

# PLEASE READ ME FIRST

01/16/22

The TR-35 Upper and Lower PC boards are shipped inside the plastic enclosure. Remove the 4 black screws holding the enclosure together and remove the board set. Discard any anti-rattle bubble material. Place the case screws in a safe place, you will need them later. Remove the four 3mm screws holding the lower board to the metal spacers. You will need these screws later as well. Set the lower board aside for now. The metal spacers should remain on the upper board. The upper board will be assembled first, followed by the lower board. There are separate assembly instructions for the two boards. You should read through both sets of assembly procedures before you start. Try to resolve questions or anything that seems unclear ahead of time. There are separate parts carrier strips for the upper board, the lower board, and the case final assembly parts. The parts are arranged in the carriers in the order of the assembly instruction steps. You will work from the top of the carrier strip down as you complete steps. It is recommended that you remove only the parts needed for the particular building step as outlined in the assembly instructions. Some of the hardware is small and could easily be lost or misplaced. A clean working environment will help prevent lost or misplaced items. This might be a good time to clean up your workbench before you start assembly.

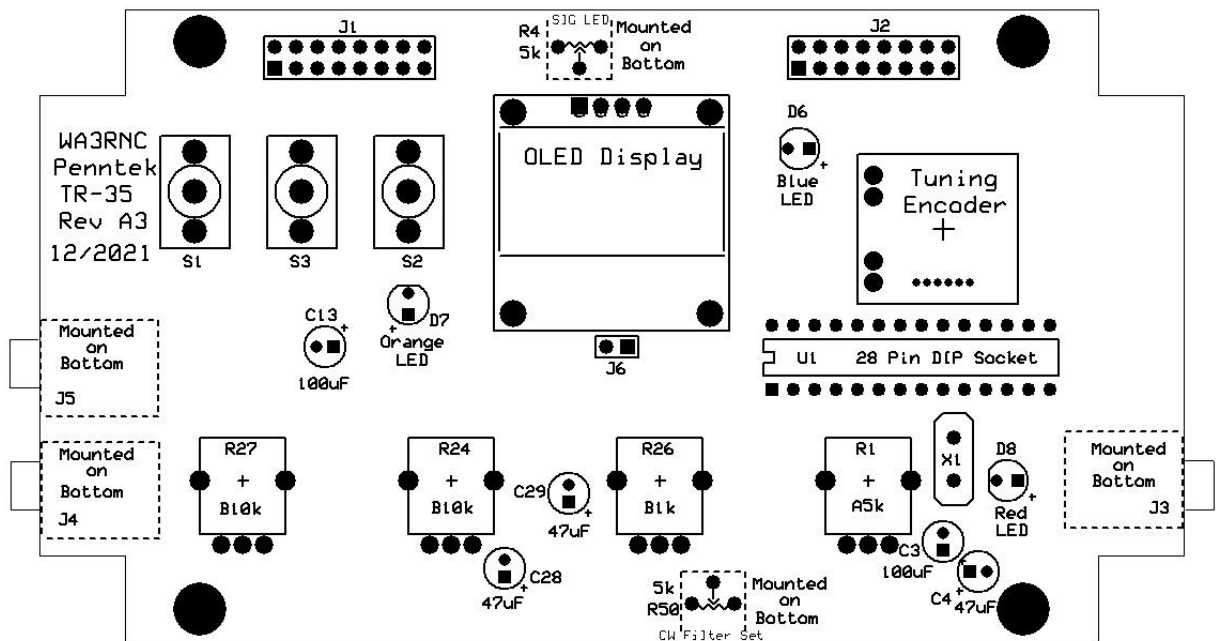
**Upper Board Notes:** All the parts (except the crystal) need to be tight against the board, especially the capacitors. If they extend above the 12mm metal spacers, the case will not fit together. After the display is mounted, be sure to use nail polish on the screws and nuts under the board. The nuts could come loose and cause damage. This has happened on prototype units. Don't forget to remove the display protective covering before final case assembly (pull the green tab). The microprocessor (U1) socket pins must be trimmed after soldering so that they do not poke into the toroid inductors on the bottom board.

**Lower Board Notes:** Don't neglect to trim leads and pins under this board when instructed lest the case might not fit together. It's tight in there! Be sure you get

the orange relay positioned correctly. It's not easy to remove if you get it wrong. The BNC antenna connector has been installed at the factory due to the high amount of heat required for soldering due to its mass. Don't forget that capacitors C77 and C78 must be installed lying down on the board. Bend the leads before installing. The poly-fuse will also need to be installed lying over. Do not molest the four brown or yellow trimmer capacitors on the lower board. They affect receiver sensitivity and have been carefully adjusted as part of the total alignment procedure performed at the factory on a bed-of-nails fixture prior to shipment. Thermal heat sink compound was not used on the prototype units, but you may use a small amount if you wish. Also, the toroids were not glued to the board in the prototypes and there were no issues. If you routinely subject your radio to extreme shock and vibration, you could glue the toroids to the board with hot melt glue, or maybe epoxy. Do NOT use any silicon sealer that liberates acetic acid as it cures (smells like vinegar) as this would be very corrosive and would most likely cause damage.

**Final Assembly Notes:** Remember to remove the OLED display protective covering. Follow the instructions for adjusting the PA bias control. Adjust the blue "SIG" quality LED sensitivity on the mounted to the underside of the upper board. Some users have commented that the unit looks better without the plastic display window installed. You may or may not install it, as you wish. Before installing the plastic protective window, you most likely will need to remove the thin clear protective film from one or both sides of the window and poke out any remaining plastic in the screw holes. The plastic display window should appear water-clear after the plastic protective coatings are removed from both sides. The four small knobs may have burrs inside the brass inserts that make for difficult attachment. Loosen the setscrews and twist a ¼ inch drill bit by hand inside the shaft holes to remove any burrs.

