QRPGuys KD1JV SL Code Trainer

DIFFICULTY LEVEL
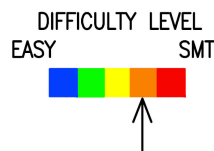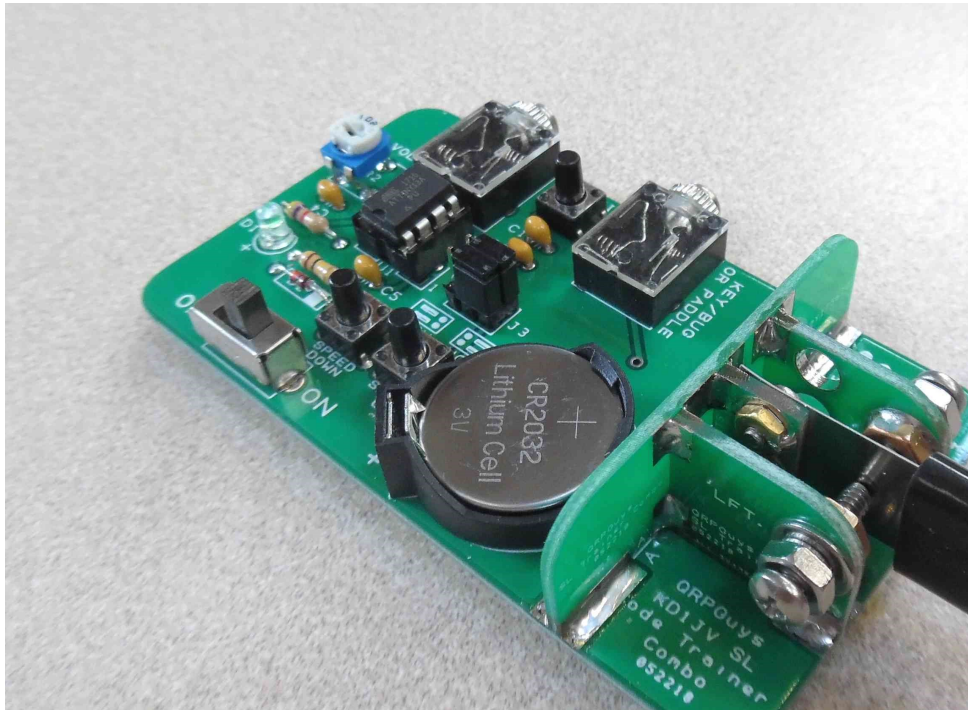EASY   SMT

First, familiarize yourself with the parts and check for all the components. If a part is missing, please contact us and we will send one. You must use *qrpguys.parts@gmail.com* to request a part.

Please read all the instructions before starting the assembly.

Parts List

1 – KD1JV DL Code Trainer pcb's, 5 pieces in all
1 – U1, ATTiny13 dip IC
1 – D1, green led
1 – D2, 1N4148 diode, small glass with black band on one end
5 – C1,2,3,4,5, .1uF mono capacitor, marked 104
1 – R1, 4.7K resistor, (yellow-violet-red-gold)
1 – R2, 1K trimpot
1 – R3, 100K resistor, (brown-black-yellow-gold)
1 – S1, SPDT slide switch
3 – S2,3,4 pushbutton switch
2 – J1,2, 3.5mm audio jack
1 – 8 pin dip socket
1 – J3, 2x3 pin header
2 – header jumper (Berg connector)
1 – coin battery holder
4 – 3/8" dia. rubber foot

1 – SS paddle leaf, 1.25" long
1 – 4-40 x 3/8"L SS pan head Phillips screw *(used for soldering assembly holding)*
2 – 4-40 x 1/2"L SS pan head Phillips screw
2 – 4-40 SS nut
2 – 4-40 brass nut
2 - #4 SS lock washer
2 – #4 SS flat washer
2 – 2-56 x 3/16" SS pan head Phillips screw
2 – 2-56 brass nut
2 - #2 SS lock washer
1 - 1/2" wide x 2"L plastic shim
1 - 1/2" x 1" vinyl caplug

Even if you have done radio kit assembly before, please read through all the instructions before you start. This kit is a little different, in that the mechanical components are parts of a printed circuit board. The instructions give you the scope of the project and an understanding of the techniques we have employed. You will be assembling the paddle from PCB material, and when assembled, also forms the electrical connections. There are solder pads and registration marks that must be observed so that when you tack and solder, it will make a sturdy mechanical and electrical assembly.

