Ham Radio Solutions
CW Hotline Kit
Assembly Manual
Version 0.6 12-11-2023

The Ham Radio Solutions CW Hotline kit is a fairly simple construction project that can usually be built in an hour or two. You will need a low wattage pencil-type soldering iron with a small tip, some thin solder, a pair of diagonal cutters and a Phillips head screwdriver. Desoldering braid may be required to correct soldering mistakes. Be sure to wear eye protection when soldering and cutting leads.

Most parts, except for a few at the end, should be inserted into the side of the PCB with the jack silkscreens J1, J2, J6. Unless otherwise indicated, parts should be flush with the PCB. After inserting, turn the board over and solder the leads to the pads on the other side. It is often helpful to just solder one lead, then ensure the component is correctly positioned before soldering the remaining leads. Be sure to only solder the correct pads, and do not let any solder touch any other pad or trace. Trim any excess leads with diagonal cutters after soldering each batch of components. The checklist will be useful to ensure all components are properly assembled.

Build slowly and follow the instructions. Use the images to confirm component placement. CW Hotline may be built with a straight key, Iambic paddles, or neither.

CW Hotline Kit Styles

CW Hotline kits are available in 2 assembly styles:
- Kit Style B - with a blank PCB, and all through hole components. For those that want a full kit building experience.
- Kit Style C - with a partially assembled PCB. You just need to add the ESP8266 module, 2 LEDs, a button and speaker, and key of your preference. For those who prefer an easier assembly.

Follow the assembly directions below for your kit style.

Kit B PCB Parts

- ☐ PCB - blank CW Hotline Printed Circuit Board
- ☐ R1, R2, R4 - 680 ohm resistors (blue-gray-brown)
- ☐ R3 - 10K ohm resistor (brown-black-orange)
- ☐ R5 - 330 ohm resistor (orange-orange-brown)
- ☐ C1 - 0.1uf capacitor (marked 104)
- ☐ Q1, Q2 - 2222A NPN transistors
- ☐ J1, J2, J6 - 3.5mm stereo TRS jacks
- ☐ 2 1x8 male header posts for ESP8266
- ☐ Additional parts listed with Kit C below

Kit B PCB Assembly

- ☐ Install resistors R1, R2, & R4. For each resistor, bend the leads near the bulb 90 degrees and parallel and insert into the PCB. Orientation is not important.
- ☐ Install resistors R3 & R5 as resistors above.
- ☐ Install capacitor C1. Orientation is not important.
- ☐ Install transistors Q1 & Q2. Be sure to match the orientation with the flat side on the silkscreen. Leads are often very close together so do not let solder contact between any 2 leads.
- ☐ Install stereo jacks J1, J2, J6. Ensure all jacks are flush with the PCB.
- ☐ Install 2 1x8 male header posts into PCB. Insert the short sides of the post in the PCB holes. Solder just one pin each on the other side of the PCB, ensure the pins are perpendicular and flush with the PCB, temporarily test fit the blue ESP8266 PCB, and then solder the remaining pins. Use standard ESD precautions when handling the ESP8266 PCB. If you do not have a grounding strap, touch a large piece of metal before touching the ESP8266 PCB.
- ☐ Insert the blue ESP8266 PCB onto the long sides of the previous header posts, being sure to match the silk screen orientation, with the reset button nearest the upper left corner. Solder only two diagonally opposite pins to the hole on the top face of the blue ESP8266 PCB and verify the board is flush. Solder the remaining pins. Do not trim the remaining exposed posts.
- ☐ Insert the green LED D1 onto **the other side of the PCB**. The shorter lead, nearest the flat side of the LED, should go into the square hole. **The LED should not be flush with the PCB**, but instead a 5/32" or 4mm gap between the PCB and the bottom of the LED. If the case has been drilled, you can fit the LED and PCB in the case to set the position for the LEDs to slightly protrude. Solder just one lead and adjust until the spacing is correct, then solder the other lead.
- ☐ Insert the red LED D2 the same way as D1.
- ☐ Insert button SW1 on the same side of the PCB as the LEDs. It should only fit one way and the 2 middle pads will not be used. **The button should not be flush with the PCB**, but instead 1/32" or 1mm gap between the PCB and the bottom of the button.
- ☐ Install the speaker leads into pads marked SP1. If the speaker has a connector on the end of the leads, remove it and strip the insulation. The red wire should go to the square hole. Solder on the other side. Use the small square of double sided foam tape to stick the speaker to the PCB above the circle.
- ☐ Continue assembly following Kit C instructions below.

Kit C PCB Parts

- ☐ PCB - partially assembled CW Hotline Printed Circuit Board
- ☐ ESP8266 in WeMos D1 mini form factor, programmed with CW Hotline firmware
- ☐ D1 - green 3MM LED
- ☐ D2 - red 3MM LED
- ☐ SW1 - SPST momentary button
- ☐ 1 small speaker
- ☐ 1 small piece foam tape
- ☐ 1 MicroUSB cable

