

HF TRANSCEIVER

TS-950S DIGITAL TS-950S

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 following models:

TS-950S DIGITAL: HF TRANSCEIVER with the DSP-10, SO-2, YK-88C-1, YG-455C-1, YG-455CN-1 and YG-455S-1, are included in this transceiver as standard equipment.

TS-950S : HF TRANSCEIVER
Illustrations show the TS-950S.

FCC WARNING

This equipment may generate or use 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.

Note

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 may cause harmful interference to radio communications, if it is not installed and used in accordance with the instructions. However, there is no guarantee that 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 or an experienced radio/TV technician for help.

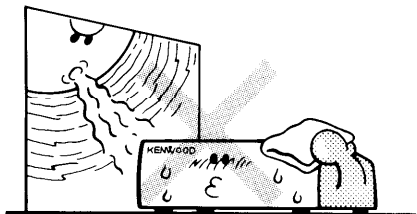
CONTENTS

1. BEFORE OPERATION	3
2. SPECIFICATIONS AND ACCESSORIES	4
2-1. SPECIFICATIONS	4
2-2. ACCESSORIES	6
3. INSTALLATION AND CONNECTION	7
3-1. INSTALLATION	7
3-2. CONNECTION	7
4. OPERATION	10
4-1. OPERATING CONTROLS	10
4-2. RECEIVER OPERATION	21
4-3. TRANSMITTER OPERATION	28
4-4. MEMORY	35
4-5. SCAN	38
4-6. REPEATER OPERATION	40
4-7. OPERATION WITH A PERSONAL COMPUTER	40
4-8. VOICE SYNTHESIZER	41
4-9. DIGITAL MODULATION FUNCTION	41
5. CIRCUIT DESCRIPTION	43
5-1. GENERAL DESCRIPTION	43
5-2. TRANSMITTER SECTION	43
5-3. RECEIVER SECTION	43
5-4. CIRCUIT BOARD DESCRIPTION	43
5-5. BLOCK DIAGRAM	45
5-6. CIRCUIT DIAGRAM	46
6. MAINTENANCE AND ADJUSTMENTS	67
6-1. GENERAL INFORMATION	67
6-2. SERVICE	67
6-3. CLEANING	67
6-4. IN CASE OF DIFFICULTY	68
6-5. ORDERING SPARE PARTS	69
6-6. ADJUSTMENTS	69
7. OPTIONAL ACCESSORIES	73
7-1. YG-455S-1 SSB FILTER INSTALLATION	73
7-2. OTHER FILTER INSTALLATION	73
7-3. VS-2 VOICE SYNTHESIZER INSTALLATION	74
7-4. SO-2 TCXO UNIT INSTALLATION	75
7-5. DSP-10 DIGITAL SIGNAL PROCESSOR INSTALLATION	76
7-6. OTHER ACCESSORIES	76
8. REFERENCE	78

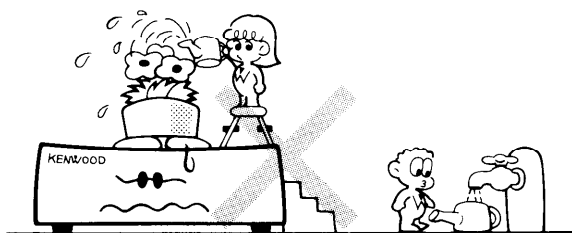
1. **WARNING** BEFORE OPERATION

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

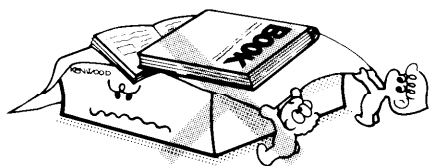
Do not place this unit, where it will be exposed to direct sunlight or close to heating appliances.



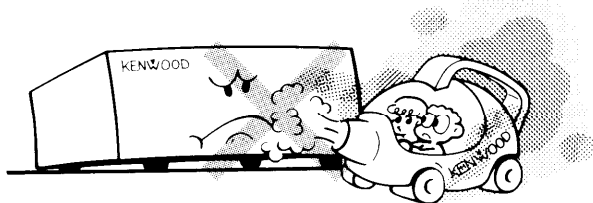
Do not place anything on top of the cabinet.



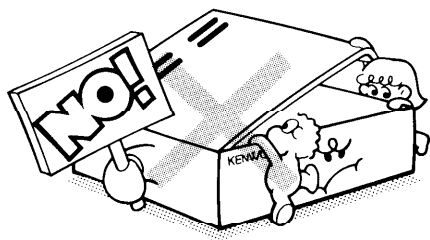
To ensure good ventilation, do not put anything on top of the cabinet and allow at least 15 cm (6 inches) of space behind the unit.



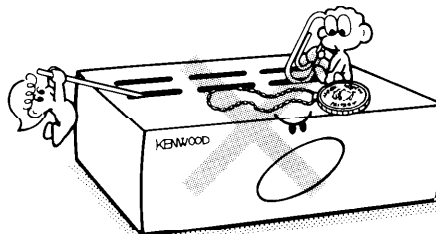
Do not place the unit in areas of excessive dust, high humidity or on unstable surfaces.



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.



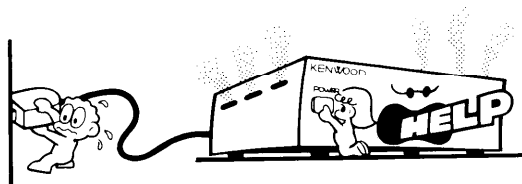
Do not touch the power plug, when your hands are wet.



Do not pull the power cord, when disconnecting it from the AC wall outlet. Grasp the plug and ensure that your fingers do not touch the live pins.



If an abnormal odor or smoke is detected, immediately turn the power off and pull out the power plug. Contact the KENWOOD service station or your dealer.



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-950S	TS-950S DIGITAL
General	Mode				J3E (LSB, USB), A1A (CW), A3E (AM), F3E (FM), F1A (FSK)	
	Memory Channels				100	
	Antenna impedance				50 ohms With Antenna Tuner 20~ 150 ohms	
	Power requirement		K and P type		120VAC± 10%	
			M type		120/220VAC± 10%	
			W type		220/240VAC± 10%	
			X type		120/240VAC± 10%	
	Power dissipation		Receive mode with no input signal		110W	
			Transmit mode		700W (7.5A)	
	Operating temperature				10 to + 50°C (+ 14 to + 122°F)	
	Frequency stability				Less than ± 10 PPM	Less than ± 0.5 PPM
Frequency accuracy				Less than ± 10 PPM	Less than ± 0.5 PPM	
Dimensions (W×H×D) (Projections included)				409×154×446mm (16-3/22"×6-1/16"×17-9/16")		
Weight				23kg (50.6lbs)		
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	1.9~ 24MHz	SSB, CW, FSK, FM	MAX	150W	
				MIN	20W	
			AM	MAX	40W	
				MIN	10W	
		28MHz	SSB, CW, FSK, FM	MAX	110W	
				MIN	20W	
AM			MAX	40W		
			MIN	10W		
Modulation		SSB		Balanced modulation		
		FM		Reactance modulation		
		AM		Low level modulation		

Specifications			Model	TS-950S	TS-950S DIGITAL
Transmitter	Spurious radiation			Less than -40dB	
	Carrier suppression (with 1.5kHz reference)			More than 40dB	More than 50dB
	Unwanted sideband suppression (with 1.5kHz reference)			More than 50dB	More than 60dB
	Maximum frequency deviation (FM)			Less than ± 5 kHz	
	Frequency response (-6dB)			400 to 2600Hz	200 to 3100Hz
	XIT variable range			± 9.99 kHz	
	Microphone impedance			500 ohms to 50 k Ω	
Receiver	Circuitry	Main	SSB, CW, FSK, AM	Quadruple conversion superheterodyne	
			FM	Triple conversion superheterodyne	
		Sub	SSB, CW, FSK	Double conversion superheterodyne	
	Frequency range			100kHz to 30MHz	
	Intermediate frequency		Main	1st: 73.05MHz, 2nd: 8.83MHz, 3rd: 455kHz, 4th: 100kHz	
			Sub	1st: 40.055MHz, 2nd: 10.695MHz	
	Sensitivity	SSB, CW (at 10dB S+N/N)	100kHz ~ 150kHz	Less than 2.5 μ V	
			150kHz ~ 500kHz	Less than 1 μ V	
			500kHz ~ 1.62MHz	Less than 4 μ V	
			1.62MHz ~ 30MHz	Less than 0.2 μ V	
		AM (at 10dB S+N/N)	100kHz ~ 150kHz	Less than 25 μ V	
			150kHz ~ 500kHz	Less than 10 μ V	
			500kHz ~ 1.62MHz	Less than 32 μ V	
			1.62MHz ~ 30MHz	Less than 2.0 μ V	
		FM (at 12dB SINAD)	28MHz ~ 30MHz	Less than 0.5 μ V	
	Selectivity		SSB, AM(N), FSK	-6dB: 2.4kHz, -60dB: 3.8kHz	
			AM(W)	-6dB: 6kHz, -50dB: 15kHz	
			CW(N)	—	-6dB: 250kHz -60dB: 550kHz
			CW(W)	-6dB: 2.4kHz, -60dB: 3.8kHz	-6dB: 400kHz -60dB: 900kHz
			FM	-6dB: 12kHz, -60dB: 24kHz	
	Image ratio			More than 80dB	
	1st IF rejection			More than 70dB	
	Notch filter attenuation			More than 45dB	
	RIT variable range			± 9.99 kHz	

Specifications				Model	TS-950S	TS-950S DIGITAL
Receiver	Squelch sensi- tivity	SSB, CW, FSK, AM	100kHz ~ 150kHz	Less than 6.3μV		
			150kHz ~ 500kHz	Less than 2.5μV		
			500kHz ~ 1.62MHz	Less than 10μV		
			1.62MHz ~ 30MHz	Less than 0.5μV		
		FM	28MHz ~ 30MHz	Less than 0.32μV		
	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 transmitting output power within the power limitations of your license.

2-2. ACCESSORIES

Unpack your TS-950S/950S DIGITAL 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.
Fuse (6A) (M type only)	F05-6021-05	1 ea.
Control location sticker	B42-3371-04	1 ea.
External control Instruction Manual.....	B50-8351-XX.....	1 copy
Instruction Manual.....	B50-8298-XX.....	1 copy
Warranty card (U.S.A., Canada and Europe version only)		1 ea.

Attach the control location sticker on the upper case where it can be seen easily.

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

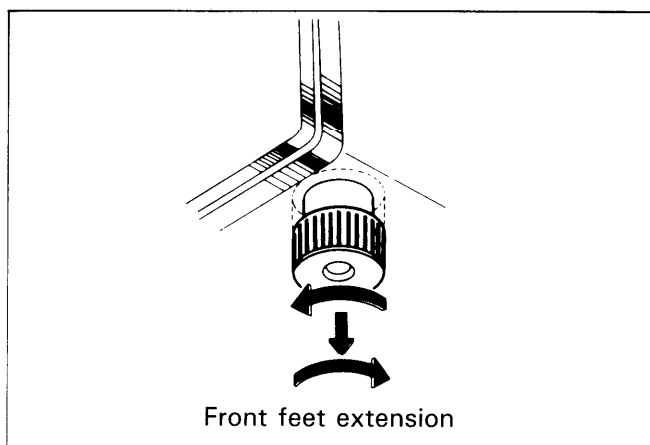
By extending the front feet, the front panel can be elevated for operating convenience.
Turn the front feet left and pull down.
Then turn right to lock.

3-2. CONNECTION

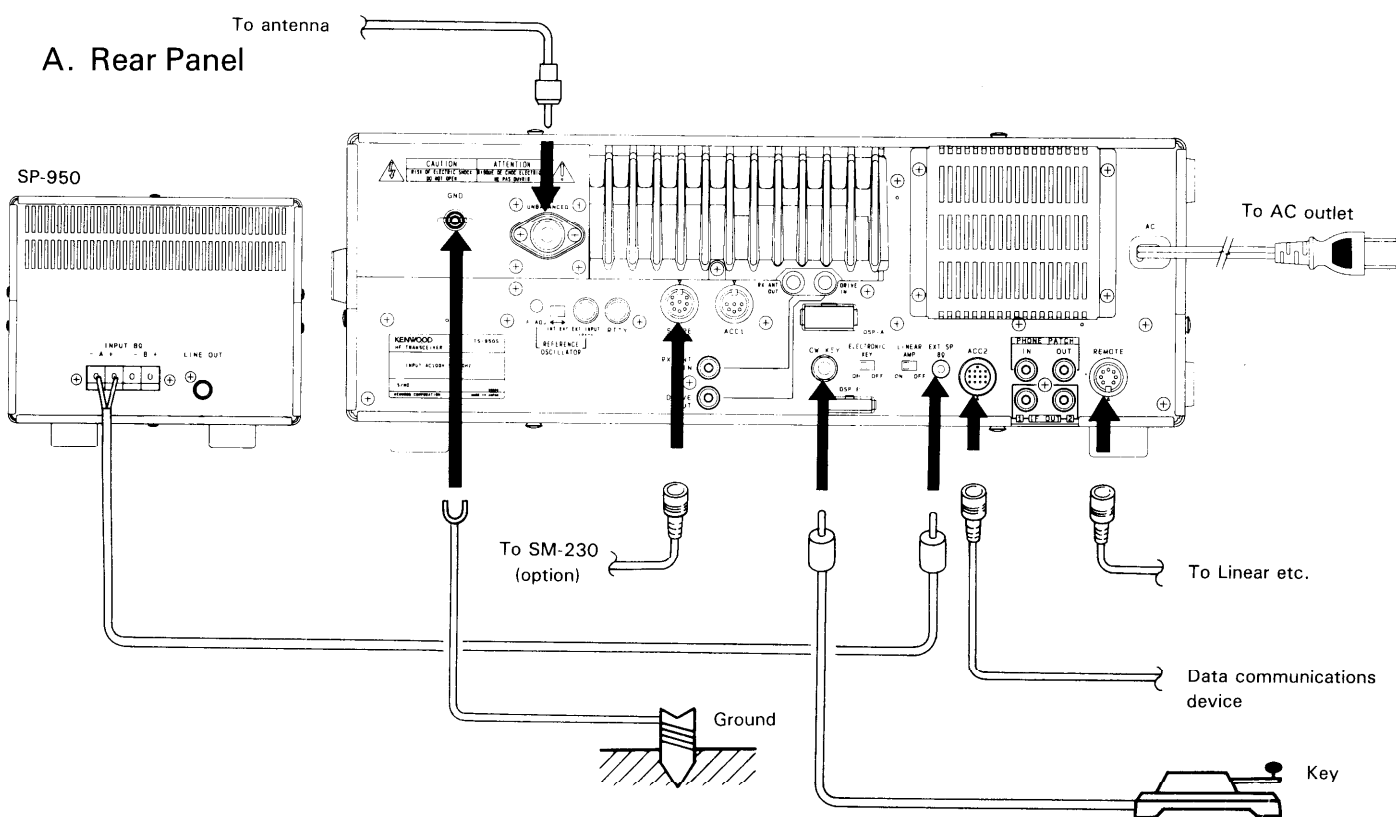
The TS-950S/950S DIGITAL is supplied to operate from a 120V AC, 220V AC or 240V AC 50/60 Hz power source capable of supplying 700 watts or more.

Note

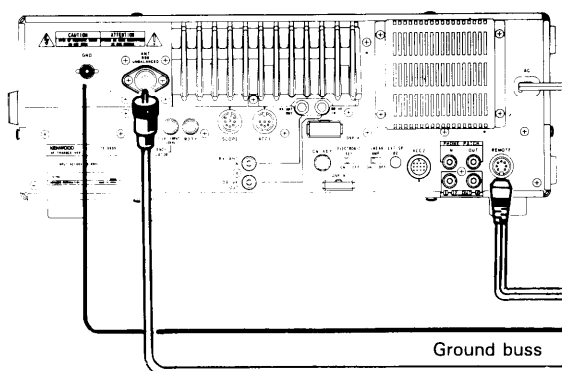
U.S.A. versions of this radio are equipped with a non-switchable 120V AC 60 Hz power supply.



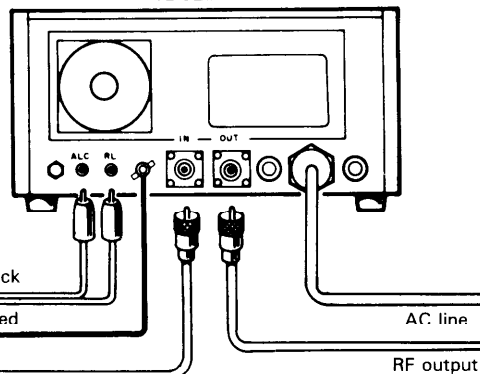
A. Rear Panel



Exciter, TS-950S



TL-922A



CAUTION:

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

TL-922A Interconnection to TS-950S/950S DIGITAL

(1) Antenna

Caution

Protect your equipment — Use a LIGHTNING AR-RESTER.

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 for this connection. If the antenna is far from the transceiver the use of low loss coaxial cable, such as 5D-2V is 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.

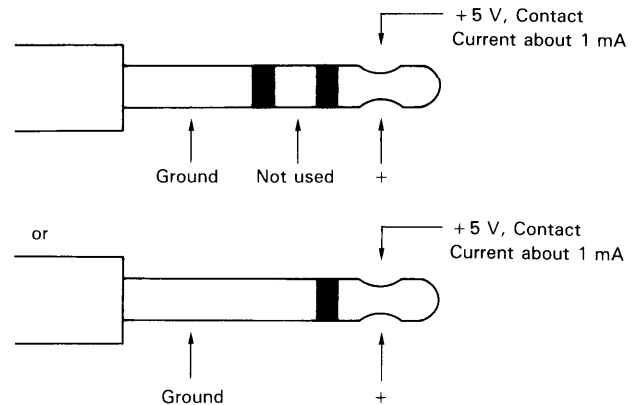
(3) External speaker

The TS-950S/950S DIGITAL includes a built-in speaker. If you would like to use an external speaker, such as the SP-950, it may be connected to the EXT SP jack on the rear of the radio. 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-950 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)

■ To use external straight key

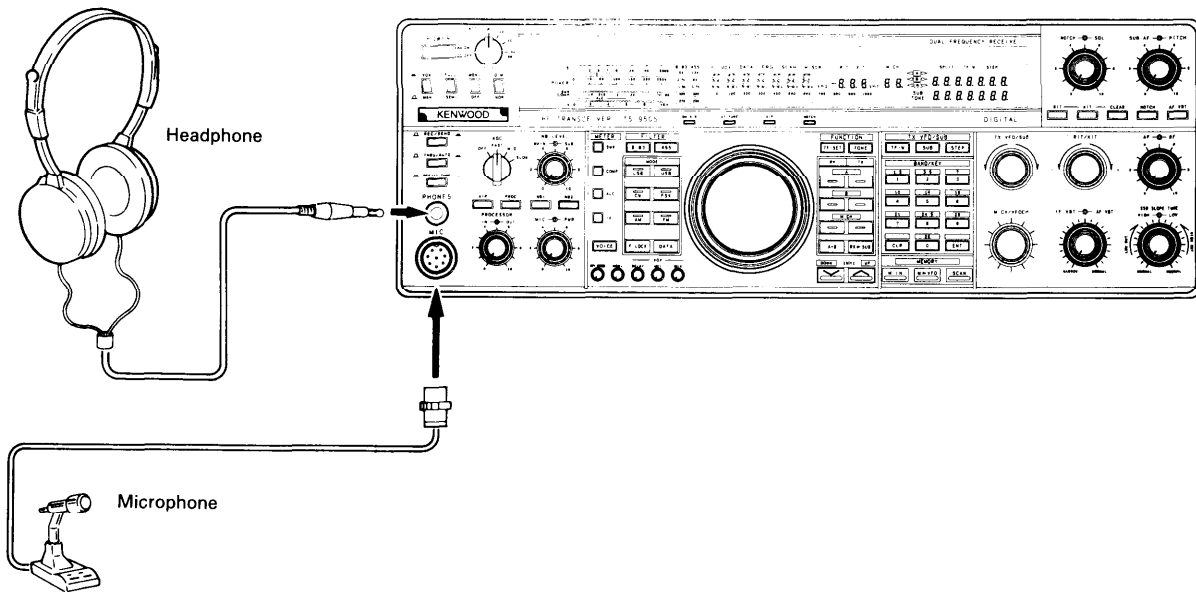


Note

Check the polarity of the plug when you use an electronic keyer.

See Section 4-3-6 for additional CW key / keyer connection information and diagrams.

B. Front Panel



(1) Headphones

Any low-impedance (4-16 ohms) headphones 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 between 500Ω to $50k\Omega$ may be used with this transceiver. The KENWOOD microphones MC-43S (handheld), MC-60A, MC-80, MC-85 (table-top type) are recommended.