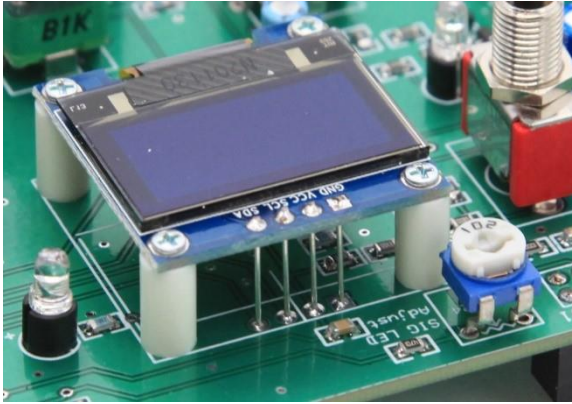
## TR-35 Upper Board Assembly Instructions 01/16/22



TR-35 Upper Board User Installed Parts

Refer to the above placement diagram while performing the following steps

- 1) Install and solder X1, 16MHz crystal. Make certain that the crystal is NOT down tight against the PC board. It should be about 1/32 to 1/16 inch above the board surface. Solder and trim 2 leads.
- 2) Install and solder the 28-pin socket for U1 tight against the board. The notch must be toward the center of the board. Verify that orientation is correct, and that all 28 pins are through the board before soldering. Solder and trim 28 pins. (Untrimmed pins might touch toroids on lower board.)
- 3) Install the OLED display using the provided white plastic spacers and 4 each miniature screws and nuts. The nuts go on the bottom of the board. Take your time with this, and be very careful not to lose your nuts (always good advice). Do not overtighten this hardware. Once the display is mounted, install 4 wires cut from two included sacrificial resistors, from the display connection points to the PC board. See the photo. Make certain that the wires do not short together. The resistors can be discarded. Solder and trim 8 connections, 4 on the display, and 4 on the PC board. **Important:** Place

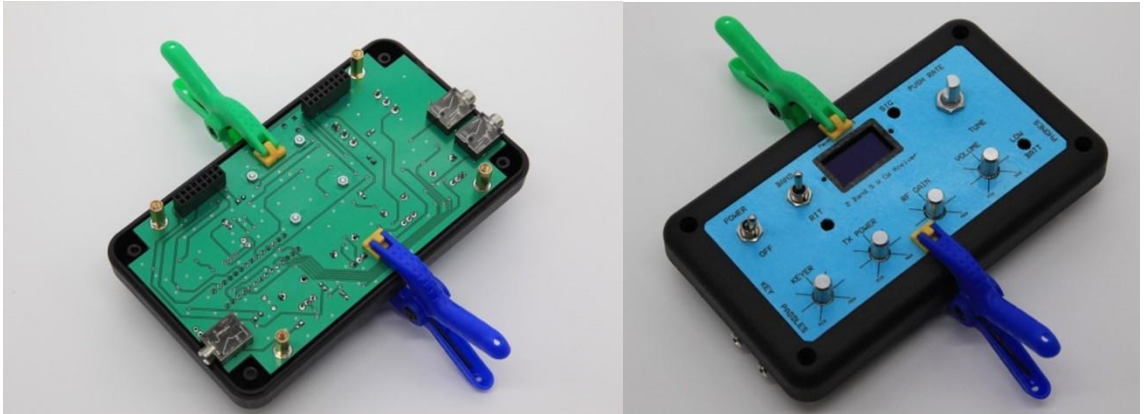


some clear fingernail polish on the screws and nuts on the bottom of the board so that they don't come loose and find trouble later. This has occurred several times on prototype units. The photo shows a TR-25, but TR-35 display mounts the same way.

- 4) Install and solder R4, 5k signal LED sensitivity, and R50, 5k AF filter trimmer pots on the underside of the board. Solder 6 leads on the board top side.
- 5) Install and solder D6, the blue Signal Quality LED, mounted on a plastic spacer. The longer lead connects to the square hole. Make sure the LED is straight and tight against the board. Solder and trim 2 leads.
- 6) Install and solder D7, the orange RIT warning LED, using the same procedure as for D6. The longer lead goes to the square hole. Solder and trim 2 leads.
- 7) Install and solder D8, the red low battery warning LED, using the same procedure as for D6 and D7 above. The longer lead goes to the square hole. Solder and trim 2 leads.
- 8) Install and solder (2) electrolytic capacitors C3 and C13, 100uF, tight against the board. The longer lead (+) goes to the square hole. Solder and trim 4 leads.
- 9) Install and solder (3) electrolytic capacitors C4, C28, and C29, 47uF, tight against the board with the longer lead to the square hole. Solder and trim 6 leads.
- 10) Install and solder jacks J3, J4, and J5 TIGHT AGAINST THE BOTTOM of the PC board. Straighten any bent pins before installing. Solder 15 pins.
- 11) On each of the toggle switches S1, S2, and S3, install a single nut (used as a spacer) onto the bushing. Tighten the nuts for a snug fit. Save the 3 remaining nuts for later. Set the switches aside for now.
- 12) The 4 potentiometers (R1, R24, R26 and R27) are fitted with a nut and a washer (used as spacers) on the bushings. Tighten the nuts if

necessary. Set the potentiometers aside with the switches previously prepared with nuts.