Kit C PCB Assembly

- ☐ Insert the blue ESP8266 PCB onto the long sides of the header posts on the PCB, being sure to match the silk screen orientation, with the reset button nearest the upper left corner. Solder only two diagonally opposite pins to the hole on the top face of the blue ESP8266 PCB and verify the board is flush. Solder the remaining pins. Do not trim the remaining exposed posts.
- ☐ Insert the green LED D1 onto **the other side of the PCB**. The shorter lead, nearest the flat side of the LED, should go into the square hole. **The LED should not be flush with the PCB**, but instead a 5/32" or 4mm gap between the PCB and the bottom of the LED. If the case has been drilled, you can fit the LED and PCB in the case to set the position for the LEDs to slightly protrude. Solder just one lead and adjust until the spacing is correct, then solder the other lead.
- ☐ Insert the red LED D2 the same way as D1.
- ☐ Insert button SW1 on the same side of the PCB as the LEDs. It should only fit one way and the 2 middle pads will not be used. **The button should not be flush with the PCB**, but instead 1/32" or 1mm gap between the PCB and the bottom of the button.
- ☐ Install the speaker leads into pads marked SP1. If the speaker has a connector on the end of the leads, remove it and strip the insulation. The red wire should go to the square hole. Solder on the other side. Use the small square of double sided foam tape to stick the speaker to the PCB above the circle.
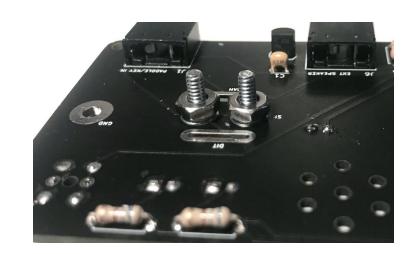
After Above PCB Assembly

Decide if the CW Hotline will be built with a straight key or Iambic paddles and follow the corresponding instructions below. If it will be only used with external keys and paddles, both instructions may be disregarded.

Straight Key Parts

- ☐ 1 Straight Key PCB arm
- ☐ 1 PCB wrench for #4 nuts
- ☐ 3 #4-40 ⅜" screws
- ☐ 2 #4 washers
- ☐ 7 #4 nuts
- ☐ 1 knob & cap
- ☐ 1 #4-40 ⅝" screw

Straight Key Assembly

- ☐ Insert 2 ⅜" screws into the 2 holes nearest the center of the main PCB with the screw heads on the LED side of the PCB. On the other side, insert a #4 washer and nut onto each screw and hand tighten. Ensure the washers do not contact the slot labeled DAH. Note that the kit includes two #4 washers and one larger #6 washer. The #6 washer is for use with the paddle.

- ☐ Insert the last ⅜" screw into the hole nearest the center of the PCB arm, and lightly secure with a nut.

- ☐ Insert the PCB arm onto the main PCB on the ESP8266 side through the 2 first screws, with the third screw through the PCB hole marked GND. Secure to the first 2 screws with 2 nuts.

- ☐ Add the final nut to the third screw on the LED side of the PCB. This screw should be rigidly secured to the main PCB, and the screw head should only make contact with the plated ring around the hole on the arm when the arm is pressed. Using the PCB wrench, adjust the 2 nuts on the screw so the head of the screw is just below but doesn't contact the ring on the PCB arm.

- ☐ Insert the ⅝" screw to the last hole in the PCB arm with the head on the ESP8266 side. Remove the cap from the knob, add the knob to the other side, and secure with the last nut. Place the cap back on the knob.

Paddle Parts

- ☐ 2 Paddle PCB arms (1 left, 1 right)
- ☐ 2 #4-40 3/16" screws
- ☐ 1 13/32" #4-40 hex standoff (10.3mm long)
- ☐ 1 #4-40 ⅜" screws
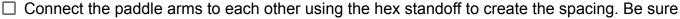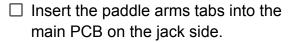- ☐ 1 #6 steel washer (9.8mm x 1.1mm thick)
- ☐ 2 #4 nuts

Paddle Assembly

- ☐ Separate the paddle arms from each other and lightly sand or file the edge where they were connected.
- ☐ Connect the paddle arms to each other using the hex standoff to create the spacing. Be sure the paddle arm text is on the outside, the exposed contact pads are on the inside facing each other. Use the two 3/16" screws through the two large holes in the paddle arm corners.
- ☐ Insert the paddle arms tabs into the main PCB on the jack side.
- ☐ Solder just one corner of one of the arm tabs on the LED side of the main PCB, ensuring the arm is parallel with but doesn't contact the main PCB except at the soldering pad. Once it is in position, solder the rest of the tab.
- ☐ Solder the other arm in a similar manner.
- ☐ Install the larger #6 washer to the ⅜" screw and secure with a nut. This washer will be the contact point for both paddle arm pads.
- ☐ Insert that screw into the hole on the main PCB marked GND with the washer between the paddle arms. Secure on the other side of the PCB with a nut.
- ☐ Adjust and rotate the washer so that it is equally spaced between the paddle arms.
- ☐ Optionally push or pull the arms slightly while melting the solder to fine tune the arm spacing.

CW Hotline Case

CW Hotline includes a pre-drilled and cut case. There are 2 case styles:
- with a hole for a built-in straight key or iambic paddles, and
- without that hole for a version that only works with an external key.

After PCB is assembled:
- ☐ Secure PCB to case with 4 black screws in the corner holes. Optionally, just use 2 screws on the side furthest from the 3.5mm jacks. Do not over tighten or the plastic may crack.
- ☐ Close case with the case lid, with the notched lip end near the built in key if included.
- ☐ Apply vinyl label.

In some cases, the lip on the lid may contact the iambic paddles. If this is the case, cut away a small piece of the lip with diagonal cutters.

Schematic