Antique Wireless Association's

Morse Assistive Technology Trainer (MATT) Instructions

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Thank you for purchasing **AWA's Morse Assistive Technology Trainer!**

We hope you will find AWA's MATT a fun and educational kit to assemble, and when complete, a useful tool for Morse Code practice.

The speaker comes presoldered to the Printed Circuit Board, or PCB, no soldering is required by the builder. The kit uses screws for connecting components to the PCB for ease of assembly. Be sure to read all instructions before starting to assemble the kit. A YouTube tutorial on assembly of the MATT is available at https://youtu.be/imek3EGOIn8.

Please check your kit with the parts list below, to make sure it is complete, and to become familiar with the kit. *Be Careful*, some components are very small and are easily lost! A small cup or other container for the resistors, capacitors, transistors and other small parts may be useful. The kit includes:

(1) Wood Base
(1) PCB with Speaker
(1) Key Arm
(1) Battery Connector
(1) Battery Clip
(2) Resistor 220 ohm (Red, Red, Brown, Gold) (R1, R5)
(2) Resistor 10K ohm (Brown, Black, Orange, Gold) (R2, R3)
(1) Resistor 82 ohm (Grey, Red, Black, Gold) (R4)
(2) Capacitor 0.1uF (C1, C2)
(2) Transistor 2N2222 (Q1, Q2)
(2) 8-32 spacer nuts for under the key arm
(2) Screw #4 X 1/2" long
(16) Screw #6 x 1/2" long
(2) Screw #6 x 3/4" long
(19) #6 Washers

Recommended Tools:

Small wire cutters, #1 and #2 Phillips screwdrivers, small needle nose pliers. A 9-volt battery is required and **not** included in the kit. #1 Phillips is used for #4 screws and #2 Phillips is used for #6 screws.

Getting Started:

( ) Place the PCB on the wooden base so that all the pilot holes are visible through the PCB. Position the PCB and base so that the key outline is closest to you and the connections labeled "battery connection" are on your left.

( ) Insert a #6 x 1/2" screw in the screw hole in the lower right of the PCB. Tighten screw until it contacts the PCB, it should be snug, but *don't overtighten!* Make sure all the holes still line up.

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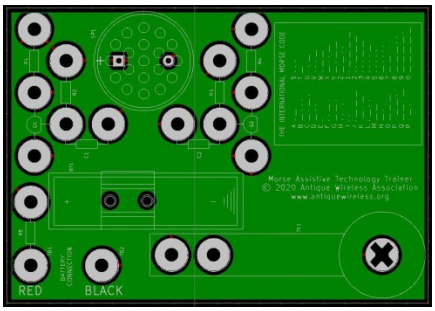
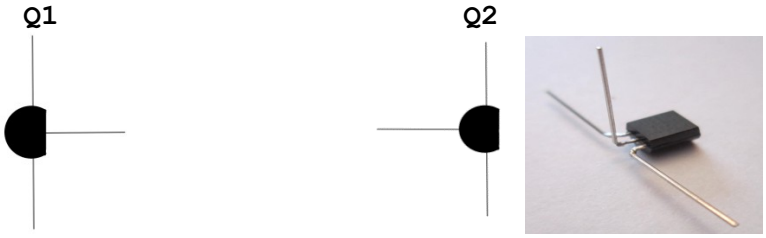


Assembling the Components:

*Each component has one free end where there is not a junction with another component. Mount the component at that end **first** then make the other connections **second**. This will hold the component in place to make it easier to make multiple connections at the other junction.

*Carefully bend the transistor leads to as shown below. Bend leads about 1/16" (1.5mm) from the transistor body.

Note, the center lead is pointed toward the flat face on one transistor, and pointed away from the flat face on the other transistor. **See illustrations Below:**



*A tiny dab of grease, barely visible, on the top of the washer, applied with a sharp toothpick will cause the washer to stick to the screw head and out of the way, for locating the component leads.

*All component leads are to be located under the washers, between the washer and the PCB ***except*** locations 6 and 12. These are the only locations with 3 leads. These will have 2 washers, where 1 lead will be against the PCB and 2 leads will be **between** the washers.