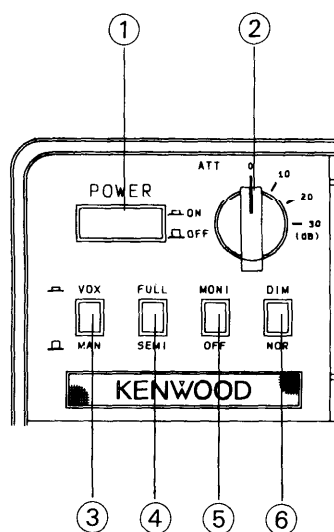
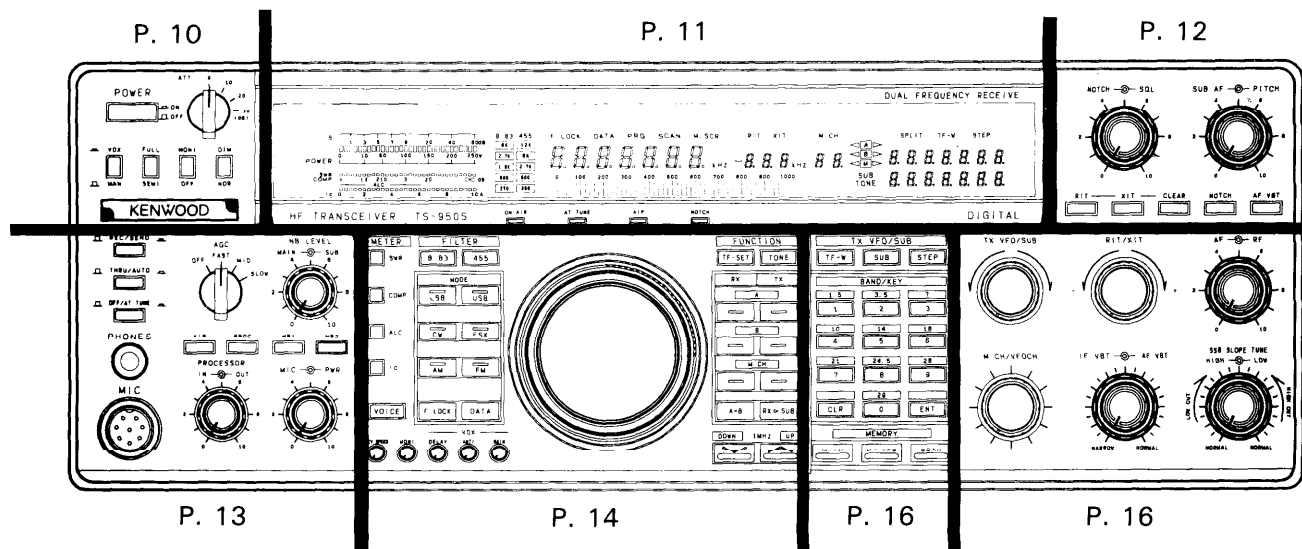
4. OPERATION

4-1. OPERATING CONTROLS

4-1-1. Front Panel

Note

All segments on the Display Panel and Indicators are shown on for this explanation.



① POWER switch

Press to turn the power ON or OFF.

② ATT (Attenuator) switch

When the incoming receive signal is very strong, the signal should be attenuated to prevent distortion of the signal, thereby stabilizing the receiver performance. This is easily done by activating the ATT switch. 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. This switch allows attenuation of the input signal by 10, 20 or 30 dB. For normal receiver performance, this switch should be in the 0 dB position.

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

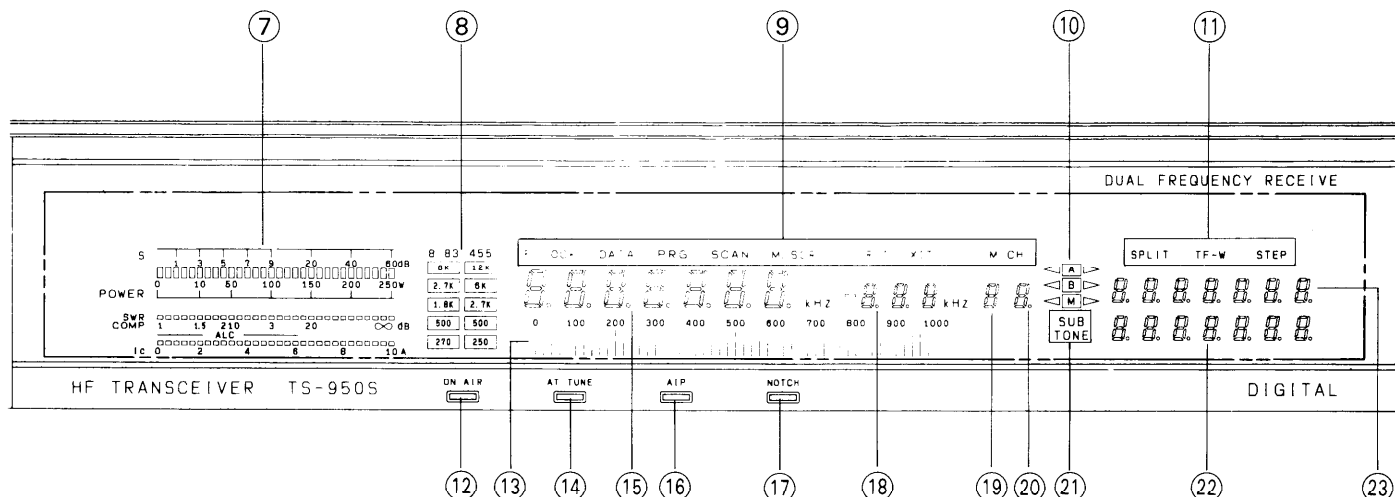
This switch affects the transmit/receive recovery time. In the SEMI position the transceiver will key when the key is depressed and remain in the transmit position until a preset delay has been reached. In the FULL position the transceiver will switch back to receive as soon as the key is released, thus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

⑤ MONI (Monitor) switch

Allows monitoring of your transmit signal.

⑥ DIM (Dimmer) switch

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



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 switch, and provides either VSWR, COMP level, ALC level, or Ic meter readings.

Notes

1. Simultaneous reading of SWR and COMP level is not possible.
2. Simultaneous reading of ALC level and Ic is not possible.
3. Simultaneous reading of more than three data items is not possible.

⑧ Filter indicators

Indicates which filters have been selected.

⑨ F.LOCK display

Lights when the F.LOCK key is ON.

DATA display

Lights when the DATA key is ON.

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.

RIT display

Turns ON when using RIT.

XIT display

Turns ON when using XIT.

M.CH (Memory channel) display

Turns ON during a Memory Channel operation.

⑩ ◀ A ▶ display

Lights when VFO A is selected and shows that the VFO is operating.

◀ B ▶ display

Lights when VFO B is selected and shows that the VFO is operating.

◀ M ▶ display

Lights when a memory channel is selected and shows that the Memory function is operating.

⑪ SPLIT display

Turns ON during split operation.

TF-W (TX Frequency Watch) display

Turns ON during TF-W operation.

STEP display

Turns ON while the STEP key is ON.

⑫ ON AIR indicator

Lights during transmit.

⑬ Analog Scale

Shows the frequency selected. Full scale can be switched to either 1 MHz or 100 kHz depending on the function setting when the power switch is turned on. (See section 4-2-11.)

⑭ AT TUNE (Antenna Tuner) indicator

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

⑮ Frequency display

Indicates the operating frequency.

⑯ AIP(Advanced Intercept Point) indicator

Lights when the AIP switch is ON.

⑰ NOTCH indicator

Lights when the NOTCH switch is ON.

⑱ 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.

⑲ Memory Channel number display

Memory Channel Number is displayed.

⑳ Memory Channel Lockout Indicator

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

㉑ SUB display

Lights when the SUB key is ON.
TONE display

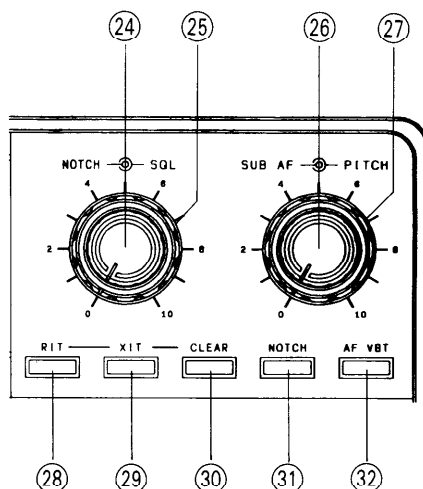
Lights when the TONE key is ON.

㉒ SUB Frequency display

Indicates the sub operating frequency or tone frequency.

㉓ TX frequency display

Indicates the TX operating frequency or memory channel frequency.



㉔ 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.

㉕ 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.

㉖ SUB AF gain control

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

㉗ PITCH control

The CW PITCH control is provided so that you may adjust the pitch or tone of the incoming CW signal so that the tone is pleasing to you. The TS-950S/950S DIGITAL accomplishes this without shifting the actual transmit or receive frequency, by shifting the 100kHz IF frequency, just prior to Product Detection.

㉘ RIT switch

Press to turn the RIT ON or OFF.

㉙ XIT switch

Press to turn the XIT ON or OFF.

㉚ CLEAR switch

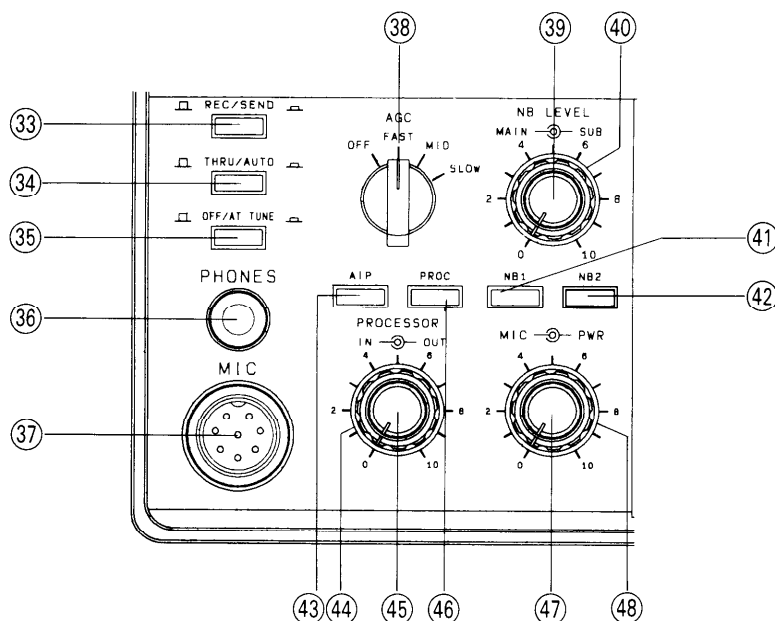
Pressing the CLEAR switch restores the RIT/XIT to zero.

㉛ NOTCH switch

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

㉜ AF VBT switch

The AF VBT circuit is just the opposite of the NOTCH circuit. With this control it is possible to accentuate the desired signal by providing additional rejection of noise and interfering signals whose pitch (tone) falls outside the audio passband.



③③ REC/SEND switch

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

REC : Places the radio into receive.

SEND : Places the radio into transmit.

③④ THRU/AUTO switch

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

AUTO : The auto antenna tuner is used in transmit.

③⑤ OFF/AT TUNE switch

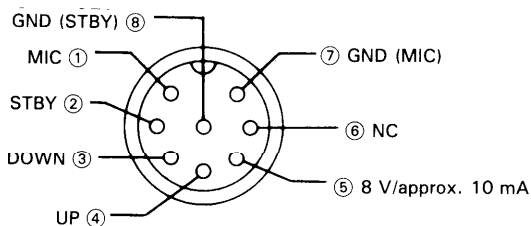
When this switch is tuned ON with the THRU/AUTO switch is placed in the AUTO position, the automatic tuner will be engaged and the tuner will try to match the antenna.

③⑥ PHONES jack

Output terminal for headphones.

③⑦ MIC jack

Microphone connection.



MIC connector (Front view)

③⑧ 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 operations.

③⑨ MAIN NB LEVEL control

Controls the noise blanker operating level.

Use only the minimum level necessary.

④① SUB NB LEVEL control

Controls the noise blanker operating level.

Use only the minimum level necessary.

④① 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.

④② 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-950S/950S DIGITAL are effective in most cases.

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

④③ AIP (Advanced Intercept Point) switch

Use AIP when good signal reception is obtained. When switched on, it reduces interference from strong signals.

Note

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

④④ PROCESSOR-OUT control

Set the METER switch to ALC and adjust the PROCESSOR-OUT control while speaking into the microphone. Ensure that the meter deflection is within the ALC zone!

④⑤ PROCESSOR-IN control

Adjust the PROCESSOR-IN 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.

④⑥ PROC (Processor) switch

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

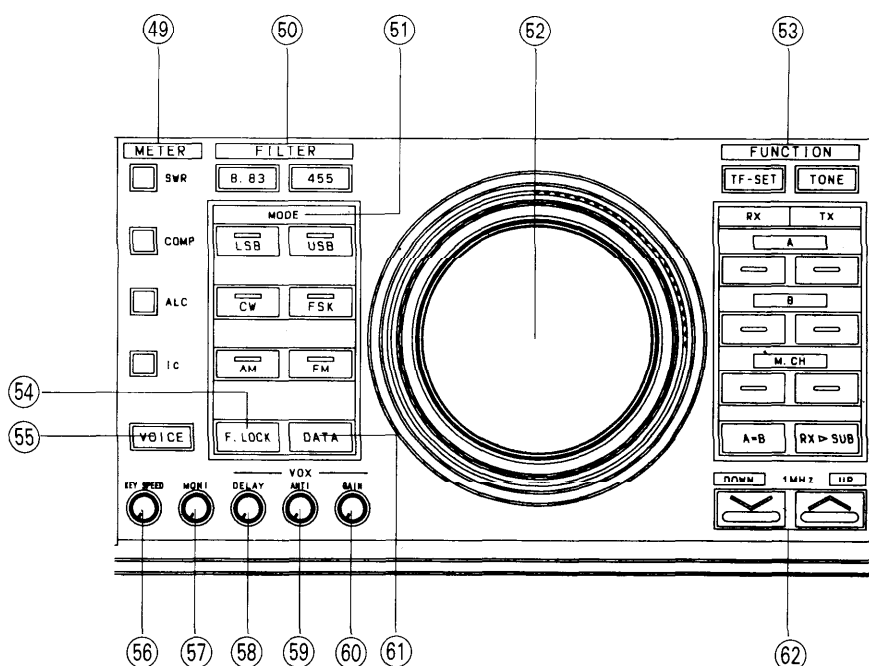
④⑦ MIC gain control

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

④⑧ 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.



④⑨ METER switch

SWR : Indicates voltage standing wave ratio (VSWR).

COMP : Indicates compression level during speech processor operations. Do not exceed 10 dB of compression.

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

Ic : Indicates the power transistor collector current (IC). The Ic meter is calibrated at the values normally encountered at full power, its indication may not be accurate at lower power settings.

⑤① FILTER switch

8.83 : Selects the desired 8.83MHz filter regardless of mode.

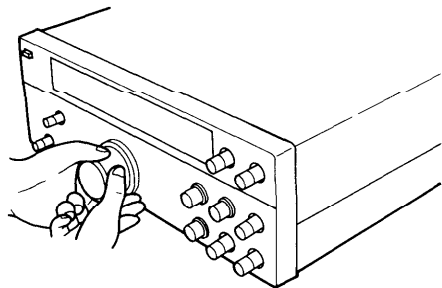
455 : Selects the desired 455kHz filter regardless of mode.

⑤① 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.

⑤② 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.



⑤③ 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.

TONE key

Activates the tone circuit for repeater control.

Note

This function is used during SPLIT operations when both the receive and transmit setting are in the FM mode.

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) key

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

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

A=B key

Equalizes the frequencies and modes of VFO A and VFO B.

RX►SUB key

Press this key to transfer the receive frequency to SUB.

Note

The receive frequency cannot be transferred when SUB is off.

⑤④ F.LOCK key

The selected dial frequency and mode are locked.

Note

When the F.LOCK key is on, TF-SET key, RIT, XIT, CLEAR switch and RIT/XIT control are still active.

⑤⑤ VOICE switch

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

⑤⑥ KEY SPEED control

This controls the speed of the electronic keyer. Turn the knob clockwise to increase speed.

⑤⑦ MONI (Monitor) control

This controls the volume of the transmit monitor.

⑤⑧ DELAY control

This control adjusts how long the radio will remain keyed after voice input has stopped.

⑤⑨ 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.

⑥① GAIN control

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

⑥① DATA key

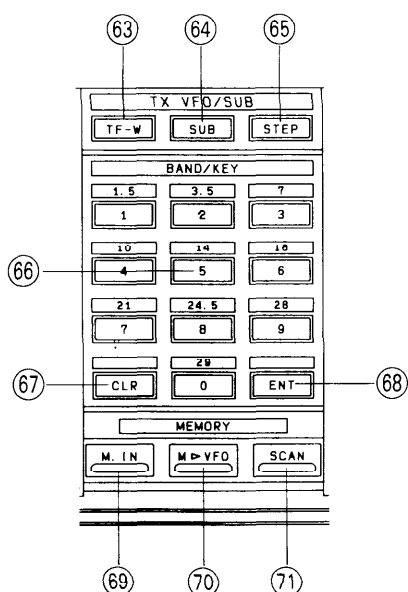
Use this key to switch to the DATA mode for packet communications and RTTY. When this key is pressed, signals from the microphone are blocked and modulation is provided by the incoming data signal from the ACC2 connector on the rear panel during transmit. When in the FM mode, the time constant for the squelch becomes fast.

Notes

1. When this key is ON, no modulation will be provided from the microphone.
2. This function is cancelled whenever the mode of operation changes.

⑥② 1MHz UP/DOWN switch

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



63 TF-W (TX Frequency Watch) key
Use this key to activate/deactivate the TF-Watch function.

64 SUB Receiver key
Use this key to turn the SUB Receiver ON or OFF.

Note

This function is operational in the SSB, CW and FSK mode.

65 STEP key
Press this key to set the frequency step of the TX VFO/SUB controls to 100 Hz. Press it again to set the step to 10 Hz.

Note

This function is active when the SUB Receiver is ON or during split operation.

66 BAND/KEY key
Used to select an amateur radio frequency band. When used in conjunction with the ENT key, used to directly enter a frequency from the numeric keypad. When used in conjunction with the M.IN key, used to enter data into a memory channel.

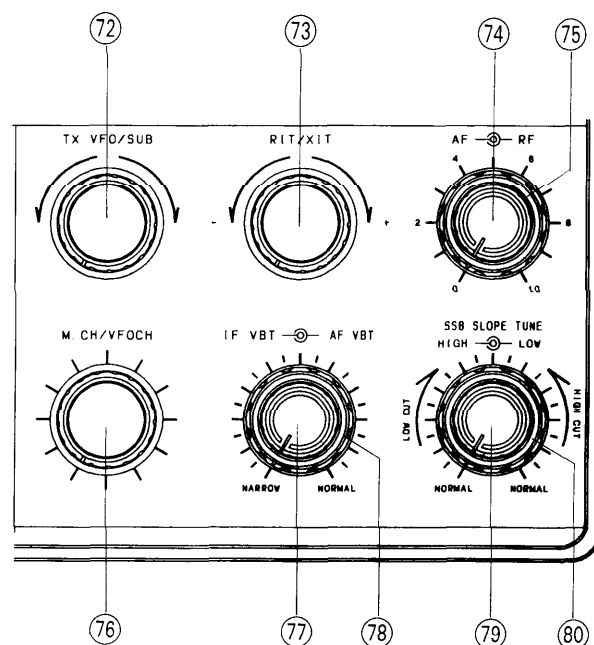
67 CLR (Clear) key
Used when reentering memory channel data, erasing a memory channel, clearing scan, or when specifying the channels that will be skipped during scan operations.

68 ENT (Enter) key
Used to directly enter a frequency from the numeric keypad.

69 M.IN key
Used to enter data into a memory channel.

70 M-VFO key
Used to transfer a frequency from memory to the VFO.

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



72 TX VFO/SUB control
When the SUB receiver is OFF, the transmit frequency indicated in the TX frequency display can be changed with this control.

Note

This control does not function during simplex operations.

When the SUB receiver is ON, the SUB receiver frequency indicated in the SUB receiver frequency display can be changed with this control.

73 RIT/XIT control
RIT (Receiver Incremental Tuning)
First, cancel any previously programmed offset using the CLEAR switch, then turn the RIT switch ON. The RIT control allows shifting the receiver frequency ± 9.99 kHz. 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. Pressing the CLEAR switch restores the RIT to zero.

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.

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.

Offsets of ± 9.99 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.

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

⑦④ 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 the setting of the AF gain control.

⑦⑤ 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.

⑦⑥ M.CH/VFO CH control

This control is used to change the frequency in 10 kHz steps during VFO operations.

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

⑦⑦ IF VBT control

This control is very similar to the SSB Slope Tuning controls. However, with the IF VBT control both

sides of the IF passband are narrowed at the same time. The actual range depends upon the CW filter(s) that have been installed.

⑦⑧ AF VBT control

Turn the knob to remove interference when in the CW receive mode.

⑦⑨ SSB 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. The AF slope tune circuit, of the TS-950S Digital version is simultaneously adjusted with this control.

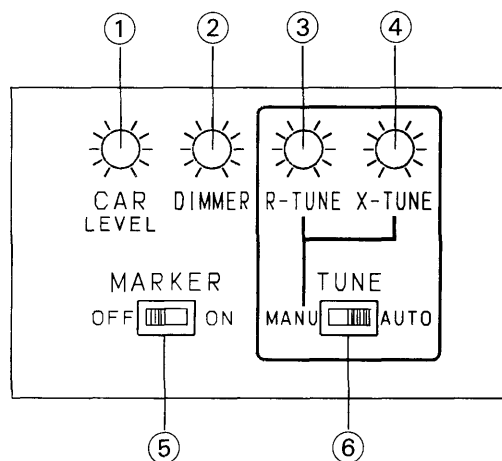
⑧⑩ SSB SLOPE TUNE LOW CUT control

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. The AF slope tune circuit, of the TS-950S Digital version is simultaneously adjusted with this control.

