

TS-930 Supply Upgrade Kit

The TS-930S Power supply upgrade kit was designed to replace the original power supply. This kit is easy to install and should provide years of extended life to your TS-930S, in our opinion one of the best radios ever made by Kenwood.

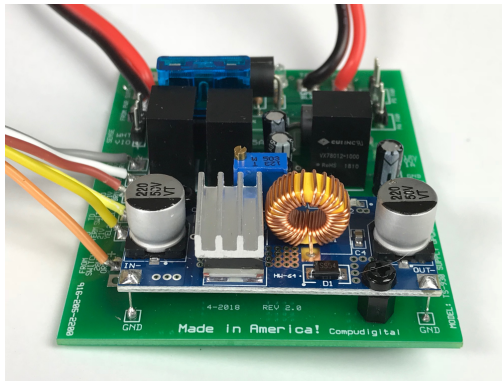
Unpacking the kit:

Unpack the kit and make sure that you have the following components:

- The TS-930S Upgrade Board with the attached 21V Buck Converter.
- 1 ea. Phoenix 24V @ 20A Power supply (if you purchased the full kit)
- 1 ea. Trimmed Snap Track section
- 2 pcs of Velcro Tape for power supply mounting (if you purchased the full kit)
- This Instruction Manual and Theory of Operation

The TS-930 Supply replacement kit is really easy to install! Refer to the video on our website at k6iok.com/videos and review the video on removing the old power supply. Below is a picture of the new board.

Snap Track installation: To install the supplied length of Snap Track, review the video to see the location and simply apply a small amount of RTV (Silicone) type sealant to the back of the track and attach it to the metal surface vertically as seen in the video. You should let it dry overnight or use some glue that dries quickly.



The TS-930S Supply Upgrade Board

You will see that the board comes with +28V in and Ground, and +28V out to the PA. The PA cable already has bullet connectors installed that match with the connectors on the PA power cables. You also have a grey, brown, white, 2 yellow, and an orange cable that have been pre-wired to the board and already contain a bullet connector.

For more details, be sure to watch our installation videos at k6iok.com/videos

Headers: There are only 3 headers on the board. One is the sense header (3 pin) and the other 2 are to connect your fans (9v outputs) Every other connection is a flying lead. Please refer to the video online to see all of the details.

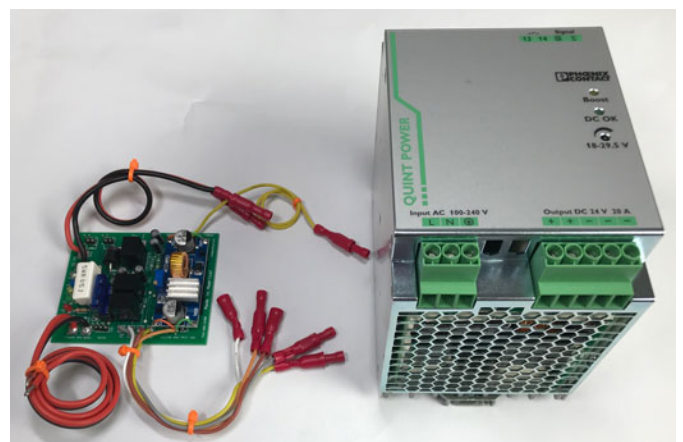
28V Power connector

We provide a #16 AWG - 2 conductor cable with flying leads on one end which is used to connect the 28V Quint power supply to the board. There is also another 16 AWG cable to tie the 28V output from the board to the PA module. This cable comes pre crimped with bullet connectors.

Testing the board and setting the voltages

The board is easy to test and we highly recommend that you do before installing it in the radio. The board is clearly marked with all the voltages and the color codes of the cables that attach all 6 of the pre installed bullet connectors.

