KENWOOD

INSTRUCTION MANUAL

HF/50 MHz TRANSCEIVER

TS-990S

JVC KENWOOD Corporation

©B62-2389-10
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PRIOR TO YOUR FIRST QSO

Thank you for purchasing this TS-990S transceiver.

This chapter, Prior to your first QSO, gives you a product overview, conditions of your use, notations applied to this manual and safety precautions. Prior to your first QSO, carefully read through the following precautions to become familiar with the safety precautions applicable to this transceiver.

After reading through this instruction manual, store it with the warranty card and packing materials.

FEATURES

- A main receiver with a class-leading +40 dBm third-order IP and a sub receiver which incorporates the TS-590S receiver architecture. Capable of receiving two signals at once, in different bands.
- 7-inch wide and 3.5-inch color TFT displays can show independent contents.
- Covers the HF and 50 MHz bands.
- Clean 5 to 200 W transmit power through the 50 V FET final unit.
- High-speed relay-driven automatic antenna tuner built-in allows fast tuning.
- Built-in Baudot RTTY, PSK31, Demodulator and Modulator for PSK63.
- Compliant with SSB, CW, FSK, PSK (QPSK31, BPSK31, BPSK63), AM, and FM Modes.
- Three Analog Devices 32-bit floating-point arithmetic DSPs.
- Equipped as standard with USB, Serial and LAN ports.
- Video signal output for display by an external PC (main screen display only).
- Various PC applications (free software): ARCP-990 enabling PC control, ARHP-990 enabling remote control, and ARUA-10 enabling the USB audio interface.

SUPPLIED ACCESSORIES

The following accessories are supplied with the transceiver. After carefully unpacking the transceiver, identify the accessories listed in the table.

Description		Quantity
AC Power Cable	UL plug (K-type only)	1
	BS plug (E-type only)	1
	CE plug (E-type only)	1
7-pin DIN plug		1
13-pin DIN plug		1
Fuse 4 A for an external antenna tuner		1
Instruction Manual		1
Warranty Card		1
Circuit Diagram		4
Line Filter (E-type only)		1

MARKET CODES

K-type: The Americas

E-type: Europe

The market code is shown on the carton box.

- The AC power cable supplied with the product is suitable for AC 120V(K-type) or AC 220V-240V (E-type)
- Do not use a power cable other than supplied with this product.

NOTICE TO THE USER

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

FCC WARNING

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

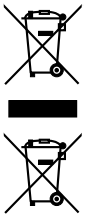
INFORMATION TO THE DIGITAL DEVICE USER REQUIRED BY THE FCC

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can generate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Information on Disposal of Old Electrical and Electronic Equipment and Batteries (applicable for countries that have adopted separate waste collection systems)



Products and batteries with the symbol (crossed-out wheeled bin) cannot be disposed as household waste.
Old electrical and electronic equipment and batteries should be recycled at a facility capable of handling these items and their waste byproducts.
Contact your local authority for details in locating a recycle facility nearest to you.
Proper recycling and waste disposal will help conserve resources whilst preventing detrimental effects on our health and the environment.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions : (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

NOTIFICATION

This equipment complies with the essential requirements of Directive 1999/5/EC.

The use of the warning symbol ⓘ means the equipment is subject to restrictions of use in certain countries.

This equipment requires a license and is intended for use in the countries below.

AT	BE	DK	FI	FR	DE	GR	IS
IE	IT	LI	LU	NL	NO	PT	ES
SE	CH	GB	CY	CZ	EE	HU	LV
LT	MT	PL	SK	SI	BG	RO	

ISO3166

CE 0682 ⓘ

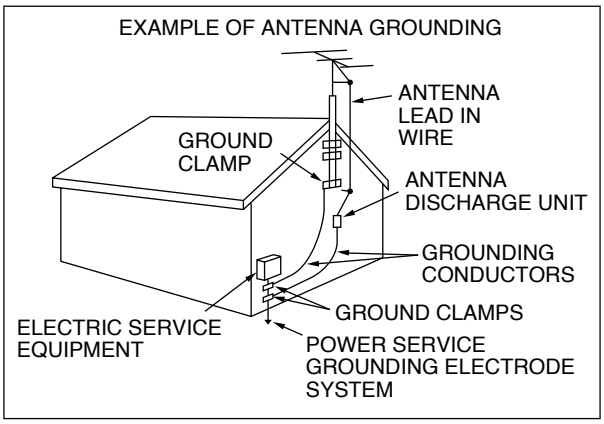
This product is designed for connection to an IT power distribution system.

Bu ürün 26891sayılı Resmi Gazete'de yayımlanan Elektrikli ve Elektronik Eşyalarda Bazı Zararlı Maddelerin Kullanımının Sınırlandırılmasına Dair Yönetmeliğe uygun olarak üretilmiştir.
This product complies with Directive, Number 26891 regarding "REGULATION ON THE RESTRICTION OF THE USE OF CERTAIN HAZARDOUS SUBSTANCES IN ELECTRICAL AND ELECTRONIC EQUIPMENT".

PRECAUTIONS

Please observe the following precautions to prevent fire, personal injury, and transceiver damage:

- Connect the transceiver only to a power source as described in this manual or as marked on the transceiver itself.
- Route all power cables safely. Ensure the power cables can neither be stepped upon nor pinched by items placed near or against the cables. Pay particular attention to locations near AC receptacles, AC outlet strips, and points of entry to the transceiver.
- Take care not to drop objects or spill liquid into the transceiver through enclosure openings. Metal objects, such as hairpins or needles, inserted into the transceiver may contact voltages resulting in serious electrical shocks. Never permit children to insert any objects into the transceiver.
- Do not attempt to defeat methods used for grounding and electrical polarization in the transceiver, particularly involving the power input cable.
- Adequately ground all outdoor antennas for this transceiver using approved methods. Grounding helps protect against voltage surges caused by lightning. It also reduces the chance of a build-up of static charge.



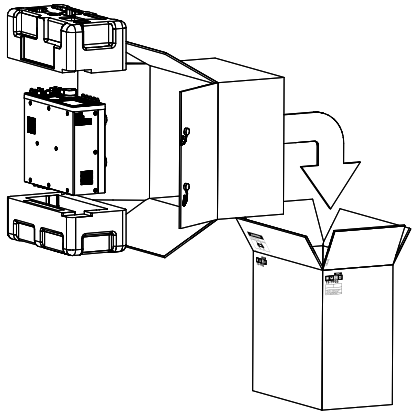
- Minimum recommended distance for an outdoor antenna from power lines is one and one-half times the vertical height of the associated antenna support structure. This distance allows adequate clearance from the power lines if the support structure fails for any reason.
- Locate the transceiver so as not to interfere with its ventilation. Do not place books or other equipment on the transceiver that may impede the free movement of air. Allow a minimum of 10 cm (4 inches) between the rear of the transceiver and the wall or operating desk shelf.
- Do not use the transceiver near water or sources of moisture. For example, avoid use near a bathtub, sink, swimming pool, or in a damp basement or attic.
- The presence of an unusual odor or smoke is often a sign of trouble. Immediately turn the power OFF and remove the power cable. Contact a KENWOOD service station or your dealer for advice.
- Locate the transceiver away from heat sources such as a radiator, stove, amplifier or other devices that produce substantial amounts of heat.
- Do not use volatile solvents such as alcohol, paint thinner, gasoline, or benzene to clean the cabinet of the transceiver. Use only a clean cloth with warm water or a mild detergent.
- Disconnect the input power cable from the power source when the transceiver is not used for long periods of time.
- Remove the transceiver's enclosure only to carry our accessory installations described in this manual or accessory manuals. Follow the provided instructions carefully, to avoid electrical shocks. If unfamiliar with this type of work, seek assistance from an experienced individual, or have a professional technician do the task.
- Enlist the services of qualified personnel in the following cases:
  a) The power supply or plug is damaged.
  b) Objects have fallen into or liquid has spilled into the transceiver.
  c) The transceiver has been exposed to rain.
  d) The transceiver is operating abnormally or performance has seriously degraded.
  e) The transceiver has been dropped or the enclosure damaged.
- Do not touch the power plug while your hands are wet to avoid risk of electric shock.
- Keep children away from the transceiver, to avoid unnecessary risk of harm to the child.
- Do not remove the plug from an AC outlet by pulling the AC cable.
- Plug the AC cable only into a grounded AC outlet.
- Do not block the transceiver air vent. Do not cover the transceiver. To maintain good ventilation, place the transceiver at least 10 cm (4 inches) away from the wall.

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TRANSPORTATION, INSTALLATION AND PACKING MATERIAL STORAGE

This transceiver is precise and sensitive, and is heavy. Take care not to hurt yourself and damage the transceiver by dropping it.

To protect the transceiver from damage, the transceiver must be transported and installed by two or more persons securely holding the transceiver.



Store all packing materials for the transceiver for future use, such as when transporting the transceiver when moving or requesting after-sales service. To prevent it from being damaged during transportation, wrap the transceiver with the white protective cover in the same way as it wrapped the transceiver at the time of purchase, then the transceiver must be packed with its original packing materials and transported with the front panel facing up as illustrated above. Do not transport the transceiver placed sideways.

ABOUT THIS MANUAL

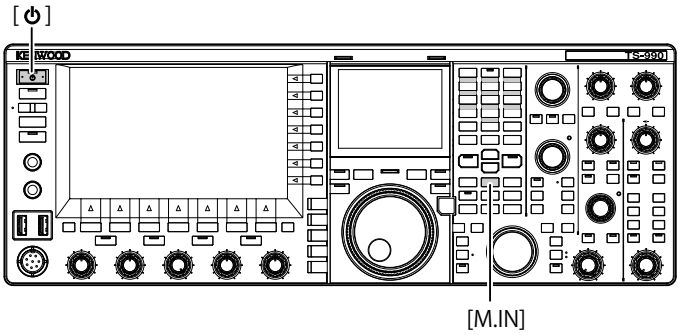
This manual was written subject to the specifications and designs described below.

Specifications are described in SPECIFICATIONS in chapter 19, "OTHERS". {page 19-2}

Firmware Version: 1.00 (and later)

You can verify the firmware version as described below.

1 Press the main power switch (I/O) located on the rear panel, to the "I" (ON) position to apply power to the transceiver.
While the transceiver power (⏻) is turned OFF, the "⏻" LED lights orange. While the transceiver power (⏻) is turned ON, the "⏻" LED lights green.



2 Hold down **[M.IN]** (Memory), then press **[⏻]**.
After startup,the **Firmware Update** screen appears, and the firmware version can be viewed.

