KB2LJJ

Modifications for the Kenwood TS-930

www.r6-ru4montesecchieta.it

IZ5CCV

TS-930S PLL Unlock

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 869 (29-3-1983)

Some users of the TS-930S have reported a problem where the PLL will sometimes not lock (digital display does not come on) if the power switch is turned off and on while xx.499.9 MHz is displayed, after the unit has warmed up. This may occur also in the FSK mode.

This may be caused by detuning of VCO-2 and VCO3 in the PLL unit (X50-1880-00). This may be cured by a simple increase in the voltage obtained in the PLL alignment procedure. Make the following change in your service manual.

Service Manual page 58.

3. VCO-3 T14 change 3.7v to read 4.2 vdc
4. VCO-2 T15 change 3.0v to read 3.5 vdc

Notes:
Be sure to adjust T14 and T15 of VCO-2 and VCO3 whenever a PLL related circuit is serviced.
This change applies to units before S/N 306XXXX.
Installation time for this change is 1/2 hour or less.

TS-930S Service Notes on AT-930

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 877 (23-8-1983)

Some of the symptoms and cures for troubles that have been encountered with the AT-930 are listed below.

The motors do not stop on all bands.

Possible causes:
a. Cold solder joint of platee VCJ wire.
b. Cold solder joint of L18 lead.
c. Cold solder joint of the wire between pin 13 of Q39 and R139, D33 and R138.

The motors do not stop on the 7 MHz band.

Possible Cause:
The rotor of VC2 contacts (shorts against) the stator.

The motors do not stop on the 28 MHz band.

Possible Cause:
Cold solder joint between D33 and R84

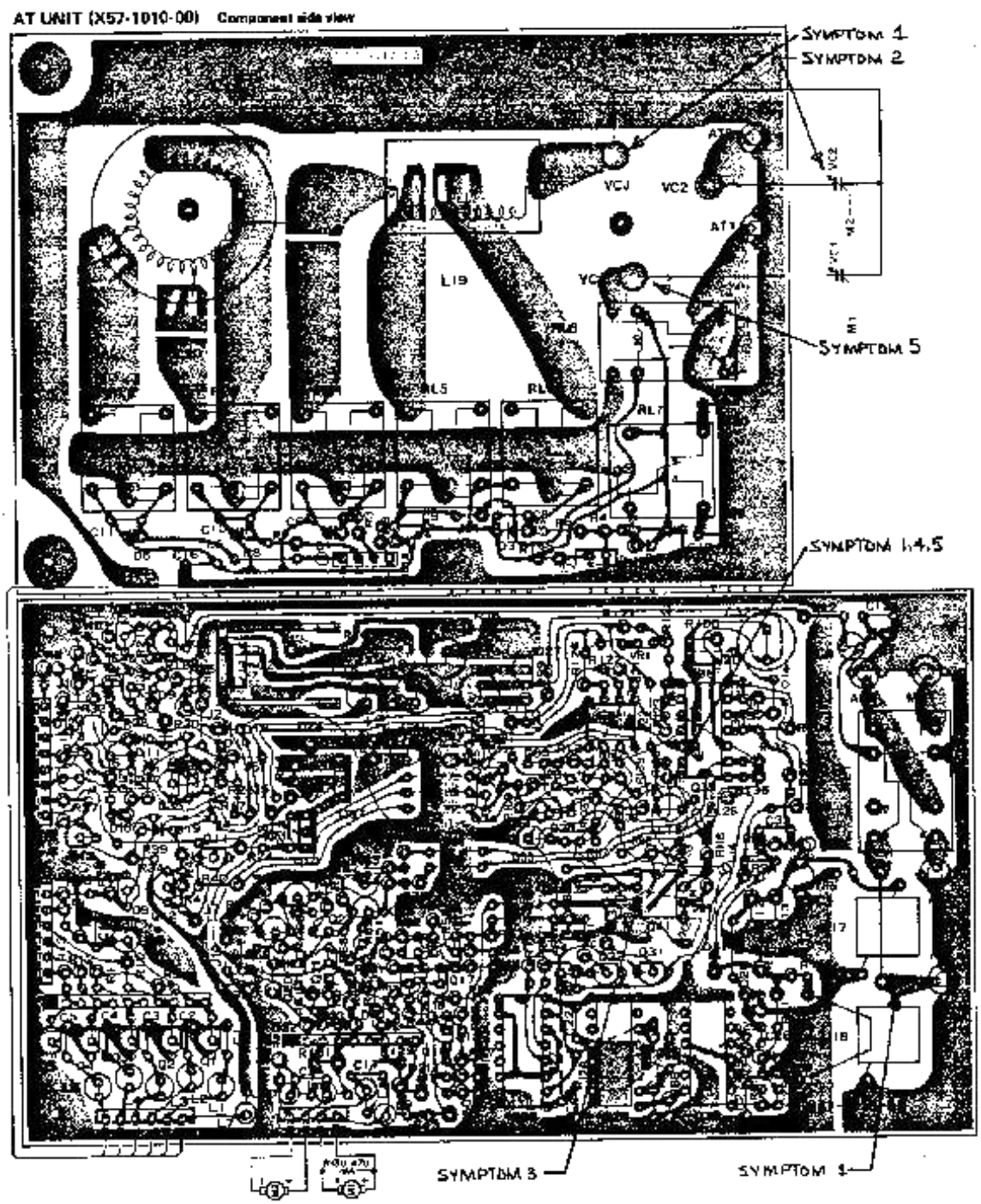
The AUTO mode does not reset.

Possible Cause:

The wire from R138, R139 and D33 may touch Q39 pin 14.

The motor stop when SWR is at Maximum.

Possible Cause:
The wire from R138, R139 and D33 touches Q39 pin 14 and the foil is broken around VC1.



TS-930S Intermittent TX Power Output

Service Bulletin no. 886 (11-5-1984)

The following procedure should correct any tendency of the TS-930S to exhibit intermittent TX power output. Most of the reported cases of this nature have been traced to poor contact of one or more plated thru holes mentioned below. Careful adherence to this procedure should prevent reoccurrance of this symptom.

Procdeure:

Remove the top and bottom covers.
Remove the 10 screws securing the final unit to the chassis.
Disconnect all cable assemblies from the final assembly, and remove it from the radio. The fan motor cable may have to be removed for easy access.
Remove all Final Unit PC board screws and turn the circuit board foil side up.
Desolder Q6, D2, and the plated-thru hole connecting the foils from R20 and Q8 base together (between T2 and VR1). Do not remove the components!
Carefully remove the green solder resistant coating from the immediate areas of these six points, so that there is bare copper foill up to and surrounding the eyelets.
Carefully resolder these six points, and those listed below:
Q1 Emitter and base
D4 anode and cathode
Q2 Emitter and base
Q3 Emitter and Base
Q7 Emitter and Base
Q4 and Q5 Base and collectors
Plated-thru hole between C36 and C15
(2) Plated-thru hole sby the molex connector.
Check and resolder the input and output coax connectors.

Double check your work to ensure that there are no solder bridges or splashes.
Check the value of R19. If it is not 6.8 K ohms, change it so it is.
Reinstall the final assembly, and readjust the idle bias currents of the driver and final transistors in accordance with Service Bulletin 867.

CAUTION:
Ensure that no cables are pinched between the final assembly and chassis when reinstalling the final unit. The fan cable is especially vulnerable, so pay close attention!

Tuning Mods TM-930

The resolution of the main tuning digital readout can be increased from 100Hz to 10Hz. No digits are lost since the readout has the extra digit for this purpose. This change can be accomplished by grounding pin 1 of connector 8 on the digital unit PCB.
The tuning rate is 10KHz per revolution of the main tuning knob.
The tuning rate can be changed to 5KHz per revolution by removing or lifting one end of diode D-13 on the digital unit PCB.
Note that the black marks on the tuning knob itself are exactly 500Hz apart. The knob can be "corrected" by tuning in an exact frequency, such as 10,000.00KHz, pressing the DIAL LOCK switch, then turning the knob to line up a black line.

As long as you don't spin the dial too fast, it will track nicely from one end to the other. With the slow rate tuning modification above, the dial increments become 250Hz per division.
You may desire to switch the new reduced tuning rate on and off. For example, you can select the new rate on just VFO B by using an unused section of the FUNCTION switch to make or break the circuit on diode D-13. Another pssibility is to use the display DIM switch.
There are an additional 8 memories available. These can be util- ized by grounding pin 5 of connector 7 on the digital unit PCB. This lead is designated as "M3". The additional memories can be selected by using the unused contac on the FUNCTION switch or by adding a new switch.

Amtor keying mod

Look at the signal board and locate C500. C500 is an electrolytic 4.7uF located near the center of the board (if viewed with the radio upside down with the front facing you) near connector 30.
Remove this capacitor by carefully twisting it with a pair of needle nosed pliers. This capacitor cannot be easily removed any other way without completely disassembling the radio. The function of this capacitor was to de-bounce the PTT switch and is a big reason why the TS-930 will not work satisfactorily in AMTOR mode.
Next, locate R476 wich is on the same board as above and is positioned just above the large CW filter. The lead that is exposed needs to be grounded. An easy way to do this is to locate R474 which is right next to R476 and scrape away some of the insulation from both of the exposed leads, then solder a bridge between them.

TS-930S CW Pitch Tone Shift

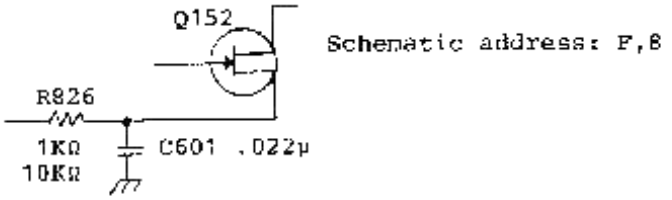
Author: *Trio-Kenwood Communication, inc.*

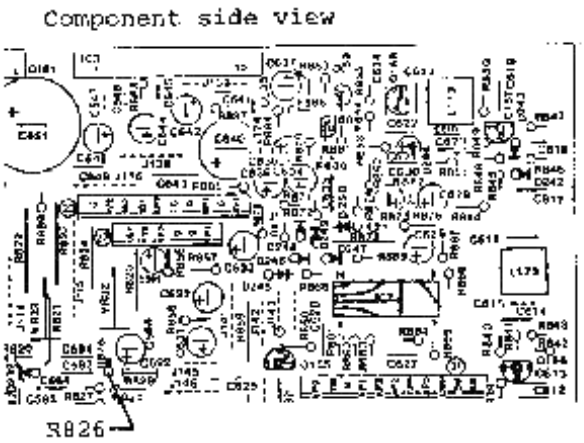
Service Bulletin no. 872 (6-7-1983)

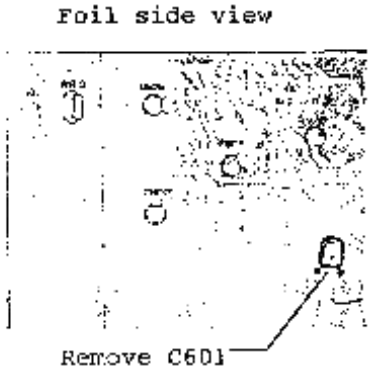
Some users of the TS-930S have reported a slight change in the CW pitch tone when the MONI switch is turned ON and OFF.

This may be corrected by changing the following components:

On the Signal unit (X57-1000-XX) change R826 from a 1 K ohm resistor to a 10 K ohm resistor and remove C601, a .022uF capacitor from the foil side of the circuit board.







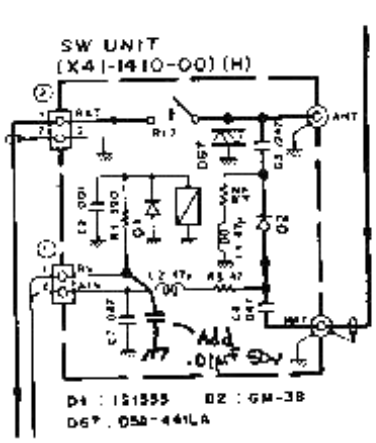
Notes: This change is applicable to units before serial number 3070221 only.

