KN-Q10 Assembly Manual

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Thank you for purchasing the KN-Q10 4 Band SSB/CW Dual Mode kit! Please review the following to ensure your assembly is a success. KN-Q10 assembly is very similar to KN-Q8 and KN-Q9, so most of the experience building those kits can be leveraged.

Totally there are four boards to be stuffed with components. We call them the PA board, digital board, analog board and internal front panel board. Two black boards are used for the front panel and the rear panel.

If you have any question or need any assistance, please join CHINA_QRP yahoogroup at http://groups.yahoo.com/group/CHINA_QRP/ which is coordinated by Adam Rong, BD6CR/4.

Components preparation

Prepare IF Transformers (IFT)

The built-in capacitor need to be removed from some of the IFTs.

First, take all the DIY7-3.5, one DIY7-7 and one DIY7-14 IFTs from the bag. Then break the pipe-like capacitor in the bottom of the IFTs using a small screw driver. Be careful not to break IFT backbone and the pins as well. The modified DIY7-14 and DIY7-7 IFTs will be installed on locations marked as L3-1 and L3-2 on the digital board.

To re-iterate, the built-in capacitors need to be removed from all the DIY7-3.5 IFTs, including the two used in BPF.

Rework the encoder switch

Just like KN-Q9, the encoder switch needs to be reworked to have a resolution of 40 steps per circle. Refer to another manual for the details.

Coil winding

- B1-1 (PA board) and B2-1 (analog board): Use small pig-nose (binocular) ferrites, wind 6 turns with 0.2~0.3mm diameter magnetic wire. Primary and secondary windings are not important to differ when you install them on boards, but exchange the primary and secondary will slightly impact power output according to experiment.
- B1-3 (PA board): Use small pig-nose (binocular) ferrite, wind 4 turns on the primary winding,

and 1+1 turns on the secondary, tapped in the middle. The diameter of magnet wire is recommended to be 0.2~0.3mm. Wind the primary winding first, then wind the secondary evenly over the primary winding. Note not to scratch the enamel coating of the wire, or it may cause short circuit.

- B1-4 (PA board): Use big pig-nose (binocular) ferrite, wind 1+1 turns with tap in the middle on the primary winding, and 3 turns on the secondary. Because this high frequency transformer is used in the power output stage, magnet wire of 0.5~0.7mm diameter should be used. Again, don't scratch the enamel coating of wire.
- B1-2 (PA board): Use NXO-100 toroid (black), wind 5~6 turns using twisted pair magnet wire, connect one beginning end with the other finishing end as the middle tap.
- RFC (PA board): Use NXO-100 toroid (black), wind 15 turns evenly using 0.5mm diameter magnet wire.

LPF coils (PA board):

- L1-1 (3.8MHz): works with capacitors of 820pF. Use NXO-10 toroid (gray), wind 18 turns evenly using 0.5mm diameter magnet wire.
- L1-2 (7MHz): works with capacitors of 470pF. Use NXO-10 toroid (gray), wind 12 turns evenly using 0.5mm diameter magnet wire.
- L1-3 (14MHz): works with capacitors of 270pF. Use NXO-10 toroid (gray), wind 8 turns evenly using 0.5mm diameter magnet wire.
- L1-4 (21MHz): works with capacitors of 150pF. Use NXO-10 toroid (gray), wind 8 turns evenly using 0.5mm diameter magnet wire.

Due to the height limitation, install the LPF coils with a slight tilt. Make sure that the height of all coils does not exceed the height of the relays.