3 Press **[⏻]** to turn the transceiver power (⏻) OFF.

Note:

- There are two **[M.IN]** keys on this transceiver; one is for Memory and the other for Quick Memory. To view the firmware version, ensure to use **[M.IN]** (Memory).
- Refer to Chapter 4 "Basic Operations" for the details of the power sourcing. {page 4-1}

The latest firmware and its corresponding instruction manual, in PDF format, can be downloaded from the following URL:

http://www.kenwood.com/i/products/info/amateur/software_download.html

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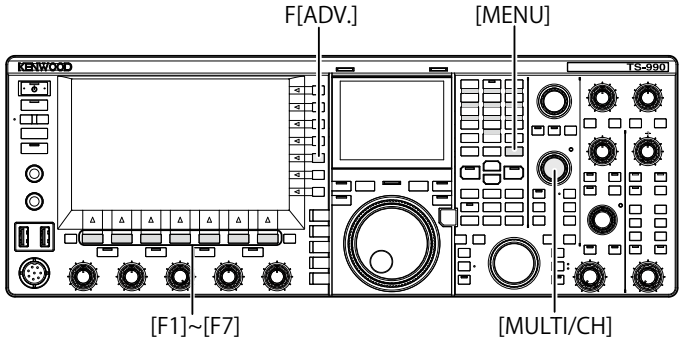
Furthermore, any reselling, assigning or transferring of the software is also strictly prohibited without embedding the software in KENWOOD product memories.

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Software License Agreement contains the terms and conditions of use of the software embedded in or used with the transceiver. A user is entitled to use the software subject to the acceptance and agreement of this Software License Agreement by the user. Also, this Software License Agreement stipulates the terms and conditions of use of this software embedded in or used with the transceiver, and a user has the right to use the transceiver with the software embedded subject to the applicable laws and regulations, the description and defined in this manual and the warranty card.

The following procedures allow you to display the Software License Agreement on the main screen.

Refer to Menu for the details of configuration method in the **Menu** screen. {page 3-1}



1. Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.
2. Select Menu 28, "Software License Agreement", from the **Advanced Menu** screen.
3. Press **[SELECT]** (F4) to display the Software License Agreement.
4. Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to scroll through the Software License Agreement.
5. Press **[MENU]** to end.

IMPORTANT NOTICES CONCERNING THE SOFTWARE

The software embedded in this transceiver consists of a multiple number of and individual software components. Title to and ownership of copyrights for each software component is reserved for JVC KENWOOD Corporation and the respective bona fide holder.

This product employs the software component in accordance with the End User License Agreement (hereinafter referred to as the "EULA") stipulated by JVC KENWOOD Corporation and/or the respective bona fide holder.

There is free software stipulated and governed by the “EULA”, and this, a distribution condition of the software component in the executable format under the terms and conditions contained in the GNU General Public License or Lesser General Public License (hereinafter referred to as the “GPL/LGPL”), requires to make the source code for the relevant software components available.

Access the URL below for details of the software component stipulated in the "GPL/LPGL".

http://www2.jvckenwood.com/gpl/index.html

The following procedures allow you to display Important Notices concerning Free Open Source Software on the main screen.

1. Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.
2. Select Menu 29, "Important Notices concerning Free Open Source", from the **Advanced Menu** screen.
3. Press **[SELECT]** (F4) to display the Important Notices concerning Free Open Source.
4. Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to scroll through the texts about Important Notices concerning Free Open Source Software.
5. Press **[MENU]** to end.

ABOUT THE GPL/LPGL LICENSE

The following procedures allow you to display About the GPL/LPGL License on the main screen.

1. Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.
2. Select Menu 30, "About Various Software License Agreements", from the **Advanced Menu** screen.
3. Press **[SELECT]** to display About Various Software License Agreements.
4. Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to scroll through the texts about About the GPL/LPGL License.
5. Press **[MENU]** to end.

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- JVC KENWOOD Corporation shall be free from any responsibilities for any incidental losses or damages, such as missing communications or call opportunities caused by a failure or performance error of the transceiver.

YOUR QUERIES ABOUT EXTERNAL DEVICES OR PC CONNECTED TO THE TRANSCEIVER

JVC KENWOOD Corporation are pleased to answer, within the scope of corporate efforts we can provide, your queries about your operation of this transceiver. Please bear in mind that we cannot answer any and all technical questions regarding methods of connection to, configuration for and operation of any external device and PC beyond our knowledge.

OPERATION OF THE OPTIONAL APPLICATIONS

This manual is dedicated to describe the operation of this transceiver. Refer to the help texts supplied with the ARCP-990 and ARHP-990 for details of operation of the ARCP-990 and ARHP-990 software installed onto your PC.

TREATMENT OF YOUR IMPORTANT DATA

There is always a risk of Losing your important data by a transceiver failure, occurrence of an unforeseen contingency, erroneous operation or faulty behavior of the transceiver. The data, such as the operating information, recorded audio, messages, configuration data, logs, etc., must be backed up as necessary by yourself and stored in the external storage device such as a USB flash drive.

TROUBLESHOOTING

If you aware of a failure, read through chapter 18, "TROUBLESHOOTING". {page 18-7}

Maintenance methods, troubleshooting, and a list of error messages are described.

Prior to transporting the transceiver for after-sales servicing, contact KENWOOD service center for transportation.

ABOUT THE URL AND CONTACTS OF JVC KENWOOD CORPORATION

The latest URL and contacts of JVC KENWOOD Corporation at the time when this manual was written are described in this manual. Due to changes of social circumstances or the management environment, the URL and contacts of JVC KENWOOD Corporation may change from time to time. If you are unable to access the URL or contacts, contact your dealer to determine the latest URL and contacts.

NOTATIONS APPLIED TO THIS MANUAL

This transceiver has many user operations, such as those for the main band and the sub band, keys and controls, function keys and operations with connected equipment, etc., as well as unique transceiver functionality. To clarify and simplify the descriptions provided in this manual, the following notations and writing conventions have been used.

The captioned display images may differ from what appears on your transceiver, due to your operating environment, design changes, etc.

■ MAIN BAND AND SUB BAND

Following a key or control name, (M) or (S) is shown, allowing you to distinguish on which band, either the main band or the sub band, the key or control is to be used. If the band that the key or control is to be used for is not specified as either the main band or the sub band, the band is specified as "the selected band" in this manual.

■ KEYS AND CONTROLS

The transceiver has many keys and controls. The notation "key" is omitted from individual keys; however, the notation "control" is not omitted, allowing you to distinguish controls from keys.

■ LED AND DISPLAYS

On the transceiver front panel, there are LEDs that indicate the status of the corresponding function as either active or inactive. Information that appears on the main screen or the sub screen is described as the "display". Refer to chapter 2, "PANEL DESCRIPTION", for further details. {page 2-1}

■ SCREEN AND MESSAGES

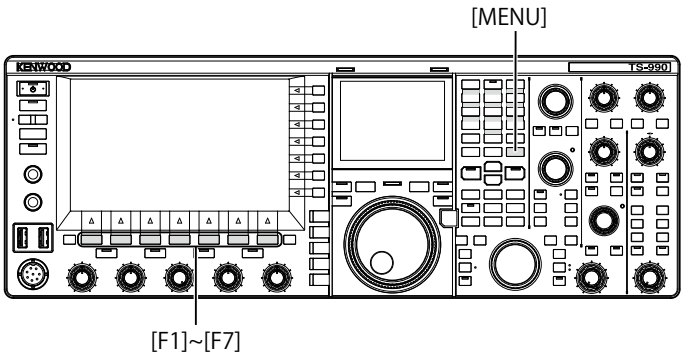
Information that appears on the main screen after pressing the MENU key or by a long press of any particular key is described as the "screen". A text string (mainly in a message box) navigating your operation or notifying you of an error is described as a "message".

■ AUDIBLE OPERATION AIDS

This transceiver assists your operation with a beep upon a key press and the use of voice guidance. Configuration methods for those audible operation aids are described in this manual.

■ FRONT PANEL ILLUSTRATION ONLY FOR [MENU] AND [X.X.X] (F1) TO [X.X.X] (F7)

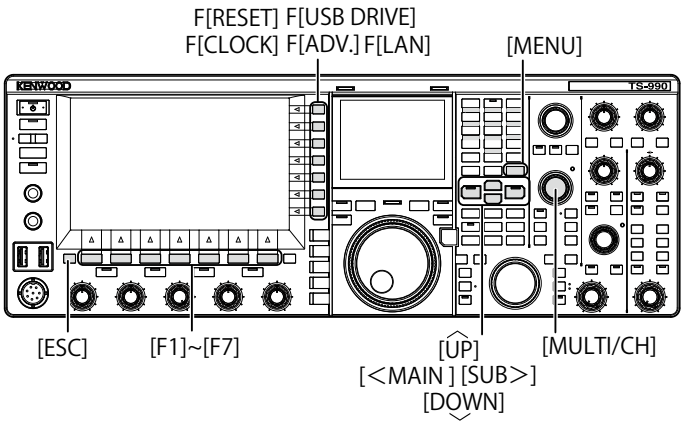
In this manual, due to availability of space, the front panel illustration which indicates locations only of **[MENU]** and **[X.X.X]** (F1) to **[X.X.X]** (F7) is exempted. When you read this manual for the first time, you must note the locations of the **[MENU]** and **[X.X.X]** (F1) to **[X.X.X]** (F7) keys. {page 2-7} {page 2-11}



■ IDENTICAL KEY OPERATION ON THE FRONT PANEL

There are several methods of key operations to select a parameter while the parameter box in the menu screen, sub-menu screen, or configuration screen allows your entry of the parameter. This manual describes operation methods using the function keys; however, the operations below are identical.

- Press **[▲]** (F2) or **[▼]** (F3).
- Press **[-]** (F4) or **[+]** (F5).
- Press **[UP]** or **[DOWN]**.
- Rotate the **MULTI/CH** control.



■ NOTATION FOR KEYS, CONTROLS AND DISPLAYS

In this manual, each key, control, and display are described.

Notation	Example	Overview
[x.x.x]	**[CW/CW-R]** **[M>S]** (M)	Keys located on the front panel
The **X.X.X** control	The **MULTI/CH** control The **NB 1** (M) control	Controls located on the front panel
The **Tuning** control	The **Tuning** (M) control The **Tuning** (S) control	The **Tuning** controls located on the front panel
The "x.x.x" LED	The "MAIN BUSY/TX" LED The "MONI/SEL" LED	LEDs located on the front panel or on the keys with the front panel
The **X.X.X** connector	The **ACC 2** connector	Connectors, jacks and ports located on the front and rear panels
The **x.x.x** screen	The **Menu** screen The **Bandscope** screen	Screens that appear on the main screen to configure or select a parameter.
"x.x.x"	"FSK" "Off"	What appears on the main screen and the sub-screen, or a selected parameter from the parameter box.
[X.X.X] (F)	**[ATT -12dB]** (F)	Function keys corresponding to the key guide along the right side of the main screen. The task name displayed on a key guide appears in brackets. This task name (key guide) may vary from screen to screen.
[X.X.X] (F1 to F7)	**[(RESET)]** **[MODE]** (F7)	Function keys corresponding to the key guide along the bottom of the main screen. The task name displayed on a key guide appears in brackets. This task name (key guide) may vary from screen to screen.

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■ NOTATIONS FOR USER OPERATION

In this manual, various user operations are described, as below.

Notation	Example	Overview
Press down the main power switch (I/O)		Press the main power switch (I/O) located on the rear panel, to the "I" (ON) or "O" (OFF) position.
Press **[⏻]**.		Press **[⏻]** on the front panel.
Press	Press **[MENU]**.	The **MENU** screen appears. If the **MENU** screen is open, the **MENU** screen closes.
Press	Press **[VOX]**.	Press momentarily to activate the unique function of the key.
Press	Press **[ESC]**.	Press to revert to the screen which was displayed prior to the current screen, or to close the screen assigned for the particular task.
Press and hold	Press and hold **[CW/CW-R]**. Press and hold **[(RESET)]**	Press and hold a key for the time configured in Menu 0-12, "Long Press Duration of Panel Keys", to activate the unique function of the key or the function assigned to the key.
Hold down	Hold down the **[PTT]** switch.	Hold down a key to activate or enable the specific function or behavior, until the key is released.

