

**KENWOOD**

HF TRANSCEIVER

**TS-850S**

WZ5Z  
RPI-ARC

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**INSTRUCTION MANUAL**

KENWOOD CORPORATION

Thank you for purchasing this new transceiver.

**IMPORTANT**

Please read this Instruction Manual carefully before placing the transceiver in service.

**SAVE THIS INSTRUCTION MANUAL.**

The following explicit definitions apply in this manual:

**Note** : If disregarded, inconvenience only, no risk of equipment damage or personal injury.

**Caution** : Equipment damage may occur, but not personal injury.

This Instruction Manual covers the TS-850S, with and without AT (Automatic Antenna Tuner) unit. When there are differences in operation, separate instructions will be given for each model. Illustrations show the TS-850S with AT unit.

**Notice to the user:**

One or more of the following statements may be applicable to this equipment.

**FCC WARNING**

This equipment generates or uses radio frequency energy. Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved in the instruction manual. The user could lose the authority to operate this equipment if an unauthorized change or modification is made.

**Information to the digital device user required by the FCC:**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can generate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer for technical assistance.

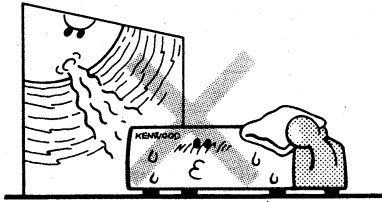
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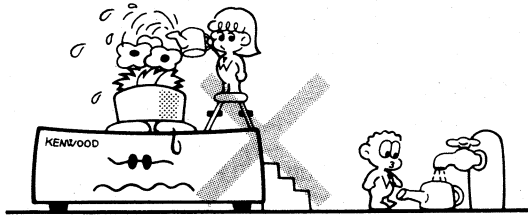
**1.  WARNING BEFORE OPERATION**

TO PREVENT ELECTRIC SHOCK, FIRE AND OTHER INJURY. PLEASE NOTE THE FOLLOWING:

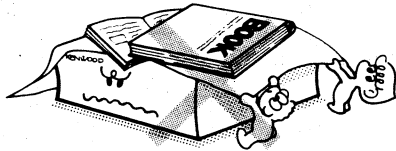
Do not place this unit, where it will be exposed to direct sunlight or close to heating appliances.



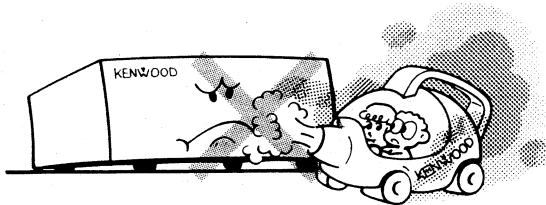
Do not place anything on top of the cabinet.



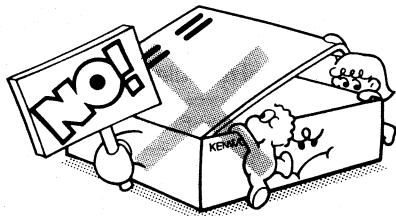
To ensure good ventilation, do not put anything on top of the cabinet and allow at least 15 cm (6 inches) of space behind the unit.



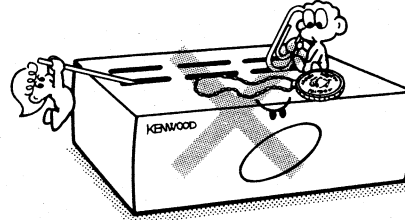
Do not place the unit in areas of excessive dust, high humidity or on unstable surfaces.



To avoid risk of electric shock, under no circumstances should the unit be opened:

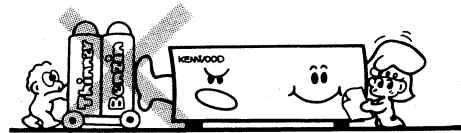


Do not drop pieces of metal, needles, coins and other electrically conductive materials into the unit.



**CLEANING**

1. Turn the power off, before cleaning the unit.
2. Do not use any type of abrasive pad, thinner, benzene or any substances which may damage the unit.
3. Wipe the front panel and other exterior surfaces of the unit with a soft dry cloth or a soft cloth lightly moistened with water.



## 2. SPECIFICATIONS AND ACCESSORIES

### 2-1. SPECIFICATIONS

Specifications		Model	TS-850S				
General	Mode		J3E(LSB, USB), A1A(CW), A3E(AM), F3E(FM), F1A(FSK)				
	Memory Channels		100				
	Antenna impedance		50 ohms With AT-850 Antenna Tuner 20~150 ohms				
	Power requirement		12 to 16 VDC (13.8 VDC reference)				
	Grounding		Negative				
	Current drain	Receive mode with no input signal	2A				
		Transmit mode	20.5A				
	Operating temperature		-10°C to +50°C (+14°F to +122°F)				
	Frequency stability		Less than ±10 PPM				
	Frequency accuracy		Less than ±10 PPM				
	Dimensions [W×H×D] (Projections included)		339×135×375mm (13-11/32"×5-5/16"×14-3/4")				
	Weight	With AT unit		10.9kg (24lbs)			
		Without AT unit		9.4kg (20.7lbs)			
Transmitter	Frequency range		160m band	1.8	to	2.0	MHz
			80m band	3.5	to	4.0	MHz
			40m band	7.0	to	7.3	MHz
			30m band	10.1	to	10.15	MHz
			20m band	14.0	to	14.35	MHz
			17m band	18.068	to	18.168	MHz
			15m band	21.0	to	21.45	MHz
			12m band	24.89	to	24.99	MHz
	10m band	28.0	to	29.7	MHz		
	Output power		SSB, CW, FSK, FM	MAX	100W**		
MIN				20W			
AM			MAX	40W			
			MIN	10W			
Modulation		SSB		Balanced modulation			
		FM		Reactance modulation			
		AM		Low level modulation			
Spurious radiation		Less than -60dB					
Carrier suppression (with 1.5kHz reference)		More than 40dB					



Specifications		Model	TS-850S	
Transmitter	Unwanted sideband suppression (with 1.5kHz reference)		More than 40dB	
	Maximum frequency deviation (FM)		Less than $\pm 5$ kHz	
	Frequency response ( $-6$ dB)		400 to 2600Hz	
	XIT variable range	10 Hz step	More than $\pm 1.2$ kHz	
		20 Hz step	More than $\pm 2.4$ kHz	
Microphone impedance		600 $\Omega$		
Receiver	Circuitry		Triple conversion superheterodyne	
	Frequency range		100kHz to 30MHz	
	Intermediate frequency		1st : 73.05MHz, 2nd : 8.83MHz, 3rd : 455kHz	
	Sensitivity	SSB, CW, FSK (at 10dB S + N/N)	100kHz~500kHz	Less than 0.2 $\mu$ V
			500kHz~1.62MHz*	Less than 4 $\mu$ V
			*1.62MHz~24.5MHz	Less than 0.2 $\mu$ V
			24.5MHz~30MHz	Less than 0.13 $\mu$ V
		AM (at 10dB S + N/N)	100kHz~500kHz	Less than 2 $\mu$ V
			500kHz~1.62MHz*	Less than 32 $\mu$ V
			*1.62MHz~24.5MHz	Less than 2 $\mu$ V
			24.5MHz~30MHz	Less than 1.3 $\mu$ V
	FM (at 12dB SINAD)	28MHz~30MHz	Less than 0.25 $\mu$ V	
	Selectivity	SSB, CW, FSK		$-6$ dB:2.4kHz, $-60$ dB:3.8kHz
		AM		$-6$ dB:6kHz, $-60$ dB:15kHz
		FM		$-6$ dB:12kHz, $-60$ dB:24kHz
	Image ratio		More than 80dB	
	1st IF rejection		More than 80dB	
Notch filter attenuation		More than 40dB		
RIT variable range	10 Hz step	More than $\pm 1.2$ kHz		
	20 Hz step	More than $\pm 2.4$ kHz		
Squelch sensitivity	SSB, CW, FSK, AM	100kHz~500kHz	Less than 2 $\mu$ V	
		500kHz~1.62MHz*	Less than 20 $\mu$ V	
		*1.62MHz~30MHz	Less than 2 $\mu$ V	
	FM	28MHz~30MHz	Less than 0.25 $\mu$ V	
Output		1.5W across 8 ohms load (10% distortion)		
Output load impedance		8 ohms		

**Notes**

1. Circuit and ratings are subject to change without notice due to advancements in technology.
2. Remember to keep the transmit output power within the power limitations of your license.
3. \* : The U.S.A. version is 1.705 MHz.
4. \*\* : With auto antenna tuner in "THRU" or bypass position.

## 2-2. ACCESSORIES

Unpack your TS-850S carefully and confirm that it is supplied with the following accessories.

Dynamic microphone	T91-0352-15	1 ea.
DIN plug (7-pin)	E07-0751-05	1 ea.
DIN plug (13-pin)	E07-1351-05	1 ea.
DC power cable assembly	E30-3035-05	1 ea.
Calibration cable	E31-2154-05	1 ea.
Fuse (25A)	F51-0011-05	1 ea.
Fuse (3A)	F06-3026-05	1 ea.
External control Instruction Manual	B62-0065-XX	1 copy
Instruction Manual	B62-0061-XX	1 copy
Warranty card (U.S.A., Canada and Europe version only)		1 ea.

After unpacking

Shipping container:

Save the boxes and packing in the event your unit needs to be transported for remote operation, maintenance, or service.

### 3. INSTALLATION AND CONNECTION

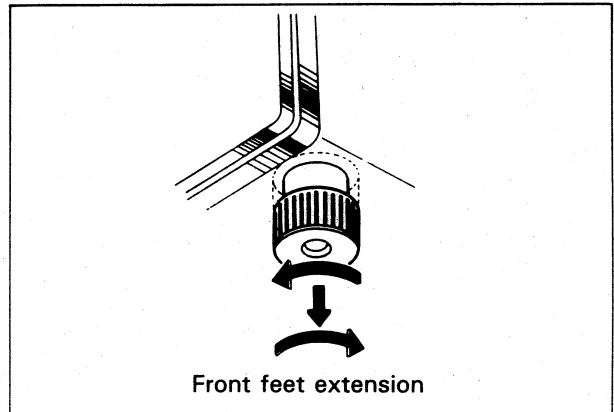
#### 3-1. INSTALLATION

##### ■FRONT FEET

By extending the front feet, the front panel can be elevated for operating convenience.

Turn the front foot left and pull down.

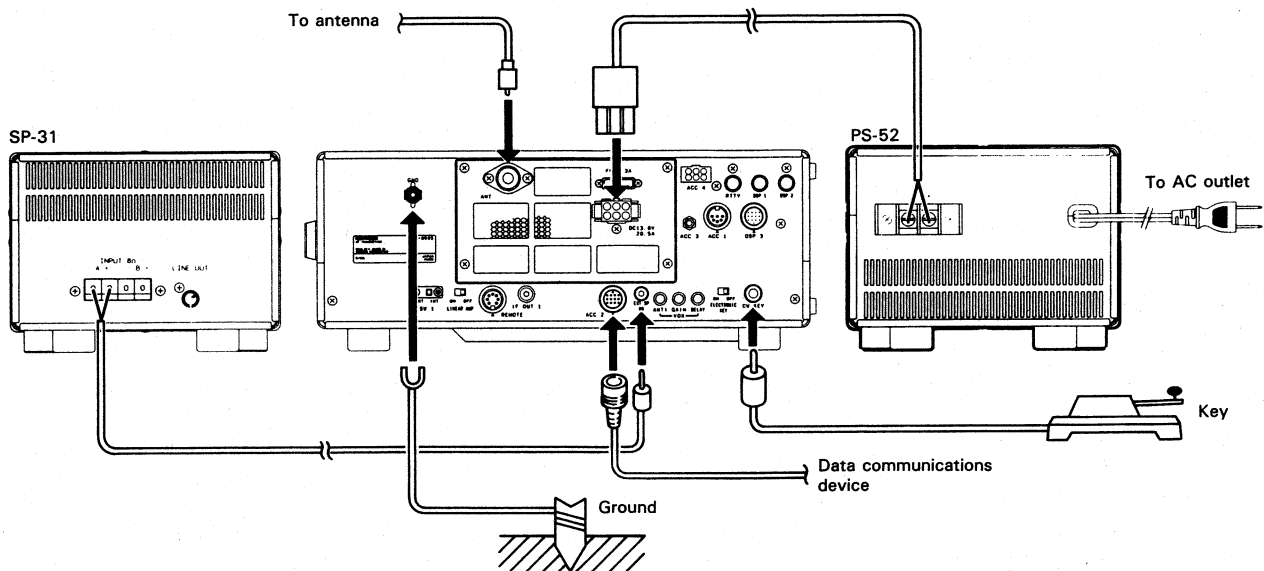
Then turn right to lock.



#### 3-2. CONNECTION

The TS-850S requires more than 20.5 A at 13.8 VDC when transmitting at full power. Use the PS-52 power supply for fixed station operation.

##### A. Rear Panel



(1) Antenna

**Caution**  
Protect your equipment — Use a LIGHTNING ARRESTER.

The type of antenna that is used will greatly affect the performance of the transceiver. Use a properly adjusted antenna, of good quality, to enable your transceiver to perform at its best. The antenna input impedance is 50 ohms. Use 50-ohm coaxial cable such as 5D-2V or RG-213/U (RG-8A/U) for this connection. If the antenna is far from the transceiver the use of low loss coaxial cable, such as 5D-2V or RG-213/U (RG-8A/U) are recommended. Match the impedance of the coaxial cable and that of the antenna so that the SWR is less than 1.5 to 1. The protection circuit in the transceiver will activate if the SWR is particularly poor (greater than 3 to 1). High SWR value will cause transmitter output to drop, and may lead to TVI or BCI reports.

(2) Grounding

**Caution**  
Never use a gas pipe or electrical conduit pipe.

**Notes**

1. A ground connection that is a 1/4 wavelength or its multiple may provide a good DC ground, but it will not provide a good RF ground.
2. A city water pipe cannot be used as a good earth in some cases.

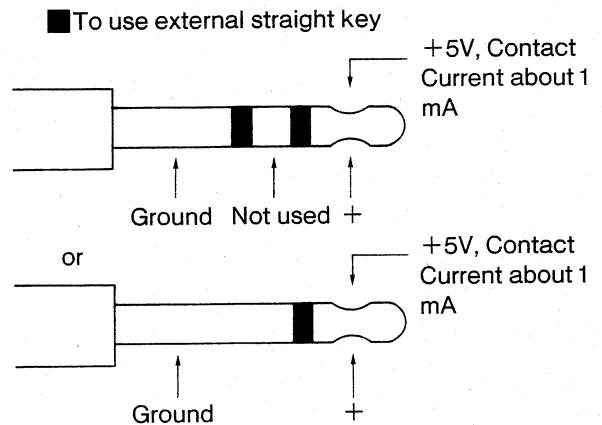
Making a good earth connection is important for preventing dangers such as electric shock and for emitting a high quality signal with minimum spurious radiation. Bury a commercially available ground rod or copper plate under the ground and connect it to the GND terminal. A thick wire, cut as short as possible, should be used for the connection. To make a good earth connection, connect the GND terminal to a grounded metal water pipe.

(3) External speaker

The TS-850S includes a built-in speaker. If you would like to use an external speaker, such as the SP-31, it may be connected to the EXT SP jack on the rear of the transceiver. The speaker may be any good 8 ohm permanent magnet type speaker. The diameter should be at least 4 inches for good audio quality. If you plan on using a speaker other than the SP-31 it should be equipped with a miniature phone jack plug. (diameter 3.5 mm)

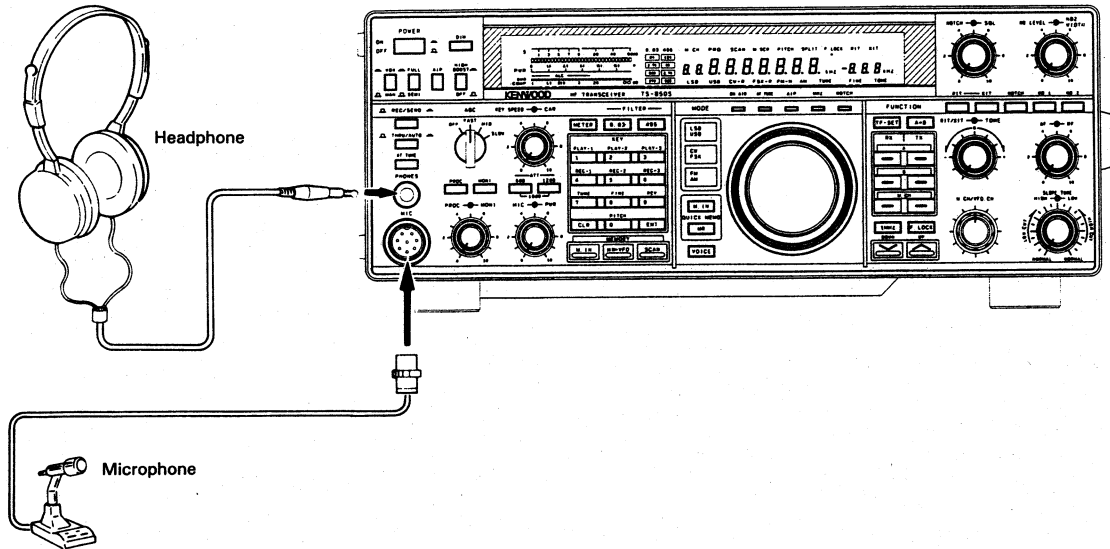
(4) Key connection

Your key should be connected as illustrated in the figure below. When using an electronic keyer, make sure that polarity is set for positive. Always use shielded line from the key to transceiver. (diameter 6.0 mm)



**Note**  
Check the polarity of the plug when you use an electronic keyer.  
Please refer to Section 4-4.

## B. Front Panel



### (1) Headphones

Any low-impedance (4-16 ohms) headphone may be used with the transceiver. Connect the headphones to the front panel PHONES jack. (diameter 6.0 mm). The optional HS-5 or HS-6 headphones are best suited for use with the transceiver. Stereo type headphones can also be used.

### (2) Microphones

Any microphone with an impedance to 600 $\Omega$  may be used with this transceiver. The KENWOOD microphones MC-43S (handheld), MC-60A, MC-80, MC-85 (table-top type) are recommended.

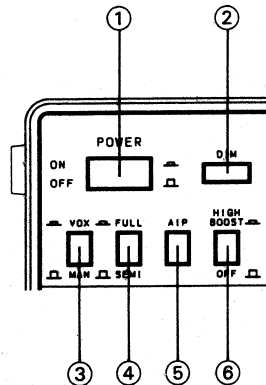
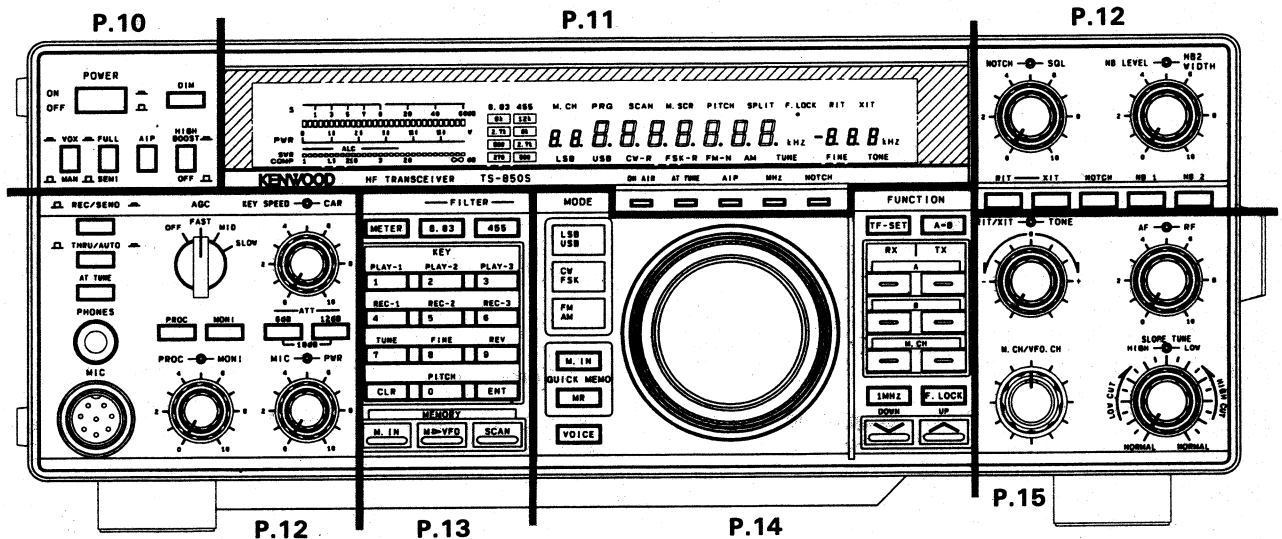
## 4. OPERATION

### 4-1. OPERATING CONTROLS

#### 4-1-1. Front Panel

#### Note

When switching on the power after a prolonged period of non-use, several seconds may pass before indicators appear on the display. This is normal operation.



#### ① POWER switch

Press to turn the power ON or OFF.

#### ② DIM (Dimmer) switch

Selects the intensity of both the digital display and the meter illumination, bright or dim.

#### ③ VOX/MAN switch

VOX (Voice Operated Switch) operation is possible in SSB, AM or FM operations. Break-in operation is possible in CW operation. To activate the VOX circuitry place the VOX switch ON (▲).

#### ④ FULL/SEMI (Break-in) switch

This switch affects the transmit/receive recovery time. In the SEMI position the transceiver will key when the key is depressed and remain in the transmit position until a preset delay has been reached. In the FULL position the transceiver will return to receive as soon as the key is released, thus allowing you to copy incoming signals between characters.

#### ⑤ AIP (Advanced Intercept Point) switch

Use AIP when good signal reception can not be obtained. When switched on, it reduces interference from strong signals.

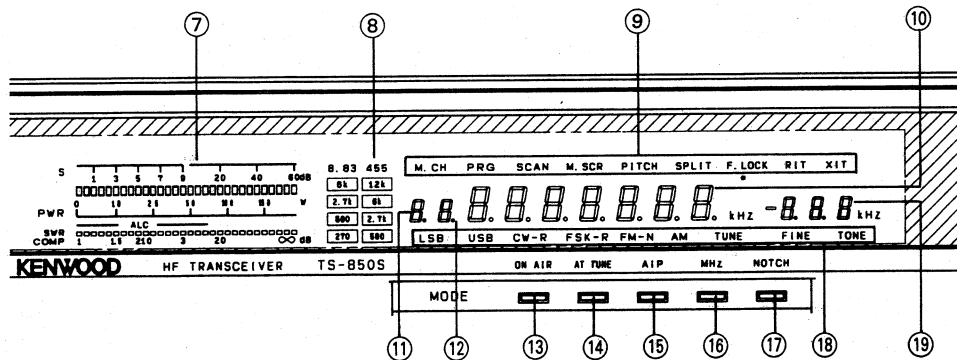
When the frequency falls below 9.5 MHz, initialization takes place automatically.

#### Note

When AIP is on, the sensitivity of the receiver is reduced about 10 dB.

#### ⑥ HIGH BOOST switch

The high-frequencies of the transmit audio signal are emphasized. Intelligibility may be improved, depending on the characteristics of the microphone and atmospheric conditions.



**⑦ Meter**

During receive the meter is used as an S-meter. During transmit the meter is used as a POWER meter, and is controlled by the METER key, and provides either VSWR, COMP level or ALC level readings.

The meter can be used as a peak hold meter. (Please refer to Section 4-10-15.)

**Note**

One or two segments of the S meter may light when there is no signal, due to atmospheric noise.

**⑧ Filter indicators**

Indicates which filters have been selected.

**⑨ M.CH (Memory channel) display**

Turns ON during a Memory Channel operation.

**PRG (Program) display**

Lights during selection or operation on memory channels 90 to 99.

**SCAN display**

Turns ON during scanning.

**M.SCR (Memory scroll) display**

Lights when the M.IN key is pressed. When the memory scroll function is active you can review the contents of the memory channels without a loss of the incoming receive frequency.

**PITCH display**

Lights when the PITCH function is ON.

**SPLIT display**

Turns ON during split operation.

**F.LOCK display**

Lights when the F.LOCK key is ON.

**RIT display**

Turns ON when using RIT.

**XIT display**

Turns ON when using XIT.

**⑩ Frequency display**

Indicates the operating frequency. The 10 Hz digit may be suppressed. (Please refer to Section 4-10-15.)

**⑪ Memory Channel number display**

Memory Channel Number is displayed.

**⑫ Memory Channel Lockout Indicator**

The ● display indicates the Memory Channel currently in the display will be skipped during Memory Channel scan.

**⑬ ON AIR indicator**

Lights during transmit.

**⑭ AT TUNE (Antenna Tuner) indicator**

Lights to show that the automatic antenna tuner is in operation. Do not attempt to operate further until it goes off.

**⑮ AIP (Advanced Intercept Point) indicator**

Lights when the AIP switch is ON.

**⑯ MHz indicator**

Lights when the 1 MHz key is ON.

**⑰ NOTCH indicator**

Lights when the NOTCH switch is ON.

**⑱ LSB indicator**

Indicates the LSB has been selected.

**USB indicator**

Indicates the USB has been selected.

**CW indicator**

Indicates the CW has been selected.

**CW-R indicator**

Indicates the CW-R (Reverse) has been selected.

**FSK indicator**

Indicates the FSK has been selected.

**FSK-R indicator**

Indicates the FSK-R (Reverse) has been selected.

**FM indicator**

Indicates the FM has been selected.

**FM-N indicator**

Indicates the FM-N (narrow) has been selected.

**AM indicator**

Indicates the AM has been selected.

**TUNE indicator**

Indicates the TUNE has been selected.

**FINE indicator**

Indicates the FINE tuning has been selected.

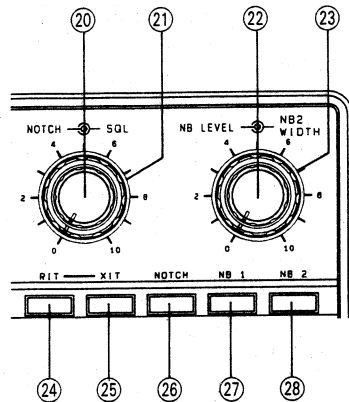
**TONE indicator**

Indicates the TONE function has been selected.

⑲ RIT/XIT frequency display

Shows the amount of RIT/XIT offset to the nearest 10 Hz. Minus “-” appears in the display when the RIT / XIT offset is below the transmit / receive frequency.

Shows the scan speed during scanning.



⑳ NOTCH control

The NOTCH function is used to reduce or eliminate heterodyne, or CW type signals. The NOTCH filter will not be effective against SSB, AM or FM type signals.

㉑ SQL (Squelch) control

This control is used to eliminate atmospheric noise, and receiver static noise during no signal periods. Slowly rotate the control clockwise to the point where the ambient noise just disappears, and the speaker shuts off. This point is known as the squelch threshold point. Now you will only hear output from the speaker when an incoming signal is present. For weak signal reception this control should be fully counterclockwise.

㉒ NB LEVEL control

Controls the noise blanker operating level. Use only the minimum level necessary.

㉓ NB2 WIDTH control

This control varies the width of the blanking pulse of NB2.

Notes

1. The NB2 control only works on woodpecker type noise.
2. If the control is turned too far, the received signal may be distorted. Set the control for the best receive signal.

㉔ RIT switch

Press to turn the RIT ON or OFF.

㉕ XIT switch

Press to turn the XIT ON or OFF.

㉖ NOTCH switch

When this switch is ON, the notch filter is activated.

Note

This switch is disabled during FM operation.

㉗ NB 1 switch

For pulse type noise, such as generated by automotive ignition systems, turn the NB 1 switch ON.

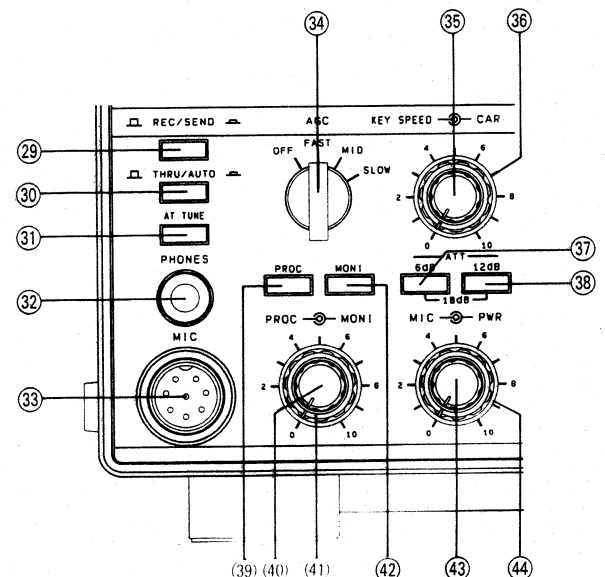
This switch will not help to eliminate atmospheric or line noises, only pulse type noise.

㉘ NB 2 switch

Noise blanker 2 is used for long duration pulse noise, like the “woodpecker”. To reduce “woodpecker” radar noise interference, set switch NB 2 to the ON position (NB 2’s effectiveness depends on the specific type of interference). If you use NB 2 for short duration pulse noise, the receive signal may become distorted, making it difficult to hear.

Unfortunately no noise blanker can remove all different types of interference; but the two noise blankers that have been provided in the TS-850 are effective in most cases.

If there is no “woodpecker” present, the switch should be in the OFF position.



㉙ REC/SEND switch

This switch is used when you want to manually control transmit or receive.

REC : Places the transceiver into receive.

SEND : Places the transceiver into transmit.