- 13) In this step, the tuning encoder, switches, and potentiometers will be soldered to the PC board using the top case half as an alignment fixture. Take your time with this effort. It is important for a good fit within the housing. Do not solder any of these components until instructed to do so. To start, position the PC board with the display side up and with the jacks closest to you. Place the on-off toggle switch S1 onto the board with the slot in the bushing toward the board center. Place the 2 remaining 3-position spring return switches in the S2 and S3 positions with the slot in the bushings to the center of the board. Do not solder the switches yet. The pots will now be placed. Pot R1 (volume control) must read "A5K" or "A10K" on the rear side of the part (either one will work fine). R26 (RF Gain Control) must read "B1K", R24 (TX Power Control) and R27 (Keyer Speed Control) must read "B10K". Please check this carefully as these parts are difficult to remove if you make a mistake! Straighten any bent pins. Install the potentiometers into the board but do not solder yet. The tuning encoder is supplied mounted on a sub-board, with 2 nuts and a washer. Make sure the first nut is tight on the bushing. This nut is used as a spacer. The washer and second nut will attach the encoder to the panel. Place the 4 pins of the tuning encoder sub-board into the PC board, to the right of the display (do not solder yet). Now carefully fit the top case half down over the switches and control shafts. You might need to gently nudge some of the controls, tuning encoder and switch bushings to allow the top inside of the case half to make contact with the 12mm spacers and/or the switch and potentiometer nuts. Once contact is made, clamp the board to the top case half with small plastic clamps as shown in the photos. The small clamps in the photos came from Harbor Freight (6 pieces for 2 bucks). Anything similar should work. You might be able to improvise by using rubber bands and an additional object to keep pressure on the backside of the PC board. The idea is to maintain pressure of the board components against the inside of the top case half while soldering the switches and controls.



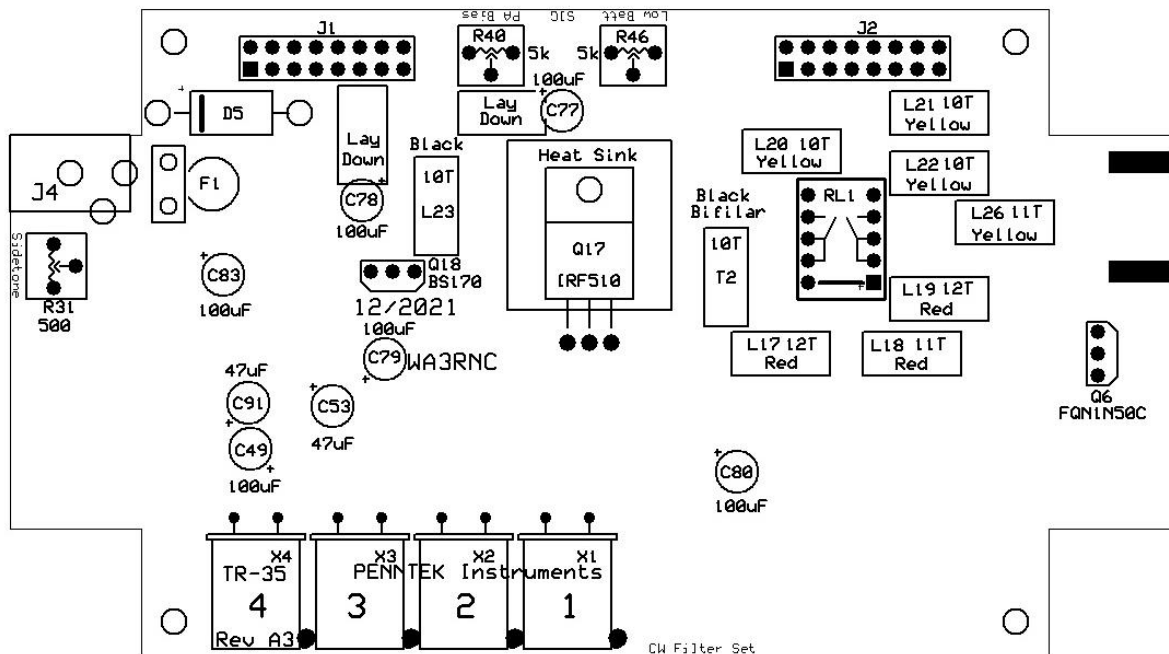
These photos depict a TR-25, but the concept is the same with the TR-35.  
(Do this if you don't have suitable clamps)



Attach the switches temporarily to the panel with their three remaining nuts and snug them up. Be careful not to scratch the panel. Attach the tuning encoder to the panel with the washer and second nut on its bushing as well. The nut must pull the encoder tight against the inside of the front panel, but be careful not to overtighten it. Carefully turn the assembly over and verify that the PC board is level with and centered in the case half. If one

end of the board seems higher than the other, or if the board seems crooked, investigate and find the cause. Once you are satisfied with the alignment, the switches, potentiometers, and tuning encoder can be soldered. There will be a total of 33 soldered connections in this step. After soldering, remove the clamps and four nuts holding the board to the panel. Don't lose the nuts, you will need them later. Separate the board from the case top, Set both aside for later. The upper board is finished. Proceed to the Lower board assembly procedure.