The tools you will need are a soldering iron with a small tip, rosin core solder, a small Phillips screwdriver, needle nose pliers, tweezers for the small 2-56 screws and hardware, and a flat surface to work on.

Refer to the graphic below and the PCB silk screening for the placement of the components.
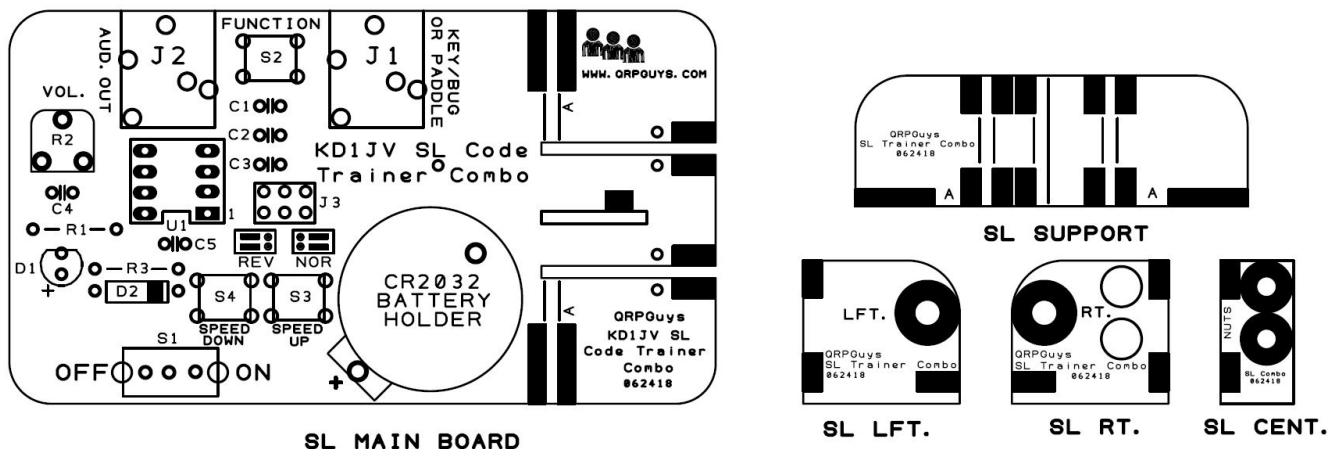

These are the five pieces and the names we will be using during the mechanical assembly. Notice that the base and SL support are marked with registration lines. They will guide you when they are in the correct alignment.

Important:

On all the mechanical soldering you do, you will use the same technique. You tack a single tiny point first and, then check to see that it is square and aligned with the registration lines and other notes. It is easy to re-heat the joint and adjust the alignment when there is only a single point. Then you tack the other pads, before you do the finish soldering.

First, solder the two 2-56 **brass** nuts to the SL center. Use the two 2-56 stainless steel screws to secure the brass nuts on the side of the paddle leaf holder marked **"nuts"**, and solder the brass nuts to the PCB. *The lock washer insures that the nut will be flush with the PCB when it is heated.* It is helpful to rub the face of the nut on some scotchbrite or emery paper to clean up the surface contacting the PCB.
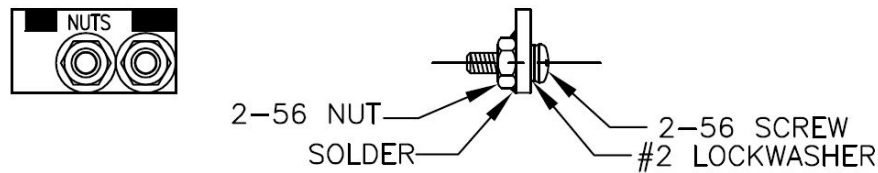