㉚ THRU/AUTO switch

THRU : The auto antenna tuner is not used in transmit.

AUTO : The auto antenna tuner is used in transmit.

㉛ AT TUNE switch

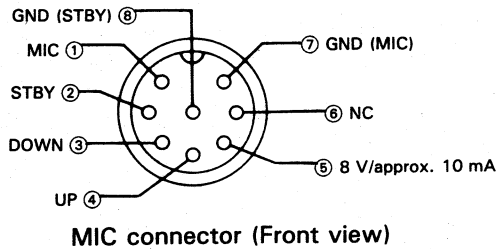
When this switch is tuned ON and the THRU/AUTO switch is placed in the AUTO position, the automatic



tuner will be engaged and the tuner will try to match the antenna.

③② PHONES jack  
Output terminal for headphones.

③③ MIC jack  
Microphone connection.



③④ AGC switch  
This switch selects the operating time constant of the AGC (Automatic Gain Control) circuit. When the AGC switch is set to SLOW, the receiver gain and S-meter readings will react slowly to large input changes, and when set to FAST, the receiver gain and S-meter will react quickly to changes in the input signal level.

The normal position when using all modes is the SLOW position. When working any of the following you might wish to use the FAST position.

- When tuning rapidly, use the FAST position.
- When receiving weak signals.
- When a high-speed CW signal is being received.

Note  
This switch is disabled during FM operation.

③⑤ KEY SPEED control  
This controls the speed of the electronic keyer. Turn the knob clockwise to increase speed.

③⑥ CAR (Carrier level) control  
Used to adjust carrier level during CW, AM and FSK.

③⑦ 6dB ATT (Attenuator) switch  
The incoming receive signal level is attenuated by approximately 6 dB when this switch is activated.

③⑧ 12dB ATT (Attenuator) switch  
The incoming receive signal level is attenuated by approximately 12 dB when this switch is activated.

The incoming receive signal level is attenuated by approximately 18 dB when both the 6 dB switch and 12 dB switch are activated.

This control is also useful when a strong signal is near your desired signal; while some loss will occur to the desired signal, as well as the undesired signal, the use of the attenuator will sometimes allow you to understand what is being received. For normal receiver performance, this switch should be in the OFF position.

③⑨ PROC (Processor) switch  
Effective transmit power output will increase when the PROC switch is turned ON during SSB mode operations.

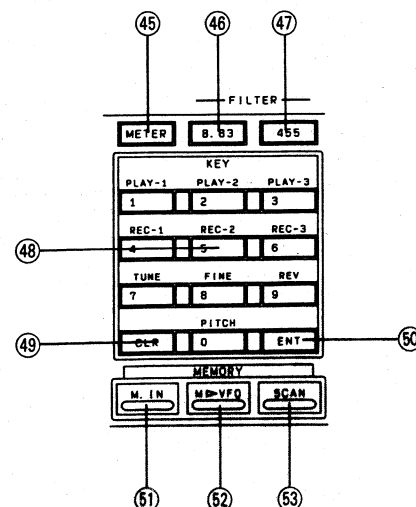
④① PROC (Processor) control  
Adjust the PROC control while speaking into the microphone in a normal tone of voice, for a peak COMP scale reading of no more than 10 dB. Do not overdrive the COMPRESSOR. Over driving the compressor will deteriorate voice quality, increase transmitter noise level, and in general make copying your signal more difficult.

④② MONI (Monitor) control  
This controls the volume of the transmit monitor. This control is operational in the SSB and FSK mode.

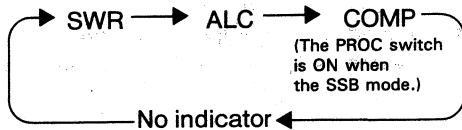
④③ MONI (Monitor) switch  
Allows monitoring of your transmit signal. This control is operational in the SSB and FSK mode.

④④ MIC gain control  
Microphone gain can be adjusted during SSB and AM operations. Gain is increased by turning the control clockwise.

④⑤ PWR (Power) control  
Power can be controlled in all modes. Power is increased by turning the control clockwise. Keep the transmit power within the output power limits of your license.



④⑤ METER key  
The meter function can be changed as follows during transmission.



**SWR** : Indicates voltage standing wave ratio (VSWR).

**ALC** : Indicates internal ALC voltage, or the ALC voltage fed back from a linear amplifier connected to this transceiver.

**COMP** : Indicates compression level during speech processor operations. Do not exceed 10 dB of compression. The PROC switch is ON when the SSB mode.

**④⑥ 8.83 FILTER key**

Selects the desired 8.83MHz filter regardless of mode.

**④⑦ 455 FILTER key**

Selects the desired 455kHz filter regardless of mode.

**④⑧ Numeric keypad**

Consists of a series of switches which will be used to set, turn on and/or turn off functions.

When used in conjunction with the ENT key, the keypad is used to directly enter a frequency.

When used in conjunction with the M.IN key, the keypad is used to enter data into a memory channel.

**PLAY, REC key**

Used to record and play voice or CW messages for transmission. (The optional DRU-2 digital recording unit is required.)

**TUNE key**

Sets the transmit power to half the rated power regardless of the position of the PWR control. Outputs a zero beat in CW receive mode. This key is useful when tuning a linear amplifier.

**FINE key**

Makes one turn of the tuning knob equal 1 kHz (1 Hz step) to facilitate precise tuning. When the key is pressed again, normal tuning returns.

**REV key**

The BFO uses USB for normal CW reception. With this key, reception becomes possible on LSB. The BFO uses LSB for normal FSK operation. With this key, reception becomes possible on USB. By pressing this key, reverse shift is also used for transmission.

**PITCH key**

Press to turn the PITCH function ON or OFF.

**④⑨ CLR (Clear) key**

Used when reentering memory channel data, erasing a memory channel, clearing scan, or when specifying the channels that will be skipped during scan operations.

**⑤① ENT (Enter) key**

Used to directly enter a frequency from the numeric keypad.

**⑤① M.IN key**

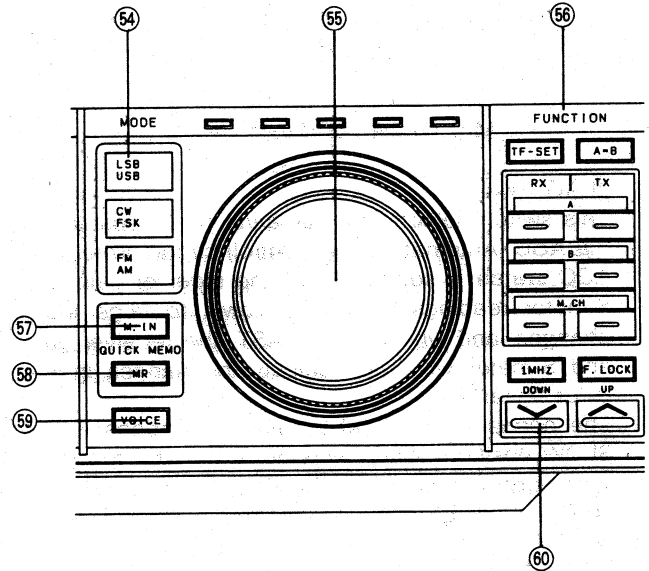
Used to enter data into a memory channel.

**⑤② M▶ VFO key**

Used to transfer a frequency from memory to the VFO.

**⑤③ SCAN key**

Pressing during VFO operation will initiate program scan, and pressing during memory operation will initiate memory scan.



**⑤④ MODE keys**

These keys are used to select the desired mode of operation. When a MODE key is pressed the first character of that mode will be sounded in Morse code thru the internal speaker.

**LSB/USB key**

Press the LSB/USB key to alternate between LSB and USB mode.

**CW/FSK key**

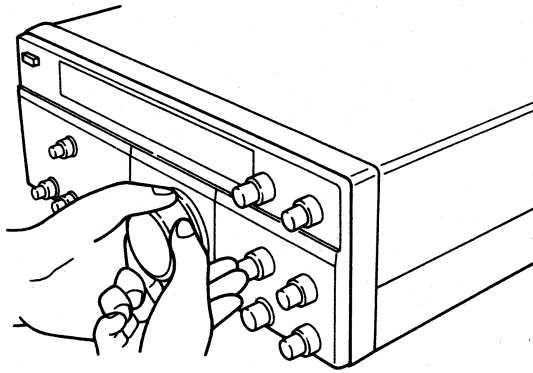
Press the CW/FSK key to alternate between CW (R) and FSK(R) mode.

**FM/AM key**

Press the FM/AM key to alternate between FM(N) and AM mode.

**⑤⑤ TUNING knob (VFO)**

Rotate the knob to select the desired frequency. Fast tuning is possible by rotating the knob rapidly. The dial drag is adjustable by holding the outside knob and turning the inside knob clockwise to increase drag, and counterclockwise to decrease drag.



**56 FUNCTION keys**

**TF-SET key**

Depressing this key will allow you to rapidly set or check the transmit frequency, during SPLIT operations, without the need of actually transmitting.

**A=B key**

Equalizes the frequencies, modes and filter selection of VFO A and VFO B.

**A (VFO A) key**

RX: Press this key to receive signals on VFO A.

TX: Press this key to transmit signals on VFO A.

**B (VFO B) key**

RX: Press this key to receive signals on VFO B.

TX: Press this key to transmit signals on VFO B.

**M.CH (Memory Channel) key**

RX: Press this key to receive signals on the memory channel.

TX: Press this key to transmit signals on the memory channel.

**Note**

When just an RX key (VFO A, VFO B, or M.CH.) is pressed, the same VFO or memory channel is used for both reception and transmission. For split operation, select VFO A or VFO B for reception, and, for transmission, either select the other VFO or select TX M.CH.

**1MHz key**

This key is used to determine if the UP/DOWN switches will function in 1 MHz steps or only thru the amateur bands. When the 1 MHz step position is selected, the MHz indicator will light.

**F.LOCK key**

The selected dial frequency and mode are locked.

**Note**

When the F.LOCK key is on the TF-SET, FILTER, METER, VOICE keys, AIP, RIT, XIT switches and RIT/XIT control are still active.

**57 QUICK MEMO M.IN key**

This key writes data to the quick memory.

**58 QUICK MEMO MR key**

This key recalls the quick memory.

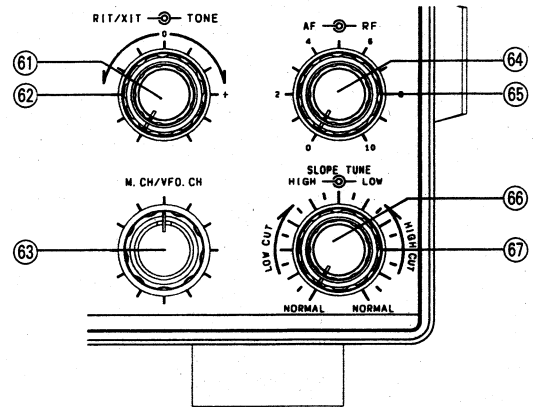
**59 VOICE key**

Press this key to activate the optional voice synthesizer unit VS-2.

**60 UP/DOWN switch**

Pressing the UP switch increases the frequency, and pressing the DOWN switch decreases it.

When the function setting at power on is on, this switch changes the setting.



**61 RIT/XIT control**

**RIT (Receiver Incremental Tuning)**

The RIT control allows shifting the receiver frequency. Use of the RIT control will not affect the transmit frequency.

When the RIT switch is ON, the RIT indicator will light, and the receive frequency can be adjusted by using the RIT control.

**Note**

When the RIT is ON the transmit frequency may be different from the receive frequency. For normal operation leave the RIT switch OFF. It should be used only when necessary.

The scan speed can be changed during scanning with the RIT control.

**XIT (Transmitter Incremental Tuning)**

XIT is very similar to RIT. XIT is only active in the transmit mode. By using the XIT function it is possible to offset the transmit frequency without the normal loss of receiver audio that is experienced when using the SPLIT function.

The RIT / XIT offset can be preset, without affecting the actual operating frequency by turning OFF the RIT/XIT and using the RIT/XIT display to determine the offset.

This is useful when working a DX station who is "split" within the XIT range.

The RIT / XIT step size is either 10 Hz or 20 Hz. Please refer to Section 4-10-15 for information on how to select the desired step size.

**62 TONE control**

Turn the control to increase or decrease the receiver audio tone.

The standard position is with the control turned fully clockwise. As the control is turned counterclockwise, high frequencies are cut.

③ M.CH/VFO CH control

This control is used to select the desired memory channel during Memory Channel Operation. This control is also used to change the frequency in 10 kHz steps during VFO operations. The control is also used to select the desired power on function you wish to change. See section 4-10-15.

④ AF gain control

Turn the knob to increase or decrease the volume. Clockwise rotation increases the volume and counterclockwise rotation decreases the volume.

**Note**

The output level of the "Beep" and "Sidetone" are not affected by adjusting of the AF gain control.

⑤ RF gain control

This control adjusts the gain of the receiver high-frequency amplifier section. For normal receiver performance, and maximum gain, this control should be all the way to the right. If you are having trouble copying the desired signal make a note of the stations peak S-meter reading. Then, adjust the RF gain control left, so that the meter needle is stationary at this level. Now, all signals that were less than the desired signal will be attenuated, such as static noise, etc., making reception easier.

If the incoming signal pegs the S-meter you can also reduce the receiver gain by moving the RF gain control to the left. The S-meter pointer will always advance up-scale as the RF gain control is moved, to indicate that the gain has been reduced.

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, move the RF gain control to the left so the meter pointer remains at about the original deflection peak and turn the AGC switch to the FAST position. This will reduce the unwanted AGC voltage and permit clear reception.

**Note**

This control is disabled during FM operation.

⑥ SLOPE TUNE HIGH CUT control

Adjust the HIGH CUT control counterclockwise, and interference from signals higher than the operating frequency will be reduced. The high-frequency components of the resulting receiver audio will also be reduced.

**Note**

This control is disabled during FM operation.

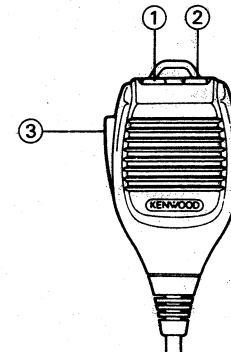
⑦ SLOPE TUNE LOW CUT control

Adjust the LOW CUT control clockwise, and interference from signals lower than the operating frequency will be reduced. As with the HIGH CUT control, use of the LOW CUT control will also affect the audio frequency passband. In this case the low frequency components of the audio signal will be reduced.

**Note**

This control is disabled during FM operation.

■ Microphone



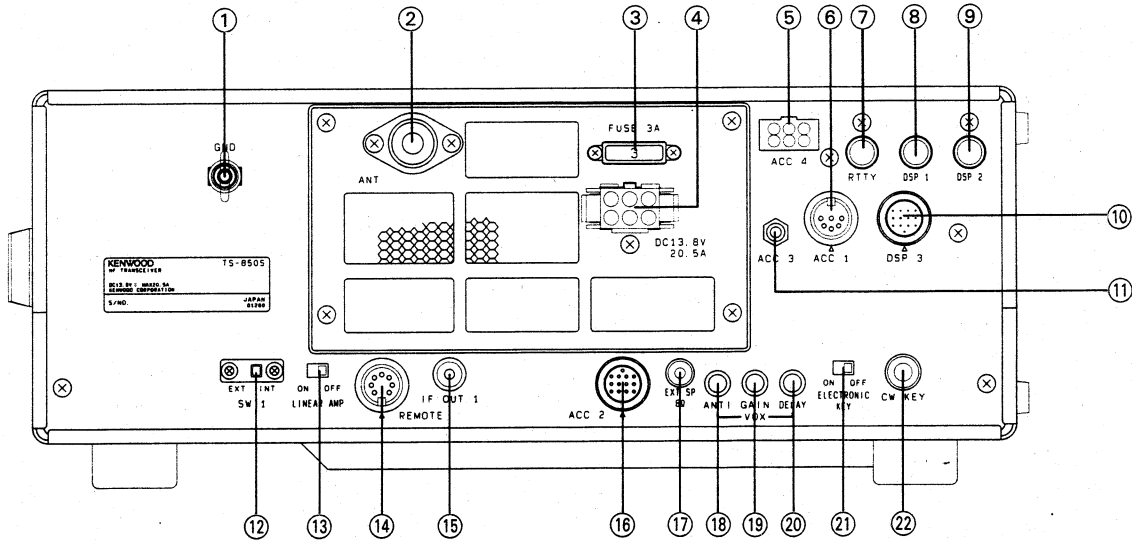
①② UP/DWN(Up/Down) switches

These switches are used to step the VFO frequency or memory channel up and down. The frequency will change continuously if the switches are pressed and held.

③ PTT (Push To Talk) switch

The transceiver will be placed into Transmit whenever this switch is pressed.

## 4-1-2. Rear Panel



### ① GND (Ground) terminal

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

### ② ANT (Antenna) connector

This connector should be attached to a suitable antenna for transmitting and receiving. The antenna cable should be 50-ohm coax, terminated with a PL-259 connector.

### ③ FUSE

Power fuse for the ACC 4 connector.

### ④ DC power connector

This is used to connect the DC power supply.

### ⑤ ACC 4 connector

The optional AT-300 may be connected here.

### ⑥ ACC 1 connector

The optional DSP-100 or the optional IF-232C is connected here.

### ⑦ RTTY terminal

For connection to an RTTY interface unit. (direct FSK keying) The terminal is equipped the short pin plug for the factory.

### ⑧ DSP 1 terminal

The optional DSP-100 is connected here.

### ⑨ DSP 2 terminal

The optional DSP-100 is connected here.

### ⑩ DSP 3 connector

The optional DSP-100 is connected here.

### ⑪ ACC 3 terminal

This is used to connect the remote controller.

### ⑫ SW 1 switch

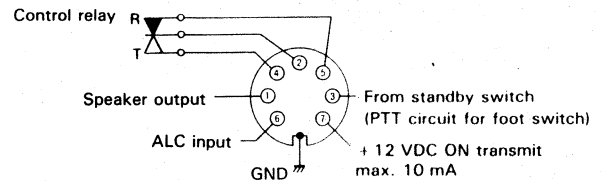
This transceiver has a cover on the back to protect against misoperation. To connect the external antenna tuner to this unit, remove the cover and slide switch SW1 to EXT. The built-in antenna tuner will then not operate.

### ⑬ LINEAR AMP switch

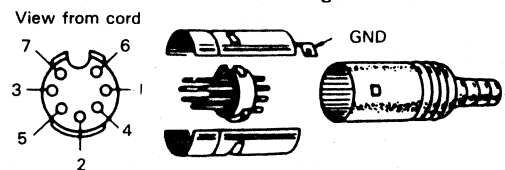
Activates the internal keying relay for linear amplifier control.

### ⑭ REMOTE connector

This connector is used when a linear amplifier is used.



### Internal wiring

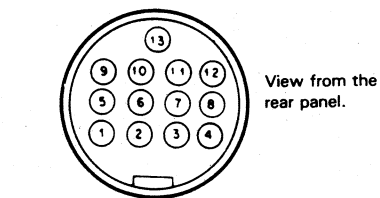


### ⑮ IF OUT 1 terminal

This terminal is for the band scope of the station monitor.

IF 1 is for connection to the SM-230 for Pan Display. (8.83 MHz)

⑩ ACC 2 connector  
Terminal numbers and their applications are as follows :



13-pin DIN plug (E07-1351-05)

ACC2 pin assignments

Pin number	Symbol	Use
1	NC	No connection
2	NC	No connection
3	ANO	The receiver audio at a fixed level independent of AF gain control setting. Output voltage : 300 mV / 4.7kΩ or more at high input level
4	GND	Grounding (The shielded wire of the audio output terminal is connected here.)
5	PSQ	This pin is used for connecting a TNC (Terminal Node Controller) for use with packet radio. It is the Squelch Control terminal and will not allow packet communications while squelch is off.
6	Output voltage pin for S-meter.	Output voltage varies with S-meter indication.
7	NC	No connection
8	GND	Grounding
9	PKS	This is the standby pin used exclusively for the terminal unit. When this pin is in use for standby, the microphone input is automatically shut off and the transmit is operational.
10	NC	No connection

ACC2 pin assignments

Pin number	Symbol	Use
11	PKD	This is the MIC (microphone) input pin from the terminal unit. The input level is approximately 20 mV.
12	GND	Grounding (The shielded wire of the audio output terminal is connected here.)
13	SS	Standby terminal. Grounding transmits.

⑰ EXT SP (External speaker) jack  
This jack is for connection of an external speaker.

⑱ ANTI control  
VOX operations are sometimes difficult with high speaker volume control settings. The ANTI control is used to reduce the tendency of the VOX to activate from inputs from the speaker. The ANTI control is not active when headphones are connected.

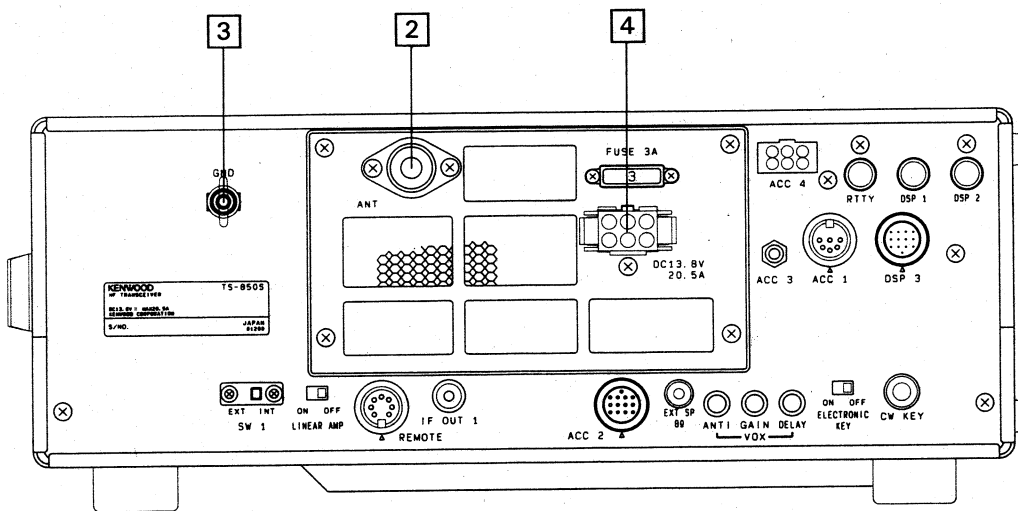
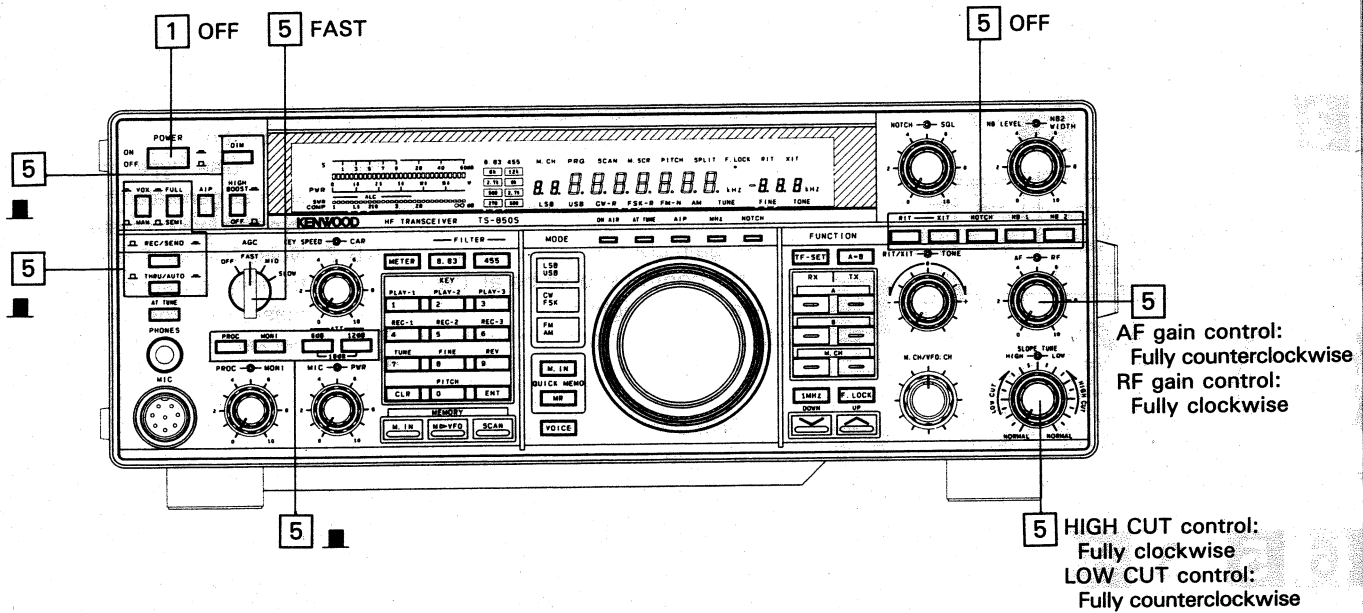
⑲ GAIN control  
This control adjusts the sensitivity of VOX amplifier. Adjust this control for your personal preference.

⑳ DELAY control  
This control adjusts how long the transceiver will remain keyed after voice input has stopped.

㉑ ELECTRONIC KEY switch  
Turns the electronic keyer on or off. Turn the switch off when CW is initiated by a straight key or when using an external electronic keyer.

㉒ CW KEY jack  
Using shielded line, connect a 6.0mm diameter phone plug to this jack for CW operation. Connect a paddle type key to the key jack use a 6.0mm diameter stereo plug. Open-terminal voltage is approximately 5 VDC. (See Section 4-4 for additional key information.)

## 4-2. INITIAL SETTING



Prior to operation ensure the following switches and controls are set as indicated in the figure below:

1 Ensure the POWER switch is OFF.

2 An antenna must be connected.

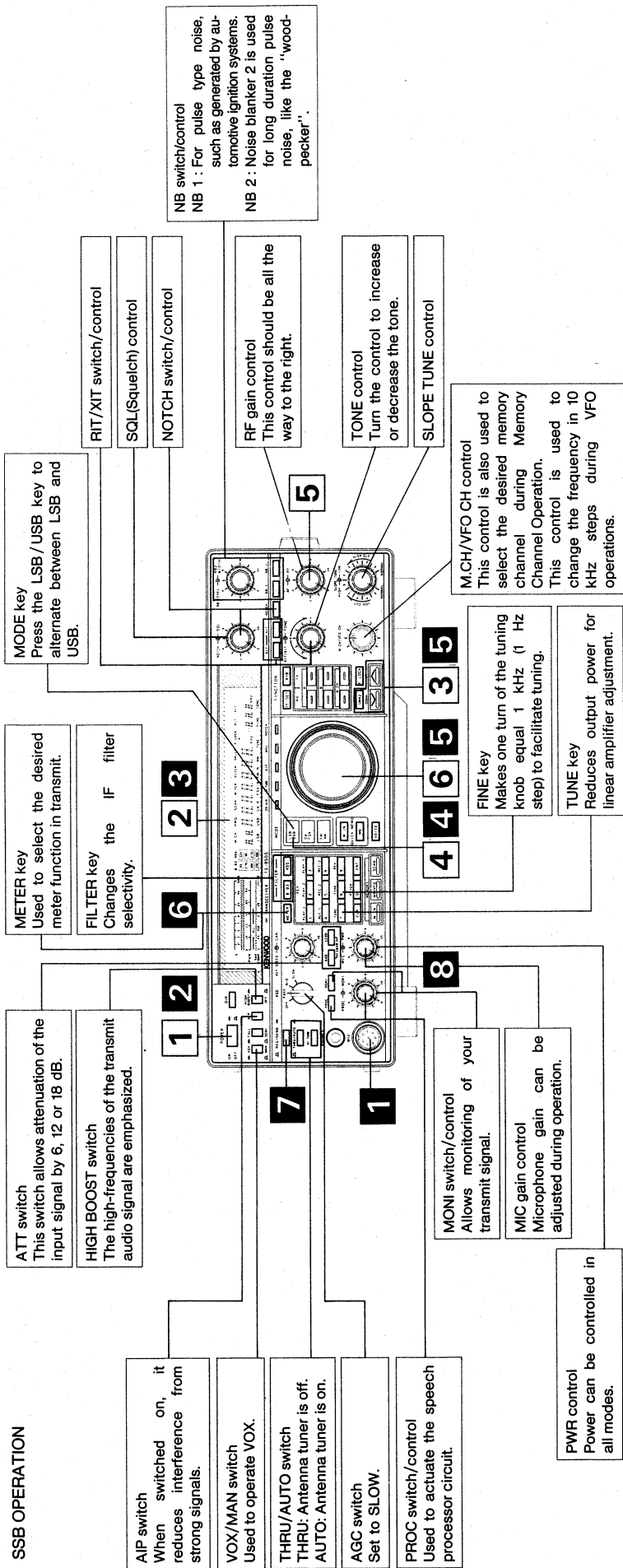
**Caution**  
Never transmit without the antenna connected.

3 A ground must be connected.

4 The DC power cable is connected.

5 Ensure the front panel controls and switches are set as shown in the figures above.

### 4-3. SSB OPERATION



#### (RECEIVING)

- 1 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 2 A frequency is shown in the display.
- 3 Press the UP/DOWN switches to select the desired frequency band. When the 1 MHz step position is selected, the MHz indicator will light.
- 4 Select USB or LSB with the MODE key. The automatic switchover point on the transceiver is 9.5 MHz.
- 5 Turn the AF gain control clockwise until a signal or noise is heard.
- 6 Rotate the TUNING knob and select an open channel.