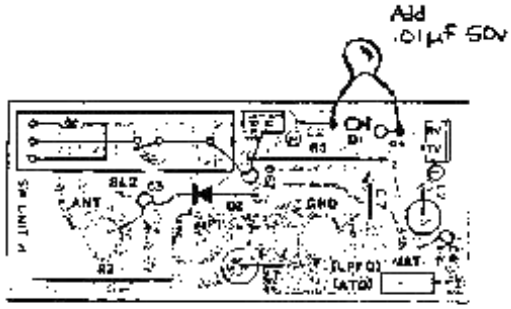
TS-930S 15 Meter Internal Beat Tone

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 884 (27-1-1984)

Some users have reported an internal beat tone that appears every 10 KHz, when operating in the range of 20-21.5 MHz.
Apparently the RV terminal switch unit H is being affected by the 1st loop of the PLL unit.
The cure is relatively simple. Add a .01 µF 50V disc ceramic capacitor on the RV line of switch unit H as shown below.





Time required for this modification is ½ hour or less.

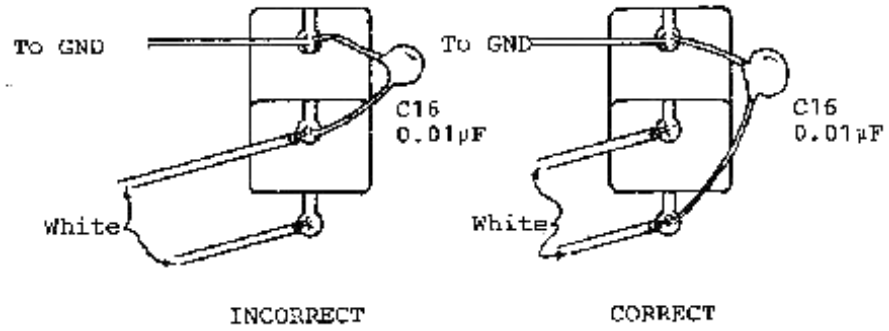
TS-930S RF Feedback

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 874 (15-7-1983)

For reports of RF feedback from the external speaker, especially when using a vertical antenna, or a linear amplifier, check for correct installation of capacitor C16 on the EXT SPKR jack.

C16 should go from ground to the white wire on the opposite side of the jack. Some units have the capacitor soldered to the middle terminal in error!



Note: This bulletin is applicable to radios with serial numbers prior to 3070420. Time required for this procedure is ½ hour or less.

TS-930S SSB TX Tone Quality

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 867 (29-3-1983)

The transmitted audio tonal quality of the TS-930S may be improved by the following procedure:

In the TS-930S Service Manual page 64, make the following change:

```
5. 100 W Final Bias VR2 adjust for 70 ma
                    VR1 adjust for 1.3A
```

Note:
This change is applicable to units with serial numbers prior to S/N 3080001.

Error in the operator's manual of the DIGITAL UNIT pin

Note: In the operator's manual supplied with the 930, there is an error on one of the drawings. On the upper left corner of the DIGITAL UNIT schematic locate connector 8. The lead designations are as follows (note that some of the designations do not appear on this sheet so you can add them to the drawing):

Pin	Desig.
1	100
2	MU
3	SCN
4	M2
5	MIN
6	FSK
7	B2
8	FT

On the main drawing, called SCHEMATIC DIAGRAM, the pin numbers shown on connector 8 are reversed from the way they are numbered on the DIGITAL UNIT schematic. In the following changes, I am assuming that the numbering on the DIGITAL UNIT sheet is correct. In any event, it will be obvious which end is which since the end pin is vacant.

Incorrect AC line voltage setting

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 863 (22-10-1982)

It has been found that a few TS-930S (and other) transceivers have been shipped in the 220V or 240V line position. If you should encounter an initial transceiver failure, please check for correct line voltage selector setting. The voltage selector is located on the bottom case at the rear of the unit.

TS-930S CW Hetrodyne Tone

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 866 (24-3-1983)

Some users of the TS-930S have reported that a hetrodyne is heard when the VFO control is turned in the CW mode. The tone may be more noticeable with no signal present, (e.g. no antenna connected.), or when the AF tune or CW PITCH controls are tuned. This may be reduced or eliminated by the following procedures.

Parts required

Qty	Description	Kenwood part number
1	Shield Kit	Z930CARSHIELD
	Cover CAR 1	F11-0813-04
	Shield CAR 1	F10-1308-04
	8.2 Kohm ¼ Watt Resistor	
	22 Kohm ¼ Watt Resistor	
	3 pF disc capacitor	
	.5 pF disc capacitor	
	1 pF disc capacitor	

Procedure

Remove the top and bottom covers from the TS-930S.
Turn the radio bottom up to allow access to the Signal unit (X57-1000-11).
Remove the twenty-two (22) screws that secure the Signal Unit/Heat sink to the chassis. Unplug the RAT, DRV, XVT, FRQ and the VCOF coaxial cables from the Signal unit. These are located along the rear and the left side of the Signal unit. Unplug connectors number (16) and (20) located along the right of the Signal unit.
Gently lift up on the rear of the Signal unit and fold the board over towards the front panel to allow access to the bottom of the board.
Install the shield plate as shown in figure 1. Cut the circuit foil and add the jumper wire as shown.
Change the following components:

Change R635 to 8.2 Kohm
Change R501 to 22 Kohm
Change C469 to 3 pF
Change C473 to .5 pF
Change C476 to 1 pF

Reinstall the Signal unit. Pay careful attention to the coaxial connectors when reinstalling to ensure they are in the correct locations.
Install the top cover to CAR 1 enclosure to complete the Signal Unit modification.
Turn the set over so top is up. Remove the four (4) screws that secure the speaker assembly to the chassis and lift up gently (unplug the battery backup connector). The assembly may then be folded over to the right with cables attached.
Remove the four (4) screws that secure the Digital assembly to the chassis and fold the assembly up and towards the front panel, to allow access to the PLL unit.
Remove resistor R73 and capacitor C99 from the PLL unit.
Reverse the procedure in step 9 to reinstall the Digital and Speaker units.

Adjustments.

Connect an oscilloscope probe to the CAR 1 terminal (24) of the Signal unit. Adjust L161 for 300 mV p-p signal amplitude.
Connect the oscilloscope probe to the emitter of Q79.
Adjust L142, L144, and L145 for maximum signal amplitude, then adjust L139 for 1 V p-p amplitude.
Note: Note the USB frequency before adjusting L139

Adjust TC4, TC5, and TC6. (Refer to Service Manual)
Adjust TC3 so the frequency is again the same as measured in step 2.
Replace top and bottom covers to complete the modification.

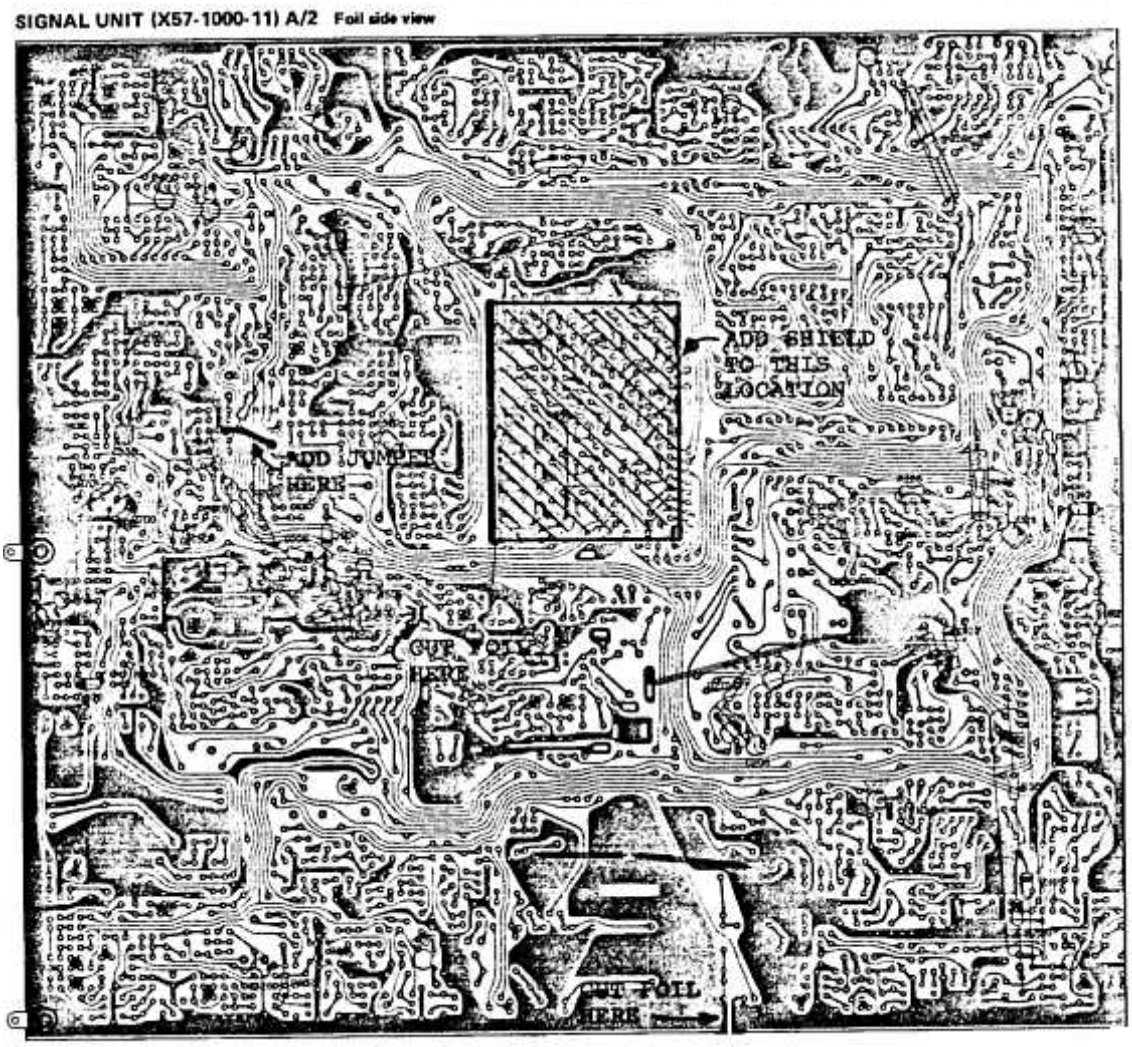


Figure 1

TS-930S Low RX sensitivity

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 868 (29-3-1983)

A loss of receiver sensitivity (6-30dB) may be caused by shorted switching diodes in the Signal unit (X57-1000-xx). The following procedure will increase the capability of the unit to withstand high RF voltage levels.

Procedure

Signal unit (X57-1000-xx)

Replace Signal unit jumper J27 with an XZ-070 Zener diode.

(PCB coordinate C-1, see figure 2.)

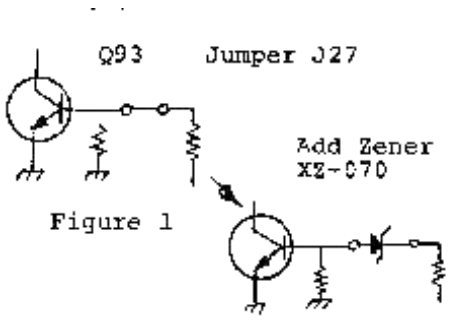


Figure 1

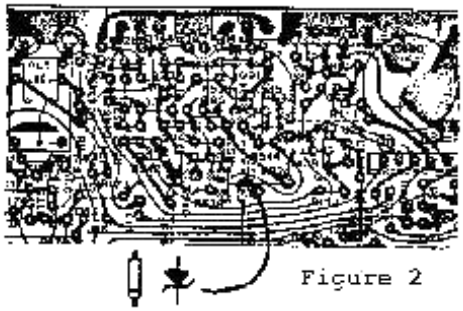


Figure 2

Change diodes D15 through D33 from BA2B2's to 1S2588's. Change only the defective diodes when making the repair.

Figure 3 show a circuit that is capable of withstanding antenna input levels of up to 50 Watts. Use this on units that may be subject to high levels of RF. (This is an optional change that may not be done in-warranty.)