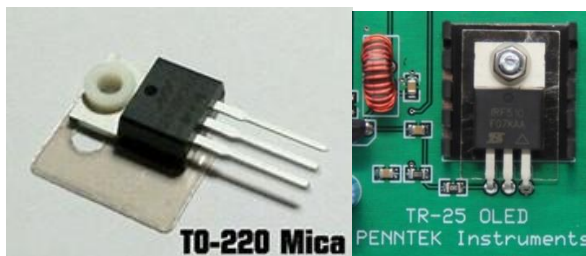
# TR-35 Lower Board Assembly Instructions 01/16/22



Refer to the above diagram while performing the following steps:

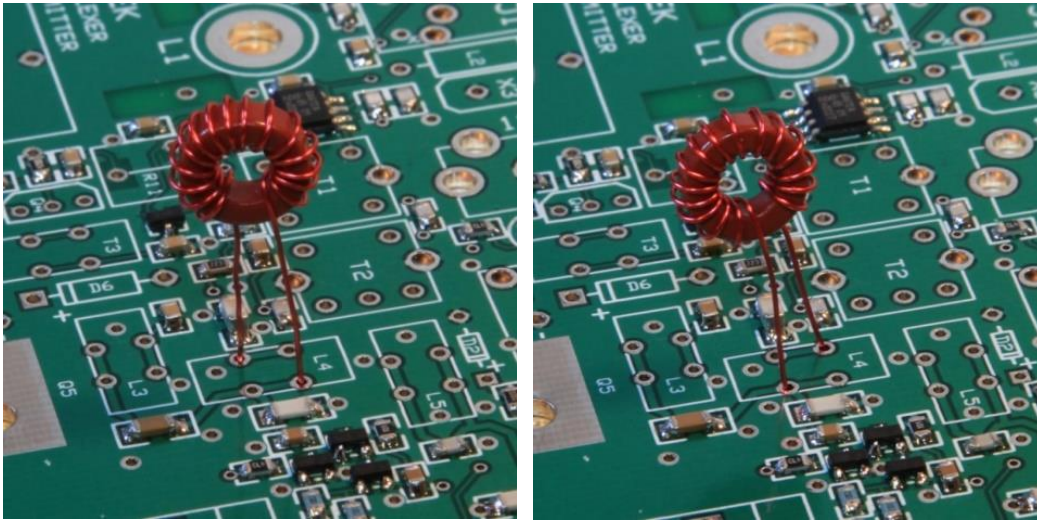
- 1) Install and solder relay RL1 to the board with the polarity bar toward the board center. See the photo. Solder 10 pins.
- 2) Carefully form the leads of diode D5, if necessary, to fit on the board. The banded end goes to the square pad. Position the diode fairly close to the board. Solder and trim 2 leads.
- 3) Install and solder Polyfuse F1 to the board. Bend this part over as shown on the overlay before soldering. Solder and trim 2 leads.
- 4) Install and solder the DC power jack J4. Make certain this jack is tight against the board and is straight. Solder and trim 3 pins. These pins must be trimmed after soldering to allow for proper fit into the case.
- 5) Install and solder the side-tone level 500-ohm pot R31 (marked 501). Solder and trim 3 pins.

- 6) Install and solder PA bias pot R40 and low battery warning adjustment pot R46. Both are 5k (marked 502). Solder and trim 6 pins.
- 7) Install Q18 BS170 TO-92 FET (marked with red). Place the flat side as shown on the parts overlay. Position the part with about ¼" lead length above the board. Solder and trim 3 leads.
- 8) Install Q6 FQN1N50C TO-92 FET (marked with blue). Place the flat side as shown on the parts overlay. Position the part with about ¼" lead length above the board. Solder and trim 3 leads.
- 9) Install and solder (6) 100uF electrolytic capacitors C49, C77, C78, C79, C80, and C83. The longer positive leads goes to the square pad. All the capacitors except C77 and C78 must be installed tight against the board. Note that C77 and C78 must be installed lying down on the board. Bend the leads BEFORE soldering. Solder and trim 12 leads.
- 10) Install and solder (2) 47uF electrolytic capacitors C53 and C91 tight against the board. The longer lead goes to the square pad. Solder and trim 4 leads.
- 11) Form the leads of Q17, the final RF amplifier FET IRF510 so that the 3 leads mate with the mounting holes while the tab hole mates with the FET mounting hole through the heatsink. See the photo. Place the heatsink against the board, with the clear mica washer between the heatsink and the FET. Fit the FET leads into the mounting holes, and then insert the mounting screw from the bottom through the board, heatsink, mica washer, FET tab, and plastic insulator. Place the nut on top of the plastic insulator. Make sure the plastic insulator fits inside the FET mounting hole. Align the FET and heatsink with the mica washer between them. Tighten the screw fairly tightly. Don't deform or damage the plastic insulator. Use an ohmmeter to check for shorts from the FET metal tab to ground. Solder and trim 3 pins. Secure the nut to the screw with clear fingernail polish.

