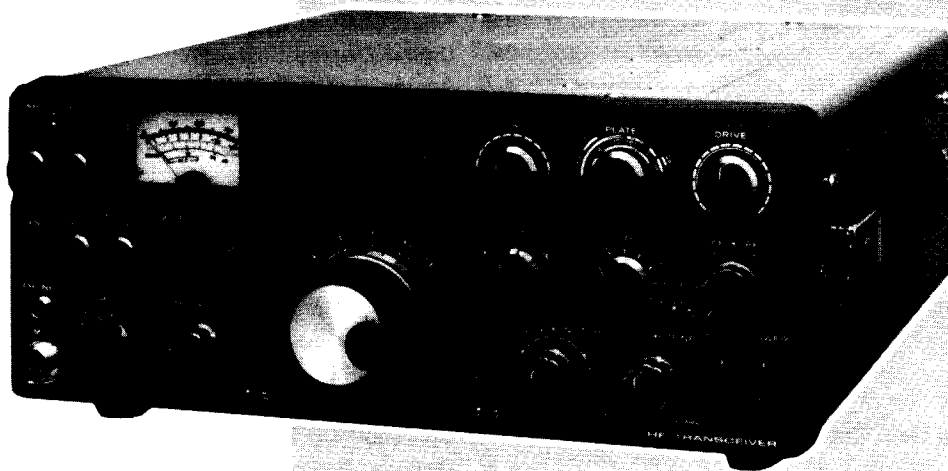




HF TRANSCEIVER

Model TS-830S



INSTRUCTION MANUAL

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AFTER UNPACKING

It is advisable to save all original packing cartons (inner and outer) to protect your valuable transceiver from damage should you wish to transport it for remote operation or ship it for after-sales service.

The following explicit definitions apply in this manual. Be sure to read these definitions:

NOTE: If disregarded, inconvenience only — no damage or personal injury.

CAUTION: Equipment damage may occur, but not personal injury.

WARNING: Personal injury may occur — do not disregard.

CAUTION: _____
Read Operating Manual Section 4. before placing transmitter in service.

WARNING: _____
HIGH VOLTAGES PRESENT.

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TS-830S SPECIFICATIONS

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[GENERAL]

Frequency Range	160 m Band 1.8 ~ 2.0 MHz 80 m Band 3.5 ~ 4.0 MHz 40 m Band 7.0 ~ 7.3 MHz 30 m Band 10.1 ~ 10.15 MHz (10.0 MHz WWV) 20 m Band 14.0 ~ 14.35 MHz * 17 m Band 18.068 ~ 18.168 MHz 15 m Band 21.0 ~ 21.45 MHz * 12 m Band 24.89 ~ 24.99 MHz 10 m Band 28.0 ~ 29.7 MHz
Modes	SSB/CW
Frequency Stability	Within 1 kHz during the first hour after 1 minute of warmup. Within 100 Hz during any 30 minute period after warmup.
Power Requirement	120V AC (220V, 240V modifiable), 50/60 Hz
Power Consumption	Transmit: 295 watts Receive: 32 watts (with heaters off)
Dimensions	333 (13.3) × 133 (5.3) × 333 (13.3) mm (inch)
Weight	13.5 kg (29.8 lbs)

[TRANSMITTER]

*Final Power Input	220W PEP for SSB operation 180W DC for CW operation
Audio Input Impedance	500Ω ~ 50 kΩ
RF Output Impedance	50Ω ~ 75Ω
Carrier Suppression	Better than 40 dB
Sideband Suppression	Better than 60 dB
Spurious Radiation	Better than 60 dB
Harmonic Radiation	Better than 40 dB
Audio Freq. Response	400 to 2,600 Hz, within -6 dB
3rd Order Intermodulation Distortion	Better than -36 dB
ALC Input	-10V DC MAX
Linear Amp Relay Contact Rating	100V DC 1A

[RECEIVER]

Receiver Sensitivity	0.25 μV at 10 dB S + N/N
Image Ratio	Better than 60 dB
IF Rejection	Better than 80 dB
Receiver Selectivity	
SSB/CW WIDE	2.4 kHz (-6 dB), 3.6 kHz (-60 dB)
CW NARROW	With YK-88C (option) 500 Hz (-6 dB), 1.5 kHz (-60 dB) With YK-88CN (option) 270 Hz (-6 dB), 1.1 kHz (-60 dB) With YG-455C (option) 500 Hz (-6 dB), 820 Hz (-60 dB) With YG-455CN (option) 250 Hz (-6 dB), 500 Hz (-60 dB)
Variable Bandwidth	
SSB with 2.4 kHz filter	500 Hz ~ 2.4 kHz (-6 dB) continuously variable
CW with 500 Hz filter	500 Hz ~ 150 Hz (-6 dB) continuously variable With optional filter YK-88C and YG-455C added.
Notch-filter Attenuation	Better than 40 dB
Audio Output Impedance	8 ~ 16Ω
Audio Output	1.5W (8Ω)

*Will transmit on the 17, and 12 meter bands. Diodes installed for preventing accidental transmission before government amateur authorization.

NOTE: The circuit and ratings may change without notice due to developments in technology.

SECTION 1. INTRODUCTION AND FEATURES

1.1 KENWOOD TS-830S

The TS-830S is a highly sophisticated solid state Amateur band transceiver employing only three vacuum tubes. Operating on all Amateur bands between 1.8 and 29.7 MHz, this unit is constructed modularly. The TS-830S includes many built-in features usually found as extras on other transceivers. Included are VOX, 25 kHz calibrator, RIT, RF attenuator, and an effective noise blanker. The TS-830S also includes automatic gain control (AGC), automatic level control (ALC), semi-break-in CW with sidetone, a speech processor, speaker and built-in AC power supply. Designed for operation on SSB or CW, the TS-830S delivers more than 220 watts PEP input. Any complicated electronic device will be damaged if operated incorrectly, and this transceiver is no exception. Please read all of the operating instructions before putting your TS-830S on the air.

1.2 FEATURES

1. Interference-free DX operation

* Variable bandwidth IF filter circuit (VBT)

The built-in VBT (Variable Bandwidth Tuning) circuit allows IF filter pass-bandwidth to be varied as you wish to eliminate unpleasant interference. It is adjustable independent of the IF shift.

* IF shift circuit

The IF SHIFT (also called pass-band tuning) is a circuit to shift IF pass-bandwidth without changing receive frequency. It eliminates interference or adjusts receive frequency characteristic as desired.

* High reliability 455 kHz notch circuit

Interference is also eliminated by the built-in notch circuit. The TS-830S uses 455 kHz notch-frequency. The notch circuit shifts the BFO frequency and the local mixer frequency at the same time, thereby equivalently changing the notch frequency. Thus, accurate notch characteristic is realized even when the notch point is changed, completely eliminating nearby interference signals.

* NARROW/WIDE BANDWIDTH selection and optional filters for enhanced CW operation:

NARROW or WIDE CW operation can be selected when using the following optional filters:

YK-88C (500 Hz), YK-88CN (270 Hz),

YG-455C (500 Hz), YG-455CN (250 Hz)

* Variable tone control circuit.

2. WARC bands

The TS-830S fully covers 160-10 m Amateur bands, including the new WARC bands of 10, 18 and 24.5 MHz.

The TS-830S VFO covers more than 50 kHz above and below each 500 kHz band. The optional VFO-230 external digital VFO covers about 100 kHz above and below each band, for MARS and other applications.

3. Self-contained, compact AC Power supply.

4. Advanced circuit design for improved two-signal characteristics. Cleverly designed front-end circuit components and receive circuit system assure excellent two-signal characteristics. Cross-modulation and blocking are reduced.

5. TX final unit uses 6146B's

The finals are a pair of 6146B transmitting tubes. RF negative feed back and amplified ALC provide clear, strong signals with reduced cross modulation.

6. Variable level noise blanker

Conventional fixed level noise blankers are sometimes less than effective in removing pulsating noise over weak signals or rejecting strong interference signals. This variable level noise blanker is equipped to control the optimum threshold level of the gate pulse amplifier.

7. RF speech processor to increase average power during SSB operation

This is an RF clipper speech processor, using both the 455 kHz and 8.83 MHz IF's. Unwanted frequency components are removed by the 8.83 MHz crystal filter, providing a compression ratio of approximately 20 dB.

8. Transmit monitor circuit

The built-in monitor circuit permits easy adjustment of the RF processor and mic gain.

9. XIT (Transmit Incremental Tuning) for fine adjustment of transmit frequency independent of receive frequency.

10. A combination of precise, easy-to-read digital frequency indicator and an analog dial.

The digital indicator has a Digital Hold memory function.

11. The controls are arranged on the die-cast front panel for easy operation.

12. A full variety of accessory circuits are provided:

The TS-830S includes:

VOX circuit (available for Semi-Break-in), Market circuit, side-tone oscillator, selectable AGC (OFF, FAST, SLOW), RF ATTENUATOR, Fixed crystal oscillator circuit, Audio frequency characteristics selector circuit for each mode, CW zero-beat circuit, IF OUT-1 (for BS-8 Pan Display) and OUT-2 (for RX Display) for SM-220 Station Monitor, HEATER switch, Screen Grid switch, and a built-in speaker.

SECTION 2. INSTALLATION

2.1 UNPACKING

Remove the TS-830S from its shipping container and packing material and examine it for visible damage. If the equipment has been damaged in shipment, notify the transportation company immediately. Save the boxes and packing material for future shipping or moving.

The following accessories should be included with the transceiver.

1. Instruction Manual (B50-2738-00) 1
2. Plastic Extension Feet with Screws (J02-0049-14) 2
3. Speaker Plug 1/8" (E12-0001-05)..... 1
4. 7P DIN Plug (E07-0751-05) 1
5. Fuse (6A) (F05-6021-05) 1

2.2 OPERATING LOCATION

As with any solid state electronic equipment, the TS-830S should be kept from extremes of heat and humidity. Choose an operating location that is dry and cool, and avoid operating the transceiver in direct sunlight. Also, allow at least 3 inches clearance between the back of the equipment to any object. This space allows an adequate air flow from the ventilating fan to keep the transceiver cool.

CAUTION:

Do not operate the radio in an RF Field greater than 6V RF. Receiver damage may occur.

2.3 CABLING (See Figure 2-1.)

■ GROUND

To prevent electric shock, and reduce the possibility of TVI and BCI, connect the transceiver to a good earth ground, through as short and heavy a lead as possible. Use ground rods or metal cold water feedline.

NOTE:

A ground connection greater than $1/4 \lambda$ away from the transceiver may be a good DC ground, but NOT an RF Ground.

■ ANTENNA

Connect through a 50 ohm antenna feedline to the coaxial connector on the rear panel.

■ KEY

If CW operation is desired, connect a key to the KEY jack. Use shielded line or coaxial cable.

■ POWER CONNECTIONS

Make sure the POWER switch on the front panel is turned off, the stand-by switch is in the REC position, and the line voltage is correct. Then connect the power cord to the line source.

■ AC POWER

For fixed station operation, the TS-830S is supplied to operate from a 120V AC, 50/60 Hz power source capable of supplying 280 watts or more.

2.4 MICROPHONE

Attach the microphone connector to a suitable microphone, as shown in Figure 2-1. Be sure the microphone PTT switch is separate from the microphone circuit, as shown in Figure 2-1A.

It should be noted that a microphone with a 3P plug using a common ground terminal should not be used.

The microphone input is designed for 500~50 k Ω microphones. The choice of microphone is important for good speech quality, and should be given serious consideration. The crystal lattice filter in the transceiver provides all the restriction necessary on audio response, and further restriction in the microphone is not required. It is more important to have a microphone with a smooth, flat response throughout the speech range.

Follow the microphone manufacturer's instructions for connecting the microphone cable to the plug. With many microphones, the push-to-talk button must be pressed to make microphone audio available. For VOX operation, this unwanted feature may be eliminated, if desired, by opening the microphone case and permanently connecting the contacts which control the microphone audio.

Standard microphone sensitivity is within the range of -50 dB to -60 dB. If a microphone having a higher sensitivity is used, the ALC and compressor circuits will not function properly. In this case, insert in the mike line an attenuator as shown in Fig. 2-1C. A typical MIC gain control setting is 12 o'clock. If you must run this control at 9 o'clock or less, use an attenuator.

2.5 KEY

If CW operation is desired, connect a key to the KEY jack. Use shielded cable, and a standard (mono or 2P) phone plug.

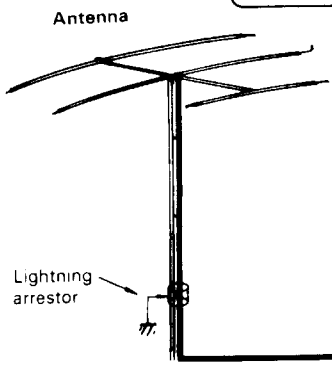
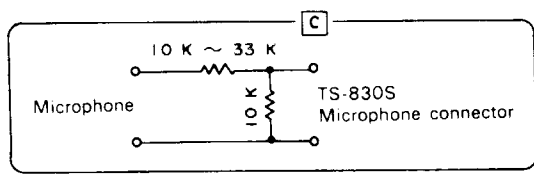
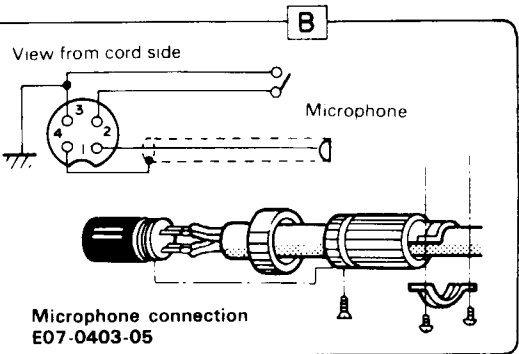
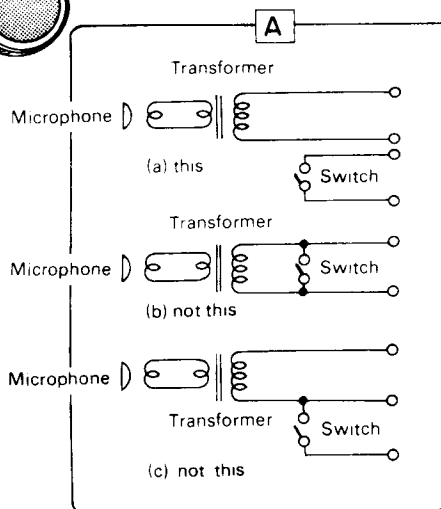
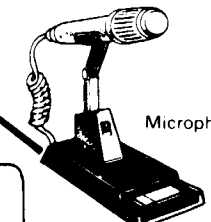
Headphones

Use headphones of 4 to 16Ω impedance. The optional HS-4, HS-5 headphone is best suited for use with the TS-830S. Stereo-type HEADPHONES can also be used.



Microphone

Either a low or high impedance microphone (500Ω to 50 kΩ) can be used. The P.T.T. switch should be isolated from the mic circuit (shown in "A"). Use a microphone with a separate switch and MIC line so both P.T.T. and VOX are available.



Key
For CW operation, connect your key to the KEY jack at the rear. Use shielded cable

Monitor scope SM-220
Can be used for RX monitor, pan display, and TX monitor.

External speaker
Besides the built-in speaker, an external speaker can also be used. Connect to the rear EXT SP jack using the supplied plug.

GND terminal
It is recommended that a ground lead be connected to the GND terminal at the rear of the set to prevent the possibility of electric shock, TVI and BCI. Use as short, and heavy a lead as possible.

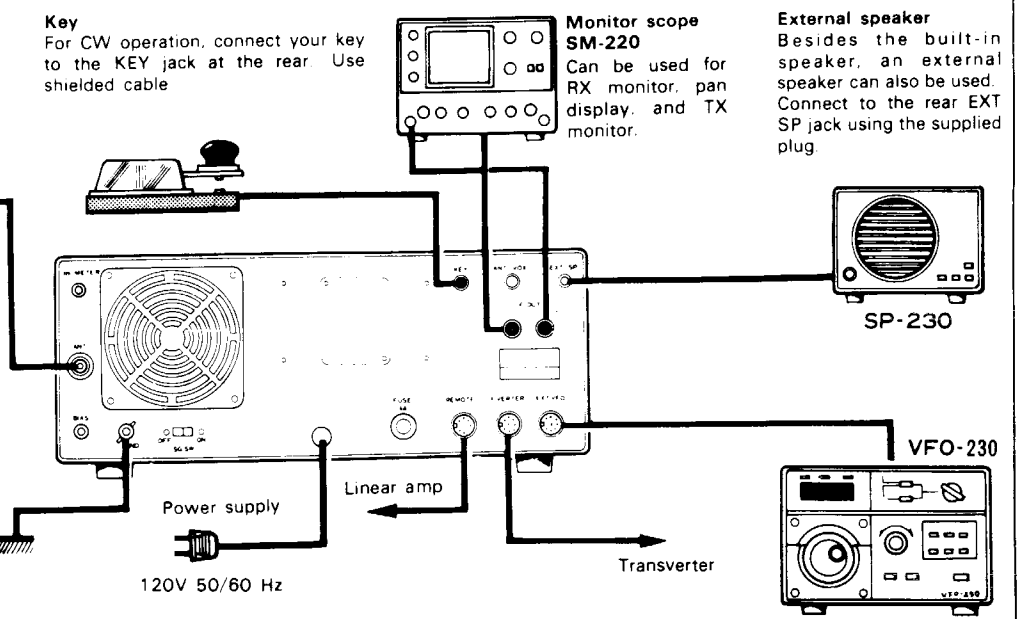


Fig. 2-1 TS-830S Connections

2.6 EXTERNAL SPEAKER AND HEADPHONES

Receive audio output from the TS-830S is 1.5 watts at 4 to 16 ohms. The TS-830S has a built-in the SPEAKER plus an external speaker jack on the rear panel. The speaker may be an 8-ohm permanent-magnet type, 4 inches or larger. The internal speaker is disconnected when an external speaker is used. Headphones should also be 4 to 16 ohms impedance. When the headphones are connected to the front-panel PHONES jack, the speaker is disabled.

2.7 GROUND

To prevent electric shock, and reduce the possibility of TVI and BCI, connect the transceiver to a good earth ground through as short and heavy a lead as possible.

2.8 ANTENNA

Any of the common antenna systems designed for use on the high frequency amateur bands may be used with the TS-830S, provided the input impedance of the transmission line is not outside the capability of the pi-output matching network. The transmission line should be coaxial cable. An antenna system which shows a standing wave ratio of less than 2:1 when using 50 or 75 ohm coaxial transmission line, or a system that results in a transmission line input impedance that is essentially resistive, and between 15 and 200 ohms will take power from the transceiver with little difficulty. If openwire or balanced type transmission line is used with the antenna, a suitable antenna tuner with balun is recommended between the transceiver and the feed line. Methods of construction and operating such tuners are described in detail in the ARRL Antenna Handbook, and similar publications. For operation on the 160, 75 and 40 meter bands, a simple dipole antenna, cut to resonance in the most used portion of the bands, will perform satisfactorily. For operation of the transceiver on the 10, 15 and 20 meter bands, the efficiency of the station will be greatly increased if a good directional rotary antenna is used. Remember that even the most powerful transceiver is useless without a proper antenna.

CAUTION: _____
Protect your Equipment — Use a LIGHTING ARRESTOR.