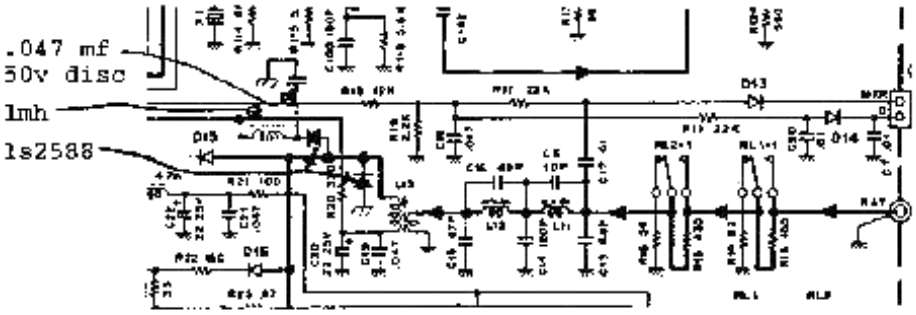


Figure 3

Installation time for this procedure is ½ hour or less.

TS-930S CW VBT

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 873 (15-7-1983)

This procedure will allow a simplified alignment method for the TS-930S CW VRT section, when a VBT-1 jig is not available.

Test Equipment required

Oscilloscope
Audio signal generator (2)
AF VTVM

Procedure

Preset the TS-930S controls as follows:

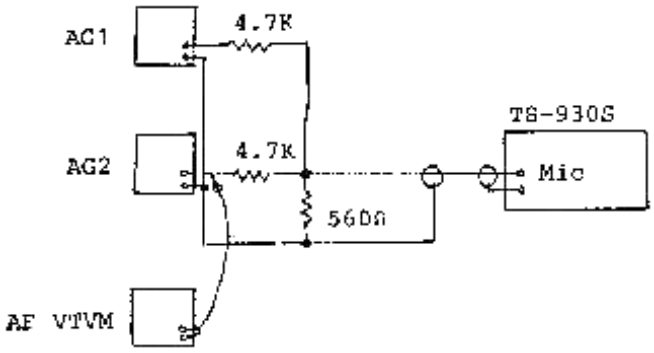
MODE: ……. LSB

Disconnect the DRV connector from the Signal unit.

Confirm that CAR2 frequency is the same when switched from transmit to receive. If it does not stay constant adjust VR23.

Connect the oscilloscope probe to R176 in the Signal unit.

Connect the two Audio Generators as shown in the figure below. Set AG1 to 300 Hz and AG2 to 2.9 KHz.



Ensure that the output level of AG1 and AG2 are equal by using the AT VTVM.

Connect the cathode of D133 to that of D132 in the Signal unit using a 0.01 µF capacitor.

Clip the lead of D124 and place the STBY switch to SEND.

Adjust TC4 (CAR1 8.8315 KHz for USB) so that complete tone waveform is observed, as shown in figure 2. Return to REC, and resolder D124.

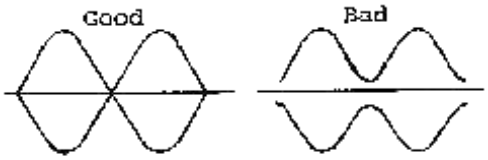


Figure 2

Remove the 0.01µF capacitor installed in step 5.

Set STBY to SEND and adjust TC3 (CAR2 8.375MHz) so that a complete two tone signal is displayed, as in Figure 2.

Return to REC, and reconnect the DRV connector. This completes the simplified alignment procedure.

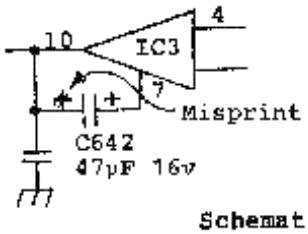
TS-930S Audio oscillation

Author: *Trio-Kenwood Communication, inc.*

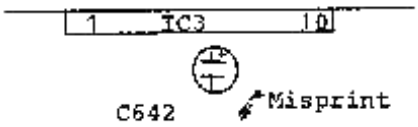
Service Bulletin no. 875 (16-8-1983)

Some users have reported an audio oscillation when the AF gain control is set between 10:00 and 12:00.

The cause may be that Signal unit (X57-1000-xx) capacitor C642 is installed backwards. See figures below. Please change your service manual schematic to reflect the correct positioning when you check the board.



Schematic



PC Board View

Note: This change is applicable to units before S/N 307xxxx.

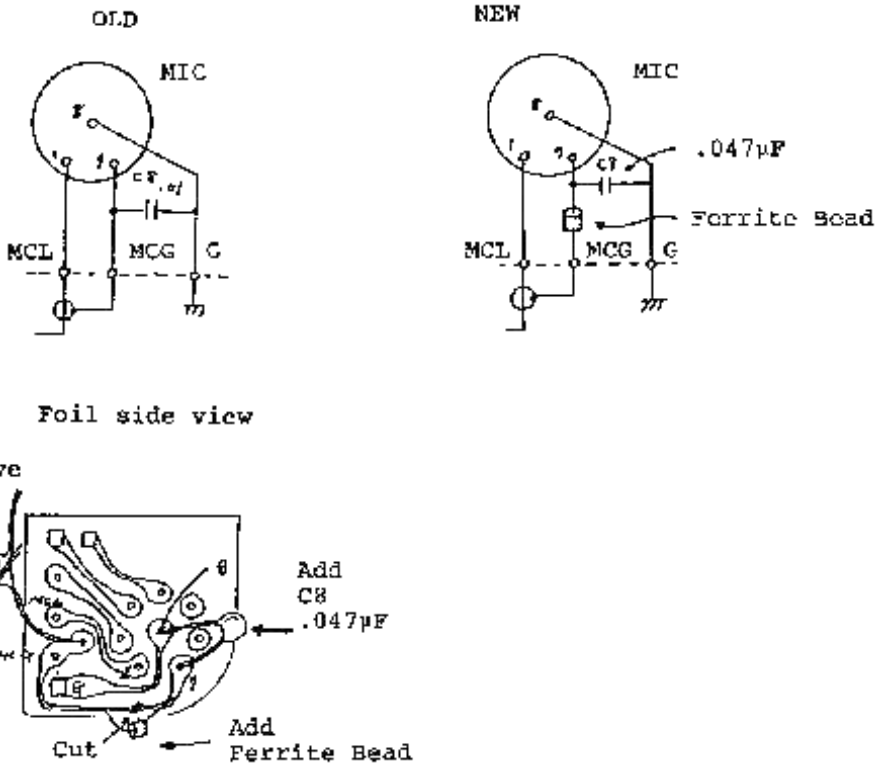
TS-930S Feedback into MIC CRT

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 876 (16-8-1983)

Some users may report RF feedback to the MIC at low frequencies, for example: 3.5 MHz.

Make the following changes to SW unit (J) (X41-1410-00):



Note: This change is applicable to units before S/N 308xxxx.

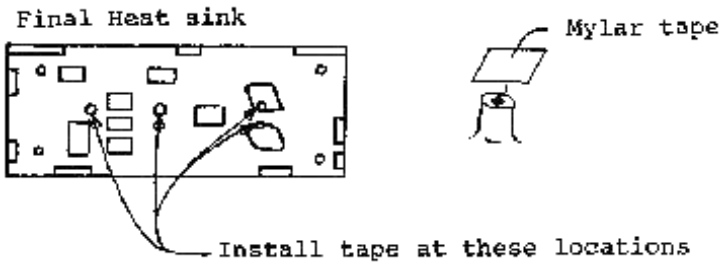
TS-930S ALC level drift 28 MHz CW

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 879 (25-8-1983)

Some users have reported that the ALC meter indication occasionally jumps during long key down periods on the 28 MHz portion of the bands. The symptom may be caused by the ground foil of the Final unit (X56-1430-00) coming in contact with one or more of the projections on the final heat sink, due to expansion when the temperature rises.

Apply Mylar insulating tape to the projections on the heat sink, to prevent reoccurrence of this symptom. See figure below.



Notes: This bulletin is applicable to units prior to serial number 3080001.
Time required for this modification is ½ hour or less.

TS-930S Power Supply surge protection

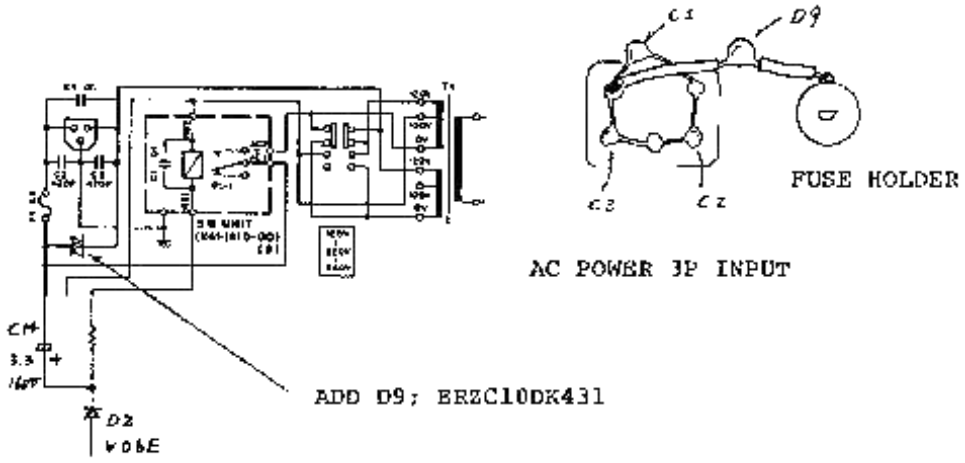
Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 881 (27-10-1983)

A line surge (exceeding approximately 4.5 kV) due to static electricity or nearby lighting discharge may short power relay diode, D2 (V06E), and cause electrolytic capacitor C14 (3.3 µF to break down. This results in relay chatter and the relay contacts may finally weld.

Addition of the surge absorber to the primary power supply input circuit, as shown below, should help avoid this type of failure.

Note: This symptom has occasionally occurred in those limited areas subject to frequent and violent lighting discharges. A good earth ground and antenna system lightning protection is still strongly recommended.



Note: This change applies to units before S/N 3080301.

TS-930S Noisy Power Supply Fan

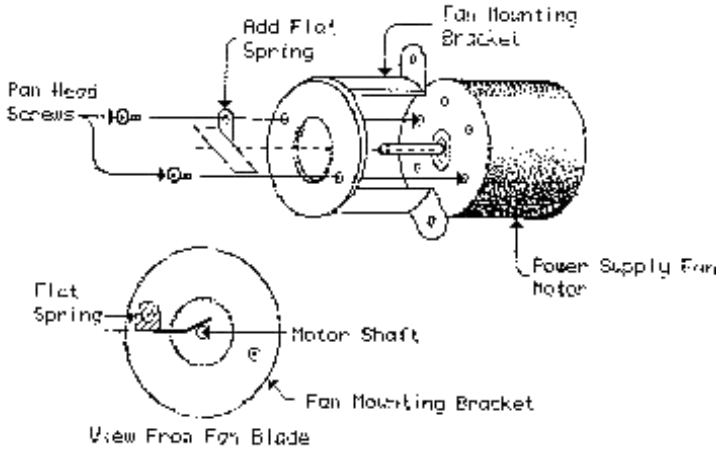
Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 893 (3-1-1985)

Some users of the TS-930S have reported that the Power Supply Fan motor makes excessive noise. This fan motor was originally designed to drive a pulley system. By adding a small amount of lateral tension to the motor shaft this noise is reduced or eliminated. The procedure listed below should correct any tendency of this motor to make noise.

Parts Required: Flat Spring Part Number: G02-0549-04

Add the Flat Spring as shown in the figures below.



Time required for this modification is ½ hour or less.

Expanded R.F. on the Kenwood TS 930 S

Author: *Bill Wallace KC4YRN*

Disconnect the power and antenna.

Remove the top and bottom covers of the radio.

Remove the four screws from the speaker mounting and the top panel assembly.

Swing the assembly away and unplug the Red/Black battery leads from the digital unit X54-168-00.

Solder small ga. wires between the following locations.

```
IC21 pin 12 to IC11 pin 9
```

```
IC22 pin 12 to IC12 pin 9
IC23 pin 12 to IC24 pin 8
```

Tack sodering on the component side of the board is O.K.

Reassemble the radio

You should now be able to Transmit on the MARS/CAP frequencies.

Bill Wallace KC4YRN

If you modify the TX for wide cover / MARS bands, keep in mind that the atu will still only be working on the ham-bands.