Next, assemble the SL Main board and the SL support. Both pieces are the same width and should be flush on each side when installed properly. There are silkscreened lines and reference letters showing where to position the SL Support on the SL Main board. The support should be flush on each side and 90° to the base. You can check this angular alignment with corner of a 3x5 file card.
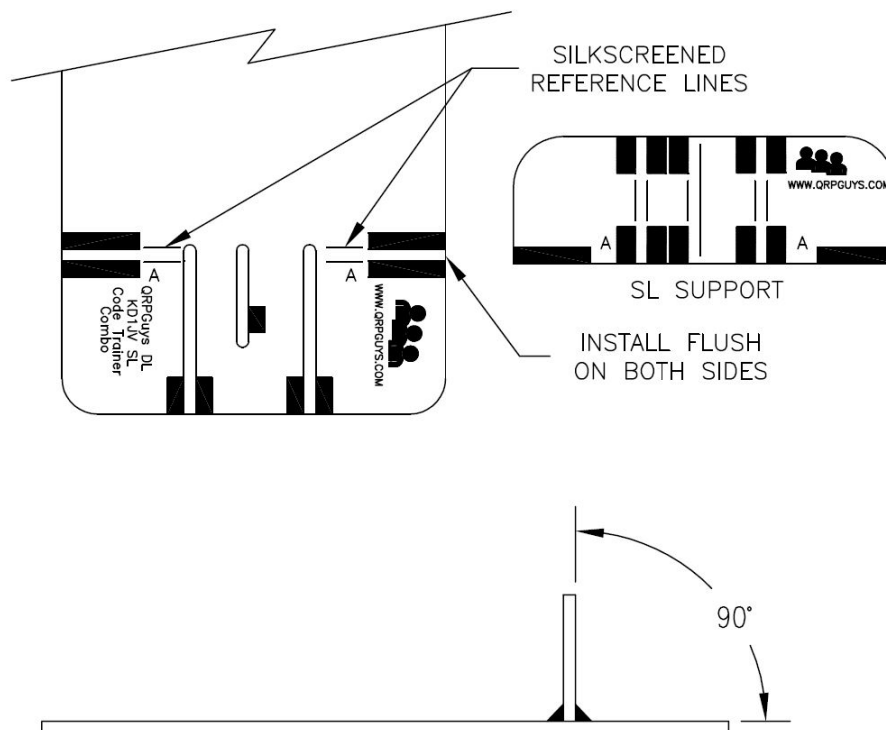
Next to assemble is the SL cent. assembly that has the two nuts soldered onto it. Place the Main board subassembly on a flush surface. Position the SL cent. into the slot of the base as shown in the graphic below and flush with the bottom surface, up against the SL Support. Use the same technique of placing a small tack and checking the 90° angular alignment. Correct if necessary and proceed to finish soldering all the pads.

SL CENT.
FLUSH WITH
BOTTOM
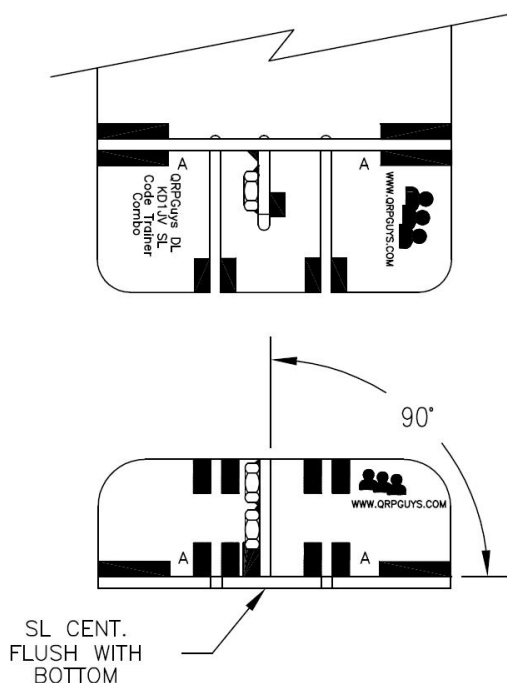
Next to assemble are the two contact holders, named SL Lft. and SL Rt.. Place the Main board subassembly on a flush surface. Position each of the SL contact holders into the slots of the base as shown in the graphic below, and contacting the SL Support. Use the same technique of placing a small tack and checking the 90° angular alignment. You can check this angular alignment with corner of a 3x5 file card. Correct if necessary and proceed to finish soldering all the pads.