Notes for components without marking on PCB

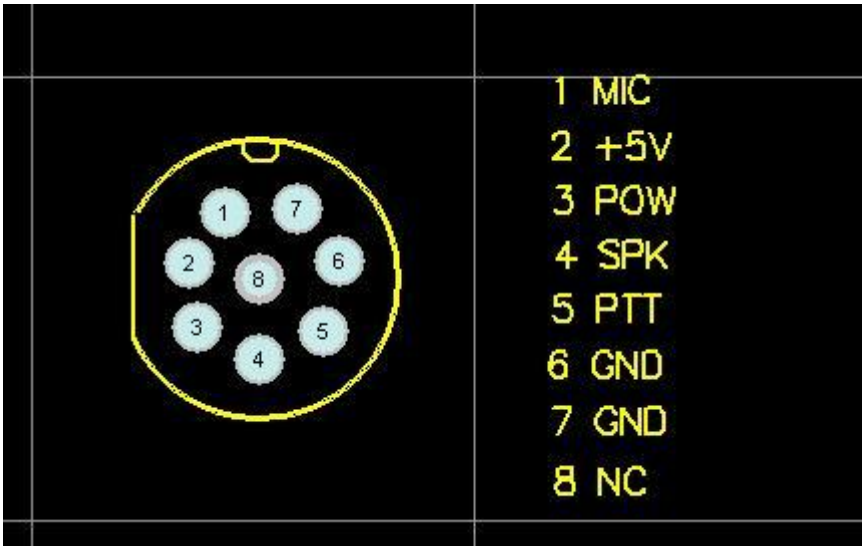
1. All SMD capacitors are 104 and should be installed on the solder layer (bottom layer). Pay attention to the orientation of the capacitors if there are install locations side by side (watch outline of SMD capacitor).
2. All diodes without marking are 1N4148. Make sure you understand which end is A and which end is K.

Components worth noting

1. V11: 3SK131 dual-gate MOSFET. 3SK131 is a 4-pin device with a very small footprint. One of the pins is a bit wider and this is the source. Install this pin to the corresponding wider pad on the PCB. Use care to solder this tiny component. Do not overheat it. Make sure you don't create any solder bridges, or end up with a cold soldering joint. This MOSFET is an electrostatic sensitive component, so don't touch it with your fingers. Ground the solder iron properly or unplug the solder iron from power when you solder the MOSFET.
2. Big frequency knob: The knob is designed and machined specifically for this kit. With the silicon rubber skidproof ring, it makes for a good operation experience. To ensure it lasts

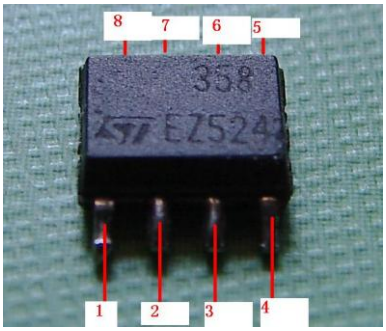
longer, please clean the aluminum knob before you put on the rubber ring.

3. TDA2003: The 10W hi-fi audio power amplifier is widely used for audio amplification in many commercial radios. To achieve good audio quality and high enough volume, this IC has been selected for the Q10 as the audio amplifier as well. Because power dissipation is much bigger than low power audio amplifiers like LM386, a suitable heat-sink solution should be considered. The Q10 uses the PCB as the heat-sink, so it should be installed horizontally. Use pliers to bend the pins of TDA2003 before installation. The heat-sink metal part of TDA2003 is connected to ground pin, so no insulation is required, however, thermal grease is recommended to ensure better a heat-sink effect.
4. Pin-out of Microphone connector: Same as KN-Q9.



Cautionary notes for the kit assembly

1. **SMD components**: Beginners might be confused about how to identify the pin-out of the SMD package ICs. Q10 uses five types of SMD ICs. All of them can be identified by the diagram shown in the figure. The AD9832 DDS chip pin-out can also be identified this way. On the PCB, there is one white dot to show the location of pin 1. Be sure to connect it correctly.



2. **Three high power transistors on PA board**: There are three TO-220 insulation sheets and M3 insulation washer (white plastic) in the components bag. All three transistors need to use insulation sheets to insulate them from the metal case. Two IRF530 transistors need to use

insulation washers, while the D882 does not need to due to its plastic package. Caution: Solder these parts only in the final assembly phase, because IRF530 and D882 use the bottom case as the heat-sink. Do not attempt to align transmitter before they are properly installed on the bottom case, or they could be destroyed by overheating.