Note

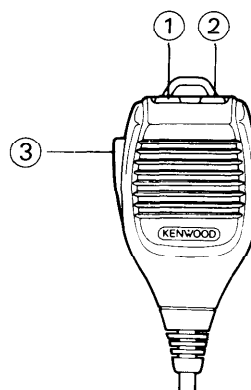
When using TS-950S DIGITAL to receive SSB, noise may be heard while turning the SSB SLOPE TUNE control with the AF slope tune in operation when the POWER switch is turned on.

■ TOP COVER



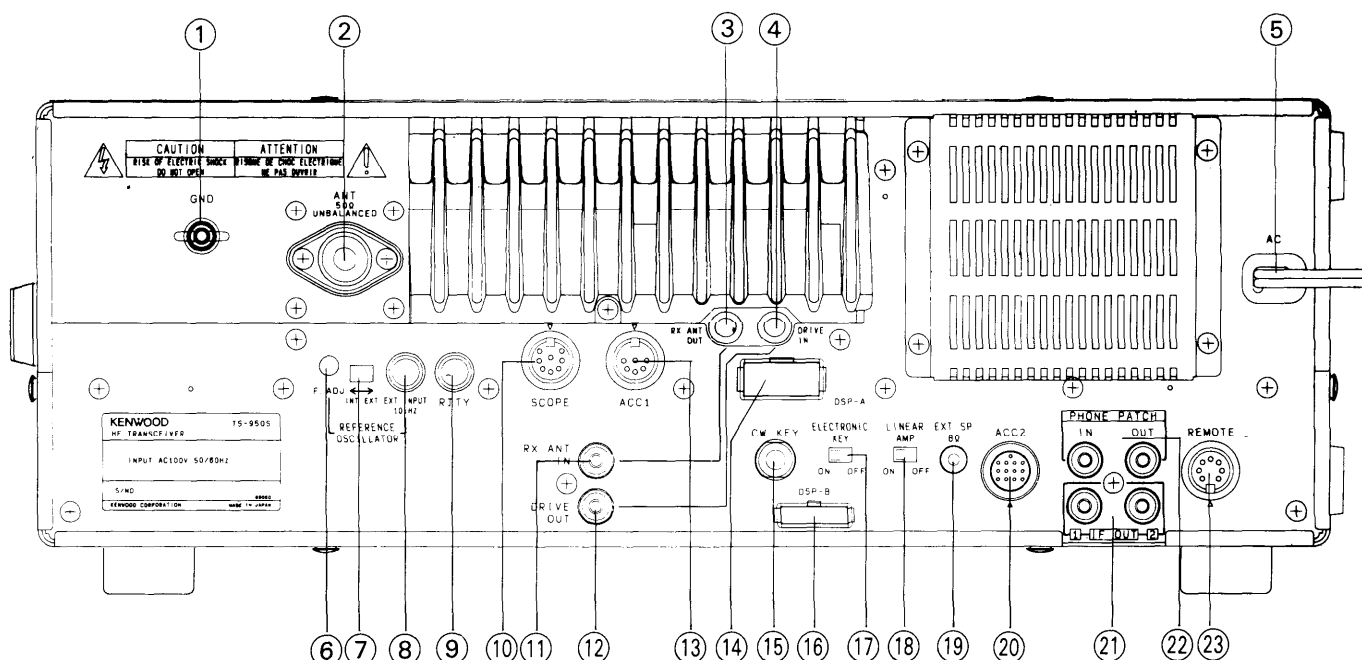
- ① CAR LEVEL (Carrier level) control
Used to adjust carrier level during CW and AM.
 - ② DIMMER control
Adjusts the brightness of the display panel when the DIM switch is pressed.
 - ③ R-TUNE (Resistance tune) control
Manually adjusts the antenna tuner.
 - ④ X-TUNE (Reactance tune) control
Manually adjusts the antenna tuner.
 - ⑤ MARKER switch
When this switch is ON during reception, the built-in oscillator will generate a marker signal at 500 kHz intervals. This switch is also used to zero beat the internal oscillator frequency with a standard frequency (WWV).
- Note**
The marker output level varies slightly from band to band.
- ⑥ TUNE switch
Selects auto or manual antenna tuner operation. The TUNE switch should normally be in the AUTO position.

■ 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 RX ANT OUT terminal

This is the antenna terminal for reception. Signals received at the ANT connector are sent to this terminal. This terminal is normally linked to the RX ANT IN terminal ⑪ with a jumper. If you wish to use an external receiver it would be connected to this point.

④ DRIVE IN terminal

This is the final stage input terminal. It is normally linked to the DRIVE OUT terminal ⑫ with a jumper.

⑤ AC power cable

Connect this cable to an electric outlet.

⑥ F.ADJ trimmer

Adjusts the frequency of the internal oscillator with a standard frequency.

⑦ REFERENCE OSCILLATOR switch

Switch to OSCILLATOR using tweezers to receive an external frequency standard signal.

⑧ EXT INPUT terminal

This is the input terminal for an external standard signal.

⑨ RTTY terminal

For connection to an RTTY interface unit. (direct FSK keying)

⑩ SCOPE connector

Use this connector to plug in the Station Monitor SM-230 (option).

⑪ RX ANT IN terminal

This is the antenna input terminal during reception. It is normally linked to the RX ANT OUT terminal ③ with a jumper. An antenna for receive only can be connected to this terminal.

⑫ DRIVE OUT terminal

This is the drive output terminal for transmitting signals. It is normally connected to the DRIVE IN terminal ④ with a jumper. The TX Drive level at this point is 700 mV RF 50 Ω Impedance.

⑬ ACC 1 jack

The optional IF-232C is connected here.

⑭ DSP-A connector

The optional DSP-10 is connected here.

⑮ 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 4-3-6 for additional key information.)

⑯ DSP-B connector

The optional DSP-10 is connected here.

⑰ 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.

⑱ LINEAR AMP switch

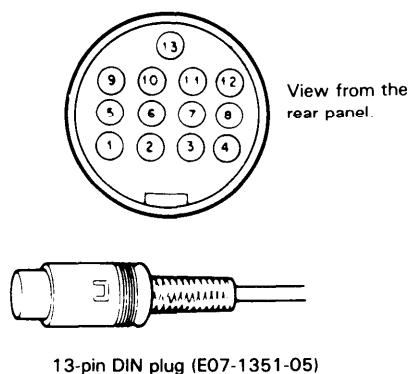
Activates the relay for the linear amplifier control.

⑲ EXT SP (External speaker) jack

This jack is for connection of an external speaker.

⑳ ACC 2 connector

Terminal numbers and their applications are as follows :



ACC2 pin assignments

Pin number	Symbol	Use
1	SANO	SUB receiver audio at a fixed level independent of SUB AF gain control setting. Output voltage : 300 mV/4.7kΩ or more at high input level
2	NC	No connection
3	MANO	MAIN 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.

ACC2 pin assignments

Pin number	Symbol	Use
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
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.

㉑ IF OUT jack

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

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

IF 2 is for connection to the SM-230 for RX Modulation Display. (100 kHz)

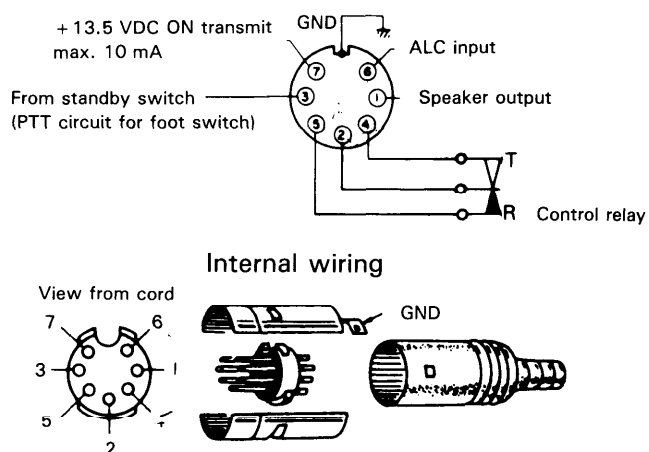
㉒ PHONE PATCH jacks

The IN terminal is used for transmit audio from the phone patch (600 Ω).

The OUT terminal is used for received audio from the transceiver to the phone patch (600 Ω). These jacks can also be used for input to and from SSTV, or RTTY terminals.

㉓ REMOTE connector

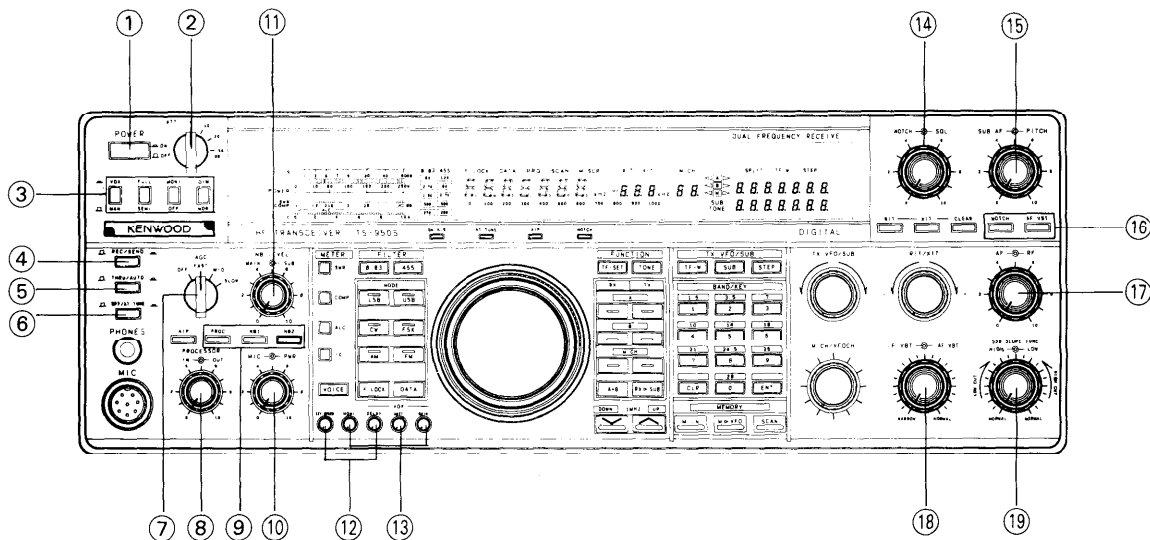
This connector is used when a linear amplifier is used.



4-2. RECEIVER OPERATION

Different MAIN and SUB receiver frequencies can be received simultaneously. (Less than $\pm 500\text{kHz}$) Reduce the audio of the band you do not want to hear. You can turn off SUB receiver audio, if you do not need it, with the SUB key. A beep will follow depression of any key.

4-2-1. Receiving



1. Connect the AC power supply and the antenna, and then set the switches and controls as follows:

- | | |
|--|--------------------------|
| ① POWER switch | : OFF (■) |
| ② ATT switch | : 0 dB |
| ③ VOX/MAN, FULL/SEMI, MONI, DIM switches | : OUT (■) |
| ④ REC/SEND switch | : REC (■) |
| ⑤ THRU/AUTO switch | : THRU (■) |
| ⑥ OFF/AT TUNE switch | : OFF (■) |
| ⑦ AGC switch | : FAST |
| ⑧ PROCESSOR IN, OUT | : Center |
| ⑨ PROC, NB1, NB2 switches | : OFF (■) |
| ⑩ MIC, PWR controls | : Fully counterclockwise |
| ⑪ NB LEVEL control | : Fully counterclockwise |
| ⑫ KEY SPEED, DELAY controls | : Center |
| ⑬ MONI, ANTI, GAIN controls | : Fully counterclockwise |
| ⑭ SQL control | : Fully counterclockwise |
| ⑮ SUB AF gain control: | Fully counterclockwise |
| PITCH control | : Center |
| ⑯ NOTCH, AF VBT switches | : OFF (■) |
| ⑰ AF gain control | : Fully counterclockwise |
| RF gain control | : Fully clockwise |
| ⑱ IF VBT control | : Fully clockwise |
| AF VBT control | : Fully clockwise |

⑱ SSB SLOPE TUNE

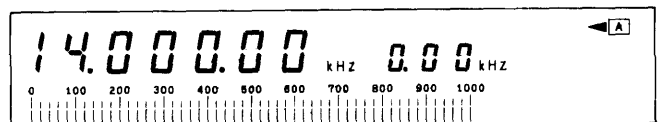
HIGH CUT control : Fully clockwise

LOW CUT control : Fully counterclockwise

2. After presetting the controls as described above turn the transceiver's POWER switch ON. The display panel will indicate as shown below.

Note

If the display is not as shown reset the microprocessor using the procedure provided in Section 4-4-2.



3. Turn the AF gain control clockwise until a signal or noise is heard.
4. Rotate the TUNING knob and select an open channel. If desired, adjust squelch as follows: turn the SQL control clockwise until the noise just disappears.
5. Select the desired operating frequency. When a signal is received the S-meter will deflect.
6. To turn off the transceiver, turn off the POWER switch.

4-2-2. 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 6-6-4.)

4-2-3. 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	• • — •

Note

You can select a single audio beep rather than Morse Code confirmation by pressing the CW key while turning on the POWER switch. (Please refer to Section 4-2-11.)

4-2-4. SSB AUTO mode shift

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

10kHz	9.5MHz	30MHz
LSB	USB	

Notes

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

4-2-5. 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

B. TX VFO/SUB control

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

Mode	Frequency Step	One revolution of TX VFO/SUB control
SSB/CW/FSK	10Hz	4 kHz
AM/FM	100 Hz	40 kHz

2. The SUB receiver frequency step depends on the position of the STEP key (ON or OFF).

STEP key	Frequency Step	One revolution of TX VFO/SUB control
OFF	10 Hz	4 kHz
ON	100 Hz	40 kHz

C. 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	250 kHz

The frequency step may be reprogrammed when turning on the POWER switch. (Please refer to Section 4-2-11.)

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

4-2-6. Amateur Radio Bands selection

Press the BAND/KEY key to change amateur radio bands. If the SUB receiver function is active it will also be changed.

4-2-7. 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 or VFO (the VFO that is not currently being displayed in the main display area) to change to the same data that is contained in the main 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 (show on the display). Depressing the A=B key will cause RX VFO B to change to 7 MHz in LSB.

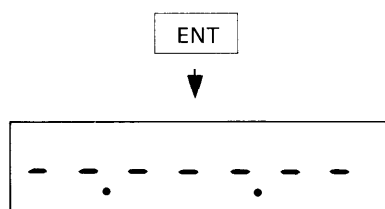
4-2-8. Direct keyboard frequency entry

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.

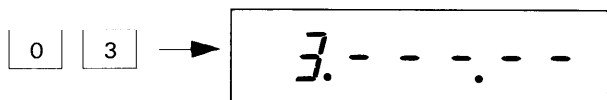
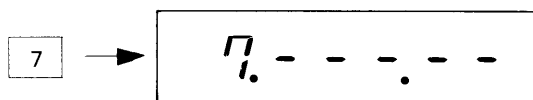
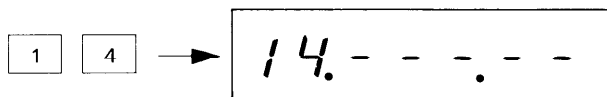
Note

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.



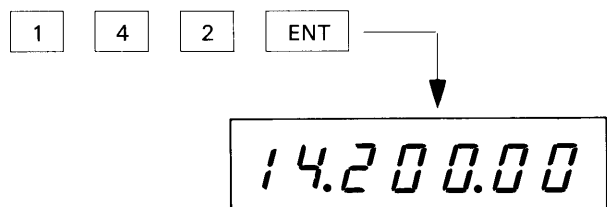
3. After the least significant digit has been entered press the ENT key again to signify you want the radio to change frequency. If you entered the frequency down to the nearest 10 Hz a beep will sound and the radio will automatically change to the new frequency without the need of pressing the ENT key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

4-2-9. CW zero-beat Operation

In CW operation equalizing the receiving frequency with that of your transmit is called "Zero beating". The TS-950S/950S DIGITAL enables you to zero beat in the following manner.

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.

Note

Turn the MONI switch to OFF.

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.

4-2-10. Simultaneous reception of two frequencies and TF-W Operation

The TF-W function allows you to transfer the sub receiver data into the split transmit VFO (A or B). The capability of receiving on two frequencies at the same time and the TF-W function are provided to make split frequency operation as convenient as possible.

The capability of receiving on two frequencies at the same time and the TF-W function are provided to make split frequency operation as easy and convenient as possible.

After tuning in the DX station press the SUB key to begin receiving on the sub receiver. You can listen for those stations who are currently talking to the DX station at the same time as you are monitoring the DX station. This will make it easy for you to find out how far he is operating up or down in frequency! Once you have discovered his pattern you should select split transmit operation and then press the TF-W key.

Notes

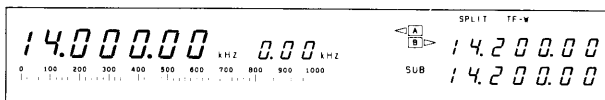
1. This feature is disabled when the difference between the TX and RX frequencies is greater than ± 500 kHz. A morse code "OVER" will sound thru the speaker if you press the TF-W key under these circumstances.
2. When the TX VFO is operating in the MEMORY mode or if both the RX and TX VFO are in the MEMORY mode this feature will not function.
3. Some combinations of transmit and receiver frequencies might result in an internal heterodyne signal (birdie). This is not a defect and is caused by certain frequency relationships.

For example

- (1) The receiver frequency in VFO A is 14.000 MHz, the transmit frequency in VFO B is 14.200 MHz, and the SUB frequency is 14.100 MHz. Pressing the TF-W key will cause the VFO B frequency (the one we want to transmit on) to become 14.100 (the same as the SUB frequency).



- (2) The receiver frequency in VFO A is 14.000 MHz, the transmit frequency in VFO B is 14.200 MHz and the SUB receiver is off (i.e. Single frequency reception). Now when the TF-W key is pressed the transmitter frequency will remain 14.200 MHz the SUB receiver will turn on, and will begin monitoring the transmitter frequency of 14.200 MHz as confirmed by the SUB frequency display.



4-2-11. 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.

Switch or key	These functions include
CW	Audible mode announcement: Beep tones/Morse code
LSB	SSB AUTO mode shift: ON/OFF
USB	Enables the pitch of the SSB and FSK signal to be changed by the CW pitch control. The receive frequency differs from the transmit frequency, so correction using RIT is required.
AM	M.CH/VFO CH control step frequency selection: 10 kHz/9 kHz

Switch or key	These functions include
FM	M.CH/VFO CH control step frequency selection: 10 kHz/5 kHz
FSK	The shift range of the FSK mode can be set to 170,200,425, or 850 Hz by using the TX VFO/SUB control.
SWR	Meter peak hold: ON/OFF
VOICE	Beep tones: ON/OFF
F.LOCK	Audible alarm: Beep tones/Morse code
TONE	Sub tones: Continuous tones/Tone burst
UP	1 MHz UP/DOWN switch: 500 kHz/1 MHz
0	Analog scale selection: 1 MHz/100 kHz
CLR	10 Hz display resolution: ON/OFF
M.IN	Automatically increments the memory channel data time each time you enter a frequency into memory.
SCAN	Program scan hold: ON/OFF
4 and 6	Storing the band frequency before the BAND key is pressed: Required/Not required
455	AF SLOPE TUNE for DSP-10: ON/OFF

4-2-12. 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
When the SCAN key is pressed and the receiver is unable to execute memory scan.	CHECK
- When you exceed the operating limits while using the numeric keys to enter a frequency. - When the SUB frequency exceeds the operating frequency range while operating the BAND key.	OVER

4-2-13. Interference Reduction

■SSB mode

SSB SLOPE TUNE control

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

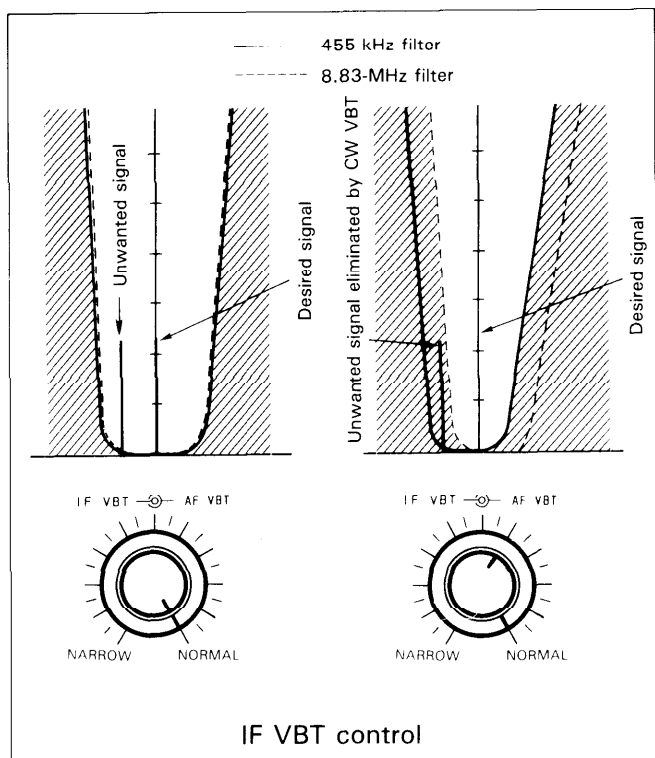
●SSB SLOPE TUNE HIGH CUT control

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.