Mobile Station — Mobile antenna installations are critical, since any mobile antenna for use on the high frequency bands represents a number of compromises. Many amateurs lose the efficiency of their antenna through improper tuning. Remember the following points when using the TS-830S with a mobile antenna.

The "Q" of the antenna loading coil should be as high as possible.

The loading coil must be capable of handling the power of the transceiver without overheating. In the CW mode the power output of the transceiver will exceed 80 watts.

The SWR bridge is a useful instrument, but unfortunately it is quite often misunderstood, and overrated in importance. Basically, the SWR bridge will indicate how closely the antenna load impedance matches the transmission line. With long transmission lines, such as will be used in many fixed station installations, it is desirable to keep the impedance match fairly close in order to limit power loss. This is particularly true at the higher frequencies. The longer the line, and the higher the frequency, the more important SWR becomes. However, in mobile installations the transmission line seldom exceeds 20 feet in length, and an SWR of even 4 to 1 adds very little power loss. The only time SWR will indicate a low figure is when the antenna presents a load close to 50 ohms, but many mobile antennas will have a base impedance as low as 15 or 20 ohms at their resonant frequency. In such cases, SWR will indicate 3 or 4 to 1, and yet the system will be radiating efficiently.

The really important factor in your mobile antenna is that it should be carefully tuned to resonance at the desired frequency. The fallacy in using an SWR bridge lies in the fact that it is sometimes possible to reduce the SWR reading by detuning the antenna. Field strength may actually be reduced in an effort to bring SWR down. Since field strength is the primary goal, we recommend a field strength meter for antenna tuning.

For antenna adjustments, the transceiver may be loaded lightly, using the TUNE position instead of operating at full power output. This will limit tube dissipation during adjustments, and will also help to reduce interference on the frequency. In any case, do not leave the transmitter on for very long at one time. Turn it on just long enough to tune and load, and get a field strength reading. Start out with the antenna whip at about the center of its adjustment range. Set the VFO to the desired operating frequency and then adjust the PLATE control for a dip, and then the LOAD control. Then observe the field strength reading. The field strength meter may be set on top of the dash, on the hood, or at an elevated location some distance from the car.

Change the whip length a half inch or so at a time, retune the finals each time, and again check the field strength at the antenna. Continue this procedure until the point of maximum field strength is found. This adjustment will be most critical on 75 meters, somewhat less critical on 40, until on 10 meters the adjustment will be quite broad. After tuning the antenna to resonance, the finals can be loaded to full power.

SECTION 3. CONTROLS AND THEIR FUNCTIONS

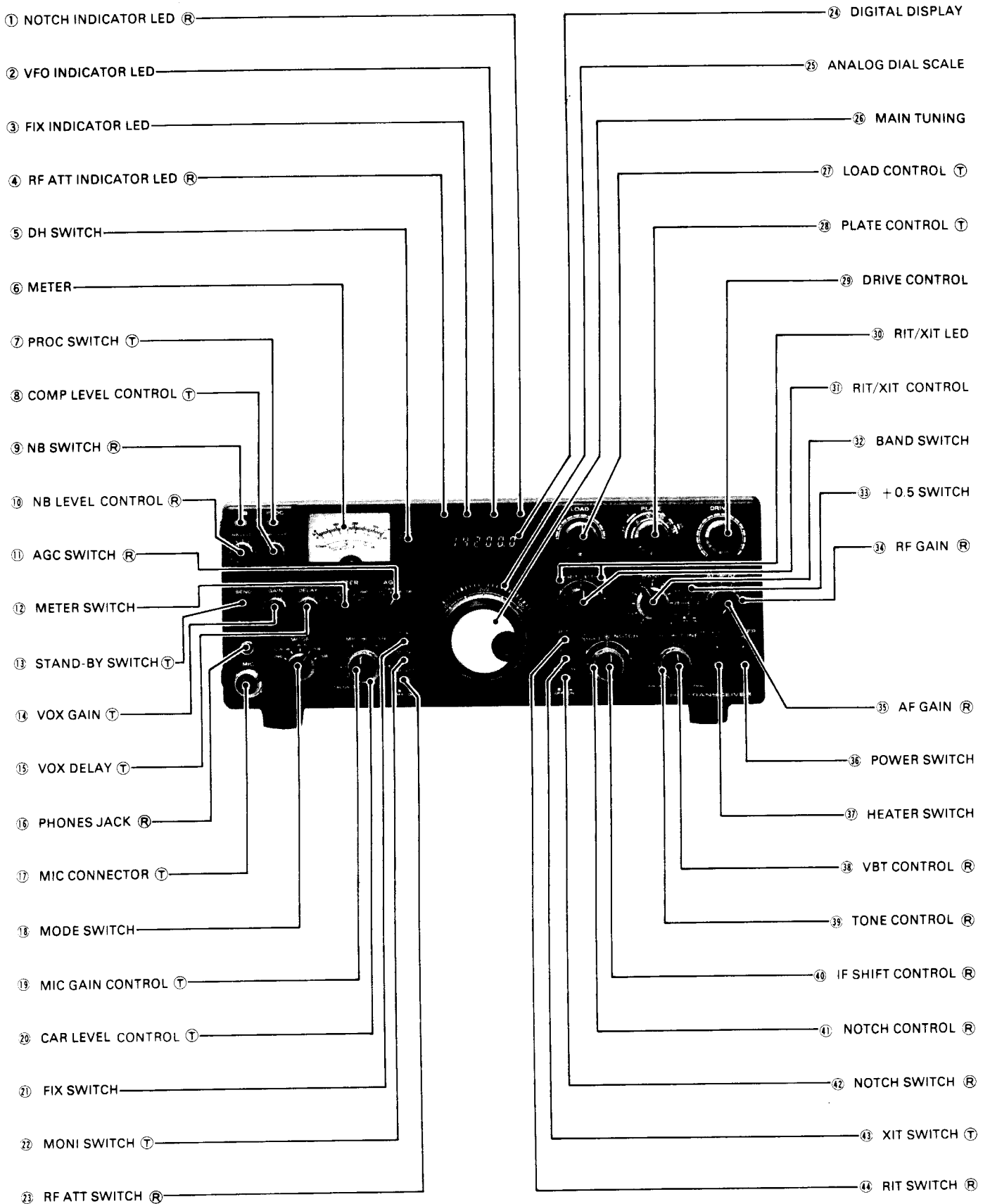


Fig. 3-1 Front Panel View

3.1 FRONT PANEL

The symbol after the part name indicates:

Ⓡ: Active only during reception.

Ⓣ: Active only during transmission

No symbol: Always active

1. NOTCH INDICATOR LED Ⓡ

This indicator, (light emitting diode), illuminates when the NOTCH circuit is turned ON.

2. VFO INDICATOR LED

The VFO indicator illuminates when the internal VFO controls transceiver operation. The indicator is not lighted during fixed channel or remote VFO operation.

3. FIX (FIXED CHANNEL) INDICATOR LED

The FIX indicator illuminates when the internal fixed frequency oscillator controls transceiver operation.

4. RF ATT INDICATOR LED Ⓡ

This illuminates when the RF ATTENUATOR is turned ON.

5. DH (DISPLAY HOLD) SWITCH

With this switch ON, the display frequency remains ON even if the main tuning is changed. This feature is used to memorize the original frequency when checking another frequency.

6. METER

The meter monitors six different functions, depending on METER switch position. In receive the meter is automatically an S-meter, and shows received signal strength on a scale of 0 to 40 dB over S9. In transmit, meter function depends on the position of the METER switch, as described below. This is an average-responding meter, NOT peak-reading.

7. PROC (SPEECH PROCESSOR) SWITCH Ⓣ

This switch is used during SSB operation. Set the switch to the ON position and the speech processor will be activated, increasing the average talk power. Compression level can be adjusted by the processor control (8).

8. COMP LEVEL CONTROL Ⓣ

This control adjusts compression level. Set the meter switch (12) to the COMP position and adjust this control while observing the meter COMP scale.

9. NB SWITCH Ⓡ

With the push switch, the noise blanker circuit is turned ON reducing pulse-type (ignition) noise. Power-line, radar, QRM and atmospheric "white" noises will not operate the blanker. The noise blanker circuit operating level is adjustable by the noise blanker control (10).

10. NB LEVEL CONTROL Ⓡ

This control adjusts the noise blanker circuit operating level according to receiving conditions or noise level.

11. AGC SWITCH Ⓡ

This controls the AGC (Automatic Gain Control) circuit:
OFF..... AGC disabled (no AGC).
FAST..... Normally used for CW operation.
SLOW..... Normally used for SSB operation.

12. METER SWITCH

This determines the transmit meter function:

ALC (Automatic Level Control)

Monitors internal ALC voltage, or the ALC voltage feedback from a linear amplifier operated in conjunction with the TS-830S. For SSB operation the ALC reading for voice peaks should be within the indicated ALC range. ALC voltage adjustment is made with the MIC control for SSB and with the CAR control for CW.

IP (Plate Current)

In this position the meter monitors final tube plate current. The scale is calibrated from 0 to 350 ma.

RF (Output Power)

This monitors relative output power of the transceiver. There is no meter scale for this position. Normally the reading should be adjusted (with the RF METER control) for a 2/3 scale reading.

COMP

This indicates compression level when the speech processor is operating.

HV (High Voltage)

This position monitors the high voltage power supply. The meter scale is calibrated from 0 to 10, indicating 0 to 1000 volts.

13. STAND-BY SWITCH Ⓣ

This two-position lever switch selects:

REC..... The transceiver is receiving unless the microphone PTT switch, or the VOX circuit is activated.

SEND..... Locks the unit in transmit.

14. VOX GAIN $\text{\textcircled{T}}$

This controls sensitivity of the VOX (Voice Operated Transmit) circuit.

15. VOX DELAY CONTROL $\text{\textcircled{T}}$

The DELAY control adjusts the hold time for VOX or break-in CW operation. Adjust for individual preference.

16. PHONES JACK $\text{\textcircled{R}}$

The headphones jack allows use of a 4 to 16 ohm headphone through a 1/4" phone plug. When phones are used the speaker is disconnected.

17. MIC CONNECTOR $\text{\textcircled{T}}$

The four pin connector allows use of a microphone with PTT. Figure 2-1 shows plug wiring.

18. MODE SWITCH

The mode switch selects type of emission, and TUNE.

TUNE This position provides reduced carrier and shorted key line for transceiver tuning. (Input power to the final section is reduced to prevent tube damage during tune-up.)

Frequency is shifted approximately +800Hz from the USB or CW receive frequency.

This is the actual CW transmit offset. This feature allows you to Zero-Beat an incoming CW signal.

CW.W Used for CW operation. A high-cut filter is inserted in the receiver audio circuit to reduce unwanted noise.

SSB filter selected for WIDE receive bandwidth.

CW.N (NARROW) Used for CW operation with CW filters YK-88C (500 Hz), YK-88CN (270 Hz), YG-455C (500 Hz) or YG-455CN (250 Hz), which are available as optional accessories. Without an optional CW filter installed, the pass-bandwidth is the same as in CW.W.

USB Used for upper-sideband operation. International Amateur practice dictates the use of USB on and above the 10 MHz band.

LSB Selects lower-sideband. International Amateur practice dictates the use of LSB on and below the 7 MHz band.

19. MIC GAIN CONTROL $\text{\textcircled{T}}$

This control adjusts microphone amplifier gain for SSB operation. Adjust for an on-scale ALC reading on voice peaks.

In the CAL ON position, receive frequency can be calibrated at 25 kHz intervals using the built-in oscillator.

20. CAR LEVEL CONTROL $\text{\textcircled{T}}$

This controls carrier level during CW operation. Adjust for approximately the center of the ALC meter reading.

21. FIX SWITCH

Place this switch ON for fixed channel operation; (an optional crystal is required. Trio-Kenwood does not supply these crystals.)

22. MONI (MONITOR) SWITCH $\text{\textcircled{T}}$

This delivers a sample of the demodulated transmit IF signal to the AF for monitoring modulation.

23. RF ATT SWITCH $\text{\textcircled{R}}$

With this switch ON, A 20 dB attenuator is inserted in the antenna circuit, protecting the RF amplifier and mixer from overload on strong input signals.

24. DIGITAL DISPLAY

The digital display indicates operating frequency to the nearest 100 Hz.

25. ANALOG DIAL SCALE

The mono-scale permits direct analog frequency readout over the 0 to 500 kHz range, graduated at 1-kHz intervals. Operating frequency equals the dial (in kHz) plus the BAND switch frequency (in MHz). An additional 50 kHz both above and below the 500 kHz range is also covered.

26. MAIN TUNING

This controls the VFO, selecting the transceiver's operating frequency. The indented knob is convenient for quick tuning.

27. LOAD CONTROL $\text{\textcircled{T}}$

This controls the loading of the network between the final section and the antenna. Adjustment is described in Section 4.

28. PLATE CONTROL $\text{\textcircled{T}}$

This controls the plate tuning of the final amplifiers. Calibration is approximate.

29. DRIVE CONTROL

This control tunes the plate tank circuit of the 12 B Y 7A driver as well as the receiver's antenna and mixer coils. In receive the DRIVE control is tuned for maximum sensitivity (maximum S-meter deflection), and in transmit for a maximum on-scale ALC reading. These points occur concurrently. Tuning for one also achieves the other.

30. RIT/XIT INDICATOR LED

This indicator will light when the RIT switch (44) or XIT switch (43) is ON.

31. RIT/XIT CONTROL

This control allows the receive frequency, transmit frequency or both to be shifted without using the main tuning control. With the RIT switch (44) ON, the RIT circuit is activated to shift only the receive frequency.

With the XIT switch (43) ON, the XIT circuit is activated to shift only the transmit frequency.

When both switches are ON, both frequencies are shifted. The center (O) position equals no shift.

32. BAND SWITCH

The 10-position switch selects all Amateur bands from 1.8 to 29.7 MHz. To select the 28.5 or 29.5 MHz bands, push the +0.5 switch (33) ON.

Use the 10 MHz band for WWV reception.

An AUX receive band is also available.

Coilpack (Receiver front-end) and PLL components must be installed and aligned for the specific receive frequency range desired.

33. +0.5 SWITCH

This switch is used in conjunction with the bandswitch (32.). Depress the switch with the bandswitch set to "28", and the transceiver will operate in the 28.5 MHz band. When the bandswitch is set to "29", the transceiver will operate in the 29.5 MHz band. This switch has no function at any other bandswitch position.

34. RF GAIN $\text{\textcircled{R}}$

This adjusts receiver RF amplifier gain. Turn fully clockwise for maximum gain and a correct S-meter reading.

35. AF GAIN $\text{\textcircled{R}}$

This adjusts receiver audio level. Volume increases clockwise.

36. POWER SWITCH

This switches all power to the transceiver.

37. HEATER SWITCH

This switch turns the three transmitting tube filaments ON.

38. VBT CONTROL $\text{\textcircled{R}}$

The VBT (Variable Bandwidth Tuning) continuously adjusts the IF Filter bandwidth to eliminate radio interference. For normal operation, this control may be left fully clockwise (NORMAL Position).

39. TONE CONTROL $\text{\textcircled{R}}$

This adjusts the audio tone quality of received signals. Adjust as desired.

40. IF SHIFT CONTROL $\text{\textcircled{R}}$

During reception, the center frequency of the IF crystal filter can be shifted ± 1.2 kHz facilitating adjustment of tone quality, or eliminating interference from nearby frequencies. For normal operation, set to the center detent position (click stop).

41. NOTCH CONTROL $\text{\textcircled{R}}$

Turn the NOTCH switch ON to activate the Notch filter. Adjust the notch frequency to null a beat (tone interference) signal.

42. NOTCH SWITCH $\text{\textcircled{R}}$

This switch controls the NOTCH circuit and indicator.

43. XIT SWITCH $\text{\textcircled{T}}$

This push switch activates the XIT (Transmit Incremental Tuning) circuit and the XIT indicator. By adjusting the XIT control, the VFO transmit frequency can be varied ± 2 kHz without changing the receive frequency.

44. RIT SWITCH $\text{\textcircled{R}}$

This push switch activates the RIT (Receiver Incremental Tuning) circuit, and the RIT indicator. By adjusting the RIT control, the VFO receive frequency can be varied ± 2 kHz, without changing the transmit frequency. If both switches are ON, both the transmit and receive frequencies will shift simultaneously.

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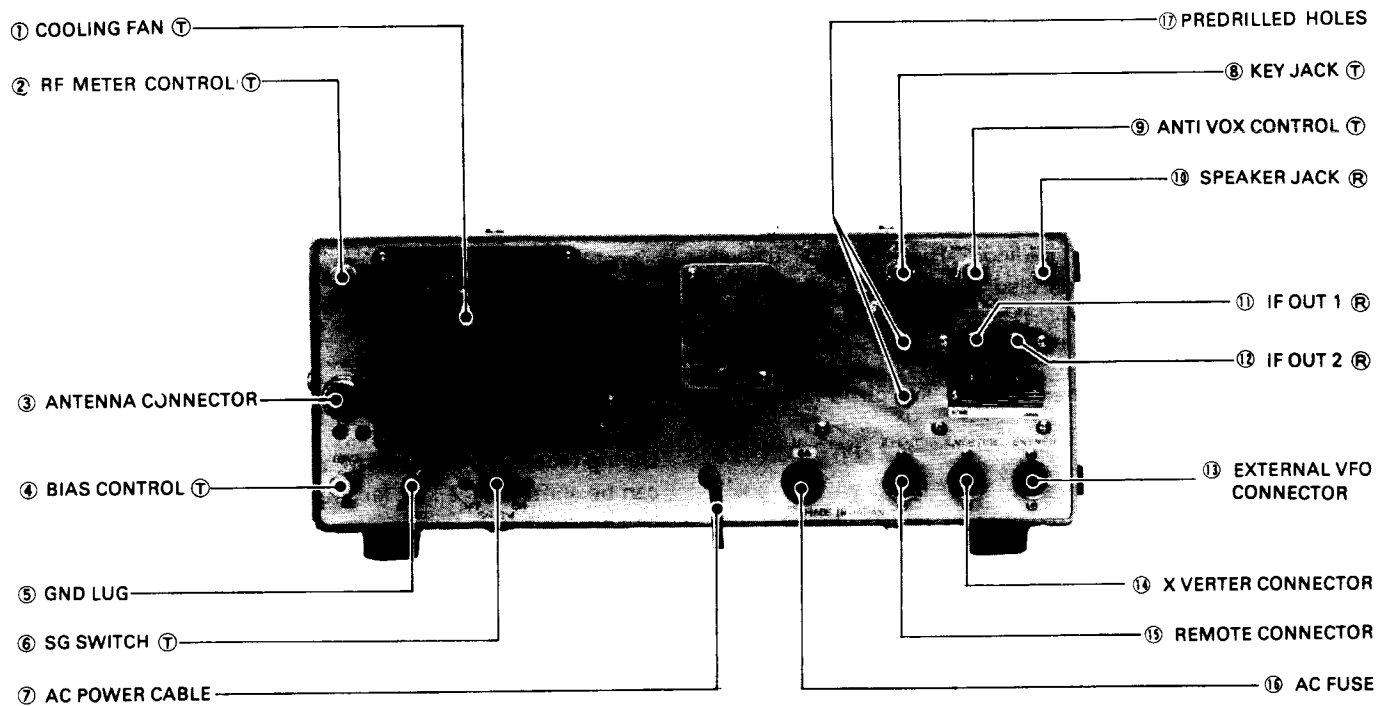


Fig. 3-2 Rear Panel View

3.2 REAR PANEL

1. COOLING FAN (T)

This fan cools the RF amplifier section to insure reliable and efficient operation.