*It is recommended that components be installed in the order below.

( ) Install screws and washers into the PCB at locations 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, and 15 where component leads will be connected. Do not install screws at locations 6, 12 or for the key arm or the battery clip now. Tighten screws until they just contact the PCB then loosen three or four of turns. Use the illustration below for reference during the assembly.

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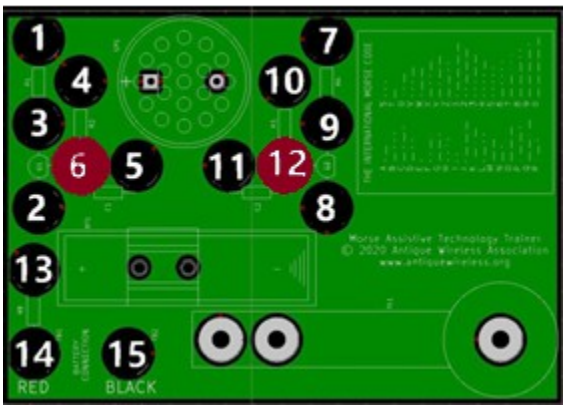
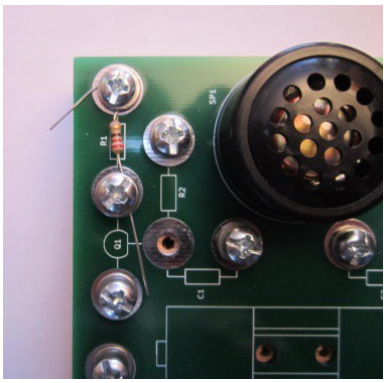
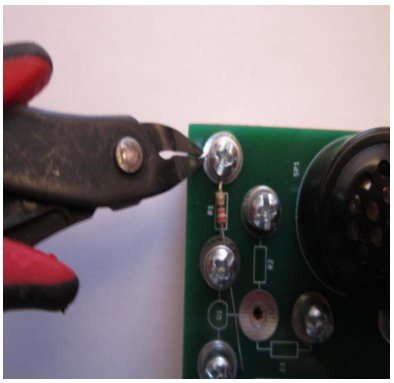
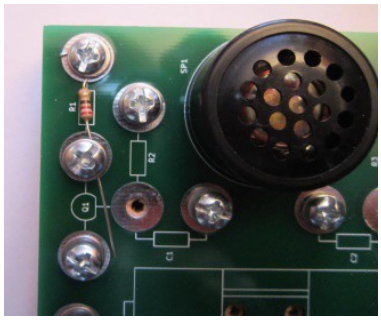


( ) Locate the resistor (R1) **220 ohm (Red, Red, Brown, Gold)** and place one lead under the washer at position **1**. Form a half loop around the screw, tighten the screw and cut off the excess wire to prevent electrical shorts. The other lead should be positioned under the washer at position **3** which will remain loose.







( )Locate the **transistor that has the center lead pointing toward the flat side, (Q1)** and position one lead under the washer at position **2** as illustrated on the PCB. Tighten the screw. The opposite lead should be under the washer at position **3**.

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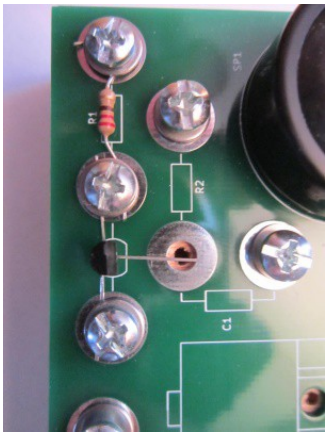
( )At position **3**, verify that the transistor lead (Q1) and the resistor lead (R1) are under the washer and on opposite sides of the screw, and that the middle transistor lead is over position **6**. Tighten the screw at position **3**. Cut off the excess lead.



( ) Install a #6 screw and 2 washers at position **6**. The center transistor lead should be under the bottom washer.