Digital Unit through-plated hole defects and their symptoms

Author: *Trio-Kenwood Communication, inc.*

Service Bulletin no. 0045 (29-10-1983)

SUBJECT:

Digital Unit through-plated hole defects and their symptoms

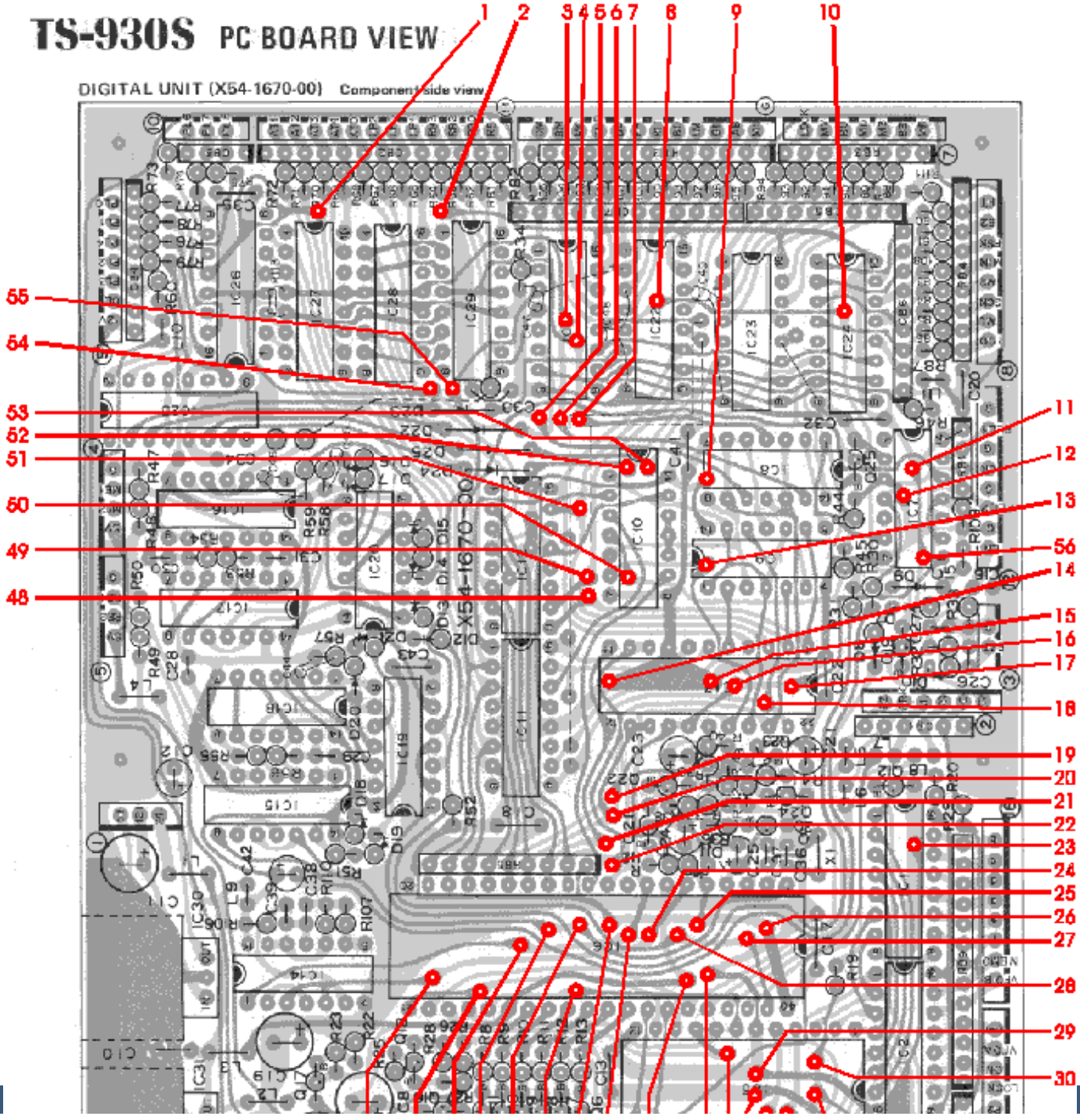
CONTENTS:

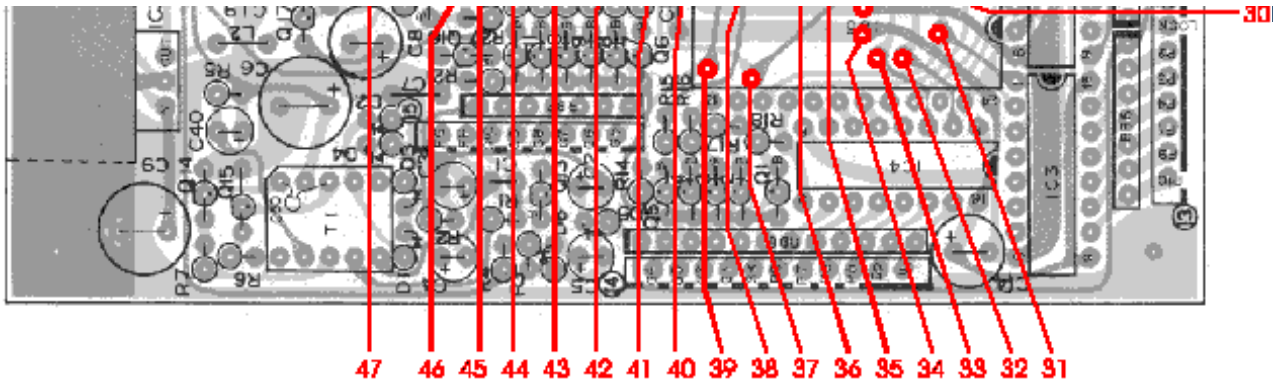
The unit shows symptoms as listed below, when any of the 56 Digital Unit through-plated holes are open. These examples were compiled by Mr. Negishi of the Kanto service center. Make full use of the Material as a technical reference for repair.

Through-hole No.	Symptom
1	(GND)
2	(GND)
3	Transmit mode not entered.
4	N/C
5	No display. However, pressing the BAND switch operates the BAND changeover relay.
6	Transmit mode not entered.
7	N/C
8	RIT operates in transmit mode.
9	Continuous tone and no display.

10	RIT operates in transmit mode.
11	(GND)
12	(GND)
13	Continuous sound. All indications are displayed.
14	(GND)
15	(GND)
16 & 17	No display, display disappears when main dial is turned, or display appears when main dial is turned (when nothing is displayed).
18	Turning the main dial generates an abnormal sound. The abnormal sound increases as the receive frequency is approached.
19	No display. However, 80.888.8 .88 is displayed when connector 9 is removed.
20	No display or 54.444.4 is displayed.
21	36.222.2 or 14.444.4 is displayed.
22	RIT-1.1 kHz is displayed when an odd numbered frequency is displayed.
23	Only the 'g' segment of the display lights; "-"
24	
25	
26	No display or only segments "egf" light. "1-"
27 & 28	The main dial and UP and DOWN switches do not operate.
29	
30	Only segments "g, DP" light.
31	Many analog pointers light. The brightness of the pointers varies widely.
32	All 'g' segments light. "----- "
33	The "DP" segment remains continuously it.
34	Analog values from 0 to 700 are displayed, but values from 700 to 1000 are not.
35	Segments "b,g" only are not displayed. Some of the analog pointers do not light.
36	
37	No display because UL.
38	No display, continuous tone.
39	Three digits of values are not displayed ex. 14.XXX.5
40	
41	
42	
43	
44	
45	

46	
47	
48	(The main dial does not operate.) 14.000.0 is displayed. Turning on the RIT switch displayes 14.100.00.
49	Continuous tone. Display is locked, RIT is turned ON and 14.001.4 is continuously displayed. Transmission in no possible.
50	Frequency varies.
51	As if scanning were being performed. Transmission is possible.
52	
53	
54	
55	
56	





W6NL Mods for the TS-930 (Very long)

Author: *Dave, W6NL*

Introduction

The Kenwood TS-930, while many years out of production and lacking many of the technology developments of the past twenty years, continues to be an excellent HF radio with a unique ability to hear multiple signals in a pileup. This particular performance advantage has, for whatever reason, eluded the designers of more modern radios. As a partner in the new HC8 contest station on Isla San Cristobal, I undertook to obtain and refurbish a number of 930s, but we were disappointed by the lack of reliability we experienced.

The problems we observed included

> Several radios experienced outright power supply failure, and one had a difficult-to-trace low frequency oscillation in the 28V circuit that involved the output amplifier, and destroyed amplifier driver bias transistors (this was cured by replacing the 2N5885 regulator transistors).
>
> One radio experienced intermittent loss of receiver sensitivity, and another experienced loss of microphone input on SSB.
>
> AGC overshoot made reception difficult of signals in the range of S9+20 dB.

I aligned each radio and ran it for a four-day period at high transmitting duty cycle on CW and SSB, using computer logging software to transmit into a dummy load (which itself required a cooling fan). At the end of the burn-in period I checked for unchanged sensitivity, power output and fan operation. Despite this we experienced failures in contests, with the requirement to return the radios to the US for repair.

I was aware of the change of TS-930 design at S/N 310XXXX that responded to the many early problems (digital board through holes, amplifier through holes, receiver muting, sidetone, etc.) that are well documented in listings of modifications, as well as in Kenwood's application notes. Our radios have serial numbers ranging from 4M to 8M. All have been standardized to the same configuration, so we would be able to separate the sources of any problems. All our radios have the stock CW and SSB IF filters (TS-930 SSB filters are wider than the pin-compatible ones for TS-940/850) and the PIEXX digital board, both for reliability, new functions such as main tuning knob control of RIT when dial is locked, and to be able to use computer logging and control.

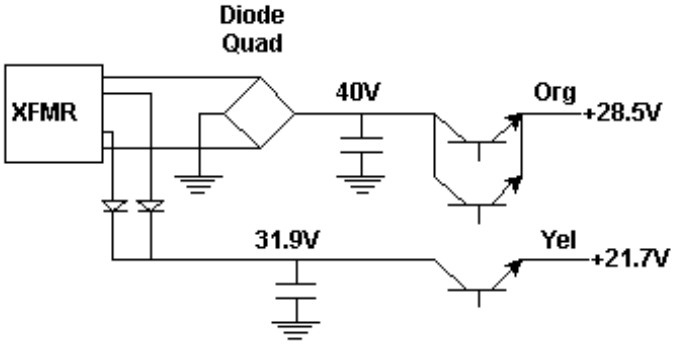
It should be noted that the power situation at the end of a long rural line is not favorable, nor is the fact that our radios experience the rough handling as airline baggage (even in the excellent foam-lined Pelican cases) and then sit idle for extended periods in the foggy and humid equatorial mountain-top air. In order to minimize our exposure to line voltage variations and

surges, we configured all the radios for 240V operation and used professional-grade surge protection. The short line cords are a unique color and are firmly attached to the radios so other equipment in the shack cannot inadvertently be connected to 240V through the standard EIA connector. We have the option to switch to 220V if the line voltage sags, although that has not been necessary.

With the modifications outlined in this note, our TS-930s now exhibit excellent reliability, and have worked well for the entire preparation and contest time in both modes of the recent CQWW contest. I thought there might be some interest in what I found was required to make them bulletproof.

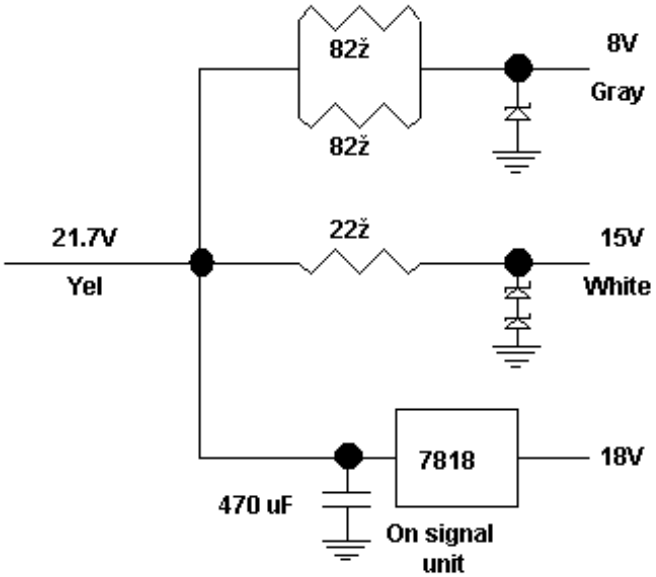
Replacing TS-930 Resistors and Shunt Zeners with Series Regulators

The TS-930 power supply for serial numbers higher than 310xxxx generates two voltages, 28.5V for the power amplifier and antenna tuner, and 21.7V for the digital board and the signal board. The 28.5V is regulated by the two TO3 pass transistors on the heat sink, and the 21.7V is generated by separate transformer secondary taps and diodes that generate 31.9V which is reduced to 21.7V by the TO220 transistor on the power supply heat sink.