2. RF METER CONTROL (T)

This adjusts the RF output meter reading. Set for 2/3 scale reading during CW transmission.

3. ANTENNA CONNECTOR

This SO-239 coax connector should be attached to a suitable 50Ω antenna for transmitting and receiving.

4. BIAS CONTROL (T)

This adjusts the bias voltage to the 6146B amplifier tubes. Clockwise rotation increases the idling plate current. Section 4 describes adjustment to 60 ma.

5. GND (GROUND) LUG

To prevent electric shock, as well as RFI and BCI, connect the transceiver to a good earth ground.

6. SG SWITCH (T)

This slide switch controls the screen grid voltage to the final tubes. For neutralizing, switch OFF. The switch remains ON for normal operation.

7. AC POWER CABLE

This cable is used to connect an AC power source to the transceiver.

8. KEY JACK (T)

Using shielded line, connect a key to this 1/4" phone jack for CW operation. Key open-terminal voltage is approximately -65V.

9. ANTI VOX CONTROL (T)

Adjust the control to prevent speaker output from tripping the VOX.

10. SPEAKER JACK (R)

The receiver audio output can be connected through this jack to an external 4 to 16 ohm speaker. The internal speaker is disconnected when an external speaker is connected.

11. IF OUT 1 (R)

A buffered Mixer output for pan display use. This is a wide-band, low-level IF signal to feed an SM-220, BS-8 oscilloscope/pan display combination.

12. IF OUT 2 (R)

A high-level, narrow-band IF output, taken before the RX Produce Detector, for scope display of received signal waveform (to feed an SM-220, verticle input.)

13. EXTERNAL VFO CONNECTOR

This DIN connector is used to interface the KENWOOD VFO-230 external VFO. The interconnecting cable is provided with the VFO-230.

PIN	FUNCTION	PIN	FUNCTION
1	VFO signal	5	VFO control
2	Relay control (+ on transmit)	6	Display control
3	+9V	7	Ground
4	CW freq. shift control	8	+12V

Schematic example

14. XVERTER CONNECTOR

This DIN connector is used to interface a VHF transverter.

PIN	FUNCTION	PIN	FUNCTION
1	Ground	5	Transverter input (RX)
2	Relay control (+ on transmit)	6	Transverter ALC input
3	Ground	7	Transverter output (TX)
4	X-verter ON-OFF control	8	HF ANT output

An 8 Pin DIN plug is available as a spare part E07-0851-05

NOTE:

S-19 is part of the din chassis connector

15. REMOTE CONNECTOR

This connector is used to interconnect a linear amplifier or other accessory item. See page 25 for details.

16. AC FUSE

This fuse protects the transmitter power supply against short circuits. Never use a higher amperage fuse than specified; it will eventually cause extensive damage. If the fuse blows, try to determine the cause before replacing.

For 120 volt operation, use a 6 ampere fuse.

17. PREDRILLED HOLES

These are provided for owner-installed switches or connectors.

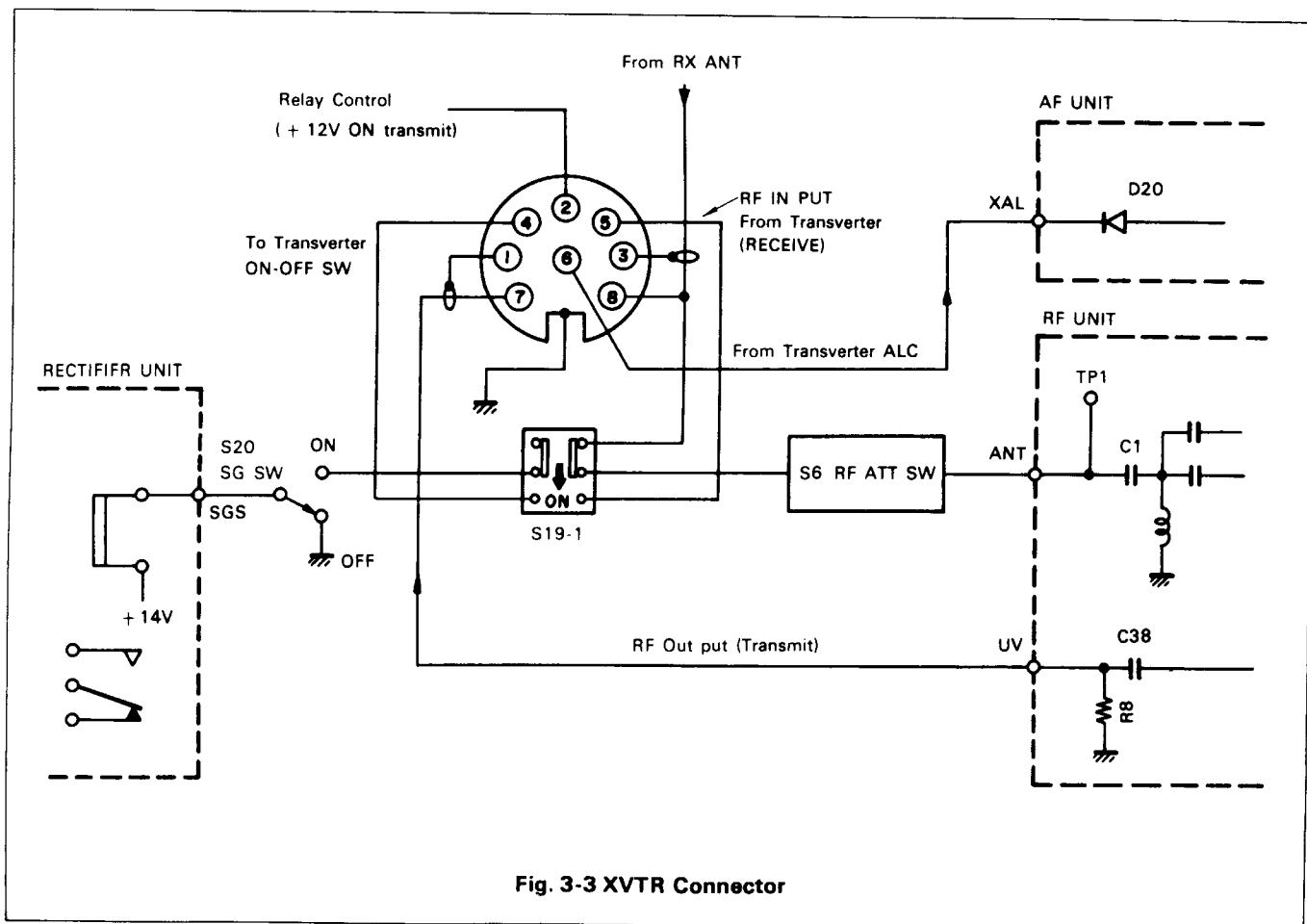


Fig. 3-3 XVTR Connector

SECTION 4. OPERATION

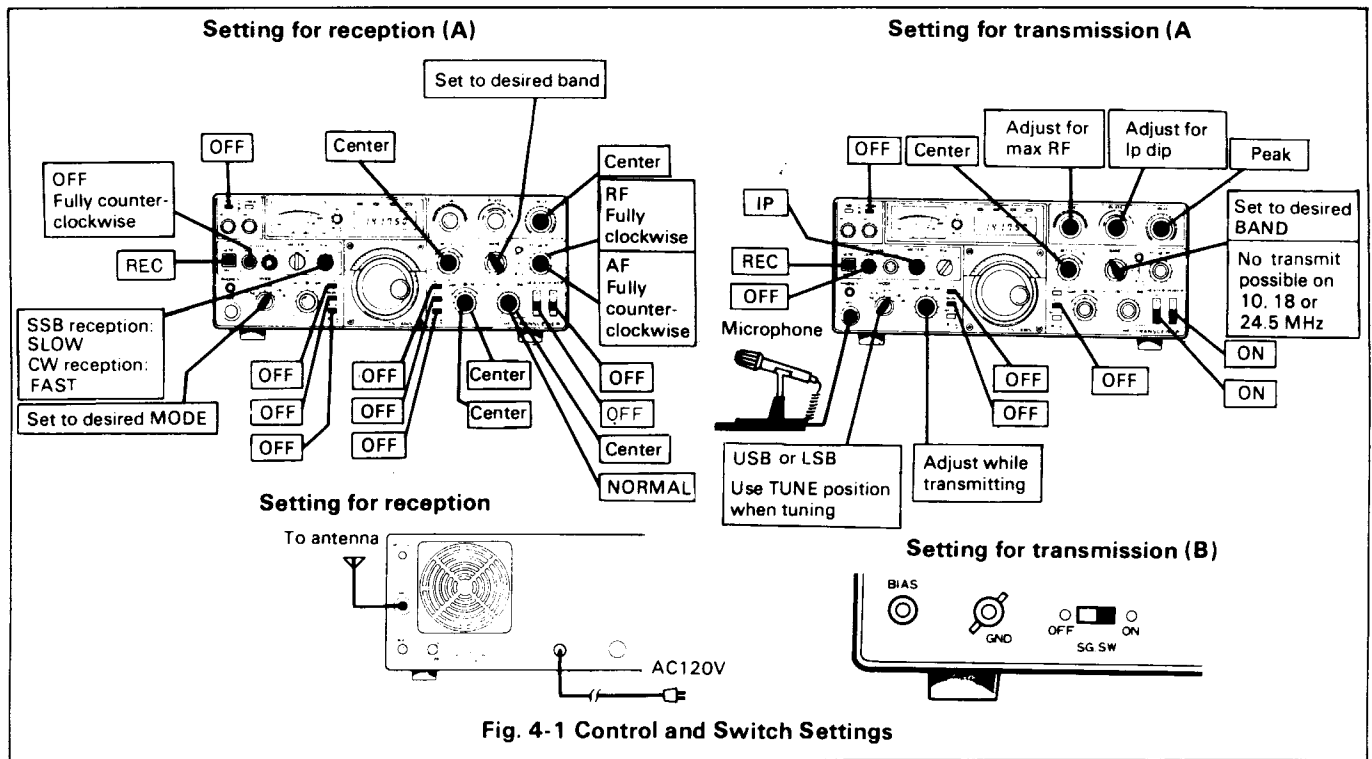


Fig. 4-1 Control and Switch Settings

4.1 RECEPTION (I)

NOTE:

Set the MIC and CAR controls to minimum to prevent accidental transmission before tune-up is completed. The TS-830S must be operated into a 50 ohm antenna or dummy load with an SWR less than 2:1. Random length wire antennas or light-bulb dummy loads cannot be used. Conventional half-wave dipoles and beam antennas should only be used at or near their resonant frequency. Exceeding an SWR of 2:1 can damage the output stage of the transceiver.

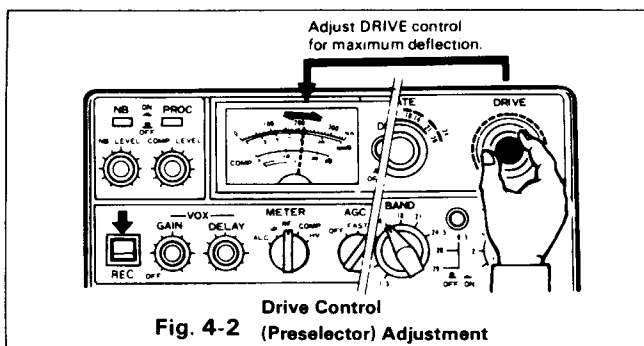


Fig. 4-2 Drive Control (Preselector) Adjustment

(1) Basic Procedures for Receive Operation

The TS-830S has many advanced features such as VBT, IF SHIFT, NOTCH, etc. to assure enhanced receive operation. For the use of these specialized controls and switches, refer to Section 4.2 "Reception (II)".

With a suitable antenna and microphone or key connected to the transceiver, set the controls as described in Fig. 4-1.

Turn the POWER switch ON. The meter, dial scale, and VFO indicator will light, indicating the transceiver is operating. Advance the AF GAIN control clockwise until some receiver noise is heard in the speaker. Turn the main tuning dial within the frequency range of the Amateur band chosen until a signal is heard. Tune the signal for clearest reception, and then adjust the DRIVE control for maximum S-meter deflection. (Fig. 4-2).

(2) WWV Reception

Set the band switch to "10" and turn the main tuning control to 10.0 MHz.

4.2 RECEPTION (II)

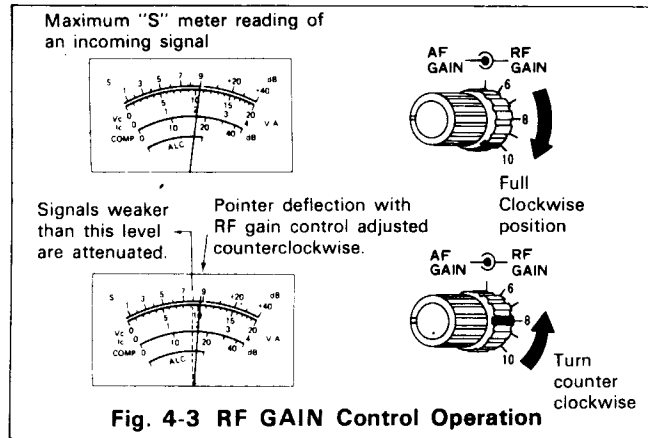
This section covers operation of controls and switches to provide maximum performance from the TS-830S.

(1) RF ATT SWITCH

The input to the receive RF amplifier is attenuated approximately 20 dB, providing distortion-free reception. This feature may be used in cases of receiver overload, caused either by a strong local signal, or during weak signal reception when a strong adjacent signal may blank the receiver or "Pump" the noise blanker.

(2) RF GAIN CONTROL

RF GAIN is controlled by changing the AGC threshold voltage. Adjust the RF GAIN so the S-meter does not deflect excessively. This also reduces noise during reception. For normal operation, this control should be turned fully clockwise for maximum sensitivity.



(3) AGC (AUTOMATIC GAIN CONTROL)

Set the AGC switch to the appropriate position: Generally for SSB, SLOW, for CW FAST, and for very weak signals, the AGC may be turned OFF.

Simultaneous Use of the RF GAIN CONTROL and AGC Switch

If a strong signal (such as a local station) appears in the vicinity of the intended receive signal, the S meter may show unusual deflection due to the AGC voltage developed from the strong disturbing signal. If this occurs, turn the RF GAIN down so the meter pointer remains at about the original deflection peak and turn the AGC switch OFF. This will eliminate the unwanted AGC voltage and permit clear reception.

(4) RIT/XIT

First set the RIT/XIT control to center, and turn the RIT switch ON.

The RIT/XIT control allows shifting the receive frequency by approximately ± 2 kHz without changing the transmit frequency.

With the RIT switch ON, the receive frequency can be adjusted by using the RIT control.

With both the RIT and XIT switches ON, both the transmit and receive frequencies can be shifted.

For XIT switch operation, refer to Section 4.4 "Transmission (II)"

NOTE:

When the RIT is ON, transmit frequency is different from the receive frequency. For normal operation, leave the RIT switch OFF. It should be turned ON only when needed.

(5) VBT CONTROL (Variable Bandwidth Tuning)

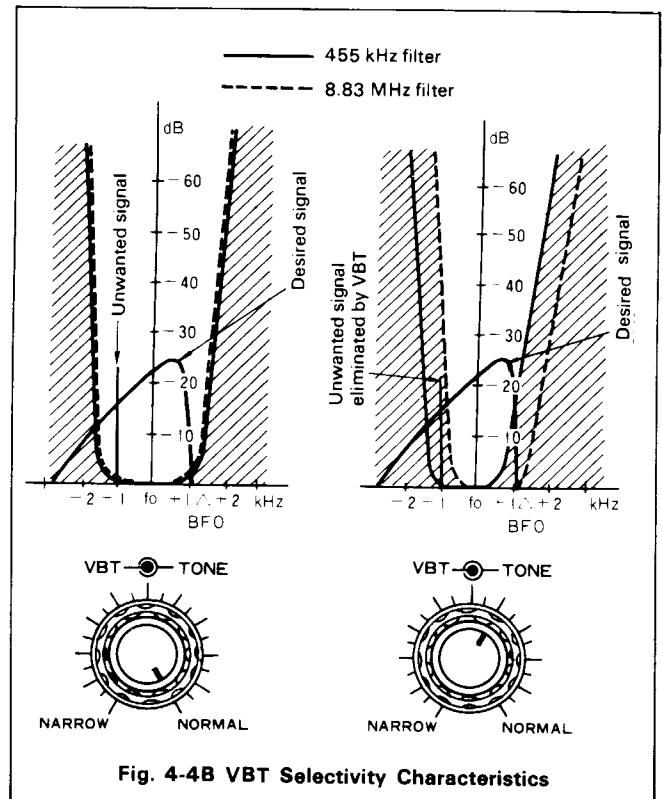
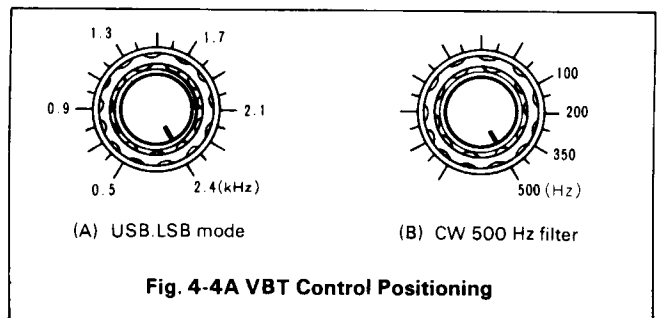
This control is used to eliminate radio interference by changing the IF passband-width. Use this control in

conjunction with the IF SHIFT and NOTCH filter to obtain optimum results. By setting the VBT control to the NORMAL position, maximum passband-width is obtained. The IF filter passband-width is narrowed as the control is adjusted counterclockwise, while center frequency remains unchanged. Fig. 4-4 illustrates operation. The range of variability depends on the type of optional filter used.

(i) When the filter bandwidth is 2.4 kHz (without an optional filter), the passband-width varies within the range of 500 Hz to 2.4 kHz. See Fig. 4-4A.

(ii) With an optional YK-88C filter (8.83 MHz, 500 Hz bandwidth) or YG-455C filter (455 kHz, 500 Hz bandwidth), the passband-width varies from 500 Hz to approximately 150 Hz.

Since an optional filter center frequency is 700 Hz higher than that of the built-in 2.4 kHz filter, the CW receive tone will be about 800 Hz without using the IF shift. Fig. 4-4A shows the VBT function with an optional filter.



(6) IF SHIFT

By using the IF SHIFT during reception, the crystal filter passband frequency can be shifted approximately ± 1.2 kHz. This is achieved by use of a PLL (Phase-Locked Loop) in the L.O. (local oscillator) circuit. This is a major feature of the TS-830S and can be used in the following cases:

1. Adjustment of tone quality and interference rejection during SSB Reception.

When the transceiver is on 20 meters and above, USB mode, turn the IF SHIFT in the "+" direction and the lower frequencies are attenuated. Turning the knob in the "-" direction cuts the higher frequencies. (These procedures are reversed for LSB operation below 20 meters). Adjust the control to your listening preference. The IF SHIFT is also effective in eliminating interference from adjacent receive signals.

2. Adjustment of tone quality during CW operation.

For a detailed description, refer to Section 4.4. "CW" operation".

