

## TCI-1 V3.x Assembly Instructions (2/05/05)

All components will be mounted to the top side of the printed circuit board (the side with the silk screened component layouts). Pay particular attention to the orientation of the crystal (X1) and the FETs. Installing a FET backwards will most likely cause it to fail the first time power is applied to the circuit.

Install the components in the order listed, solder the leads to the PC board, and then inspect the joint carefully under a magnifying glass to ensure that it is clean and shiny and that there are no solder bridges across circuit runs. ***All leads and pins, except for the toggle switch, should be clipped off after soldering to ensure that they do not contact the bottom of the case when the PC board is installed.*** Check off each step as you complete it.

[ ] 1. Before starting construction, check the printed circuit board for a proper fit into the case. Slide the board into the case using the bottom set of slots and ensure that the board can be pushed all the way into the case with a reasonable amount of effort. If necessary, use a sanding block or fine flat file to remove an equal amount of material from each edge of the board. You do not need to remove much material. A maximum of about six light swipes of the file or sanding block on each side should be plenty. You should never find it necessary to go back to the grounding foil.

[ ] 2. Install the surface mount crystal at location X1. Be sure that the crystal is orientated with the slanted edge **away** from the 32kHz marking on the front of the board. This is most important! ***It will not function if installed backwards and once soldered in place you will be unlikely to be able to remove it without damaging the crystal.*** The key to soldering this component is to get the iron in and out as quickly as possible so that you do not overheat and damage the crystal. First, place a small amount of solder flux on each of the four circuit pads. Next, tin one of the pads with a small amount of solder. Hold the crystal in the proper position over the pads using a pair of tweezers. With a small amount of downward pressure on the crystal, touch the tinned connection just long enough for the solder to melt. This will hold the crystal in place while you solder the remaining three connections. Finally, re-solder the first lead to ensure a good connection. Allow a few seconds between soldering each pad in order to minimize the heat build up in the crystal.

[ ] 3. Double check the crystal for proper orientation and inspect the solder joints. Once the other components have been placed on the PC board it will be most difficult to remove the crystal. If you do have to remove the crystal it is recommended that you just cut it in two with a sharp pair of small wire cutters and then unsolder the pieces from the PC board. Attempting to unsolder the crystal in one piece risks lifting a pad on the PC board and will likely damage the crystal from heat anyway.

[ ] 4. Install the terminal block at J2. Be sure to orientate it so that the holes for the wire entry are facing the rear edge of the board where the TUNER label is located. It is suggested that you solder one pin and then double check the orientation and ensure that the block is pressed all the way down against the PC board. Then solder the remaining pins.

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Note: No terminal block will be installed at J1. The 4 wires from the radio cable will be soldered directly to the PC board at location J1 during the final assembly into the case.

5. Install the 14-pin IC socket at U2. Be sure to orient it so that the notch is facing the front edge of the PC board. It is recommended that you solder one pin and then double check the orientation and ensure that the socket is pressed all the way down against the PC board. Then solder the remaining pins.

6. Install the LED at DS1. Make sure that it is positioned with the front edge in line with the front edge of the PC board. Again it is recommended that you solder one pin and then recheck the alignment and ensure that it is tight against the PC board before you solder the second pin.

7. Install the toggle switch at SW1. Bend the pins slightly as needed to ensure that they go through the holes in the PC board. Press the switch down tight against the board and ensure that it is exactly vertical. The front edge of the switch should make a 90-degree angle with the PC board. Solder the two front tabs and then recheck the position. Lay a small ruler or straight edge along the PC board to check the alignment. At this point you can still move the switch a little to align it exactly vertical if necessary. Next solder the remaining two or three pins into place.

Caution! Failure to align the front edge of the switch parallel to the front edge of the PC board and stand it up exactly vertical (90 deg) will result in the switch not lining up correctly with the hole in the front panel. You may wish to try the fit of the board into the case before soldering all the terminals.

8. Install the 1N4148 diode at D1. Orient the band towards the rear of the board as shown on the silk screen. Be sure not to overheat the diode. Solder one lead, wait a few seconds, and then solder the other lead.

9. Install the five 100 uH chokes.

L1

L2

L3

L4

L5

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10. Install the two 33K (Orange, Orange, Orange) resistors.

R1             R14

11. Install the eight 10K (Brown, Black, Orange) resistors. For neatness and ease in reading resistor color codes later on, it is suggested that the resistors be oriented with the color codes reading left to right or top to bottom.

R2             R4             R5             R6             R7  
 R9             R11            R13

12. Install the 4.7 ohm (Yellow, Violet, Gold) resistor at R3.

13. Install the 82K (Grey, Red, Orange) resistor at R8.

14. Install the 270 ohm (Red, Violet, Brown) resistor at R10.

15. Install the 1K (Brown, Black, Red) resistor at R12.

16. Install the five 0.01uFd (103) capacitors.

C1             C2             C3             C4             C5

17. Install the 22pFd (220) capacitor C8 in the appropriate location near the crystal. Be certain not to overheat the nearby crystal in the process.

18. Install the 33pFd (330) capacitor C9 in the appropriate location near the crystal. Be certain not to overheat the nearby crystal in the process.

19. Install the 0.1uFd (104) capacitor C7 near the notch of the socket at U2.

20. Install the 22uFd tantalum capacitor C6 near the edge of the PC board. Be certain to observe the polarity as displayed on the silk screened outline. The positive end must face U1 and the front of the PC board.