First, connect +28v to the supply cable on the board. When you apply power, the RED LED should light up but all others will not. Next, connect a jumper cable between the +28v supply red cable and the orange cable. All of the LEDs should now be lit up. Then, just measure from ground to each cable, White Grey, Brown, Orange and both Yellows and simply make sure that the voltages marked on the board match with the voltages you see. Grey should be 9V, White is 15V, Brown is 21V, The larger gauge Yellow should be 28V, the smaller Yellow should be 21V and the Orange should be 28V.



If there are any variations from what is marked on the board, do not continue to connect the board to the radio.

Completing the installation is easy. You simply install the appropriate bullet connectors to the ends of the cables you cut during the de-installation of the old power supply and match them color by color to the new supply board. Again, it is really important that you review the videos to get step by step details regarding the uninstall and re-installation of the new supply system at K6IOK.com/videos.

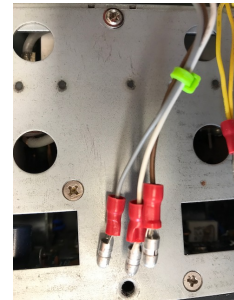
The female connectors that come from the upgrade board all supply power to the radio. The Male connectors that come from the board are receiving power from somewhere.

The longer Black and Red power cables on the upgrade board connect directly to your Power Supply (set at +28V). The shorter Black and Red power cables with the pre-installed connectors connect to your PA power. They are bullet connectors and just connect together with red to red and black to black. **The system ground comes from the black PA connector so even if you are not going to connect the PA, be sure to connect the Black Ground cable.**

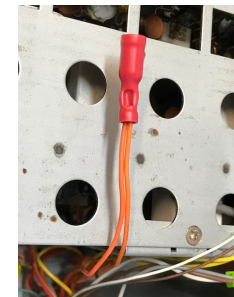
Grey, White, and Brown cables - Next, install the male bullet connectors (Right) on the Grey, White, and Brown cables that you cut during the power supply de-install process. Then, just match the colors with the Grey, White, and Brown cables that come from the new upgrade board.



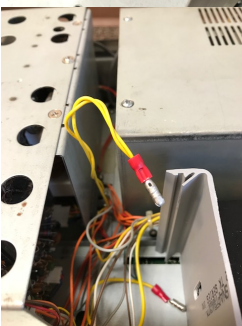
Large Yellow - The Larger Teflon 16AWG Wire coming from the supply upgrade board supplies +28V to the power switch. (Left) Install the male connector on the end of the larger yellow 16AWG wire coming from the Power switch and match it up with the Yellow line on the upgrade board labeled "Yellow to Switch". On the board, it is marked "To Switch 28V"



Orange wires - Next, gather all of the orange wires that were disconnected when you removed the original power supply and install them into a single Female bullet connector as shown (Right). There can be from 2 to 4 orange wires included in this connector depending on the vintage of your TS-930 radio. You should notice that most of them tie to the same place, a terminal strip in the bottom of the radio. Connect that orange bullet connector with the Male orange connector coming from the radio. This is +28V coming back from the power switch. On the board, it is marked "From Switch +28V"



Smaller yellow wires - Finally, there are a couple of yellow lines left (Left). These both come from the same place, a terminal strip on the bottom of the radio. Both of these should have a male bullet connector installed and matched up with the remaining female connector on the upgrade board. This line is the +21V line from the upgrade board and acts as the source for +21V throughout the radio. On the board, it is marked "To term 21V".



Initial Power Up - Double check your work, and then you can supply power to the Quint power supply and power it up. When you do, the 28V Red LED will light by itself and the radio should remain off. When you press the power switch, everything else should come alive.

Be sure to watch our installation videos at k6iok.com/videos

Theory of Operation

Construction of the Supply Upgrade Board

At Compudigital Industries, we take pride in delivering the highest quality product possible. This is why we have been through 2 revisions of this board before we released the first one for sale. The board is made using commercial quality FR4, .062" double sided circuit board material with solder mask and screen printing to indicate component locations, voltages, and cable colors. The board traces are silver plated to assure maximum current passing capability and the highest level of solderability. The high current through holes are filled with solder as well. The high current traces are wide and as short as possible to make sure that the voltage drops remain minimal during transmit conditions.