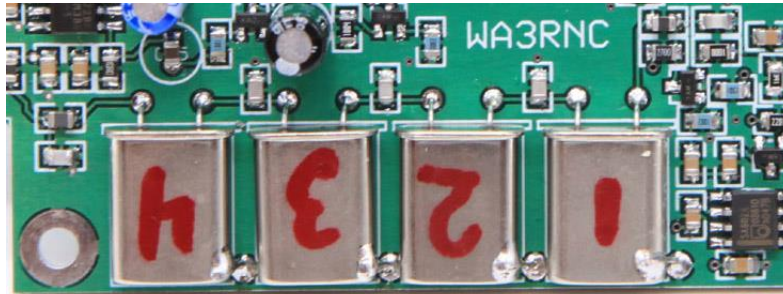




12) This step involves installation of 2 black ferrite toroidal inductors. The 3-leaded toroid is installed at T2. The twisted 2-wire center lead goes to the center hole, while the single wires go to the outside holes. The single red and green wires can go into either outside hole (1 in each hole). The 2-leaded 10-turn toroid is installed at L23. Mount the toroids vertically against the board. Solder and trim 5 leads. Note that there are two sets of holes for L17 through L23, and L26. Depending on how the coils were wound, left hand or right hand, one pair of holes will make for a better fit. Use either diagonal pair of holes, but be sure not to connect both coil leads to pads that are connected together! See the Photo for examples of left- and right-hand wound toroids. Neither is wrong, and either will work fine. Note that turns on a toroidal core are always counted on the inside of the core. Each time the wire goes through the center hole, it counts as a turn.



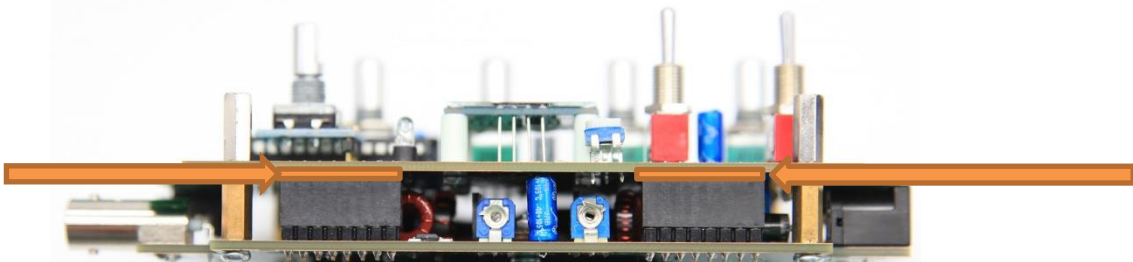
- 16) Install the IF filter crystals X1 through X4. The crystals have been measured and sorted, so they must be installed properly for maximum IF filter effectiveness. The crystals are numbered according to the reference designator where they will be installed. The crystal marked “1” will be mounted at X1, and so on. The crystal leads need to be formed by carefully bending them 90 degrees. See the photo.



- Mount the crystals down tight against the board. Solder and trim 8 leads. Ground the crystal cans with wires cut from the included sacrificial resistors. Do not overheat the crystal cans! Be quick when soldering to the cans. Trim the grounding wires. The resistors may be discarded.
- 17) The 16 pin connectors J1 and J2 will be installed together on both the upper and lower boards. This step requires some attention. The male connectors (.025" square pins) will be installed on the lower board (the one with the heatsink), and the female connectors on the upper board (the one with the OLED display). To allow for maximum pin engagement for these connectors, the female connectors will not be assembled tight against the upper board. There will be a small gap between the female connector body and the bottom of the upper board. Start this step by installing the male header pins into the top side of the board with the heat sink (lower board). Make certain that these connectors are tight against the board. Solder one pin on each connector and examine them for straightness before soldering the rest of the pins. Once all 32 pins are soldered, locate the assembled top board with the 12mm spacers attached, and place the board upside down in front of you, with the spots for the upper board connectors J1 and J2 closest to you. Place the female 16 pin connectors into the bottom of the upper board. Do not solder these connectors. Now carefully place the lower

board upside down over the upper board, carefully aligning the 4 connectors. The lower board mounting holes should line up with the spacers mounted on the upper board. Once everything is lined up, carefully press the boards together. Stop and investigate if something doesn't seem right, or if the board mounting holes do not line up. With the boards tight together, locate the four 3mm x 6mm screws and use them to secure the boards together. Turn the board set assembly right side up with the display and controls facing up. Now, the object is to fully engage the female connectors onto the lower board pins by pushing the female connectors down onto the male pins as far as they will go. This may require the use a flat surfaced object to gently push on the upper board connector pins to fully seat them onto the lower board pins.

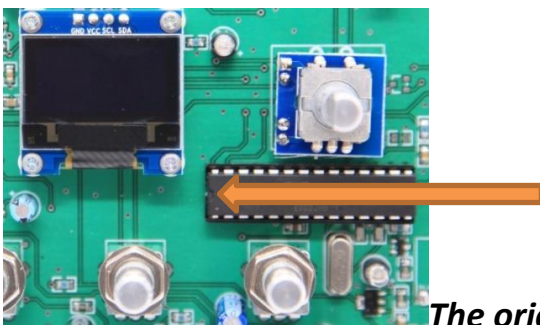
Note that this will let a small gap between the upper board surface and the female connector. See the picture.