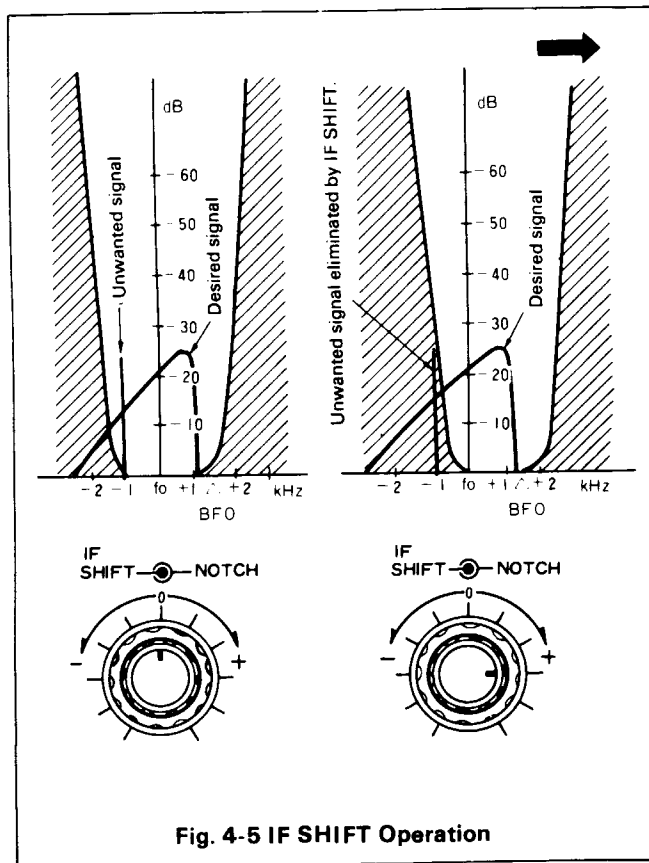


Fig. 4-5 IF SHIFT Operation

(7) VBT AND IF SHIFT IN COMBINATION

If excessive radio interference is encountered during SSB operation, adjust the VBT for optimum bandwidth, and the IF SHIFT for maximum intelligibility.

In CW mode, first adjust the VBT. Turn the IF SHIFT "-" (counter clockwise), adjusting for approximately 800 Hz tone. If pitch lower than 800 Hz is desired, adjust the RIT and IF SHIFT.

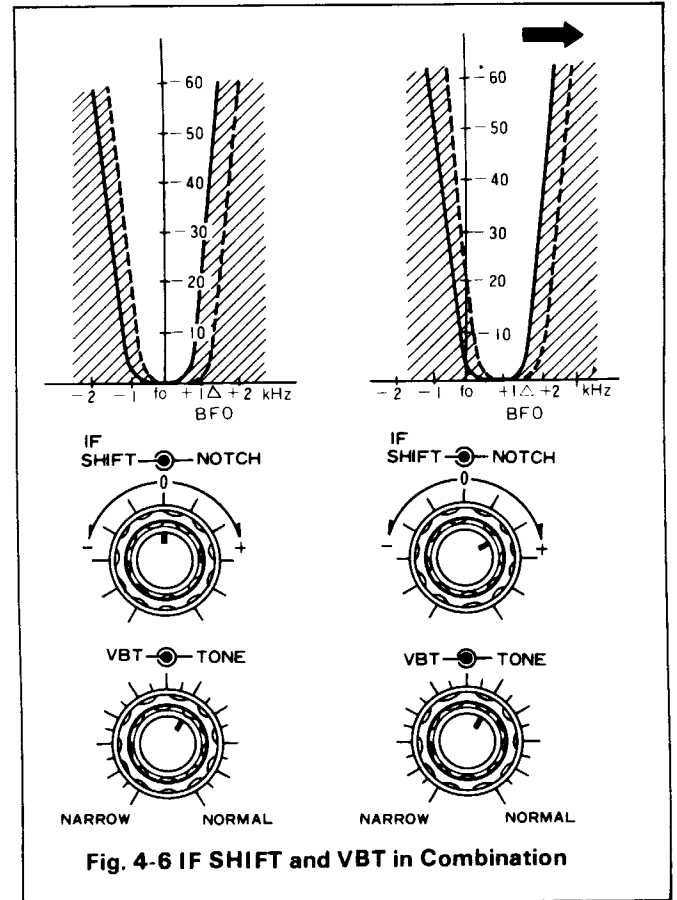


Fig. 4-6 IF SHIFT and VBT in Combination

(8) NOTCH CONTROL

If a single tone such as a CW signal is superimposed on the receive signal, turn the NOTCH ON and adjust the NOTCH control to eliminate or minimize the beat signal. A beat of approximately 1.5 kHz can be eliminated at the center position of the control. In USB or CW mode, a beat signal lower than 1.5 kHz can be eliminated by turning the control clockwise. In LSB mode, adjust the control counterclockwise.

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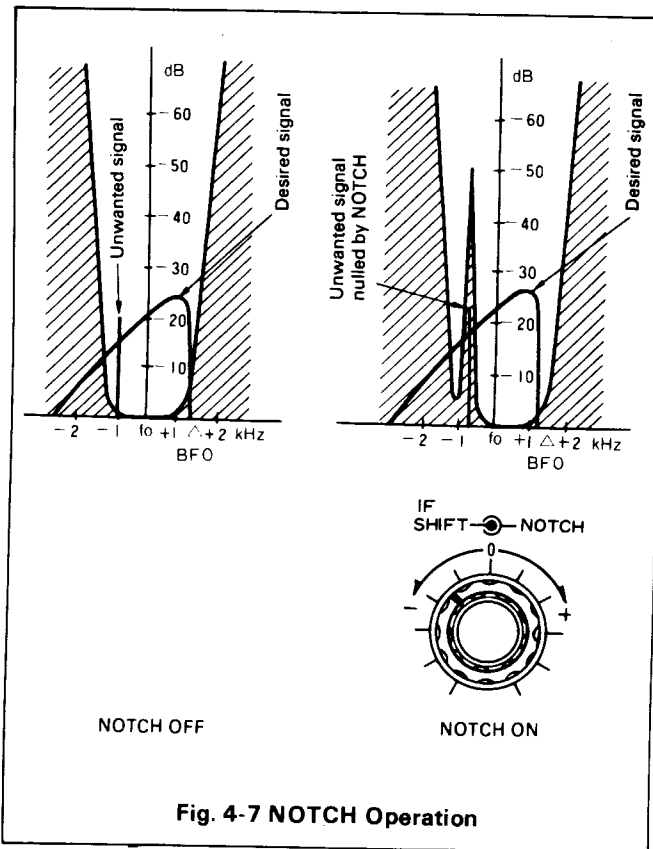


Fig. 4-7 NOTCH Operation

(9) NOISE BLANKER (NB)

For pulse type noise, such as generated by automotive ignition systems, turn the NB switch ON. Adjusting the NB LEVEL control varies the blanker's threshold, eliminating even low level noises.

NOTE:

If high level signal or noise is present on an adjacent frequency, do not use excessive NB threshold LEVEL as it may distort the received signal. If you are operating near other strong signals, use the RF ATT along with the noise blanker level control.

(10) TONE CONTROL

Adjust this control to obtain desired tone quality.

4.3 TRANSMISSION (I)

This section covers adjustment of the transceiver for transmission.

Refer to Fig. 4-1 for initial transmitter switch settings. Set the main tuning to the desired operating frequency. (Refer to Table 4-1 for a summary of the following.)

CAUTION:

DO NOT turn the BANDSWITCH while the transceiver is in transmit mode.

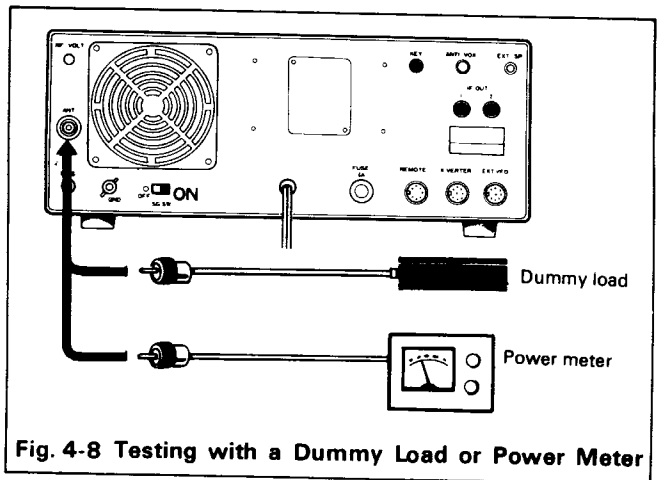


Fig. 4-8 Testing with a Dummy Load or Power Meter

1. Connect a 50Ω antenna for the band you will operate or a dummy load, and connect a key. SWR must be 2:1 or better. The life of the final tubes is directly related to the SWR of the antenna, and to the length of tuning periods.
2. Turn POWER and HEATER ON.
3. Place the MODE switch to SSB, METER switch to Ip.
4. Place the STAND-BY switch to SEND and adjust bias to 60 mA with the BIAS control on the rear panel.

CAUTION:

If the plate current is higher than 60 mA do not leave the stand-by switch on for more than a few seconds. Excessive plate current shortens the life of the final tubes.

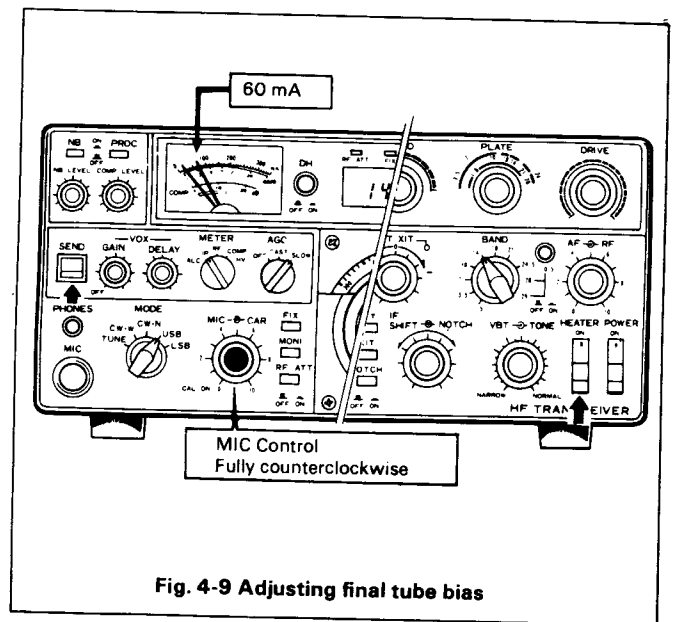


Fig. 4-9 Adjusting final tube bias

- Place MODE switch to TUNE, METER switch to ALC. Peak the DRIVE control. If the meter pegs or goes out of the ALC range, reduce the CARRIER control setting for an on-scale reading. (the CAR control is a level adjustment, while the DRIVE control is a resonating adjustment.)

NOTE:

The TUNE position permits tuning of the final tank circuit at reduced power without danger to the tubes. In the TUNE position, the screen voltage to the finals is reduced approximately 50% and the keying circuit is closed.

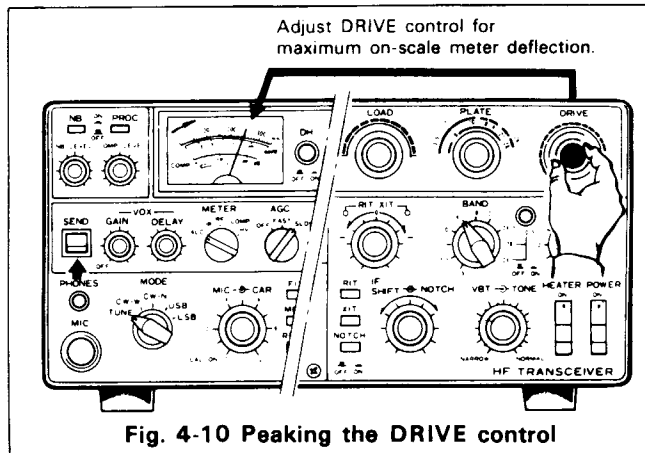


Fig. 4-10 Peaking the DRIVE control

- Place the meter switch to IP and dip the PLATE. Dip will be typically only about 5ma. (or to RF and peak the plate.)

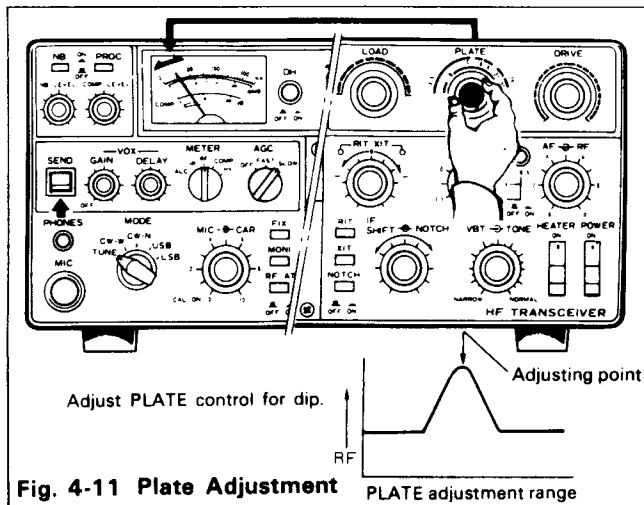


Fig. 4-11 Plate Adjustment

Table 4-1. Summary of Transmitter Tuning Procedure

MODE Switch	METER Switch	Stand-by Switch	Procedure
USB or LSB	IP	REC → SEND	Adjust BIAS control for 60 ma.
TUNE	ALC	REC → SEND	Peak the ALC reading with the DRIVE control.
TUNE	IP	REC → SEND	DIP the PLATE reading with the PLATE control.
TUNE	RF	REC → SEND	PEAK RF Reading with the load control.
CW	RF	REC → SEND	Peak RF output by alternately adjusting the PLATE and LOAD controls.

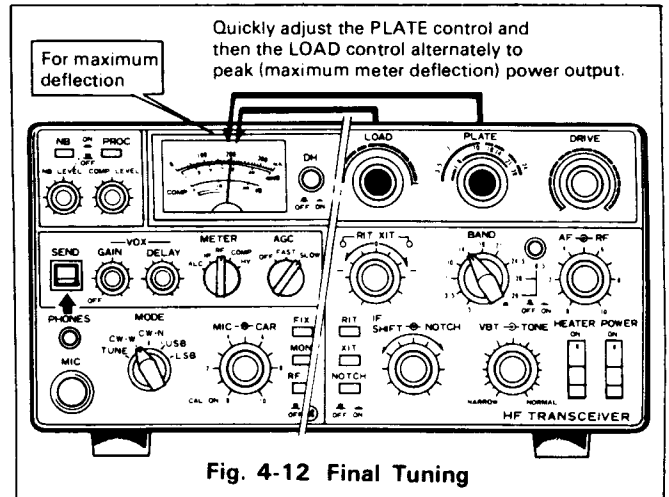


Fig. 4-12 Final Tuning

- Place the meter switch to RF and peak the LOAD control.
- Place the Mode switch to CW. Meter switch to Ip. Close the key and IMMEDIATELY redip the PLATE control. Reduce the carrier control setting if Ip reads over 265ma. Open the key.
- Place the meter switch to RF. Close the key and repeat the LOAD for maximum RF output. You may at your option also redip the PLATE for maximum RF output. Open the key. You are tuned up for CW operation. If necessary, adjust the RF METER control on the rear panel to bring the output reading to about 2/3 scale. This is a meter adjustment, not an output adjustment.

NOTE:

Dip point may not always coincide with maximum output, because neutralization is accomplished on the 10 meter band.

For this reason, you may simply adjust both the PLATE and the LOAD controls for maximum output as described in both tune-up procedure and summary Table 4-1.

(1) SSB OPERATION

Tune the TS-830S as described in steps 1 through 9. Set the MODE switch per Table 4-2, to USB or LSB and connect a microphone to the MIC input.

NOTE: International Amateur practice dictates using USB or LSB as shown in Table 4-2.

To operate SSB, connect a microphone. (The Key and CARRIER control have no effect in SSB mode.) Place the MODE switch to SSB, METER switch to ALC. Adjust the MIC gain control for an on scale ALC reading on voice peaks. (Disregard RF and Ip meter readings in SSB- they are not accurate or relevant.)

1.8 MHz Band	LSB
3.5 MHz Band	LSB
7 MHz Band	LSB
10 MHz Band	USB
14 MHz Band	USB
18 MHz Band	USB
21 MHz Band	USB
24.5 MHz Band	USB
28 MHz Band	USB

TABLE 4-2. MODE by Band

■ PTT (Push to talk) OPERATION

By using a microphone equipped with a PTT switch, the transceiver is ready for PTT operation. To key, depress the PTT switch with the stand-by switch left in the REC position.

4.4 TRANSMISSION (II)

To obtain maximum transmitter performance from your TS-830S you should understand the proper operation of the following controls and switches.

(1) SPEECH PROCESSOR

In SSB operation (particularly DX operation), it may be desirable to increase "talk-power" by using the speech processor. This may make the difference between a marginal, and a copiable signal.

Operation

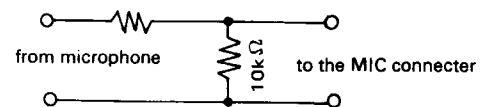
The speech processor system in the TS-830S is an RFclipper using two filters, one in the VBT circuit and the other in the IF.

Turn the PROCESS switch ON and place the METER switch to COMP. Adjust the COMP LEVEL control while speaking into the microphone in a NORMAL tone of voice for a peak COMP scale reading of about 10-20 dB. Do not overdrive the COMPRESSOR: This will deteriorate voice quality, increase transmitter noise level, and in general make copying your signal more difficult.

Next, set the METER switch to ALC and adjust the MIC control while speaking into the microphone. Ensure that meter deflection is within the ALC zone.

NOTE: When a high-output microphone is used, input overload and distortion will result. To prevent this, use an attenuator in the microphone circuit as shown below, or connect a 10 — 33 kΩ resistor (depending on microphone used) across the microphone input. ("Normal" mic control setting should be approximately 12 O'clock).

10k — 33 kΩ (depending on microphone used.)



The MC-50 microphone is recommended (Microphone sensitivity: -55 ± 3 dB for approx. 5 cm distance to the mic.)

(2) VOX (Voice Operated Transmit) OPERATION

Adjust the transceiver as described in the previous paragraph. Flip the VOX switch on and while speaking into the microphone, increase the VOX GAIN control until the VOX relay just operates. For VOX operation it is sometimes desirable to close-talk the microphone to prevent background noises from tripping the transmitter.

Check that the ALC reading for voice peaks is still within range on the meter. If necessary, adjust the MIC control for proper ALC reading.

If the VOX circuit is activated by speaker output, adjust the ANTI-VOX control (on the rear panel) as necessary for proper VOX operation.

Do not use excessive VOX or ANTI VOX gain more than necessary to control VOX operation. If the VOX circuit transfers between words, or holds too long, adjust the release time constant by the DELAY control.

(3) XIT

By using XIT, transmit frequency can be shifted independent of receive frequency.

With the XIT switch ON, the XIT is controlled by the RIT/XIT knob and transmit frequency can be shifted by about ± 2 kHz. When both the RIT and XIT switches are ON, both receive and transmit are shifted without adjusting the main tuning.

(4) MONITOR

To monitor transmitted SSB signal quality, turn the MONITOR switch ON to sample and demodulate a part of the transmit IF signal.