●SSB 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.

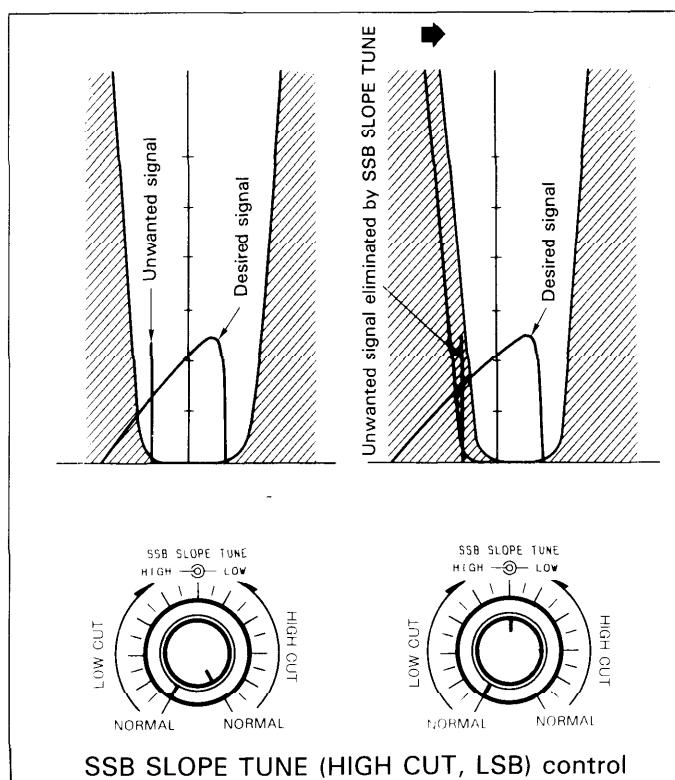
Maximum bandwidth occurs with the LOW CUT control fully counterclockwise, and the HIGH CUT control full clockwise.



■CW mode

[I] IF VBT control

This control is very similar to the SSB Slope Tuning controls. However, with the IF VBT control both sides of the IF passband are narrowed at the same time. The actual range depends upon the CW filters that have been installed.

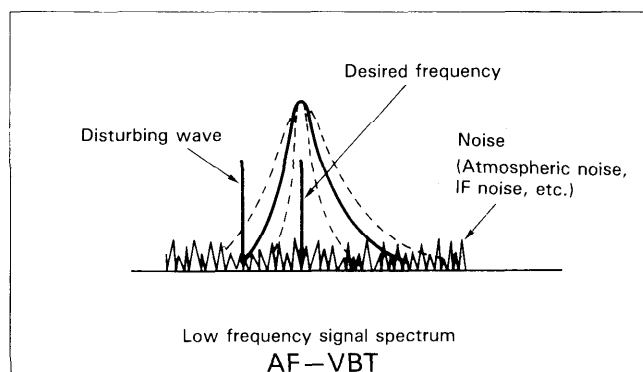


[II] AF VBT switch, AF VBT control

The AF VBT circuit is just the opposite of the NOTCH circuit. With this control it is possible to accentuate the desired signal by providing additional rejection of noise and interfering signals whose pitch (tone) falls outside the audio passband.

Turn the AF VBT switch ON and adjust the AF VBT control to peak the desired signal.

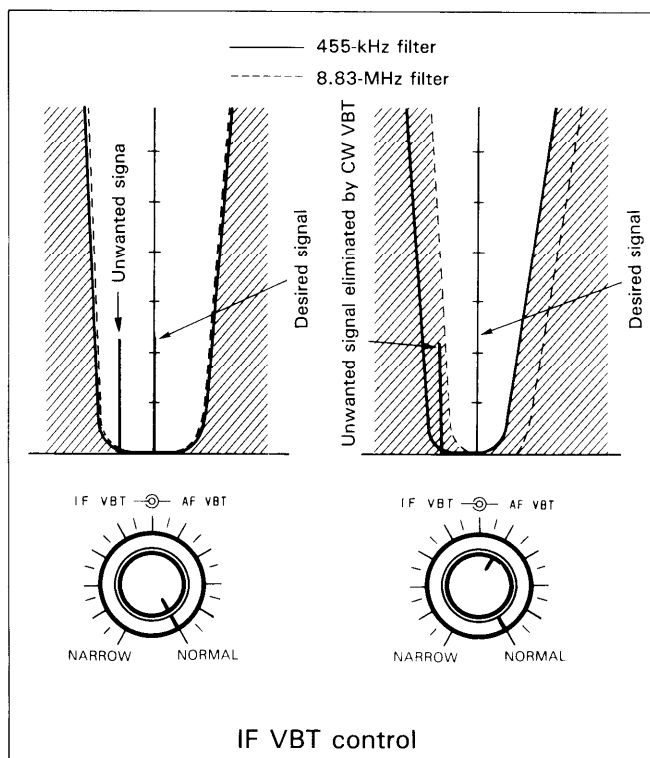
The PITCH control moves to match the AF VBT center frequency.



■ FSK, AM mode

IF VBT control

This control is very similar to the SSB Slope Tuning controls. However, with the IF VBT control both sides of the IF passband are narrowed at the same time. The actual range depends upon the CW filters that have been installed.



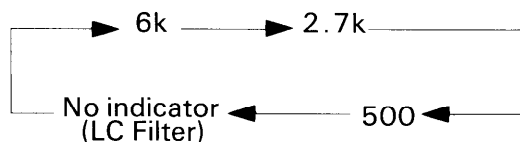
■ All mode

[I] Filter switch

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. (Please refer to Section 7-2.)

8.83 MHz filter bandwidth

The value changes each time the 8.83 switch is pressed.

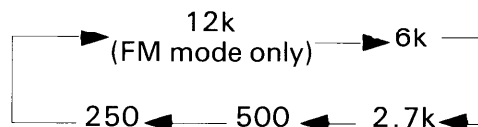


Notes

1. This function is not active in the FM mode.
2. Some bandwidths cannot be selected unless the required filter is installed.

455 kHz filter bandwidth

The value changes each time the 455 switch is pressed.



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.

Initial state

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

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.

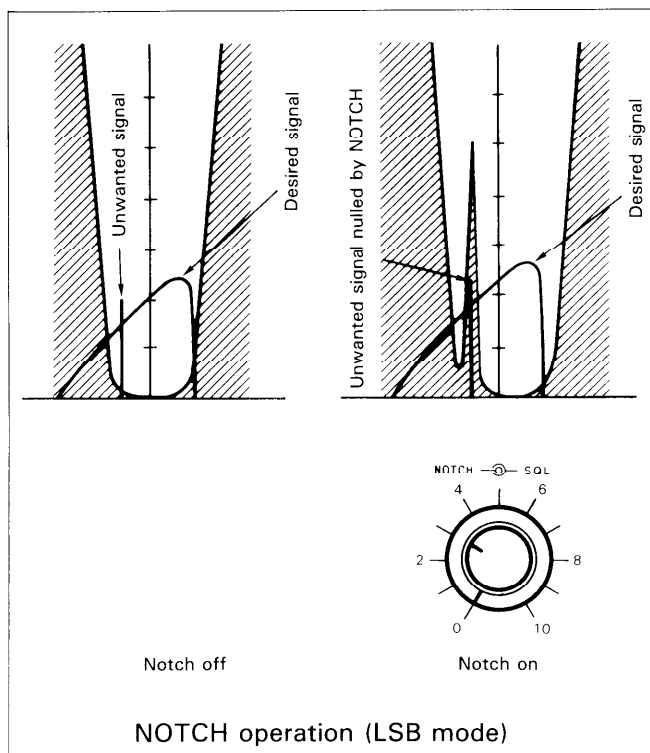
[II] NOTCH control (Except FM mode)

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.



●MAIN NB LEVEL control

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

●SUB NB LEVEL control

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

4-2-15. RIT control

First, cancel any previously programmed offset using the CLEAR switch, then turn the RIT switch ON. The RIT control allows shifting the receiver frequency $\pm 9.99\text{kHz}$. 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. Pressing the CLEAR switch restores the RIT to the previous status.

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.

4-2-14. Noise Blanker

The MAIN receiver and the SUB receiver have their own noise blankers.

●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-950S/950S DIGITAL are effective in most cases.

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

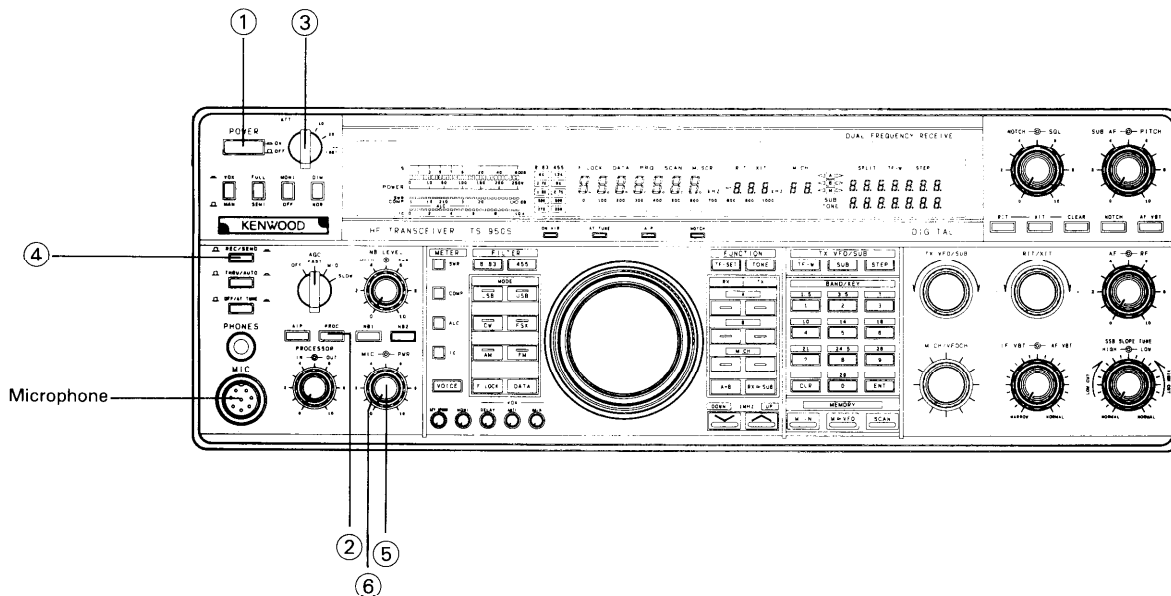
4-3. TRANSMITTER OPERATION

4-3-1. Precaution

Before transmitting check the frequency for activity so that you do not interrupt another QSO.

Note

All segments on the Display Panel and Indicators are shown on for this explanation.



1. Set the switches and controls as follows:

- ① POWER switch : OFF (■)
- ② PROC switch : OFF (■)
- ③ ATT switch : 0 dB
- ④ REC/SEND switch : REC
- ⑤ MIC gain control: Fully counterclockwise
- ⑥ PWR control : Fully clockwise

2. Connect a microphone to the MIC jack.

4-3-2. SSB mode

1. Place the POWER switch ON.
2. Set the MODE keys to USB or LSB. By international convention frequencies below 10 MHz utilize the LSB (Lower Sideband) mode, and frequencies above 10 MHz use USB (Upper Sideband). The actual switchover point on the transceiver is 9.5 MHz. The transceiver will select the proper mode when you tune to the desired frequency. You can override this by simply pressing the desired mode key.
3. Enter the desired frequency.
4. Set the METER switch to ALC.
5. Press the microphone PTT switch, or set the REC/SEND switch to SEND. The ON AIR indicator will light.

Note

The transmitter will not operate unless the FULL/SEMI switch is in the FULL position.

6. 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

1. Adjustment using the ALC meter provides greater accuracy than if you try and use the power meter for adjustment. Never adjust for ALC deflection above the ALC zone, as this will cause distortion of the transmitted audio signal.
2. The REC/SEND switch will not cause the radio to transmit when a key is inserted in the CW KEY jack on the rear panel.

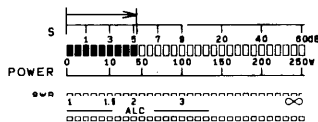
7. Turn on the PROC switch if required. (Please refer to Section 4-3-7.)
8. Release the PTT switch, or place the REC/SEND switch to REC. The ON AIR indicator will turn OFF.

4-3-3. FM mode

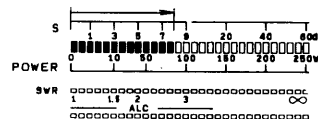
1. Place the POWER switch ON.
2. Place the MODE key to FM.
3. Select the desired frequency within the 28 MHz amateur radio band.
4. Set the METER switch to ALC.
5. Press the microphone PTT switch, or set the REC/SEND switch to SEND. The ON AIR indicator will light.
6. Speak into the microphone, holding 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.
7. Release the PTT switch, or place the REC/SEND switch to REC. The ON AIR indicator will turn OFF.

4-3-4. AM mode

1. Place the POWER switch ON.
2. Place the MODE key to AM.
3. Enter the desired frequency.
4. Set the METER switch to ALC.
5. Press the microphone PTT switch, or set the REC/SEND switch to SEND. The ON AIR indicator will light.
6. Adjust the CAR LEVEL control so that the meter indicates 40 watts.



7. Speak into the microphone and adjust the MIC gain control so that the meter indicates 80 watts.



8. Release the PTT switch, or place the REC/SEND switch to REC. The ON AIR indicator will turn OFF.

4-3-5. FSK mode

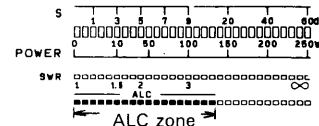
1. Connect the RTTY keyboard to the RTTY terminal on the rear panel.
2. Place the POWER switch ON.
3. Place the MODE key to FSK.
4. Select the desired FSK shift. (See section 4-2-11.)
5. Enter the desired frequency.
6. Set the METER switch to ALC.
7. Set the REC/SEND switch to SEND. The ON AIR indicator will light.
8. Adjust the PROCESSOR-OUT control so that the meter deflection is within the ALC zone.
9. Operate the RTTY keyboard.
10. Place the REC/SEND switch to REC. The ON AIR indicator will turn OFF.
11. Follow the instructions contained in your terminal units operating manual for the correct settings before you start transmitting. The DATA mode will be automatically selected in the FSK mode. The shift step can be selected when the POWER switch is turned on. (Please refer to Section 4-2-11.)

4-3-6. CW mode

●Sidetone oscillator

The transceiver contains a sidetone oscillator circuit to permit you to monitor your own signal. If the key is closed in a mode other than CW, transmit will not be selected but a sidetone will come out of the speaker, to allow Morse code training. The volume of the sidetone can be adjusted internally. (Please refer to Section 6-6-3.)

1. Connect a key or electronic keyer to the rear panel CW KEY jack.
2. Place the POWER switch ON.
3. Place the MODE key to CW.
4. Enter the desired frequency.
5. Set the METER switch to ALC.
6. Press the key; the ON AIR indicator lights and the meter pointer deflects.
7. Adjust the CAR LEVEL control until the meter deflection is within the ALC zone.



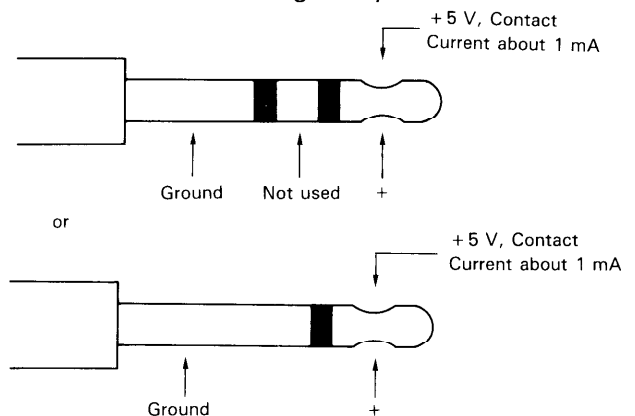
8. Release the key. Receive will be restored and the ON AIR indicator will turn off.

●SEMI and FULL break-in

I. Keyer connections

When the internal keyer is turned off and you intend to use either a straight key or external keyer you should connect the plug as shown in the accompanying diagram. Use a plug with a diameter of 6.0mm.

■To use external straight key

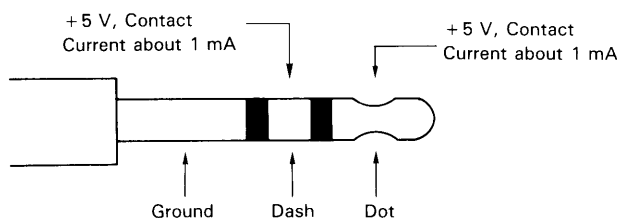


Note

1. The ELECTRONIC KEY switch on the rear panel should be in the OFF position when you use an external key and keyer.
2. Use of a stereo plug in this instance will cause misoperation of the set.

II. Electronic keyer connection

When using the internal keyer you should connect the CW key as shown in the accompanying diagram. Note internal keyer operation requires the use of a stereo type plug (6.0 mm dia.), do not use a mono plug when internal keyer operation is desired.



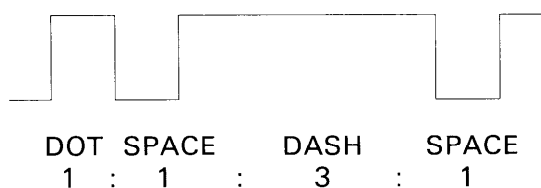
III . Electronic Keyer Circuit Operation

Place the ELECTRONIC KEY switch on the rear panel to ON. Connect a paddle type key to the 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 forcefully change the ratio to your own personal preference or you can select AUTO-WEIGHT control where the weighting adjusts for changes in keyer speed.

Switch S2 in the Control Unit controls this function.

Position 4 selects Auto/Manual switching

Position 3 selects Manual control

Position 1 and 2 control the manual weight ratio

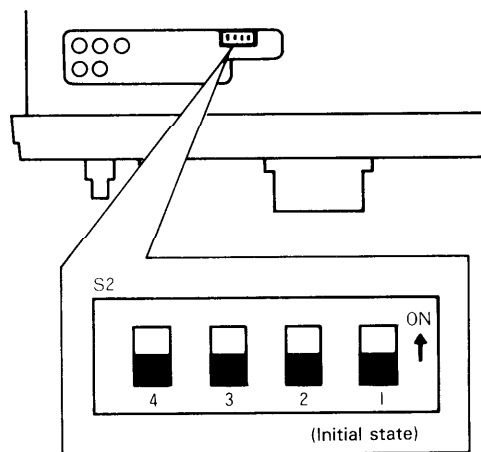
Manual Weight adjustments

Four different dot/dash ratios are possible by adjusting switch S2 positions 1 and 2. Note these will only be effective when position 3 is turned ON.

DOT : DASH RATIO	S2-1	S2-2
1 : 3.0	OFF	OFF
1 : 2.8	ON	OFF
1 : 3.2	OFF	ON
1 : 3.4	ON	ON

Note

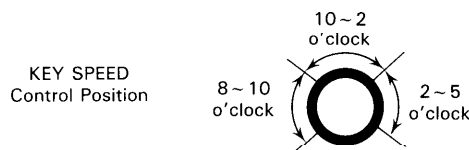
These dot/dash ratios are only approximate.



Auto Weight

Four dot/dash ratios can be set by using switch S2 positions 3 and 4.

S2-3		S2-4
OFF (Normal mode)	ON (Reverse mode)	
The faster the keying speed the longer the dash.	The faster the keying speed the shorter the dash.	ON



KEY SPEED Control Position	8~10 o'clock	10~2 o'clock	2~5 o'clock
NORMAL MODE	1 : 2.8	1 : 3.0	1 : 3.2
REVERSE MODE	1 : 3.2	1 : 3.0	1 : 2.8

Note

It requires a little time to change the ratio at about the 10 o'clock and 2 o'clock positions of the KEY SPEED control where some hysteresis occurs.

■ SEMI and FULL break-in operation

Note

The ELECTRONIC KEY switch on the rear panel should be in the OFF position when you use an external key and keyer.

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.

The 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.

On occasion an electronic keyer may be used that has no method of producing a continuous transmit condition. In order to obtain a continuous carrier for tuning simply place the REC/SEND switch to the SEND position, and the CW switch to FULL.

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. When the FULL/SEMI switch is in the FULL position, set the REC/SEND switch to SEND for continuous transmission. This is convenient when you are adjusting a linear amplifier.

4-3-7. 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 PROCESSOR IN 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 PROCESSOR OUT control while speaking into the microphone. Ensure that the meter deflection is within the ALC zone!

4-3-8. 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 necessary control setting.
4. If the VOX circuit transfers between words, or holds too long, adjust the release time-constant using the DELAY control.

4-3-9. ON AIR MONITOR

I. MONI switch

Turn the MONI switch ON to monitor the transmitted signal.

Note

Turning the TUNING control or the TX VFO/SUB control with the MONI switch ON generates a switching noise in the speaker.