SL LFT. & SL RT.
FLUSH WITH FRONT

SL LFT. & RT.
FLUSH WITH
BOTTOM
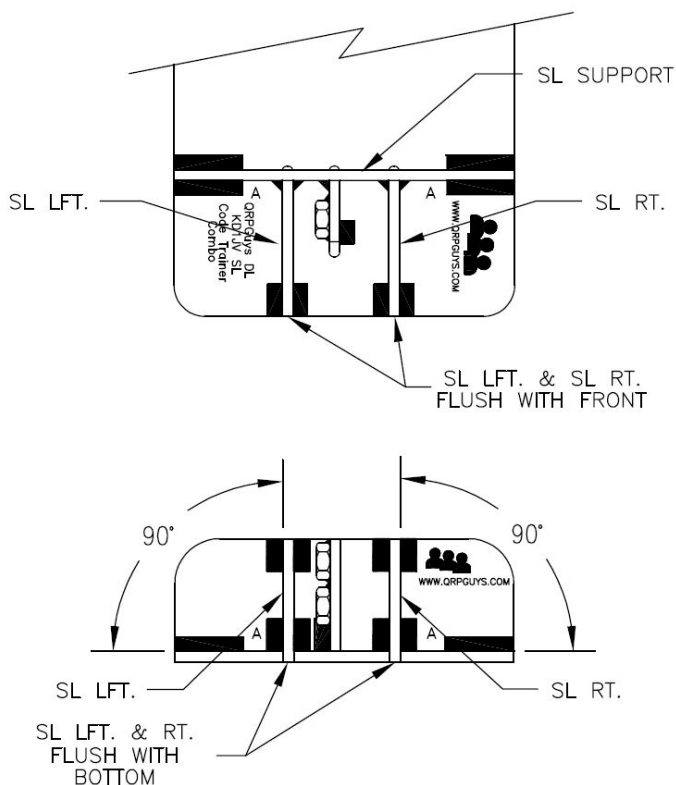
Next, the two **brass** 4-40 nuts need to be permanently soldered to the "inside" of both the contact holders. Use the 4-40 x 3/8"L SS screw, and, a #4 lock washer to hold them in place, and solder the brass nuts to the PCB. *The lock washer insures that the nut will be flush with the PCB when it is heated.* Rub the face of the nut on some scotchbrite or emery paper to clean up the surface contacting the PCB.
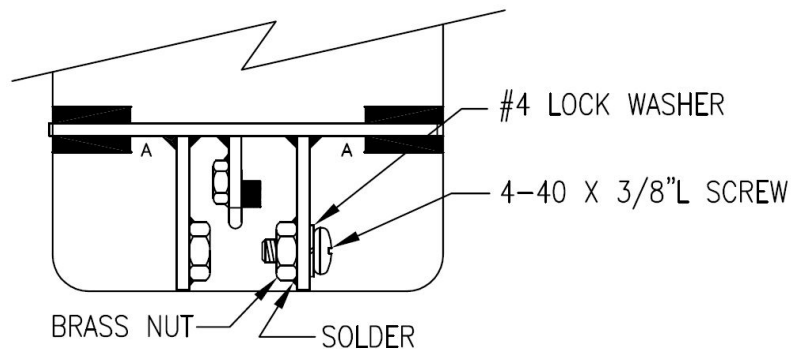