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1 INSTALLING AND CONNECTING THE TRANSCEIVER

PRECAUTIONS FOR INSTALLATION

To carry and install the transceiver requires two or more persons. Due to the size and weight of the equipment, installing the transceiver by yourself may cause you personal injury and/or damage the transceiver.

Do not grasp the transceiver by the **Tuning** control, the knobs or connectors on the front and rear panels. Doing so may cause you personal injury and/or damage the transceiver knobs and connectors.

ANTENNA INSTALLATION AND CONNECTION

An antenna system consists of an antenna, a coaxial cable and a ground. With careful installation, a good antenna system can result in optimal performance for the transceiver.

Ensure that you are using a correctly tuned 50Ω antenna and that the coaxial cable and appropriate connectors also have an impedance of 50Ω. All connections must be clean and tight.

After making the connection, match the impedance of the coaxial cable and antenna until the SWR becomes 1.5:1 or less.

A high SWR results in a drop in the transmit power as well as radio frequency interference to consumer products such as broadcast radio and television.

If you are notified that the signal has been distorted, the antenna system may not be efficiently radiating the transceiver's power.

PRECAUTIONS

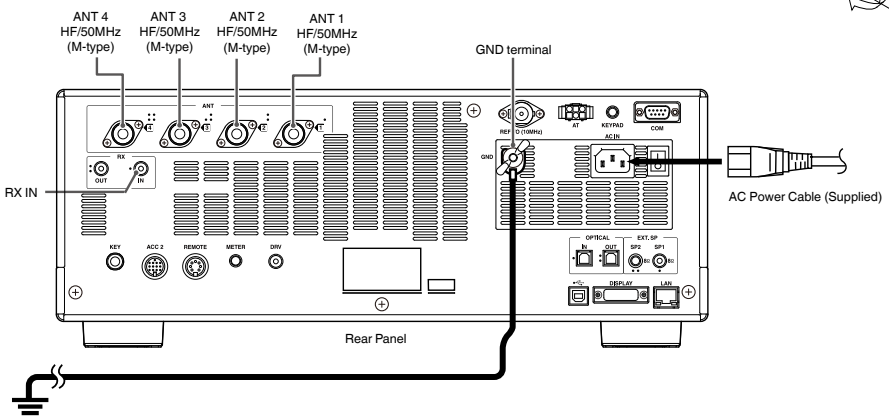
- Transmission without connecting an antenna to the transceiver may damage the transceiver. Prior to transmitting, connect an antenna or a 50Ω dummy load to the transceiver.
- When using the transceiver as a base station, we recommend you install an arrester so as to avoid fire, electric shock, damage and injury.
- If the antenna SWR exceeds 1.5:1 or more, the protection circuit activates in the transceiver. Ensure that the antenna SWR is 1.5:1 or lower.
- If the antenna dedicated for reception uses a semiconductor, such as an active antenna, do not transmit with it nor activate the antenna tuner. Doing so will supply power to the antenna system, damaging the semiconductor circuits of the antenna.

CONNECTING AN AC POWER CABLE

Use the supplied AC power cable to plug to an AC outlet with a protective grounding contact. Ensure that the grounding lead from the AC plug has been properly connected to the ground terminal before plugging the AC plug into the outlet. Likewise, remove the ground connection only after unplugging the AC plug. Failure to do so may result in an electrical shock.

PRECAUTIONS

- The AC power cable supplied with the K-type transceiver can only be used for the supply voltage from AC 90 V to AC 132 V. Do not use or modify the supplied AC power cable with the UL plug for the supply voltage from AC 180 V to AC 264 V.
- The AC power cable with the CE plug and the AC power cable with the BS plug are supplied with the E-type transceiver. Use one of the supplied cables that can correctly be plugged to an AC outlet.



GROUND CONNECTION

To avoid dangers such as electric shock, a good ground connection is necessary.

Bury one or more grounding rods or a large copper plate in the ground and connect it to the GND terminal on the rear panel of the transceiver using a thick conductive wire or a well fitted copper band plate.

PRECAUTION

- Do not use a gas pipe, an electrical conduit pipe, a plastic water pipe, etc., for grounding. These items will not create a proper ground and may cause an accident or fire.

LIGHTNING ARRESTER INSTALLATION

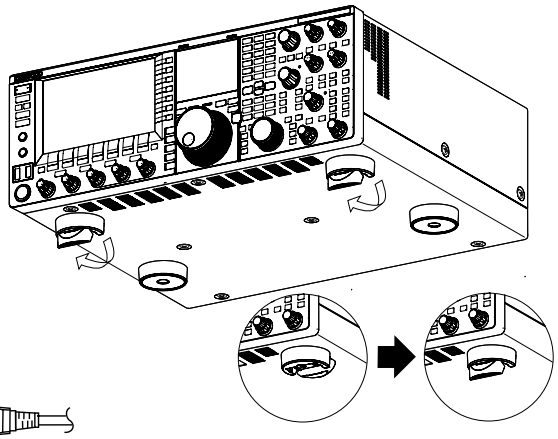
To avoid fire, electrification, damage, and injury by the lightning strike, install the lightning surge protector.

If a lightning storm is in the area, disconnect the antenna cable from the transceiver.

TRANSCEIVER TILT MECHANISM

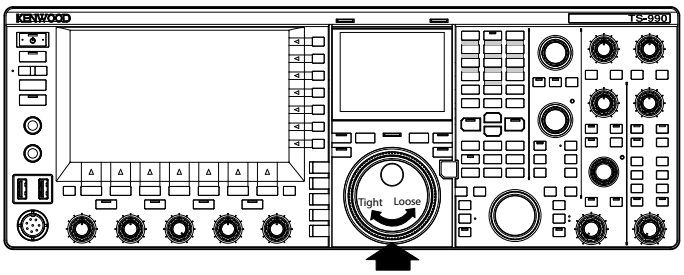
The lift-up supplementary bases are on the front bases on the bottom of the transceiver. To position the front panel slightly toward the upper side, pull the supplementary bases forward to the limit.

To use the front bases, be careful not to catch your fingers when lifting up the front bases' mechanism.



TORQUE ADJUSTMENT FOR TUNING (M) CONTROL

You can change the rotation torque of the **Tuning** (M) control as desired by pinching the ring at the back of the dial, then rotating the dial. Clockwise increases the rotation torque and counterclockwise decreases it.



Hold the ring securely, allowing you to rotate the knob.

ACCESSORIES CONNECTIONS (FRONT PANEL)

HEADPHONES (PHONES)

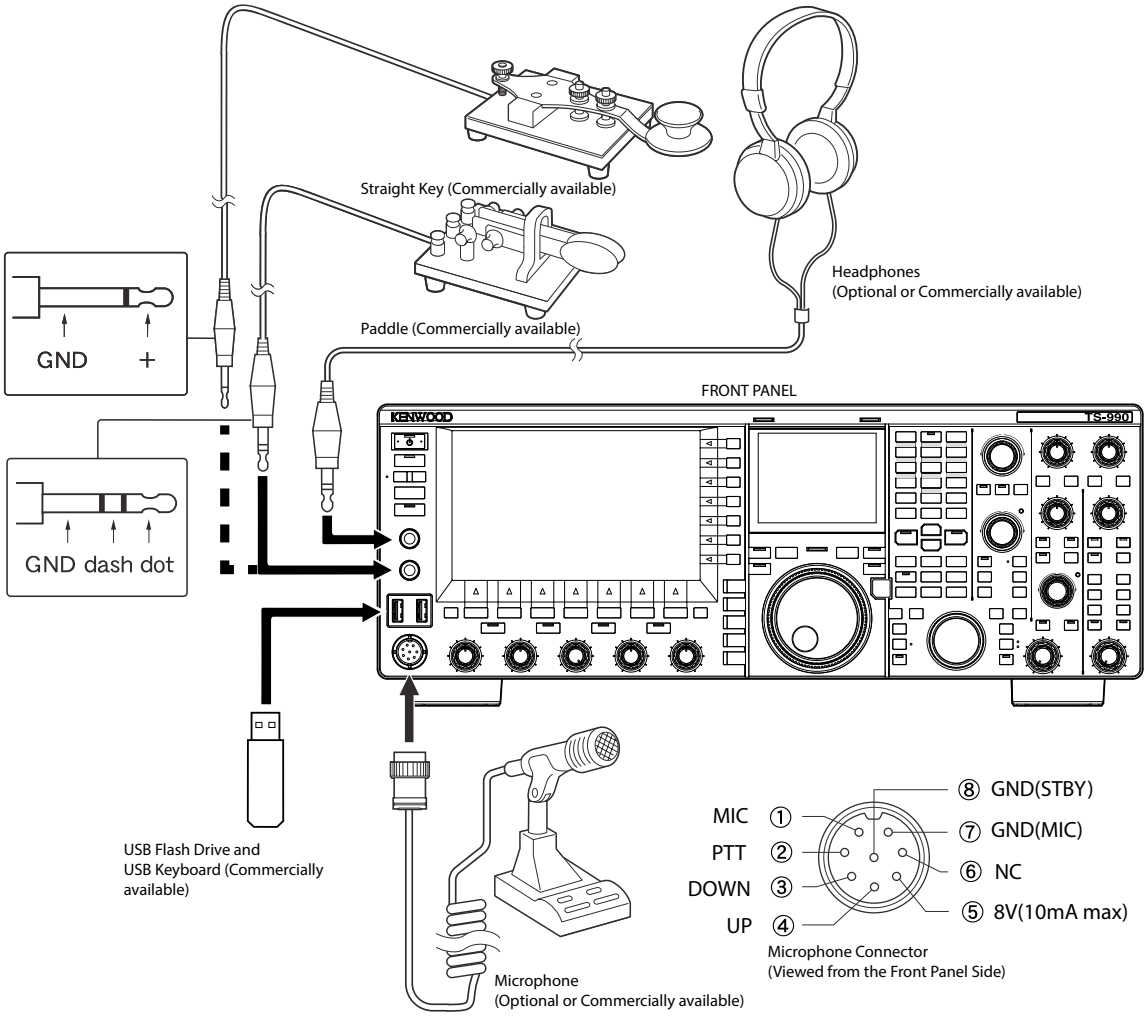
The PHONES jack accepts 2-conductor (mono) or 3-conductor (stereo) headphones with an impedance of 4Ω to 32Ω (standard is 8Ω) and a 6.3 mm (1/4") diameter plug.

While the headphones are plugged in, the audio line for the internal speaker (or an optional external speaker) is muted and the audio is heard through the headphones. The following optional headphones can be used with this transceiver:

• HS-5 (monaural) • HS-6 (monaural)

Note:

- Headphones with a higher impedance also have a higher volume level.
- Refer to "BASIC OPERATIONS" for details of configuration for the mixing balance to the headphones output and the left and right reverse. {page 4-23}



▶ Index ▶ Contents

MICROPHONE (MIC)

The MIC jack accepts a microphone with an impedance of 250Ω to 600Ω.