21. Install the 78L05 voltage regulator at U1. Be certain to orient it as show on the silk screen with the flat side towards the edge of the PC board. Solder the center pin, recheck the orientation and then solder the other two pins.

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22. Install three ZVN2106A (or 2N7000) FETs at Q1, Q4, and Q5. Be sure to orient these with the flat sides towards resistor R4 as shown on the silk screen. It is often difficult to determine which side is the flat side. Look closely because it is of utmost importance that they be installed correctly before applying voltage to the circuit. An incorrectly installed FET will probably fail (shorted) when power is applied. Note that these three are installed with the same orientation. Solder the center pin, recheck the orientation and then solder the other two pins. Be sure to leave a few seconds between soldering each pin in order to prevent overheating the FET.

Q1       Q4       Q5

23. Install the remaining two ZVN2106A (or 2N7000) FETs at Q2 and Q3 using the same procedure. Note that these two are oriented opposite of the other FETs.

Q2       Q3

24. If you will be using the interface with an Alinco radio, solder a jumper across the pads at OPT-B.

25. Recheck all component locations and orientation. Check for cold solder joints or solder bridges. Note that there should be no components at location Rf or J1.

26. Perform the following resistance checks using a good quality multimeter before inserting the processor IC. The negative lead should go to one of the ground pads around the edge of the PC board. The positive lead should go to the specified pin.

U2, Pin-1	> 3K
U2, Pin-6	> 9K
U2, Pin-8	> 9K
U2, Pin-9	> 10K
U2, Pin-10	> 10K
U2, Pin-12	> 10K

27. Insert the programmed PIC16C505 processor chip into the 14-pin socket. Be sure to orient it so that the end with the circle or notch lines up with the notch in the socket. Be careful not to bend any pins.

This completes the assembly of the circuit board. There is a rather close fit between the bottom of the PC board and the bottom of the case. Be sure to check that all leads are short enough that there is no possibility of them touching the case when the PC board is installed. It is recommended that you carefully trim the excess lead length from the IC socket and the terminal blocks using a sharp set of diagonal cutters. Re-inspect the solder joints for possible fractures after cutting and re-flow the solder if necessary.

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### Assembly of the Radio Cable

The 4-conductor cable between the radio and the tuner interface should be kept rather short. A 12-inch long cable is suggested. One end will have the Molex connector installed on it. The other end will have tinned leads suitable for soldering directly to the PC board. When stripping the insulation off the wires, make sure to hold the cable coiled in your hand to prevent pulling the individual wires from the outer insulation. Complete the following steps:

- 1. Cut a 12-inch length of 4-conductor cable.
- 2. Remove  $\frac{3}{4}$ -inch of outer insulation from each end of the cable.
- 3. Remove  $\frac{1}{8}$ -inch of insulation from each wire on each end of the cable.
- 4. On each wire, twist and then tin the strands with a small amount of solder.
- 5. Install a connector pin on each of the wires at one end of the cable as follows:
  - Clip the two tabs sticking up at the rear of the pin to the same length as the second set of tabs.
  - Place the tinned wire between the second set of tabs and fold them over with a pair of needle nose pliers to form as tight a crimp as possible.
  - Flow a small amount of solder under the tabs to attach the wire to the pin.
  - Using the needle nose pliers, fold the rear tabs over the insulation on the wire.
- 6. Insert each pin into the appropriate spot in the connector housing, pushing it in until a click is heard. ***Be sure you have the correct spot because it is nearly impossible to remove a pin from the housing once it has clicked into place.***

Pin 1 is closest to the pointed end of the connector (see the drawing on the schematic). ***Always use the ICOM color code for the PCB connections.*** Use the Icom or Alinco color code for the connector end, depending on the type of connector. Connect the wires as follows:

#### ICOM COLOR CODE

Pin 1 – Green wire  
Pin 2 – White wire  
Pin 3 – Red wire  
Pin 4 – Black wire

#### ALINCO COLOR CODE

Pin 1 – Black wire  
Pin 2 – Red wire  
Pin 3 – Green wire  
Pin 4 – Unused  
Pin 5 – White wire

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This completes the construction of the radio cable. Insert the free end of the cable through the grommet on the left hand (looking at the rear) side of the rear panel. Push each wire into the appropriate PC board hole using the Icom color code shown above. Push the wire down until the insulation is flush with the PC board and then solder it into place from the bottom. Note that the plastic bezel can be slipped over the connector, down the wire, and worked around the end plate into position after the installation is complete. It is not necessary to position the bezel before attaching the wires to the PC board.

### **Final Installation**

The four tuner control wires will be attached to the TUNER terminal block during final installation in the mobile. These wires will be threaded through the grommet on the right side of the rear plate. ***Be sure the bezel is in place before completing these steps.*** You may want to remove some of the outer covering of the SGC cable assembly in order to free up additional control wire and coax in order to have enough length to position the controller in the desired location near the radio. Connect the wires as follows:

<b><u>SG-237 COLOR CODE</u></b>
Pin 1 – White/Black wire
Pin 2 – White/Red wire
Pin 3 – Red wire
Pin 4 – Black wire

Lightly tin each wire and then insert it into the appropriate hole at the rear of the terminal block and tighten the screw to hold the wire in place.

Insert the PC board into the housing from the rear, attach the rear panel and bezel with the two Phillips screws provided, and plug the connector into the rear of the radio. This completes the installation of the controller.