The power switch has a pole that opens the +28.5V to most of the radio, including the circuit that runs the 21.7V regulator. This is apparently so the radio will just turn off without the time delay and rude noises of the filter capacitors discharging.

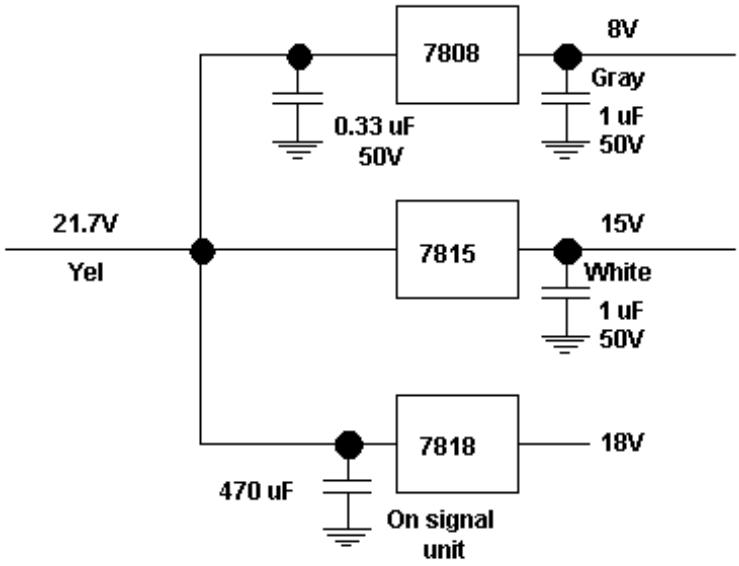
The power supply uses high-wattage resistors and zener diodes in the power supply fan case to reduce the 21.7V secondary supply voltage 7.5V and 15V for the digital board (which has 5V and 12V regulators) and for the signal unit, which has an 18V regulator. The 21.7V is distributed by the yellow wires via a black terminal block between the antenna tuner and the filter unit; this block also has the switched +28.5V orange wires. The original circuit looks like this:



The main schematic diagram of the radio is wrong, it shows the 33? resistor that is the third supply voltage for the digital board connected to the 21.7V instead of the 28.5V line.

The dissipation in the resistors and diodes is above their ratings, and this could be a reliability problem. This new circuit replaces the resistors and diodes with 78xx 1 A. TO220 regulators mounted on the power supply heat sink. In addition to

having less dissipation, the regulators are short-circuit proof. There are holes in the heat sink, and the TO220 tabs can be bolted with 4-40 small-pattern nuts and bolts. I use a locking compound on the bolts so they won't vibrate loose later.



The regulators need capacitors near them, especially if they are driving the PIEXX board, which has switching regulators with inductors at the input. The regulators should be prewired, and the wires are connected to the voltage points inside the power supply fan case.

To make the change, proceed as follows (the same steps are necessary to replace the pass transistor with an NTE377, if the original is burned out).

Unplug the radio and remove the top cover.

Remove the four black screws holding the fan case onto the heat sink, and unplug the fan wire from the power supply board so it won't break at the fan connection. Free the tab from the case bottom, and tip the case down and put something under it to hold it horizontally to work on.

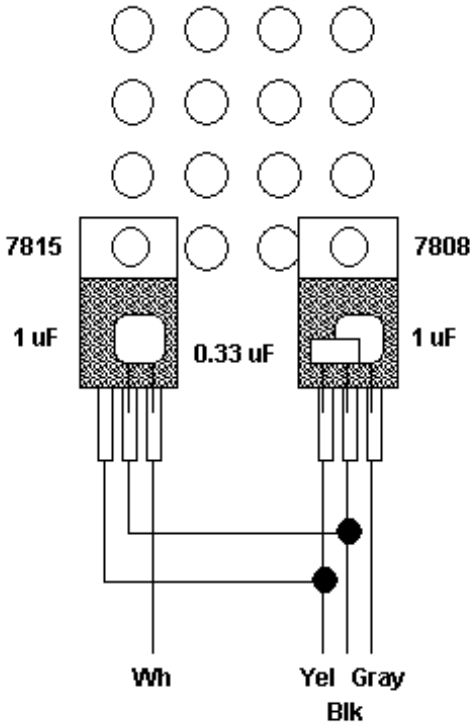
Remove the remaining two black screws holding the power supply heat sink to the radio. You will find the heat sink will not tip out without additional work.

Unscrew the screw holding the diode bridge to the heat sink. This screw will be retained by the heavy wires from the transformer, so you don't need to pry it out completely, just free the diode quad from the heat sink so the heat sink can move.

Remove the two lugs and heavy red wire from the TO3 pass transistors by unscrewing the two middle screws while holding the nuts with long-nose pliers on the inside. Leave the screws in place in the transistors to hold the insulating washers.

Now you can tip the heat sink forward far enough to be able to reach the screw that holds the pass transistor. This transistor has had loose screws in some radios, so tighten it up while you can. If you unplug the pass transistor, be sure to note which way the plug goes on (some have plugs, some have the blue, green and violet leads soldered on and covered with heat shrink tube).

Locate the field of small holes near the upper edge of the heat sink, near the outside edge of the radio. As viewed from inside the radio, the two regulators mount to the holes in the bottom row (the top row is also OK, and easier to reach if you are not removing the heat sink). Before you do anything else, route the wires from the regulators beneath the heat sink so they can be connected to the terminal strips in the fan case.

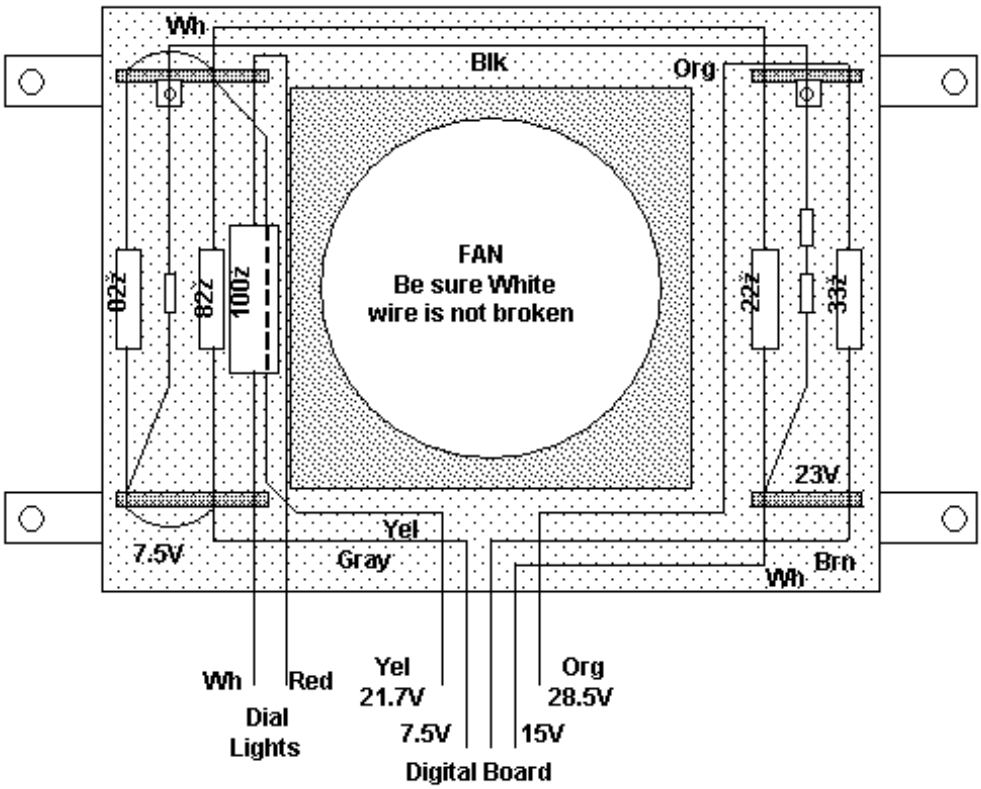


The 4-40 small pattern nut just fits between the heat sink fins. Use a thin tool that can hold the nut on the end, and orient the flats of the nut to go between the fins. It's helpful if the parts are magnetic, so you can recover a dropped nut (be sure to cover the holes in the chassis with tissue or a rag). Use a 4-40x3/8" screw to fasten the regulators to the heat sink. The same nuts and screws are used in DB9 and DB25 connector shells. I use some heat sink compound on the back of the regulators. No insulation is required. Check again to be sure the screw for the TO220 pass transistor is tight and the transistor is oriented up so you can get to the terminals.

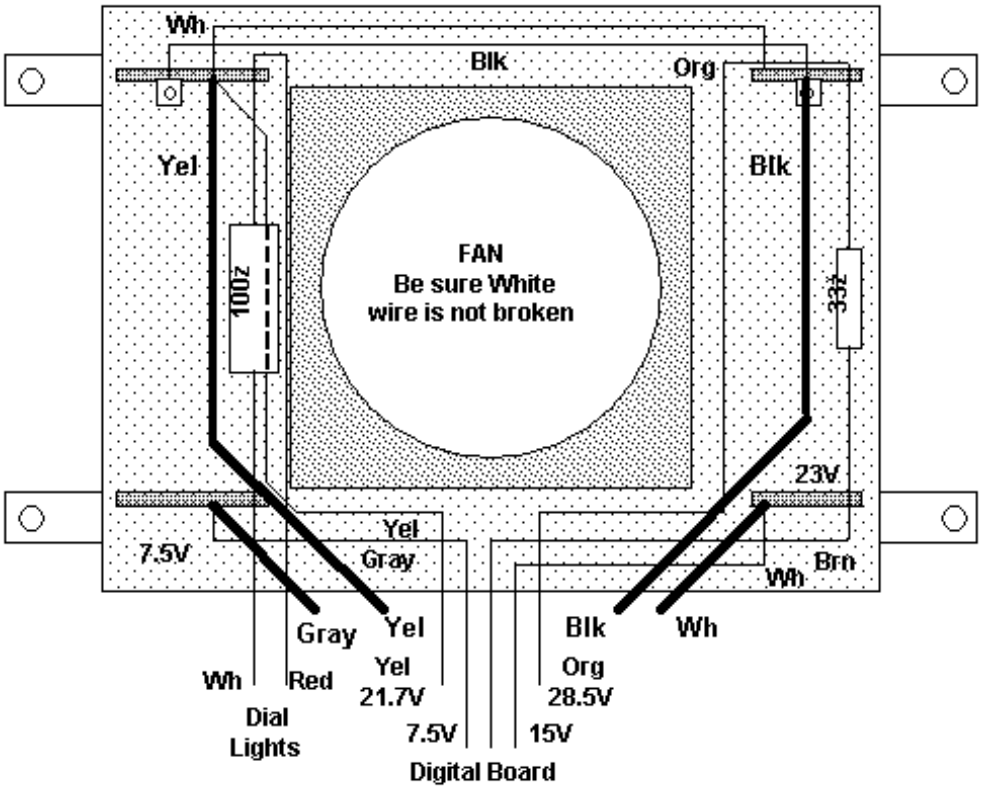
Reconnect the lugs to the backs of the TO3 pass transistors, holding the nuts with log-nose pliers and using a drop of retaining glue or Loctite. Reattach the diode quad to the heat sink.

Attach the heat sink to the radio with the middle black screws. Check that there are no wires being pinched between the heat sink and the chassis. Now you can hook up the regulator wires to the terminal strips in the fan case.

The resistors to be replaced are inside the power supply fan case. You will notice that the resistors will have lost their color coding from overheating, and the terminal strips may be somewhat charred, from overheating. Cut out the two 82? resistors and their zener diode, and cut out the 22? resistor and its two zener diodes. You can save these in case of trouble, but the new circuit should be more reliable.



The fan case should now look like this:



Cut to length and solder the Yellow, Black, Gray and White wires to the terminal strips, making sure they are connected to the same color wire that is already there. Dress the wires in place to avoid the fan with a tiny nonmetallic cable tie or twister.