( ) Locate the resistor (R2) **10K ohm (Brown, Black, Orange, Gold)** and place one lead under the washer at position **4**. Form a half loop around the screw, tighten the screw and cut off excess wire to prevent shorts. The other lead should be positioned between the washers at position **6** which will remain loose.

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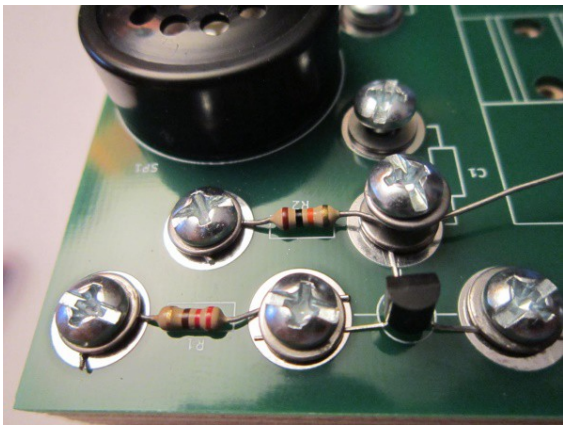
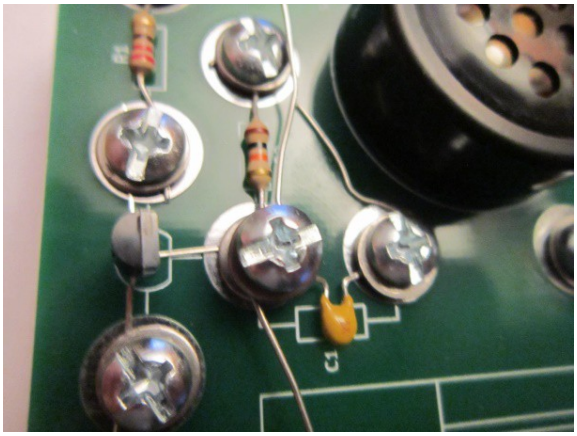
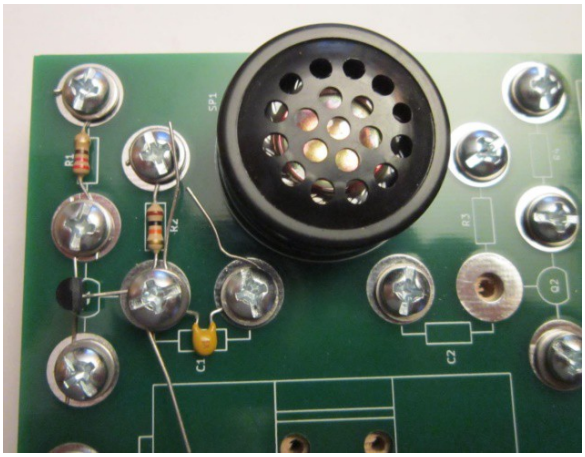


( ) Locate the .1uf capacitor (C1) and place one lead under the washer at location **5.** Form a half loop around the screw, tighten, and cut off excess wire. The other lead should be positioned between the washers at location **6.**





( ) The screw with 3 leads at position **6** can now be tightened. Trim the leads to prevent shorts.

( ) Gently probe all connections with a pencil or toothpick to make sure there are no loose wires at any of the locations.