This feature is useful for checking modulation, or when adjusting the speech processor.

When monitoring, use a headphone to avoid audio feedback.

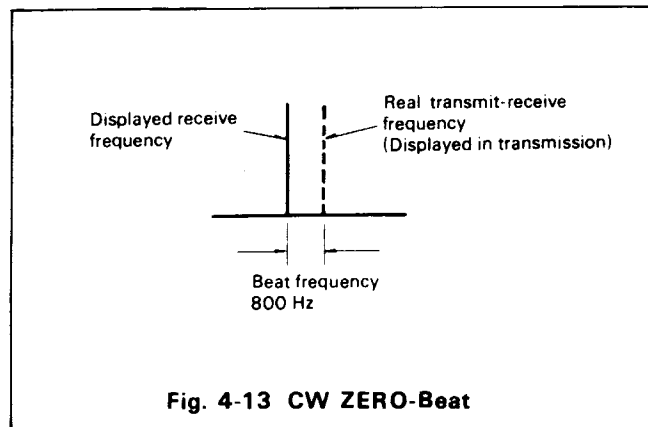
NOTE:

If the HEATER switch is OFF or the DRIVE control is incorrectly adjusted, the ALC circuit will not operate properly, causing excessively high transmit IF signal level, resulting in a distorted monitor signal.

(5) CW OPERATION (fig. 4-13)

Tune and load the TS-830S as described in Sections 4.3. Using shielded line, connect a key to the rear panel KEY jack, set the MODE switch to CW, and set the stand-by switch to SEND for transmitting.

CW transmission is automatically monitored through the transceiver's speaker. Sidetone audio gain can be adjusted through the opening in the bottom cover.



(i) Reception

The TS-830S operates in two different CW modes: WIDE and NARROW. In the WIDE mode, the SSB filter (pass bandwidth 2.4 kHz, -6 dB) and an audio filter are used.

In the NARROW mode, option CW filters (YK-88C, YK-88CN, YG-455C, YG-455CN) may be used to narrow the IF pass bandwidth to 500 Hz (-6 dB) or 250 Hz along with the audio filter. In both modes, high frequencies are cut so the received signal will be more easily copied.

■ OPERATION WITHOUT CW FILTERS

To receive CW, set the IF SHIFT control to its center position and the RIT switch to OFF. Adjust the main tuning for about an 800 Hz beat and your transmit frequency will be tuned (zeroed) to the transmit frequency of the station you are receiving. During reception, the side tone is activated by the key (VOX off). Listen to the side tone superimposed on the receive signal and adjust the main tuning for similar side tone and incoming CW audio tone. By doing so, transmit frequencies will be ZERO-bes. You may now adjust the RIT for a pitch which suits your preference. If interference is encountered, adjust the IF SHIFT. For more convenient and effective CW operation, use of the optional CW filters is recommended.

■ OPERATION WITH CW FILTERS (OPTION)

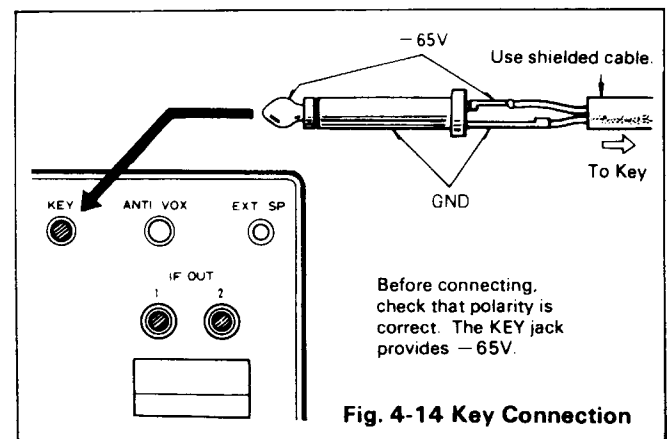
Set the IF SHIFT to its center position and the RIT OFF. Adjust the main tuning for maximum S-meter deflection. Receive signal pitch will be about 800 Hz, indicating correct tuning. For optional CW filter information, See Page 24.

■ KEY CONNECTION (Fig. 4.14)

Your key should be connected as illustrated in Fig. 4-14. When using an electronic keyer, make sure that polarity is correct. Use shielded line from the key to transceiver.

NOTE:

When using an electronic keyer, set polarity of the keyer for NEGATIVE keying.



Before connecting, check that polarity is correct. The KEY jack provides -65 V.

■ SEMI-BREAK-IN OPERATION

The TS-830S has a built-in side-tone oscillator to permit semi-break-in operation, besides the normal CW operation. During semi-break-in operation, the transceiver is set in transmit mode when the key is depressed, and returns to receive mode when the key is released. For semi-break-in operation, place the STANDBY switch to REC and turn the VOX GAIN control ON. Adjust the DELAY control for your preference.

4.5 FIXED CHANNEL OPERATION

A fixed channel is available for common use on all bands by installing a crystal in the socket on the PLL unit (X50-1680-00). The crystal frequency can be computed by the following formula:

Crystal Frequency (MHz) = 5.5 MHz - X + Operating Frequency (MHz).

X = Band Switch frequency (1.5, 3.5, etc.)

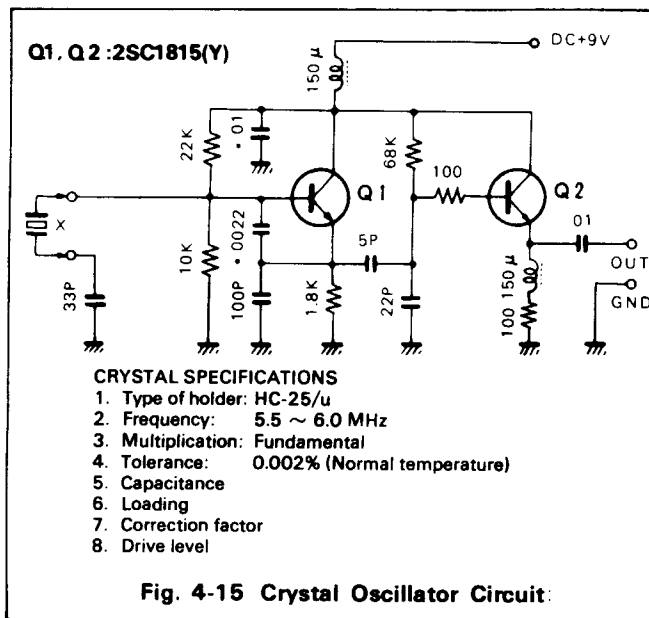
Crystal specifications: See Fig. 4-15

NOTE:

TRIO-KENWOOD does not supply crystals.

The shift set circuit CW frequency between transmit and receive, and the RIT/XIT circuit are not effective in FIXED CHANNEL OPERATION.

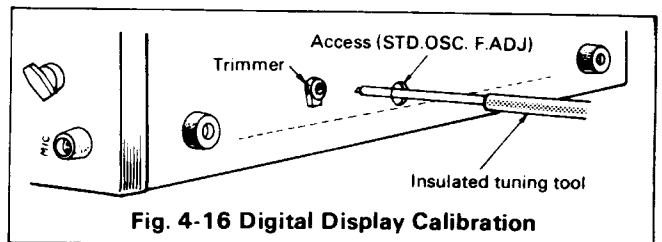
To use the fixed frequency oscillator, depress the FIX push switch.



4.6 DIGITAL DISPLAY CALIBRATION

Connect the antenna and set the BAND switch to WWV. Turn the main tuning dial to receive 10 MHz WWV. Adjust the dial until a low-frequency beat is heard. Next, turn the MIC control to the CAL position and a marker signal will be superimposed on the WWV signal. A double beat (two beat signals of high and low frequencies) will now be heard. Adjust the IF shift for low AF response.

While receiving this double beat, adjust the Standard oscillator trimmer through the reference frequency adjustment access opening (on the bottom of the TS-830S) so the two beats are heard as a single beat. Repeat this procedure 2 or 3 times. This completes calibration of the Digital Display. After calibration turn of the CAL switch.



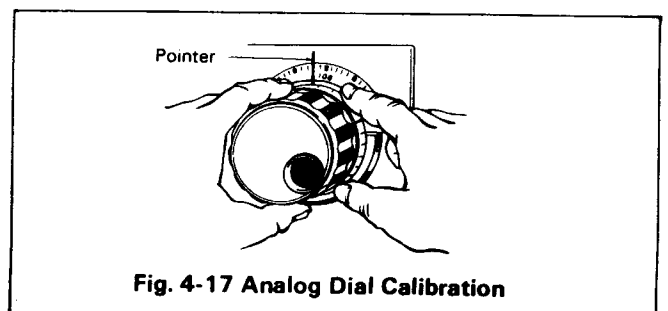
4.7 ANALOG DIAL CALIBRATION

The dial scale is graduated at 1 kHz intervals. One revolution of the main dial covers 25 kHz. To calibrate the scale, turn the MIC control to the CAL position. Zero-beat in either SSB or CW mode. Hold the main tuning knob from rotating and slip the calibration ring to the nearest major (5 kHz) graduation.

The dial is now calibrated.

NOTE:

For exact frequency, read the Digital Display.



SECTION 5. OPTIONAL ACCESSORIES

5.1 OPTIONAL ACCESSORIES

The following optional accessories are available for use with the TS-830S.

■ REMOTE VFO

VFO-230:

The VFO-230 digital VFO provides maximum efficiency and flexibility for all operating conditions, including split-frequency operation, by combining a 20 Hz step digital VFO with five memories.

VFO-240:

The VFO-240 is an all solid-state VFO with high stability, designed to match the TS-830S in design and performance.

The T-F switch makes it possible to check the transmit frequency while in the receiving mode.

■ ANTENNA TUNER

AT-230:

The AT-230 antenna tuner includes the three new bands and such functional features as a through-line wattmeter, SWR meter and antenna selector switch.

■ EXTERNAL SPEAKER

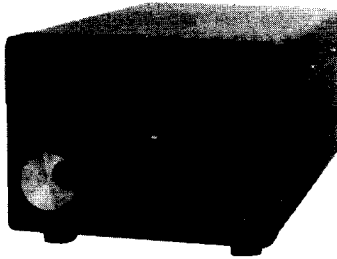
SP-230:

The SP-230 is a low-distortion speaker with selectable frequency response for high intelligibility in any mode. The frequency response is determined by the built-in audio filters, which are effective in improving signal-to-noise ratio under certain interference conditions, or when receiving weak signals.

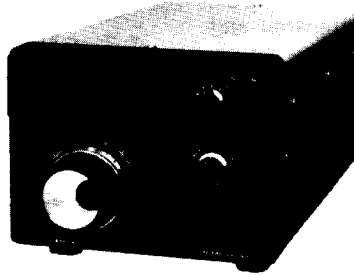
■ LINEAR AMPLIFIER

TL-922A:

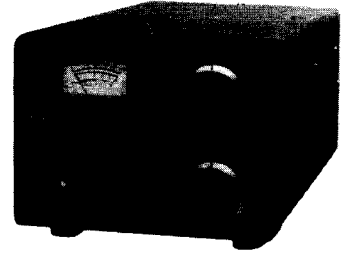
The TL-922A is an HF linear amplifier operating at maximum legal power, and employing a pair of 3-500Z high performance transmitting tubes.



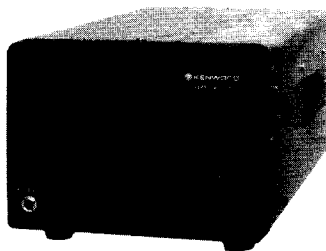
VFO-230



VFO-240



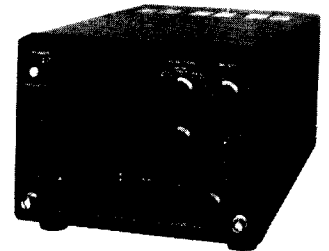
AT-230



SP-230



TL-922A



SM-220 (with BS-8)

■ STATION MONITOR

SM-220:

Based on a wide-frequency-range oscilloscope (up to 10 MHz), the SM-220 station monitor features, in combination with a built-in two-tone generator, a wide variety of waveform-observing capabilities. An optional feature is the BS-8, a unique pan-display capability.

■ PHONE PATCH

PC-1: (Available only where phone patch operation is legal.)

Hybrid phone patch with VU meter for null and audio gain measurements.

The PC-1 Phone Patch provides connection between a transceiver and a telephoen line.

Providing excellent performance, it is designed with high isolation between receive input and transmit output.

Its compact design permits easy installation in a limited space.

Simply plugs in to the transceiver.

■ HEAD PHONES

HS-4: 8 Ω communications headphones.

HS-5: Deluxe 8 Ω headphone set.

HS-6: Deluxe 12.5 Ω lightweight headphone set.

■ MICROPHONE

MC-50: Desk Microphone (50 k Ω /500 Ω)

MC-35S: Noise Cancelling Hand Microphone (50 k Ω)

MC-30S: Noise Cancelling Hand Microphone (500 Ω)

■ FILTER

* YG-455C: 500 Hz CW filter for 455 kHz IF

YG-455CN: 250 Hz CW filter for 455 kHz IF

* YK-88C: 500 Hz CW filter for 8.83 MHz IF

YK-88CN: 270 Hz CW filter for 8.83 MHz IF

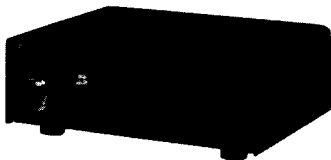
* Recommended filter pair.

■ DIGITAL WORLD CLOCK

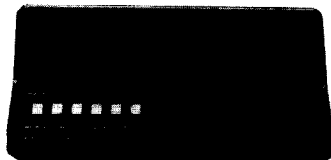
HC-10:

The HC-10 is a highly advanced world clock with dual display which can memorized 10 world major cities and 2 additional regions.

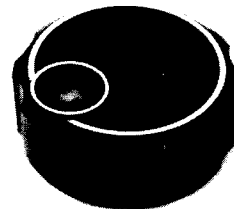
■ KB-1 : DELUXE FLYWHEEL VFO TUNING KNOB



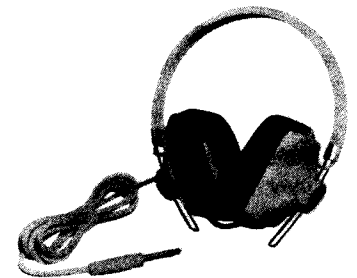
PC-1



HC-10



KB-1



HS-4



HS-5



HS-6



MC-50



MC-30S

5.2 INSTALLATION OF ACCESSORIES

■ REMOVING THE CABINET (See Fig. 5-1)

Figure 5-1 illustrates cabinet removal. Remove the eight top-cover and eight bottom-cover screws and lift away the panels.

NOTE:

This product uses metric hardware.

CAUTION:

The speaker lead is attached to the chassis, so be careful when removing the top cover.

The lead can be unplugged, if necessary.

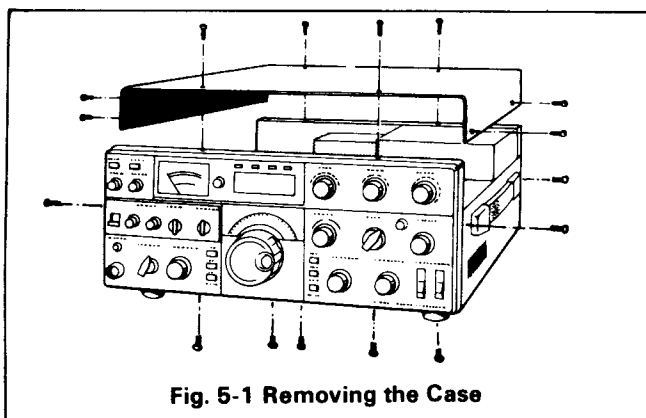


Fig. 5-1 Removing the Case

■ OPTIONAL FILTER INSTALLATION

- Using a number 2 Phillips screwdriver, remove the top cover (eight screws). Unplug the speaker and set the cover aside.
- Remove the bottom cover (eight screws).
- Remove the eight screws holding the IF unit X48-1290-00 and swing the printed-circuit board over.
- Using a 45-W (or less) soldering pencil, clear the six holes for the filter, if they are filled with solder.
- YK-88C, CN: there is no polarity to the filter. Install the filter into its position on the IF unit. Solder the two mounting tabs and the four input and output pins to the circuit boards.
Solder sparingly, and heat the connections only long enough to insure a good solder joint. Don't overheat the filter or circuit board.
YG-455C, CN:
Install the filter into its position on the IF unit. Tighten the two nuts, and solder the four input and output pins to the circuit boards.
- Carefully inspect your soldering. Be certain that all pins are actually soldered, and that you have not soldered across any spots on the board or between any of the pins on the filter. Clip the pins flush to the board.

- Replace the IF unit. Make certain no wires will be pinched underneath the board. Replace the eight screws.
- Move the connector as illustrated from CW1 to CW2 ~ CW4.
- Reinstall the bottom cover. Reconnect the speaker lead, and reinstall the top cover.
- Apply power and verify your work. Filter installation is now complete.

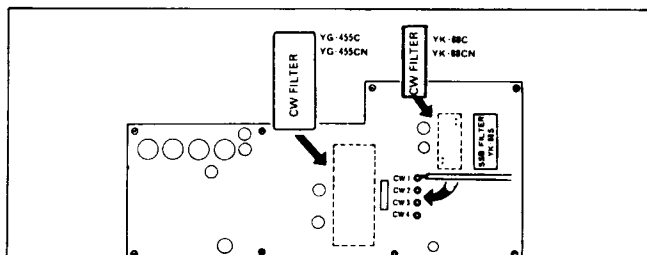
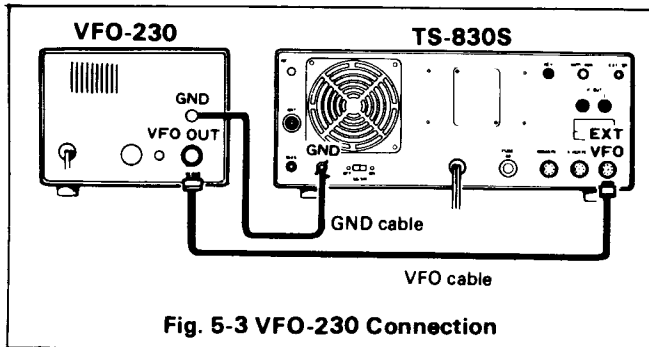


Fig. 5-2 Installing the Accessory CW Filters

Optional Filter (s)	Terminal	Total Passband	Receiver Characteristics
Installed None		2.4 kHz	Same as SSB and Wide CW. Variable Bandwidth Tuning (VBT) adjusts passband from 2.4 kHz to 500 Hz, retaining shape factors of built-in 2.4-kHz filters in first (8.83-MHz) IF and second (455-kHz) IF.
YK-88C (500 Hz) in 8.83-MHz IF	CW2	500 Hz	General-purpose CW filter. VBT not fully effective.
YK-88CN (270 Hz) in 8.83-MHz IF	CW2	270 Hz	Narrow CW filter, with general-purpose shape factor. VBT not fully effective.
YG-455C (500 Hz) in 455-kHz IF	CW3	500 Hz	Very sharp CW filter. VBT not fully effective.
YG-455CN (250 Hz) in 455-kHz IF	CW3	250 Hz	Very sharp, very narrow CW filter. VBT not fully effective.
YK-88C and YG-455C	CW4	500 Hz	Excellent selectivity. Very sharp passband. Maximum VBT flexibility, which adjusts passband from 500 Hz to 150 Hz. Best overall combination.
YK-88CN and YG-455C (Combination not recommended)	CW4	270 Hz	Excellent selectivity and narrow passband, but VBT not flexible (too narrow on one side of passband).
YK-88C and YG-455C (Combination not recommended)	CW4	250 Hz	Excellent selectivity and very sharp, narrow passband. VBT not flexible (too narrow on one side of passband).
YK-88CN and YG-455CN	CW4	250 Hz	Optimum selectivity, most sharp and most narrow lowest noise floor, best dynamic range. However, greatest filter insertion loss and very little VBT range (adjusts no wider than 250 Hz) ...not good for contest operation or "tuning around", but excellent for high-speed CW schedules requiring narrowest, sharpest passband.