Connect the microphone plug to the **MIC** socket on the front panel and screw the retaining ring until the microphone is securely tightened.

The following optional microphones can be used with this transceiver:

- MC-43S
- MC-60A
- MC-90
- MC-47

The following microphones cannot be used with this transceiver.

- MC-44
- MC-44DM
- MC-45
- MC-45DM

PADDLE (PADDLE)

For CW operation using the built-in electronic keyer, connect a keyer to the **PADDLE** jack. The **PADDLE** jack accepts a 3-conductor plug with a 6.3 mm (1/4") diameter. The straight key can be connected to the **PADDLE** jack. In this case, select "Straight Key" from Menu 5-00, "Paddle Jack Configuration (Front)". {page 5-18}

USB FLASH DRIVE/USB KEYBOARD (•⇆)

You can connect any commercially available USB flash drive or USB keyboard to the USB-A port.

Connect it securely to the •⇆(USB-A) port.

Note:

- Do not disconnect the USB flash drive from the transceiver while it is in use, such as while reading or writing data. Additionally, do not turn the main power switch (I/O) OFF. {page 12-1}
- To avoid any damage to the data, you must remove the USB flash drive after executing Safe Removal of USB Flash drive. {page 12-1}
- Only a USB flash drive or a keyboard can be connected to the **USB** connector.

EXTERNAL SPEAKERS (EXT.SP1/EXT.SP2, 8Ω)

The transceiver is equipped with two independent receivers. In general, audio from both receivers sounds from the internal speaker. However, connecting an external speaker allows you to separate the audio outputs.

On the rear panel, two jacks for external speakers are available, allowing you to connect two external speakers.

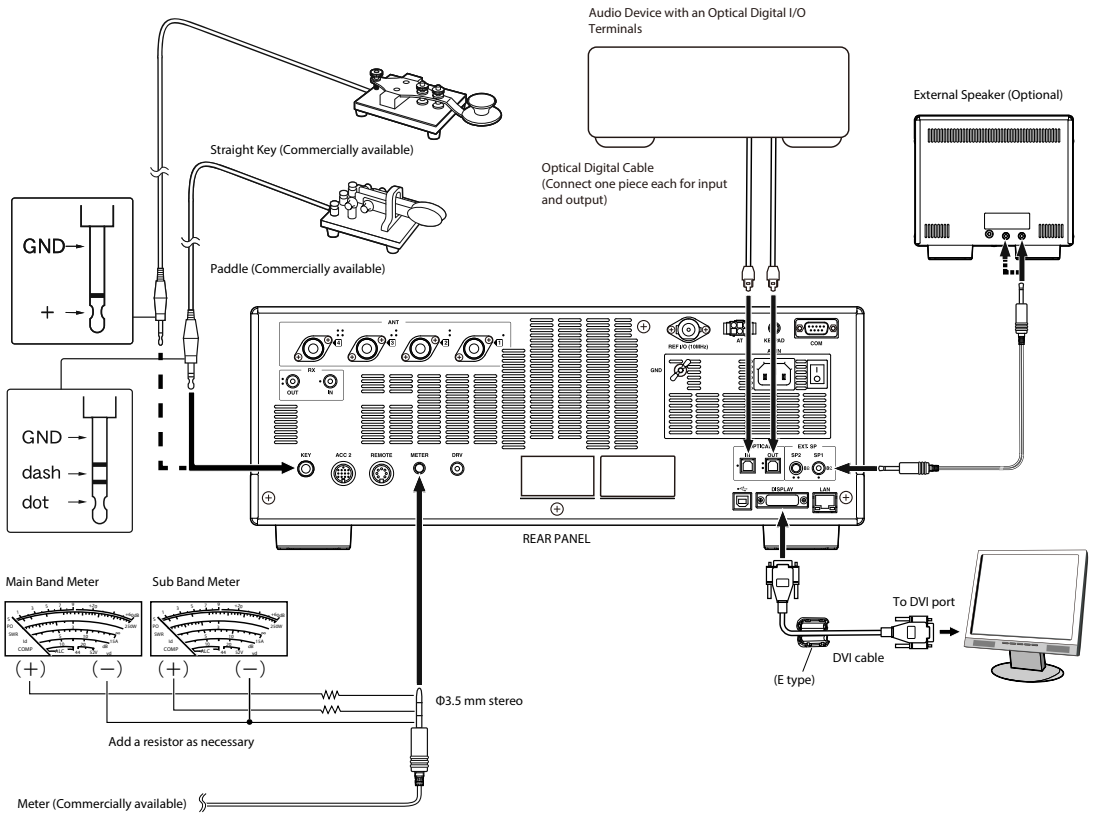
An external speaker with an impedance of 4Ω to 8Ω (standard is 8Ω) can be connected using the 2-conductor (mono) plug with a 3.5 mm (1/8") diameter.

If an external speaker is connected to **EXT.SP1**, no audio sounds from the internal speaker.

If an external speaker is connected to **EXT.SP2**, the audio sounds from both the external speaker and the internal speaker.

Note:

- The **EXT.SP1** and **EXT.SP2** jacks with 8Ω impedance are dedicated for external speakers. Do not connect headphones to these jacks. Doing so will result in a high audio volume level which may cause an auditory disorder.
- Audio to sound from an external speaker can be selected from the menu. {page 16-17}



KEY FOR CW (KEY)

For CW operation without using the built-in electronic keyer, the plug from a electronic key, a straight key, a external electronic keyer or a PC keyer can be connected. The KEY jack accepts a 2-conductor (mono) plug with a 3.5 mm (1/8") diameter.

Shorting the center pin of the jack to its outer represents “keydown”.

Depending on how you configure the menu, you can connect a paddle to the **KEY** jack and use the internal electronic keyer instead. {page 5-18}

Note:

- Refer to Chapter 5 "ASSISTING YOUR SMOOTH QSO" for the details of the built-in electronic keyer. {page 5-18}

KEYPAD (KEYPAD)

You can connect a personalized (self-made) PF keypad to the **KEYPAD** connector. {page 16-7}

CONNECCTION TO AUDIO DEVICES WITH OPTICAL DIGITAL INPUT TERMINAL

With a commercially available optical digital cable an audio device can be connected to the transceiver.

Note:

- Connect the transceiver to the audio device using the commercially available optical digital cable with the TOSLINK connector.
- If the transceiver is connected to the audio device, the transceiver may not work correctly depending on the operating environment of your PC. {page 18-11}
- Turn the transceiver power (⏻) and audio device OFF, then connect the transceiver to the audio device.
- If you turn the transceiver power (⏻) ON while the audio signal sourced from the transceiver is being recorded by the audio device, the digital processing cannot be synchronized when you turn the transceiver power (⏻) ON next time; hence, the audio device cannot correctly record. Turn the transceiver power (⏻) after the recording by the audio device has been stopped completely.

CONNECTION TO THE EXTERNAL DISPLAY UNIT

You can connect the transceiver to an external display using the commercial available DVI cable. The ferrite core is supplied with the transceiver (E-type only), and to connect the transceiver with an external display, you must attach the ferrite core to the DVI cable.

You can view the same contents using an external display as those that are displayed on the main screen. {page 16-18}

Note:

- Use an external display with 800x600 or 848x480 resolution.

METER

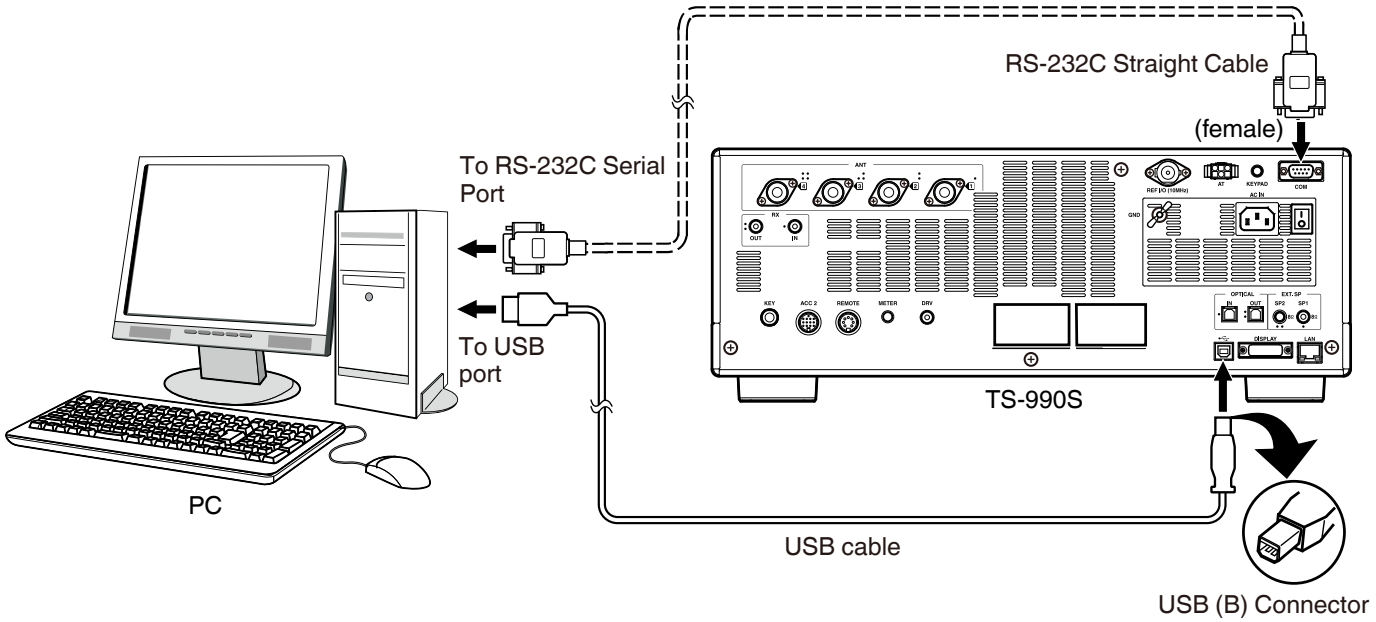
Connect to a commercially available meter. {page 16-15}

CONNECTION TO A PC

The transceiver can be connected to a PC using a USB cable or an RS-232C straight-through cable.

Note:

- Turn the transceiver and your PC OFF prior to connecting your PC to the transceiver using the cable.
- Use the commercial available USB cable or RS-232C straight-through (not “crossed”) cable.
- In principle, using the USB audio results in a delay. Additionally, audio interruptions may occur depending on the characteristics of your PC and the status of the load. Use USB audio for communications where time lag is inconsequential or for recording received audio in the PC.
- To control the transceiver via the USB connector using a PC, you need to install the virtual COM port driver onto the PC.
- To use the USB audio, the driver available in your PC as standard will be used. You can down load the ARUA-10 USB Audio Controller from the KENWOOD web site.