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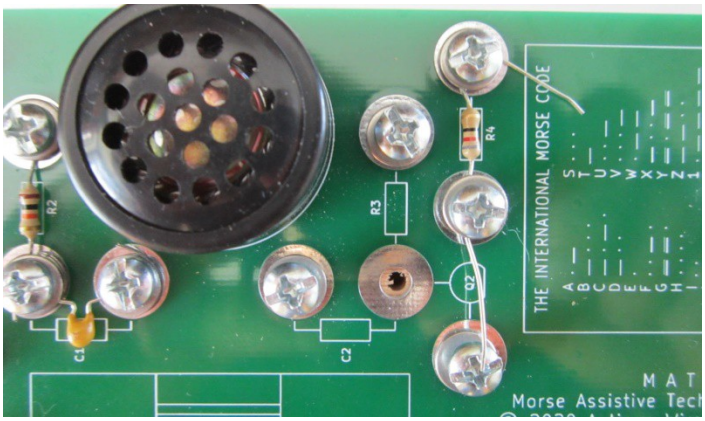
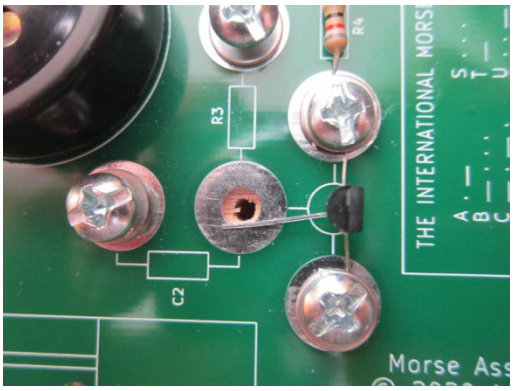
( ) Locate the resistor (R4) **82 ohm resistor (grey, red, black, gold)** and place one lead under the washer at position **7**. Form a half loop around the screw, tighten the screw and cut off the excess wire to prevent electrical shorts. The other lead should be positioned under the washer at position **9** which will remain loose.



( ) Locate the **transistor that has the center lead pointing away from the flat side, (Q2)** and position one lead under the washer at position **8** as illustrated on the PCB. Tighten the screw. The opposite lead should be under the washer at position **9**.

( ) At position **9**, verify that the transistor lead (Q2) and the resistor lead (R4) are under the washer and on opposite sides of the screw, and that the middle transistor lead is over position **12**. Tighten the screw at position **9**. Cut off the excess lead.



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( ) Install a #6 screw and 2 washers at position **12**. The center transistor lead should be under the bottom washer.

( ) Locate the resistor (R3) **10K ohm (Brown, Black, Orange, Gold)** and place one lead under the washer at position **10**. Form a half loop around the screw, tighten the screw and cut off excess wire to prevent shorts. The other lead should be positioned between the washers at position **12** which will remain loose.

( ) Locate the .1uf capacitor (C2) and place one lead under the washer at location **11.** Form a half loop around the screw, tighten, and cut off excess wire. The other lead should be positioned between the washers at location **12.**