#### (TRANSMISSION)

- 1 Connect a microphone to the MIC jack.
- 2 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 3 A frequency is shown in the display.
- 4 Select USB or LSB with the MODE key. The automatic switchover point on the transceiver is 9.5 MHz.
- 5 Enter the desired frequency. Before transmitting check the frequency so that you do not interrupt another QSO.
- 6 Press the METER key until the ALC meter lights.
- 7 Press the microphone PTT switch, or set the REC/SEND switch to SEND.
- 8 Speak into the microphone and adjust the MIC gain control so that the meter deflection does not exceed the ALC zone on voice peaks.

#### Note

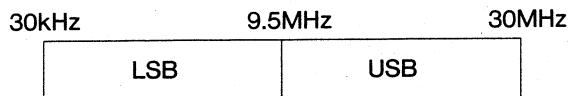
Speak into the microphone, holding the microphone about 5 cm away from your mouth. Close talking or talking too loudly may reduce transmission clarity or spread the side bands too much.





#### 4-3-1. SSB AUTO mode shift

This transceiver automatically selects the appropriate sideband when in the SSB mode.



##### Notes

1. USB is selected for 9.5 MHz and above.
2. The AUTO mode selection will not function when using RIT.

#### 4-3-2. Speech Processor

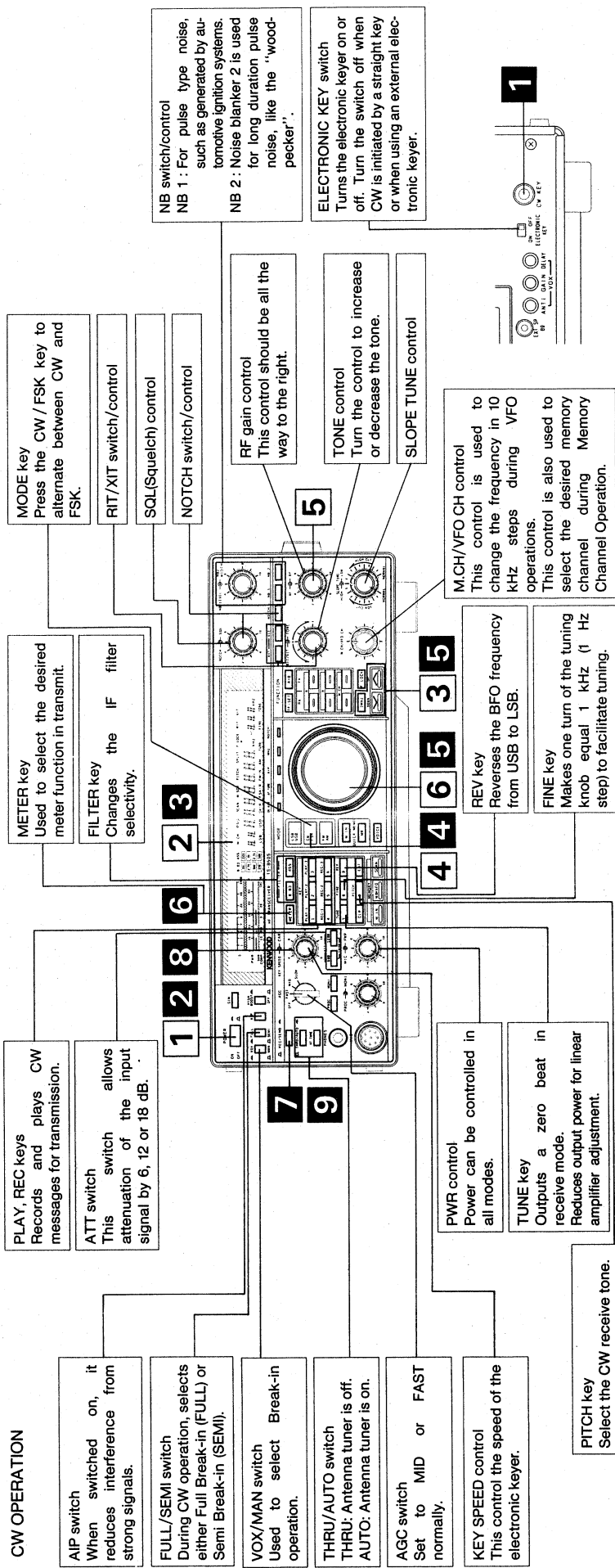
The Speech Processor is used when signals from your station are weak at the distant station. During SSB operation (especially DX operations), it may be desirable to increase the relative "talk-power" of the transmitter by using the speech processor circuitry. This may make the difference between a marginal, and a copyable signal.

##### ● Operation

Turn the PROC switch ON and place the METER switch to COMP. Adjust the PROC control while speaking into the microphone in a normal tone of voice, for a peak COMP scale reading of no more than 10 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 gain control while speaking into the microphone. Ensure that the meter deflection is within the ALC zone!

#### 4-4. CW OPERATION

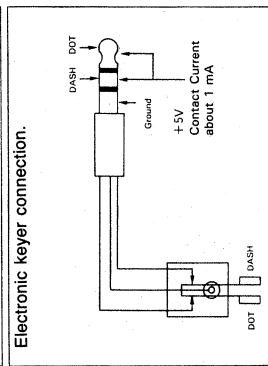
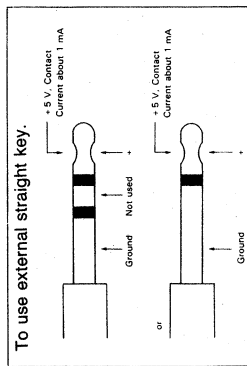


#### (RECEIVING)

- 1 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 2 A frequency is shown in the display.
- 3 Press the UP/DOWN switches to select the desired frequency band. When the 1 MHz step position is selected, the MHz indicator will light.
- 4 Select CW with the MODE key.
- 5 Turn the AF gain control clockwise until a signal or noise is heard.
- 6 Rotate the TUNING knob and select an open channel.

#### (TRANSMISSION)

- 1 Connect a key or electronic keyer to the rear panel CW KEY jack.
- 2 Turn on the DC power supply and then turn the transceiver's power switch ON. Place the VOX/MAN switch to the VOX position.
- 3 A frequency is shown in the display.
- 4 Select CW with the MODE key.
- 5 Enter the desired frequency. Before transmitting check the frequency for activity so that you do not interrupt another QSO.
- 6 Press the METER key until the ALC meter lights.
- 7 Press the key; the ON AIR indicator lights and the meter pointer deflects.
- 8 Adjust the CAR control until the meter deflection is within the ALC zone.
- 9 Release the key. Receive will be restored and the ON AIR indicator will turn off.



#### 4-4-1. CW zero-beat Operation

In CW operation equalizing the receiving frequency with that of your transmit is called "Zero beating". The TS-850 enable you to zero beat in the following manner.

A.  
Press the TUNE key and adjust the tuning knob so that the signal from the other transceiver is zero beat, and deactivate the TUNE key. The CW can then be used with the other transceiver zeroed in.

B.  
1. If the VOX/MAN switch is VOX, set it to MAN and depress the key.  
2. A side tone will be heard from the speaker.  
3. Adjust the TUNING knob so that the transmit frequency of the station you are receiving is equal to the side tone frequency.  
Zero beating is now completed.

#### 4-4-2. PITCH function

You can specify the desired pitch of the receive tone during CW reception.

1. Press the PITCH key during CW receiving.  
2. Select the desired pitch with the M.CH/VFO CH control.

400 ↔ 450 ↔ 500 ↔ 550 ↔ 600 ↔ 650 ↔ 700

1000 ↔ 950 ↔ 900 ↔ 850 ↔ 800 ↔ 750 ←  
(Initial state) (Hz)

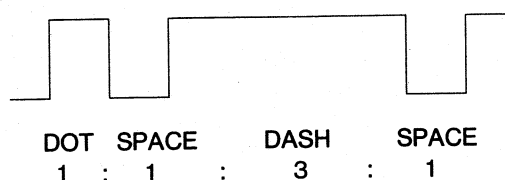
3. When the PITCH key is pressed again, the pitch is set, and the normal frequency display returns.  
4. The sidetone frequency is the same as the frequency set for the pitch.

#### 4-4-3. Electronic Keyer Circuit Operation

Place the ELECTRONIC KEY switch on the rear panel to ON. Connect a paddle type key to the CW KEY jack use a 6.0 mm diameter stereo plug. Adjust the KEY SPEED control for the desired speed.

##### ■ Weight Adjustment

The ratio of dot / space / dash can be adjusted as follows:



The dot-dash ratio has been factory preset to 1 : 3 and will remain so regardless of the keyer speed.

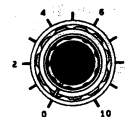
You can forceable change the ratio to you own personal preference or you can select AUTO-WEIGHT control where the weighting adjusts for changes in keyer speed.

● Auto Weight (Initial state) [When the Power on function selection (Number 21) is ON.]

The dot-dash ratio can be set according to the keying speed. The reverse mode can be turned on or off with the power on function (menu number 22). (Please refer to Section 4-10-15.)

Reverse mode	
OFF	ON
The faster the keying speed the longer the dash.	The faster the keying speed the shorter the dash.

KEY SPEED — CAR



Number 22	KEY SPEED Control Position		
	0~3	3~7	7~10
OFF	1:2.8	1:3.0	1:3.2
ON	1:3.2	1:3.0	1:2.8

##### Notes

1. It requires a little time to change the ratio at about the 3 and 7 positions of the KEY SPEED control where some hysteresis occurs.
2. These dot/dash ratios are only approximate.

● Manual Weight [When the Power on function selection (Number 21) is OFF.]

The dot-dash ratio can be set between 1:2.5 and 1:4.0 with the power on function (menu number 23). (Please refer to Section 4-10-15.)

For the CW message storing, see Section 4-13. DRS function.

##### ■ SEMI and FULL break-in operation

Two break-in methods are provided with the transceiver, SEMI and FULL break-in. With either break-in operation, depressing the CW key will cause the radio to transmit without the need for manually switching the REC / SEND switch. The difference between FULL and SEMI break-in is that during FULL break-in operation it is possible to listen between dots and dashes, and that during SEMI break-in it is not.

**Note**

With either SEMI or FULL break-in operation, cross band / cross mode operation is not possible. Additionally, when you are using FULL break-in you should not work cross band splits, only in the same band.

This transceiver also provides a sidetone oscillator circuit to allow monitoring of your CW signal during transmission.

**(a) Semi-automatic break-in**

Depressing the CW key will automatically place the transceiver into the transmit mode. Transmit mode will be maintained for a period determined by the setting of the DELAY control on the front panel of the transceiver, even after the CW key is released.

**(b) Full-automatic break-in**

Depressing the CW key will automatically place the transceiver into the transmit mode. Releasing the CW key will return the radio to receive immediately enabling reception between characters.

**Cautions**

1. The TL-922 / 922A linear amplifier is not designed for full break-in type operation. Attempting to use this accessory in the FULL break-in mode may cause damage to the linear amplifier.
2. The switching time between transmit and receive decreases as you increase your keying speed. This limits the maximum keying speed that is available during FULL break-in operation. When using high speed CW you should use SEMI break-in.
3. During SPLIT operations with FULL break-in, clicks may be heard in the monitoring tone or received signal depending on the combination of the transmit / receive frequencies.
4. During full break-in, the received audio that passes through the 250 Hz band CW narrow filter may click because of its delay time.
5. If the TS-850S is used with CW filter YK-88CN-1 (option) or YG-455CN-1 (option), it is not suitable for full break-in operation because it has a delay time when the signal passes through the narrow-band filter. In this case, you are recommended to perform SEMI break-in operations.

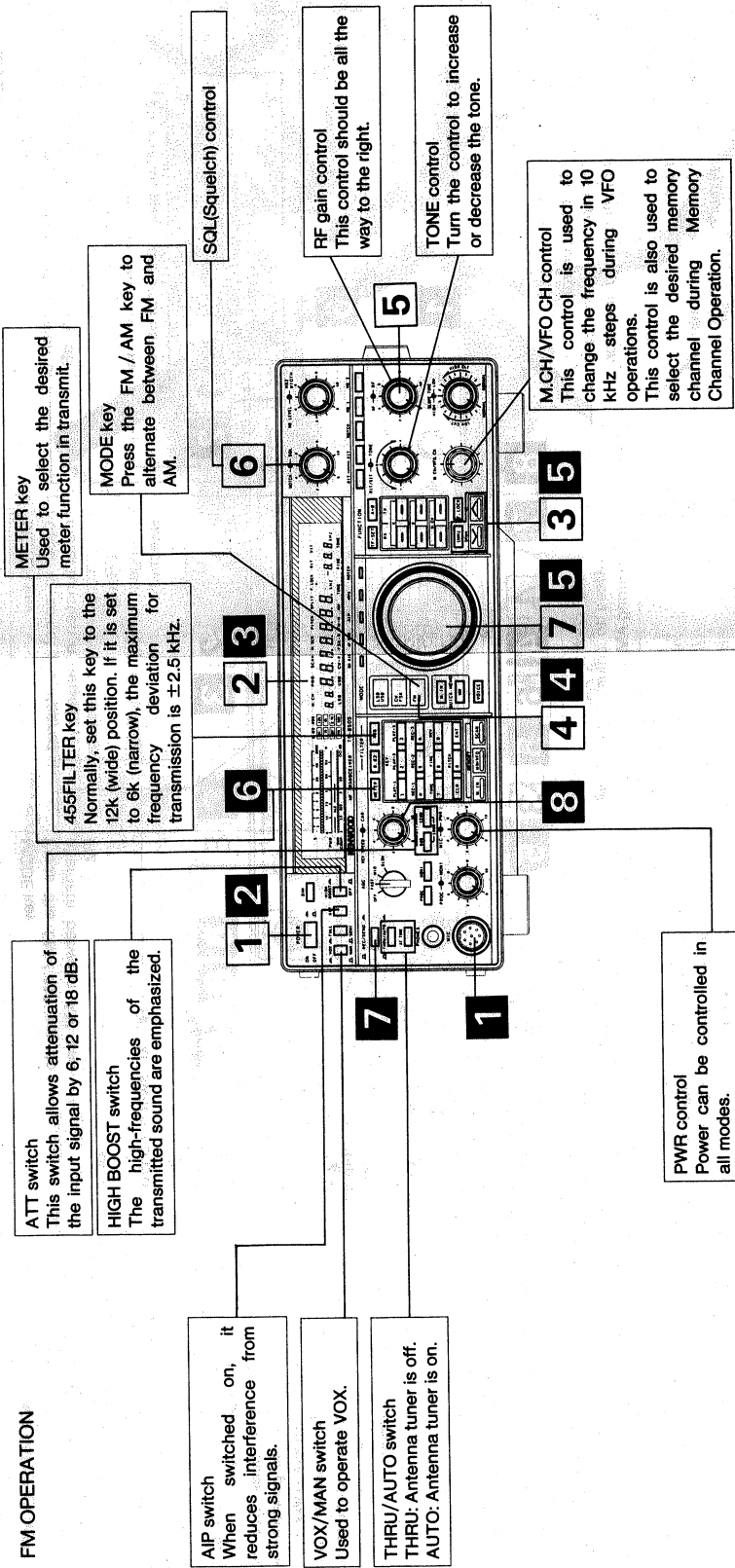
■ **When the electronic keyer is used as Bug key**

When the electronic keyer is used as the Bug key, turn the function on with the function setting (menu number 24) at power on. (Please refer to Section 4-10-15.)

**Note**

When the ELECTRONIC KEY changeover switch is on, menu number 24 is displayed.

#### 4-5. FM OPERATION



#### (RECEIVING)

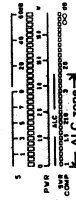
- 1 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 2 A frequency is shown in the display.
- 3 Press the UP/DOWN switches to select the desired frequency within the 28 MHz amateur radio band. When the 1 MHz step position is selected, the MHz indicator will light.
- 4 Select FM with the MODE key.
- 5 Turn the AF gain control clockwise until a signal or noise is heard.
- 6 To eliminate the no signal noise turn the SQL control clockwise to the point the background noise just disappears. This point is known as the squelch threshold point.
- 7 Rotate the TUNING knob and select an open channel.

#### (TRANSMISSION)

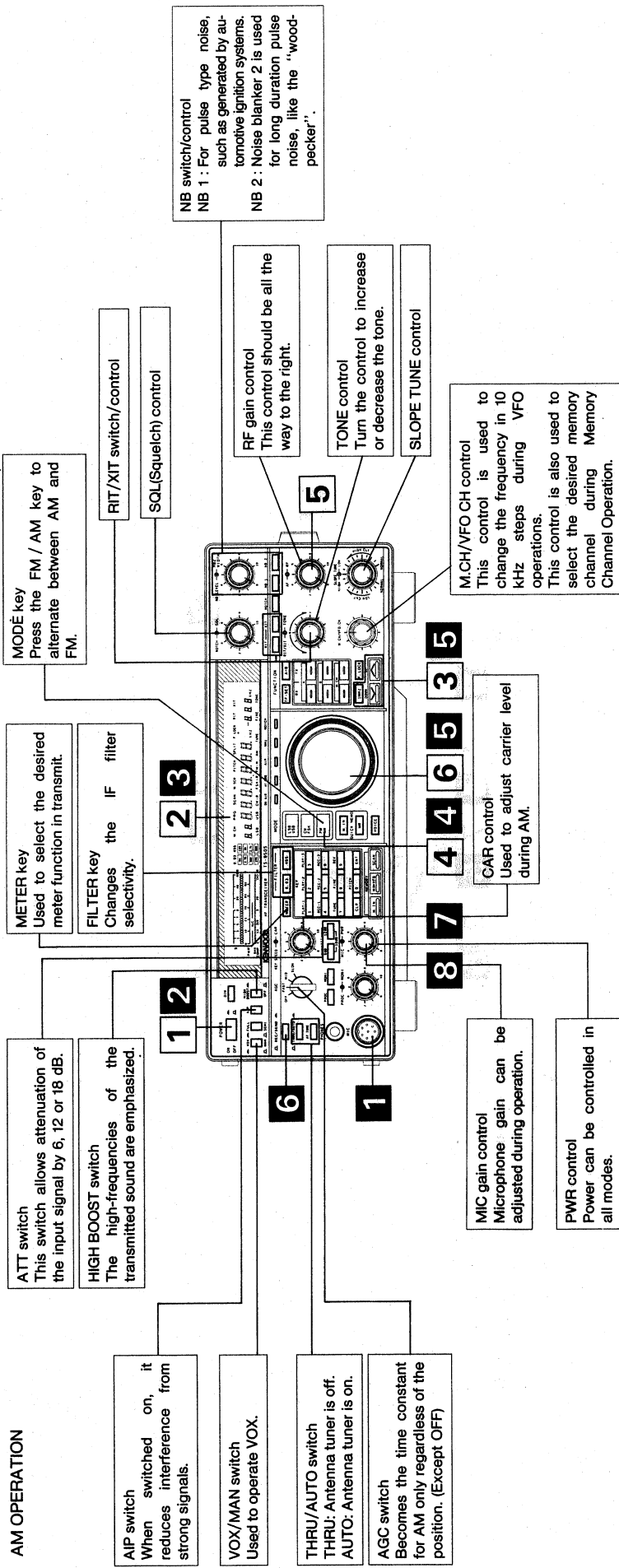
- 1 Connect a microphone to the MIC jack.
- 2 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 3 A frequency is shown in the display.
- 4 Select FM with the MODE key.
- 5 Enter the desired frequency within the 28 MHz amateur radio band. Before transmitting check the frequency for activity so that you do not interrupt another QSO.
- 6 Press the METER key until the ALC meter lights.
- 7 Press the microphone PTT switch, or set the REC/SEND switch to SEND.
- 8 Speak into the microphone and adjust the CAR control so that the meter deflection does not exceed the ALC zone on voice peaks.

#### Note

Speak into the microphone, holding the microphone about 5 cm away from your mouth. Close talking or talking too loudly may reduce transmission clarity or spread the side bands too much.



#### 4-6. AM OPERATION



#### (RECEIVING)

- 1 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 2 A frequency is shown in the display.
- 3 Press the UP/DOWN switches to select the desired frequency band. When the 1 MHz step position is selected, the MHz indicator will light.
- 4 Select AM with the MODE key.
- 5 Turn the AF gain control clockwise until a signal or noise is heard.
- 6 Rotate the TUNING knob and select an open channel.

#### (TRANSMISSION)

- 1 Connect a microphone to the MIC jack.
  - 2 Turn on the DC power supply and then turn the transceiver's power switch ON.
  - 3 A frequency is shown in the display.
  - 4 Select AM with the MODE key.
  - 5 Enter the desired frequency. Before transmitting check the frequency for activity so that you do not interrupt another QSO.
  - 6 Press the microphone PTT switch, or set the REC/SEND switch to SEND.
  - 7 Adjust the CAR control so that the meter indicates as shown Fig.1.
  - 8 Speak into the microphone and adjust the MIC gain control so that the meter indicates as shown Fig.2.
- Note**  
If the MIC gain control is advanced too far for clockwise, the transmit signal will become distorted.

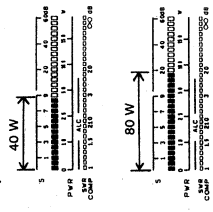
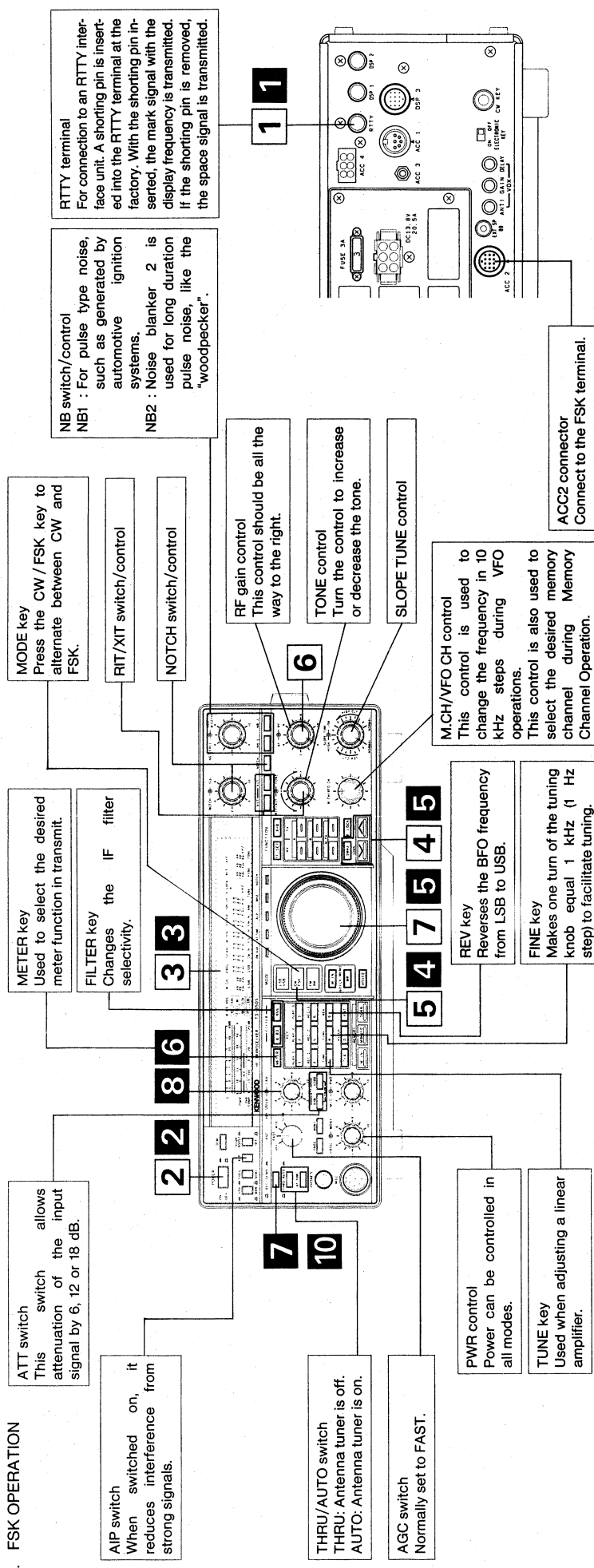


Fig. 2

#### 4-7. FSK OPERATION

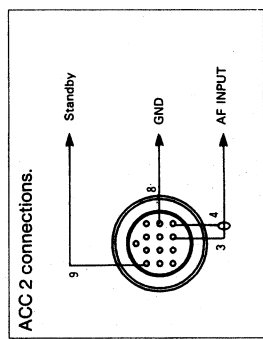


#### (RECEIVING)

- 1 Connect the RTTY keyboard to the RTTY terminal on the rear panel.
- 2 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 3 A frequency is shown in the display.
- 4 Press the UP/DOWN switches to select the desired frequency band. When the 1 MHz step position is selected, the MHz indicator will light.
- 5 Select FSK with the MODE key.
- 6 Turn the AF gain control clockwise until a signal or noise is heard.
- 7 Rotate the TUNING knob and select an open channel.

#### (TRANSMISSION)

- 1 Connect the RTTY keyboard to the RTTY terminal on the rear panel.
- 2 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 3 A frequency is shown in the display.
- 4 Select FSK with the MODE key.
- 5 Enter the desired frequency. Before transmitting check the frequency for activity so that you do not interrupt another QSO.
- 6 Press the METER key until the ALC meter lights.
- 7 Set the REC/SEND switch to SEND. Or key the transceiver from the FSK terminal.
- 8 Adjust the CAR control so that the meter deflection is within the ALC zone.
- 9 Operate the RTTY keyboard.
- 10 Set the REC/SEND switch to REC or unkey the transceiver from the FSK terminal to return to the receive mode.



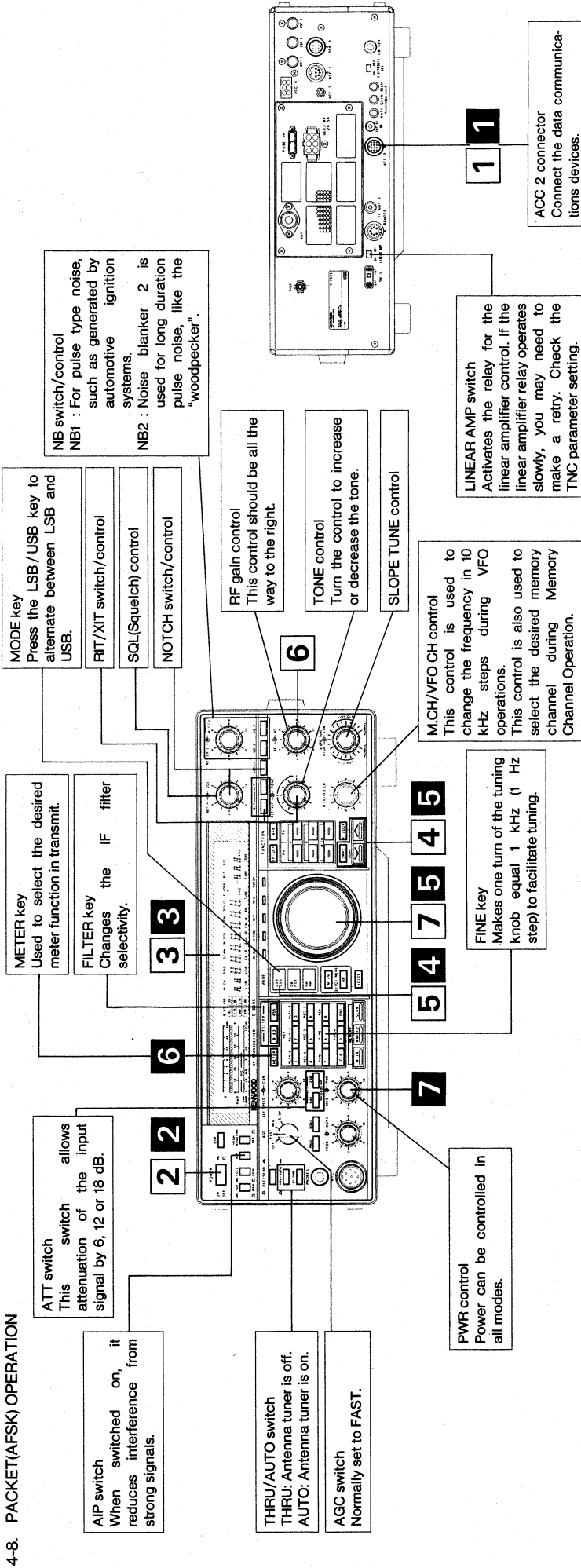
ACC 2 connections.

The FSK shift width is set to 170 Hz. It can be changed to 200, 425 or 850 Hz. (Please refer to Section 4-10-15.)

The FSK receive tone is set to 2125 Hz (high). It can be changed to 1275 Hz (low). (Please refer to Section 4-10-15.)



#### 4-8. PACKET(AFSK) OPERATION



#### (RECEIVING)

- 1 Connect the communication terminal signal line to the ACC2 connector on the rear.
- 2 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 3 A frequency is shown in the display.
- 4 Press the UP/DOWN switches to select the desired frequency band. When the 1 MHz step position is selected, the MHz indicator will light.
- 5 Select LSB or USB with the MODE key.
- 6 Turn the AF gain control clockwise until a signal or noise is heard.
- 7 Rotate the TUNING knob and select an open channel.

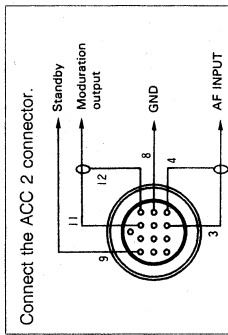
Since AFSK using the SSB mode is normally used for 300 baud packet transmissions, the AFSK signal is applied to the MIC signal line. This is possible in both the USB and LSB modes, but the frequency of the signal that is actually transmitted is the display frequency plus the modulation frequency in USB mode, and the display frequency minus the modulation frequency in LSB mode. Since various modulation frequencies are used by different TNC's, you should determine the correct operating frequency, taking the AFSK frequency of the TNC that you are using into consideration when performing your calculations.