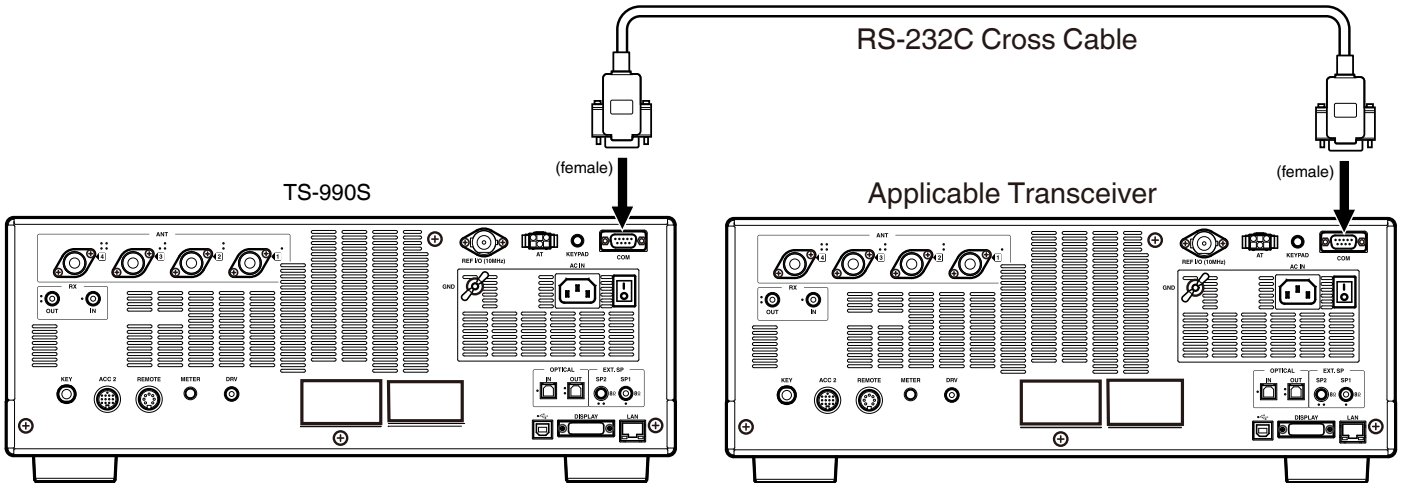


CONNECTION TO AN APPLICABLE TRANSCEIVER (QUICK DATA TRANSFER)

For data transfer, use an RS-232C cross-cable (female to female) to connect the transceiver **COM** connector to the COM connector of the secondary transceiver. {page 16-26}

You can connect this transceiver to the following applicable transceivers:

• TS-990 series • TS-590 series • TS-480 series • TS-2000 series • TS-570 series



CONNECTION TO THE LINEAR AMPLIFIER

You can connect a linear amplifier to the **REMOTE** connector.

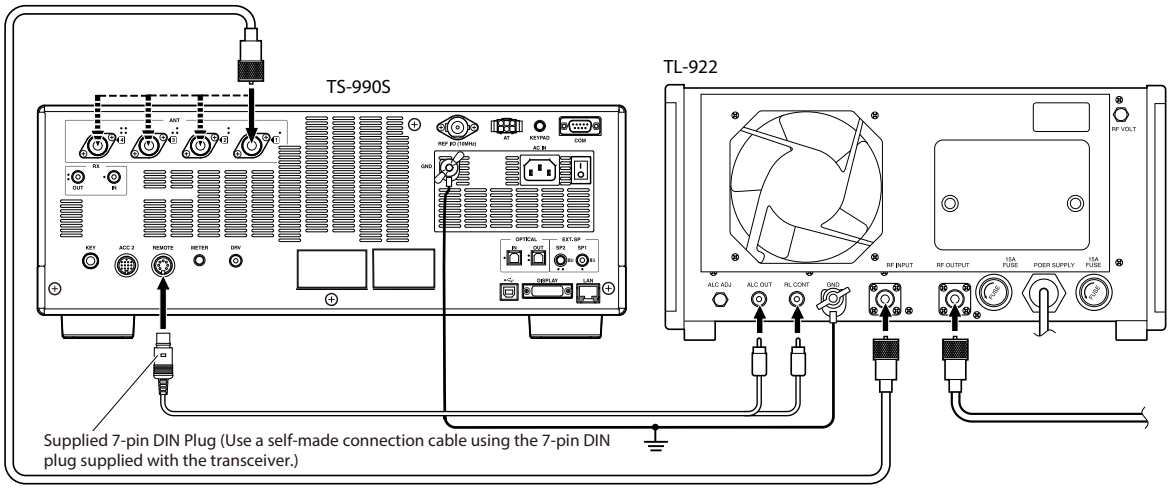
Prior to activating the linear amplifier, ensure that you have configured the linear amplifier controls. {page 16-31}

10 ms is the response time from when the transceiver changes from receive to transmit to when is actually transmitted. In operation other than CW Full Break-in, changing the menu configuration extends the response time to 25 ms (45 ms for SSB, FM and AM modes).

Note:

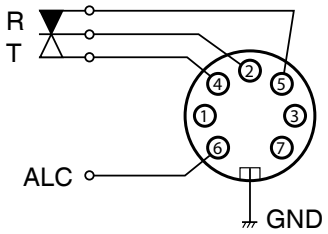
- The TX/RX control method may vary depending on the type of external linear amplifier. Some linear amplifiers may enter TX mode when the control terminal is switched to the ground line. For such a linear amplifier, allocate pin number 2 in the **REMOTE** connector to connect to the GND terminal and pin number 4 to the control terminal of the linear amplifier.
- TL-922 have been discontinued and is no longer available.

CONNECTION TO THE TL-922



CONTROL RELAY

Activates if “Active High + Relay” or “Active High + Relay & TX Delay Control” has been configured for Advanced Menus 11, “Linear Amplifier Control (HF Band)”, and 12, “Linear Amplifier Control (50 MHz Band)”. To use with TL-922, you need to configure only in Advanced Menu 11.



REMOTE CONNECTOR {page 1-10}
(View from the rear panel)

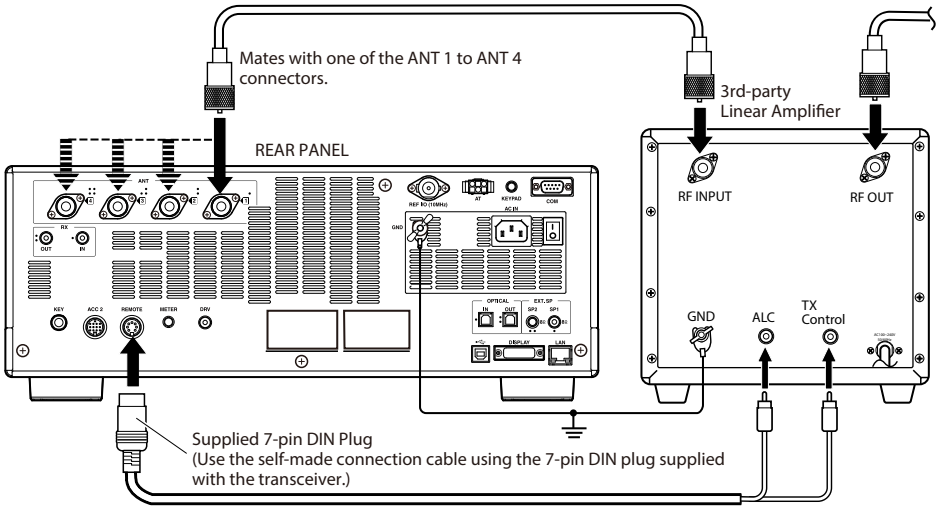
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CONNECTING A TYPICAL LINEAR AMPLIFIER

To connect a commercially available linear amplifier to the transceiver, follow the instructions given in the illustration below.

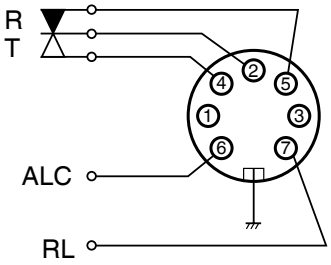
Note:

- Use a linear amplifier that has the ALC output level in the range from 0 V to -7 V. Do not use a linear amplifier that has the ALC output level outside the 0 to -7 V range. This may cause distortion and transmit power reduction by faulty ALC performance and abnormal oscillation.
- Refer to the instruction manual supplied with the linear amplifier for connection to the linear amplifier.



CONTROL RELAY

Activates if “Active High + Relay” or “Active High + Relay & TX Delay Control” has been configured for Advanced Menus 11, “Linear Amplifier Control (HF Band)”, and 12, “Linear Amplifier Control (50 MHz Band)”.



REMOTE CONNECTOR {page 1-10}
(View from the rear panel)

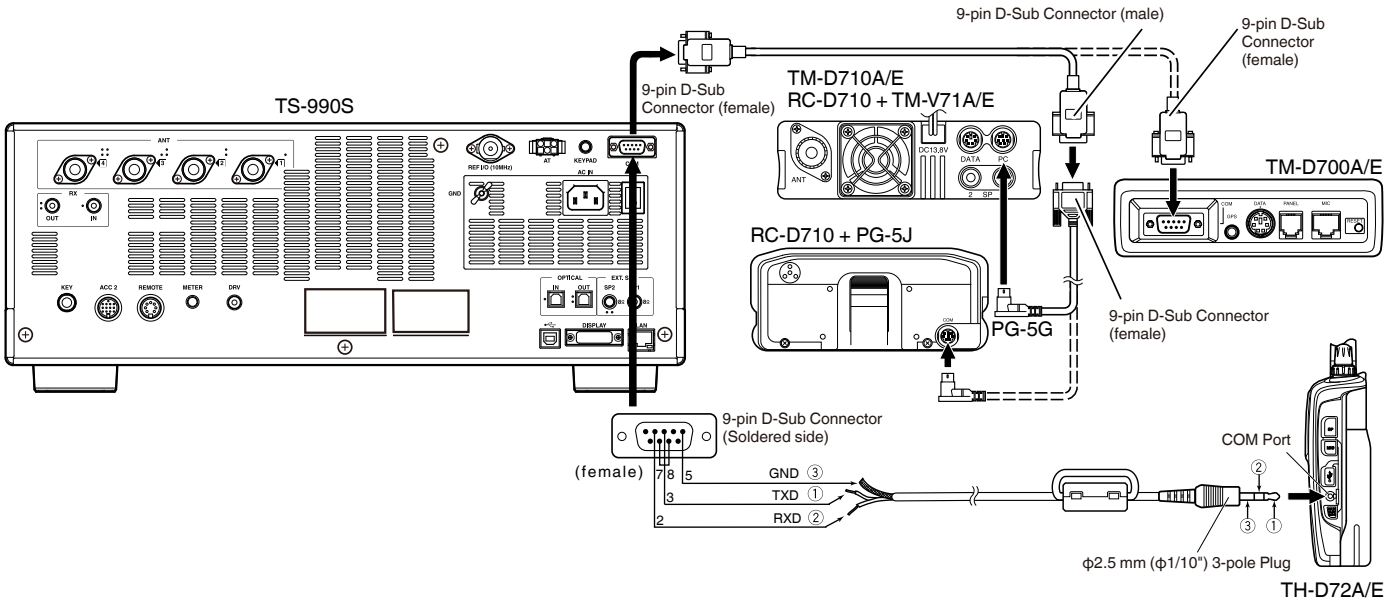
CONNECTION TO OTHER KENWOOD TRANSCEIVERS WITH A TNC TERMINAL

The connection illustrated below allows packet cluster tuning using a TH-D72A/E, TM-D710A/E, or TM-D700A/E. {page 16-27}

You can connect the TS-990S to a TM-D710A/E or RC-D710 using an optional PG-5G and a commercially available RS-232C cross-cable. If the RS-232C cross-cable has female plugs or male plugs, use a female to male conversion plug. You can connect the transceiver to a TM-D700A/E using a commercially available RS-232C cross-cable.