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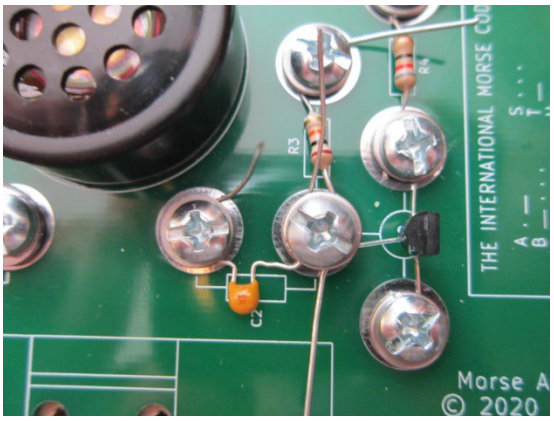
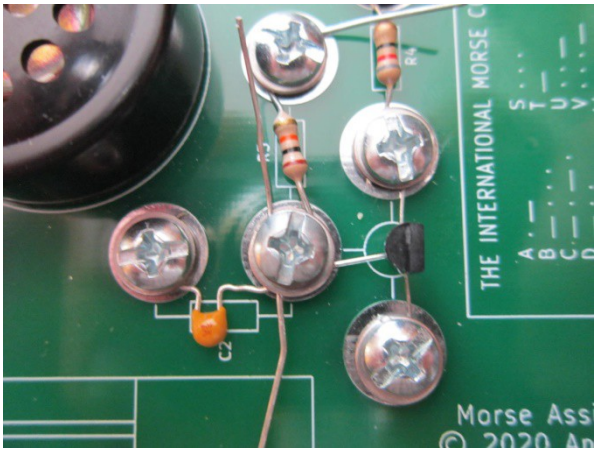
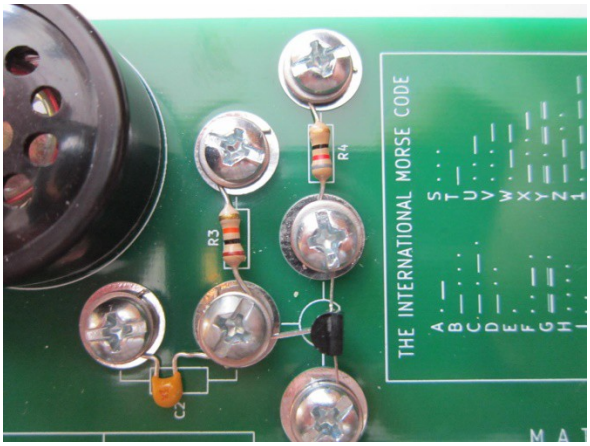
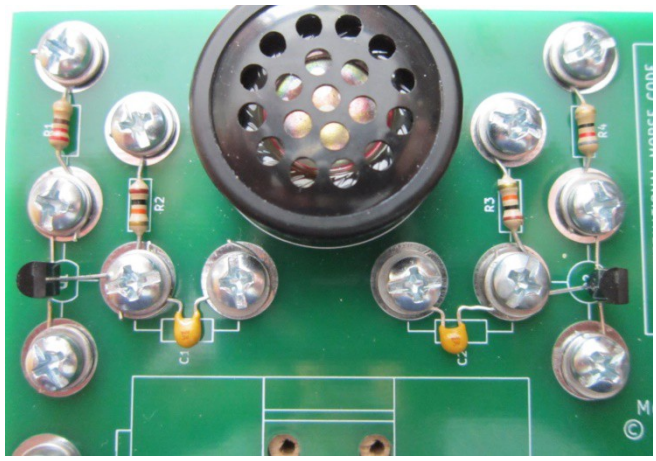




( ) The screw with 3 leads at position **12** can now be tightened. Trim the leads to prevent shorts.



( ) Gently probe all connections with a pencil or toothpick to make sure there are no loose wires at any of the locations.



( ) Locate the resistor (R5) **220 ohm (Red, Red, Brown, Gold)** and place one lead under the washer at position **13**. Form a half loop around the screw, tighten the screw and cut off the excess wire to prevent

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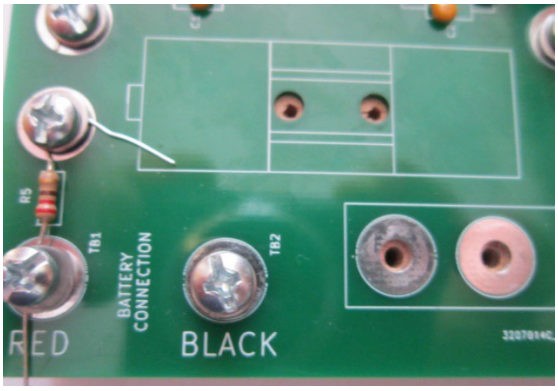
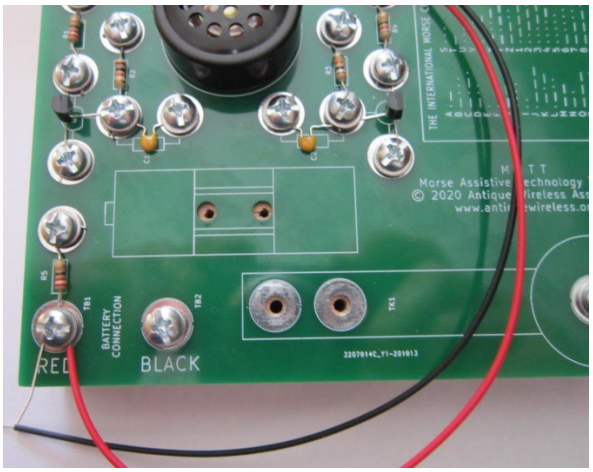
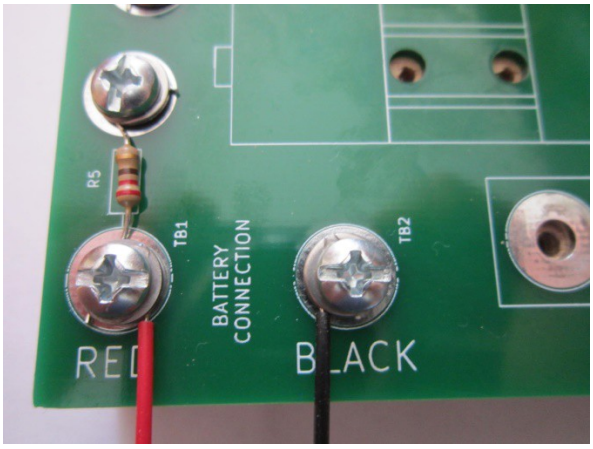
electrical shorts. The other lead should be positioned under the washer at position **14** which will remain loose.