The original Supply board in the TS-930 served many functions. First, it controls the fans to make sure that they each come on as the radio requires them. These fans cooled the original power supply and the PA section. The fan controls and thermistors on the supply board are prone to failure, causing the fans to fail to come on when the components get hot. The new board provides 2 fan

outputs, both operating at 9 volts and they run continuously. The Quint Power supply requires very little cooling but does need some air moving through it. The finals also do not require a full speed fan and so the 9V line has proven to work very well.

Another function of the original supply replacement board was to provide +21 volts, +9V, and +15V using the external pass transistors, regulators, heat sinks etc. Our new board has a +21V DC to DC 5 amp converter mounted on the board, and a 9V, 15V, a 12V Switching Power supply mounted on the circuit board. These on board converters run with up to an amazing 98% efficiency and so they run cool, providing everything the TS-930 needs to run properly.

You will notice that the new board has a +28 volt input and a +28 volt output (Marked +28V-PA) which serves the PA module. You will notice that this 28V source goes through a 15A fuse, and then a .05 ohm (50 milli-ohm) 1% 5W resistor, used as a current sensor. This sense voltage provides an indication of the transmit current through the 3 pin plug via the two 150uh chokes. This voltage is used to provide the meter reading for current during transmit, and to control the output power to make sure the driver and final stages remain safe. The original power resistor is subject to change which can throw off the readings to the control circuits of the radio. The maximum specified power output in all modes is 110 Watts and the radio uses this resistor to determine the output level.

LED Indicators We use 5 multi colored LEDs to indicate the different voltages within the upgrade board. The RED Led is used for 28V, Green is for 21V, Yellow for 15V, Blue for 12V, and White for 9V. These LEDs do not confirm that the voltages are correct, they just indicate that the voltages are there.

Radio Reverse Polarity Protection

We have installed a protection Schottkey diode for reverse polarity protection. If either of the voltages somehow get reversed, the diode will simply not conduct and the you will not see any output.

The 12V output

We know that many of you are experimenters like I am and in this radio, 12 volts Just doesn't exist. So we added the option of a high efficiency 12V @ 1A switching power supply to the board and placed the output via the 2 pads on the board.! If you have this option feel free to use this to provide power for your experiment or addition to the TS-930! The other reason we added this regulator is for power to run the new driver if your original driver fails. The driver transistors are impossible to get but there are 12V replacements available and this 12V supply line can be used to provide the power you need for that driver.

The Cooling Fan Outputs

We have provided 2 fan outputs so that you can hook your fans directly to the board. The fan included in the full kit is a 12V low current model used to put minimal air through the switching power supply. It runs perfectly at 9 volts. The fan that cools the TS-940 Final stages is a 12 volt fan that we also run at 9 volts. Running at a full 12 volts gets pretty noisy and is really not required.

Securing the power supply in the case

The Quint power supply is sized perfectly to fit within the TS-930 case. The best way we have found to secure it to the bottom of the case is using Velcro Tape (supplied). After you have completed all of the wiring and are ready to wrap the project up, you can secure the supply to the radio with the supplied VELCRO tape.

NOTE ABOUT KENWOOD CONNECTORS:

The connectors used in the Kenwood TS-940 are delicate and do not respond well to plugging and unplugging continuously. We recommend that you keep this repetitive action to a minimum to prevent damage to the plugs. The original pins on the AVR board and other parts of the radio are .037" and these header connectors are no longer available. We use a header with .035" pins, the only option we have been able to find anywhere. Many thanks to one of our partners PIEXX for their assistance in locating the headers we use!

If you have any questions about your installation, please contact us at 916-205-2200.