Note:

- TM-D700A/E has been discontinued and is no longer available.
- Refer to the instruction manual supplied with the device with the built-in TNC for details of connection.



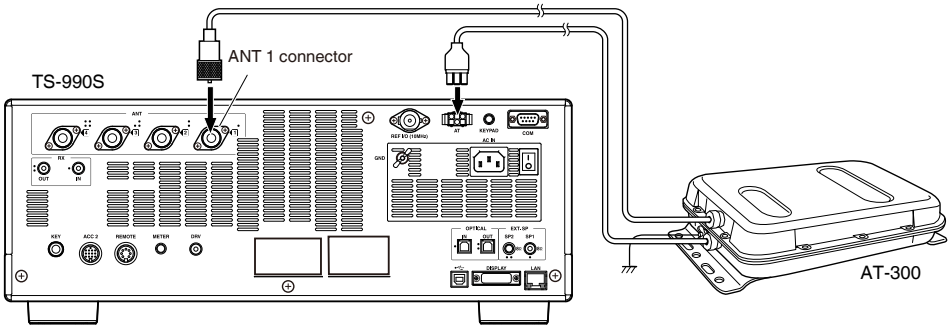
CONNECTION TO AN EXTERNAL ANTENNA TUNER AT-300

The external antenna tuner AT-300, can be connected to the ANT1 connector and AT connector.

The AT-300 does not function if it is connected to a connector other than the ANT1 connector. The AT connector is dedicated for AT-300. Other external antenna tuners cannot be controlled. If another external antenna tuner is connected to the transceiver, use the TX tuning function. {page 9-14}

Note:

- Connect the AT-300 to the transceiver after the main power (I/O) shuts down.
- The AT-300 cannot be used in the 50 MHz band. The antenna for the 50 MHz band must be connected to an antenna connector other than antenna connector 1 (**ANT1**).
- Connecting the AT-300 to the AT connector using the ANT 1 results in the signal bypassing the internal antenna tuner (through).
- If you connect the AT-300 to the AT terminal, the transmit power will be limited to 100 W. (Depending on the specifications for AT-300)
- The AT-300 has been discontinued and is no longer available.



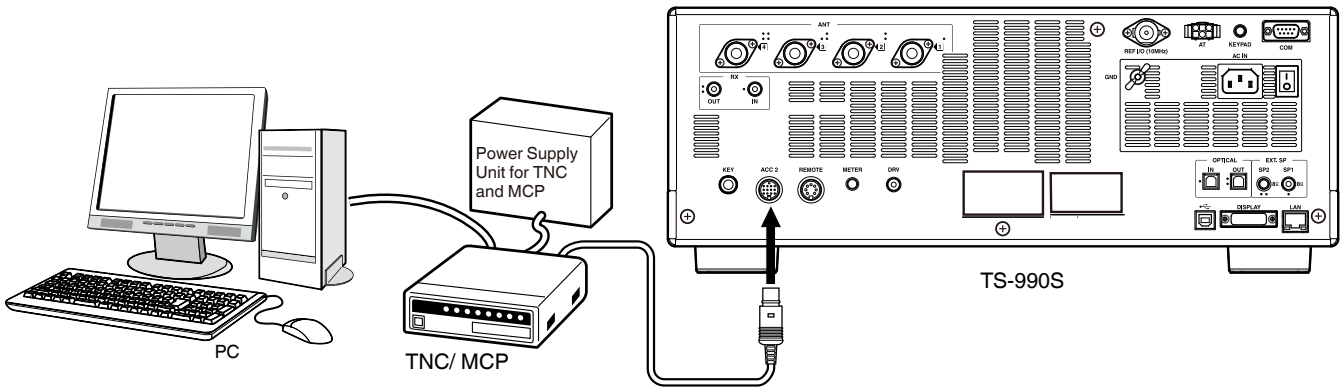
CONNECTION TO A TNC, MCP, ETC.

For packet communications, use an external TNC (terminal node controller) or MCP (multi-mode communication processor) terminal, or the sound capability in a PC. For digital communications such as RTTY, PSK and SSTV, use the **ACC2** connector on the rear panel of the transceiver.

- Use a cable with a 13-pin DIN plug to connect the transceiver to an external device such as a TNC, MCP or a PC having sound capability.
- To connect the PC to a TNC or MCP, use a commercially available RS-232C cable.

Note:

- To avoid any noise interference, keep the distance between the transceiver and a PC as great as possible.
- The external device can be connected to the ACC 2 connector with the self-made cable.



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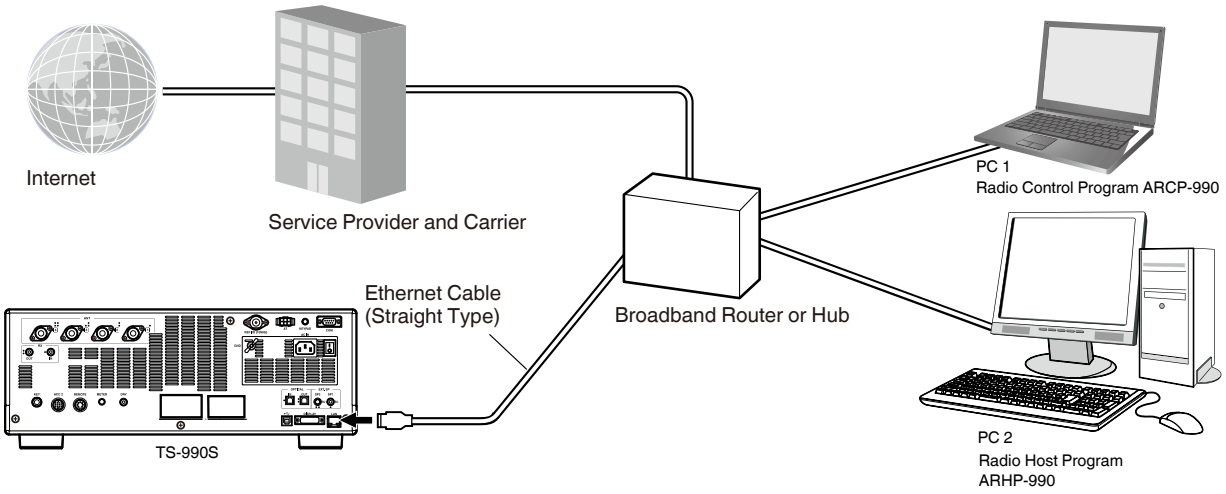
CONNECTING TO YOUR LAN

To connect the transceiver to your LAN so as to automatically correct the clock or to operate with KNS (KENWOOD NETWORK COMMAND SYSTEM), use an Ethernet cable (straight type) as shown in the illustration below.

{page 15-3} {page 16-12}

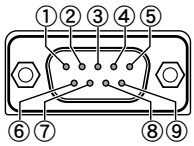
Note:

♦ Use a commercially available Ethernet cable.



TERMINAL DESCRIPTIONS

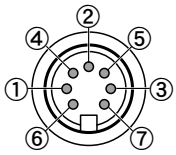
COM



COM CONNECTOR

Pin No.	Pin Name	Function	Input/Output
1	NC	No connection	—
2	RXD	Sends the serial data to a PC.	O
3	TXD	Receives the serial data from a PC.	I
4	NC	No connection	—
5	GND	Ground	—
6	NC	No connection	—
7	RTS	Sends from a PC to the transceiver. If the PC cannot accept serial data, the PC sends the "L" state signal to disable the transceiver from sending serial data.	I
8	CTS	Sends from the transceiver to a PC. If the transceiver cannot accept serial data, the transceiver sends an "L" state signal to disable the PC from sending serial data.	O
9	NC	No connection	—

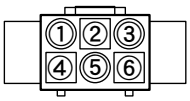
REMOTE



REMOTE CONNECTOR

Pin No.	Pin Name	Function	Input/Output
1	SPO	Speaker output	O
2	COM	Commonly used for an internal relay	I/O
3	SS	PTT Input • Shorting the SS terminal to Ground starts transmission.	I
4	MKE	The make terminal for an internal relay. Shorts to the common terminal during transmission.	I/O
5	BRK	The break terminal for an internal relay Shorts to the common terminal during reception.	I/O
6	ALC	ALC input from the linear amplifier	I
7	RL	+12 V DC with a maximum of 10 mA signal is sent during TX in the HF or 50 MHz band. Following configuration in Advanced Menus 11 and 12, it is possible to short the signal with a maximum of 10 mA to the GND terminal. {page 16-31} {page 16-32}	O

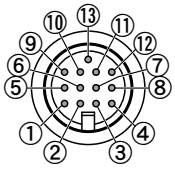
AT



EXT.AT CONNECTOR

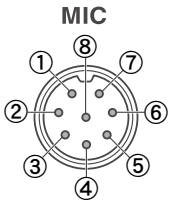
Pin No.	Pin Name	Function	Input/Output
1	GND	Ground	—
2	TT	EXT.AT control (TTI/TTO)	I/O
3	GND	Ground	—
4	NC	No connection	—
5	TS	EXT.AT control (TSI/TSO)	I/O
6	14S	13.8 V DC source for EXT.AT	O

ACC 2



ACC2 CONNECTOR

Pin No.	Pin Name	Function	Input/Output
1	SANO	Audio Output for the Sub Band Audio Sends the audio signal to external devices, such as TNC, MCP and PC. • The audio output level cannot be changed with the **AF** control on the front panel. • Audio output level can be changed in Menu 7-11, "Sub Band Audio Output Level (ACC 2)". 0 Vp-p audio signal is transferred with “0” configured for the audio output level, 0.5 Vp-p audio signal is transferred with “50” as the default, and 1 Vp-p audio signal is transferred with “100” configured. (Output Impedance: 10kΩ)	O
2	RTTY	RTTY (FSK keying terminal) • The keying polarity can be changed in Menu 2-07, "FSK Keying Polarity".	I
3	MANO	Audio Output for the Man Band Audio Sends the audio signal to external devices, such as TNC, MCP and PC. • The audio output level cannot be changed with the **AF** control on the front panel. • Audio output level can be changed in Menu 7-10, "Main Band Audio Output Level (ACC 2)". 0 Vp-p audio signal is transferred with “0” configured for the audio output level, 0.5 Vp-p audio signal is transferred with “50” as the default, and 1 Vp-p audio signal is transferred with “100” configured. (Output Impedance: 10kΩ)	O
4	GND	Ground	—
5	MSQ	Sends the main band squelch control signal. • Connects to the squelch input terminal of the TNC or MCP, or the interface terminal for connection to a PC. • Open Squelch: Low impedance • Tight Squelch: High impedance	O
6	MMET	Sends the main band meter levels.	O
7	SSQ	Sends the sub band squelch control signal.	—
8	GND	Ground	—
9	PKS	PTT Input for data communication (DATA SEND) • Connecting to the PTT output interface for the TNC, MCP and PC connection • Shorting the PKS pin to Ground starts the transmission. • During transmission using the PKS pin, mutes the unnecessary modulation input signal. INPUT LINES FOR TRANSMIT AUDIO {page 5-11}	I
10	SMET	Sends the sub band meter levels. Type of output signal and its output level can be selected from Advanced Menus 1, "Indication Signal Type (Main Band)", and 3, "Output Level (Sub Band)".	O
11	ANI	Audio input for data communication • Connects to the audio output of the TNC, MCP, PC (or the interface for connection to a PC). • The audio input level cannot be changed with the **MIC** control on the front panel. • Audio input level can be changed in Menu 7-06, "ACC2: Audio input Level". If “0” is configured, the transceiver transmits nearly without modulation. With the default of “50”, the transceiver transmits with standard modulation by 10 mVrms input. If “100” is configured, the transceiver transmits with standard modulation by 1 mVrms input. (Input Impedance: 10kΩ)	I
12	GND	Ground	—
13	SS	PTT Input • Has the same function the SS terminal assigned to 2nd pin of **MIC** connector on a front panel and 3rd pin of **REMOTE** connector on a rear panel. • The same behavior as when **[SEND]** on the front panel is pressed • Shorting the SS terminal to Ground starts the transmission. • During transmission using the SS pin, mutes the unnecessary modulation input signal. INPUT LINES FOR TRANSMIT AUDIO {page 5-11}	I