Plug in the radio, being careful of high voltages at the power switch and transformer. Connect a digital voltmeter to radio chassis ground and check the voltages at the terminals in the fan case. Turn the radio power on momentarily to check each of the voltages:

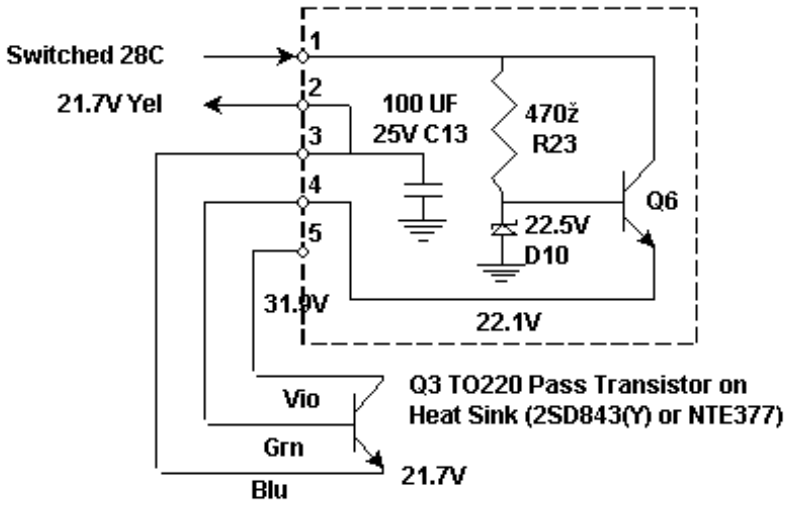
```
Orange  +28.5
Yellow  +21.7
White   +15
Gray    +8
```

Unplug the radio. If you wish, you can replace the 100ohm resistor with a 5W unit, and the 33ohm resistor with a 3W unit. Using a piece of wire or an oiler, place a drop of oil on the fan shaft. Check to be sure the fan wires aren't broken, and reattach the fan case with the four black screws. Plug the fan back into the power supply board. Replace the top cover and test the radio.

Replacing the 21.7V Pass Transistor

Despite the attention in the literature to the 28.5V TO3 regulators that supply the power amplifier, almost all of our power supply failures have been traced to the 21.7V regulator circuit. As the pass transistor is failing the radio will typically exhibit unusual operation, such as chirpy signal or intermittent display.

The 21.7V regulator is a pair of cascaded emitter followers driven by a 22.5V zener diode fed from the 28.5V supply switched through the power switch. The zener diode D10 and the first transistor Q6 are on the power supply board, and the second transistor Q3 is the TO220 transistor on the heat sink. The schematic incorrectly shows C13 to be 25 uF 100V (it is 100 uF 25V).



Use an insulated clip probe. If the output of the 21.7V supply measures OK on the yellow wire at the terminal strips in the power supply fan case or the black terminal strip in the narrow space between the output low-pass filter and the antenna tuner, then all is OK.

If the voltage is not correct, it will typically be either 31.9V or near 0V (say, 0.5V). This means the pass transistor Q3 is either shorted or open.

Unplug the radio and remove the top cover.

Plug in the radio and power on, measure the voltage on the orange wire, either at the top of the power supply board or at the 33ohm resistor in the power supply fan case. It should read 28.5V. If it is OK, the 28V regulator on the board and the pass transistors are OK.

Measure the voltage on the yellow wire, either at the power supply fan case terminal strips (you can reach them with an insulated probe in the slot above the heat sink) or at the black terminal strip in the space between the output low-pass filter and the antenna tuner. If it is approximately 21.7V, Q3 and Q6/D10 are OK and the problem, if any, is not in this part of the power supply.

If it is not 21.7V, it will typically be either approximately zero volts (0.5V or so) or 31.9V. This means Q3 either has an open or it has a collector-emitter short . Usually, but not always, if Q3 is zapped it will take Q6 and D10 with it. If the voltage isn't right, you need to determine if the problem is Q3 or Q6 or both. With the radio unplugged, unplug the 5-pin connector on the power supply board and use a digital voltmeter with a diode scale to check the Q3 B-C and B-E diodes; also check for a C-E short. Poke a short length of solder into the connector, and use clip-type meter leads. The readings will typically be (assuming the open circuit meter reads 1.4V)

	Pins on 5-pin conn.	Red lead on Base	Black lead on Base
Grn-Blu	2-3	0.7	1.4
Grn-Vio	2-5	0.7	1.4
Blu-Vio	3-5	1.4	1.4

If the readings are OK, it is likely that the problem is on the power supply board. If any of these readings is not as expected, Q3 is dead and will have to be replaced (a remote possibility in the case of an open circuited diode is a bad connection at Q3, so check the connector by wiggling it). If Q3 has blown, it may also have taken Q6 and D10 with it. It is worth disconnecting Q3 before removing anything and checking Q6 and D10 to determine if you also need to take out the power supply board. Either unplug the connector at Q3 or cut the three thin wires right at Q3. Be careful not to short anything when measuring voltages, as you will hate yourself if you zap a working circuit while measuring voltages. Reattach the 5-pin connector to the power supply board, plug in the radio and turn it on momentarily to check the voltages on the three wires:

Vio	31.9
Grn	22.3
Blu	0 (with Q3 disconnected, 21.7 in working regulator with Q3 connected)

If these voltages are OK, the PS board is OK; unplug the radio and review the data

21.7V OK	Q3 OK	This part of PS is working; check resistors in PS fan case, look for pinched white or gray wires, check 7818 18V regulator on Signal Unit
21.7V bad	Q3 OK	Probably means Q6/D10 bad; remove power supply board and replace
21.7V bad, 22.3V (Q6) OK	Q3 open or short	Replace Q3; Q6/D10 OK
21.7V bad, 22.3V (Q6) bad	Q3 open or short	Replace Q3 and Q6/D10

Replacing Q3

To replace Q3, you need to remove the power supply heat sink as in steps 1-6 above. Remove the four black screws holding the fan case onto the heat sink, and unplug the fan wire from the power supply board so it won't break at the fan connection. Free the tab from the case bottom, and tip the case down and put something under it to hold it horizontally to work on. Remove the remaining two black screws holding the power supply heat sink to the radio. You will find the heat sink will not tip out without additional work. Proceed to free the diode quad and the lugs on the TO3 transistors so you can get at the screw that holds Q3.

Now you can tip the heat sink forward far enough to be able to reach the screw that holds the pass transistor. If you unplug the pass transistor, be sure to note which way the plug goes on (some have plugs, some have the blue, green and violet leads soldered on and covered with heat shrink tubing, my preference). Remove the pass transistor and replace it

with a new one. If the transistor has a gray silicone insulator under it, use it again with the plastic washer to insulate the screw; if it has a mica insulator, use a new one and smear a bit of heat sink compound on both sides before placing it. If there is a connector, plug it onto the transistor now; if you need to solder the wires on, cut the pins on the transistor shorter and use heat shrink tubing on the wires. In some radios, I've found this screw was not tight so be sure it is snug when you are finished so the transistor won't overheat and fail.

If you are going to replace the resistors with regulators, now is the time to do it while the heat sink is accessible. Also, if Q6/D10 are to be replaced, it's easier to do with the heat sink out of the way.

Reconnect the lugs to the backs of the TO3 pass transistors, holding the nuts with long-nose pliers and using a drop of retaining glue or Loctite. Reattach the diode quad to the heat sink.

Attach the heat sink to the radio with the middle black screws. Check that there are no wires being pinched between the heat sink and the chassis. Clean, oil and replace the fan.

Replacing Q6 and D10

You can check Q6 for a collector-emitter short by measuring from pins 1-4 of the 5-pin connector (should show an open with both polarities), but you can't measure all the junctions. If you need to replace Q6 or D10, you will need to remove the power supply board. Make a sketch of where all the connectors and wires go. If both Q3 and Q6 are blown and you have the heat sink open, do the power supply board repair before reinstalling the heat sink. The power supply board can be removed without removing the heat sink, but it is more convenient to do it before you reinstall the heat sink if you have replaced Q3.

Unplug the inline bayonet connector in the red wire to the power amplifier. Unsolder the heavy yellow and white wires from terminal 28A. Unsolder the orange wires from 28B. Unsolder the black ground wires from the ground terminal. These terminals are at the top of the power supply board. Wear safety glasses so you don't flick solder in your eye, and use a solder suction pump to remove excess solder. Typically, the lugs will come unsoldered from the circuit board, but it is easy to put them back straight after the wires are unsoldered.

Unplug all the connectors, noting which goes where. Now remove the two screws that hold the bracket to the chassis, using a magnet (a necessary tool for any of these jobs) to reclaim them so they don't roll down a hole into the space under the signal board (it's a big job to remove and replace it). Lift out the power supply board.

Remove the power supply board from the bracket by removing the four screws at the corners. Now you can locate Q6 and D10. Once you have gone this far, you might as well replace both, since it takes a separate setup to measure the zener, and the transistor is easy enough to change out. Use a solder suction pump and observe the polarity of the zener and the connections of the proper leads. After the old transistor is removed, you can check the junctions using the digital multimeter. I'd add a 47 ohm current-limiting resistor in series with the collector of Q6.

Replace the power supply board by reattaching it to the bracket, then reattaching the bracket to the chassis. Be careful not to pinch under the bracket any of the wires coming from the fan case or the back of the chassis. Plug in all the connectors. Resolder the black wires to the ground terminal, the orange wires to the 28B lug and the yellow and white wires to the 28A lug. Make sure the lugs are well-soldered to the circuit traces. Plug in the red wire to the power amplifier.

Before you power up, check with an ohm-meter from the orange (28.5V) and yellow wires (21.7V) to be sure there are no shorts. You should see capacitors charging up in either case. If there is a short, check carefully for a pinched wire under the power supply board. If this measurement shows no shorts, plug in the radio and power on, measuring the voltages on the orange and yellow wires (you can reach the yellow wire terminal in the fan case with a well-insulated probe). The voltages should be

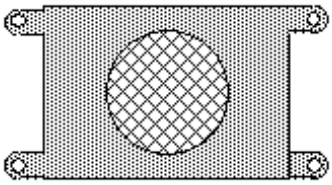
```
Orange    28.5
Yellow    21.7
```

If OK, you are done and can replace the heat sink, fan cover and case top. The 21.7 voltage has no effect on any critical adjustments, so no realignment is required.

Fan Operation Check or Repair

Check the operation of the 12V Power Supply fan and the 12V Power Amplifier fan by running into antenna or dummy load at 50W as follows:

```
Mode:       TUNE
Send/Rec:   SEND
Car:        Midscale on meter
Power:      50W
```



After a few moments both fans should start up. In any event, proceed to refurbish as follows:

Unplug radio
Remove 4 black screws holding metal tabs top and bottom of fan box.
Tip PS fan assembly back, rotating around wires at bottom (pull some slack in the black fan wire from radio so the weight of the fan motor won't break the connection to the fan))
Fan blades should spin freely when turned by hand, with the lumpy feeling of a DC motor
Check for mechanical interference with fan blades, for example by fan screen; correct if found
Fan white wire should read about 60? to ground, and black wire should connect to ground; if motor reads open the fan is doomed and will need to be replaced
Remove 4 silver screws on outside of fan box to remove fan motor assembly
While fan is out, remove screen and reshape it to bow out enough to ensure clearance
Place a drop of WD-40 or light oil on the bronze bearing where the shaft goes through, spin shaft
Check for mechanical interference; on later serial number radios there is a small flat spring wiping the motor shaft under the fan hub to quiet the motor, don't damage it
Being careful not to crush any wires, replace the four silver screws to fasten fan to box; make sure no wires rub the fan blades; look in holes and rotate the screen to get openings for the four screws
Test fan by plugging in radio, run 50W transmit test with antenna or dummy load; fan should start and run quietly if motor measured good. Voltage on fan should be 10 to 12 VDC when PS is hot
Some have suggested wiring the fan to run continuously through a diode from the +8V available in the fan case, but this has not proven necessary with the power supply modification to remove the shunt regulators, as the heat sink runs noticeably cooler after the mod

Once PS fan is working, clean and oil the Power Amp fan, which comes straight out after four mounting screws and washers are removed.

If a either fan is beyond repair, substitute a replacement or an 80x25mm 12V computer muffin fan. New holes are needed for the mounting screws, which are 2.81" on centers (the existing holes are 2.45" on centers). Wire the red fan wire to the white supply wire, and the black fan wire to the black supply wire.