Assembling the paddle lever components:

It's a good idea to assemble the hardware over a cookie sheet. Any hardware is difficult to find if dropped. Secure the paddle leaf to the holder using the hardware as shown. The hardware is small but with some patience and tweezers, can be assembled. It is easier to do the bottom screw first. Observe the order of the hardware. There are two clearance holes in the right contact holder for a small screwdriver to tighten the 2-56 screws. After assembly, if the paddle leaf holder is not perfectly square, the paddle leaf may be off to one side, or on an angle. Simply bend it to be centered between the two contact holders. Center the paddle leaf before installing the contact screws.
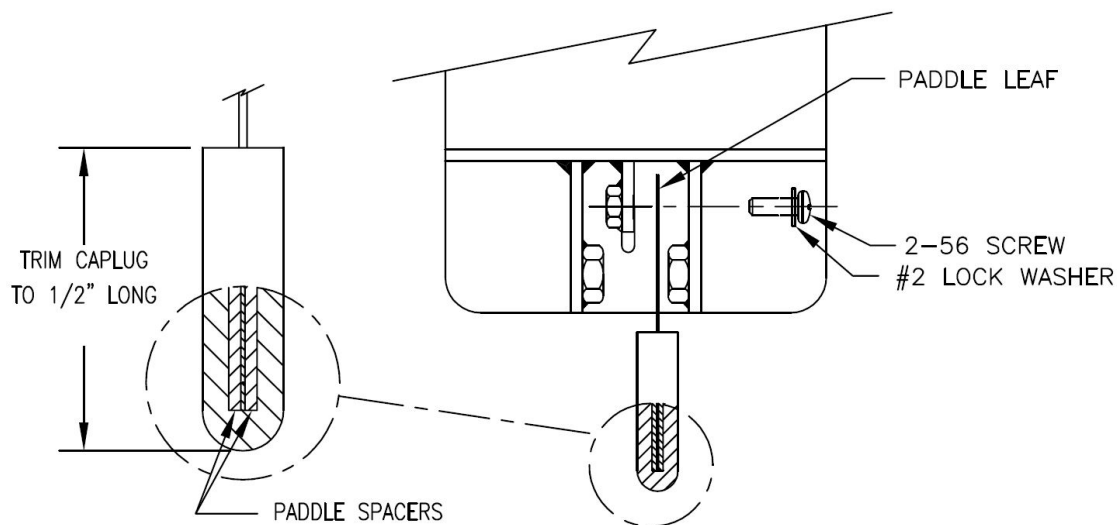
Cut the vinyl caplug lever cover 1/2" long from the closed end. Scissors will work easily. Cut the piece of 1/2" wide plastic into two 7/16"" long pieces. Sandwich the paddle lever between the plastic spacers and slide the caplug over the end of the paddle leaf.

<u>Installing the contact screws:</u>

Install the contact screws to each contact holder as shown. Observe the order of the hardware. The contact distance to the paddle leaf can be adjusted from a few thousandths of an inch to whatever the user feels comfortable with for sending. Start with a small clearance, and increase if needed. Secure the nuts when satisfied.
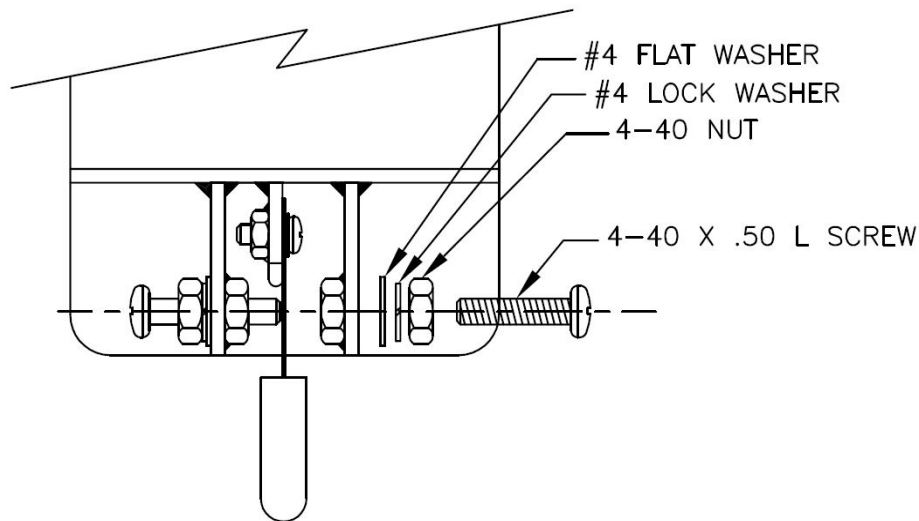
[ ]   Install the four rubber feet on the bottom corners where indicated by the silkscreen.