#### (TRANSMISSION)

- 1 Connect the communication terminal signal line to the ACC 2 connector on the rear.
- 2 Turn on the DC power supply and then turn the transceiver's power switch ON.
- 3 A frequency is shown in the display.
- 4 Select LSB or USB with the MODE key.
- 5 Enter the desired frequency. Before transmitting check the frequency for activity so that you do not interrupt another QSO.
- 6 Press the METER key until the ALC meter lights.
- 7 Enter a transmit command from the communication terminal (generally, from the keyboard), and adjust the MIC gain control so that the meter deflection is within the ALC zone.

#### Notes

1. Follow the instructions contained in your terminal units operating manual for the correct settings before you start transmitting.
2. If the output of the terminal unit causes the ALC meter to register above the recommended limits even with the MIC gain control turned all the way down you should reduce the output of the terminal unit. Excessive signal levels can cause distortion! If the terminal unit output level is fixed you should add a potentiometer between the transceiver and the terminal unit. (Refer to Section 6-4-4.)



Connect the ACC 2 connector.



#### 4-8-1. RTTY

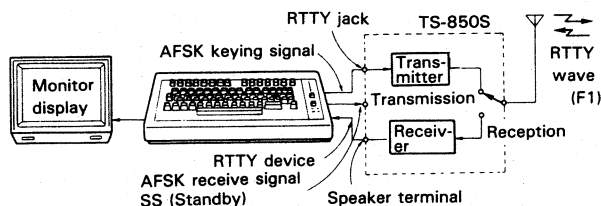
RTTY operation requires a demodulator and a teletypewriter. A demodulator including 2125 and 2295 Hz (170 Hz shift) filters, will be acceptable and may be connected directly to the REMOTE connector. To use the transceiver's FSK circuit with older high voltage teletype equipment, you must use an external keying relay in the teletypewriter closed loop, and connect the relay contacts to the rear panel RTTY terminal.

During FSK operation, the MARK frequency is shown on the display.

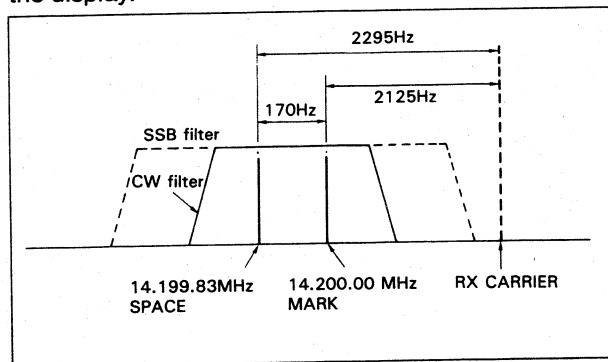
#### RTTY SYSTEM

This transceiver will adapt to Slow Scan Television or AFSK (Audio Frequency Shift Keying) RTTY operation.

For SSTV, the ACC 2 connector should be connected to the Camera output. The ACC 2 connector should be connected to the monitor input. For AFSK operation, connect the Tone Unit output to the ACC 2 input, and ACC 2 output to the Tone Unit input.



The figure below shows the frequency relationship between receive and transmit with this transceiver. In FSK operation the mark frequency is indicated on the display.



#### Note

The display frequency 14.200.00 MHz.

- The BFO normally uses the LSB mode for RTTY operation. When the REV key is pressed, the BFO changes to the USB mode. In the FSK-R (FSK reverse) state, the display frequency is the space frequency. If the other transceiver is using reverse shift, the receiver polarity can be adjusted with the REV key.
- The display indicates the mark frequency even if the shift width is changed.

- Normally a mark frequency is transmitted when the key is closed, and the space frequency is transmitted when the key is open. Since a shorting pin is inserted into the RTTY terminal at the factory, the mark frequency is transmitted.
- The polarity can be reversed so that the mark frequency is transmitted when the key is open with a power on function. (Please refer to Section 4-10-15.)

#### 4-8-2. DATA COMMUNICATIONS (PACKET, AMTOR, RTTY, SSTV, etc.)

1. The ACC 2 connector has been provided for connection of Data communications devices. All necessary connections can be accomplished from the same connector.
2. When using AFSK (Audio Frequency Shift Keying) or modulating the signal with any form of audio tones you should select LSB or USB. If F2 operation is desired select the FM mode. In general LSB is used for RTTY and PACKET communications in the HF band (F1), and USB is used for AMTOR.
3. The transceiver will transmit according to the signals received on the STBY connector. These inputs are generated by the terminal unit in response to inputs from the associated terminal input device.
4. When using LSB, or USB the MIC gain control should be used to adjust the input level for an on scale ALC meter reading.
5. Pin number 9 of the ACC 2 connector is used to disable the front panel microphone connector during the periods that your communication terminal is in use (grounding the pin accomplishes this task). This prevents unwanted errors from in your text.

#### 4-9. AUTO ANTENNA TUNER OPERATION

If the transceiver is operated into an antenna with a high SWR, the final stage SWR protection circuit may operate (when SWR is greater than approximately 2 : 1). Use of the Automatic Antenna Tuner will help you to match the antenna to the transceiver. The AT unit is capable of matching a 20 - 150 ohm load, or approximately a 2.5 : 1 SWR. If the antenna and feed line exceed this range the tuner may not be able to find the correct match. If the tuner cannot match after two attempts, check your antenna and feed lines.

Output power of the transceiver will automatically be reduced to approximately 10 watts during the tuning process to protect the finals against damage.

##### Note

The carrier control should be adjusted for normal CW output (at least 10 watts).

While the automatic antenna tuner is capable of reducing the apparent SWR of the antenna system, it is important to remember that maximum power output will only occur when the antenna has been adjusted for the lowest possible SWR.

The antenna tuner has the following three modes:

##### ① Preset mode

This transceiver has a Preset Memory function capable of storing tuning conditions of each amateur radio band. The transceiver stores the tuning conditions after tuning of an amateur radio band is completed, and automatically provides the stored tuning conditions when switched backed to that amateur radio band from other amateur radio bands, reducing the time for tuning. When you switch to an amateur radio band, the AT TUNE indicator lights briefly to indicate that the Preset function is operating.

1. Set the THRU/AUTO switch to AUTO. The AT TUNE indicator will light and the transceiver will adjust to it's preset condition.
2. When preset is completed, the AT TUNE indicator turns off.

##### Note

If you change BANDS and then return to the previously tuned BAND, after tuning is complete, the SWR may have changed.

If the SWR has changed, set the AT TUNE switch to ON so the unit will retune.

##### ② Auto Tune mode

In this mode, tuning signals are transmitted to tune the antenna and transceiver automatically.

##### Note

If switch SW 1 on the rear is set to EXT, the built-in antenna tuner does not work.

1. Set the THRU/AUTO switch to AUTO.

2. Set the AT TUNE switch to ON.

The transceiver switches to the CW mode, the AT TUNE indicator lights, and the unit starts tuning.

##### Note

This switch will not function when the CAR control is turned fully counterclockwise.

3. When tuning is completed and the AT TUNE indicator goes out, the frequency display returns automatically.
4. A warning beep tone is sounded if tuning is not completed within 20 seconds. If this occurs turn the AT TUNE switch OFF, and then repeat steps 1 - 3.

##### ③ Manual Tune mode

Manual adjustment of the tuner is possible with the tuning knob and M.CH/VFO CH control if auto-tuning is not possible.

1. Press and hold the LSB/USB key while you turn on the POWER switch.
2. Select the number 20 by rotating the M.CH/VFO CH control. Use the UP/DOWN switch to select OFF.

20                      OFF

3. Press the CLR key, or press the POWER switch OFF and then back ON.
4. Place the THRU/AUTO switch to AUTO.
5. Turn the AT TUNE switch ON. While reading the SWR meter, alternately turn and adjust the TUNING knob and M.CH/VFO CH control for the lowest SWR. When tuning is completed, the AT TUNE indicator will go out. Once it goes out, further tuning will not be possible even if you turn the controls.
6. The current setting is stored in memory as the preset data for the amateur band when the AT TUNE indicator turns off or you stop tuning by pressing the AT TUNE switch. If manual tuning is done in one band, then again in another only, the tuning data for the first band is memorized. So, if the first band is reselected, the memorized tuning data is recalled, reestablishing the original tuning.
7. To cancel the manual tuning mode, perform step 1, select ON in step 2, and then step 3.

##### Note

If manual adjustment fails to lower the SWR and complete the tuning, adjust the SWR of the antenna.

## 4-10. OTHER OPERATION

### 4-10-1. Beep Tones

Audible confirmation of various microprocessor functions is provided in the form of a series of audio beeps. The output level of the "Beeper" is adjustable with a variable resistor located inside the set. (Please refer to Section 6-6-3.)

### 4-10-2. Audible Mode Announcement

When a Mode key is pressed, the first character of the mode is sounded in Morse code thru the speaker. (Note that FSK is announced with an "R")

Mode	Morse Code
LSB	• — • •
USB	• • —
CW	— • — •
FSK	• — •
AM	• —
FM	• • — •

### 4-10-3. Alarm Function

Several alarms have been included to signal errors that you might encounter. The chart below lists the possible causes and the resulting Morse code alarm. Morse code will be heard from the speaker.

Indication	Morse Code
<ul style="list-style-type: none"> <li>● When the SCAN key is pressed and the receiver is unable to execute memory scan.</li> <li>● When all memory channels are full and attempt is made to find an empty channel with the 1 MHz switch ON.</li> <li>● When all memory channels are empty and an attempt is made to select memory channel with the 1 MHz switch ON.</li> </ul>	CHECK
When you exceed the operating limits while using the numeric keys to enter a frequency.	OVER

### 4-10-4. Frequency Step

#### A. TUNING knob

The frequency step depends on the mode that has been selected.

Mode	Frequency Step	One revolution of TUNING knob
SSB/CW/FSK	10 Hz	10 kHz
AM/FM	100 Hz	50 kHz

When the FINE function is ON, the frequency step is 1 Hz.

The frequency step in the AM and FM modes can be set to 10 Hz. (Please refer to Section 4-10-15.)

#### B. M.CH/VFO CH control

1. The active VFO frequency step is as shown below.

Frequency Step	One revolution of M.CH/VFO CH control
10 kHz	240 kHz

The frequency step may be reprogrammed when turning on the POWER switch. (Please refer to Section 4-10-15.)

2. This control is also used to select the desired memory channel during Memory Channel Operation.

### 4-10-5. Amateur Radio Bands selection

Press the UP/DOWN switch to change amateur radio bands.

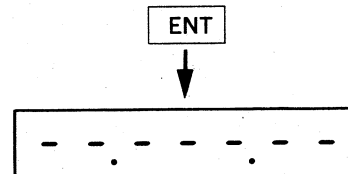
### 4-10-6. Direct keyboard frequency entry

Direct keyboard entry of the operating frequency is possible using the Numeric Keypad on the transceiver. This allows rapid changes in frequency without the delays encountered when using other tuning methods.

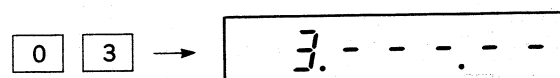
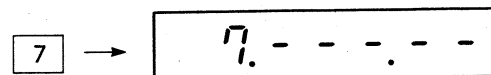
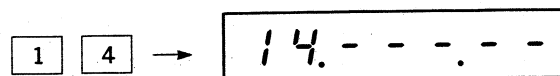
#### Note

You cannot enter any frequency which is outside the coverage of the radio.

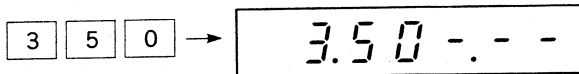
1. Press the ENT key. The display will indicate.



2. Enter the desired operating frequency from Most Significant Digit to the Least Significant Digit. You do not have to enter trailing zeros, but you must enter leading zeros.



When 3 is entered into the 10 MHz digit and then a number is entered into the 100 kHz digit, the band is shifted to the 3 MHz band.



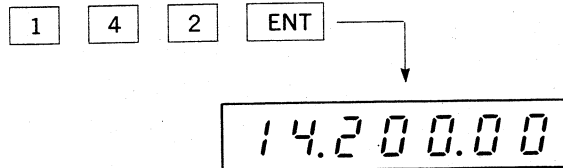
3. After the least significant digit has been entered press the ENT key again to signify you want the radio to change frequency. If you entered the frequency down to the nearest 10 Hz a beep will sound and the radio will automatically change to the new frequency without the need of pressing the ENT key for the second time.

For example:

To enter 14.200.00 MHz there are two methods:

Method one: Press [ENT], [1], [4], [2], [ENT]

Method two: [ENT], [1], [4], [2], [0], [0], [0], [0]



4. If you make a mistake while entering the frequency and have not yet pressed the ENT key, or entered the final digit, you may cancel the input by pressing the CLR key or the PTT switch.

#### 4-10-7. Dual Digital VFO's

Operational convenience is enhanced thru the use of two VFO's.

Two VFO's are provided to allow you to change frequencies rapidly with the least amount of dial rotation. For example; you could set one VFO to the lower tuning limit and the other VFO to the upper tuning limit.

#### A=B key

Depressing this key causes the data contained in the inactive VFO (the VFO that is not currently being displayed in the display area) to change to the same data that is contained in the active VFO (the one currently displayed). Both the frequency, mode and filter selection are changed.

#### Note

When a memory channel is being used for reception, the A=B key will not function.

For example:

RX VFO A is set at 7 MHz in LSB, and RX VFO B is 14 MHz in USB. RX VFO A is the active VFO (shown on the display). Depressing the A=B key will cause RX VFO B to change to 7 MHz in LSB.

#### 4-10-8. SPLIT FREQUENCY OPERATION

Different frequencies can be set for VFO A, VFO B and for memory.

For example:

VFO A is the active VFO, and VFO B is the inactive VFO. Depressing the TX VFO B key will cause the transceiver to receive on VFO A and transmit on VFO B. The mode of reception and transmission will follow the mode contained in the appropriate VFO. It

is possible to work cross band, cross mode if desired.

To avoid confusion during contest, or pile-up operations we recommend using VFO A for receive and VFO B for transmit.

#### ●TF-SET key

Depressing this key will allow you to rapidly set or check the transmit frequency, during SPLIT operations, without the need of actually transmitting.

This key is especially convenient when you are trying to locate the transmit frequency of the station currently in contact with the DX station, since depressing this key allows you to receive on the transmit frequency as long as the key is held depressed. The TUNING knob is active when this key is depressed, so it is easy to change your transmitter frequency at the same time, if necessary. Releasing the key will return you to the original receive frequency.

#### 4-10-9. Interference Reduction

##### ■All mode

[ 1 ] SLOPE TUNE control (Except FM mode)

During reception, these controls permit you to reduce the apparent IF filter bandwidth and therefore reduce adjacent channel interference.

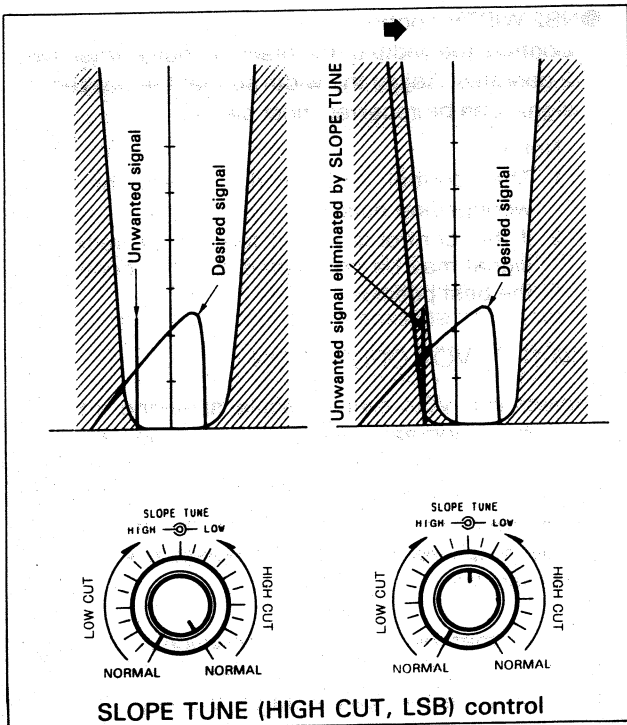
##### ●SLOPE TUNE HIGH CUT control

Adjust the HIGH CUT control counterclockwise, and interference from signals higher than the operating frequency will be reduced. The high-frequency components of the resulting receiver audio will also be reduced.

##### ●SLOPE TUNE LOW CUT control

Adjust the LOW CUT control clockwise, and interference from signals lower than the operating frequency will be reduced. As with the HIGH CUT control, use of the LOW CUT control will also affect the audio frequency passband. In this case the low frequency components of the audio signal will be reduced.

Maximum bandwidth occurs with the LOW CUT control fully counterclockwise, and the HIGH CUT control full clockwise.



**Notes**

1. In the FM mode, only 12 kHz (wide) and 6 kHz (narrow) can be selected.
2. Some bandwidths cannot be selected unless the required filter is installed.
3. Either optional YG-455C-1 or YG-455CN-1 can be installed. When the YG-455CN-1 is installed, 500 is displayed.
4. When an optional filter is installed, change the filter switch. (Please refer to Section 7-1.)

**Initial state**

MODE \ FILTER	8.83MHz	455kHz
SSB, CW, FSK	2.7k	2.7k
AM	6k	6k
FM	—	12k

**Note**

When bandwidth of the 8.83 MHz filter is approximately the same as that of the 455 kHz filter, the combined bandwidth will be narrower than the indicated bandwidth.

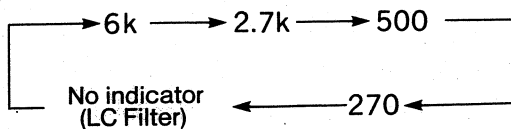
For example, when both the 8.83 MHz and 455 kHz filters are set to 2.7k, the combined bandwidth will be about 2.4 kHz.

**[II] Filter key**

The filter bandwidth for the 8.83 MHz and 455 kHz if's can be selected from the front panel. Up to 3 additional filter bandwidths may be added thru the installation of optional filters.

**8.83MHz filter bandwidth**

The value changes each time the 8.83 switch is pressed.

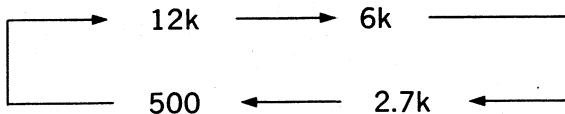


**Notes**

1. This function is not active in the FM mode.
2. Some bandwidths cannot be selected unless the required filter is installed.
3. When an optional filter is installed, change the filter switch. (Please refer to Section 7-1.)
4. If the YK-88SN-1 is installed, install it where the YK-88C-1 or YK-88CN-1 is installed. The number 500 or 270 is displayed.

**455kHz filter bandwidth**

The value changes each time the 455 switch is pressed.

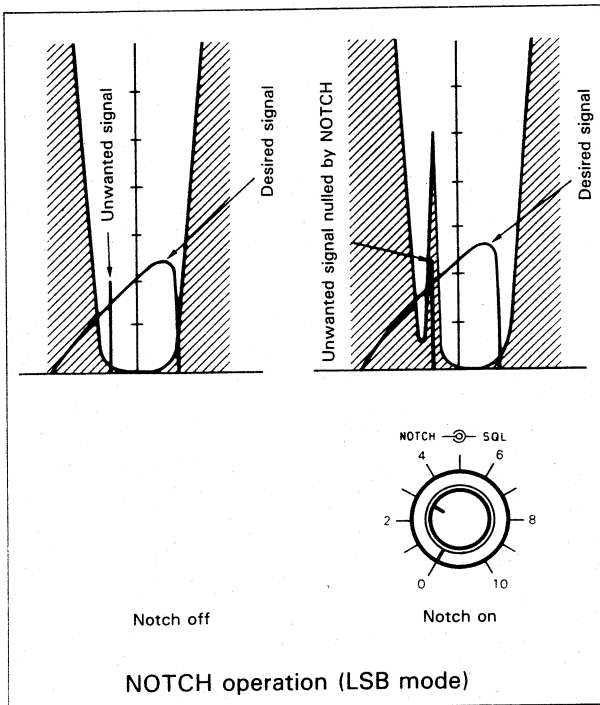


**[III] NOTCH control (Except FM mode)**

Use this control when you are experiencing interference from a CW heterodyne type signal. Turn the NOTCH ON and slowly adjust the NOTCH control to minimize the beat signal. A beat of approximately 1.5 kHz can be reduced at the approximate center position of the control. Please note that this control will not eliminate SSB, AM or FM type interference. The bandwidth of such signals is approximately 3 - 6 kHz wide. When in the USB, CW or AM mode a beat tone lower than the center frequency can be reduced by rotating the control clockwise from the center point. In LSB or FSK mode adjust the control counterclockwise.

**Notes**

1. The NOTCH frequency can be varied within a range of approximately 400 to 2600 Hz.
2. When an interfering signal such as a CW station appears, slowly rotate the NOTCH control. If you rotate the knob too quickly you may pass right over the notch point. Slow rotation will yield best results.
3. The NOTCH frequency may be shifted by the SLOPE TUNE position. Operate the SLOPE TUNE control, then the NOTCH control.
4. If the NOTCH frequency equals the frequency of the desired signal (SSB), the desired signal is attenuated slightly, but this is not in an error.
5. Since the notch is a filter with a very sharp attenuation characteristic, the adjustment point may be shifted. (Please refer to Section 6-6-6.)



#### 4-10-10. Noise Blanker

##### ●NB 1 switch

For pulse type noise, such as generated by automotive ignition systems, turn the NB 1 switch ON.

When pulsating noise, such as that caused by automobile ignitions is encountered, place the NB 1 switch ON.

This switch will not help to eliminate atmospheric or line noises, only pulse type noise.

##### ●NB 2 switch

Noise blanker 2 is used for long duration pulse noise, like the "woodpecker". To reduce "woodpecker" radar noise interference, set switch NB 2 to the ON position (NB 2's effectiveness depends on the specific type of interference). If you use NB 2 for short duration pulse noise, the receive tone may become distorted, making it difficult to hear.

Unfortunately no noise blanker can remove all different types of interference; but the two noise blankers that have been provided in the TS-850 are effective in most cases.

If there is no "woodpecker" present, the switch should be in the OFF position.

##### ●NB LEVEL control

Controls the noise blanker operating level. Use only the minimum level necessary.

##### ●NB2 WIDTH control

Controls the width of the blanking pulse when NB 2 operates. Adjust the width so that the desired signal can be received most clearly.

##### Notes

1. The control only works when there is woodpecker noise.
2. If this control is turned too far, the received signal may be interrupted. Set the control to the best position.

#### 4-10-11. VOX OPERATION

Depress the VOX switch. While speaking into the microphone, increase the GAIN control until the VOX relay just operates. Clockwise rotation of this control will increase the sensitivity. For VOX operation it is sometimes desirable to "Close-Talk" the microphone in order to prevent background noises from tripping the transmitter.

1. Check that the ALC reading on voice peaks is still within the ALC zone on the meter. If necessary, readjust the MIC gain control for the proper ALC reading.
2. If the VOX circuit is activated by the output from the speaker, adjust the ANTI control as necessary for proper VOX operation.
3. Do not use excessive VOX or ANTI VOX settings. This may cause the VOX circuit to operate erratically. Use only the minimum necessary control setting.
4. If the VOX circuit transfers between words, or holds too long, adjust the release time-constant using the DELAY control.

#### 4-10-12. ON AIR MONITOR

##### I. MONI switch

Turn the MONI switch ON to monitor the transmitted signal. Headphones are recommended.

##### II. MONI control

Adjust monitor volume level.

##### Note

This function is not active in the AM and FM mode.

#### 4-10-13. RIT control

The RIT control allows shifting the receiver frequency  $\pm 1.2$  kHz. Use of the RIT control will not affect the transmit frequency.

The RIT step size is either 10 Hz or 20 Hz. (Please refer to Section 4-10-15.)

When the RIT switch is ON, the RIT indicator will light, and the receive frequency can be adjusted by using the RIT/XIT control.

**Note**

When the RIT is ON the transmit frequency may be different from the receive frequency. For normal operation leave the RIT switch OFF. It should be used only when necessary.

**4-10-14. XIT control**

Transmitter Incremental Tuning is very similar to RIT. XIT is only active in the transmit mode. By using the XIT function it is possible to offset the transmit frequency without the normal loss of receiver audio that is experienced when using the SPLIT function. The XIT step size is either 10 Hz or 20 Hz. (Please refer to Section 4-10-15.)

Offsets of  $\pm 1.2$  kHz are possible.

The RIT/XIT offset can be preset, without affecting the actual operating frequency by turning OFF the RIT/XIT and using the RIT/XIT display to determine the offset.

**4-10-15. Power on function selection**

Several of the functions of this transceiver can be changed at the time the transceiver is turned ON. Repeat to release each function.

1. Press and hold the LSB/USB key while you turn on the POWER switch.
2. A number will appear in the display.
3. Select the desired number by rotating the M.CH/VFO CH control.
4. Change the function by pressing the UP/DOWN switch.
5. Function selection can be turned off by pressing the CLR key, or by pressing the POWER switch OFF and back ON.

No.	Programmable functions	Initial state
00	Beep tones: ON/OFF	ON
01	Audible mode announcement: ON(Morse code)/OFF(Beep tones)	ON
02	Audible alarm: ON(Morse code)/OFF(Beep tones)	ON
03	M.CH/VFO CH control step frequency selection: 10 kHz/5 kHz/1 kHz	10 kHz
04	M.CH/VFO CH control step frequency selection: 10 kHz/9 kHz (AM mode only)	10 kHz
05	TUNING knob step frequency selection: 100 Hz/10 Hz (AM and FM mode only) (Except the FINE function is ON.)	100 Hz

No.	Programmable functions	Initial state
06	UP/DOWN switch step frequency selection: 1000 kHz/500 kHz/1 kHz (When 1 MHz key is ON.)	1000 kHz
07	10 Hz display resolution: ON/OFF	ON
08	SSB AUTO mode shift: ON/OFF	ON
09	Meter peak hold: ON/OFF	OFF
10	Automatically increments the memory channel data time each time you enter a frequency into memory.	OFF
11	FSK transmission key short : OFF(SPACE)/ON(MARK)	OFF
12	The shift range of the FSK mode can be set to 170, 200, 425, or 850 Hz by using the UP/DOWN switch.	170 Hz
13	You can switch between FSK mode receive tones high (2125 Hz) and low (1275 Hz).	2125 Hz
14	Program scan hold: ON/OFF	OFF
15	Storing the band frequency before the UP/DOWN switch is pressed : Required(ON)/Not required(OFF)	ON
16	Determine whether to change the frequency with the tuning knob (ON) or not (OFF) when the standard memory channel is recalled to RX VFO.	OFF
17	RIT/XIT variable range : 1.27 kHz/2.54 kHz	1.27 kHz
18	Select the sub tones	88.5 Hz
19	Sub tones : b(Tone burst)/c(Continuous tones)	c
20	Antenna Tuner : ON(AUTO)/OFF(MANUAL) (When the SW 1 switch is INT.)	ON
21	Auto weight function : ON/OFF (When the ELECTRONIC KEY switch is ON.)	ON
22	Reverse mode: ON/OFF (When Auto weight function is ON.)	OFF

No.	Programmable functions	Initial state
23	Select the Manual weight (When Auto weight function is OFF.)	3.0
24	Bug key: ON(Used)/OFF(Not used) (When the ELECTRONIC KEY switch is ON.)	OFF
25	When split is selected, the temporary display of the transmit frequency can be turned on and off.	ON
26	Display for the 50 MHz converter : ON/OFF	OFF
27	Display for the 144 MHz converter : ON/OFF	OFF
28	Display for the 430 MHz converter : ON/OFF	OFF
29	Change the REC 1 recording time to 8 or 16 seconds. (When optional DRU-2 is installed)	8 seconds
30	Change the REC 2 recording time to 8 or 16 seconds. (When optional DRU-2 is installed)	8 seconds
31	Change the REC 3 recording time to 16 or 32 seconds. (When optional DRU-2 is installed)	16 seconds
32	Transfer function when two TS-850 are connected : ON/OFF	OFF
33	Turn on and off direct writing into VFO by the transfer function when two TS-850 are connected.	OFF
34	The IF and AF circuits of this transceiver can be switched off (mute mode) so the transceiver will not transmit even if the standby terminal is grounded.	OFF
35	Transfer function when two TS-850 are connected (SPLIT) : ON/OFF	OFF

**Notes**

1. When menu number 26, 27, or 28 is turned on, the other two menu numbers are not displayed.
2. Menu number 34 can mute the IF and AF circuits only, not the RF circuit. So if excessive power is applied to the ANT connector during muting, the RF circuit may be damaged. Do not apply excessive power directly to the muted side of the transceiver.



#### 4-11. MEMORY

The transceiver incorporates a convenient 100 channel memory that can be used to store and recall commonly used frequencies.

##### 4-11-1. Microprocessor back-up lithium battery

A lithium battery is contained in the transceiver to retain memory. Turning off the POWER switch, disconnecting the power cable, or a power failure will not erase the memory. The battery should last for approximately five years. When the battery discharges, an erroneous display may appear in the display. Lithium battery replacement should be performed by an authorized KENWOOD service facility; either your KENWOOD servicing dealer authorized service center, or the factory, since this unit contains CMOS type circuitry.

###### Notes

1. When the lithium battery is replaced, the microprocessor must be reset, using the procedure in section 4-11-2.
2. When the lithium battery fails, the radio's operating system is not affected. Only information stored in memory will be cleared.