Lubricating the Top Cover Door

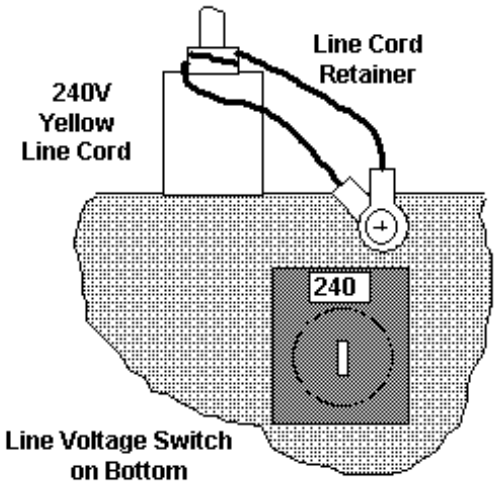
The sliding door in the top cover becomes very difficult to move after some years of service. Any time you have removed the top cover, lubricate the sliding door in the top with Silicone liquid or grease lubricant on the plastic slides. Press down one edge, hold in place with screwdriver, wet the corner of piece of paper with Silicone spray, run it between the door and the lid, do same all around and also between black plastic and door. This is much easier to do while the cover is off. Be careful of the line voltage on the POWER switch on the front panel, and don't short anything around the power supply voltage regulator. Do not use a petroleum-based lubricant such as WD-40 on plastic parts, as they will swell and deteriorate.

Line Voltage Change to 240V

Because of low line voltage and neutral wire problems, our 120V line voltage ranged from 106 to 113V, causing hum when the regulators dropped out of regulation. Attempts to rewire the transformer for 100V operation with low line voltage (below 110V with load) resulted in overheating of the power supply, since with such a large change (20%) the unregulated voltages rise above the design limits.

If the 120V line voltage is low, use the 240 or 220 volt switch position.

Replace the 6A fuse with a 4A fuse; retain the 6A fuse if it is desired to change back later
Turn the switch on the bottom of the radio to 240V, or 220V if the voltage is low
Plug in special yellow 240V line cord, attach to rear panel so it won't be used on a 120V radio
Plug into a 240V outlet or extension cord (surge absorber preferred, make sure ground is OK)



Cleaning Signal Unit Connectors with Contact Cleaner

On several occasions receivers have suddenly lost sensitivity for extended periods, and other radios have had sudden complete interruptions of microphone input. While there can be other causes for these intermittent failures, they were in each case traced to the connectors at the Signal Unit. In all cases the intermittent behavior was eliminated by cleaning the contacts of the connectors in the particular signal path.

The idea developed that this reliability issue was due to corrosion of the connectors on the Signal Unit. It was decided to clean all of the connectors to avoid any recurrence of the intermittent problems, a course which has been successful. In some cases it was possible to observe discoloration of the connectors that was possibly indicative of corrosion.

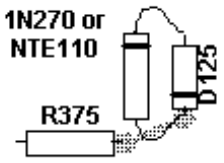
I remove each and every connector, one by one, and spray or dab the pins with contact cleaner, then rub the connector in and out a couple of times. I do all the connectors, including the filter connectors and especially the microphone and coaxial RF connectors. This has solved several complaints of intermittent or deaf radio or no transmit audio on SSB. The intermittent problems went away.

After I did this, I learned from several other TS-930 users that they had experienced the same problems, and had resolved them in essentially the same way.

AGC Modification with Germanium Diode

An AGC modification results in a big improvement in the ability to copy signals in the S9 to S9+20 range. This modification prevents the AGC overshoot that blanks the first character of a loud CW signal, with no bad side effects. A germanium is diode placed across D125 under the CW 455 kHz filter, with the "bar" end toward the rear of the radio (opposite to the bar on D125). The new diode is soldered across D125, which is located under the large 455 kHz 500 Hz IF filter.

Unplug radio
Turn radio upside down and remove bottom cover (8 screws, including the ones that hold the top cover at the sides).
Locate the 500 Hz 455 kHz crystal filter (the largest one, on your right as you face the bottom of the radio from the panel end), lift out harness, remove screw at each end and lift it out.
Underneath you will see R375 and D125; solder the Germanium diode across D125 as shown.



Replace IF filter, being careful not to damage connectors; push the connectors down tight before you replace the screws.
Put a label "R375+1N270" on the filter to show the AGC mod.
Test the radio before you replace the bottom cover; watch out for line voltage at the back and behind the POWER switch on the panel.
Before you replace the bottom cover, you should also clean the connectors on the Signal Unit.

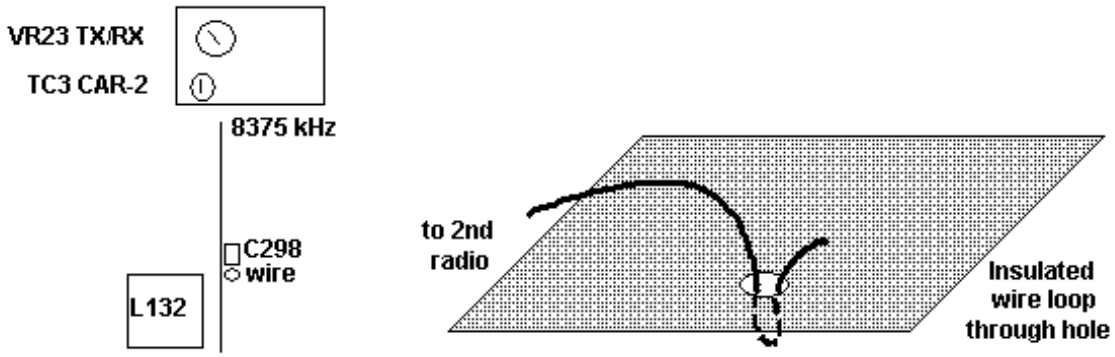
Alignment with Non-contacting Pickup for Oscillator Frequencies

In some cases it is desired to check or adjust the transceiver alignment while not having access to formal test instruments, and without opening the radio and exposing the circuits to possible damage through connecting test leads. Use an insulated wire as a pickup antenna by pushing an insulated loop through the appropriate tuning hole in the bottom (or side cover in the case of the 20 MHz master reference oscillator). A second radio can be used to measure the frequency to the accuracy required.

The first step should be to check the accuracy of the reference oscillator. I connected a small outdoor antenna wire to an insulated loop pushed into the side cover opening for the oscillator adjustment, with the other end of the loop connected to the antenna connector on the radio. With this setup, monitor the 20 MHz signal of WWV and adjust the insertion of the loop for somewhat equal signals from the external standard and the signal from the internal oscillator. You will be able to hear the beat note and adjust the oscillator for zero offset from the standard frequency. Let the radio warm up for 30 minutes or so to be sure everything has stabilized.

As another example, consider the alignment of the Carrier-2 oscillator used to provide variable bandwidth. The variable bandwidth tuning (VBT) uses two IF filters, one at 8830 kHz and the other at 455 kHz. The conversion oscillator at 8375 kHz determines the degree of overlap of the filter passbands. If the VBT knobs are set to widest position, the conversion oscillator should be at exactly 8375.0 kHz.

The can be done by connecting a counter (for example, an antenna impedance bridge counter) through a DC-isolated probe to C298 of the signal board, but if there's no other work to be done leave the case closed and use an insulated wire loop poked into the hole as an antenna to hear the oscillator on a second radio.

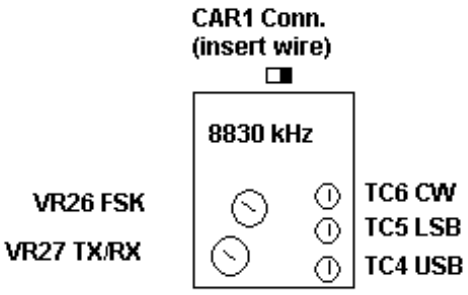


The radio should be set up (see Service Manual, pg. 67, adjustment and test points are on pg. 77)

```
Mode:         USB
Transmit:     REC
VBT:          CW, High Cut fully CW, Low Cut fully CCW (no narrowing)
```

Measure the frequency at 8375 kHz
Adjust VR23 so there is no change in frequency from transmit to receive
Adjust TC3, the small trimmer capacitor, so the frequency is exactly 8375.0 kHz

At this time you should also check the carrier oscillator at 8830 kHz



The radio should be set up (see Service Manual, pg. 66, adjustment and test points are on pg. 77)

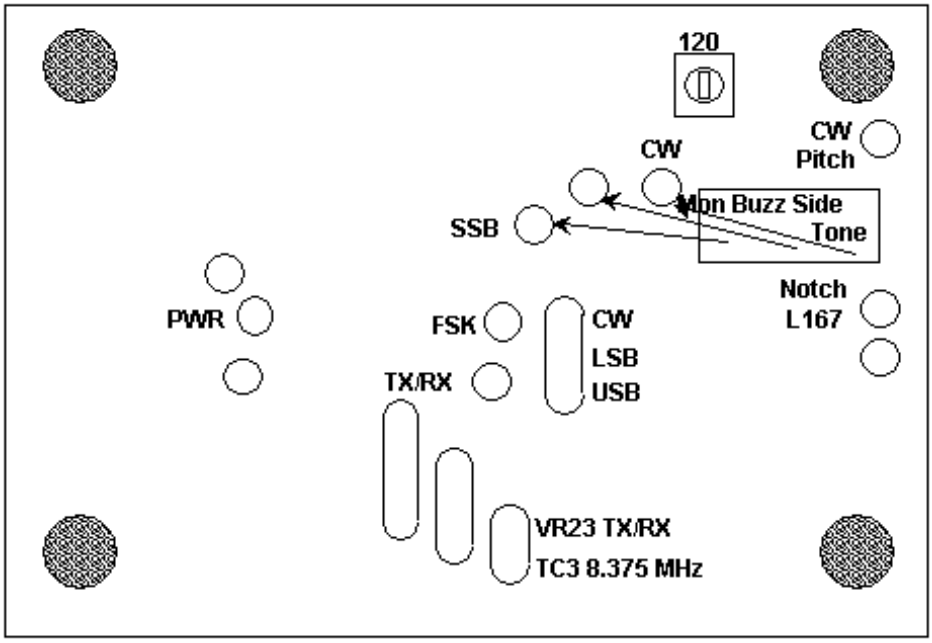
```
Mode:         USB
Transmit:     REC
VBT:          CW, High fully CW, Low fully CCW
```

Measure the oscillator frequency, which should be 8831.5 kHz.
Adjust VR27 so there is no change in frequency from transmit to receive
Set TC4 so the frequency is 8831.5 (I prefer 8831.6, you can go by the sound of the receiver audio to get the upper and lower signal levels equal, at +300 and +2.9 kHz.

Now switch to LSB, and set TC5 for 8828.5 kHz. Switch back and forth between USB and LSB, and trim the LSB oscillator until the noise sounds the same. Then switch to CW and NARROW, set TC6 for 8830.0 kHz. Last, connect a dummy load or antenna and switch to FSK transmit and set VR26 for 8827.79 kHz.

Last, check the setting of the CW Pitch and the Notch. Turn on the Marker oscillator, put the rig in CW mode, and check to see that the pitch covers the desired range. I set the CW Pitch so it is zero beat with the knob at 12 O'clock, so you can tune either sideband. The CW Pitch is set by L173 at the far right rear of the Signal Unit (bottom of rig). While you have a received tone, check the Notch by pushing in the NOTCH button and tuning the control for a null. With the offset tone at 1.5 kHz, the null should be at 12 O'clock. If it's not close, adjust L167 on the Signal Unit.

Don't forget to set Moni, Sidetone and other adjustments (AGC Delay, for example) before the radio is stuck under a shelf or cabled in place.



A Note on Alignment Levels

Clif Holland of Avvid, a respected repairer of Kenwood radios, emailed me to note that the Japanese specification for the standard signal generator used in alignment is different from the US signal generator calibration. The 930 service manual refers to signal levels in dBuV, so I had assumed 0dBuV was 1 uV and 40dBuV was 100uV.

But not so. Clif is right and I'm off by 6 dB. I checked it out, and although I see no mention of the issue in the TS-930 or TS-950 manuals, I found a table in the TS-850 service manual, pg. 96, that confirms this. It has two columns:

```
Japanese "SG"              American "SG"
-6dB                       0.25uV
 0dB                       0.5uV
 6dB                       1uV...  etc.

40dB                       50uV...  etc.
```

Apparently the JA generator defines output in terms of open circuit voltage rather than voltage into a matched load. This 6 dB difference affects the alignment of the RF PIN attenuator start point as well as the S-meter settings for S1 and S9. Since the manual specs are ±4 dB anyway the difference will be mighty small except for a more active S-meter.