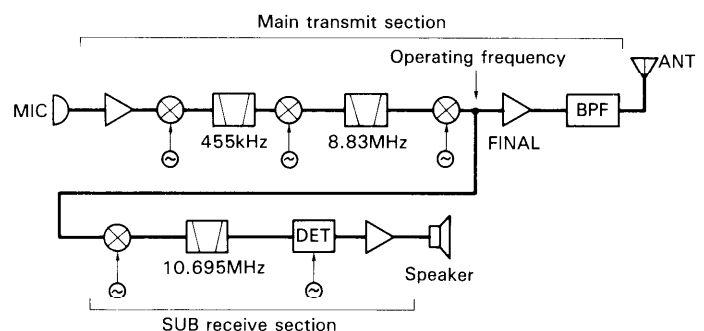
II. MONI control

Adjust monitor volume level.

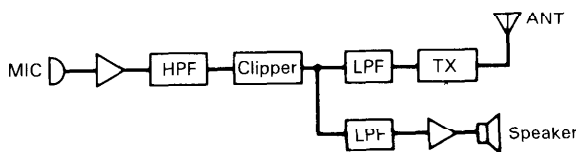
Unlike conventional IF monitor circuits, the monitor circuits of this transceiver (with the exception of FM) enable you to monitor signals under actual operating conditions as shown below.

Note

AGC in the SUB receive unit is activated automatically so that you can obtain a constant volume level regardless of transmitter output power.



In the FM mode you can check for over modulation as you can monitor the signal after it has passed through the clipper circuit.



4-3-10. 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.

Offsets of ± 9.99 kHz are possible.

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

4-3-11. 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. (See section 4-2-10.)

4-3-12. RTTY

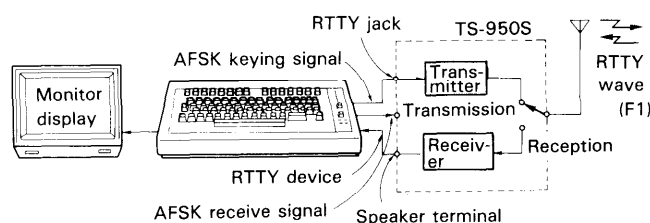
RTTY operation requires a demodulator and a teletypewriter. A demodulator including 2125 and 2295 Hz (170 Hz shift) filters, will be acceptable and may be connected directly to the PHONE PATCH OUT jack. To use the transceiver's FSK circuit with older high voltage teletype equipment, you must use an external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

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

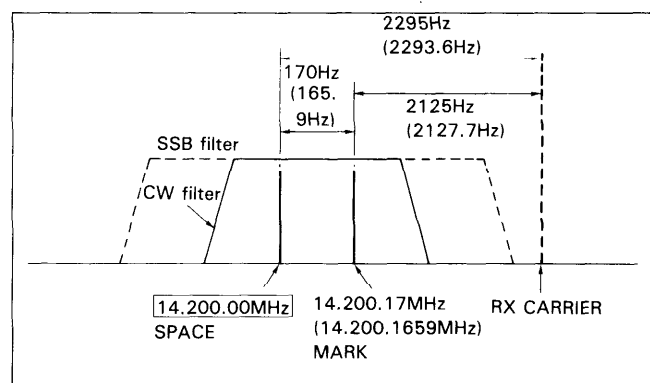
RTTY SYSTEM

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

For SSTV, the PHONE PATCH IN jack should be connected to the Camera output. The PHONE PATCH OUT jack should be connected to the monitor input. For AFSK operation, connect the Tone Unit output to the Phone Patch input, and Phone Patch output to the Tone Unit input.

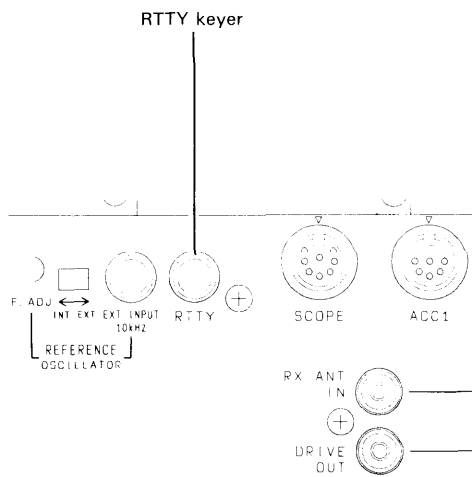


The figure below shows the frequency relationship between receive and transmit with this transceiver. In FSK operation the space frequency is indicated on the main display.



Notes

1. Main display frequency 14.200.00 MHz.
2. () denotes frequency of this transceiver.



4-3-13. 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 3 : 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 set to approximately 10 watts during the tuning process to protect the finals against damage.

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.

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 and the AT TUNE indicator goes out, set the AT TUNE switch to ON. The transceiver goes to the CW mode, the AT TUNE indicator lights, and the unit starts tuning.

Note

This switch will not function when the CAR LEVEL control on the top cover is turned fully counterclockwise.

3. When tuning is completed ($VSWR \leq 1.3$) and the AT TUNE indicator goes out, set the AT TUNE switch to OFF.
4. A warning beep tone is sounded when tuning is not completed within 15 seconds. Turn the AT TUNE switch OFF. Place the TUNE switch on the top cover in MANU and turn the AT TUNE switch back ON again. While reading the SWR meter, alternately turn and adjust the R-TUNE and X-TUNE controls on the top cover for the lowest SWR. When tuning is completed ($VSWR \leq 1.3$), the AT TUNE indicator will go out. Once it goes

out, further tuning will not be possible even if you turn the controls.

Note

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

Preset Memory

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 back 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. When this transceiver is shipped from the factory, the transceiver's tuning is preset by connecting a 50-Ohm dummy load to the antenna connector.

Note

After tuning is complete, if you change BANDS and then return to the previously tuned BAND, the SWR may have changed. If the SWR has changed, set the AT TUNE switch to ON so the unit will retune.

4-3-14. DATA COMMUNICATIONS (PACKET, AMTOR, RTTY, SSTV, etc.)

1. ACC 2 terminal 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 pin of the 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 entering your text.

Notes

1. No transmission should be attempted until you have confirmed that all terminal unit connections have been properly completed according to the instructions provided with that unit.
 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 6-6-5.)
 3. The DATA mode will be automatically activated in the FSK mode.
6. When the DATA key on the front panel is pressed, the microphone input circuit is disabled and the signals from the microphone will be blocked. Using the standby terminal (Pin number 9 of the ACC2 connector) will produce the same result. When the REMOTE connector is used for external standby, prevent unwanted errors by pressing the DATA key to disable the mic input circuit. When the DATA key is pressed in the FM mode, the time constant for the squelch becomes fast.

4-4. MEMORY

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

4-4-1. Microprocessor back-up lithium Battery

A lithium battery is contained in the transceiver to retain memory. Turning off and 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 dealer, 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 4-4-2.
2. When the lithium battery fails, the radio's microcoded functions are not affected. Only information stored in memory will be cleared.

4-4-2. 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▶SUB key and turn on the power to reset all user programmed data except the contents of the Memory Channels.

4-4-3. Memory Channel

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

4-4-4. Memory Contents

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

	00~89	90~99
Frequency	○	○
Mode	○	○
Filter	○	○
Tone Frequency data	○	X
Tone ON/OFF	○	X
Highest/Lowest operating frequency	X	○

4-4-5. Memory Entry

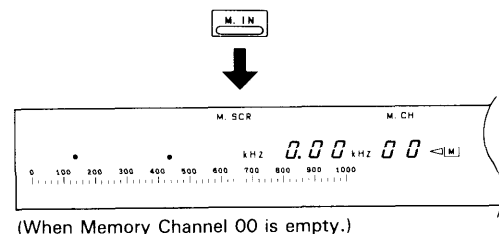
A. Standard Memory Channel

1. Select the receive frequency and the mode.

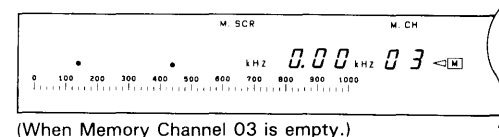
Example: 14.175MHz is selected on VFO A



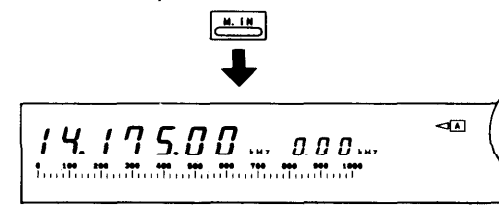
2. Press the M.IN key. The radio will enter the Memory Scroll (M.SCR) mode.



3. Select the desired Memory Channel number.



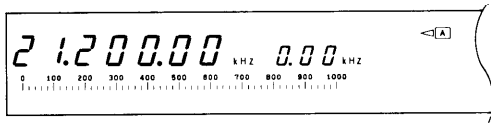
4. When the desired memory channel is found and displayed, press the M.IN key again. The current frequency and mode will be stored, the Memory Scroll mode will be canceled, and the transceiver will return to the operating mode and frequency that was displayed before the M.IN key was pressed initially.



B. Split Memory Channel

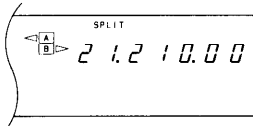
1. Select the receive frequency and the mode.

Example: 21.200 MHz is selected on VFO A.

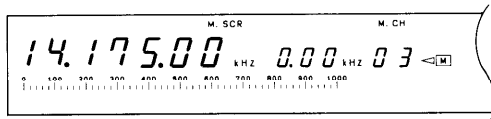


2. Press the A=B key.
3. Set the TX VFO to B and select the desired transmit frequency.

Example: 21.210 MHz is selected on VFO B.

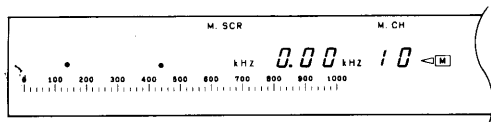


4. Press the M.IN key.



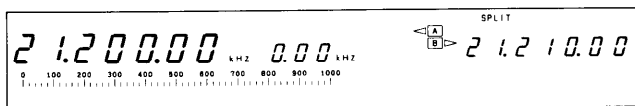
(When 14.175 MHz is stored in Memory Channel 03.)

5. Select the desired Memory Channel number.



(When Memory Channel 10 is empty.)

6. When the desired memory channel is found and displayed, press the M.IN key again. The current frequency and mode 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.



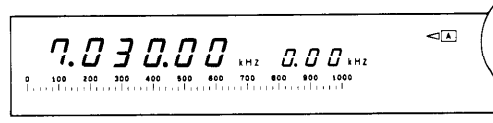
C. Programmed Scan Memory Channel

The highest and lowest frequency are stored in this memory channel. The mode and filter bandwidth settings of the lowest frequency are also stored. This channel can be used as a standard memory

channel if the highest and lowest frequencies are identical.

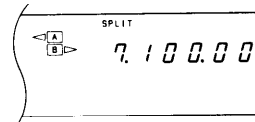
1. Select the lowest operating frequency and the mode.

Example: 7.030 MHz is selected on VFO A.

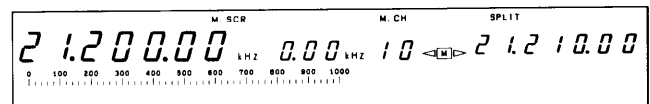


2. Press the A=B key.
3. Select the highest operating frequency.

Example: 7.100 MHz is selected on VFO B.

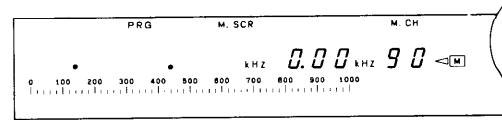


4. Press the M.IN key.



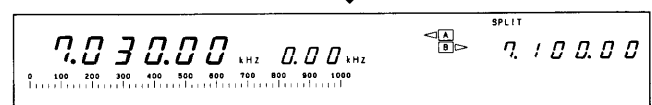
(When 21.200 MHz (RX) and 21.210 MHz (TX) are stored in Memory Channel 10.)

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 and mode 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.



4-4-6. Memory Channel Recall

The following procedure illustrates how to recall a memory channel.

1. Select memory channel operation for either RX or TX by simply depressing the appropriate FUNCTION keys. 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 appropriate display will change as this control is rotated.

4-4-7. 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 or the M.IN key again to restore Memory Channel operation.

4-4-8. 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 for either RX or TX using the FUNCTION keys.
2. 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 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.

4-4-9. 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 for RX.
2. Select the desired Program Scan memory channel by rotating the M.CH/VFO CH control.
3. Press the 1 MHz UP switch to see the upper scan limit.
4. Press the 1 MHz 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.

4-4-10. Mode and Filter Changes during Memory Channel Operation

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.

4-4-11. 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.

4-5. SCAN

Both Memory Scan and Program Scan are possible.

4-5-1. 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.

To cancel scan press the CLR key.

4-5-2. Group Scan

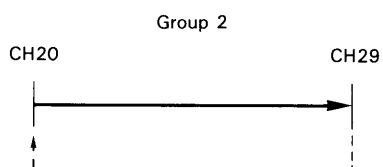
To initiate memory scan of specific memory channel groups.

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 ten 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



4-5-3. 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 the TX 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, or numeric keys.
3. Press the CLR key.

Note

Holding the CLR key depressed for longer than 2 seconds will clear that channel. Fall 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.

4-5-4. 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 main display towards the frequency specified in the sub display.
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 10.0 kHz thru 30.0 MHz and these limits will be automatically stored in memory channel 90.

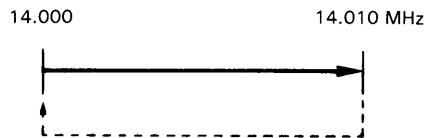
You can specify up to 10 different groups to scan. Simply hold the scan key depressed and press the numeric key corresponding to the different groups you wish to scan.

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 (upper limit) are stored in channel 92:

- [I] 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.

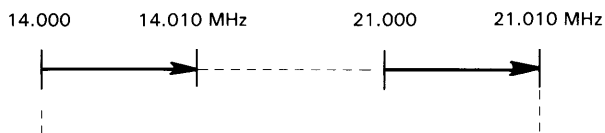
Memory channel 92



[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.

Memory channel 91

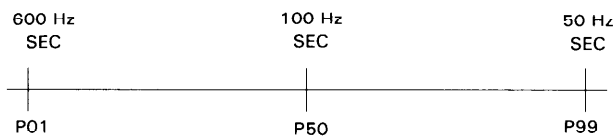
Memory channel 92



4-5-5. 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.



4-5-6. Scan Hold

The Scan Hold function is selected by using the Power on function selection described in Section 4-2-11.

4-6. REPEATER OPERATION

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

1. First select the desired receiver frequency in RX VFO.
2. Press the A=B key.
3. Set the TX VFO to B and select the transmit frequency for repeater operation by using the TX VFO/SUB control.
4. Press the TONE key. 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.

5. Select the tone frequency by using the TX VFO /SUB control. The 39 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	
77.0	127.3	210.7
79.7	131.8	218.1
82.5	136.5	225.7
85.4	141.3	233.6
88.5	146.2	
91.5	151.4	241.8
94.8	156.7	250.3
97.4	162.2	
100.0	167.9	1750.0
103.5	173.8	
107.2	179.9	
110.9	186.2	

Note

Consult your KENWOOD service center when you want to use the tone frequency of 1750 Hz.

6. 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.

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

OFFSET Trace Function

This function is active after programming a TONE FREQUENCY in the repeater operation mode.

The OFFSET Trace function will cause both the Transmit and Receive frequency to "track" each other, maintaining the OFFSET frequency relationship during tuning.

4-7. 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
- DATA mode ON/OFF setting
- VFO A, VFO B and memory frequency selection and readout
- SUB VFO 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 control setting
- RIT/XIT frequency clearance
- RIT/XIT frequency UP/DOWN
- METER switch setting
- RIT ON/OFF setting
- RX: For receive operation, TX: For transmit operation
- SUB key ON/OFF setting, TF-W key ON/OFF setting
- Scan ON/OFF setting
- Slope tune band setting and readout
- Meter signal output
- STEP ON/OFF setting
- Sub-tone frequency setting
- TONE ON/OFF setting
- VBT passband setting and display
- Generation of synthesized voice
- XIT ON/OFF setting

4-8. VOICE SYNTHESIZER

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

When the VOICE switch is pressed the transceiver will audibly announce the operating frequency.

4-9. DIGITAL MODULATION FUNCTION [The Digital Signal Processor DSP-10 (option) is required for TS-950S.]

This transceiver is capable of providing the SSB, CW, AM and FSK modulation, generating or FM carrier, and providing the AF slope tune during the SSB receive by using the input signals from the microphone and a 16-bit A/D, D/A converter for CW and FSK keying and DSP (Digital Signal Processor).

(1) Features of each Mode

① SSB mode

Modulated waves of higher-quality than those in the SSB mode are obtained through modulation by the 10th phase-shift network that digitally treats signals.

② CW mode

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

③ AM mode

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

④ FM mode

Provides the high-quality 455 kHz carrier.

Note

DSP-10 does not provide modulation.

⑤ FSK mode

Excellent, low-distortion modulated waves are obtained through FSK modulation with continuous phasing after the digital form-restoration of the rising form and characteristic of the waveform.

⑥ SSB mode (received)

AF slope tuning is provided by the digital filter, to suit the slope of this transceiver.

Notes

- Noise may be heard while turning the SSB SLOPE TUNE control if AF slope tuning is active when the power switch is turned on.
- Distortion may occur when large input signals are received with the AGC switch in the OFF position during AF slope tuning. Turn the AF slope tuning control to OFF when switching on the power. (Please refer to Section 4-2-11.)

(2) Switches

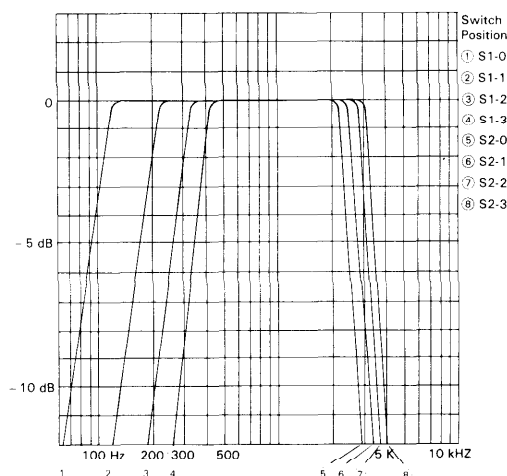
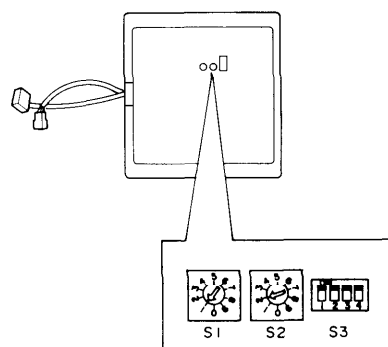
① Modulated Signal Frequency Response

A wide SSB frequency response is obtained from the DSP unit thru the use of the Phase Shift Network. It is desirable to limit the bandwidth of this signal, somewhat, to help keep the congestion down on the bands. The DSP unit provides several optional bandwidths to allow you to tailor the pass-bandwidth based on the mode of operation and personal preferences. The accompanying chart and graph illustrate the effects of rotary switches S1 and S2 on the pass-bandwidth of the transmitted signal.

S1: Switch S1 is used to alter the High Pass Filter characteristics of the signal in the SSB and AM modes. It is initially set at position 1.

S2: Switch S2 is used to alter the Low Pass Filter characteristics of the signal in the SSB and AM modes. It is also initially set at position 1.

Switch Position	S1		S2	
	SSB	AM	SSB	AM
0	110Hz	75Hz	2600Hz	2900Hz
1	200Hz	185Hz	2750Hz	2900Hz
2	300Hz	300Hz	2900Hz	2900Hz
3	400Hz	400Hz	3100Hz	2900Hz



The graph above illustrates how the pass-bandwidth is changed with switches S1 and S2. Each variable is plotted and the relationship of the switch positions is shown in the legend below the chart.

②Other Control Functions

Switch S3 is provided for several purposes which include:

The ability for the operator to select the desired CW waveform rise and decay time, based upon personal preference and the selected Keyer speed.

The ability to select the Ripple factor of the SSB signal.

The ability to control the effect of the AF tune circuit.

Specifically:

S3-1: Changes the characteristics of the CW waveform.

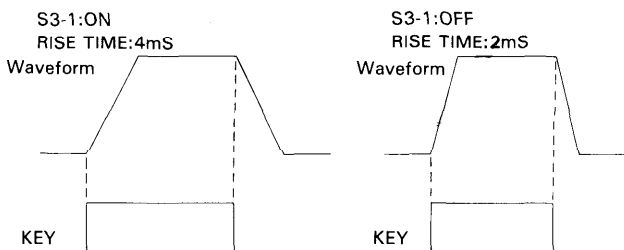
S3-2: Changes the Digital LPF pass-band ripple factor.

S3-3: Controls the action of the AF Slope tuning control.

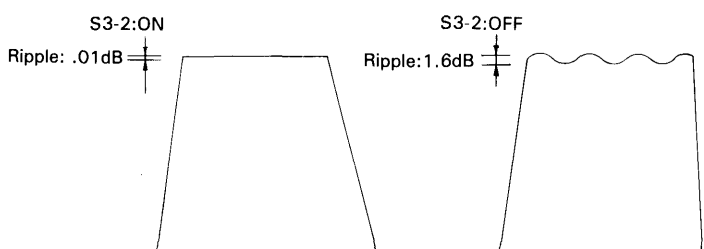
S3-4: Should always stay in the ON position.