##### 4-11-2. Initial state and reset of the microprocessor.

A. Initial state of the microprocessor from the factory.

	Frequency	Mode
VFO A	14.000.00	USB
VFO B	14.000.00	USB
Memory Channel 00~99	..	—

##### B. Microprocessor reset

There are two methods for resetting the microprocessor.

1. Press and hold the A=B key and turn on the POWER.

###### Caution

All user programmed memory will be erased with this operation.

2. Press and hold the RX-A key and turn on the power to reset all user programmed data except the contents of the Memory Channels.

##### 4-11-3. Memory Channel

Memory Channel Number	Memory Channel
00 through 89	Standard and Split
90 through 99	Programmed Scan

##### 4-11-4. Memory Contents

Each Memory Channel is capable of storing the following information: ○=yes, ×=no

	00~89	90~99
Frequency	○	○
Mode	○	○(※2)
Filter	○	○(※2)
Tone Frequency data	○(※1)	×
Tone ON/OFF	○(※1)	×
Highest/Lowest operating frequency	×	○
AIP ON/OFF	○	○(※2)

※1 When the memory is used as a split memory in FM mode for both transmission and reception.

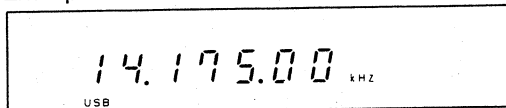
※2 During memory channel operation, the modified contents are saved as the memory channel data.

##### 4-11-5. Memory Entry

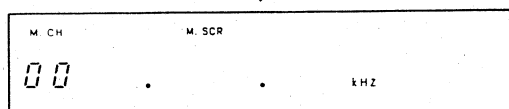
###### A. Standard Memory Channel

1. Select the receive frequency, the mode and the filter.

Example: 14.175MHz is selected on VFO A

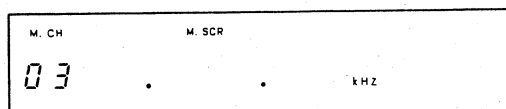


2. Press the M.IN key. The radio will enter the Memory Scroll (M.SCR) mode.



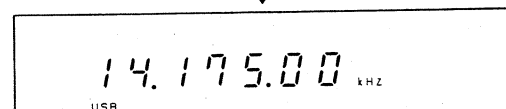
(When Memory Channel 00 is empty.)

3. Select the desired Memory Channel number.



(When Memory Channel 03 is empty.)

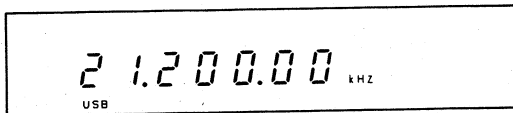
4. When the desired memory channel is found and displayed, press the M.IN key again. The current frequency, mode and filter will be stored, the Memory Scroll mode will be canceled, and the transceiver will return to the operating mode and frequency that was displayed before the M.IN key was pressed initially.



## B. Split Memory Channel

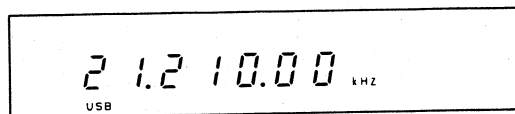
1. Select the receive frequency, the mode and the filter.

Example: 21.200 MHz is selected on VFO A.

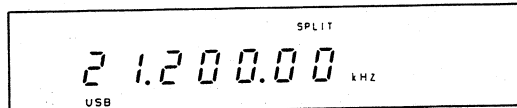


2. Press the A=B key.
3. Set the RX VFO to B and select the desired transmit frequency.

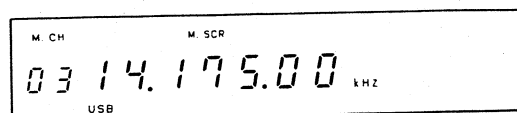
Example: 21.210 MHz is selected on VFO B.



4. Set the RX VFO to A and set the TX VFO to B. Indicate the SPLIT display. When the TX VFO B key is pressed, the transmit frequency is displayed momentarily. This momentary display may be suppressed with the function setting at power on. (Please refer to Section 4-10-15.)

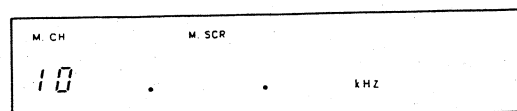


5. Press the M.IN key.



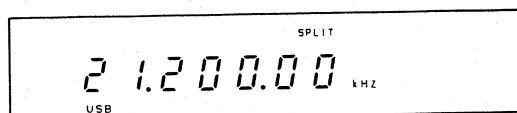
(When 14.175 MHz is stored in Memory Channel 03.)

6. Select the desired Memory Channel number.



(When Memory Channel 10 is empty.)

7. When the desired memory channel is found and displayed, press the M.IN key again. The current frequency, mode and filter will be stored, the Memory Scroll mode will be canceled. The transceiver will return to the operating mode and frequency that was displayed before the M.IN key was pressed initially.

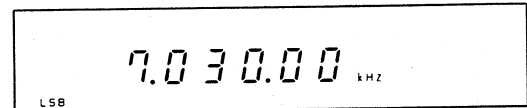


## C. Programmed Scan Memory Channel

The highest and lowest frequency are stored in this memory channel. This channel can be used as a standard memory channel if the highest and lowest frequencies are identical.

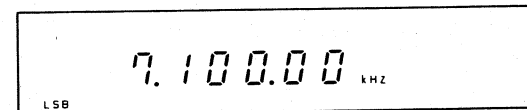
1. Select the lowest operating frequency and the mode.

Example: 7.030 MHz is selected on VFO A.

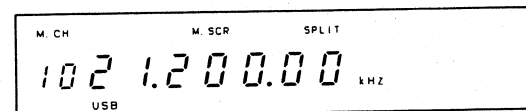


2. Press the A=B key.
3. Select the highest operating frequency.

Example: 7.100 MHz is selected on VFO B.

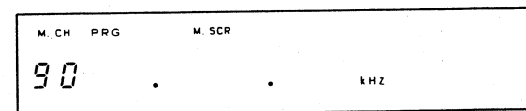


4. Press the RX-A key and Press the M.IN key.



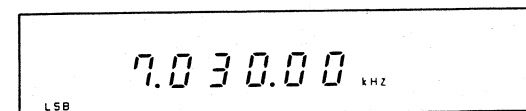
(When 21.200 MHz (RX) and 21.210 MHz (TX) are stored in Memory Channel 10.)

5. Select the desired Programmed Scan Memory Channel number (90-99ch).



(When Memory Channel 90 is empty.)

6. When the desired program scan memory channel is found and displayed, press the M.IN key again. The current frequency, mode and filter will be stored, the Memory Scroll mode will be canceled, and the transceiver will return to the operating frequency that was displayed before the M.IN key was pressed initially.



#### 4-11-6. Memory Channel Recall

The following procedure illustrates how to recall a memory channel.

1. Select memory channel operation for RX by simply depressing the appropriate FUNCTION key. The display will indicate the frequency of the memory channel you used last.
2. You can select a different memory channel by rotating the M.CH/VFO CH control. The memory channel indicator and the frequency in the display will change as this control is rotated.

#### 4-11-7. Memory Channel Scroll

The following procedure provides a method to check a Memory Channel Frequency without changing or losing the current receive frequency.

1. Press the M.IN key once to initiate Memory Scroll. The M.SCR indicator lights, and the Memory Channel Frequency is displayed. Although the displayed frequency will change, actual reception will be at the previous frequency (that is, the frequency before the M.IN key is pressed).
2. Select a Memory Channel using the M.CH/VFO CH control or numeric keys. The frequencies stored in the Memory Channel will be displayed.
3. Cancel the Memory Scroll operation, by pressing the CLR key.

#### 4-11-8. Memory Channel Selection

■ To change between the channels stored in memory

1. Select memory channel for the RX VFO or both during memory channel operations. The display will show the memory channel you used last.
2. Activate the 1MHz key (the MHz indicator will light) and rotate the M.CH/VFO CH control to select a different memory channel.
3. To return to VFO operation, press the M▶VFO key to copy the memory contents to VFO or change RX VFO to A (VFO A) or B (VFO B).

##### Note

If there is nothing in the memory channels, and the M.CH/VFO CH control is rotated, "check" is output from the speaker in Morse code.

■ To select an empty channel

1. Press the M.IN key to enter the memory scroll mode. Although the display frequency changes, the frequency set before the M.IN key was pressed is used for actual reception.
2. Press the 1MHz key (the MHz indicator will light) and rotate the M.CH/VFO CH control to select a different memory channel. You can also do this with the numeric keys.
3. To cancel the memory scroll mode, press the CLR key.

##### Notes

1. If all the memory channels are full, and the M.CH/VFO CH control is rotated, "check" is output from the speaker in Morse code.
2. If a channel stored in memory is specified with a numeric key, "check" is output from the speaker in Morse code.

#### 4-11-9. Transferring Memory Information to the VFO.

The following procedure transfers the contents of the selected memory channel to the VFO.

1. Select memory channel operation.
2. Select the desired Memory Channel by rotating the M.CH/VFO CH control.
3. Press the M▶VFO key. This will cause the contents of the memory channel to be transferred to the unused VFO position.
  - (1) Pressing the M▶VFO key will shift the memory channel data to VFO A or VFO B when using a standard memory channel.
  - (2) Pressing the M▶VFO key will cause the RX frequency to be shifted into VFO A and the TX frequency to be shifted into VFO B when using a Split Frequency Memory Channel.
  - (3) Pressing the M▶VFO key will cause the memory channel data to be transferred to the unused VFO when using a memory channel for RX or TX and a VFO channel for the other function. Please see the enclosed chart for several examples.

##### Notes

1. When the M▶VFO key is pressed, the contents of the VFO are cleared but the contents of the Memory Channel will not be cleared.
2. If nothing is stored in the selected Memory Channel, only the channel number is displayed; no transfer is carried out.

#### 4-11-10. Checking the Highest and Lowest Scan frequencies

It is possible to check the frequencies that are stored in the program scan memory channels by using the following procedure.

1. Select M.CH operation.
2. Select the desired Program Scan memory channel by rotating the M.CH/VFO CH control.
3. Press the UP switch to see the upper scan limit.
4. Press the DOWN switch to see the lower scan limit.
5. If you decide after viewing that you wish to utilize this scanning range simply press the M▶VFO key to transfer the data to the VFO, and then press the SCAN key.

#### 4-11-11. Mode and Filter Changes during Memory Channel Operation (00-89ch)

Modes and filters can be changed during memory channel operation, but, with the exception of the transmit / receive frequencies, the contents of memory channels for the selected memory channel cannot be changed.

#### 4-11-12. Clearing a Memory Channel

To erase a specific Memory Channel:  
Press and hold the CLR key for approximately 2 seconds or transfer data from an empty Memory Channel to the Memory Channel you wish to clear.

#### 4-11-13. Quick Memory Channel

There are five quick memory channels in total. Quick Memory Channel is capable of storing the following information.

Receive frequency, mode and filter  
Transmit frequency, mode and filter  
RIT ON/OFF, XIT ON/OFF, AIP ON/OFF,  
FINE ON/OFF, TUNE ON/OFF, 1 MHz key ON/OFF,  
Select the meter indicate.

##### ■ Quick Memory Channel Entry

[1] Memory entry when the VFO operation.

1. Select the receive frequency, the mode and the filter.
2. Press the M.IN key of QUICK MEMO. The data is written to quick memory channel 1.

##### Note

If RX VFO or TX VFO or both are M.CH, data cannot be written.

3. This is a stacking memory. If there is already data in channel 1, it is moved automatically to channel 2. If there is data in channel 2, it is moved automatically to channel 3 and so on. If there is data in channel 5, it is erased automatically.

[2] Memory entry when the Quick Memory Channel operation.

1. When the quick memory channel is recalled, the frequency, the mode, or other data in the memory channel can be modified.
2. To store the modified frequency or the mode in memory, press the QUICK MEMO M.IN key. The contents of the memory channel are replaced with new data. The original contents of the memory channel are automatically moved to the next memory channel. For example, if channel 3 is recalled, the frequency or the mode modified, and the QUICK MEMO M.IN key pressed, the new data is stored in channel 3, and the original contents of the memory channel are automatically moved to channel 4. If channel 5 is recalled, the frequency or mode modified, and the QUICK MEMO M.IN key pressed, the new data is stored in channel 5, and the original contents of channel 5 are automatically erased.

##### ■ Quick Memory Channel Recall

If the MR key is pressed and the M.CH/VFO CH control turned, a quick memory channel can be recalled. The frequency and mode can be modified, but if you move to another channel or VFO and then return to the original channel, the frequency and mode return to the original values stored in the memory channel. To return to VFO operation, press the MR key again. To shift the quick memory channel contents to the VFO, press the M▶VFO key.

##### Note

If all quick memory channels are empty, nothing happens even when the QUICK MEMO MR key is pressed.

## 4-12. SCAN

Both Memory Scan and Program Scan are possible.

### 4-12-1. Memory Scan

During memory channel operation, pressing the SCAN key will cause the radio to scan the memory channels repeatedly, skipping the channels that have no data stored or are locked-out.

To cancel scan press the CLR key.

### 4-12-2. Group Scan

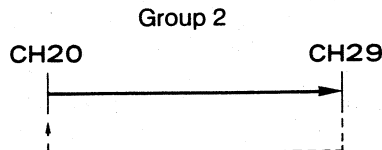
To initiate memory scan of specific memory channel groups.

1. During memory channel operation, press and hold the SCAN key.
2. You may specify which memory groups you want to scan by depressing the key that corresponds to the tens digit position of the memory channel group.

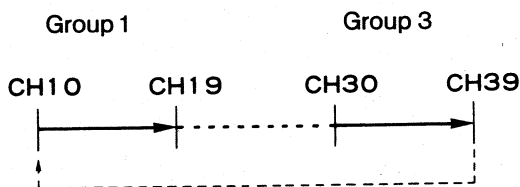
0	.....	Memory channels 00 thru 09
1	.....	Memory channels 10 thru 19
2	.....	Memory channels 20 thru 29
.		.
.		.
9	.....	Memory channels 90 thru 99

In example 1 we want to scan only Group 2, so we would press the 2 key. In example 2 we want to scan Group 1 and Group 3, so we would press the 1 key and then the 3 key.

#### Example 1



#### Example 2



### 4-12-3. Memory Channel Lockout

This transceiver has a Memory Channel lockout function which allows you to temporarily skip unwanted Memory Channels during memory scan. Locking out unwanted channels will help to increase the effective scan speed.

1. Use memory channel for the RX VFO or both during memory channel operations. The display shows the memory channel operated last.

2. Select the Memory Channel that you want to skip using the M.CH/VFO CH control.
3. Press the CLR key.

#### Note

Holding the CLR key depressed for longer than 2 seconds will clear that channel of all data.

4. A decimal point will appear in the M.CH display to indicate that the channel will be skipped.
5. To cancel the lockout, select the desired channel and then press the CLR key. The decimal point will go out indicating that the channel will again be scanned.

#### Note

If memory scan is initiated while all Memory Channels are locked out a Morse code "CHECK" will sound from the speaker.

### 4-12-4. Programmable Band Scan

Pressing the SCAN key during VFO A or VFO B operation starts the scan.

#### Channel Selection

1. While holding the SCAN key depressed press the numeric key that corresponds with the program scan range you want to scan.  
For example press the 3 key if you want to scan between the limits specified in memory channel 93. Press 4 if you want to scan between the limits specified in memory channel 94, and so on.
2. Scan will proceed from the frequency that appears in the highest frequency towards the frequency specified in the lowest frequency.
3. The mode of operation and filter bandwidth can be changed during scan.
4. To cancel scan press the CLR key.

#### Note

If no data has been stored in memory channel 90 scan will proceed from 30.0 kHz thru 30.0 MHz and these limits will be automatically stored in memory channel 90. (Initial state)

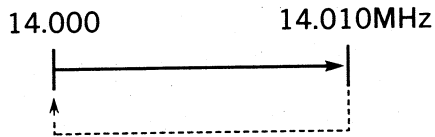
You can specify up to 10 different groups to scan. Simply hold the scan key depressed and press the numeric key corresponding to the different groups you wish to scan.

#### For example:

When 14.000 MHz (lower limit) and 14.010 MHz (upper limit) are stored in channel 91, and 21.000 MHz (lower limit) and 21.010 MHz (upper limit) are stored in channel 92:

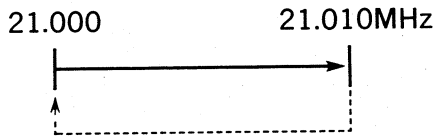
- [ 1 ] Press Numeric key 1 while holding down the SCAN key. Scanning will proceed thru the range stored in memory channel 91.

Memory channel 91

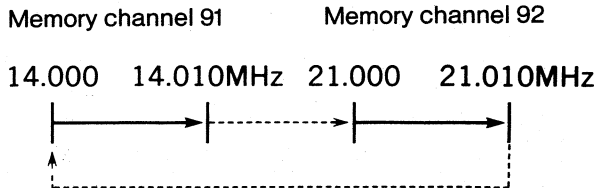


[II] Press Numeric key 2 while holding down the SCAN key. Scanning will proceed thru the range stored in channel 92.

Memory channel 92



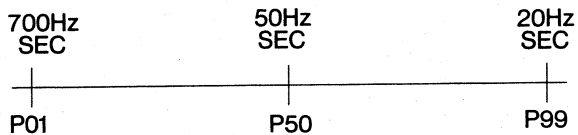
[III] Press Numeric keys 1 and then 2 while holding down the SCAN key. Scanning will be repeated within the ranges stored in channels 91 and 92.



4-12-5. Scan Speed

The scanning speed is adjustable from the front panel by using the RIT/XIT control during SCAN operations. Clockwise rotation increases the scan speed and counterclockwise rotation decreases the scan speed. This speed adjustment is effective in both VFO and M.CH scan modes. Once set the scan speed remains in memory until it is again changed by the RIT/XIT control. You must be in the SCAN mode in order to alter the scan speed.

The approximate scan speed adjustment range is shown below.



If the RIT/XIT control is turned fully counterclockwise (or clockwise) and you want to increase (or decrease) the scan speed, turn the control back and then rotate it.

4-12-6. Scan Hold

The Scan Hold function is selected by using the Power on function selection described in Section 4-10-15.

After you stop turning the TUNING knob during program scan, scanning will stop for a while and then restart.

#### 4-13. DRS(Digital Recording System) FUNCTION

CW messages or sound to be transmitted can be recorded and played back. (The optional DRU-2 digital recording unit is required.)

**Note**

This function does not work if the transmit mode is different from the receive mode. If the POWER switch is turned off during recording or playback, the recorded or stored data may be lost.

##### 4-13-1. CW Message

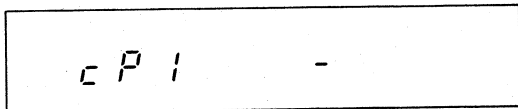
###### 1. Data Entry

Input the message you wish to transmit into memory by simply sending the desired message with you keyer. Up to 50 characters can be stored in memory.

**Note**

The CW message can only be entered into memory when the built-in electronic keyer is used. It cannot be put in memory with an external electronic keyer or key.

1. Set the MODE key to CW.
2. Place the ELECTRONIC KEY switch on the rear panel to ON.
3. Set the VOX/MAN switch to MAN. Set the FULL/SEMI switch to SEMI.
4. Press REC1, REC2, or REC3.  
Example: When REC1 is pressed.



5. When a CW message is sent with the paddle, it is automatically stored into memory.
6. When the CLR key is pressed, memory storage is terminated, and the transceiver returns to normal.

**Note**

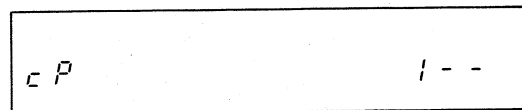
When the message length exceeds about 50 characters, memory storage is terminated, and the transceiver returns to its normal state.

###### 2. Playback method

Connect a paddle to the rear panel CW KEY jack.

1. Select the receive mode.
2. Set the VOX/MAN switch to MAN.
3. Press the PLAY key for the desired channel to start playback.

Example:



4. When the playback ends, the transceiver returns to its normal state.

**Note**

When the CLR key is pressed during playback, the transceiver returns to its normal state.

###### 3. Transmitting a message

■ From the receive mode

1. Set the VOX/MAN switch to VOX.
2. Press the desired PLAY key to start transmission.
3. When the transmission is complete, the radio will automatically return to the receive mode.

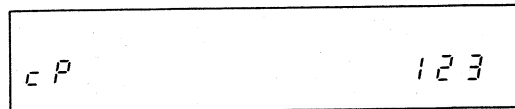
■ From the transmit mode

Press the desired PLAY key to start transmission.

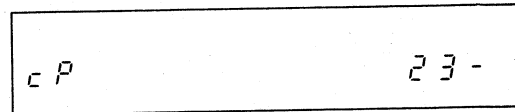
###### 4. Continuous playback

Up to three channels can be played back continuously.

Example: When PLAY1, PLAY2, and PLAY3 are pressed successively during playback.



When PLAY1 transmission is complete.



##### 4-13-2. Voice Recording (When the optional DRU-2 digital recording unit is installed)

###### 1. Recording method

The message to be transmitted is recorded with your normal microphone.

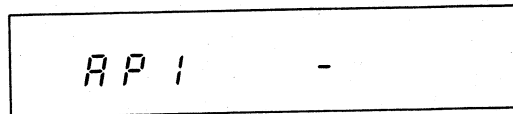
1. Select the desired mode.

**Note**

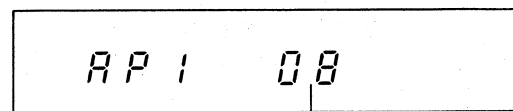
This function is disabled during FSK and TUNE operations.

2. Set the VOX/MAN switch to MAN.
3. Press REC1, REC2, or REC3.

Example: When REC1 is pressed.



4. Recording will continue as long as while the REC key is held down. (Initial setting: REC1: 8 seconds, REC2: 8 seconds, REC3: 16 seconds)



07 → 06 → 05 → ..... → 00

**Note**

If the CLR key is pressed during recording, the recorded data is erased.

5. When the REC key is released, recording is terminated, and the normal receive mode returns automatically.

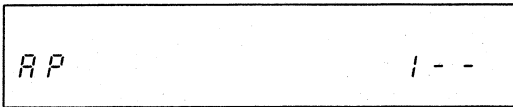
**Note**

If the available time is used up during recording, recording is terminated, and the normal receive mode returns automatically.

## 2. Playback method

1. Select the receive mode.
2. Set the VOX/MAN switch to MAN.
3. Press the PLAY key for the desired channel to start playback. Adjust the volume with the MONI control.

Example:



4. When the playback ends, the transceiver returns to its normal state.

**Note**

When the CLR key is pressed during playback, the transceiver returns to its normal state.

## 3. Transmitting a message

■ From the receive mode

1. Set the VOX/MAN switch to VOX.
2. Press the PLAY key for the desired channel to start transmission. For information about the microphone gain adjustment, see the SSB or AM transmission section.
3. When the transmission is complete, the receive mode will return automatically.

■ From the transmit mode

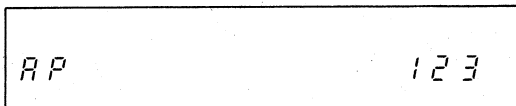
Press the PLAY key for the desired channel to start transmission.

To transmit recorded voice without delay, switch VOX off or turn the GAIN control on the rear of the radio fully counterclockwise.

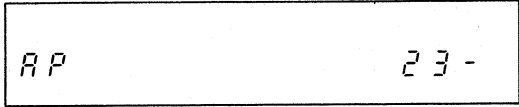
## 4. Continuous playback

Up to three channels can be played back continuously.

Example: When PLAY1, PLAY2, and PLAY3 are pressed successively during playback.



When PLAY1 transmission is complete.





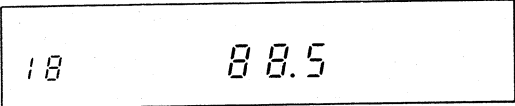
#### 4-14. REPEATER OPERATION

Repeaters permit a very wide coverage area at relatively low power levels using the FM mode. The combination of low noise combined with the generally good propagation offered by this band makes for some excellent low power contacts.

1. Press and hold the LSB/USB key and turn on the POWER. Select number 18 by rotating the M.CH/VFO CH control. The tone frequency will be displayed.

**Note**

The tone frequency is available during SPLIT operation when both the transmit and receive frequencies are in the FM mode.



2. Select the tone frequency by using the UP/DOWN switch. The 38 built-in tone frequencies are shown below.

Hz	Hz	Hz
67.0	114.8	192.8
71.9	118.8	203.5
74.4	123.0	210.7
77.0	127.3	218.1
79.7	131.8	225.7
82.5	136.5	233.6
85.4	141.3	241.8
88.5	146.2	250.3
91.5	151.4	
94.8	156.7	
97.4	162.2	
100.0	167.9	
103.5	173.8	
107.2	179.9	
110.9	186.2	

3. Press the CLR key, or turn the POWER switch OFF and back ON.
4. First select the desired receiver frequency in RX VFO.
5. Press the A=B key.
6. Set the RX VFO to B and select the transmit frequency for repeater operation.
7. Set the RX VFO to A and set the TX VFO to B. SPLIT will display. When the TX VFO B key is pressed, the transmit frequency is displayed momentarily. This momentary display may be suppressed with the function setting at power on. (Please refer to Section 4-10-15.)
8. Press the M.IN key and put the data in the desired memory channel (00 to 89).
9. Set the TX and RX VFO's to the M.CH and recall the input memory channel.
10. Press the microphone PTT switch, or set the REC/SEND switch to SEND and speak into the microphone.

**Note**

Check the intended transmitter frequency before transmitting to avoid interrupting another QSO.

11. Release the PTT switch, or place the REC/SEND switch to REC.

#### 4-15. OPERATION WITH A PERSONAL COMPUTER (Requires optional IF-232C)

Control with a personal computer is possible with the optional IF-232C interface. For more information, refer to the manuals provided with the interface.

##### ■ Function list

- AUTO INFORMATION ON/OFF setting
- Same function as microphone UP/DOWN switch
- VFO A, VFO B and memory frequency selection and readout
- Filter setting
- VFO A, VFO B and memory frequency TX/RX setting
- Model No. readout for transceiver recognition
- Display of transceiver's current condition
- F.LOCK ON/OFF setting and display
- Memory channel setting
- Mode setting
- Memory display
- Memory entry
- AIP switch ON/OFF setting
- PITCH setting
- RIT/XIT frequency clearance
- RIT/XIT frequency UP/DOWN
- METER key setting
- RIT ON/OFF setting
- RX : For receive operation, TX : For transmit operation
- Scan ON/OFF setting
- Slope tune band setting and readout
- Meter signal output
- Sub-tone frequency setting
- Generation of synthesized voice
- XIT ON/OFF setting

#### 4-16. VOICE SYNTHESIZER

(Requires the use of the optional VS-2 Voice Synthesizer)

When the VOICE key is pressed the transceiver will audibly announce the operating frequency.  
When the function is set when the power is switched on, the transceiver will audibly announce the menu number and its contents.

#### 4-17. DIGITAL MODULATION FUNCTION [The Digital Signal Processor DSP-100 (option) is required.]

SSB, CW, AM, or FSK modulation and detection in SSB receive mode are done by the 16-bit A/D and D/A converters and DSP (digital signal processor).

##### (1) Features of each Mode

###### ① SSB mode

Modulation of higher quality than a usual SSB mode is obtained through modulation by the 10th phase-shift network that digitally processes signals.

###### ② CW mode

Excellent characteristics are obtained through digital form-restoration of the wave shape.

###### ③ AM mode

Low-distortion modulation with excellent amplitude and group delay characteristics is obtained through digital modulation and by using the 84th FIR filter.

###### ④ FSK mode

Excellent, low-distortion modulation is obtained through FSK modulation with continuous phasing after the digital form-restoration.

###### ⑤ SSB, CW, and FSK mode (receive)

Received SSB, CW, and FSK signals are detected by the DSP.

##### (2) Operation

###### ① Microphone gain adjustment

When the DSP-100 TX switch is on, the microphone gain in the SSB and AM modes is adjusted with the DSP-100 MIC GAIN control so that the TS-850 ALC meter pointer does not exceed the ALC range.

###### ② Carrier level adjustment

When the DSP-100 TX switch is on, the carrier level in the CW, FM, AM, and FSK modes is adjusted with the DSP-100 CAR LEVEL control. For the level setting, see Section 4-4, CW operation (transmission), Section 4-5, FM operation (transmission), Section 4-6, AM operation (transmission) and Section 4-7, FSK operation (transmission).

##### Note

When the DSP-100 TX switch is off or the power is off, the DSP-100 MIC GAIN and CAR LEVEL controls do not work. Use the TS-850S control.