CW Reception on USB

To listen on USB on a 930 in CW mode, adjust the "CW Pitch" (BFO) coil L-173 (yellow core, farthest right-rear on bottom, there's a hole) so you have zero-beat at center position (12 o'clock) on the CW PITCH control on the front panel. If measuring frequency of this oscillator, this yields 100.0 kHz rather than 99.2 kHz.

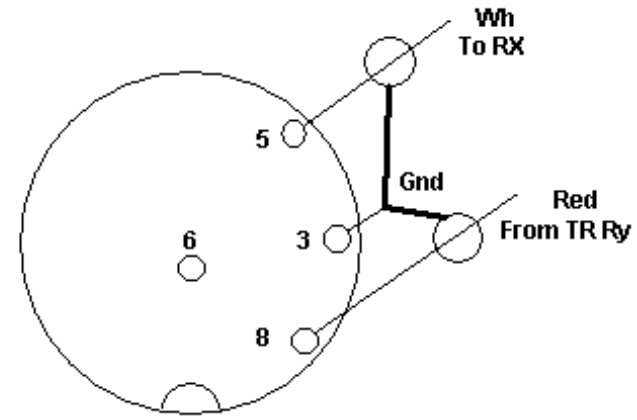
Now if you turn the pitch control clockwise from center you get LSB as before, but if you turn the pitch control CCW from center you get USB. No retuning of filters or carrier oscillators is required. This mod has no effect on SSB.

I use this on our TS-930s at HC8. The only problems are that it makes the TUNE mode zero-beat if the pitch knob is centered, and also if an op isn't familiar with the setup on CW it can be concluded that the receiver is not working if the pitch knob is centered.

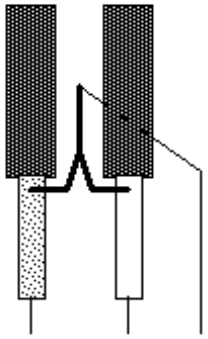
Operating Notes

I found it's difficult to tighten the nut on the Antenna UHF connector. Lacking a special spanner, you can carefully tap the Antenna connector nut with screwdriver and small hammer, as with the nuts in electric boxes. Don't overdo it.

For use with an external receiving antenna, one needs the hard-to-find 262 degree 8-pin "horseshoe" DIN-8 connector used to bring a separate receiving antenna in and out of the transverter socket (available from Kenwood and Yaesu, and HRO, but seldom found when needed). In an emergency we found that a standard DIN-5 connector will plug in and provide access to the receiver input and ground, while the small slide switch makes the transmit antenna output available at the adjacent RCA phono connector to connect to an receive-antenna selector switch (inadvertent mis-setting of this switch is a source of occasional complaints of deaf receiver).



From back of
connector P/N E07-0851-05
Special Kenwood part
DIN-8 262° (not 270°)

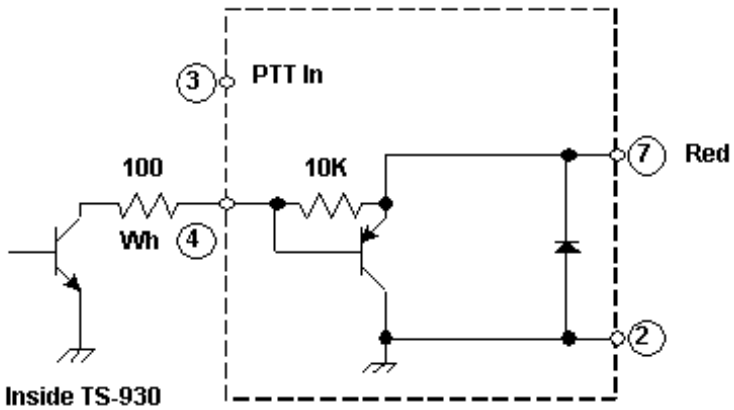


RCA Connector
Cable Detail

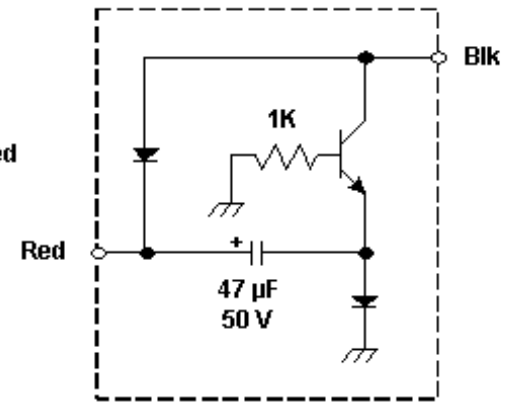
Twist braid,
solder to flexible wire,
cover with heat shrink

It's good practice to have a relay that disconnects the receiver input from any antenna and shorts it to ground during transmit, so the transmit power isn't returned to the receiver from a separate receiving antenna. When used as a second receiver in a multi-op setup, this relay can also be run by the AMP relay line of the transmitter on the same band.

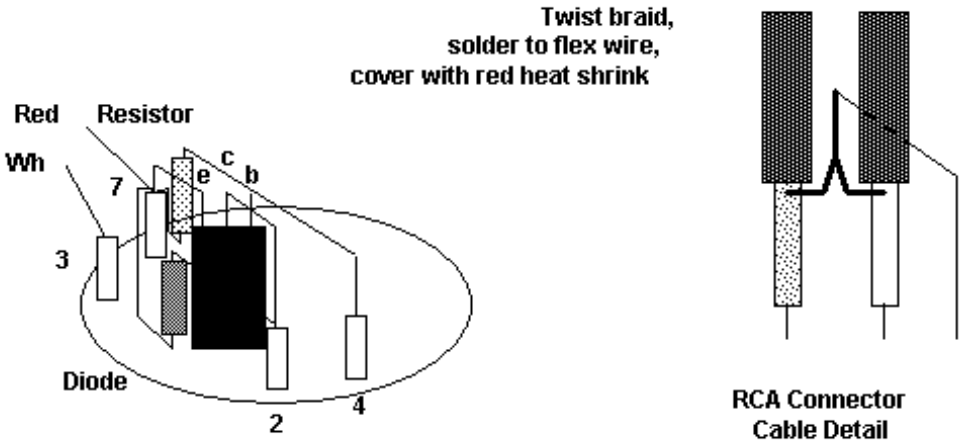
We don't use the noisy and slow amplifier relay (28V to NC pin), but make a transistor switch adapter in the DIN-7 plug for the PTT input and AMP output. This is faster, less noisy and more reliable. With the AL-1200s we use the speedup circuit found on K6XX's web site.



PTT Adapter



Amp Relay Speedup



Naturally, we've had to cure hum and RF problems when using two radios and a microphone switch box along with a voice recorder, but this has been resolved by using double shielded twisted pair but not connecting the shields at both ends except through RF bypass capacitors. I have a circuit, based on K8CC's in the NA manual, that works very well for me. There are some curious audio/brain effects I've read about in a Bell Labs book on hearing and sound that are interesting to experiment with, including wiring headphones for out-of-phase reception.

One remaining problem is RF leakage of the display waveforms on the band-select cable from the PIEXX board. It appears this should be shielded. With the removal of the resistors in the PS fan case there is now room for some real back-panel connectors, DB9(F) for the RS-232 connection and DB25(F) for the band data. I cut off the unneeded wires in the RJ45 connector to avoid any problem with the PIEXX board.

References

There are a number of sources of two text files listing mods and fixes for the early TS-930. http://www.qrz.com/download/mods-t-z/ts930.txt is an updated version of a posting by WA2ISE called "TS930 repair notes (long)." There are many other sources of this document, to be found with any search engine under "ts-930 mods" or the like. The newest version notes that replacement dial light bulbs should be 28v @ 40mA, not 12V, and that the part number for these bulbs is not correct in the service manual, and should be B30 0826 05.

http://www.artofhacking.com/Tucops/Radio/two_way/TS930.TXT is one source of a different document that is "a list of favorite changes that can be made to the Kenwood 930."

http://www.kkn.net/~k5tr/ts930fix/ts930doc.pdf is the source of a definitive service bulletin from TRIO-KENWOOD GMBH about "Digital Unit through-plated hole defects and their symptoms." The PDF was created by K5TR from a MS word doc from NØSS.

http://www.qth.net/archive/kenwood/, the Kenwood mailing list archive, is a great source of information, but is not indexed by subject.

I haven't been able to find a good reference for the idea of replacing R400 of the Signal Unit with a 7912 TO220 regulator (mounted on the heat sink at the back of the Signal Unit). If I were to do this, I'd clip one lead of the 12V zener diode D210.

Using the current-limit feature of the 723 regulator chip, some have built a protective crowbar circuit to keep the 28.5V from damaging the amplifier transistors by running away if the regulators fail. It is the same as the 28V supply circuit in the 1988 ARRL Handbook, and I haven't felt it necessary (yet). ZL2DX emailed me a copy of a 1992 circuit by NJ6O from the Kenwood/IRCI newsletter, now be available through W2VJN at http://www.qth.com/inrad/pubs.htm.

Replacement Semiconductors

Although there are many sources of the original transistors, it has proven convenient and reliable to use the current replacement semiconductors offered in the US by NTE. Here is a list of suitable replacements:

2SD843(Y) NTE377
2SC2235(O) NTE382
XZ-225 NTE5080A
2N5885 NTE181
MRF485 (2) NTE236 (2)
2SC496(Y) NTE295
2SB861(C) NTE398
2SC1815(Y) NTE85

I've looked in vain for a TO220 power transistor that does not require the insulated mounting, but have not found one that has low enough thermal impedance and high enough current and power ratings. I've seen a suggestion to replace the 22V emitter follower with a 7824, but this might sacrifice the control by the switched 28.5V. I select from the NTE5058A (nominally 22V) individual zeners that provide 22.5 volts; the lead length of mounting to the circuit board affects the voltage, which rises with the operating temperature of the diode. If I measure them in free air with clip leads, I get a higher voltage reading because they get a lot hotter after a moment's operation.

I was surprised to be able to make a successful replacement of the expensive but burned out MRF485 RF driver transistors (don't ask!) with the relatively inexpensive NTE236. I made no effort to match the NTE replacements, and the amplifier seems to work fine; I reset the bias adjustment per the instructions in the service manual.

I was concerned about the thermal impedance of the replacement TO3 transistors NTE181, which also have relatively low current gain, but a matched pair (NTE offers these designated as NTE181MP) was used with success to replace a pair of defunct 2N5885 28.5V regulators.

Kenwood Service Bulletin Reference

TS-930S	ASB-0863	INCORRECT LINE VOLTAGE SETTING
TS-930S	ASB-0866	CW HETERODYNE TONE WITH VBT CONTROL
TS-930S	ASB-0867	SSB TX AUDIO TONE QUALITY SN < 3080001
TS-930S	ASB-0868	LOSS OF RX SENSITIVITY
TS-930S	ASB-0869	PLL UNLOCK / BLANK DISPLAY
TS-930S	ASB-0872	CW PITCH TONE SHIFT WHEN MONI SWITCH IS ON
TS-930S	ASB-0873	CW VBT - SIMPLIFIED ALIGNMENT
TS-930S	ASB-0874	RF FEEDBACK WHEN USING EXTERNAL SPEAKER
TS-930S	ASB-0875	RX AUDIO OSCILLATION
TS-930S	ASB-0876	RF FEEDBACK INTO MIC CIRCUIT
TS-930S	ASB-0879	ALC LEVEL DRIFT AT 28 MHZ
TS-930S	ASB-0881	POWER SUPPLY SURGE PROTECTION
TS-930S	ASB-0884	15 MTR INTERNAL BEAT NOTE
TS-930S	ASB-0886	INTERMITTENT TX POWER OUTPUT
TS-930S	ASB-0893	NOISY POWER SUPPLY FAN

ftp://216.98.255.24/Amateur/AmateurServiceBulletins/

TS-930 power supply overheating

Author: *K9EUI*

When I first used my TS-930 on RTTY (power reduced to 50 watts out), after a period of time, the radio died, then later recovered. The supply was overheating and switching off.

The fan (at least the one in my radio) pulls the air out of the back of the supply. It is much more efficient to blow outside air into the unit. This is easily done merely by reversing the leads to the fan.

K9EUI