■ **VFO-230 OR VFO-240 CONNECTION (Fig. 5-3)**

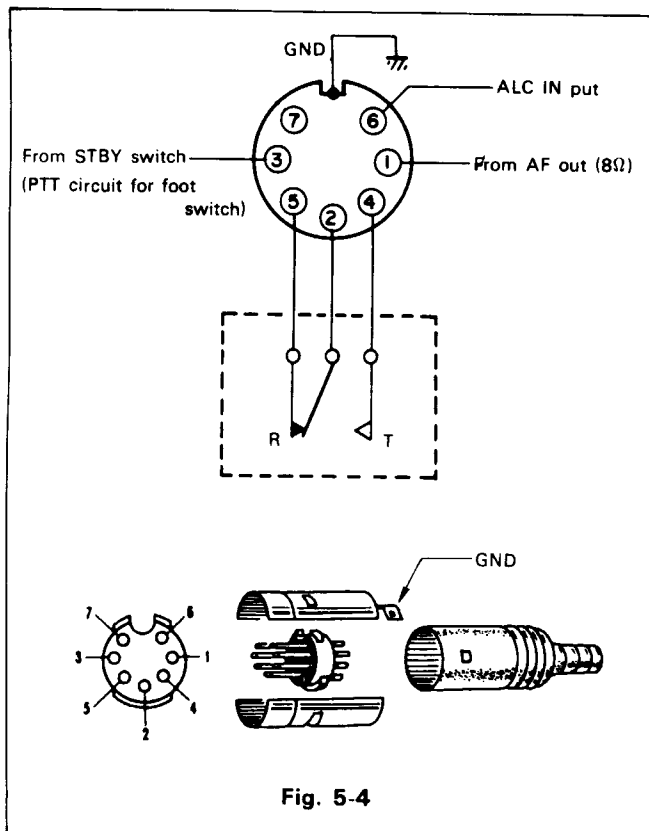
Connect the VFO-230 or VFO-240 as shown in Fig. 5-3. You will enjoy advanced operation including split-frequency capability by combining a 20 Hz step digital VFO with five memories (VFO-230).



■ **ACCESSORY CONNECTIONS**

Fig. 5-4 shows the REMOTE connector. This DIN plug can be used for attaching a linear amplifier or other external accessories to the transceiver. Always use shielded line for all functions.

NOTE:
ALWAYS use shielded line for all connections.



PIN	FUNCTION	PIN	FUNCTION
1	Speaker output	5	Normally closed (relay contact)
2	Relay common terminal (NOT grounded)	6	ALC input ALC threshold level approx. -6V
3	PTT line	7	No connection
4	Normally opened (relay contact)		

■ **OPERATION WITH A LINEAR AMPLIFIER**

Operation with a linear amplifier. Refer to Fig. 5-4, TS-830S internal wiring.

- Pin 6 ALC input
Connector metal shell Ground
 - Pin 2 Ground to connector metal shell and control line braid.
 - Pin 4 Control line center conductor.
- Use shielded line for both ALC and RL (control line).

■ **SSTV OR AFSK OPERATION**

The TS-830S will adapt very well to slow scan television or AFSK RTTY operation. For SSTV, the only cabling required are connections between the MIC connector of the TS-830S and the camera output, and between the SPEAKER jack and the monitor input.

When transmitting, adjust the transmitter output so that final input power is less than 100W (less than 125 mA Ip), or for approximately 1/2 of normal output power. for AFSK, connect the T.U. output to the MIC input, and speaker output to the T.U. input.

■ **PHONE PATCH OPERATION**

The PC-1 Phone Patch can be used with the TS-830S.

Recommended settings are:

- PC-1 RX Gain 4
- TX Gain 4
- Null as necessary
- TS-830S Vox Gain 1
- AF Gain 4
- Mic Gain 5
- Anti Vox Max

Most other phone patches will work satisfactorily without any modification to the radio, requiring only an external speaker connection, and that the Mic line be run through the patch.

For those operators who desire a Patch input similar to the TS-520S or TS-820S, an input connection and terminal must be added at the Mic input preamp circuit.

Use a 100 kΩ resistor in series, with a 10 kΩ to ground on the input side of the 100 kΩ resistor. Use shielded line, and connect as follows:

On the IF unit X48-1290-00 install the fixed divider at the junction of R111 10 kΩ, C103, 100 pF and C104 1 μF (input of Q19). Add an RCA jack at one of the predrilled hole on the rear panel for input.

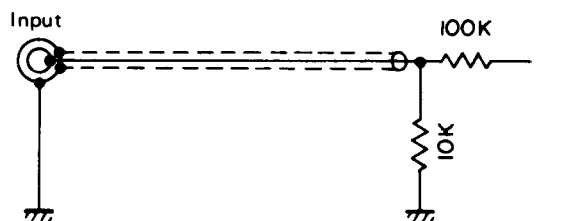


Fig. 5-5 Optional Special Phone Patch Input.

■ EXTENSION FEET

The TS-830S is provided with two extension feet which can be used to elevate the front panel. In some operating positions the tilt makes it easier to read the dial and meter. Fig. 5-6 shows how to install the feet.

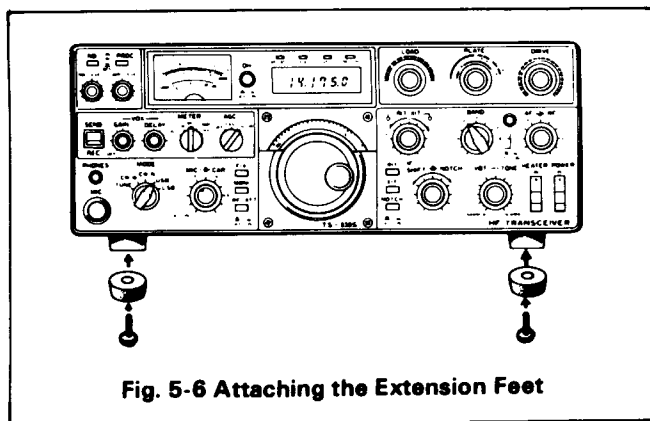
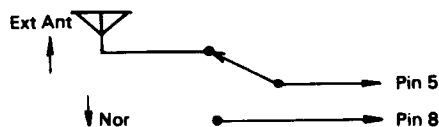


Fig. 5-6 Attaching the Extension Feet

■ OPERATION WITH A SEPERATE RECEIVER ANTENNA

Use the XVRTR port and an 8 Pin DIN Plug, Part E07-0851-05

- Pin 8 HF Ant output from the TS-830S
- Pin 5 RX Ant input
- Pin 3 GND



Either wire your extra antenna to pin 5 and ground, and use the DIN plug as the connect/disconnect, or wire pins 8 and 5 and the external antenna through a SPDT switch, as shown.

■ OPERATION WITH A SECOND RECEIVER

Use the XVRTR port and an 8 Pin DIN Plug, Part E07-0851-05.

- Pin 8 HF Ant output from the TS-830S
- Pin 5 RX Ant input
- Pin 3 GND
- Pin 2 RL control, 12V DC in TX

Connect pins 8 and 5 together and through a short length of 50Ω coax to your second receiver Ant input. Use pin 2 to mute the second receiver in TX.

■ OPERATION AS A SECOND RECEIVER

Use the Remote Connector. Connect Pin 3 (PTT line) to your XMTR control output, to ground Pin 3 in TX. Connector metal shell to Ground. Feed the antenna through the primary XCVR/XMTR Relay.

■ OPERATION WITH THE SM-220 SCOPE AND BS-8 PAN DISPLAY

No modifications or wire changes are required. Cable as follows:

- TS-830S to SM-220
- IF#1 Rear panel IF Input
- IF#2 Verticle Input



SECTION 6. MAINTENANCE AND ALIGNMENT

CAUTION:

DANGEROUS HIGH VOLTAGES ARE PRESENT WITHIN THE CASE OF THE TS-830S WHEN THE TRANSCEIVER IS TURNED ON.

EXERCISE EXTREME CAUTION TO AVOID ELECTRIC SHOCK.

6.1 GENERAL

Your TS-830S has been factory aligned and tested to specification before shipment. Under normal circumstances the transceiver will operate in accordance with these operating instructions. All adjustable trimmers and coils in your transceiver were preset at the factory and should only be readjusted by a qualified technician with proper test equipment.

Attempting service or alignment without factory authorization can void the transceivers warranty.

■ CLEANING

The knobs, front panel and cabinet of the TS-830S are likely to become soiled after extended use. The knobs should be removed from the transceiver and cleaned with a neutral soap and warm water. Use a neutral soap (not harsh chemicals) and a damp cloth to clean the cabinet and front panel.

■ FUSE REPLACEMENT

When the fuse blows, there is some cause. Be sure to find the cause before attempting operation. Use a 6 amp fuse for 120V AC operation. Under no circumstances use a higher amperage fuse than specified. This can cause extensive damage. Also, the warranty will be void if an oversized fuse is used.

■ FAN MOTOR LUBRICATION

Every 6 months dust out the final compartment, and apply a few drops of light machine oil to the front and rear fan motor bearings.

WARNING:

Be certain to disconnect power, and to discharge high voltage before servicing in the final compartment.

6.2 SERVICE POSITION

The TS-830S should be placed on its side, with the final section up, for any alignment or service. This position permits adequate ventilation for the final tubes as well as easy accessibility to the modules. Most of the described adjustments can be made without removing the boards from the transceiver.

6.3 RECEIVER ADJUSTMENTS

■ RIT ZERO (AF-AVR UNIT)

When the RIT circuit is turned on, and the RIT control is set to zero, the receive frequency should be exactly the same as the transmit frequency. If the frequency is not the same, adjust the RIT zero preset control, VR2.

To zero the RIT, turn on the calibrator and tune the VFO for about a 1000 Hz calibrator tone. Turn the RIT control to zero. Turn the RIT switch ON and adjust VR2 for the same 1000 Hz tone. Push the RIT switch ON and OFF to be sure the tones are identical.

■ NOTCH ADJUSTMENT (IF UNIT)

Turn the NOTCH switch OFF and center the NOTCH control.

Receive a 25 kHz marker signal at 1.9 MHz with a 1.5 kHz beat frequency.

Turn the NOTCH switch ON.

While monitoring AF output through the speaker, adjust L10 and VR1 alternately to minimize this signal.

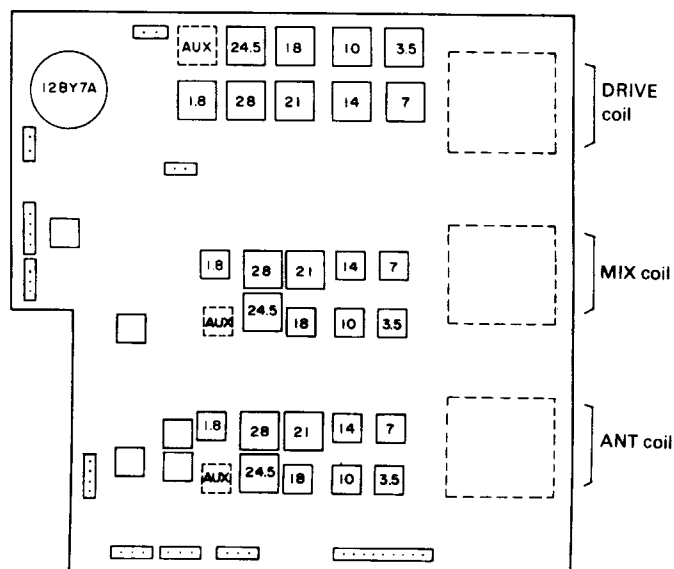


Fig. 6-1 Coil Pack Locations
FRONT Panel

BAND Switch	adjustment Frequency
1.5	1.9 MHz
3.5	3.75
7	7.15
10	10.125
14	14.175
18	18.125
21	21.225
24.5	24.95
28.5	28.8

Table 6-1 Coil pack Alignment order

■ ADJUSTMENT OF ANT AND MIX COILS (COIL PACK UNIT)

The ANT and MIX coils are included in the coil pack unit. Use the 25 kHz calibrator as a signal. Connect a 50Ω dummy load to terminate the receiver input. Set the DRIVE control to 12 o'clock. Adjust the ANT and MIX coils for maximum S meter deflection, following the frequency table. Start with the 1.8 MHz band and then proceed to the other bands. To adjust the 10m band, use only 28.8 MHz in the 28.5 MHz band.

■ ADJUSTMENT OF RECEIVE IF COILS (RF AND IF UNITS)

Receive a marker signal using any frequency. Adjust the DRIVE and the main tuning for maximum S meter deflection. Adjust T2 on the RF unit and L3, L4, L5, L6, L7, L11 and L12 on the IF unit for maximum S meter indication. DO NOT adjust L9.

■ S METER ADJUSTMENT (IF UNIT)

Disconnect the antenna with the transceiver in receive mode. Zero-point adjustment:

Adjust VR2 for meter pointer zero indication. If a standard signal generator (SSG) is available, adjust VR3 so the S-meter indicates "S-9", at 14.175 MHz for A 40 dB (50 μV) signal.

6.4 TRANSMITTER ADJUSTMENTS

■ TRANSMITTER NEUTRALIZATION

(See Internal View Bottom)

The TS-830S requires neutralization every time the final tubes are changed.

Tune up the TS-830S into a 50 ohm dummy load at 28.5 MHz for CW operation as described in Section 4. Set the SG switch to OFF and place a sensitive RF milli-voltmeter across the dummy load. Flip the stand-by switch to SEND and adjust TC1 (at the bottom of the final section) for a minimum reading on the voltmeter. After the final section is neutralized, flip the stand-by switch to REC and slide the SG switch ON.

A receiver tuned to 28.5 MHz works very well for neutralizing if an RF voltmeter is not available. Instead of tuning for a minimum voltage, tune for a minimum S-meter reading.

NOTE:

Since the drive tube operates into a fixed load (the finals) it is not always necessary to replace this tube when replacing the finals.

CAUTION:

Neutralization of the final section should be carried out with the chassis shield in place. Dangerous high voltages are present in the final section when the transceiver is turned on. Use an insulated tool to make this adjustment.

■ TRANSMIT DRIVE COIL ADJUSTMENT (RF UNIT)

The drive coils are part of the coil pack unit. Set the SG switch on the rear panel to OFF and center the DRIVE control (12 o'clock). Set the METER switch to ALC and the MODE switch to CW.W, CW.N or TUN.

With the standby switch in the SEND position, adjust the drive coils for maximum ALC deflection for each band using the same frequency and in the same order as for adjustment of the ANT and MIX coils.

During adjustment, adjust the CAR control so there is just enough injection to swing the ALC meter.

■ TRANSMIT IF COIL ADJUSTMENT (IF AND RF UNITS)

Using any frequency, place the transceiver in transmit mode in the CW.N, CW.W or TUN position. Adjust L28, 29 on the IF unit and T4 on the RF unit for maximum ALC deflection.

■ CARRIER BALANCE ADJUSTMENT (IF UNIT)

With a 50Ω dummy load connected to the ANT terminal, adjust for maximum output at 14.175 MHz. Reduce mic gain to zero. Set the transceiver in LSB mode and adjust the RF METER control on the rear panel for maximum sensitivity. The RF meter will deflect if the carrier is unbalanced. To balance the carrier, alternately adjust trimmer TC3 and trim-pot VR4 until the meter indicates minimum. Switch to USB mode and if the pointer deflects, readjust so the pointer deflects equally for both LSB and USB.

■ ADJUSTMENT OF SIDE TONE LEVEL (AF-AVR UNIT)

Adjust VR1 to your preference.

■ ADJUSTMENT OF MONITOR LEVEL (IF UNIT)

Adjust VR8 to your preference.

6.5 TRANSMITTING ON WARC BANDS

As supplied, the TS-830S will receive but not transmit on the 17, and 12 meter WARC bands. If transmit capability is desired, a minor wiring change is required.

1. For 2 bands: Break the line between the RF unit X44-1360-00, connector #6, Pin #1 (TOF terminal) and AF unit X49-1140-00, connector #6, Pin #4 (TOF terminal).
2. Or, for individual Bands: On the RF unit X44-1360-00:

Band	Remove (or Cut) Part
18 MHz	D5
24.5 MHz	D6

6.6 ANALOG DIAL ADJUSTMENT

1. Turn the main dial fully CCW. The red cursor should line up with the VFO start mark on the sub-dial. If it does not, remove the main knob (2mm allen), loosen and line the 12mm nut up the scale start point to the red cursor.
2. Turn the main knob to 50 kHz analog. Adjust the aluminum slip sub-dial to line up with any one of the larger black dial marks.
3. Note the digital error. If it is MORE than 2 kHz adjust the VFO trimmer cap TC1 (Front under the seal tape) to exactly 50.0 on the digital readout.
4. Turn the main knob to 450 analog. If the digital error is less than 2 kHz it is in spec. If the digital error is greater, proceed:
For instance if the digital error is 14.454.0 (plus 4 kHz), multiply the error times 4 (16 kHz) and adjust the VFO timmer cap to the desired frequency (14.450.0) LESS the error, or 14.434.0. Next adjust the VFO inductor L3 (Center under the seal tape) back up to the desired frequency of 14.450.0.
5. If the error in step 4 was in the minus direction, reverse the direction of the correction adjustment in step 4.
6. VFO linearity final check: The digital readout and analog dial should agree to within ± 2 kHz at every 100 kHz dial point.

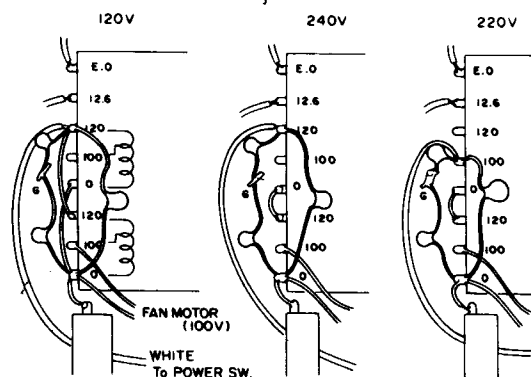
6.7 OPERATION ON 220 OR 240V AC

To operate the TS-830S on 240V AC, the power transformer split primaries must be rewired from parallel to series connection.

1. Unplug the AC power cable.
2. Remove the bottom cover.
3. Remove the jumper wires between the two 0 terminals and two 120 terminals on the bottom of the power transformer.
4. Connect the adjacent 120 and 0 terminals at the middle of the transformer. This will provide 240V AC operation.

For 220V AC operation, connect the adjacent 120 and 0 terminals, and move the white lead and Bypass, capacitors from the 120 terminal to the 100 terminal.

5. Change the AC fuse from 6A to 4A. Tag the power cord at the back of the radio to indicate that the transformer is strapped for 240V AC, and the power fuse should be 4A, and not 6A.
6. Replace the bottom cover and reconnect power to verify your work.



