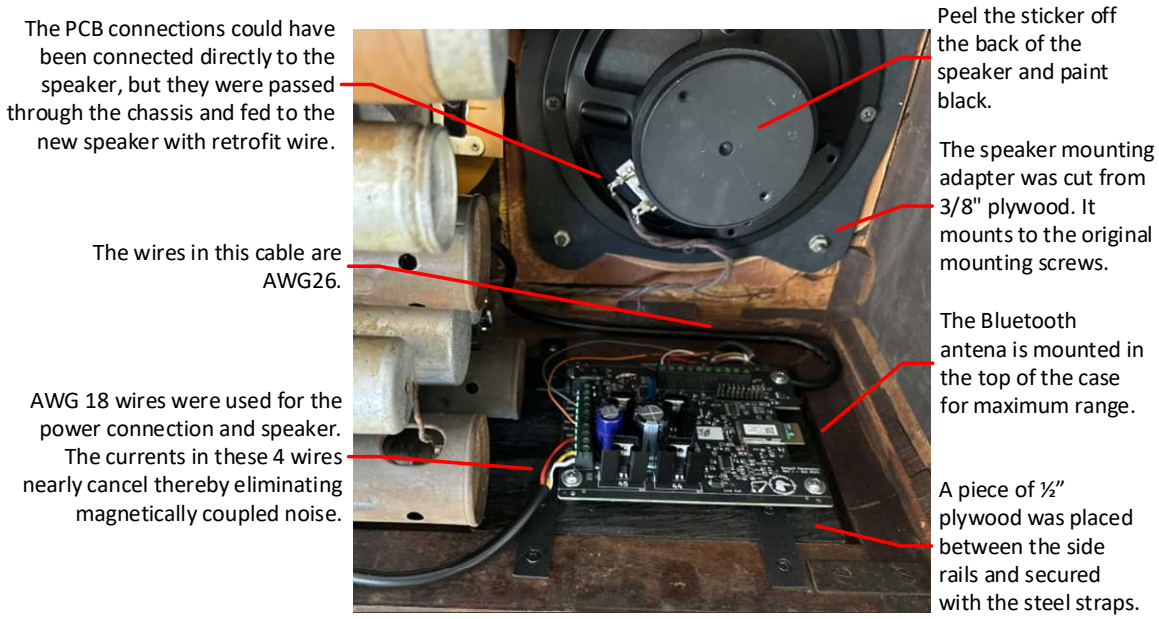

Figure 4 – Retrofit details, Philco Model 66-S

Specifications

Maximum Continuous Audio Power (1% THD), 8Ω speaker	12 Watts
Maximum Continuous Audio Power (1% THD), 4Ω speaker	24 Watts
Frequency Response (3 dB)	90 Hz to 18.2 kHz
Standby Power Supply Current (18 VDC) (excludes dial light current)	< 50 mA
Idle noise	< 1.5 mVAC measured in 11 kHz bandwidth at full volume.
Aux Input Level	< 2.0 Vpp on L or R channel
Physical Dimensions	See Figure 5 below

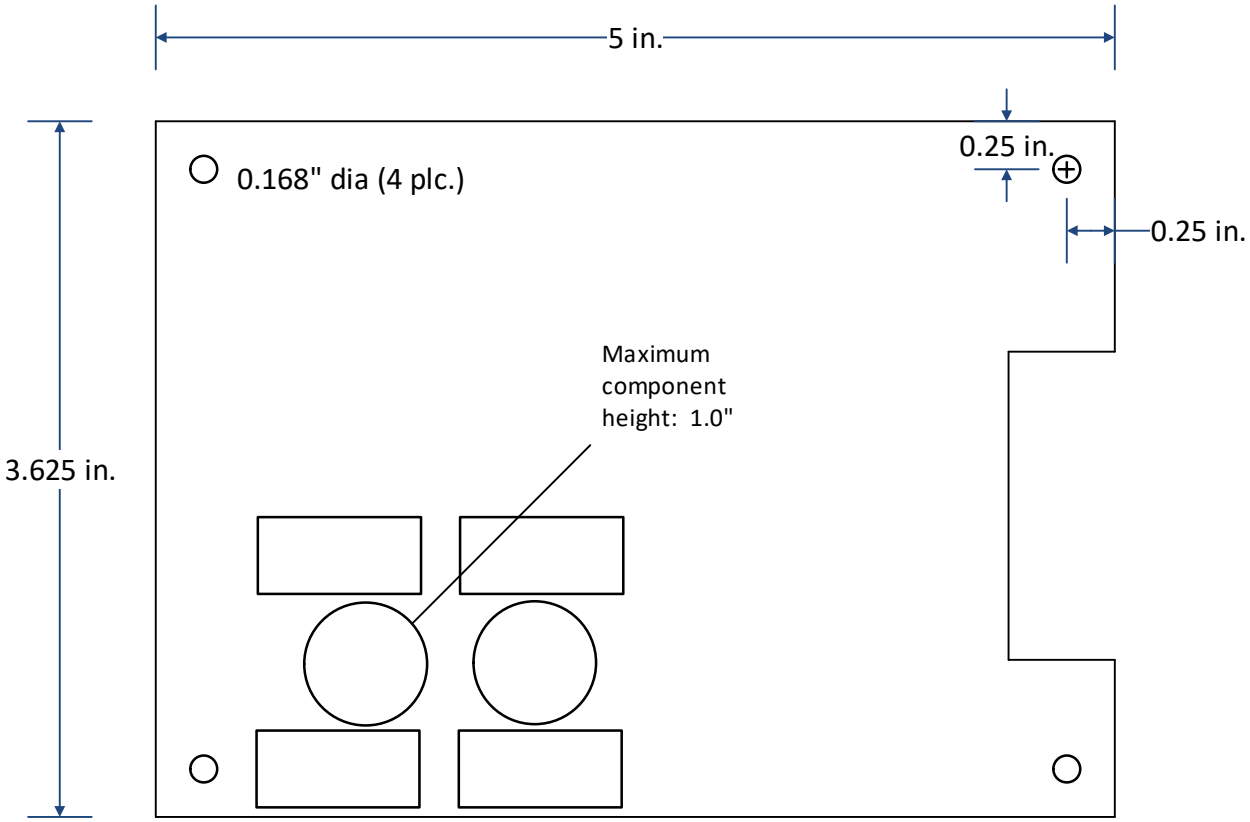

Figure 5 - Seagull PCB Dimensions and Mounting Hole Locations.

Resources

Speaker, Visaton BG-17, 8Ω. 6.5”

Speaker, Visaton BG-20, 8Ω, 8”

Speaker, Visaton FR-14, 4Ω, 5”

Speaker, Visaton W200 S – 8 Ω, 9.1”

Speaker, Visaton W200 – 8 Ω, 8.1”

Speaker, Visaton W200 – 4 Ω, 8.1”

On/Off/Vol Potentiometer, 5 kΩ (this one is 5 kΩ. Anything up to 800 kΩ will work. Linear or audio taper is selectable via a configuration jumper))

Tone Potentiometer, 10 kΩ (this one is 10 kΩ. Anything up to 800 kΩ will work. Linear or audio taper is selectable via a configuration jumper)

Type 47 LED Replacements