S3-1 provides two different leading/trailing edge time frames. When S3-1 is ON the rise/decay time is approximately 4 m seconds. This would be desirable when you are operating at a relative low keying speed, with normal weighting (dot/dash ratios). When S3-1 is OFF the rise/decay time is approximately 2 m seconds. This position would be desirable for high speed CW operators, or when operating at unusual dot/dash ratios.

The figure below illustrates the relationship of the CW waveform to keying signal.

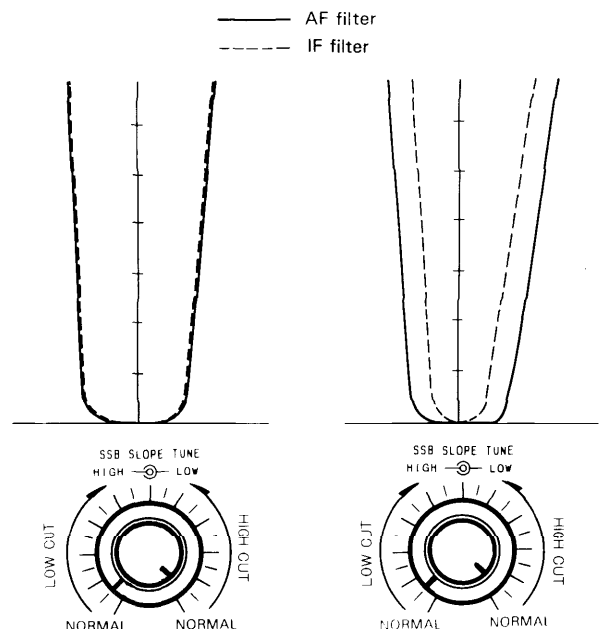


S3-2 selects the Digital filter ripple factor. When the ripple is set for 0.01 dB, the group delay characteristics are of primary importance which provides the best sound quality. When the ripple is set for 1.6 dB, the transition band characteristics of the signal are primary placing maximum effect on the bandwidth of the signal. The accompanying figure illustrates the effect of this switch setting.



S3-3 controls the action of the AF Slope tuning circuit. When the switch is ON the AF Slope tuning coincides with the SSB Slope Tuning control, i.e. the IF pass-bandwidth and the AF pass-bandwidth move equal amounts for a given change of the front panel controls. When the switch is OFF the AF pass-bandwidth does not track with the IF pass-bandwidth. If the Slope tuning controls are adjusted one detent position, the initial change in the IF pass-bandwidth will be twice the change in the AF pass-bandwidth. Each successive detent will result in a progressive decrease in the tuning difference so that by the time you have reached the full extent of the controls range the change in AF pass-bandwidth will again coincide with the change in the IF pass-bandwidth.

The accompanying diagram illustrates the relationship of the two pass-bandwidths and the position of S3-3.



Note

Before making any changes make sure the power is turned off.

(3)DSP-10 Remove (Please refer to Section 7-5.)

5. CIRCUIT DESCRIPTION

5-1. GENERAL DESCRIPTION

This transceiver utilizes quadruple-conversion for receiving in the SSB, CW, AM, and FSK modes, triple-conversion for FM mode, double-conversion for FM transmit operation and triple-conversion signals for SSB, CW, and FSK transmit operation. The IF frequencies are 73.05 MHz, 8.83 MHz, 455 kHz, and 100 kHz. The receiver section for SSB, CW, FSK and FM also have a IF 100 kHz.

A (2SK520) junction FET is used in the first and second mixers in the receiver section to provide a wide dynamic range.

In the transmit section, a single 3SK131 mixer is adopted in the first mixer. The balanced mixers use a 3SK131 for the second and third mixers.

5-2. TRANSMITTER SECTION

Voice signals from the microphone are received on the switch unit, amplified by the mic amplifier, and are then routed to the MIC GAIN, FM MIC AMP, and VOX circuits in the SSB and AM modes.

The signal for SSB is received on the signal unit, and are amplified and converted to the DSB 455 kHz if by means of the balanced modulator. This signal passes through the buffer amplifier and the ceramic filter, then goes to the IF unit as the SSB signal. This SSB signal is then mixed with the Local OSC2 (9.285 MHz) by means of the transmit first mixer in the IF unit to become the 8.83 MHz signal. This signal passes through a MCF and amplifier. It is then mixed with Local oscillator 1 (64.22 MHz), converted to the 73.05 MHz signal and is passed to the RF unit. This signal is mixed with the VCO frequency by the third transmit mixer in the RF unit, converted to the intended transmit frequency, passed through the transmit band-pass filter, amplified by the amplifier, then output on the DRIVE OUT terminal on the rear panel. From the DRIVE OUT terminal the signal is into the FINAL IN terminal on the back of the heatsink via the coaxial cable and enters the final section. The transmit signal is amplified to the required power, and unwanted spurious elements are removed by the low-pass filter. The signal then passes through the auto antenna tuner to the antenna.

5-3. RECEIVER SECTION

The input signal received from the antenna enters the RF unit and passes through the RF attenuator and circuits including the LPF that work up to 30 MHz. It then goes to the 15 section band-pass filter where the desired RF bandwidth is selected. After passing through the RF AGC circuit, this signal is either amplified in the RF amplifier with cascade connection or passed through the source floor circuit and sent to the respective first mixers of the main and sub receive sections.

The signal received in the main receive section is converted to the first IF frequency (73.05 MHz) by the first mixer then passes to the IF section. It then passes through the MCF band-pass filter, and is amplified by the IF amplifier, mixed with the local oscillator frequency of (64.22 MHz) by the second mixer for conversion to the second IF frequency of (8.83 MHz). This signal branches into the noise blanker circuit in the AF section and the signal circuits following the noise blanking gate. The receive signal then passes through the second IF filter, is mixed with the local oscillator frequency of (9.285 MHz) and converted to the third IF frequency (455 kHz) by the third mixer. Then it enters the signal section where the mode is detected (FM and other modes). In the FM mode, the signal is amplified, detected, and finally goes to the AF circuit after its level (modulation degree) is set in the AGC amplifier. In modes other than FM, the signal passes through the 455 kHz filter, is converted to the fourth IF frequency (100 kHz) by the fourth mixer, and passes through the notch filter. It then undergoes product detection in SSB and CW modes and AM detection in AM mode and finally becomes speaker audio.

In the sub receive section, the received signal, after being converted to the first IF frequency (40.055 MHz) by the first mixer is passed through the MCF and sent to the IF section where it is mixed with the local frequency (50.75 MHz) and converted to the second IF frequency (10.695 MHz) by the second mixer. It passes through filters, undergoes product detection, and finally becomes speaker audio.

5-4. CIRCUIT BOARD DESCRIPTION

The transceiver contains the following major units: Signal unit, Control unit, Final unit, etc. A brief description of these units follows.

5-4-1. RF unit

This section contains the 15 section band-pass filter, the RF attenuator, the first mixer of the main section, the first mixer of the sub section, and the RF amplifier necessary for reception, the third mixer and the RF amplifier necessary for transmission, and the VCO needed to cover 10 kHz to 30 MHz.

5-4-2. IF unit

This section contains the MCF, the first IF amplifier, the second mixer, and the third mixer of the main receive section; the first IF amplifier, the second mixer, and the second IF amplifier of the sub receive section; and the 8.83 MHz filter and the local frequency (64.22 MHz, 9.285 MHz) amplifier.

5-4-3. Control unit

This section includes the ALC circuit, the timing circuit that controls the CW break-in operation, etc.

5-4-4. PLL unit

This section contains the frequency generation system for the transceiver.

5-4-5. CAR unit

This section contains the carrier oscillators needed for the VBT and SLOPE TUNE circuits.

5-4-6. Final unit

This unit amplifies the TX RF signal for transmission. This is accomplished by utilizing a three-stage final amplifier section having a relatively low collector loss figure, and a high efficiency cooling system.

5-4-7. Signal unit

The signal unit is composed of the transmit and receive sections. These consists of the Signal system amplifiers, mixers, detectors, modulators, filters, VCO's, and the various timing circuits used for transmit / receive switching. This unit handles practically all transceiver signal processing.

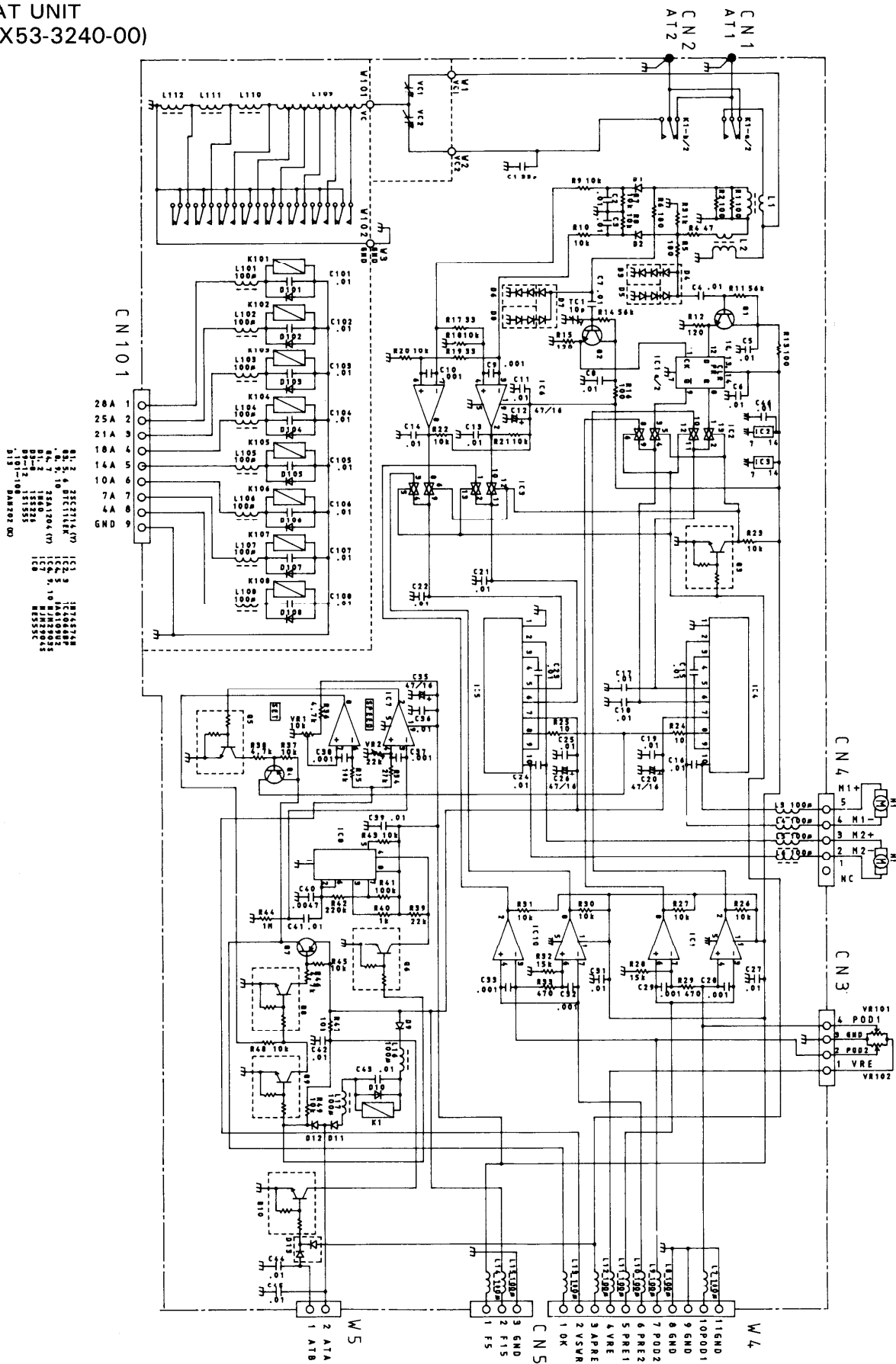
5-4-8. AF unit

This section contains the amplification and switching circuits for the AF signal, VCO, etc.

[illegible]

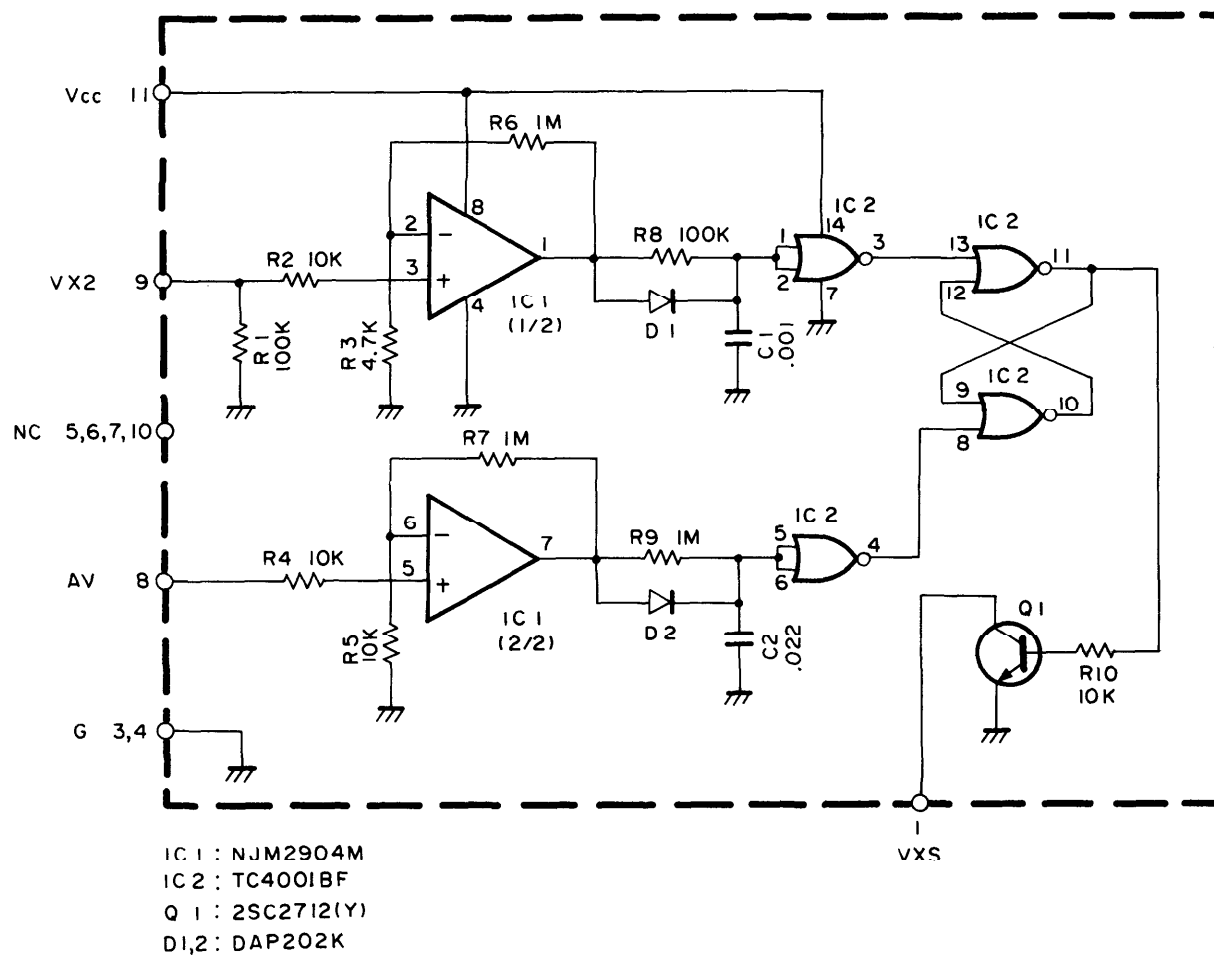
Circuit Diagram is subject to change without notice due to advancements in technology.

AT UNIT
(X53-3240-00)



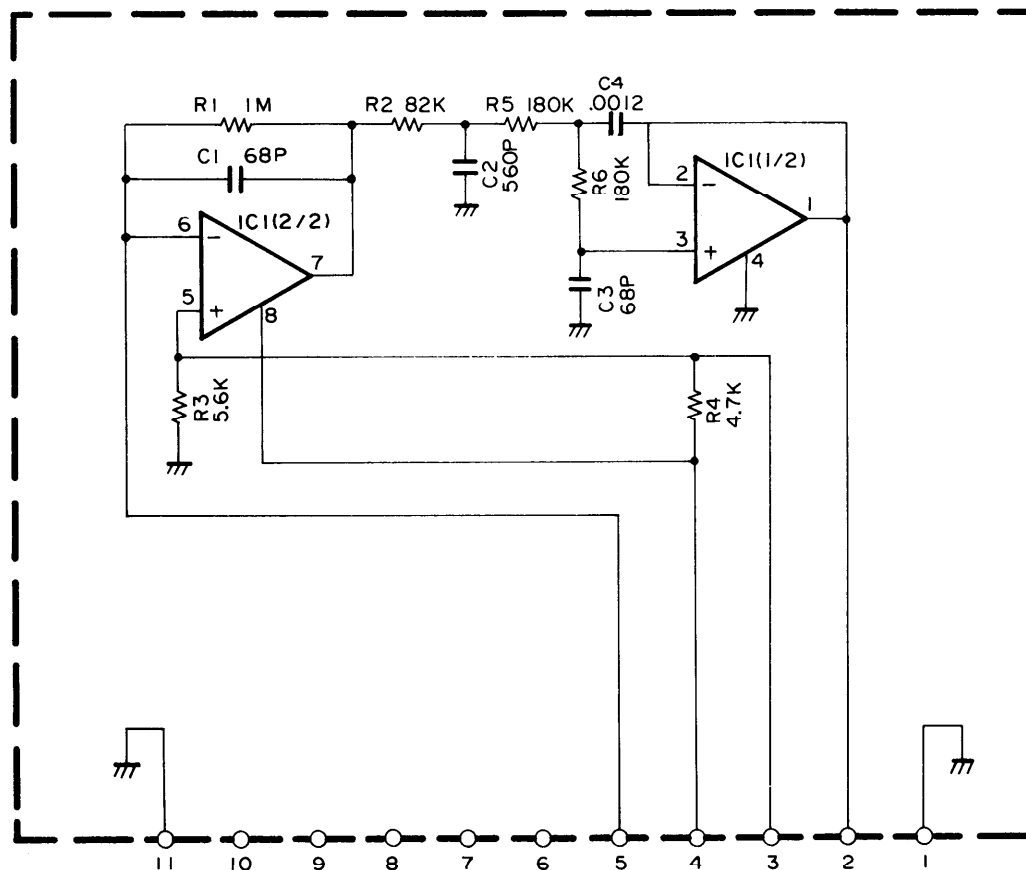
Note: Circuit Diagram is subject to change without notice due to advancements in technology.