6.8 ORDERING SPARE PARTS

When ordering replacement or spare parts for your equipment, be sure to specify the following information:

Model and serial number of the equipment. Schematic number of the part. Printed circuit board number on which the part is located. Part number and name, if known, and Quantity desired.

NOTE:

A full Service Manual is available as a separate publication.

6.9 SERVICE

Should it ever become necessary to return the equipment for repair, pack in its original boxes and packing, and include a full description of the problems involved. Also include your telephone number. You need not return accessory items unless directly related to the service problem.

You may return your radio for service to the Authorized Kenwood Dealer from whom you purchased it. A copy of the service report will be returned with the unit. Please do not send sub-assemblies or printed circuit boards. Send the complete unit, in its original boxes and packing. If you want verification of receipt, please supply a self-addressed card (or letter) and you will be informed of the date of receipt and estimated service time.

SERVICE NOTE:

Dear OM, if you desire to correspond on a technical or operational problem, please make your note short, complete, and to the point. And PLEASE make it readable.

Please list: Model and serial number.

The question or problem you are having.

Please give sufficient detail to diagnose; other equipment in the station, meter readings and anything you feel might be useful in attempting diagnosis.

NOTE:

1. Record the date of purchase, serial number and dealer from whom purchased.
2. For your own information, retain a written record of any maintenance performed on the unit.
3. When claiming warranty service, please include a photocopy of the bill of sale, or other proof of purchase showing the date of sale.

SECTION 7. TROUBLESHOOTING

6.1 GENERAL

The problems described in this table are failures caused in

general by improper operation or connection of the transceiver, not by defective components. There is a separate service manual for repair of the TS-830S.

TRANSMITTER SECTION

SYMPTOMS	CAUSE	REMEDY
No output (No plate current)	No voltage on the screen grid of the final tubes.	Turn the SG switch on the rear panel ON.
No output in SSB (No plate current)	<ol style="list-style-type: none"> 1. Open microphone cable or bad microphone. 2. Low microphone gain. 3. PROC switch is set to ON with COMP LEVEL control turned fully counterclockwise. 	<ol style="list-style-type: none"> 1. Check the microphone. 2. Increase the MIC control. 3. Increase the COMP LEVEL control.
There is output, but the RF meter shows no output.	RF METER control not adjusted correctly.	Adjust control for 2/3 scale reading at full output.
VOX does not operate.	<ol style="list-style-type: none"> 1. VOX GAIN control too low. 2. ANTI VOX control requires adjustment. 	<ol style="list-style-type: none"> 1. See section 4.4 2. See section 4.4
VOX trips by speaker output.	ANTI VOX control requires adjustment.	See section 4.4
XIT control inoperative	XIT switch is off.	Push XIT button.
Mic or radio chassis is "hot" during TX.	Excess RF in the shack. No earth ground, poor ground, or antenna is too close to the radio.	See section 2
Poor audio in SSB, TX-feedback.	Excess RF in the shack.	See section 2
RF METER reading varies by band.	SWR differences between bands	Retune antenna system.

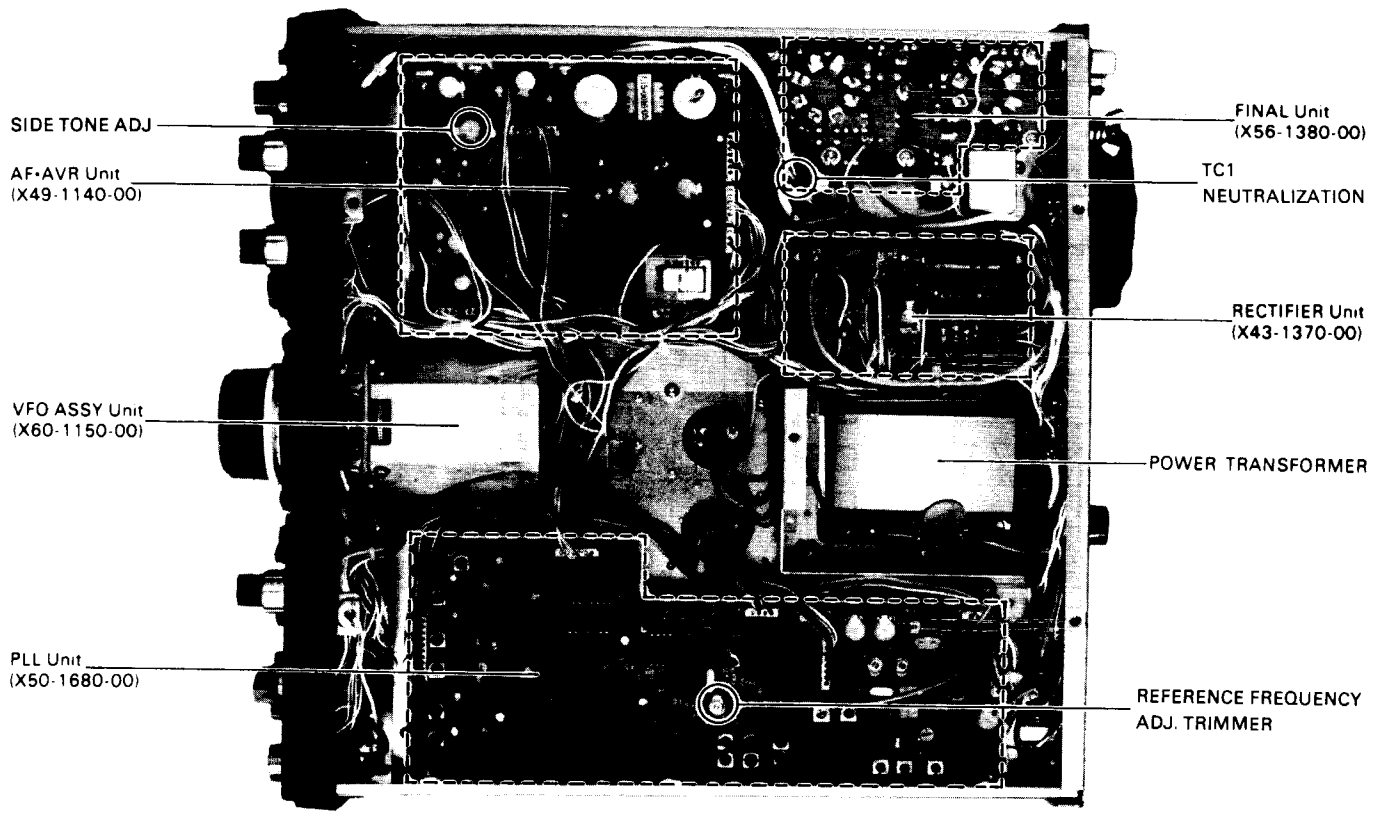
RECEIVER SECTION

SYMPTOM	CAUSE	REMEDY
Pilot lights do not light and there is no receiver noise when the POWER switch is turned on.	<ol style="list-style-type: none"> 1. Bad power cable or connections. 2. Blown power supply fuse. 	<ol style="list-style-type: none"> 1. Check cables and connections. 2. Check for the cause of the blown fuse and replace the fuse.
An antenna is connected but no signals are heard.	<ol style="list-style-type: none"> 1. FIX SW is turned ON. 2. Microphone PTT switch (or stand-by switch) is in the transmit position. 	<ol style="list-style-type: none"> 1. Turn the FIX SW off. 2. Release the PTT switch.
An antenna is connected but S-meter deflects without a received signal.	<ol style="list-style-type: none"> 1. RF GAIN control closed. 2. Low AC line voltage. 	<ol style="list-style-type: none"> 1. Open RF GAIN control. 2. Use a step-up transformer to raise the line voltage.
SSB signal unintelligible	MODE switch is set to wrong sideband.	Turn MODE switch to the correct sideband.
RIT control inoperative.	RIT switch is off.	Push RIT button.
SSB received signal is extremely high cut or low cut.	<ol style="list-style-type: none"> 1. IF shift is out of adjustment. 2. VBT is out of adjustment. 3. TONE control is out of adjustment. 	<ol style="list-style-type: none"> 1. Set to the center (click) position. 2. Set to the NORMAL position. 3. Set to the center position.

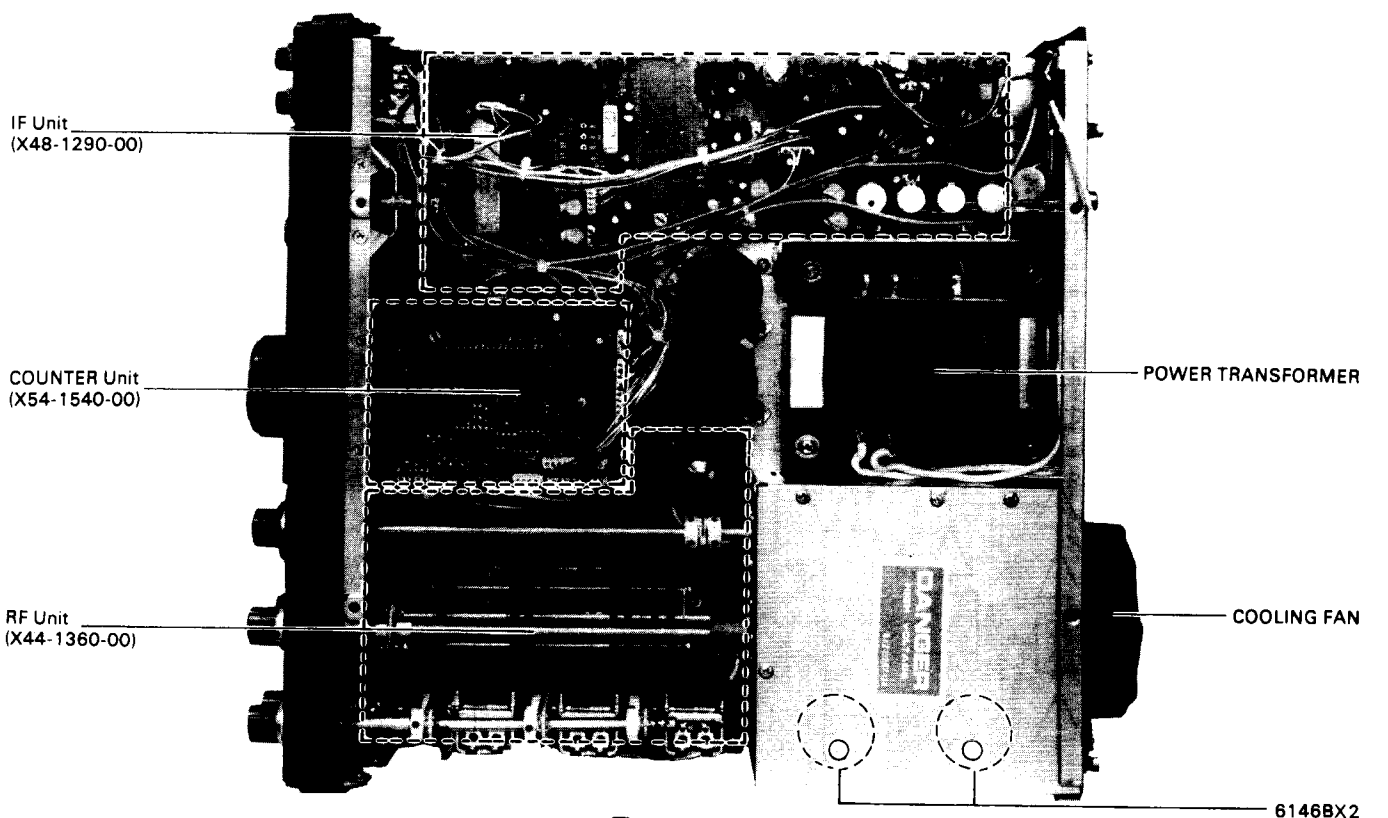
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INTERNAL VIEW



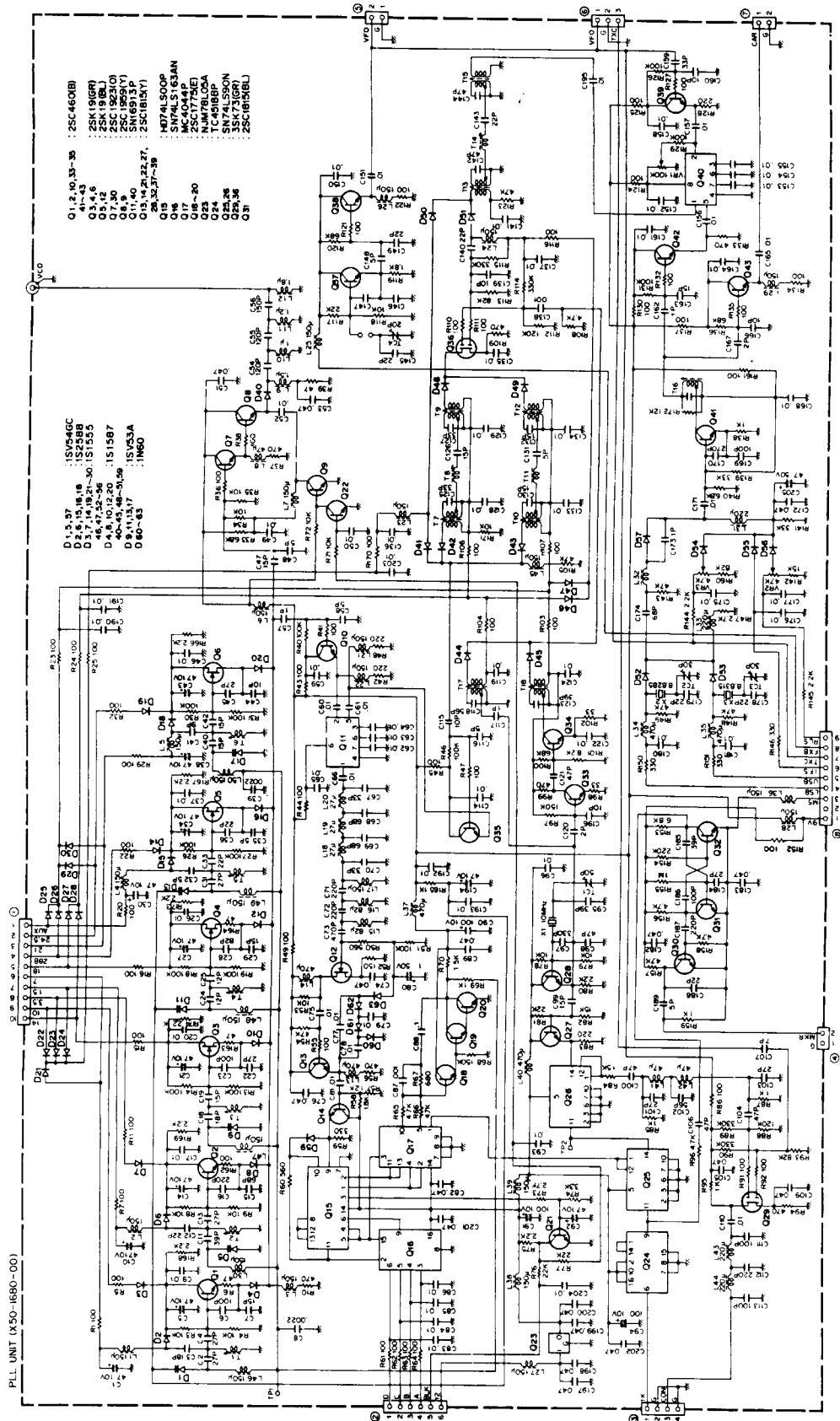
Bottom View



Top View

TS-830S SCHEMATIC DIAGRAM

PLL UNIT (X50-1680-00)



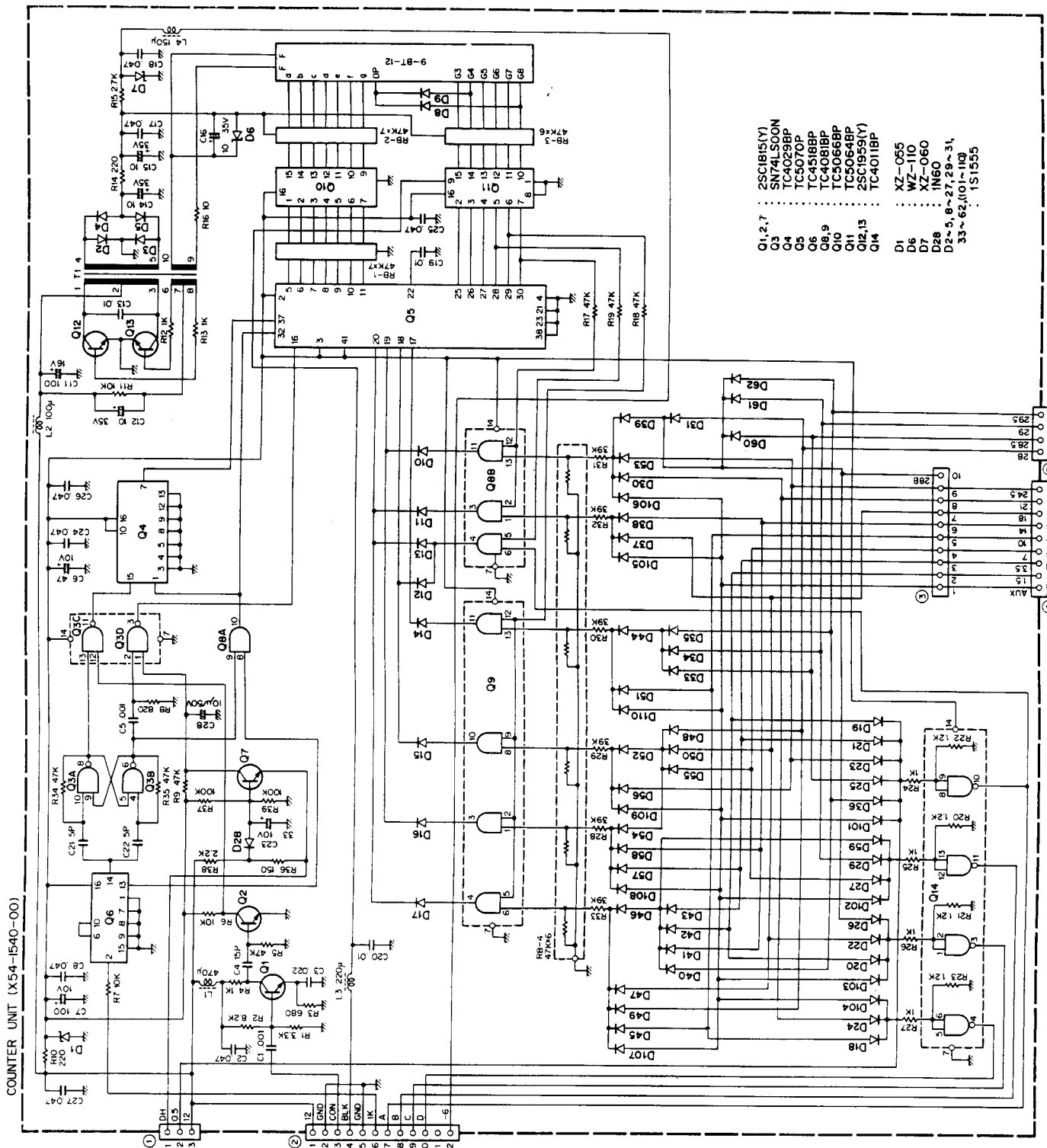
- Q1, 2, 10, 15-30 : 2SC460(B)
- Q3, 4, 6 : 2SK19(GR)
- Q5, 12 : 2SK19(BL)
- Q7, 30 : 2SC192(B)
- Q8, 23 : 2SC192(B)
- Q11, 40 : 2SC192(B)
- Q13, 14, 21, 22, 27, 28, 32, 37-39 : 2SC181(B)
- Q16 : 2SC181(B)
- Q17 : 2SC181(B)
- Q18 : 2SC181(B)
- Q19 : 2SC181(B)
- Q20 : 2SC181(B)
- Q21 : 2SC181(B)
- Q22 : 2SC181(B)
- Q24 : 2SC181(B)
- Q25, 26 : 2SC181(B)
- Q29, 36 : 2SC181(B)
- Q31 : 2SC181(B)