#### 4-18. Transfer function when two TS-850S transceivers are connected together

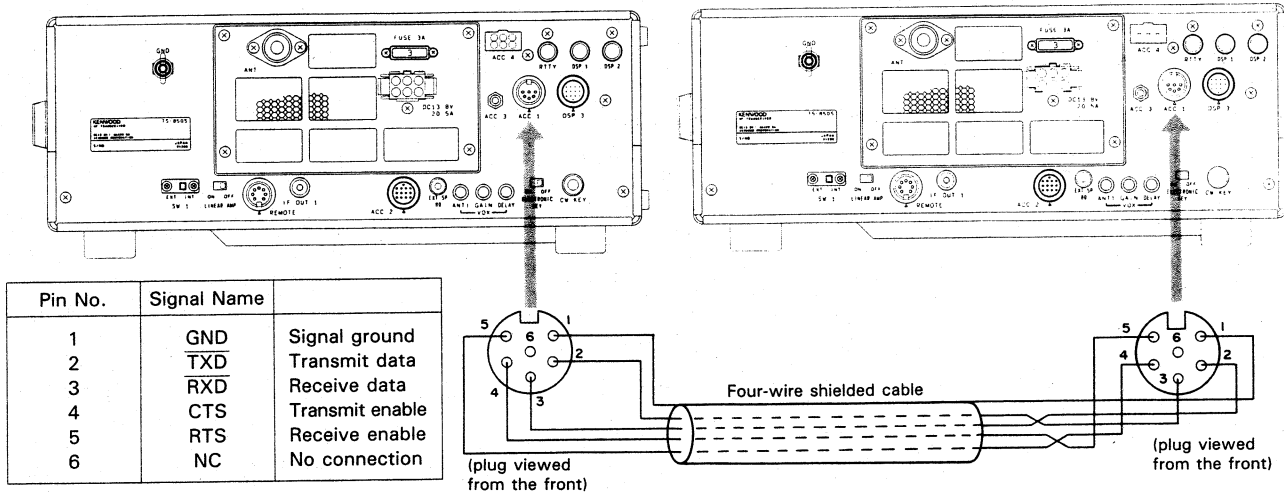
When two TS-850 are connected together, operation data can be transferred from one TS-850S (master) to the other (slave).

##### Notes

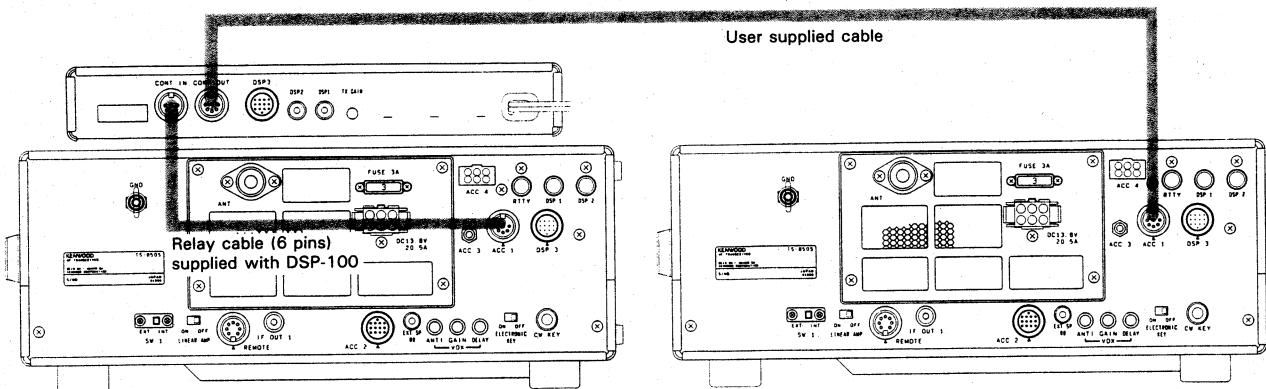
1. Other functions may be slowed down while the data is being transferred.
2. All operation data can not be transferred if the master transceiver is in memory channel mode or the slave transceiver is in Quick memory channel mode.

#### 4-18-1. Connection

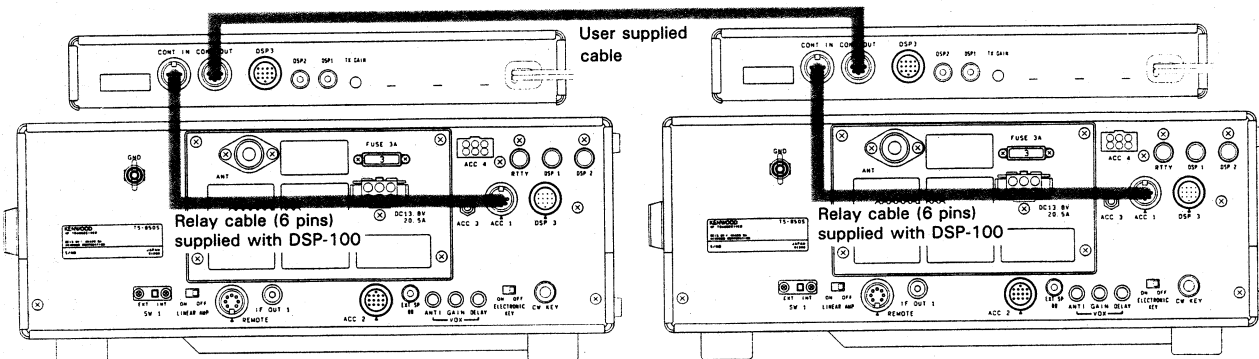
Make up a connection cable with 6-pin DIN plugs, or use a 6-pin DIN cord (1m) to connect the ACC1 connectors of the two TS-850S. For 6-pin DIN plugs (option, part No. E07-0654-05) or 6-pin DIN cord (option, part No. E30-3047-05), contact your nearest KENWOOD authorized service center or dealer.



If a DSP-100 is connected to one of the transceivers, connect as shown in Figure 1.



If a DSP-100 is connected to each of the transceivers, connect as shown in Figure 2.

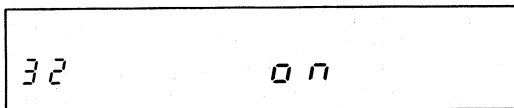


##### Note

This function does not work if the DSP-100 power is off.

#### 4-18-2. Function setting

Turn both transceivers on with the function setting (menu number 32) at power on. (Please refer to Section 4-10-15.)



#### 4-18-3. Data that can be transmitted

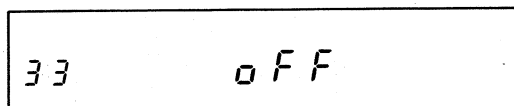
Data that can be transmitted includes the following:

VFO frequency, VFO A/B, Filter, Mode (with the TUNE mode), Selected the meter indication, AIP ON/OFF, 1MHz ON/OFF, FINE ON/OFF

#### 4-18-4. Operation

- To write the same data to the quick memory channels of both transceivers

1. Turn the slave transceiver off with the function setting (menu number 33) at power on. (Please refer to Section 4-10-15.)

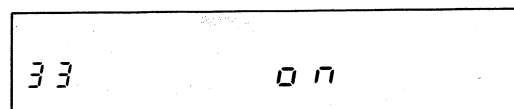


2. Press the CLR key.
3. Set the data, such as the frequency to be stored in the master transceiver, and press the QUICK MEMO M.IN key of the master transceiver. The slave transceiver beeps, and the same data is written to quick memory channels 1 of both transceivers.
4. When the QUICK MEMO M.IN key is pressed, the latest data is written to channel 1. If there is already data in channel 1, it is moved to channel 2.

For the quick memory recall method, see Section 4-11-13.

- To rewrite the VFO frequency of the slave transceiver directly

1. Turn the slave transceiver on with the function setting (menu number 33) at power on. (Please refer to Section 4-10-15.)

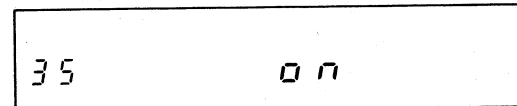


2. Press the CLR key.
3. Set the data, such as the frequency to be stored in the master transceiver, and press the QUICK MEMO M.IN key of the master transceiver. The

data, such as the VFO frequency, in the slave transceiver is replaced by the data in the master transceiver. The same data is also written to quick memory channel 1 of the master transceiver.

#### 4-18-5. SPLIT Function setting

Turn both transceivers on with the function setting (menu number 35) at power on. (Please refer to Section 4-10-15.)



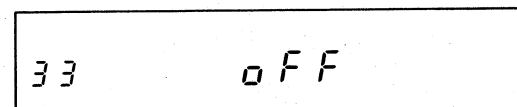
##### (1) Data that can be transmitted

Data that can be transmitted includes the following:  
VFO frequency, Mode (with the TUNE mode)

##### (2) Operation

- To write the data to the quick memory channels of slave transceiver

1. Turn the slave transceiver off with the function setting (menu number 33) at power on. (Please refer to Section 4-10-15.)

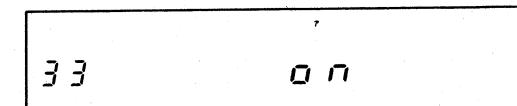


2. Press the CLR key.
3. Set the data, such as the frequency to be stored in the master transceiver, and press the QUICK MEMO M.IN key of the master transceiver. The slave transceiver beeps, and the data is written to quick memory channels 1 of slave transceiver. The data is also written to quick memory channel 1 of the master transceiver.
4. When the QUICK MEMO M.IN key is pressed, the latest data is written to channel 1. If there is already data in channel 1, it is moved to channel 2.

For the quick memory recall method, see Section 4-11-13.

- To rewrite the VFO frequency of the slave transceiver directly

1. Turn the slave transceiver on with the function setting (menu number 33) at power on. (Please refer to Section 4-10-15.)

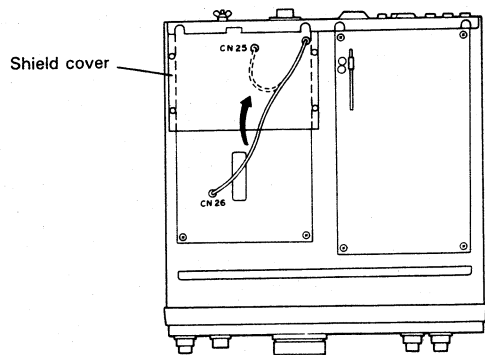


2. Press the CLR key.
3. Set the data, such as the frequency to be stored in the master transceiver, and press the QUICK MEMO M.IN key of the master transceiver. The data, such as the TX VFO frequency, in the slave transceiver is replaced by the data in the master transceiver. The data is also written to quick memory channel 1 of the master transceiver.

#### 4-19. When used as the master machine for the transverter

##### Notes

1. Be sure to unplug the DC power cable before starting work.
2. Advanced skills and knowledge will be needed for this type of operation. Be very careful to make connections exactly as shown.



##### Preparation

1. Removing the bottom cover from the transceiver.
2. Removing the shield cover.
3. Disconnect the plug of the coaxial cable from CN26, and insert it into CN25.
4. Replace the shield cover and the bottom cover.

##### Note

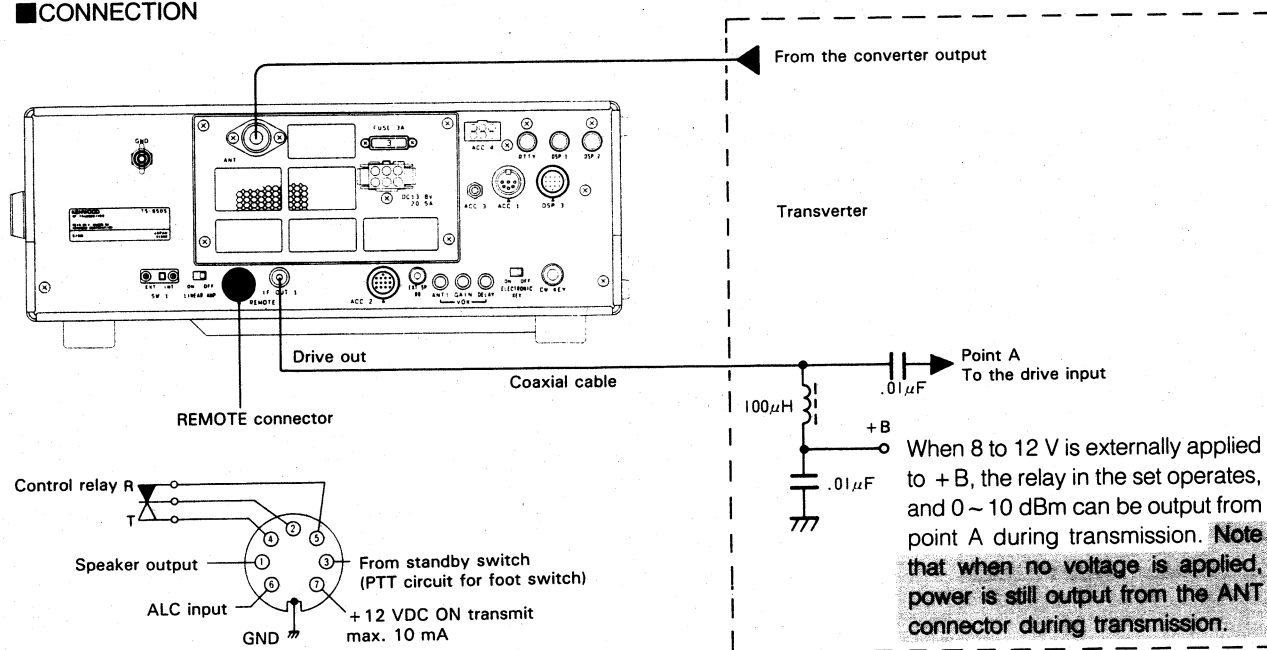
Avoid pinching the wiring harness when closing.

The IF OUT 1 terminal on the rear can be used as a drive out terminal.

##### Note

IF OUT 1 cannot be used as an output terminal for a bandscope.

##### CONNECTION



When connections are made as shown above, the PWR control on this unit does not work, so turn it fully clockwise. The external ALC input is negative. The ALC circuit operates from about  $-9$  V.

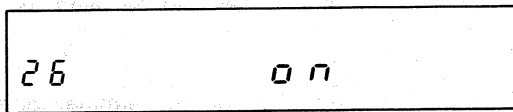
## ■ DISPLAY INDICATOR

The frequencies corresponding to the 50, 144, and 430 MHz bands can be displayed with the function setting (menu numbers 26 to 28) at power on. (Please refer to Section 4-10-15.)

For example:

When the 28 MHz band is used as the 50 MHz band.

1. Set the receive frequency is 28.000 MHz.
2. Turn the POWER switch OFF.
3. Press and hold the LSB/USB key and turn on the POWER switch.
4. Select the desired number 26 by rotating the M.CH / VFO CH control and turn ON the UP/DOWN switch.



5. When the CLR key is pressed, the menu mode is terminated, and the display frequency becomes 50.000.00 MHz.
6. When menu number 27 is selected, the 144 MHz band is displayed, and when menu number 28 is selected, the 430 MHz band is displayed.

### Notes

1. When menu number 27 or 28 is selected, deselect menu number 26.
2. If the display frequency is in the 50, 144, or 430 MHz band, the frequency cannot be set with the numeric keys.

#### 4-20. Remote control function

The front panel keys can be operated remotely via the remote control terminal (ACC3) on the rear. The following eleven functions can be remotely controlled.

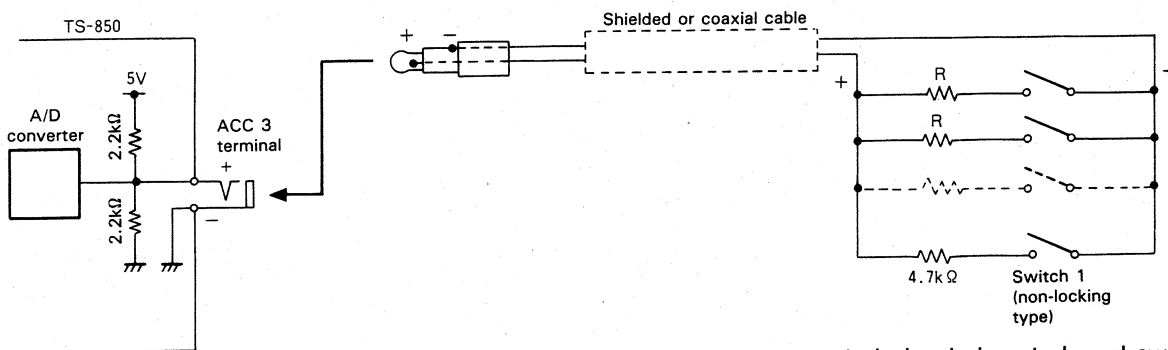
PLAY-1, PLAY-2, PLAY-3, REC-1, REC-2, REC-3, CLR,  
TF-SET, QUICK M.IN, QUICK MR, VOICE

The remote control terminal circuit in the transceiver is as follows. When the A/D converter terminal voltage reaches the voltage determined by the built-in program, the microprocessor performs operations according to the terminal voltage. For example, if a 4.7kohm resistor is connected between + and - of the remote control terminal, the A/D converter input voltage becomes about 2 V, and the QUICK MR function operates. You can make your own remote control keyboard to suit your needs by providing the necessary remote control switches.

The terminal voltages and resistance values required for operating each of the functions are as follows:

Function	Terminal voltage (V, median value)	R Resistance [ $\Omega$ ]
PLAY-1	0.22~0.36 (0.29)	150
PLAY-2	0.42~0.56 (0.49)	270
PLAY-3	0.61~0.75 (0.68)	412 (390+22)
REC-1	0.80~0.94 (0.87)	582 (560+22)
REC-2	0.99~1.13 (1.06)	820
REC-3	1.18~1.32 (1.25)	1.1k (1k+100)
CLR	1.38~1.52 (1.45)	1.5k
TF-SET	1.57~1.71 (1.64)	2.07k (1.8k+270)
QUICK M.IN	1.76~1.90 (1.83)	3.03k (2.7k+330)
QUICK MR	1.95~2.09 (2.02)	4.7k
VOICE	2.14~2.28 (2.21)	8.42k (8.2k+220)

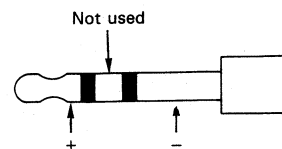
- Use non-locking switches that are open when off (N.O.).
- Use a shielded cable or a coaxial cable to connect the terminal and switches.
- Use resistors with a tolerance of 5% or better.
- If a function does not work with a specified resistance, increase or decrease the resistance until the voltage on the positive side of the remote control terminal is in the specified range.
- If two switches are pressed together, the result is unpredictable.



When the remote control plug is inserted, and switch 1 is closed, the voltage on the positive side of the remote control terminal becomes about 2 V, and the QUICK MR function operates. Set the value of R to suit the desired function.

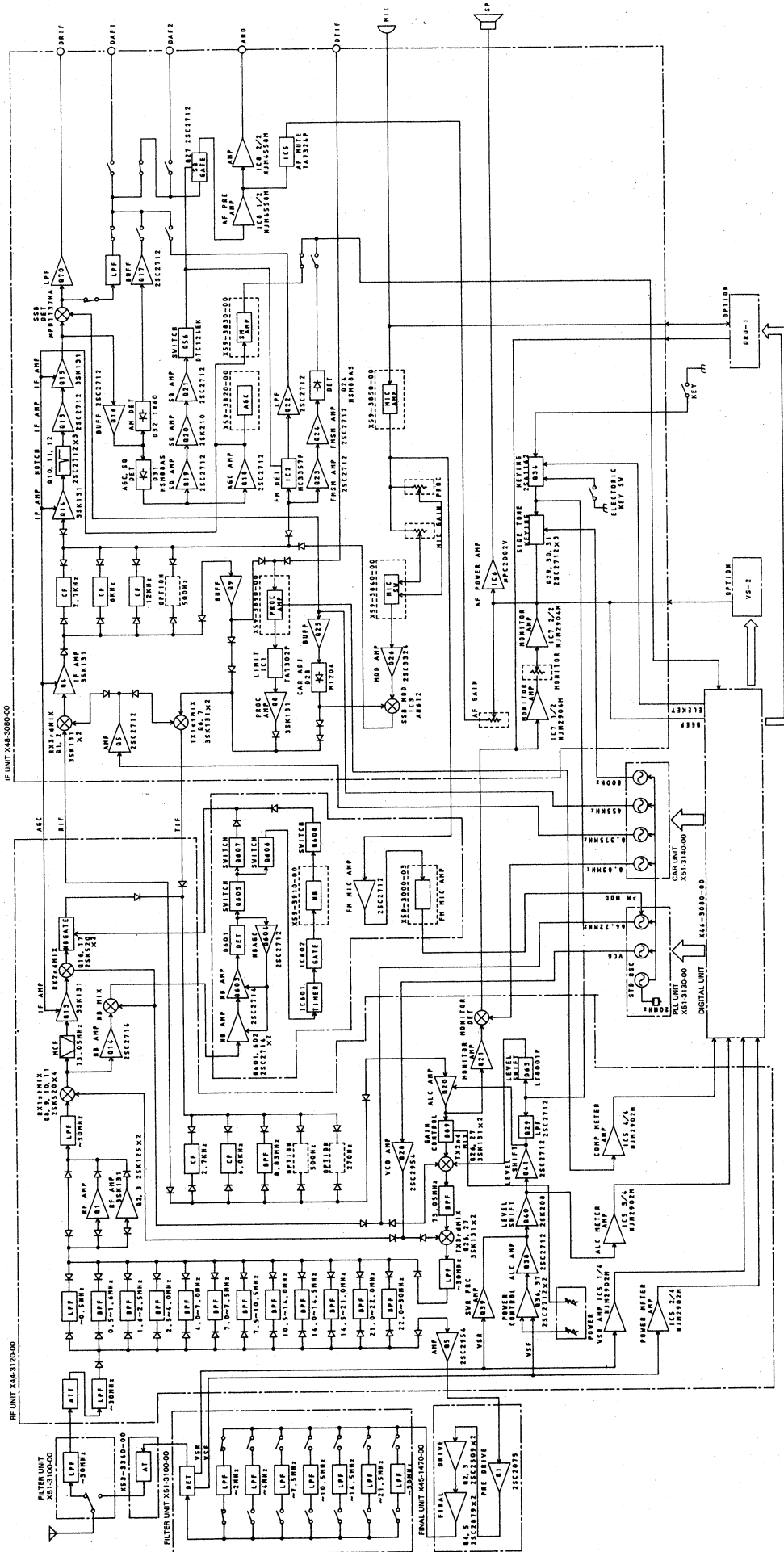
#### Notes

1. Do not apply any voltage to the ACC3 terminal from an external source.
2. Use standard plugs (3.5 mm in diameter). If a stereo plug is used, do not use the middle (ring) terminal.



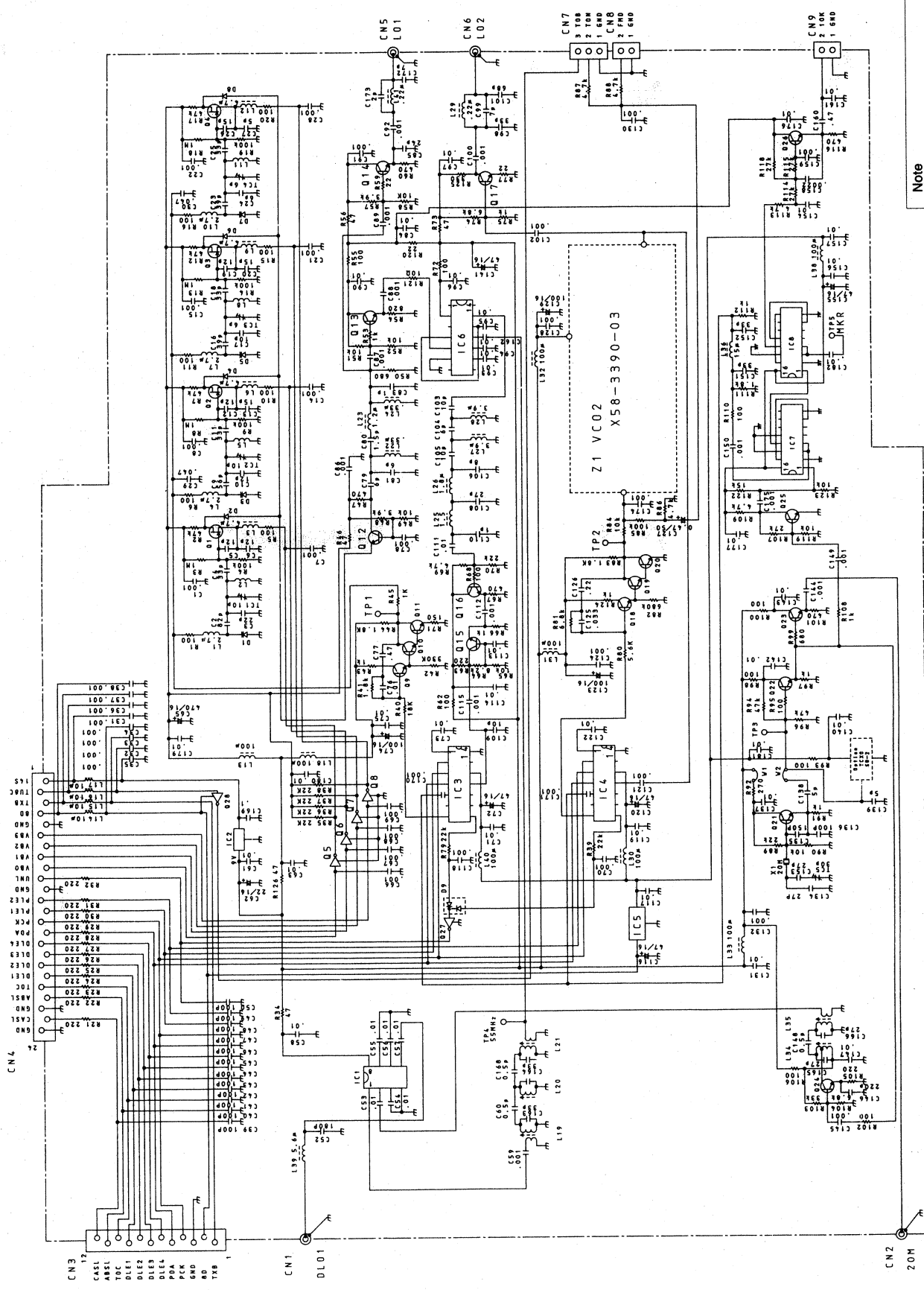
# 5. CIRCUIT DESCRIPTION

## 5-1. BLOCK DIAGRAM



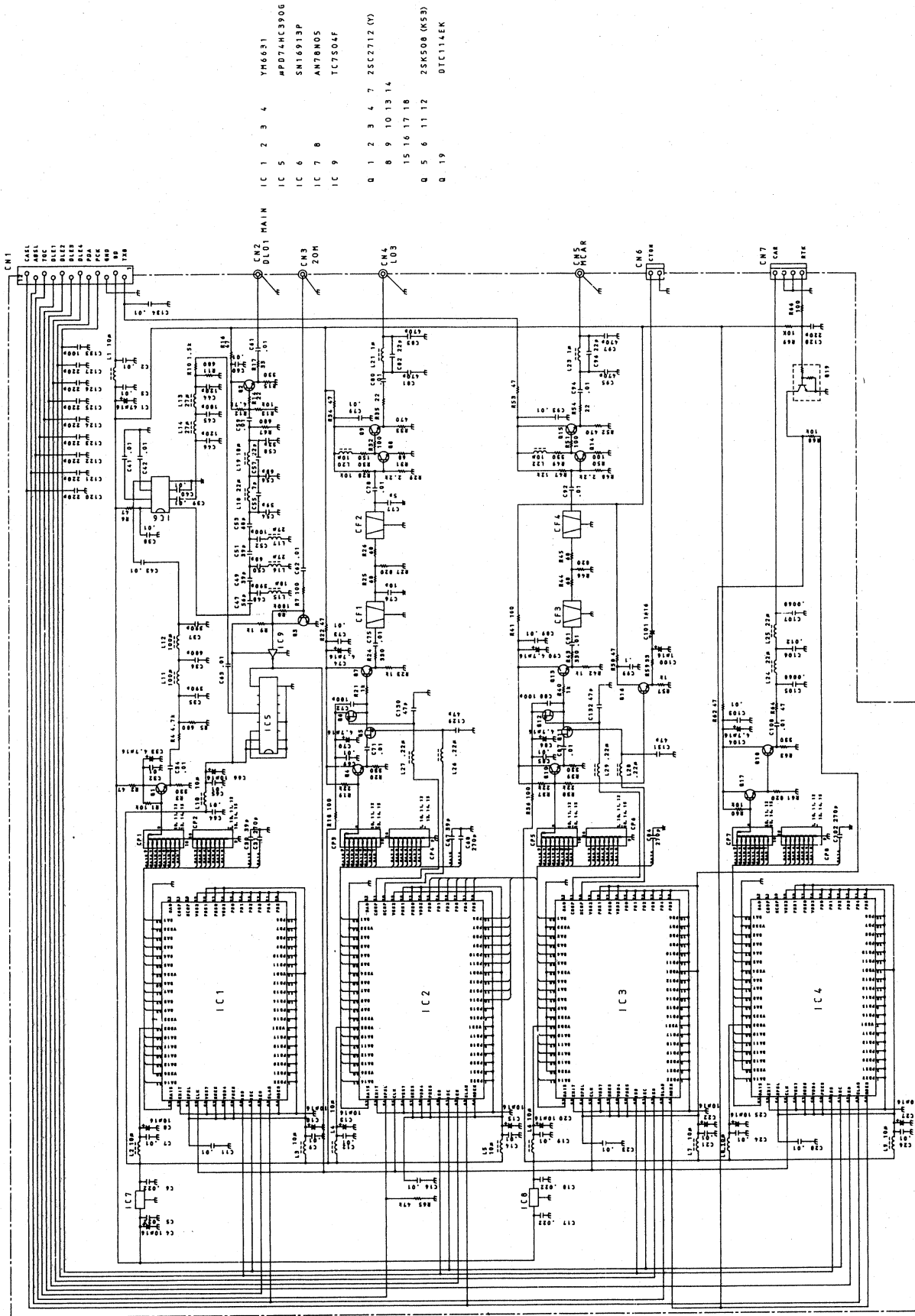


5-2. CIRCUIT DIAGRAM  
PLL UNIT (X50-3130-00)



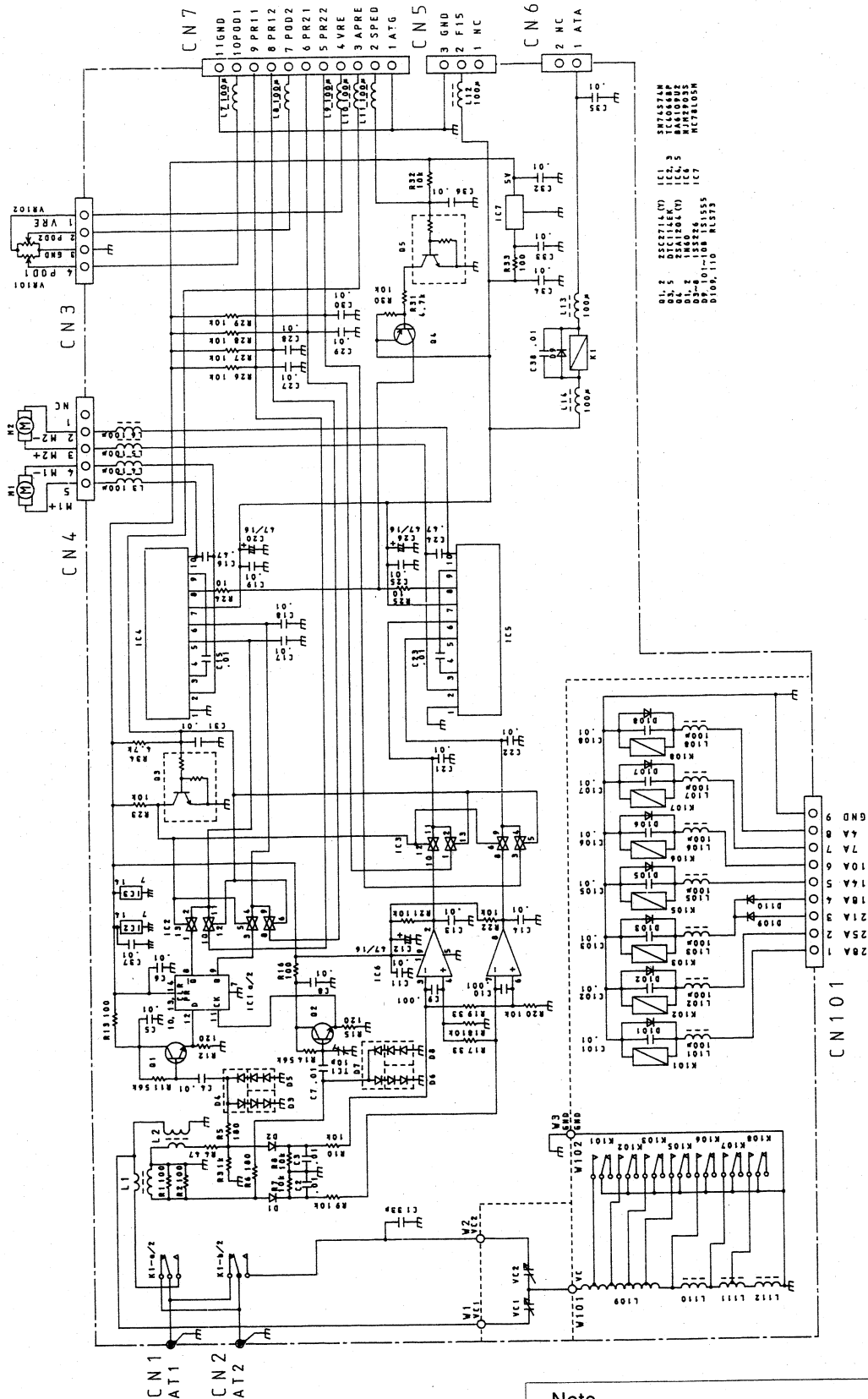
Note  
Circuit Diagram is subject to change without  
notice due to advancements in technology.