***Note the gaps between the female connectors and the upper pc board***

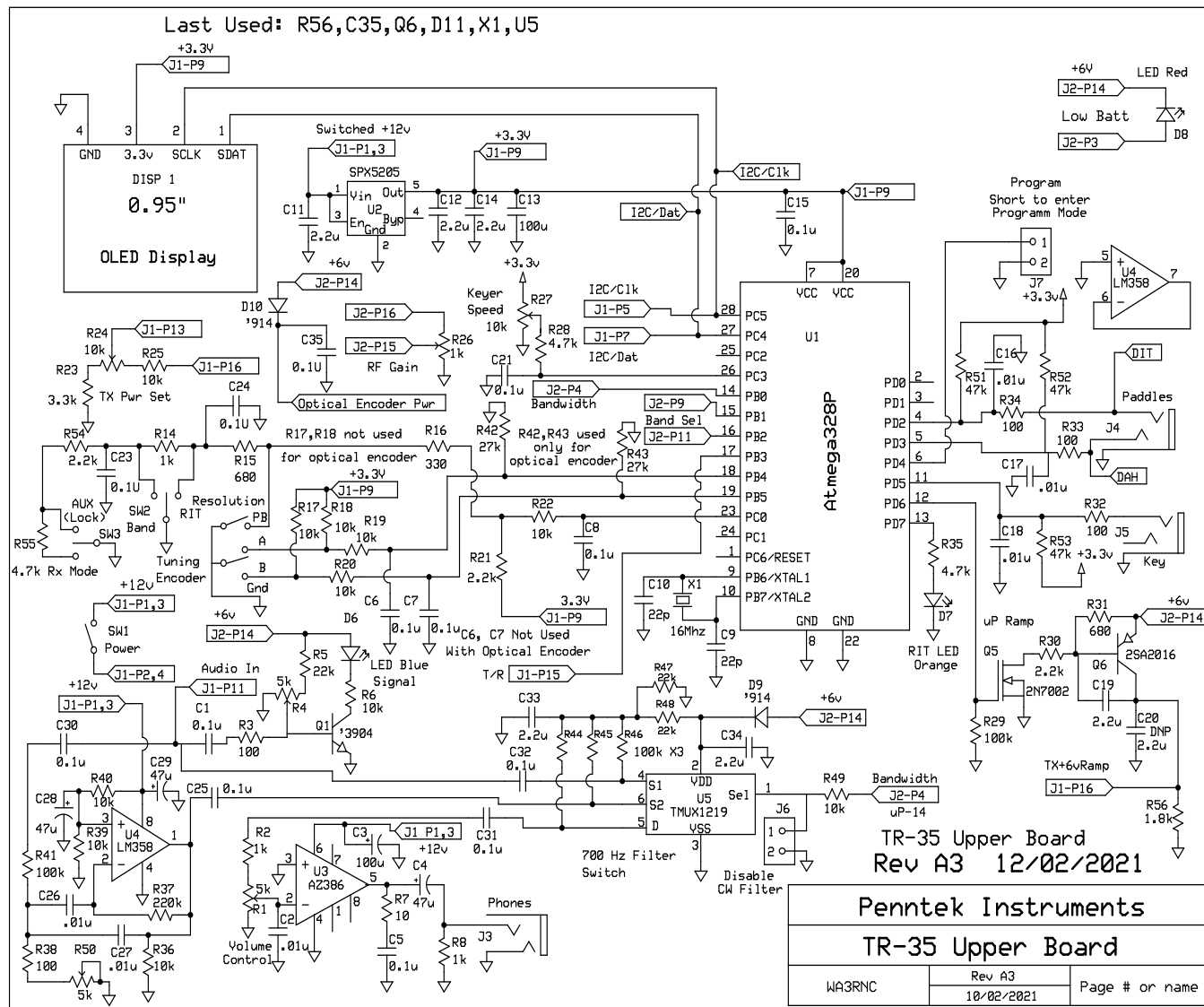
The upper board female connectors can now be soldered. Solder 32 pins.

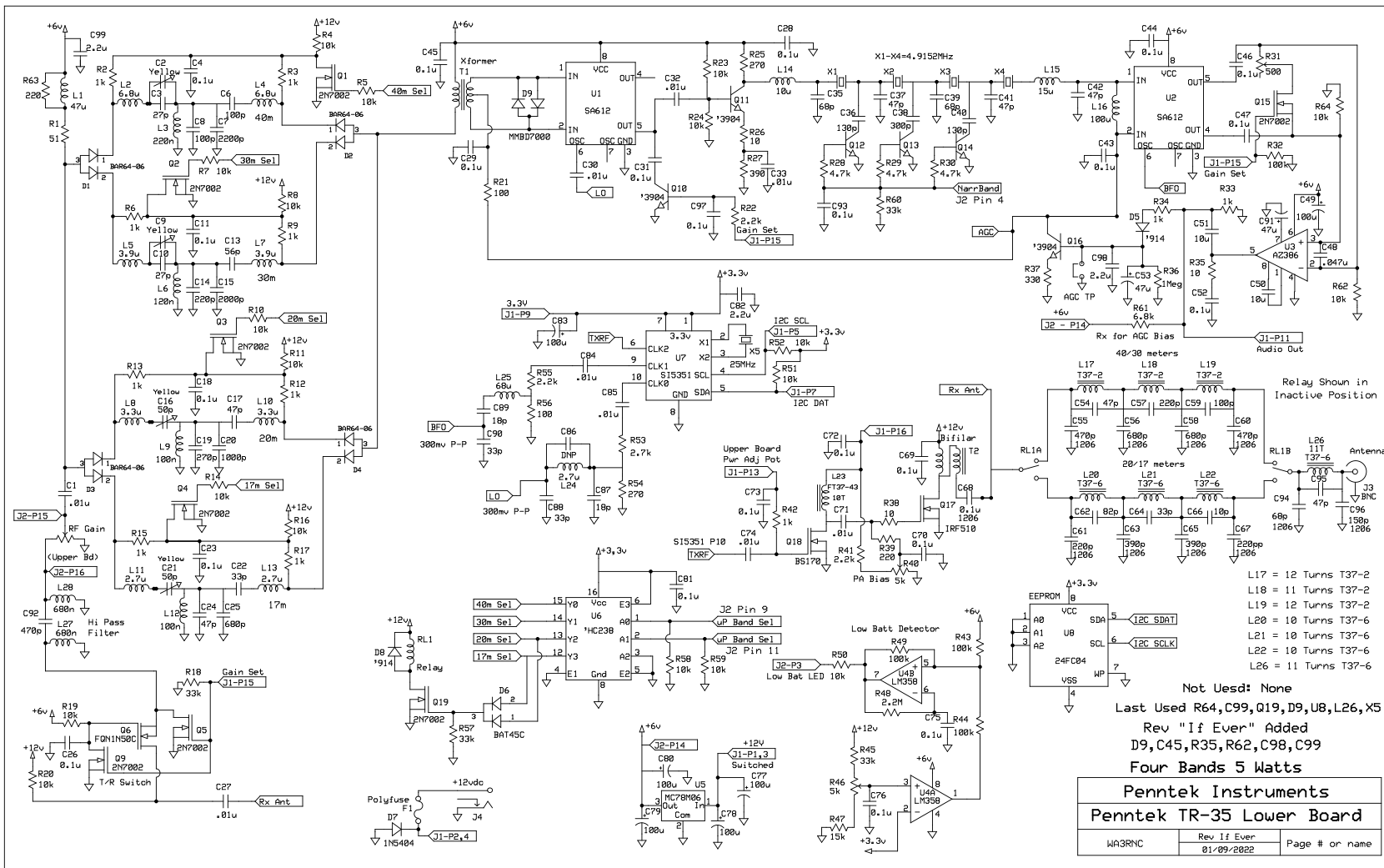
- 18) Locate the 28-pin microcontroller IC U1. Observing antistatic measures, carefully install U1 into the upper board 28 pin socket. Be sure to place the pin 1 end toward the center of the board. Be careful not to bend any pins!