This completes the mechanical assembly.

The electrical assembly will start with the smallest components first and progress to the larger ones.

[ ]   Install C1,2,3,4,5, .1uF mono capacitor (marked 104)

[ ]   Install D2, 1N4148 diode, glass with black band on one end, *match board outline*

[ ]   Install R1, 4.7K resistor, (yellow-violet-red-gold)

[ ]   Install R3, 100K resistor, (brown-black-yellow-gold)

[ ]   Install D1, green led, *observe polarity, long lead is positive.* This can be omitted if you do not need the visual code indication, and you will get better battery life.

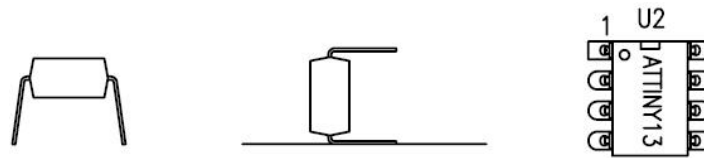[ ]   Install the 8 pin dip socket for U2

[ ]   Install J3, 2x3 pin header

[ ]   Install S1, SPDT slide switch

[ ]   Install R2, 1K trimpot

[ ]   Install J1,2, 3.5mm audio jack

[ ]   Install S2,3,4, pushbutton switch

[ ]   Install the coin battery holder as shown on the silkscreen.

[ ]   Install U2, ATTiny13 into the dip socket, observe the orientation of pin 1

When inserting the IC, the pins are flared so that they can be retained by auto insertion tools. Gently rock them on a flat surface so the pins are parallel and they will insert into the sockets more easily.

[ ]   Install the four rubber feet on the bottom corners where indicated by the silkscreen.

[ ]   Install 3V coin battery

This completes the electrical assembly.

Connecting:

The device will work with external keys, bugs and paddles. When not using the integral single lever paddle the device will need to detect a **straight key** or **bug**, wire a 3.5mm *mono* plug for the tip as one key contact and sleeve as the other key contact. If you use a *stereo* plug, wire the sleeve and ring together as one contact, and the tip as the other side of the key or bug as shown below.
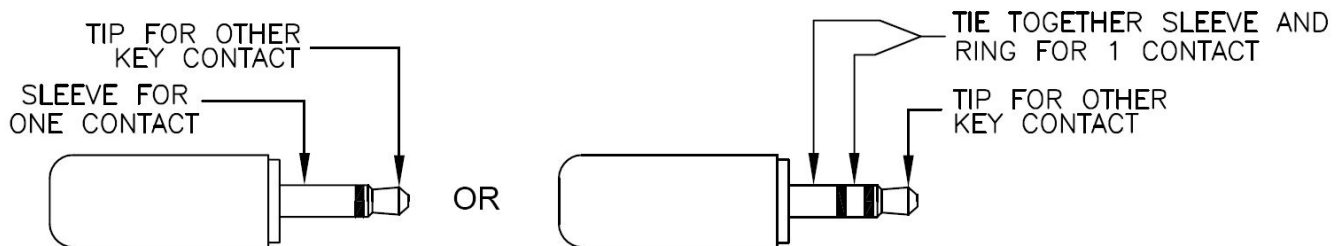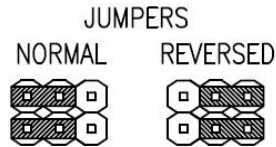