- 15V166 01, 2, 7, 8
- RES79 02, 4, 6, 8
- DAN202 (M) 09
- 25C810 (CU) 01, 2, 7, 8
- 01C114 (K) 05, 4, 7, 8
- 25C324 (M) 09, 10, 11, 16, 18, 20
- CPD122 (N) ICA, 4
- AMP2805 (C) IC6
- 25C271 (D) 01, 2, 3, 5, 6, 21, 22, 24, 25
- 25C289 (C) 01, 2, 3, 5, 6, 21, 22, 24, 25
- AD74NC308 (C) IC7, 8
- AD74NC308 (C) IC7, 8
- 01C114 (K) 05
- 01C114 (K) 05



Note  
Circuit Diagram is subject to change without  
notice due to advancements in technology.



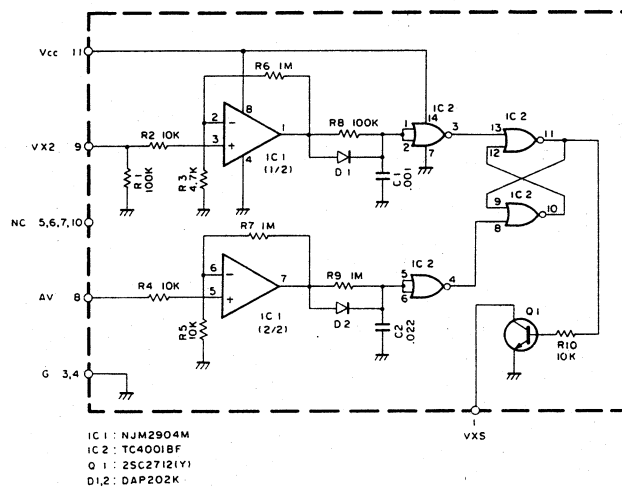


- IC1 2 25C2714(V)
- IC2 5 D1C1166K
- IC3 3 8460982
- IC4 2 1M400
- IC5 2 1M400
- IC6 4 8128035
- IC7 1 8128035
- DIOR, 110 RL573
- 2N7437M
- 1C1
- 1C2
- 1C3
- 1C4
- 1C5
- 1C6
- 1C7

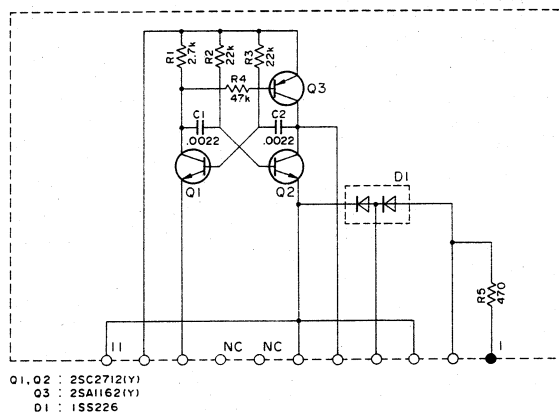
**Note**  
Circuit Diagram is subject to change without notice due to advancements in technology.



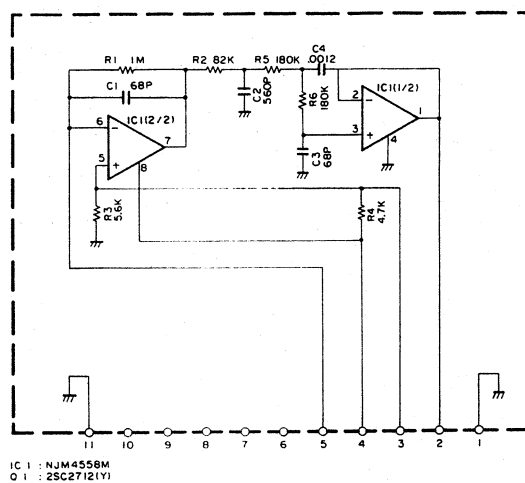
### VOX UNIT (X59-1080-00)



### DC-DC UNIT (X59-1100-00)

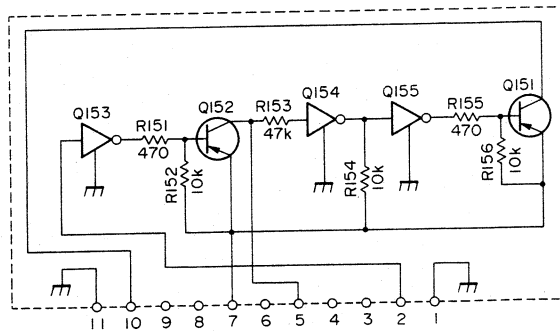


### FM MIC AMP UNIT (X59-3000-03)



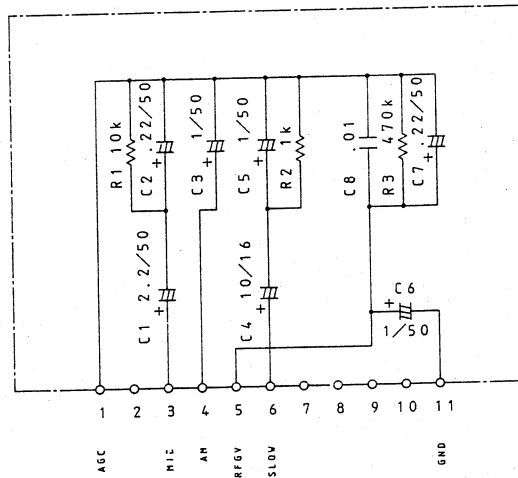
Note  
 Circuit Diagram is subject to change without  
 notice due to advancements in technology.

TRX UNIT (X59-3680-00)

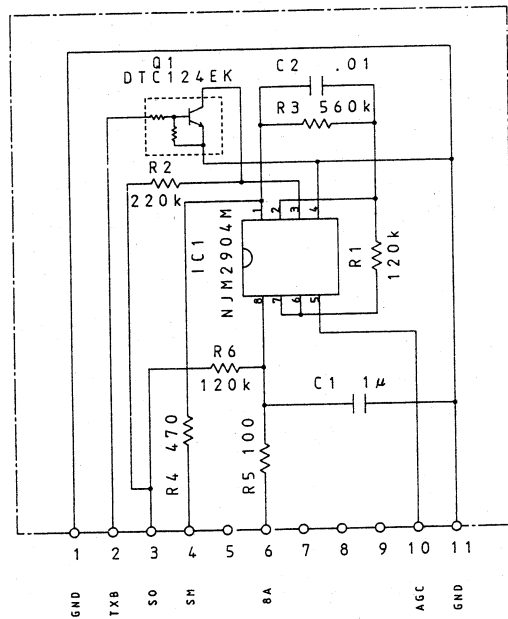


Q151, 152 : 25A1213(Y)  
 Q153, 154, 155 : DTC114TK

AGC UNIT (X59-3820-00)

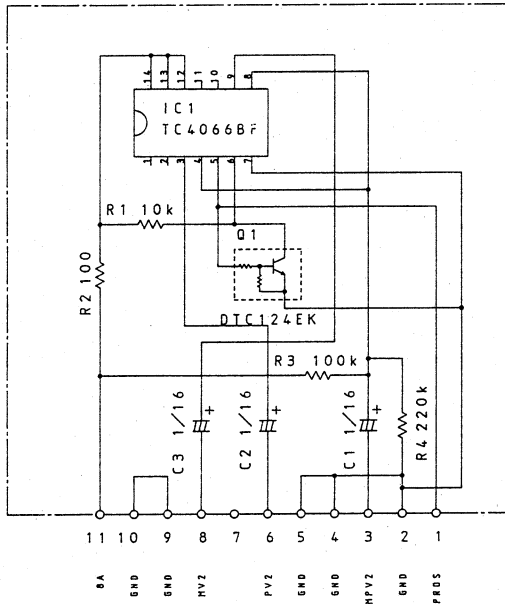


SM AMP UNIT (X59-3830-00)

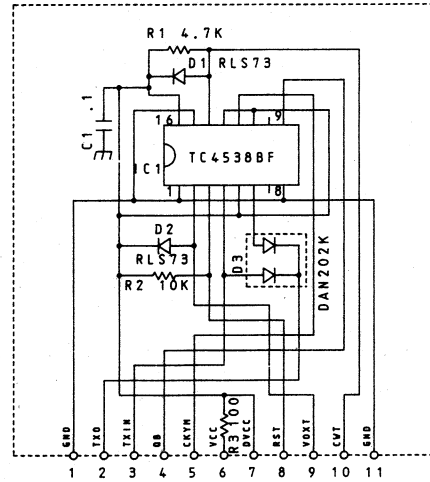


Note  
 Circuit Diagram is subject to change without  
 notice due to advancements in technology.

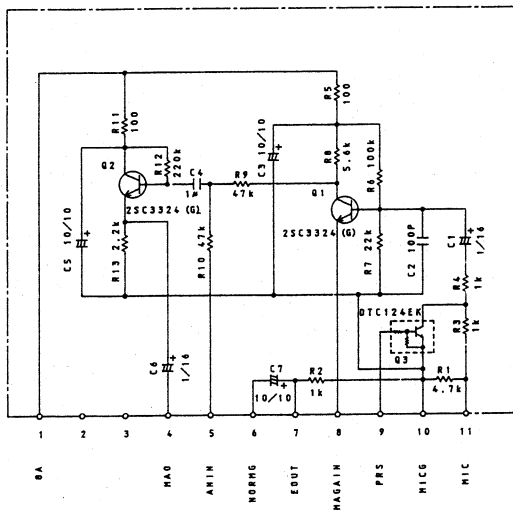
**MIC-SW UNIT  
(X59-3840-00)**



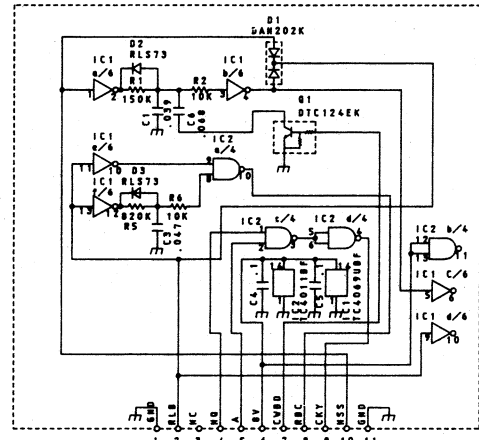
**DELAY UNIT  
(X59-3860-00)**



**MIC AMP UNIT  
(X59-3850-00)**



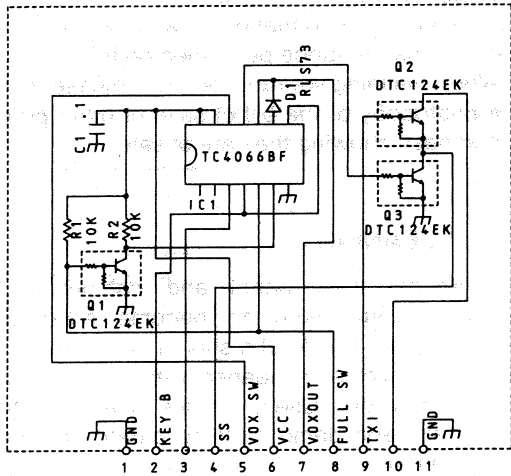
**BREAK-IN UNIT  
(X59-3870-00)**



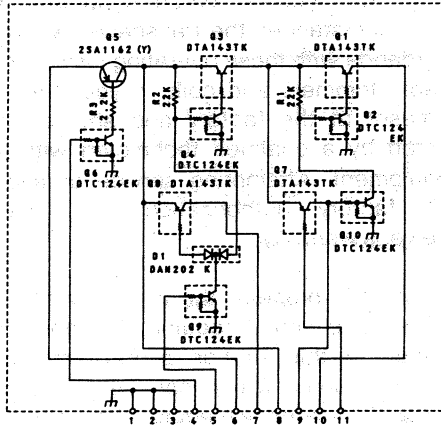
**Note**  
Circuit Diagram is subject to change without notice due to advancements in technology.



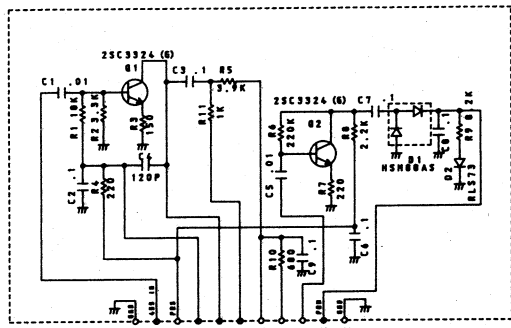
**BK SWITCH UNIT**  
(X59-3880-00)



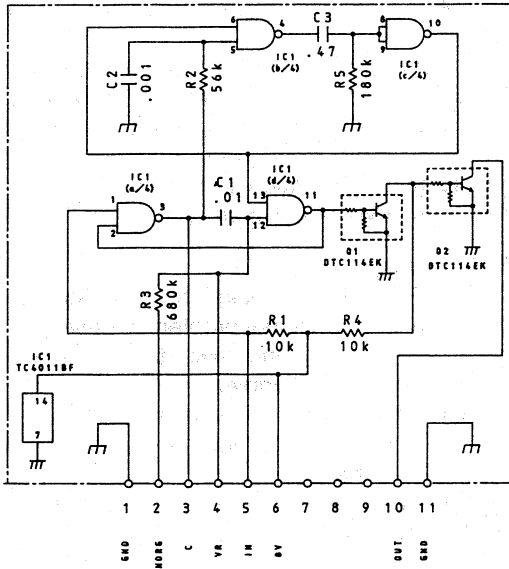
**AIP UNIT**  
(X59-3900-00)



**PROCK UNIT**  
(X59-3890-00)



**NB2 UNIT**  
(X59-3910-00)



Note  
Circuit Diagram is subject to change without  
notice due to advancements in technology.

## 6. MAINTENANCE AND ADJUSTMENTS

### 6-1. GENERAL INFORMATION

Your transceiver 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 transceiver's warranty.

When operated properly, the transceiver can give years of service without requiring realignment. The information in this section gives some general service procedures which can be accomplished without sophisticated test equipment.

### 6-2. SERVICE

Should it ever become necessary to return the equipment to your servicing dealer or KENWOOD authorized service center for repair, pack in its original box 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.

Tag all returned items with your name and call for identification. Please mention the model and serial number of your radio in any correspondence, whether phone or written. For future reference, record this information in the space provided on the back cover of this manual.

#### 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.

#### Caution

Do not pack the equipment in crushed newspapers for shipment! Extensive damage may result.

#### Notes

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.

### 6-3. CLEANING

The knobs, front panel and cabinet of the transceiver 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 damp cloth to clean the cabinet and front panel.

## 6-4. IN CASE OF DIFFICULTY

The problems described in this table are failures caused in general by improper operation or connection of the transceiver, not by defective components. Check according to the following table. If the problem persists, contact an authorized agent or service station.

### RECEPTION

Symptom	Probable cause	Corrective action
Indicators do not light and no receiver noise is heard when the POWER switch is turned on.	<ol style="list-style-type: none"> <li>1. Bad power cable or connections.</li> <li>2. Blown power supply fuse.</li> <li>3. Power supply is OFF.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check cables and connections.</li> <li>2. Check for the cause of the blown fuse and replace the fuse.</li> <li>3. Switch power supply ON.</li> </ol>
Nothing is displayed or improper digits are displayed when the POWER switch is turned on.	The microprocessor may malfunction if the input voltage is too low.	<ol style="list-style-type: none"> <li>1. Use a step-up transformer to raise the line voltage to the power supply. Use a 12 to 16 V battery.</li> <li>2. Turn on the POWER switch while depressing the A = B (or RX-A) key, and then release the A = B (or RX-A) key.</li> </ol>
When you press the POWER switch, "14 MHz USB" is displayed ... or the receive sensitivity is low.	The backup battery voltage is low.	Please refer to Section 4-11-1.
No signal is received even when the antenna is connected, or the receiver sensitivity is low.	<ol style="list-style-type: none"> <li>1. SQL control fully clockwise.</li> <li>2. The ATT switch is ON.</li> <li>3. The REC/SEND switch is in the SEND position.</li> <li>4. Microphone PTT switch is in the transmit position.</li> <li>5. SLOPE TUNE control is improperly adjusted.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn the SQL control counterclockwise.</li> <li>2. Set the ATT switch to 0dB.</li> <li>3. Set the REC / SEND switch to REC.</li> <li>4. Set the PTT switch to the receive position.</li> <li>5. HIGH control : Fully clockwise LOW control : Fully counterclockwise</li> </ol>
An antenna is connected, but no signal is received and the S-meter deflects fully.	RF gain control is too low.	Turn the RF gain control MAX clockwise.
The S-meter deflects and stays at a certain position even with no signal.	<ol style="list-style-type: none"> <li>1. Low DC or AC line voltage.</li> <li>2. RF gain control closed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Use a step-up transformer to raise the line voltage. Use a 12 to 16 V battery.</li> <li>2. Turn the RF gain control fully clockwise.</li> </ol>
Signal is received, but no sound is heard.	MODE key position is incorrect.	Change the MODE key to the correct mode.
SSB received signal is extremely high cut or low cut.	SLOPE TUNE control is improperly adjusted.	HIGH control : Fully clockwise LOW control : Fully counterclockwise
Frequency is not changed by pressing the UP/DOWN switches, turning the TUNING knob, or M.CH/VFO CH control.	F.LOCK key is ON.	Set F.LOCK key to OFF.
Memory scan fails. ("CHECK")	Nothing is stored in memory.	Store the frequency.

**Note**

Beat tones may be heard on the following frequencies. This is due to the internal frequency configuration of the radio and is not an indication of any problem. It is normal.

10.000MHz, 20.000MHz, 30.000MHz

**TRANSMIT**

Symptom	Probable cause	Corrective action
Output	1. Microphone plug is not plugged in. 2. Low microphone gain. 3. Poor antenna connection.	1. Plug MIC in. 2. Increase the MIC gain control. 3. Connect antenna securely.
VOX does not operate.	1. GAIN control too low. 2. ANTI control too high.	1. See section 4-1-2, GAIN control. 2. See section 4-1-2, ANTI control.
VOX trips by speaker output.	ANTI control too low.	See section 4-1-2, ANTI control.
Linear amplifier does not key.	1. LINEAR AMP switch on rear panel was not turned ON. 2. REMOTE connector is miswired, or has a poor contact.	1. Move the switch as described in section 6-6-5. 2. Correct wiring.
Amplitude modulation does not work.	PROC switch is ON.	PROC switch is OFF.

**6-5. ORDERING SPARE PARTS**

When ordering replacement or spare parts for your equipment, be sure to specify the following: Model and serial number of your transceiver. Schematic number of the part. Printed circuit board number on which the part is located, part number and name, if known, and quantity desired. Part numbers for most replacement parts are contained in the service manual (available as an option from your dealer or parts distributor).

**6-6. ADJUSTMENTS**

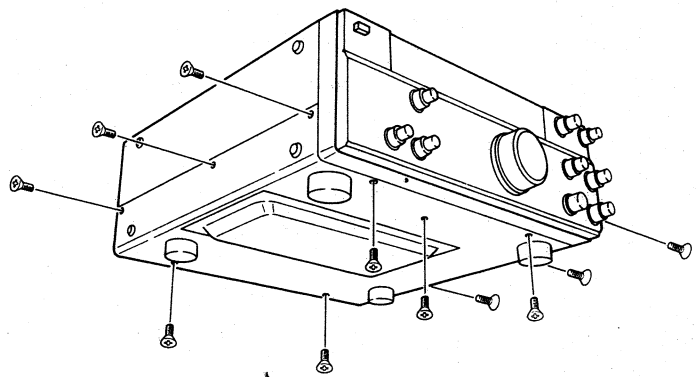
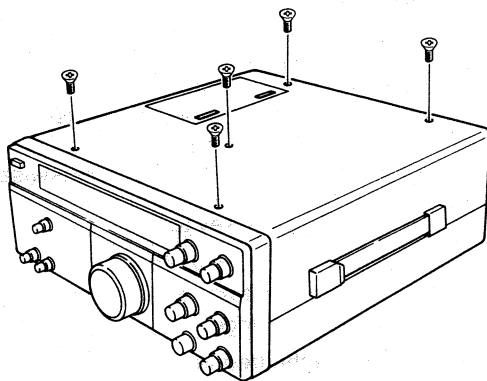
**6-6-1. Cover Removal**

**Removing the covers**

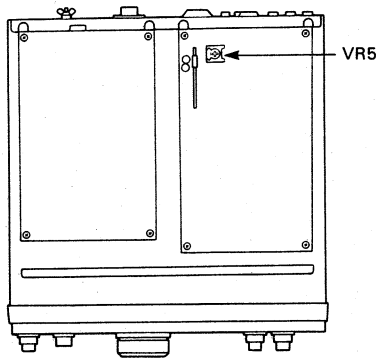
Remove the top cover, and the bottom covers from the transceiver.

**Cautions**

1. Before removing the cover, turn the DC power supply's POWER switch OFF and disconnect the power cable.
2. Do not pull wiring when opening or pinch wires when closing cases.

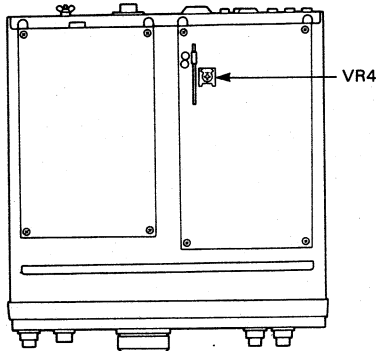


### 6-6-2. Sidetone Level



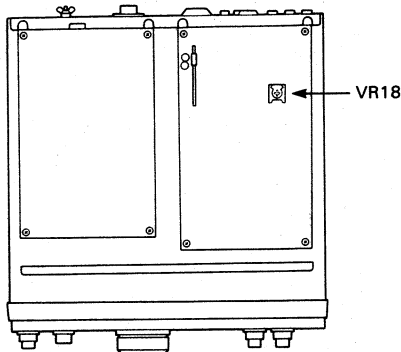
Turn VR5 while holding down the key in the CW mode for the desired tone level.

### 6-6-3. Beep Tone Level



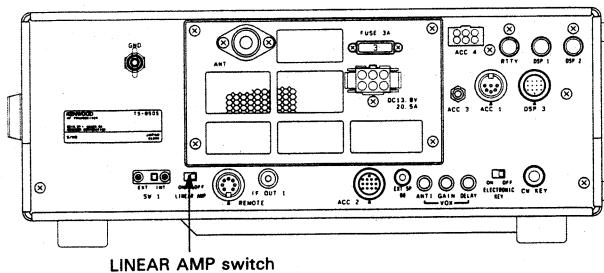
Turn VR4 to the desired tone volume.

### 6-6-4. Adjusting the Data Communications Modulation Input Level



Set the input level for the desired modulation level with VR18. Input is reduced by turning the control counterclockwise, and increased by turning clockwise.

### 6-6-5. Linear Amplifier Control



The external control relay is not activated at the factory so that the operation of the radio will remain at the lowest mechanical noise level during CW Full break-in operation. If the use of this control relay is required, such as for use with an external linear amplifier it may be activated by setting the LINEAR AMP switch to ON.

12 volts at approximately 10 mA maximum is available at pin number 7 of the REMOTE connector for control of an external keying relay, if necessary. We recommend the use of a 7 pin DIN plug for this connection. When operation of this transceiver with the TL-922/922A is anticipated you should use the control cable supplied with the linear amplifier.

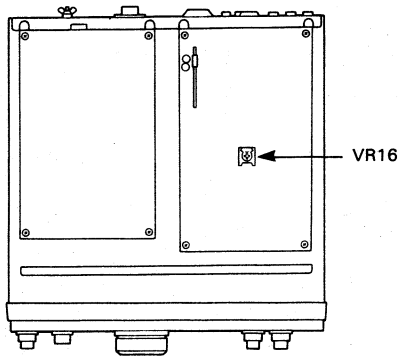
Most linear amplifiers require a ground on transmit. This is available by connecting pin 2 of the remote connector to ground. Then connect the center conductor of your

linear's relay control line to pin 4. The relay in this transceiver is capable of handling 100V DC at 500 mA.

**Note**

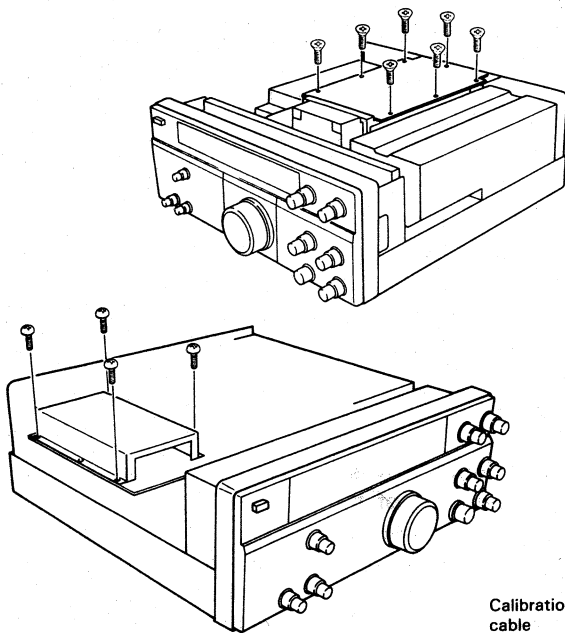
The TL-922/922A is NOT designed for Full Break-in operation. Attempting operation of the linear in this mode might lead to damage in the linear amplifier.

**6-6-6. Adjusting the NOTCH**



1. Rotate the tuning knob so that a stable signal of about S9 is received in USB mode and the beat frequency of the audio output is about 1.5 kHz.
2. Rotate the HIGH side of the SLOPE TUNE control fully clockwise and the LOW side fully counterclockwise.
3. Activate the NOTCH switch, and rotate the NOTCH control to minimize the audio output.
4. Adjust VR16 to further reduce the audio output.
5. Perform steps 3 and 4 repeatedly.
6. The best point is where the audio output does not change.