VOX UNIT
(X59-1080-01)



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

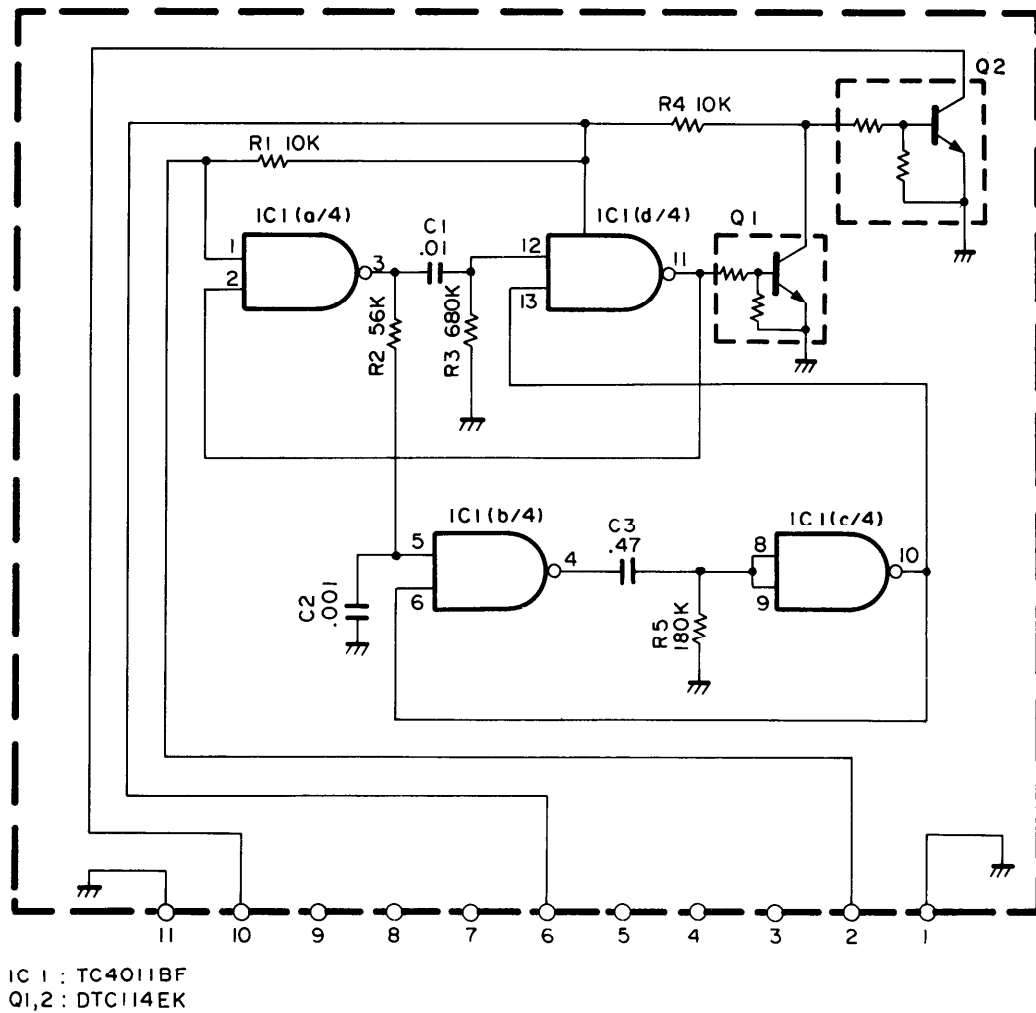
FM MIC AMP UNIT
(X59-3000-03)



IC 1 : NJM4558M
Q 1 : 2SC2712(Y)

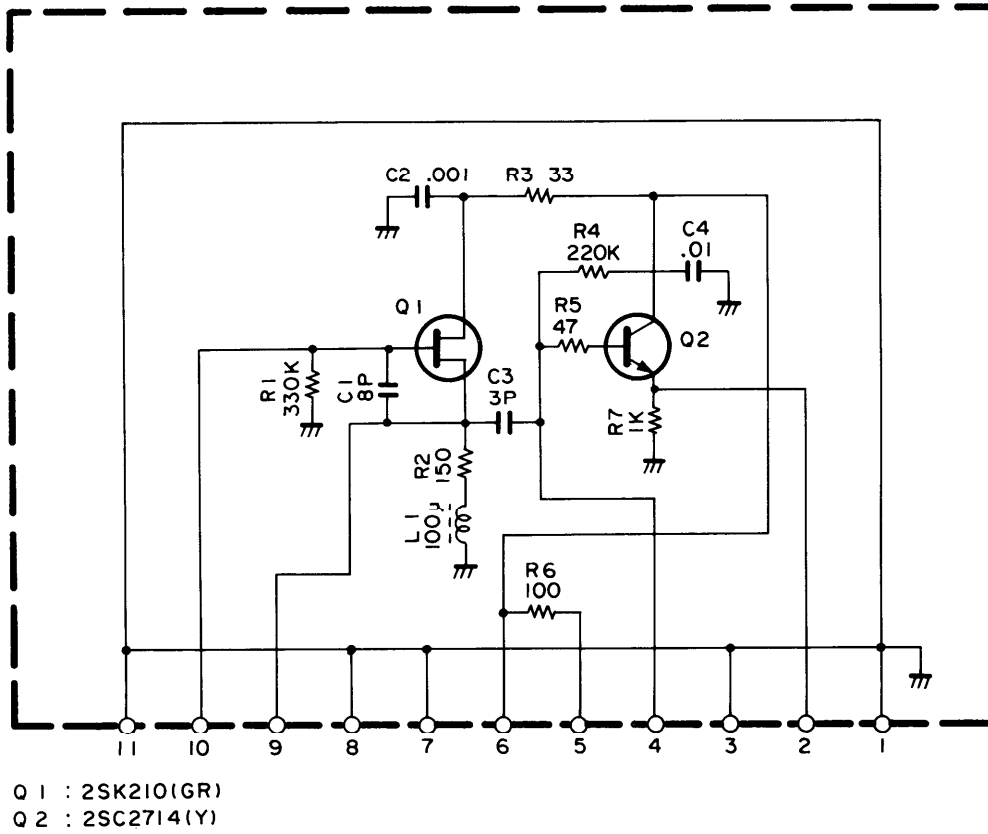
Note: _____
Circuit Diagram is subject to change without notice due to advancements in technology.

NB2 UNIT
(X59-3350-00)



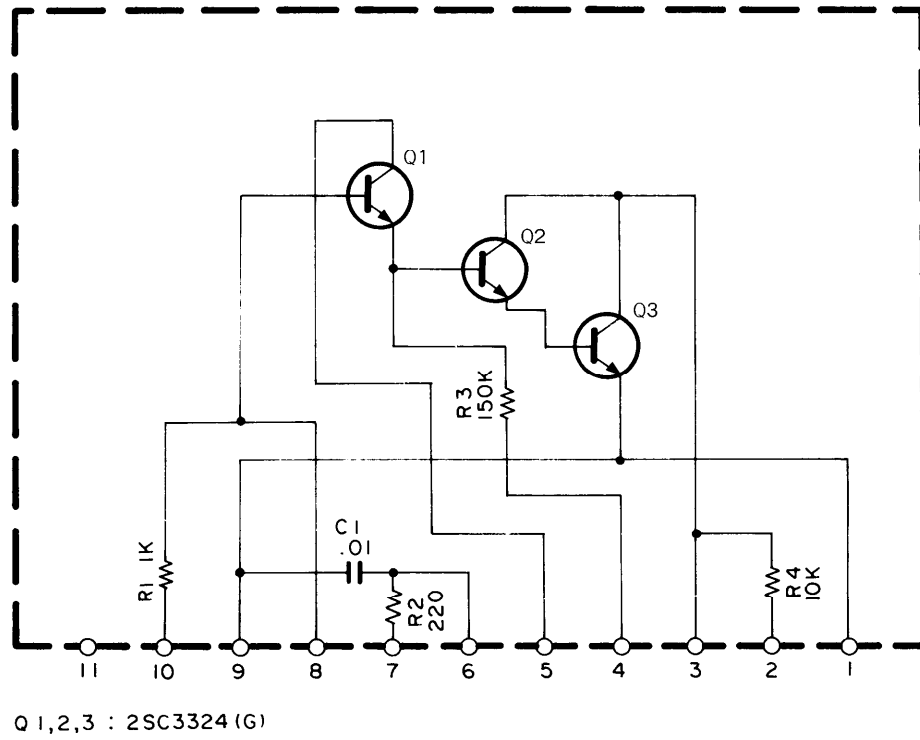
Note: _____
Circuit Diagram is subject to change without notice due to advancements in technology.

VCO1 UNIT
(X59-3440-00)



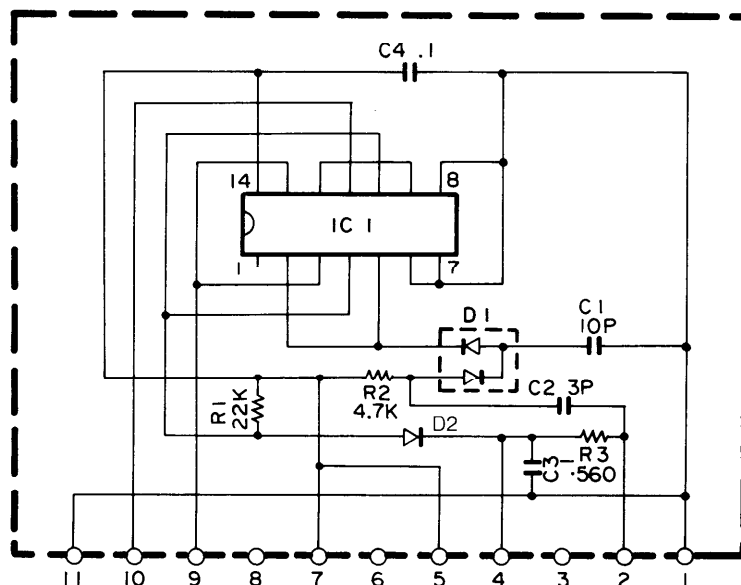
Note: _____
Circuit Diagram is subject to change without notice due to advancements in technology.

LPF UNIT
(X59-3450-00)



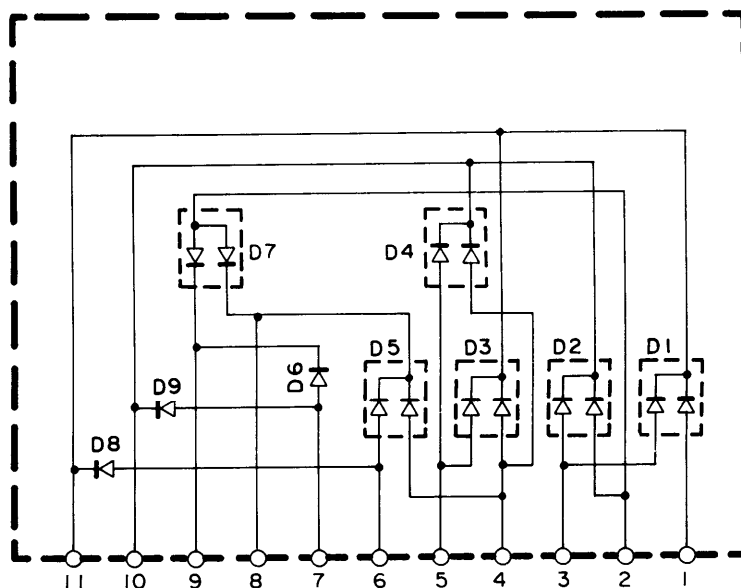
Note: _____
Circuit Diagram is subject to change without notice due to advancements in technology.

MKR UNIT
(X59-3640-00)



IC 1 : TC 4013BF
D 1 : DA204K
D 2 : RLS73

SFT UNIT
(X59-3650-00)



D1-5 : DAN202K
D7 : DAP202K
D6,8,9 : RLS73

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 dealer or 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 subassemblies 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, during shipping.

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. Examine and 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.	Bad power cable or connections. Blown fuse.	Check cables and connections. Replace fuse.
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.	Turn on the POWER switch while depressing the A=B (or RX▶SUB) key, and then release the A=B (or RX▶SUB) key.
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 4-4-1.
No signal is received even when the antenna is connected, or the receiver sensitivity is low.	1. SQL control fully clockwise. 2. The ATT switch is ON. 3. The REC/SEND switch is in the SEND position. 4. Microphone PTT switch is in the transmit position. 5. SSB SLOPE TUNE control is improperly adjusted. 6. VBT control is improperly adjusted.	1. Turn the SQL control counterclockwise. 2. Set the ATT switch to 0dB. 3. Set the REC/SEND switch to REC. 4. Set the PTT switch to the receive position. 5. HIGH control : Fully clockwise LOW control : Fully counterclockwise 6. Fully clockwise
An antenna is connected, but no signal is received and the S-meter fully deflects. The S-meter deflects and stays at a certain position even with no signal.	RF gain control is too low, decreasing the high frequency circuit gain.	Turn the RF gain control MAX clockwise.
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.	SSB SLOPE TUNE control is improperly adjusted.	HIGH control : Fully clockwise LOW control : Fully counterclockwise
Frequency is not changed by pressing the 1 MHz 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.	Nothing is stored in memory.	Store the frequency.

Notes

1. 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
2. A handheld transceiver placed very close to this transceiver may generate noise. Keep your handheld transceiver away from the transceiver when you use it.
3. The fan motor rotates when the POWER switch is turned off, it is normal.

TRANSMIT

Symptom	Probable cause	Corrective action
Output	1. Microphone jack is not plugged in. 2. Low microphone gain. 3. Poor antenna connection.	1. Plug jack in. 2. Increase the MIC gain control. 3. Connect antenna securely.
VOX does not operate.	1. GAIN control too low. 2. ANTI control requires adjustment.	See section 4-1-1, GAIN control.
VOX trips by speaker output.	ANTI control requires adjustment.	See section 4-1-1, 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 6-6-6. 2. Correct wiring.

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).

6-6. ADJUSTMENTS

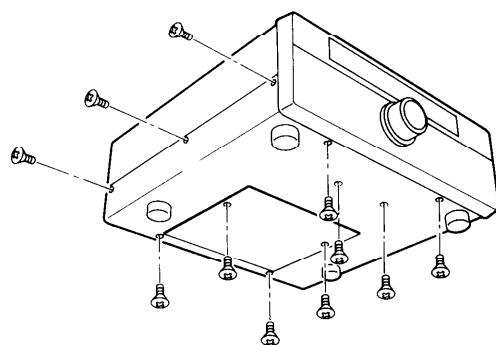
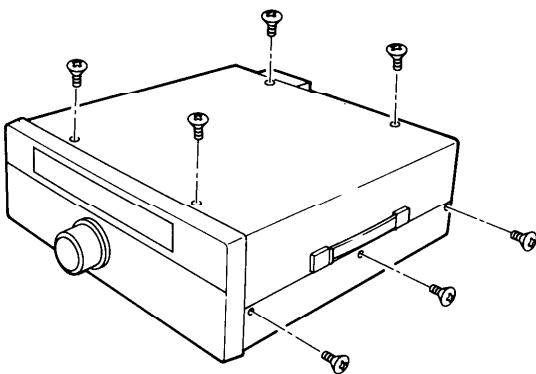
6-6-1. Cover Removal

Removing the covers

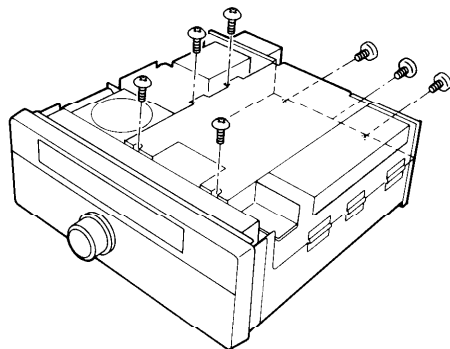
Remove the top cover, and the bottom covers from radio.

Cautions

1. Before removing the cover, turn the POWER switch OFF and disconnect the power cable.
2. Voltages of approximately 80 volts are present in this transceiver!
3. Do not pinch wiring when opening or closing cases.



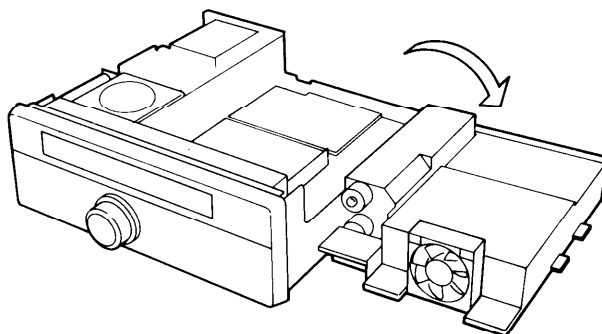
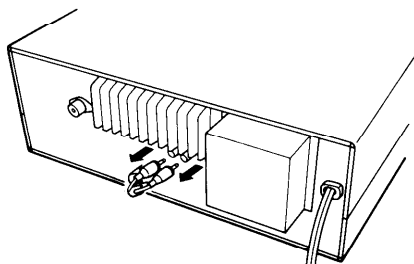
6-6-2. Remove the Subchassis



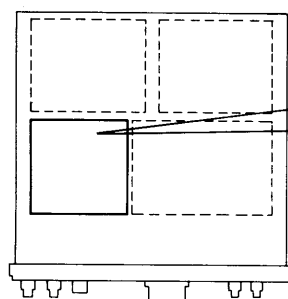
1. Remove the screws as shown in the diagram.
2. Remove the jumpers on the rear panel.
3. Open in a clockwise direction.

Cautions

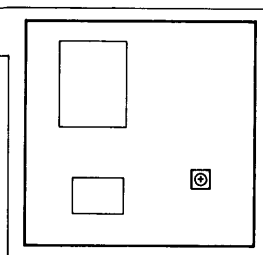
1. Open on a flat surface.
2. Be careful not to damage the wiring.
3. Do not catch your finger or the cables between the chassis when closing.



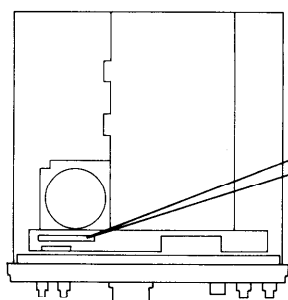
6-6-3. Sidetone Level



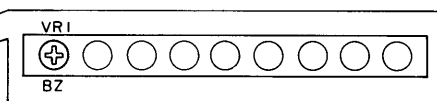
Turn VR2 while holding down the key in the CW mode for the desired tone level.



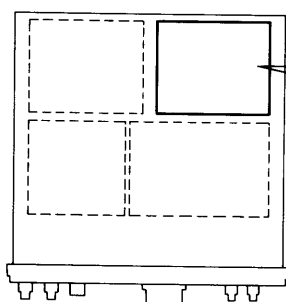
6-6-4. Beep Tone Level



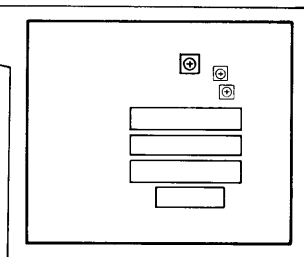
Turn VR1 to the desired tone volume.



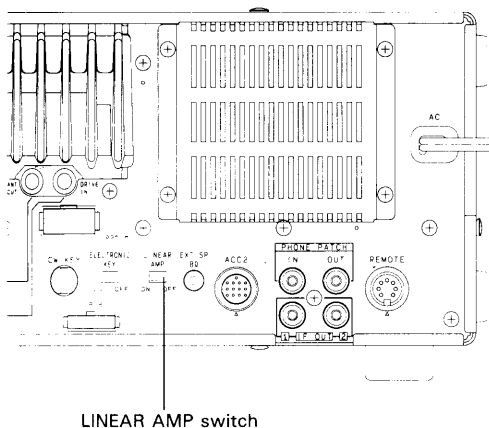
6-6-5. Adjusting the Data Communications Modulation Input Level



Set the input level for the desired modulation level with VR1. Input is reduced by turning the control counterclockwise, and increased by turning clockwise.



6-6-6. 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 operations. If the use of this control relay is required, such as for use with an external linear amplifier it may be activated with the following procedure. Set the LINEAR AMP switch is ON.

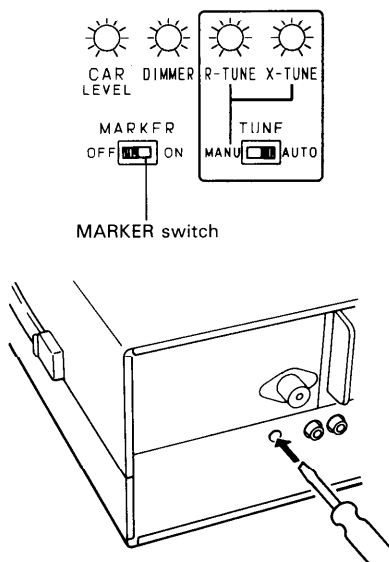
13.5 volts at approximately 10 mA maximum is available at pin number 7 of the REMOTE connector for control of an external keying relay, if necessary. We recommend the use of a 7 pin DIN plug for this connection. When operation of this transceiver with the TL-922/922A is anticipated you should use the 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 linears relay control line to pin 4. The relay in this transceiver is capable of handling 100V DC at 500mA.

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.

6-6-7. Digital display calibration

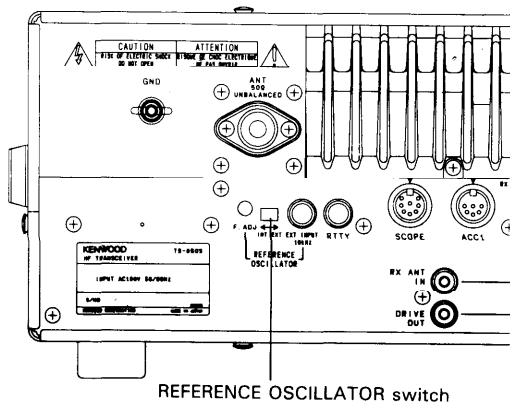


Tune the transceiver to one of the normal frequency standard channels such as are provided by WWV and JJY. Adjust the transceiver until the two signals are zero beat. As you tune closer and closer to the point where the two signals are zero beat you will hear the audio tone begin to pulsate. The faster the two tones pulsate the farther off frequency you are. When the two tones are actually "Zero Beat" the pulsing will have stopped or at least slowed to a point where it is just noticeable. Once you have reached this point you should note the frequency on the display. If it is not exactly at zero (10.000.00 MHz for example) you should tune the main tuning control for zero. This will cause the pulsing audio to reappear. Now turn the F.ADJ trimmer on the back of the set until the pulsing audio again disappears. Recheck the dial frequency to ensure you are still on zero. If so this completes the calibration, if not repeat until it does.

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.

6-6-8. External frequency standard calibration



You might wish to use an external frequency standard to accomplish the zero beat procedure. We would recommend the use of a standard that is capable of providing 1Vp-p at 10 kHz.

When using the external frequency standard you should place the REFERENCE OSCILLATOR switch to the OSCILLATOR position.

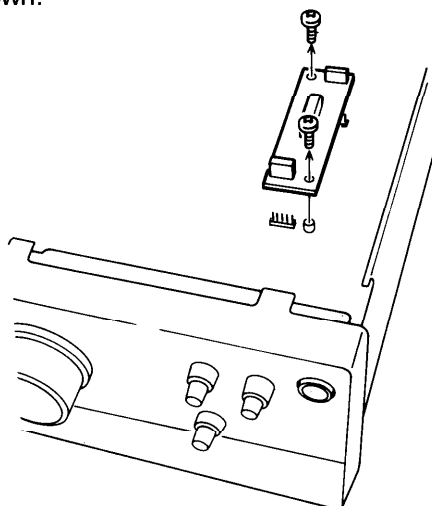
If you are using the SO-2 you must place the Xtal switch to the Xtal position. Refer to section 7-4 for additional information on this switch.