***The orientation notch indicates pin 1 end.***

This completes assembly of the upper and lower pc boards. Proceed to the "Preliminary Checks and Tests" document.





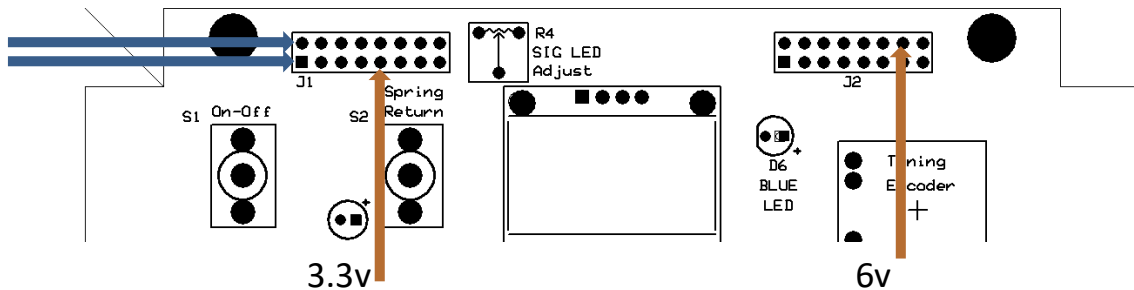
## TR-35 Final Assembly

There are four adjustments that can be made before the final case assembly. The adjustments must be made before the lower-case half is installed. The blue LED Signal level adjustment pot R4 should be adjusted for a dim blue light with no antenna connected. The R40 PA bias adjustment should have been made as part of the preliminary checks and tests. Make this adjustment before you transmit. The side-tone level control R31 should be adjusted to set the level to your liking. Note that the sidetone level will change some as you adjust the power level. To set the battery warning level pot R38, a power source with an adjustable voltage level will be required. Set the power supply voltage to the point where you wish the red warning LED to blink, and then adjust the pot until the LED just starts to blink. This level can be set from about 9.5 volts to about 11 volts. Turning the pot all the way clockwise as viewed from the rear of the TR-35 will set the level to its lowest. Once the adjustments are made, the case can be assembled. Be sure that the lower board is attached to the board spacers with four 3mm screws. Start by placing the board set into the lower case half. Slip the BNC connector through the large hole in the right side of the case bottom half. The board set should fit flat with a minimal amount of persuasion. Now place the upper case half down over the panel shafts. If it seems that the fit must be forced, investigate the reason. With the top properly fitted to the bottom, install the four original black case screws. Place the three nuts on the switches, and place the nut and washer on the encoder shaft. Slip the red vinyl cap onto the power switch toggle, and the white caps onto the Band/RIT and RCVR Mode/AUX switch. Be careful when installing the panel LED lenses. It requires some care to prevent damage to the lenses while installing them from the front side of the panel. Place the red lens for the Low Batt warning, the orange for the RIT warning, and the blue for the SIG indicator. Before installing the knobs, back out the setscrews and rotate a ¼" drill bit by hand into the shaft holes to remove any burs, and then replace the setscrews. When installing the knobs, make sure that they do not rub and mark up the pretty panel. Remember that the tuning knob must be installed far enough above the panel so as to allow for a slight downward movement with a push on the knob for setting the tuning resolution.