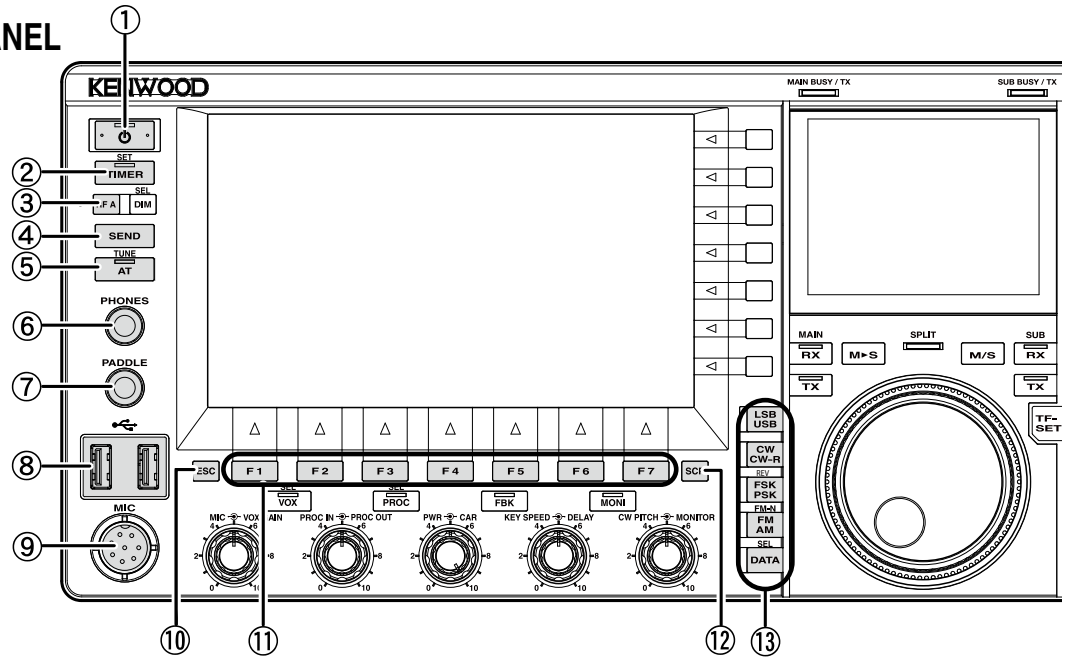


MIC CONNECTOR

Pin No.	Pin Name	Function	Input/Output
1	MIC	Signal input from the microphone	I
2	SS	Microphone standby (PTT) control	I
3	MD	Microphone Down control	I
4	MU	Microphone Up control	I
5	8 A	Provides DC 8 V to the microphone.	O
6	NC	No connection	—
7	MSG	Microphone Ground	—
8	MCG	Ground	—

2 PANEL DESCRIPTION

FRONT PANEL



① Power Switch: [⏻](POWER)
Press to turn the transceiver power (⏻) ON or OFF. {page 4-1}

"⏻" LED

Lights green when the transceiver power (⏻) is ON.

Lights orange when the transceiver turns power (⏻) is OFF.
Blinks orange when the transceiver power is turning OFF.

Note:

- While the main power switch (I/O) on the rear panel is pressed down to the "O" position, the transceiver power (⏻) cannot be turned ON even with a press of [⏻]. {page 4-1}
- Pressing the main power switch (I/O) while the "⏻" LED is blinking may cause the transceiver to malfunction.

② Timer key: **[TIMER/SET]**
Press to toggle the timed task by a timer or programmable timer between active and inactive. {page 15-4}

Press and hold to open or close the Timer screen. {page 15-4}

"TIMER" LED

Lights green while the timer is counting down.

Blinks green while the timed task by a timer is about to begin.

③ Programmable Function A key: **[PF A]**
Press to activate the function assigned to **[PF A]**. The default is "VOICE 2". {page 14-1}

④ Send key: **[SEND]**
Press to toggle the operating state between TX and RX. A key press places the transceiver into the TX state, and the next key press places the transceiver into the RX state. {page 4-17}

⑤ Antenna Tuning key: **[AT/TUNE]**
Press to toggle the internal antenna tuner between active and inactive. {page 4-21}

Press and hold to begin tuning the internal antenna tuner. {page 4-21}

"AT" LED

Lights green while the antenna tuner is active. Blinks green during tuning.

⑥ PHONES jack
Connect a set of headphones(4 to 32Ω). {page 1-2}

⑦ PADDLE jack
Connect a paddle for CW operation. {page 1-3}

⑧ ⇽(USB-A) connector
You can connect any commercially available USB flash drive or USB keyboard to the USB-A ports. {page 1-3}, {page 12-1}

It is possible to connect to USB hub.

⑨ MIC connector
Connect a microphone(250 to 600Ω). {page 1-3}

⑩ Escape key: **[ESC]**
Press to close the displayed screen.

⑪ PF 1 to PF 7 keys: **[PF 1]** to **[PF 7]** with Key Guide on the bottom of Main Screen
Press to activate or select the function specified with a key guide on the bottom of the main screen.

⑫ Scope key: **[SCP]**
Press to open the Bandscope screen on the main screen.

With the **Bandscope** screen open, press to cycles through the **Bandscope** screen, the **Bandscope with Waterfall** screen and no scope screen. {page 7-1}

⑬ Mode keys

LSB/USB key: [LSB/USB]

Press to toggle between LSB mode and USB mode. {page 4-10}

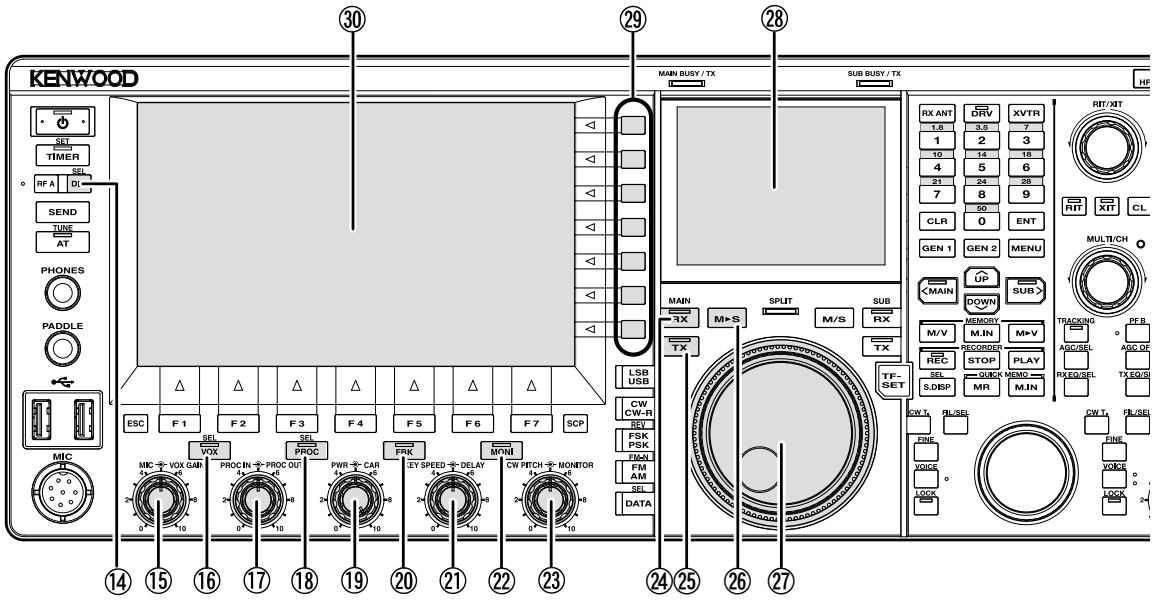
CW/CW-R key: [CW/CW-R]

Press to toggle the side band between CW and CW-R. {page 4-10}

FSK/PSK/REV key: [FSK/PSK/REV]

Press to toggle between FSK mode and PSK mode. {page 4-10}

Press and hold to toggle the side band between normal and reverse (FSK and FSK-R or PSK and PSK-R). {page 4-10}



FM/AM/FM-N key: [FM/AM/FM-N]

Press to toggle between FM mode and AM mode.

Press and hold to toggle FM mode between narrow (FM-N) and wide (FM).

• Narrow: FM-N • Wide: FM

Using Narrow FM reduces the IF filter bandwidth during RX, allowing you more accurate selection. During TX, the shift frequency is narrowed and the occupied bandwidth decreases. {page 4-10}

Data key: [DATA/SEL]

Press to cycle the DATA mode through Data Off, 1, 2 and 3. {page 5-29}

Press and hold to open or close the Modulation Source screen. {page 5-11}

⑭ Dimmer key: **[DIM/SEL]**

Press to change the display brightness. {page 4-6}

Press and hold to open or close the **Dimmer** screen. {page 4-6}

⑮ MIC ⊷ VOX GAIN control

MIC control: Adjusts the microphone gain level. {page 4-17} {page 5-14} {page 5-28}

VOX GAIN control: Adjusts the VOX gain level of the microphone. {page 9-4}

⑯ VOX key: **[VOX/SEL]**

Press to toggle VOX of a microphone or semi break-in between active and inactive. {page 9-2}

Press and hold to open or close the **VOX** screen. {page 9-3}

"VOX" LED

Lights green while the VOX of the microphone or semi break-in is active,

⑰ Speech Processor Input ⊷ Speech Processor Output controls

PROC IN control: Rotate to adjust the input level to the speech processor. {page 9-6}

PROC OUT control: Rotate to adjust the output level from the speech processor. {page 9-7}

⑱ Speech Processor key: **[PROC/SEL]**

Press to toggle the Speech Processor between active and inactive. {page 9-6}

Press and hold to open or close the Speech Processor screen. {page 9-7}

"Speech Processor" LED

Lights green while the Speech Processor is active.

⑲ Power ⊷ Carrier controls

TX POWER control: Rotate to adjust the transmit power. {page 4-17}

CAR control: Rotate to adjust the carrier level for use in CW, FSK, PSK, or AM mode. {page 5-13}

⑳ Full Break-in key: **[FBK]**

Press to toggle the Full Break-in function between active and inactive. {page 5-15}

"FBK" LED

Lights green while Full Break-in is active.