Straight key/bug plug configuration

For external **paddles**, use a 3.5mm *stereo* plug. The key/paddle jack is designed for the tip to be "dit" and the ring to be "dah", and the sleeve common. If your paddle is opposite, simply move the jumpers as shown on the board or graphic below.
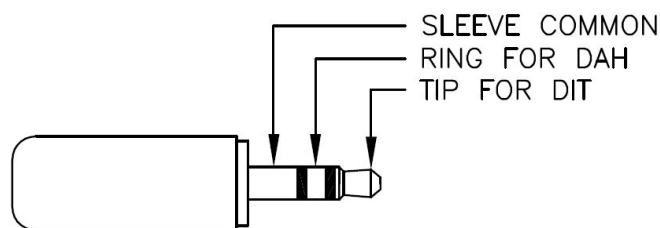
Paddle plug configuration

JUMPERS
NORMAL   REVERSED

After you have selected the paddle or key you want to use, plug in a set of ear buds, attach a small speaker, or cable to an amplified speaker. Adjust R3 (VOL.) for a comfortable audio level.

Operation:

Changing code speed:

The keyer code speed range is from about 5 WPM to about 33 WPM in about 1 WPM steps. The default power on speed is about 14 WPM.

- Momentary tap the FUNCTION button to enter speed adjust mode.
- The letter "S" will be annunciated and the LED will blink.
- To decrease speed, close the left paddle (normally DIT)
- To increase speed, close the right paddle (normally DAH)
- Continue to hold closed a paddle to scroll through the steps. A beep will be annunciated at each step and the LED will blink. The length of the beep and the delay between steps is based on the code speed for that step.
- Speed adjust mode will automatically exit after a 1 second pause in paddle use. A "I" will be annunciated when exiting.
- When using a straight key, bug, or in the absence of paddles the speed can also be changed with the board mounted "Speed Up" or "Speed Down" switches.

Iambic or "squeeze" keying

If both DIT and DAH paddles are closed, alternating elements will be sent as long as both paddles are closed. DIT-DAH-DIT-DAH.....

The first element to be sent, DIT or DAH, depends on which paddle was closed first. The last element to be sent depends on when the paddles are released

Iambic keying makes it possible to send some letters with less finger movement then would otherwise be required, such as:

- R = dit-dah-dit
- K = dah-dit-dah
- C = dah-dit-dah-dit
- . = dit-dah-dit-dah-dit-dah (period)

This mode also allows you to "insert" an opposite element into a string by tapping the opposite paddle at the right time, such as:

- Q = dah-dah-dit-dah – tap dit paddle during the second dah time or before the third dit
- F = dit-dit-dah-dit – tap the dah paddle during the second dit time or before the third dah.

Sending characters this way takes some practice in getting the timing right. The dot memory is active while the Dah is being sent and during the space following. Conversely, the dash memory is active while the dit is being sent and during the space following. Therefore, if you don't want to add an opposite element to a string, you must release the paddles during the next to last element to be sent. Because of this, sending an "A" or "N" is tricky with squeeze keying. In any event, as stated previously, it takes some practice at slow code speeds.

Random character code practice mode:

This mode generates groups of five mostly random characters for practice copy. The letters A through Z, numbers 0 to 9 and some punctuation, [.] [,] [/] [?]. The pseudo random number generator used to select characters seems to have favorite numbers, but eventually it finds all the characters.

The function key is disabled when there is a straight key in use. Therefore the code practice mode or the paddle speed adjustment is only active when using paddles or no key attached.

- To start the practice mode, hold closed the FUNCTION switch for about 1 second until the letter "P" is annunciated and release the switch. Character groups will begin to be sent. There is about a 1 second pause between groups.