( ) It is not necessary, but the battery connector wires can be shortened if desired. Locate the battery connector and place the red lead under the washer at position 14 opposite the other lead. Tighten the screw, and trim excess wire to prevent short circuits.



( ) Install the black lead under the washer at position 15.



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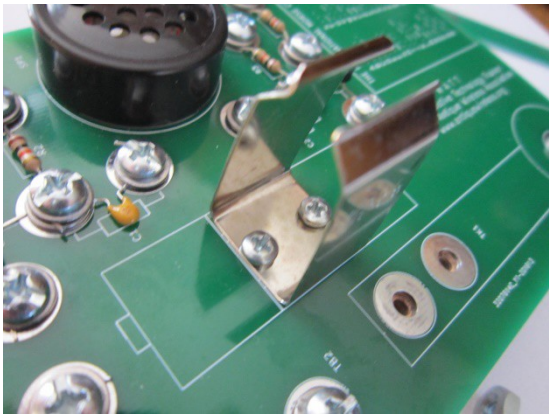
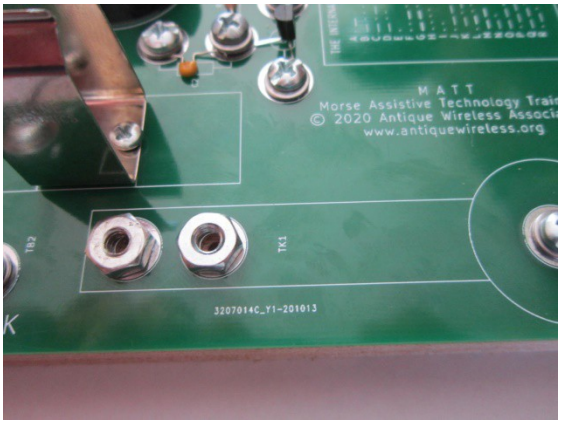
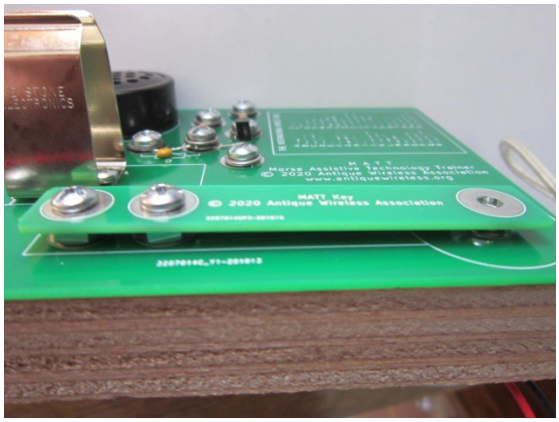
( ) Fasten the **battery clip** to the PCB using the two #4 x 1/2" screws.



( ) Fasten the **key arm** to the PCB with the two #6 x 3/4" screws and using the two #8-32 nuts as spacers under the key arm. If the key makes contact at the end, add 2 washers to the spacer nuts to raise the key.