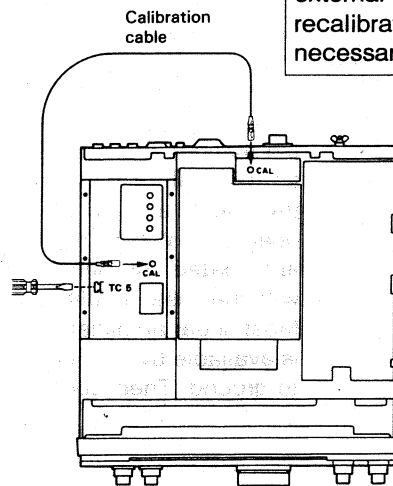
**6-6-7. Digital display calibration**



1. Remove the case.
2. Remove the shield cover of the final unit.
3. Remove the CAR unit.
4. Plug the accessory calibration cable to any one of the CAL pins on the PLL unit.  
Plug the other end of the calibration cable to CAL Pin on the ANT unit.
5. Connect your antenna and tune to WWV. Select "TUNE" on the front panel key pad.
6. Using a small flat bladed screwdriver adjust trimmer capacitor TC5 on the PLL unit for zero beat. Zero beat is the point where the two audio tones match perfectly.
7. The reference frequency has been calibrated correctly.
8. Remove the calibration cable.

**Note**

This equipment was calibrated at the factory using an external frequency standard and should not require recalibration. Do not attempt recalibration unless it is necessary.

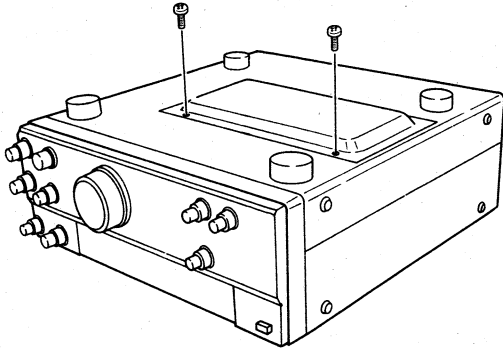


## 7. OPTIONAL ACCESSORIES

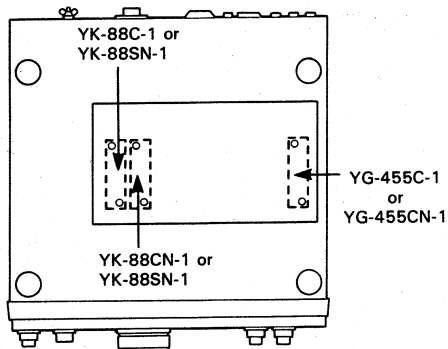
Be sure to unplug the DC power cable before starting work.

### 7-1. FILTER INSTALLATION

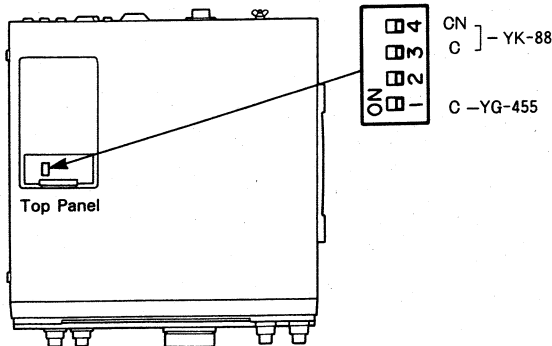
1. Remove the bottom cover of the transceiver.



2. Remove the screws and the filter cover as shown.



3. Attach the filter(s) and secure it with the supplied screws. The filters are not polarized so they may be placed in either direction.
4. The desired filters can be arranged matching the number of the filter switch to the number of the installation for each filter.



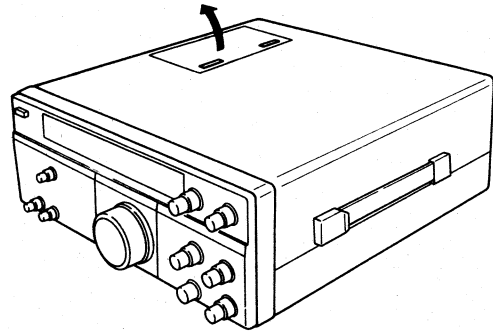
5. Replace the bottom cover.

#### Notes

1. Avoid catching your fingers or the wiring harness when closing.
2. When the YK-88SN-1 and YG-455CN-1 are installed, 500 or 270 is displayed for the YK-88SN-1, and 500 is displayed for the YG-455CN-1. They are different from the actual bands.

### 7-2. VS-2 VOICE SYNTHESIZER INSTALLATION

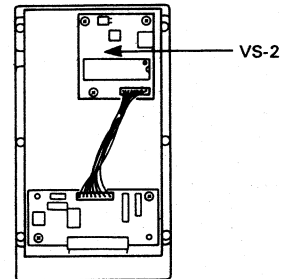
1. Remove the top cover of the transceiver.



2. Plug the 8-pin connector onto the VS-2.
3. Use the three screws supplied with the VS-2 to install the VS-2 on the chassis.

#### Caution

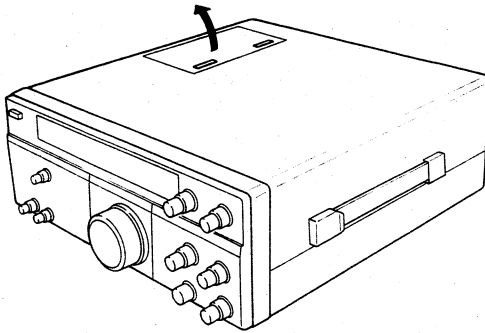
Keep the pan-head screw and cushion provided with the VS-2 for later use. They are not needed now.



4. Replace the top cover.

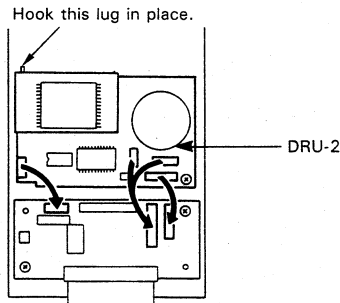
### 7-3. DRU-2 DIGITAL RECORDING UNIT INSTALLATION

1. Remove the top cover of the transceiver.



2. Use the tapping screw supplied with the DRU-2 to install the DRU-2 on the chassis.
3. Attach the three cables from the DRU-2 as shown.

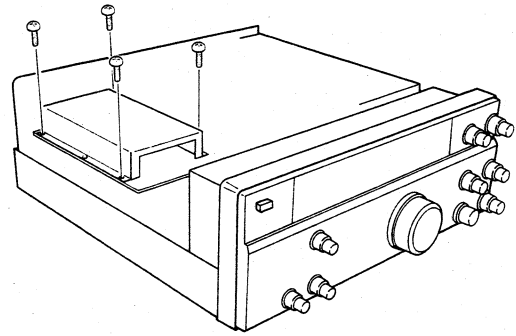
**Note**  
Keep the cushions provided with the DRU-2 for later use. They are not needed now.



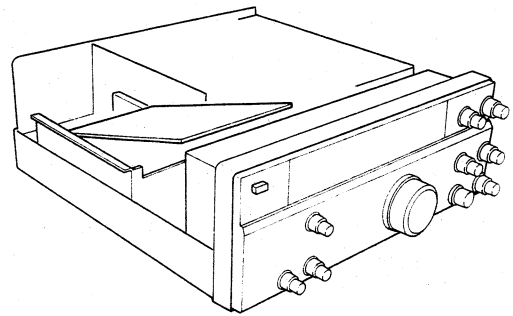
4. Replace the top cover.

### 7-4. SO-2 TCXO UNIT INSTALLATION

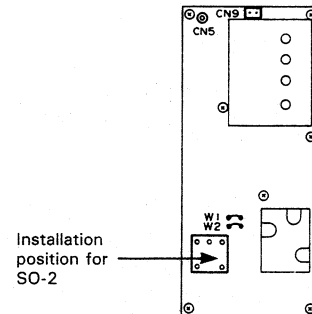
1. Remove the case. Refer to Section 6-6-1.
2. Remove the CAR unit.



3. Disconnect connectors CN5 and CN9 of the PLL unit. Remove the screws holding the PCB, and remove the PCB.



4. Cut jumpers W1 and W2.
5. Attach the SO-2 to the indicated area. Some models may come with the SO-2 factory installed.



6. Insert CN5 and CN9, replace the PCB and carrier unit in their original positions, and tighten the screws.

**Note**  
Avoid catching your fingers and wiring harness when closing.

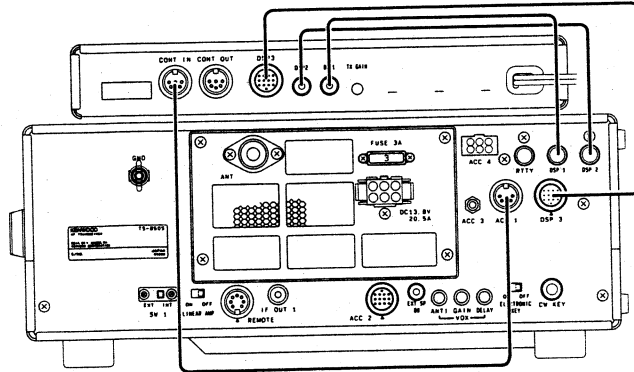
7. Replace the top and bottom covers.

**Note**  
Avoid catching your fingers and wiring harness when closing.

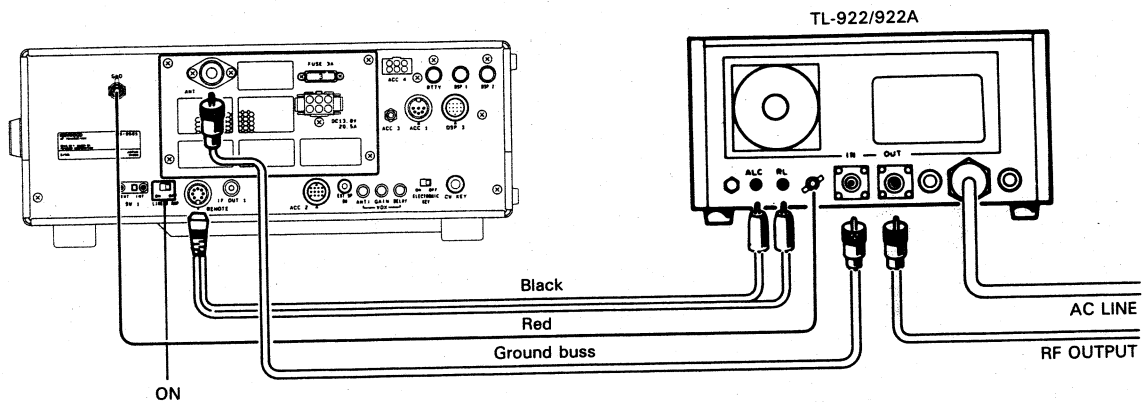


### 7-5. DSP-100 DIGITAL SIGNAL PROCESSOR CONNECTION

Connect the cable supplied with the DSP-100.

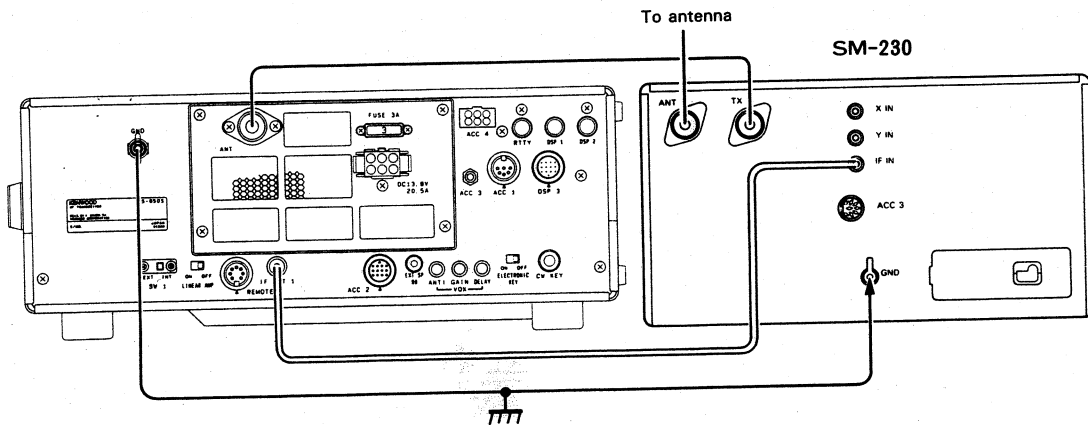


### 7-6. TL-922/922A LINEAR AMPLIFIER CONNECTION



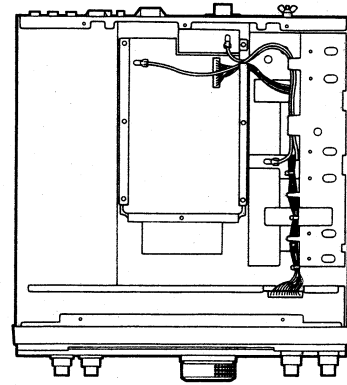
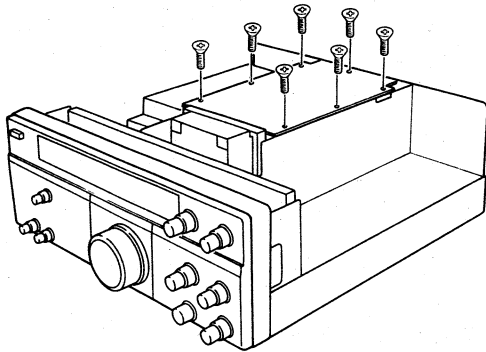
**CAUTION:**  
Do not connect the power cable unless the TL-922/922A POWER switch is set to the OFF position.

### 7-7. SM-230 STATION MONITOR INSTALLATION

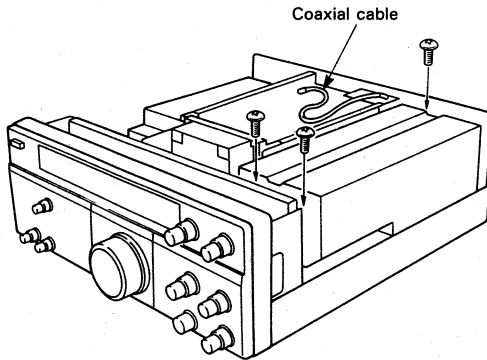


## 7-8. AT-850 AUTOMATIC ANTENNA TUNER UNIT INSTALLATION

1. Remove the top cover of the transceiver. Refer to Section 6-6-1.
2. Remove the shield cover of the filter unit.
3. Carefully remove the coaxial cable.
4. Attach the AT-850 and screw it on.
5. Attach the cables from the AT-850 as shown.
6. Replace the shield cover and the top cover.

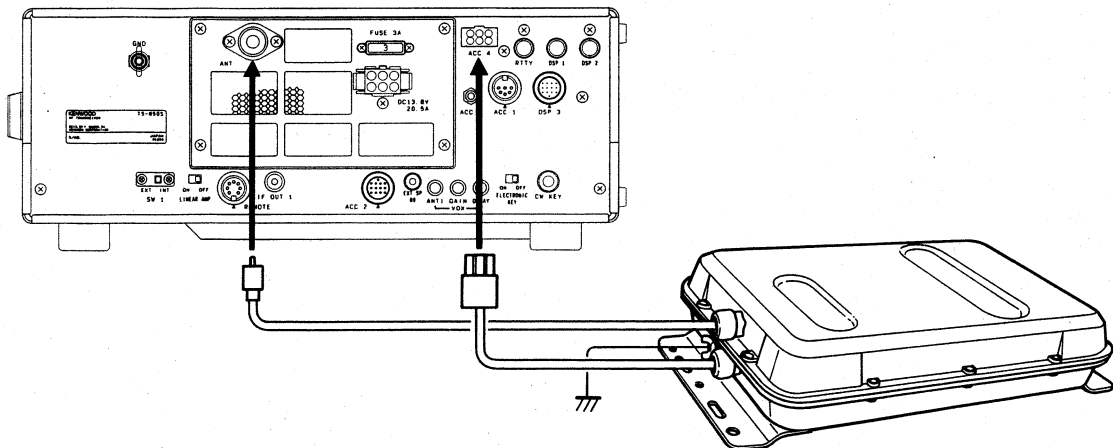


3. Carefully remove the coaxial cable.
4. Attach the AT-850 and screw it on.



## 7-9. AT-300 AUTOMATIC ANTENNA TUNER CONNECTION

When the AT-300 is connected to this unit, slide switch SW1 on the back to EXT. The built-in antenna tuner will then not operate.



## 7-10. OTHER ACCESSORIES

### ■ PS-52 HEAVY DUTY DC POWER SUPPLY

Designed to match the TS-850S. Supplies regulated 13.8 VDC at 20.5 A with built-in cooling fan and protection circuits for maximum reliability.

### ■ AT-300 AUTOMATIC ANTENNA TUNER

### ■ AT-850 AUTOMATIC ANTENNA TUNER UNIT

The TS-850S is available either with or without a built-in automatic antenna tuner. The tuner covers all amateur bands from 160 through 10 meters bands.

### ■ MC-85 MICROPHONE(8-pin)

The MC-85 is a unidirectional high-class electret condenser microphone provided with an output selector switch, audio level compensation circuit, low cut filter, level meter, PTT and LOCK switches. An 8-pin cable is provided, with optional cables, up to three outputs are possible.

### ■ MC-80 MICROPHONE(8-pin)

The MC-80 is an omnidirectional electret condenser microphone provide with UP / DOWN switches, volume adjustment for output level, PTT and LOCK switches, built-in preamplifier.

### ■ MC-60A MICROPHONE(8-pin)

The zinc die-cast base provides high stability, and the MC-60A is complete with PTT and LOCK switches, UP / DOWN switches, and impedance selector switch and a built-in preamplifier.

### ■ MC-43S UP/DOWN HAND MICROPHONE

The MC-43S is handy dynamic microphone with PTT switch and UP/DOWN switches.

### ■ LF-30A LOW PASS FILTER

### ■ SP-31 EXTERNAL SPEAKER

Designed to match the TS-850S.

### ■ TL-922/922A HF LINEAR AMPLIFIER

(Not for QSK operation.)

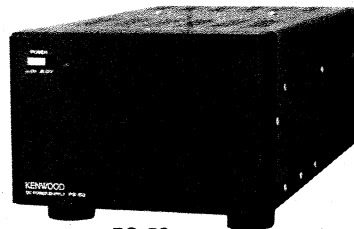
The TL-922/922A is an HF linear amplifier operating at maximum legal power, and employing a pair of 3-500Z high performance transmitting tubes. TL-922A (without 10 meter band) is available only in U.S.A.

### ■ SM-230 STATION MONITOR

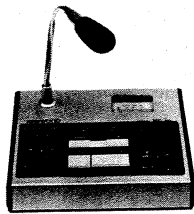
Built around a basic 10 MHz oscilloscope, the SM-230 station monitor features, in combination with a built-in two-tone generator, a variety of waveform-observing capabilities.

### ■ IF-232C INTERFACE

The IF-232C Interface is the adapter for connection between the RS-232C terminal of a personal computer and the interface terminal of the TS-850S.



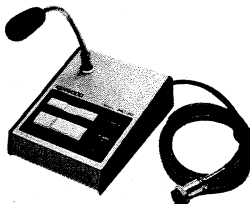
PS-52



MC-85



MC-60A



MC-80



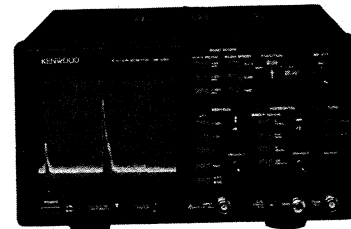
MC-43S



SP-31



TL-922A/TL-922



SM-230

■ HS-6 COMMUNICATIONS HEADPHONES (12.5 OHMS)

Deluxe, very light-weight headphones designed for communications equipment.



HS-6

■ HS-5 COMMUNICATIONS HEADPHONES (8 OHMS)

Headphones designed for communications equipment. These light-weight open air-type headphones remain comfortable during extended operation. Easily attached earpads are provided.



HS-5

■ YG-455C-1 CW FILTER (WE HAVE TO CHECK)

- ③
- Center frequency : 455.0 kHz
  - Pass band width : 500 Hz (-6 dB)
  - Attenuation band width : 820 Hz (-60 dB)
  - Guaranteed attenuation : More than 80 dB

■ YG-455CN-1 CW FILTER IN NOW

- ③
- Center frequency : 455.0 kHz
  - Pass band width : 250 Hz (-6 dB)
  - Attenuation band width : 480 Hz (-60 dB)
  - Guaranteed attenuation : More than 80 dB

■ YK-88C-1 CW FILTER (WE HAVE TO CHECK)

- ①
- Center frequency : 8830.0 kHz
  - Pass band width : 500 Hz (-6 dB)
  - Attenuation band width : 1.5 kHz (-60 dB)
  - Guaranteed attenuation : More than 80 dB

■ YK-88CN-1 CW FILTER (IN NOW)

- ②
- Center frequency : 8830.0 kHz
  - Pass band width : 270 Hz (-6 dB)
  - Attenuation band width : 1.1 kHz (-60 dB)
  - Guaranteed attenuation : More than 80 dB

■ YK-88SN-1 SSB FILTER (IN NOW)

- B/O
- ①
- ②
- Center frequency : 8830.0 kHz
  - Pass band width : 1.8 kHz (-6 dB)
  - Attenuation band width : 3.3 kHz (-60 dB)
  - Guaranteed attenuation : More than 80 dB

## 8. REFERENCE

### 8-1. ANTENNA INSTALLATION

#### ■ Fixed Station

For HF fixed-station operation, an antenna specifically designed for amateur operation is recommended. Antenna types include wire antennas, verticals, rotary beams, and other antenna types. (Fig. 8-1) HF antennas are quite large and must be installed to withstand strong wind, heavy rain, etc.

Any antenna used with this transceiver should be of 50-ohm impedance and should be connected using an appropriate coaxial cable such as 5D-2V (RG-8/U).

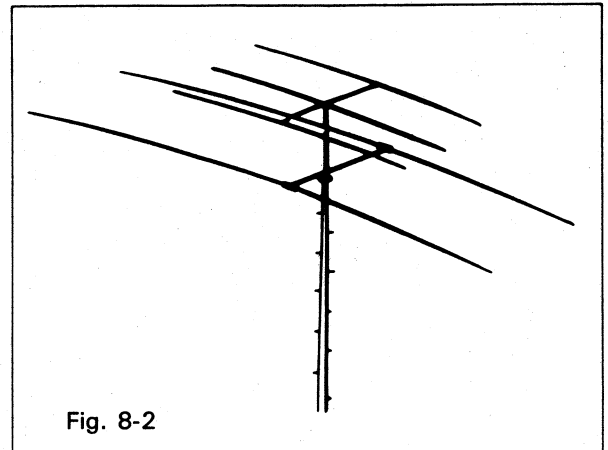
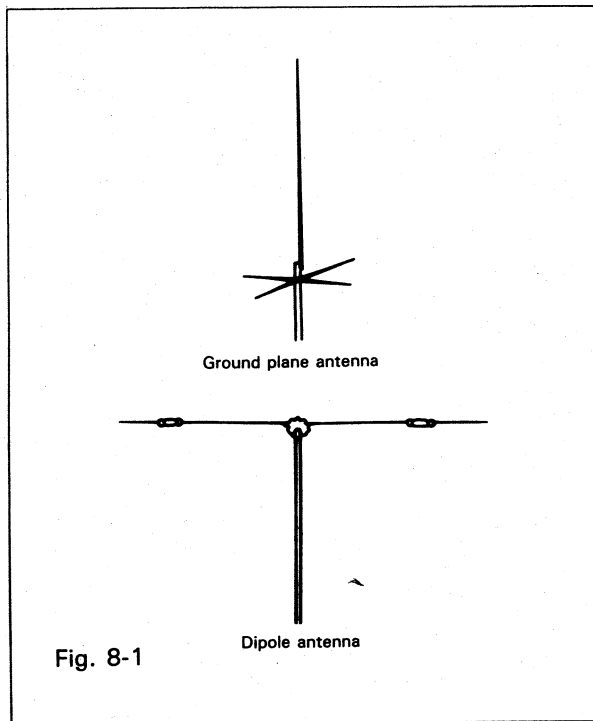
Impedance matching is important. Impedance mismatching will result in a high VSWR and power loss, or can cause unwanted harmonic radiation and interference (TVI, BCI).

The impedance match can be checked with the SWR meter. Generally, satisfactory operation is assured when the VSWR (Voltage Standing Wave Ratio) is less than 1.5 : 1.

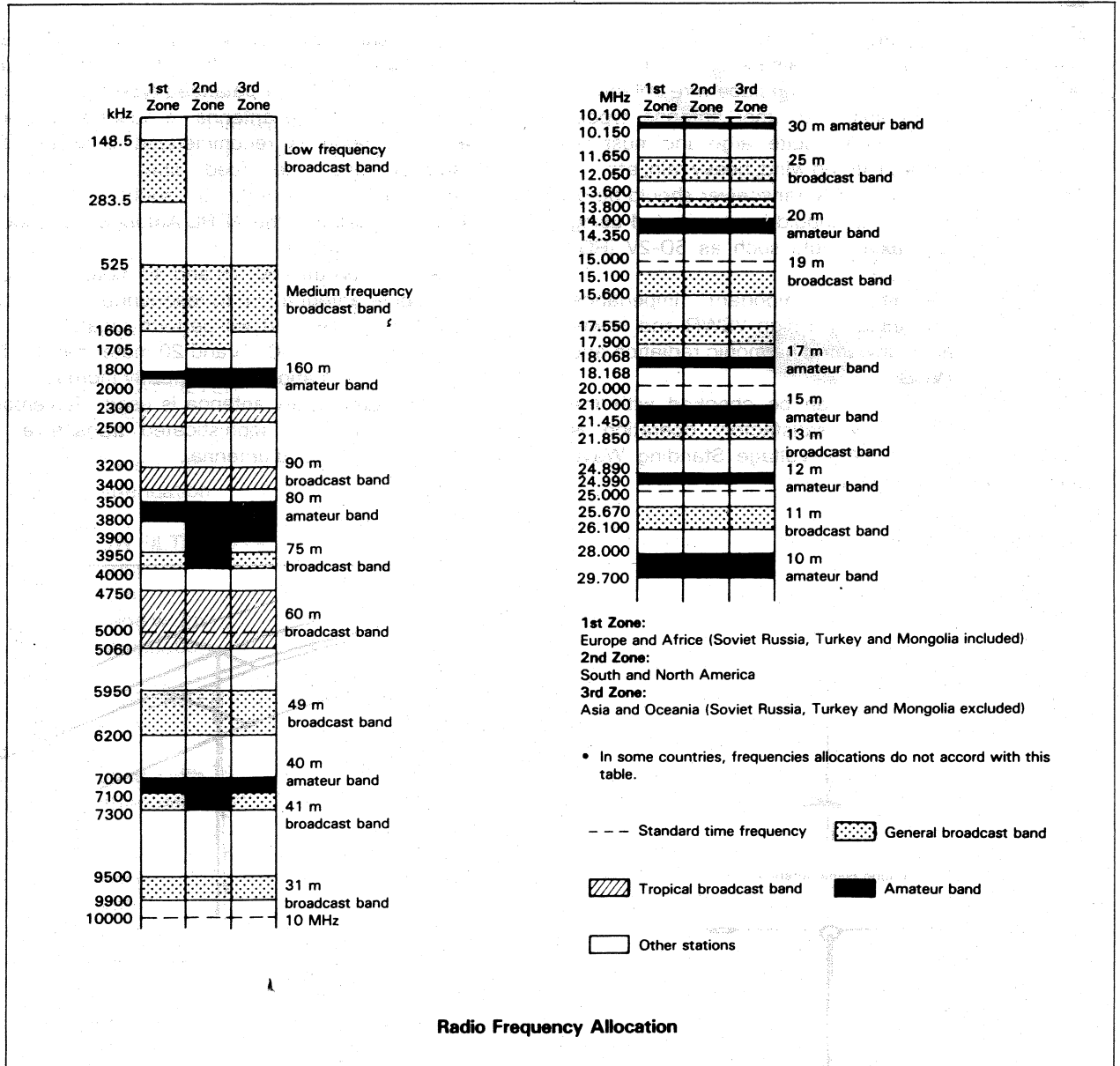
A rotary beam antenna is very effective for DX communication in the 14, 21 and 28 MHz bands. (Fig. 8-2) If open wire or balanced type transmission line is used with the antenna, a suitable antenna tuner with balun is recommended between the transceiver and the feed line. Methods of construction and operating such tuners are described in detail in the ARRL Antenna Handbook, or 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 band, will perform satisfactorily.

For operation 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 sophisticated transceiver is useless without a good antenna.



## 8-2. RADIO FREQUENCY ALLOCATION



### Frequency distribution in the broadcast and amateur bands

The general coverage receiver covers from 30 kHz to 30 MHz, to receive international broadcast and communication services.

As shown in the frequency allocation chart, above figure, broadcast and amateur radio station frequencies are allocated in specific bands expressed in megahertz (MHz) or wavelength in the meters (m). Also in the above figure the frequency of "other stations" are assigned for fixed station business use, marine mobile, aviation mobile, land mobile, radio beacon stations, etc.

### Notes

1. Radio stations throughout the world are listed in the **WORLD RADIO TV HANDBOOK** or similar publications.
2. Antennas designed for ham band operation will generally provide satisfactory reception for SW stations near the ham bands. For antenna construction details, see the **ARRL ANTENNA HANDBOOK**, or similar publications.