7. OPTIONAL ACCESSORIES

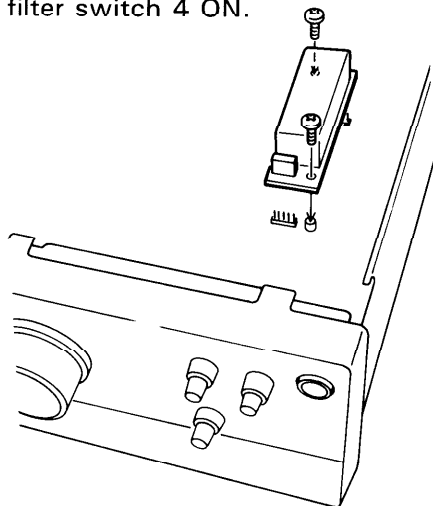
Be sure to unplug the AC power cable before starting work.

7-1. YG-455S-1 SSB FILTER INSTALLATION (TS-950S only)

1. Remove the bottom cover of the transceiver. Refer to Section 6-6-1.
2. Remove the screws and take out the filter as shown.



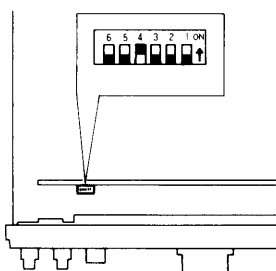
3. Attach the SSB filter and secure it with the supplied screws. The filter is not polarized so it may be placed in either direction. Set filter switch 4 ON.



4. Replace the bottom cover.

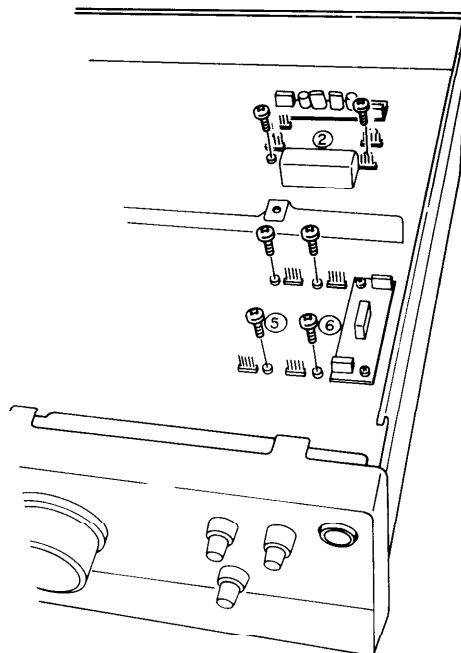
Note
Avoid catching your fingers and wiring harness when closing.

Filter switch (Initial state)



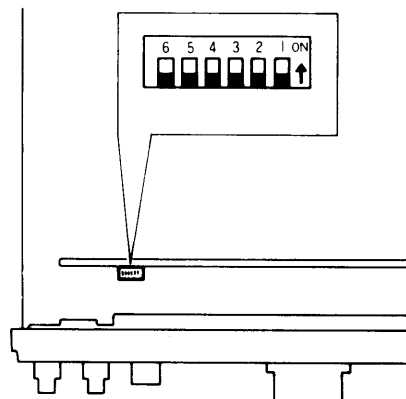
7-2. OTHER FILTER INSTALLATION (TS-950S only)

1. Remove the bottom cover of the transceiver. Refer to Section 6-6-1.
2. Remove the screws from where filters will be installed as shown in the figure.



3. Attach the filter(s) and secure it with the screws you just removed. The filters are not polarized so they may be placed in either direction.

Installation positions	Part No. for Filters to be installed	Filter switch
②	YK-88C-1	Set switch 2 ON.
⑥	YG-455C-1	Set switch 6 ON.
⑤	YG-455CN-1	Set switch 5 ON.



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.

Note

Avoid catching your fingers and wiring harness when closing.

7-3. VS-2 VOICE SYNTHESIZER INSTALLATION

1. Remove the top and bottom covers and open the subchassis. Refer to Section 6-6-1 and 6-6-2.

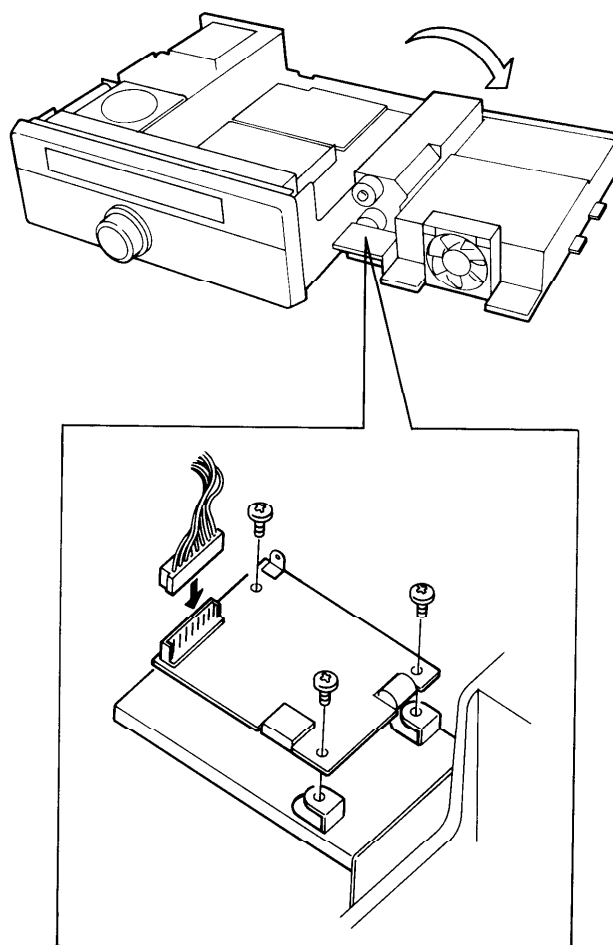
Caution

Open on a flat surface.

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 subchassis.

Caution

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



4. Close the subchassis and replace the top and bottom covers.

Note

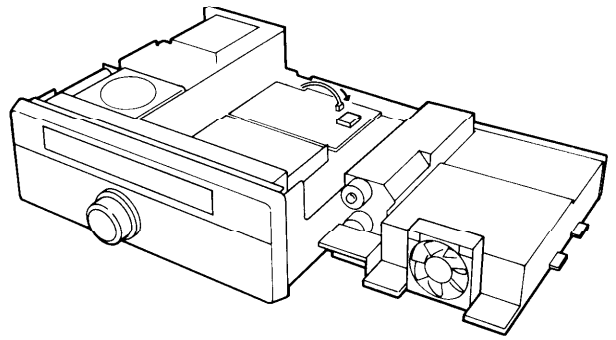
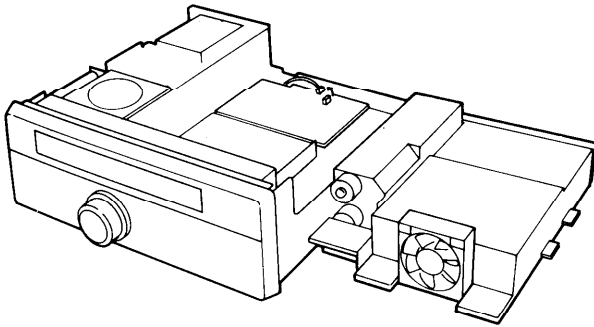
Avoid catching your fingers and wiring harness when closing.

7-4. SO-2 TCXO UNIT INSTALLATION (TS-950S only)

1. Remove the case and open the subchassis. Refer to Section 6-6-1 and 6-6-2.

Caution
Open on a flat surface.

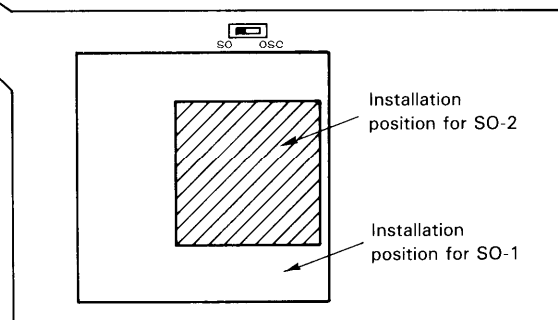
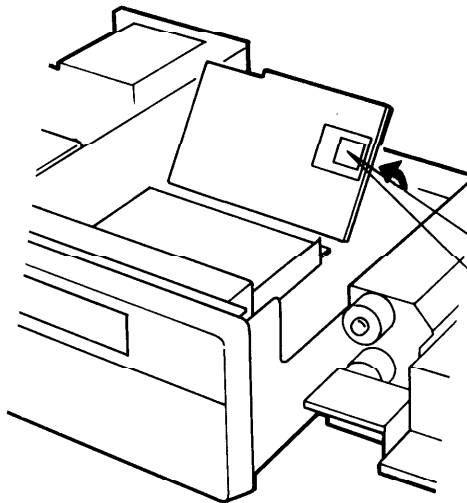
2. Remove the screws from the printed board closest to the rear panel. Take out connector CN11.



7. Close the subchassis and replace the top and bottom covers.

Note
Avoid catching your fingers and wiring harness when closing.

3. Lift up the printed circuit board.
4. Set the changeover switch to SO.
5. Attach the SO-2 to the indicated area. Some models may come with the SO-2 factory installed. The SO-1 may also be used.



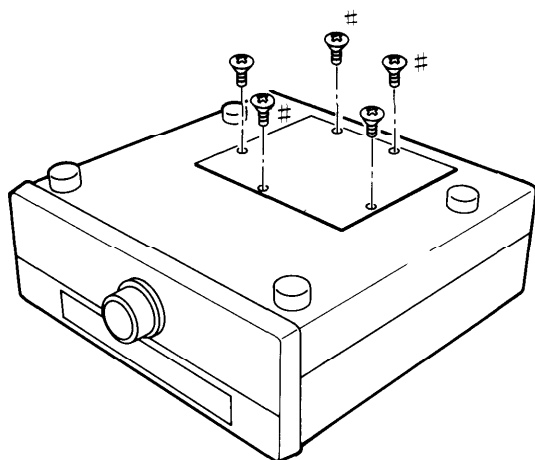
6. Replace the printed circuit board and tighten the screws. Replace connector CN11.

Note
Avoid catching your fingers and wiring harness when closing.

7-5. DSP-10 DIGITAL SIGNAL PROCESSOR INSTALLATION (TS-950S only)

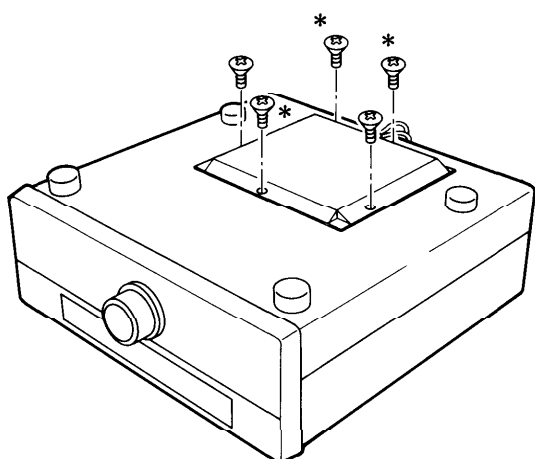
1. Remove the cover on the bottom case.

: Keep the screw provided with the unit for later use.

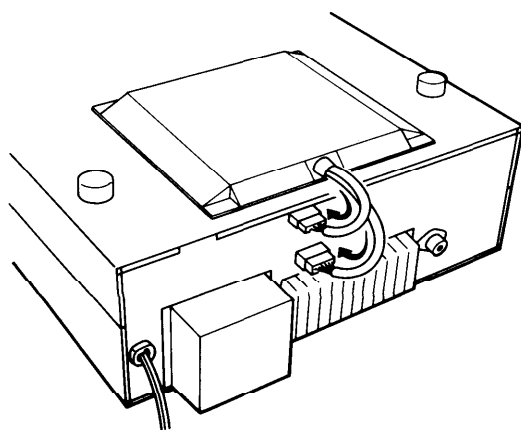


2. Attach the DSP-10 and screw it on.

* : Fasten the DSP-10 with three screws provided with the unit.



3. Plug the connectors into DSP-A and DSP-B on the rear panel.



7-6. OTHER ACCESSORIES

■ 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)

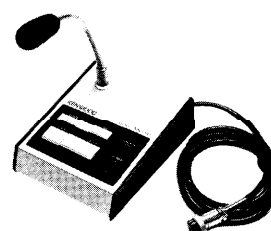
The zinc die-cast base provides high stability, and the MC-60A is complete with PTT and LOCK switches, UP/DOWN switches, and impedance selector switch and a built-in preamplifier.

■ MC-43S UP/DOWN HAND MICROPHONE

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



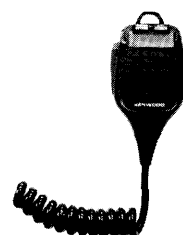
MC-85



MC-80



MC-60A



MC-43S

■LF-30A LOW PASS FILTER

■SP-950 EXTERNAL SPEAKER

Designed to match the TS-950S/950S DIGITAL.

■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-950S/950S DIGITAL.

■SO-1 TCXO UNIT

The SO-1 is a crystal oscillator used for the purpose of further improving the frequency stability of the TS-950S/950S DIGITAL.

■HS-6 COMMUNICATIONS HEADPHONES (12.5 OHMS)

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

■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.

■YG-455S-1 SSB FILTER

Center frequency : 455.0 kHz
Pass band width : 2.4 kHz (-6 dB)
Attenuation band width : 4.1 kHz (-60 dB)

■YG-455C-1 CW FILTER

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

■YG-455CN-1 CW FILTER

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

■YK-88C-1 CW FILTER

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



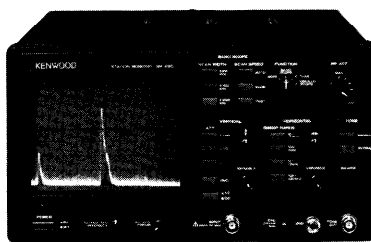
TL-922A/TL-922



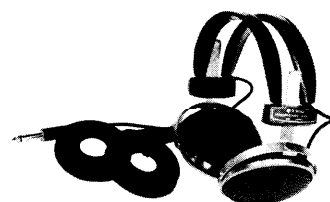
HS-6



SP-950



SM-230



HS-5

8. REFERENCE

8-1. ANTENNA INSTALLATION

■ Fixed Station

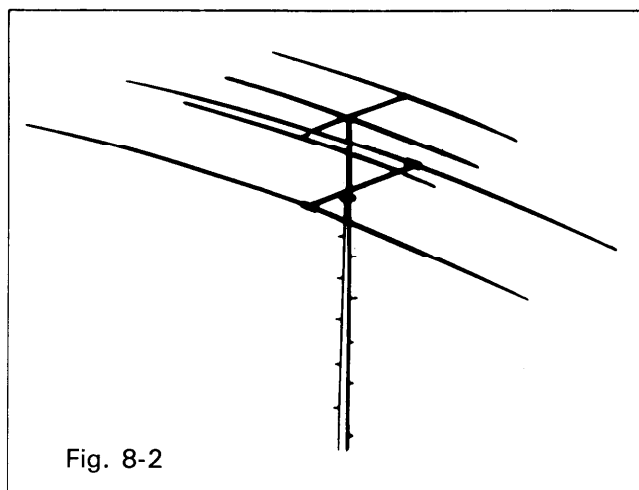
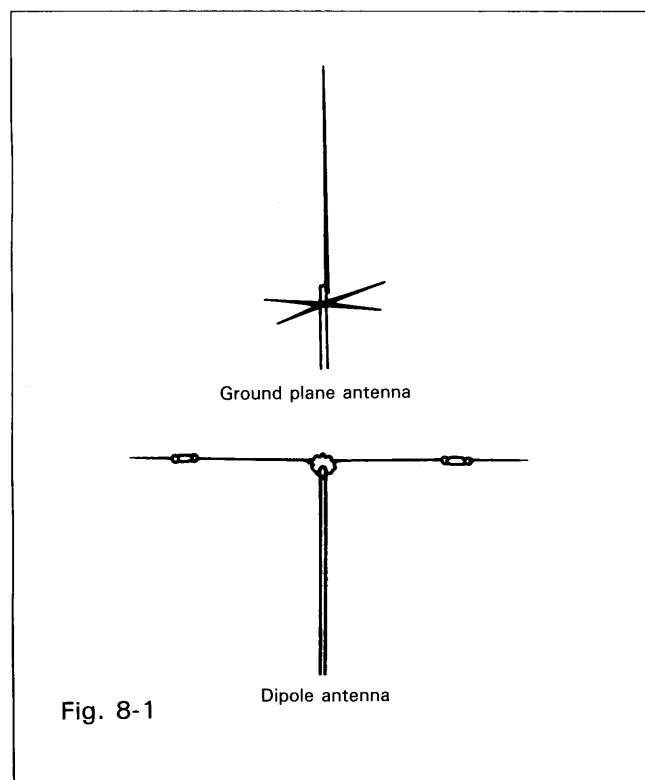
For HF fixed-station operation, an antenna specifically designed for amateur operation is recommended. Antenna types include wire antennas, verticals, rotary beams, and other antenna types. (Fig. 8-1) HF antennas are quite large and must be installed to withstand strong wind, heavy rain, etc. Any antenna used with this transceiver should be of 50-ohm impedance and should be connected using an appropriate coaxial cable such as 5D-2V.

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).

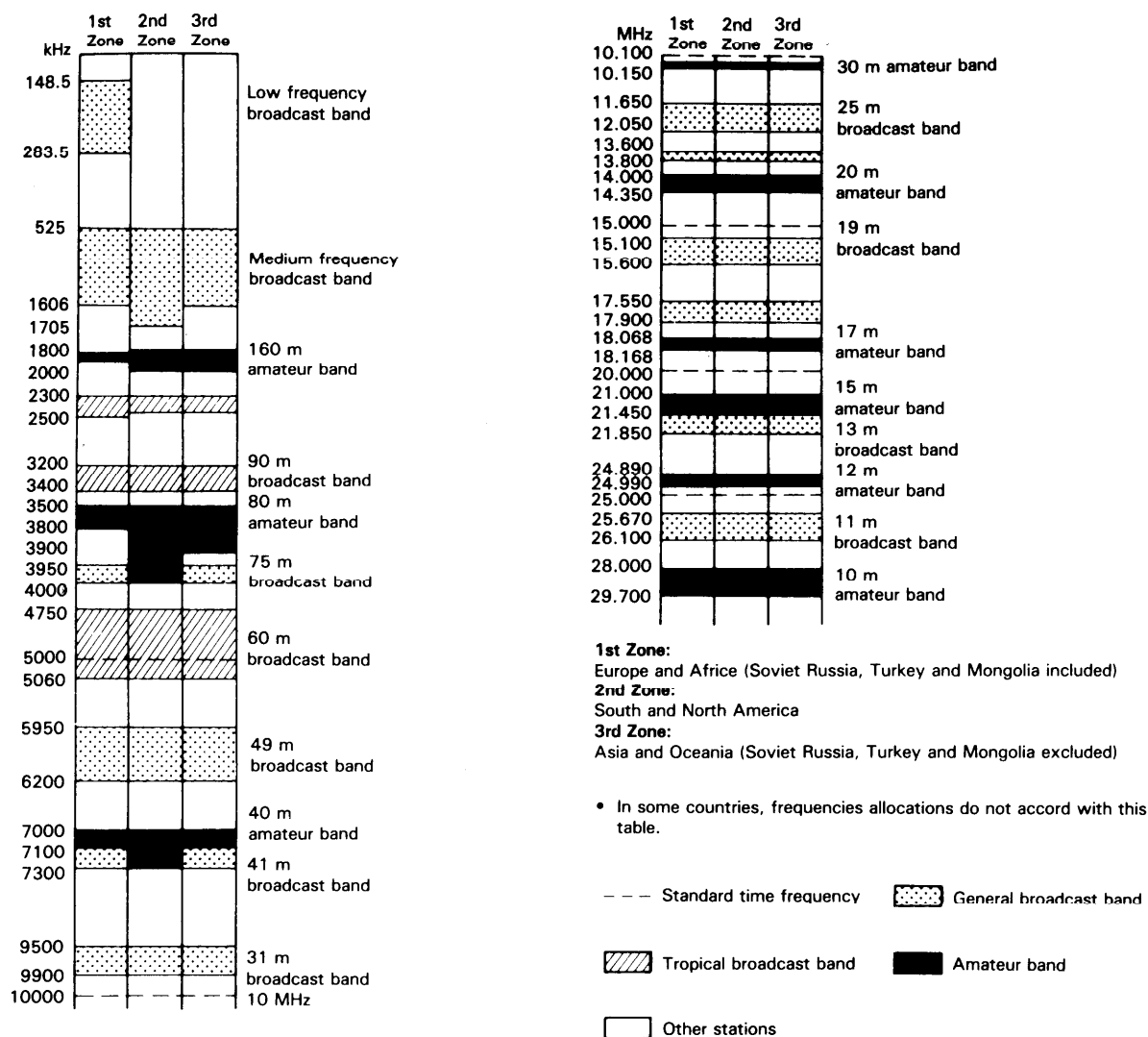
The impedance match can be checked with an SWR meter. Generally, satisfactory operation is assured when the VSWR (Voltage Standing Wave Ratio) is less than 1.5 : 1.

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



Radio Frequency Allocation

Frequency distribution in the broadcast and amateur bands

The general coverage receiver covers from 100 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.

KENWOOD