( ) Check your work! Look over the finished assembly and make sure that all the components are in their proper place, see that the transistors are oriented correctly, and that there are no leads left long and touching other screws.

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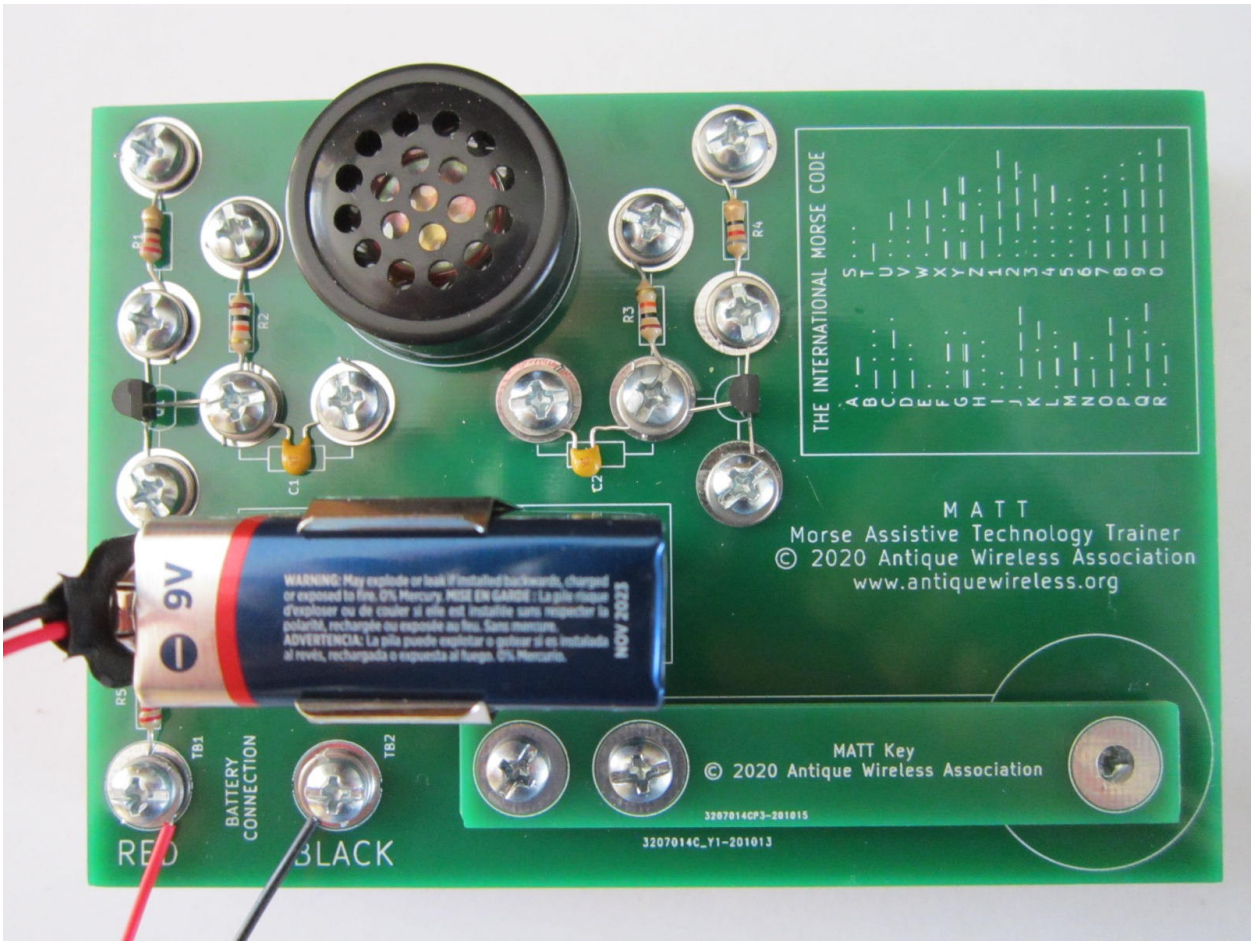

( ) Connect your 9v battery, and enjoy your new Morse Assistive Technology Trainer!

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