- D1, 5, 37 : 1S1544(C)
- D2, 6, 15, 16, 18 : 1S258(B)
- D3, 7, 14, 19, 21-30 : 1S155(5)
- D4, 8, 17, 32-36 : 1S156(7)
- D9-45, 48-50 : 1S156(7)
- D8, 9, 11, 13, 17 : 1S156(7)
- D80-83 : 1N60

PLL UNIT (X50-1680-00)

TS-830S SCHEMATIC DIAGRAM

COUNTER UNIT (X54-1540-00)

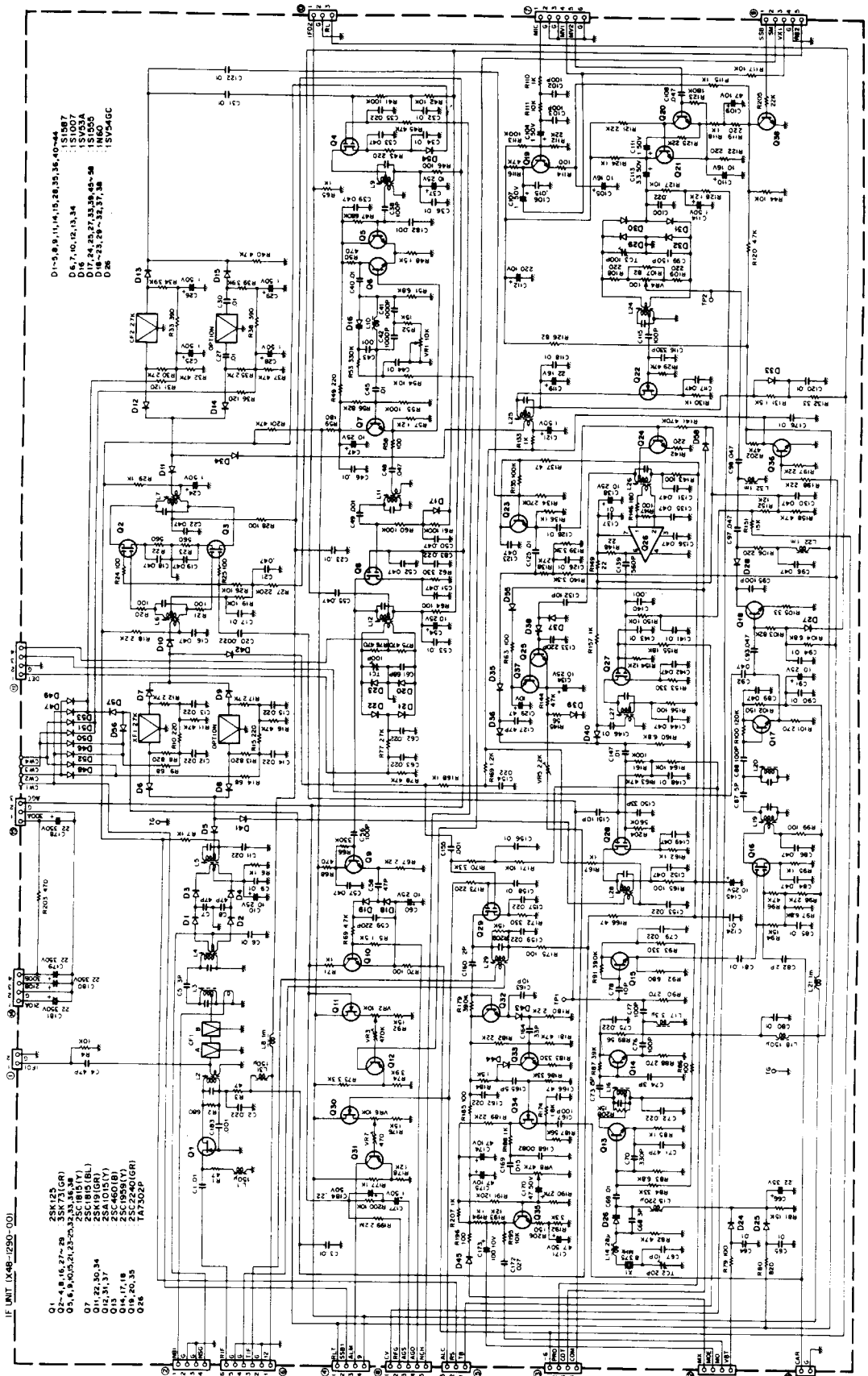


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TS-830S SCHEMATIC DIAGRAM

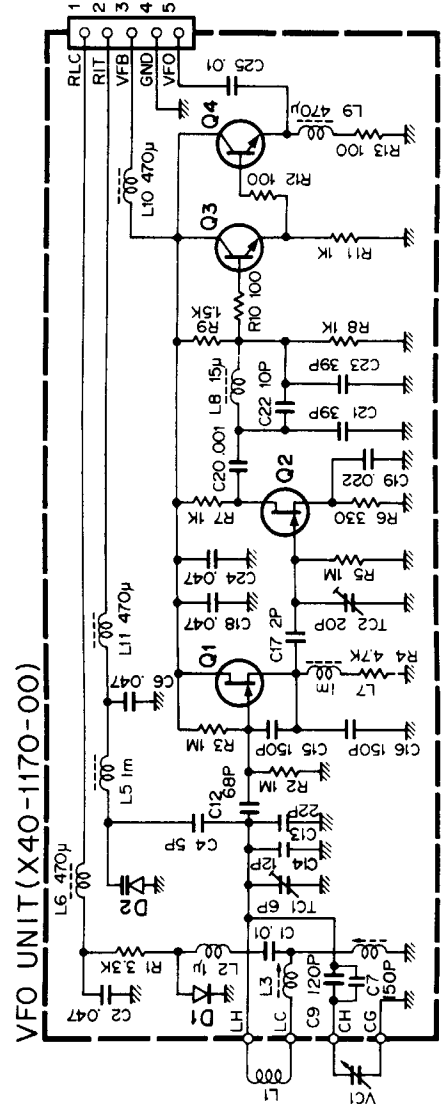
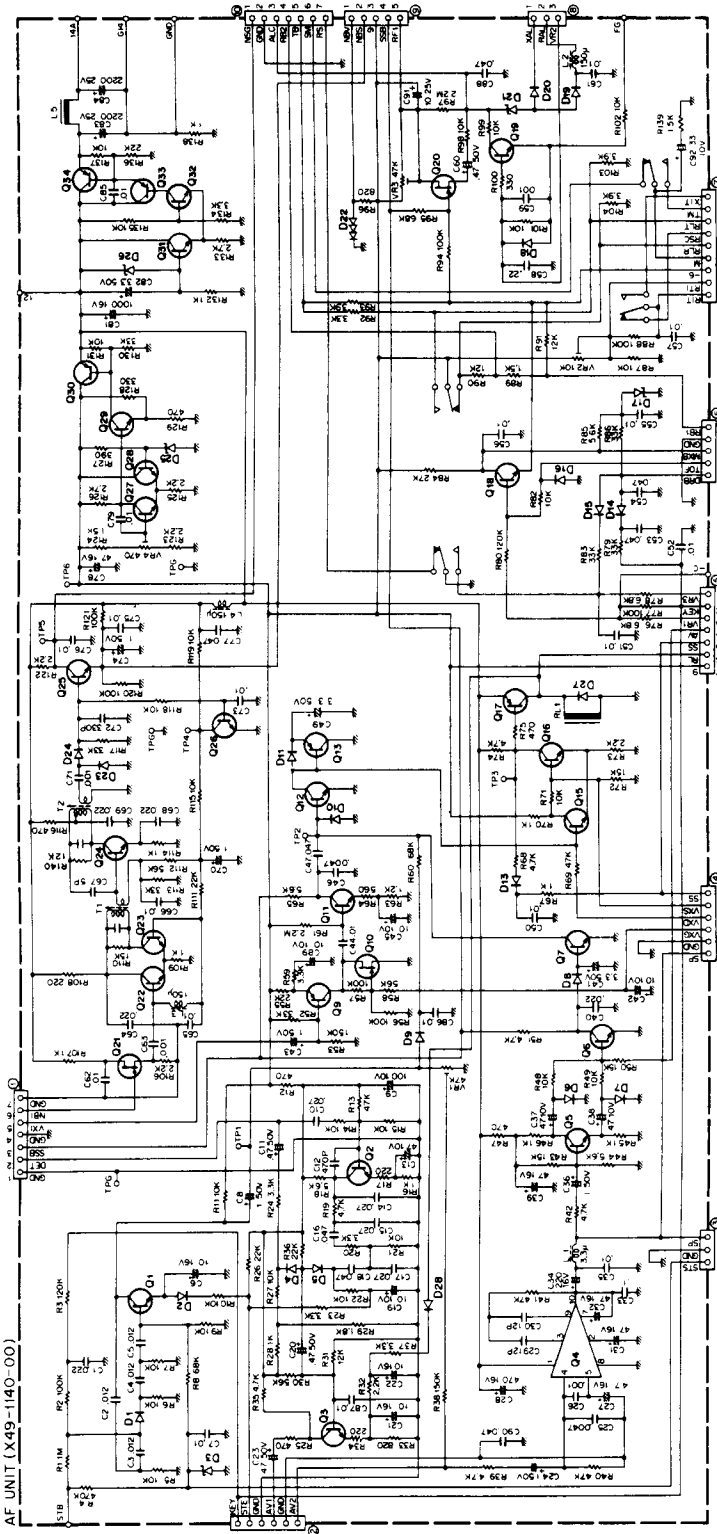
P IF UNIT (X48-1290-00)



TS-830S SCHEMATIC DIAGRAM

AF UNIT (X49-1140-00)

VFO UNIT (X40-1170-00)

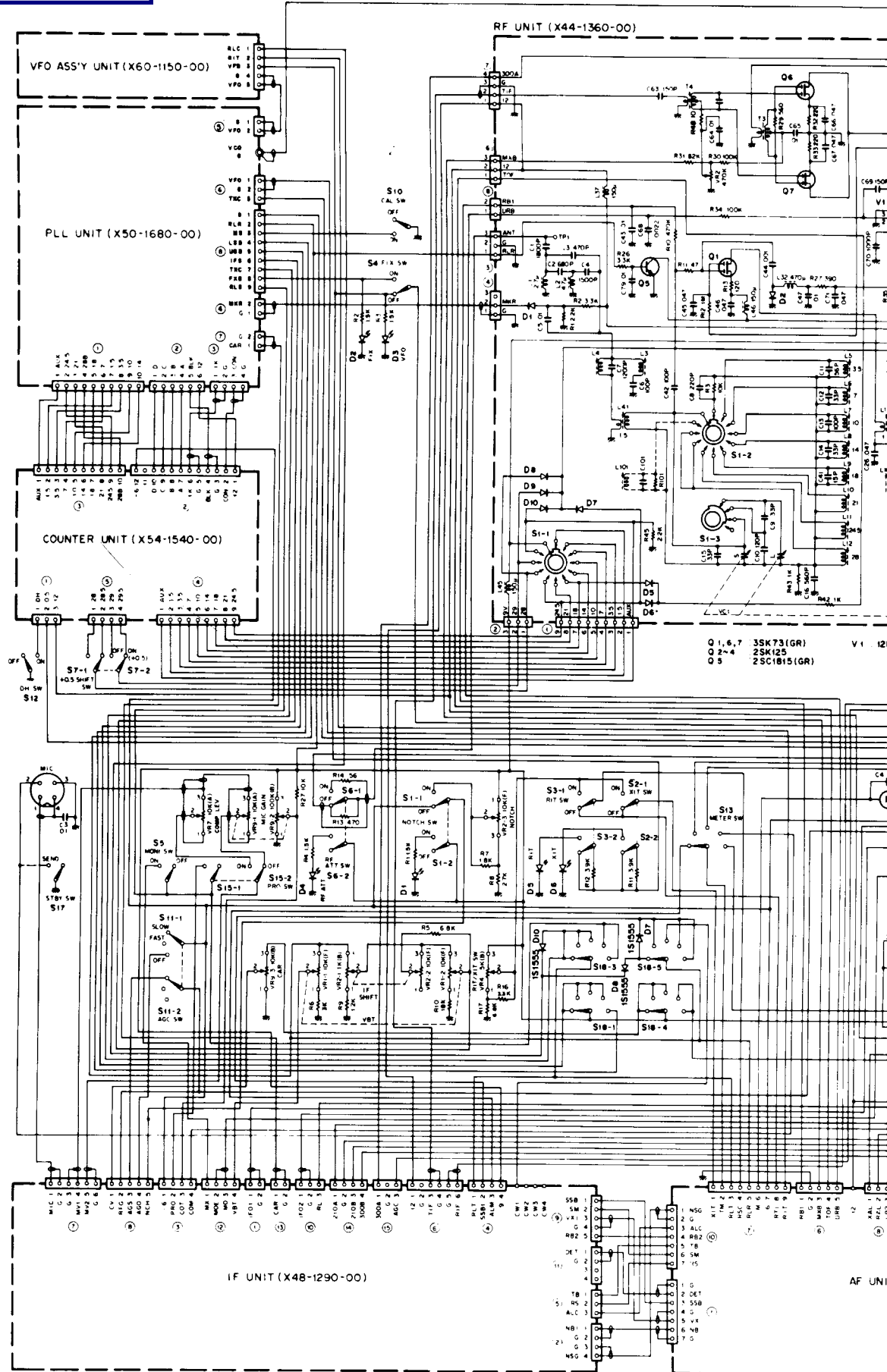


- Q1,2 ; 2SK19(Y) D1 ; 1S2588
- Q3 ; 2SC460(B) D2 ; 1SV53A
- Q4 ; 2SC1959(Y)

- Q1,5-8,11,12 2SC945(O)
- Q2,9 2SK30,32
- Q3 2SC2240(GR)
- Q4 HA1568R
- Q5 2SK301(O)
- Q6,13,15, 2SK301(O)
- Q7 2SC1815(GR)
- Q8 2SA562(Y)
- Q9 2SC1915(K)
- Q10 2SC460(B)
- Q11 2SA473(Y)
- Q12 2SK301A(GR)
- Q13 1S1955
- Q14 1S48,17,28 WZ-090
- D1,12,13,24 1N60
- D4,5,16,19,20 1N4001
- D6 1N4003
- D7 1N4004
- D8 1N4005
- D9 1N4006
- D10 1N4007
- D11 1N4008
- D12 1N4009
- D13 1N4010
- D14 1N4011
- D15 1N4012
- D16 1N4013
- D17 1N4014
- D18 1N4015
- D19 1N4016
- D20 1N4017
- D21 1N4018
- D22 1N4019
- D23 1N4020
- D24 1N4021
- D25 1N4022
- D26 1N4023

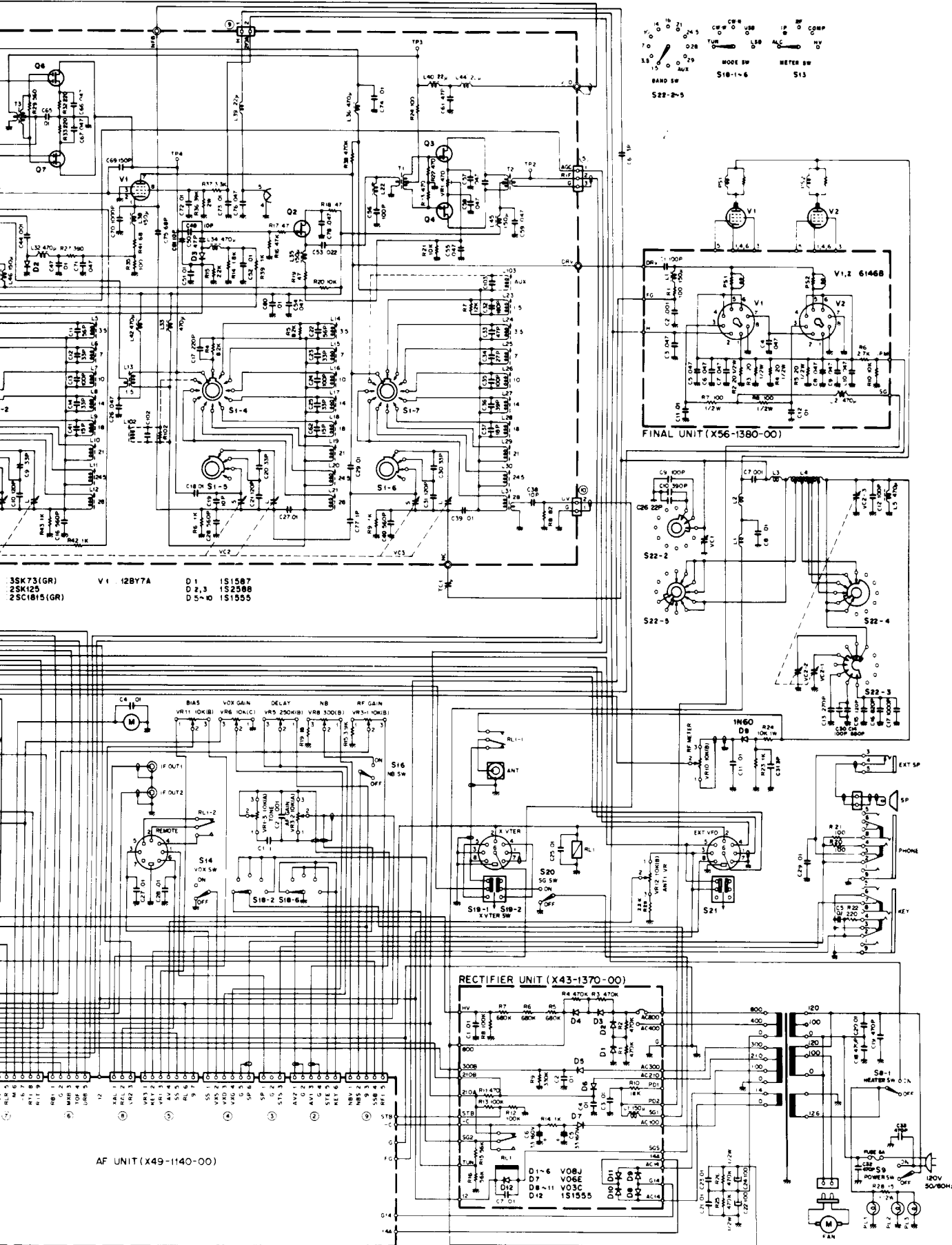
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Model TS-830S

Serial No. _____

Date of Purchase _____ / _____ / _____

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TRIO-KENWOOD CORPORATION

17-5, 2-chome, shibuya, shibuya-ku Tokyo 150, Japan

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