## TR-35 Preliminary Checks, Tests and Final Assembly

Before commencing with testing, you will need to understand the operating instructions for your TR-35 transceiver. The rotary controls and switches are pretty much self-explanatory. There are no hidden back menus, but the band switch does have a second function. While a quick upward flip and release of this switch changes operation from one band to another (40 through 17-meters consecutively), if the switch is flipped up and held for a few seconds, the current frequency and receiver mode will be stored in a semi-permanent memory. There is a separate memory for each band. Recall of this memory requires two quick successive upward clicks. The other part of this switch controls the RIT function. To engage the RIT function, a quick downward push and release of the toggle is needed. The orange RIT warning LED will come on, and the display will read out the RIT offset. Another quick downward toggle will dis-engage the RIT function. A press of the Aux switch will engage a dial lock function. Another press will dis-engage the dial lock. Tuning is inhibited with the dial lock on. The knob to the right of the display is the tuning encoder. The frequency will change in 10 Hz, 100 Hz or 1 kHz steps. The tuning step resolution is selected by a momentary switch attached to the tuning control. Short pushes on the tuning knob will alternate between 10 and 100 Hz steps. A long press will enable 1 kHz tuning steps. The frequency readout on the display will show the tuning resolution with an underline bar under the digit selected. That's pretty much it.

There are a few ohmmeter checks that should be made. The 3.3-volt and the 6-volt power supplies as well as the 12-volt rail should be checked for shorts. Measurement points for these supplies are available on the top side of the upper board. See the diagram. The resistance to ground on any of these points should be more than 1000 ohms.



***Note: The blue arrows points to the 12V pins and the orange arrows point to the 3.3V and 6V pins.***

If all is well, the receiver will be tested first. Connect a speaker or headphone to the Phone jack, and a suitable antenna to BNC antenna connector. Do not connect a key or paddles yet. Turn the TX Power pot fully counterclockwise. Set the RF gain pot fully clockwise, and the volume control to about  $\frac{1}{4}$  up. Connect a 10-to-12-volt power source able to supply up to 1.2 amps to the DC power input connector. Turn on the power switch and observe the OLED display. It should come on right away, and after a few seconds the screen will show 40 through 17-meter frequencies. The frequency should change as the tuning encoder is rotated, and you should hear signals or at least some band noise. Verify that the band switch allows 40 through 17-meter operation. Verify that the RIT function is operational. Check the RF Gain and Volume controls. Once satisfied that the receiver is in working order, disconnect the antenna and connect a 10-watt 50-ohm dummy load and a wattmeter to the antenna BNC connector. The Blue LED Signal LED adjustment control, R4 on the underside of the upper board, should be adjusted for a faint glow with no signal present. Before attempting to transmit, you must first adjust the Final RF amplifier FET bias control R40 on the lower board. This will require that you can measure the DC current from the power supply with a resolution of a few milliamps. A Digital Multi-meter connected as an ammeter in series with the power supply is perfect. First, rotate the panel RF Power control and the volume control fully counterclockwise. Also adjust the bias control R40 all the way counterclockwise as viewed from the rear of the transceiver. Select the 40-meter band. Observe the current drain in receive mode. It should be less



than 100 milliamps. Connect a key to the Key jack. With a dummy load connected to the BNC jack, close the key, and observe the power supply current. It should increase by about 10 milliamps or so. Note this reading. With the key closed, slowly advance the bias pot R40 with a small screwdriver while observing the power supply current. The object is to adjust the bias control until the supply current just starts to increase. Set the control for an additional current of 4 or 5 milliamps beyond what was previously noted. Do not set it higher as this does not appreciably increase the power output. If set too high, it can have a profound negative effect on the efficiency and heat stability of the final amplifier FET. With the bias pot set, disconnect the in-line current meter. You may now slowly increase the panel RF Power adjust control and observe the power output on the wattmeter, and the sidetone should be audible as you advance the volume control. You should see about 5 watts or a little more with the RF Power pot all the way up, depending on the supply voltage. RF power output on 17 meters will typically be a little less than on the other bands. The side-tone level control R31 should be adjusted to set the level to your liking. Note that the sidetone level will change some as you adjust the power level. To set the battery warning level pot R46, a power source with an adjustable voltage level will be required. Set the power supply voltage to the point where you wish the red warning LED to blink, and then adjust the pot until the LED just starts to blink. This level can be set from about 9.5 volts to about 11 volts. Turning the pot all the way clockwise as viewed from the rear of the TR-35 will set the level to its lowest. The final adjustment centers the audio bandpass filter frequency to 700Hz. To adjust pot R50 mounted on the underside of the upper board, set the receiver mode to 40-meter narrow band CW and set the transmitter power level about midway. Key the transmitter and adjust the pot for maximum audio loudness of the sidetone. An oscilloscope or audio dB meter connected to the speaker output would make this adjustment more precise. The final setting of this pot should be near the center of its rotation range. Note that this bandpass filter is disabled in wide band CW and SSB receiver modes. Once the adjustments are made, the case can be

assembled. Be sure that the lower board is attached to the board spacers with four 3mm screws. Start by placing the board set into the lower-case half. Slip the BNC connector through the large hole in the right side of the case bottom half. The board set should fit flat with a minimal amount of persuasion. Now place the upper-case half down over the panel shafts. If it seems that the fit must be forced, investigate the reason. With the top properly fitted to the bottom, install the four original black case screws. Place the three nuts on the switches and place the nut and washer on the encoder shaft. Slip the red vinyl cap onto the power switch toggle, and the white caps onto the Band/RIT and RCVR Mode/AUX switch. Be careful when installing the panel LED lenses. It requires some care to prevent damage to the lenses while installing them from the front side of the panel. Place the red lens for the Low Batt warning, the orange for the RIT warning, and the blue for the SIG indicator. Before installing the knobs, back out the setscrews and rotate a ¼" drill bit by hand into the shaft holes to remove any burs, and then replace the setscrews. When installing the knobs, make sure that they do not rub and mark up the pretty panel. Remember that the tuning knob must be installed far enough above the panel to allow for a slight downward movement with a push on the knob for setting the tuning resolution.