3. Each PCB is connected using **IDC-20 connectors and wires**. Align the notch mark on the PCB when you solder the IDC-20 connectors. When you plug the wires, orientation should be no problem since it is foolproof. However, you may need to change a way to plug the wires if there is any interference during final assembly.
4. **8050 and 8550 transistors**: These two transistors have similar parameters but totally different polarity, one is NPN and the other is PNP. The packages are the same (TO-92) and marking are quite similar, so it is very easy to confuse them. So identify and group them before your installation. Also, make sure you install the transistors correctly according to PCB marking outline.
5. **Diode polarity** is important always. Make sure you make no mistakes with assembling the Q10.
6. **Three 1000uF/16V capacitors** should be installed horizontally.
7. The pins of the push button switches are quite a tight fit in the pad holes in the internal front panel board. Insert them gently.
8. **Drill holes on the bottom case**. You must position and drill the installation holes for three transistors precisely. You should also drill holes for the plastic feet ensuring their position doesn't block any components on the PA board solder layer. Planning and careful study is essential before you drill these holes.
9. Insert the PA board into the notches of the case sides, and stack the analog board with the 15mm copper standoffs on the PA board, and stack the digital board again on the analog board. Copper standoffs are the main supporting structure. There are two ways to install the standoffs. One way is to install the screws towards the bottom of the case, the other way is to install towards the top case. Both ways can be used. The designer prefers the former as it facilitates the installation of later stages, however, you must cut the protruding part of the standoffs on the PA board, or you might have problems inserting it into the case.
10. Follow the rule of low to high when you install the components on PCB. For example, start with all SMD components, then install the 1N4148 diodes, the ceramic capacitors, the TO-92 package transistors and the 78L series voltage regulators etc. Again, the IRF530 and D882 are installed in the last step, because they are fixed on the bottom of the case.

Alignment

Alignment is necessary to make the KN-Q10 work properly after soldering and assembly.

VCO frequency coverage:

Different from Q9, the Q10 uses only one VCO coil (L3-1) to cover 4 bands. Adjust the L3-1 core to ensure the LCD is not blinking in all of 4 bands.

If you find LCD is blinking, make sure you haven't made any mistakes in soldering, then

adjust L3-1 core a few turns until the LCD stops blinking. LCD blinking indicates that the PLL on the band is not locked.

Analog unit alignment:

The analog unit circuit is a different design from the Q9. It has the advantage that almost no alignment is required for the IF stage of the Q10, compared with the Q9.

Although B2-2 on the analog board is an IFT, it is actually used as a 4:1 wide band transformer. This is just for ease of installation. If you feel uncomfortable with this, you can wind your own coil using toroids.

Because Q10 uses a wide band IF amplifier, and the BFO is aligned in software, there are only a few alignments to be made on the analog board. If you have a signal generator, it will be very handy and faster. If you don’t have one, following these steps will achieve the same result.

RX unit:

IF Amplifier: The Q10 IF amplifier is almost alignment-free, the only device to align is B2-4, the tuning IFT of MC1350. The Q10 has enough sensitivity even you don’t adjust this IFT, but it is an easy job to tune it to its best.

Tuning BPF: Connect an antenna to the socket, and select the different ham bands. For each band, use a screwdriver to adjust corresponding BPF IFTs to peak the signal.

IF bandwidth, BFO and frequency calibrations are aligned in software menus, hardware alignment is not required. See another manual with photos.

TX unit:

Preparation: connect KN-Q10 to 13.8V PSU with 2A current limit. If your PSU does not have current limit, please be very careful, since it may burn your components on board. Connect a 50 ohm (at least 20W) dummy load to antenna connector. In between you can connect an RF power meter. If you don't have a dummy load, you can use a resonant antenna with an SWR less than 1.5:1.

1. Connect a DMM into the power supply line. Use the 10A or 20A range. Set the trimmer resistor on the PA board fully counter-clockwise. Set to SSB mode, and press the PTT. The overall current should be around 900mA. Adjust the trimmer resistor on the PA board to increase the overall current to about 1A.

2. IF: The Q10 has a TX IF stage. Make the IFT here resonant to get the max TX gain.

3. Set to CW mode, and press PTT. You might see a very small reading on the power meter. Adjust the IFT B2-3 on the analog board to maximize the power. There is one trimmer resistor (POW SET) for power adjustment. Turning it counter-clockwise increases power, while clockwise decreases power. There is no special requirement. Set it at your will.

4. Adjust the IFTs in the BPF of each band several times to peak the output power for each band.

Software alignment and operation

Refer to the **KN-Q10 Operation Manual**.

Other materials you might need

Schematic in PDF format
Encoder switch rework instruction in PDF format