Changing the code speed for receive practice:

- Use the "changing code speed procedure" to set the code speed *before* entering the practice mode.
- The code speed can also be changed using the paddles or switches *during the pause between character groups*.

Farnsworth mode:

This mode increases the space between characters by a factor of 5. Normally the spacing is one dah time (3X dit time). Fransworth mode increases the space to five dah times. This gives you more time to decode the character in your head.

- To toggle on or off, hold the FUNCTION switch closed the until the letter "F" is annunciated. The switch is sensed *during the space between character groups*.

Exiting the receive practice mode:

Turning the power off is one way to terminate this mode. The other is to hold the FUNCTION switch closed for about 1 second until the letter "X" is annunciated. This will return you to normal paddle mode.
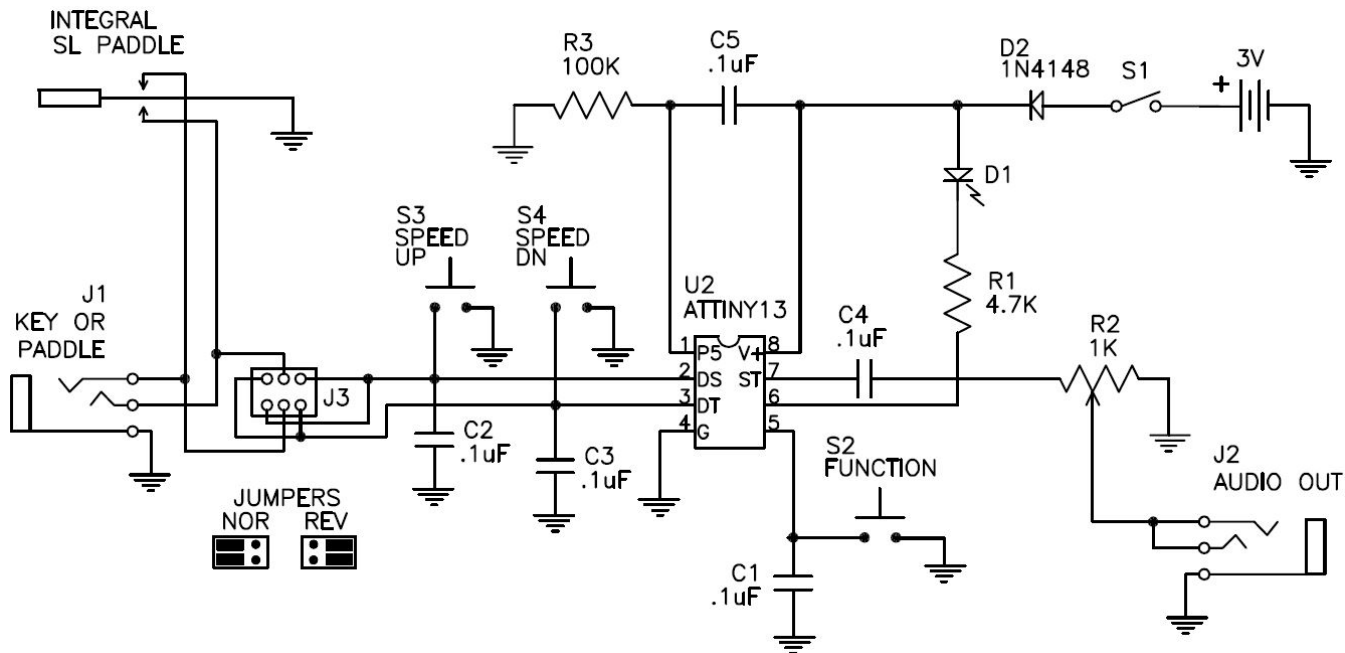
Checking your copy and sending:

Find a Morse code reader app for your PC or phone and jumper the headphone over to the PC with a cable splitter. Fldigi is one such program.

Practice sending to each other:

Two people can practice sending and receiving to each other, one using the onboard paddle, and the other using an added paddle through the external port.

Schematic:

Notes:

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