

TS-930 Supply Upgrade Kit – Version 3

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.

NOTE: WE HAVE CHANGED THE LARGE YELLOW TEFLON WIRE TO A RED WIRE IN THIS KIT. THIS CONNECTS TO THE POWER SWITCH CABLE (YELLOW) IF YOU HAVE ANY QUESTIONS, PLEASE CALL OR WRITE FOR MORE DETAILS.

Unpacking the kit:

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

- The TS-930S Version 3 Upgrade Board
- 6 ea. Crimp Connectors and 4 bullet connectors
- 1 Set 6 conductor cable and 4 conductor fan cable
- 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)
- 1 ea. Black/Red Power cable with Spade Connectors
- 1 ea. Black/Red Power cable with Spade Connectors and bullet connectors
- 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. To the right 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.

Spade Lugs - You will see that the board comes with a series of spade lugs (+28V and Ground In), and (+28V and Ground to the PA), and a new Ground connector. The PA cable already has bullet connectors installed that match with the connectors on the PA power cables. The new 6 pin header contains all of the power cables that interface with the radio. The 4 pin header is used to power 2 fans at 9 volts. The 3 pin header is the sense pins that are used to read current during transmitting.

28V Power connector - We provide a #14 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 21V line on the board is pre-aligned and easy to test .We highly recommend that you test all voltages before installing it in the radio. The board is clearly marked with all the voltages and the color codes of the cables.

To check the board, connect +28v and Ground to the supply cable on the board (upper right corner). When you apply power, the RED LED should light up but all others will not. **It is a good idea to set the output voltage on the Quint Power Supply to 28V prior to connecting to the board.**

Next, connect a jumper cable between the +28v supply red cable and the orange cable on the header connector. All of the LEDs should now be lit up. Then, just measure from ground to each cable, White Grey, Brown, Orange, Red and Yellow. Simply make sure that the voltages marked on the board match with the voltages you see.



Voltages - Grey should be 9V, White is 15V, Brown is 21V, Red should be 28V, the Yellow should be 21V and the Orange should be 28V.

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

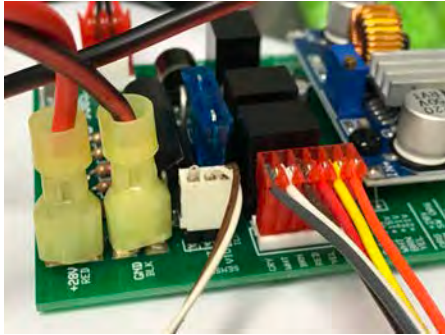


Figure 1 - Power Connection

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, connect the Grey, White, and Brown cables that you cut during the power supply de-install process to 3 individual connectors. Then, just match the colors with the Grey, White, and Brown cables that come from the header on the new upgrade board.

Red - The Red Wire coming from the supply upgrade board header supplies +28V to the power switch and connects to the **Yellow wire coming directly from the power switch.**

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 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 top of the chassis of the radio. **Connect the other end of that connector to the orange wire coming from the Power Switch.** This is +28V coming back from the power switch. Also connect the orange wire from the upgrade to the same connector. (All of the orange wires connect together. On the board, it is marked "From Switch +28V")

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 be connected to one side of a connector. The other end of the connector should be tied to the Yellow wire coming from the Upgrade Board his 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 "YEL +21V".

Power Sense lines – There is a 3 pin connector Violet, White, Grey that is used to sense current used in the Final amplifier stage. You can cut off the far left extra wire if you wish.

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.

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.

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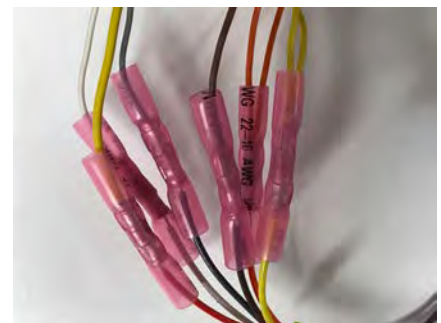


Figure 2 - 6 Pin Header Connections

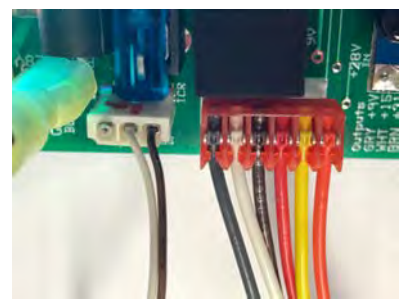


Figure 3 - Power Sense 3 pin connector

Power Switch Caution! – The top of the power switch is HOT when the radio is turned off or on. Touching these connections could be dangerous. We suggest you cover these with Velcro or another suitable tape.



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 3 revisions of this board. 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 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 AVR supply board were 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 AVR supply 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 "TO PA") which serves power to the PA module. You will notice that this 28V source (From 28V Supply) 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 current sense 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 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, a 12 volt power source 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 & TS-930 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.***