㉑ KEY SPEED ⊷ DELAY controls

KEY SPEED control: Rotate to adjust the keying speed. {page 5-19}

DELAY control: Rotate to adjust the delay time for the semi break-in function. {page 5-15}

㉒ Monitor key: **[MONI]**

Press to toggle the TX monitor between active and inactive. {page 9-5}

"MONI" LED

Lights green while the TX monitor is active. {page 9-5}

㉓ CW PITCH ⊷ MONITOR controls

CW PITCH control: Rotate to adjust the CW pitch frequency. {page 5-16}

MONITOR control: Rotate to adjust the transmit monitor and sidetone levels. {page 9-5} {page 5-16}

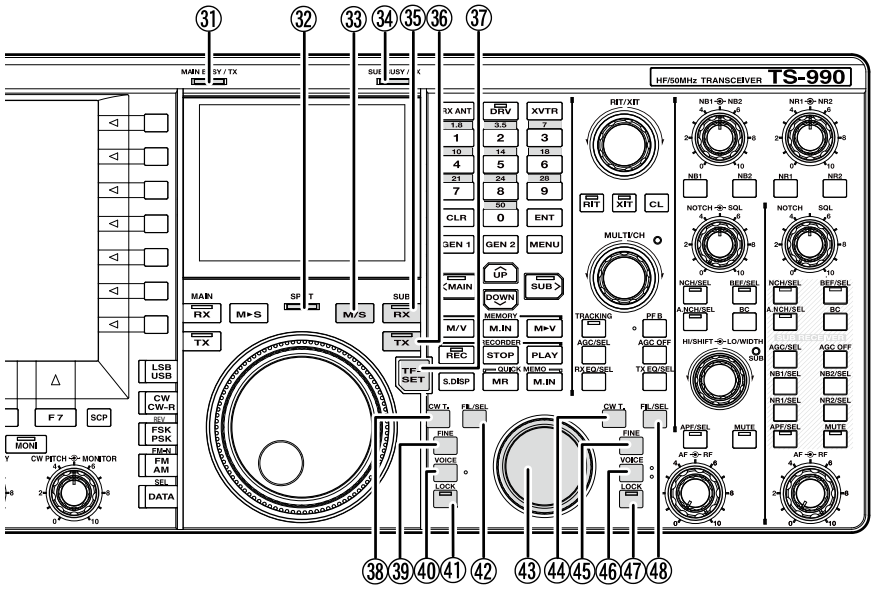
㉔ RX (Main band) key: **[RX]** (M)

Press to finish reception on two frequencies. {page 5-3}

"RX" (Main band) LED

Lights green when the transceiver power (⏻) is ON. {page 5-1}

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㉕ TX (Main band) key: **[TX]** (M)
Press to switch Split mode to Simplex mode. {page 5-1}

"TX" (Main band) LED

Lights green while in Simplex mode. {page 5-1}

㉖ Main to Sub key: **[M►S]**
Press to copy the main band frequency and mode configuration data to the sub band. {page 5-1}

㉗ Tuning (M) control
Rotate to select transmit and receive frequencies for the selected band. Rotating it clockwise increments the frequency and rotating it counterclockwise decrements the frequency. The rotation torque for the **Tuning** control can be adjusted.

㉘ Sub-screen
A 3.5" Color TFT LCD. {page 2-14}

㉙ Function keys: **[x.x.x]** (F) with Key Guide on the right side of Main Screen
Press to activate or select the function specified with a key guide on the right side of the main screen.

㉚ Main Screen
A 7" Color TFT LCD. {page 2-11}

㉛ MAIN BUSY/ TX LED
Lights red during transmit using the main band. Lights green while the main band squelch is open.

㉜ SPLIT LED
Lights yellow while in the Split mode. Blinks yellow while the split frequency is being entered.

㉝ Main Band and Sub band key: **[M/S]**
Press to toggle the frequency and operating mode between main band and sub band. {page 2-3}

㉞ SUB BUSY/ TX LED
Lights red during transmit using the sub band. Lights green while the sub band squelch is open.

㉟ RX (Sub band) key: **[RX]** (S)
Press to toggle reception on the sub band between active and inactive. {page 5-3}

"RX" (Sub band) LED

Lights green while the sub band is in receive mode.

㊱ TX (Sub band) key: **[TX]** (S)
Press while in Simplex mode to switch the operating mode to Split mode. Press again to reverts to Simplex mode. {page 5-1}

Press and hold to enable the configuration for split frequency operation. {page 5-1}

"TX" (Sub band) LED

Lights green while the transceiver is placed in Split operation.

㊲ TX Frequency Set key: **[TF-SET]**
Press down to receive using the transmit frequency. {page 5-2}

㊳ CW Auto Tune (Main Band) key: **[CW T.]** (M)
Press to activate CW auto tuning for the main band. {page 5-17}

㊴ Fine Tuning (Main Band) key: **[FINE]** (M)
Press to toggle Fine tuning for the main band between active and inactive. {page 4-14}

㊵ Voice (Main Band) key: **[VOICE]** (M)
Press to activate the function assigned to **[VOICE]** (M). The default is "VOICE 1" for the main band. {page 14-3}

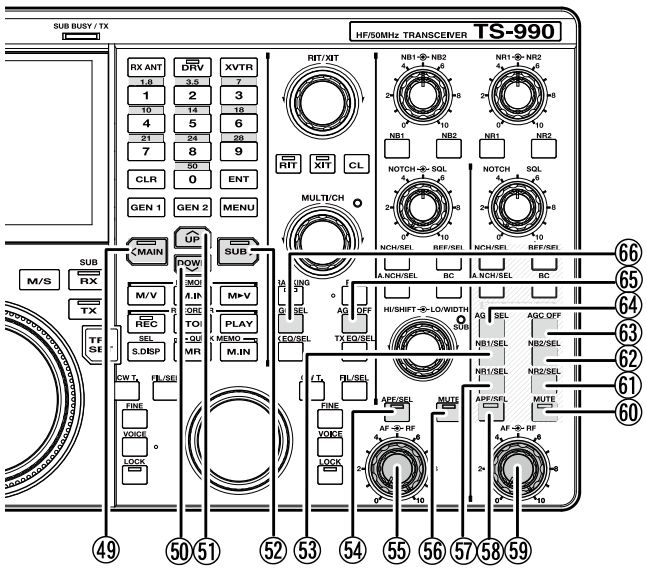
㊶ Lock (Main Band) key: **[LOCK]** (M)
Press to toggle the main band frequency lock between active and inactive. {page 4-16}

"LOCK" (Main) LED

Lights orange while the frequency lock for the main band is active. {page 4-16}

㊷ Filter (Main Band) key: **[FIL/SEL]** (M)
Press to cycle the receive filter for the main band through Filter A, Filter B and Filter C. {page 6-2}

Press and hold to open or close the Receive Filter screen. {page 6-3}



㊸ Tuning (S) control
Rotate to select the transmit and receive frequencies for the sub band. Rotate it clockwise increments the frequency and rotate it counterclockwise decrements the frequency.

㊹ CW Auto Tune key for Sub band: **[CW T.]** (S)
Press to activate CW auto tuning for the sub band. {page 5-17}

㊺ Fine Tuning (Sub band) key: **[FINE]** (S)
Press to toggle the fine tuning for the sub band between active and inactive. {page 4-14}

㊻ Voice (Sub band) key: **[VOICE]** (S)
Press to activate the function assigned to **[VOICE]** (S). The default is "VOICE 1" for the sub band. {page 14-3}

㊼ Lock (Sub band) key: **[LOCK]** (S)
Press to toggle the sub band frequency lock between active and inactive. {page 4-16}

"LOCK" (Sub) LED

Lights orange while the frequency lock for the sub band is active. {page 4-16}

㊽ Receive Filter (Sub band) key: **[FIL/SEL]** (S)
Press to cycle the receive filter for the sub band through Filter A, Filter B and Filter C. {page 6-2}

Press and hold to open or close the **Receive Filter** screen. {page 6-3}

㊾ Main Band access key: **[<MAIN]**
Press to switch the current operating band to the main band. This key also shifts the cursor to the left while the configuration screen is open. {page 4-7}

"Main band" LED

Lights green while the main band is the current operating band.

㊿ Down key: **[DOWN]**
Press to decrease the frequency in steps of 1 MHz. Hold the key down to continuously decrease the frequency. While a configuration screen is open, press to execute the key task which varies depending on the configuration screen. For example, press to decrease or continuously decrease the parameter in the proper step size. {page 4-14}

(51) Up key: **[Up]**
Press to increase the frequency in steps of 1 MHz. Hold the key down to continuously increase the frequency. While a configuration screen is open, press to execute the key task which varies depending on the configuration screen. For example, press to increase or continuously increase the parameter in the proper step size. {page 4-14}

(52) Sub Band access key: **[SUB>]**
Press to switch the current operating band to the sub band. This key also shifts the cursor to the left while the configuration screen is open. {page 4-7}

"Sub band" LED

Lights green while the sub band is the current operating band.

(53) Noise Blanker 1 (Sub band) key: **[NB1/SEL]** (S)
Press to toggle the Noise Blanker 1 for the sub band between active and inactive. {page 6-9}

Press and hold to open or close the Noise Blanker 1 (Sub Band) screen. {page 6-10}

(54) Audio Peak Filter (Main band) key: **[APF/SEL]** (M)
Press to toggle the Audio Peak Filter for the main band between active and inactive. {page 6-7}, {page 6-8}

Press to open the **Audio Peak Filter** screen for the main band. {page 6-8}

"APF" (Main band) LED

Lights green while Audio Peak Filter for the main band is active. {page 6-7}, {page 6-8}

(55) AF ◉ RF (M) control
AF (M) control: Rotate to adjust the AF level for the main band.

RF (M) control: Rotate to adjust the RF level for the main band.

(56) Mute key for Main band received audio: **[MUTE]** (M)
Press to toggle the mute for the received audio of the main band between On and Off. {page 4-7}

"Mute" (Main band) LED

Lights orange while the audio line for the main band is being muted.

(57) Noise Reduction 1 (Sub band) key: **[NR1/SEL]** (S)
Press to toggle the Noise Reduction 1 for the sub band between active and inactive. {page 6-13}

Press and hold to open or close the **Noise Reduction 1 (Sub Band)** screen.

{page 6-14}

(58) Audio Peak Filter (Sub Band) key: **[APF/SEL]** (S)
Press to toggle the Audio Peak Filter for the sub band between active and inactive. {page 6-7}, {page 6-8}

Press to open the **Audio Peak Filter** screen for the main band.

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"APF" (Sub band) LED

Lights green while Audio Peak Filter for the sub band is active. {page 6-7}, {page 6-8}

⑲ AF RF (S) control

AF (S) control: Rotate to adjust the AF level for the sub band.

RF (R) control: Rotate to adjust the RF level for the sub band.

⑳ Mute key for Sub band received audio: **[MUTE]** (S)

Press to toggle the mute for the received audio of the sub band between On and Off. {page 4-7}

"Mute" (Sub band) LED

Lights orange while the audio line for the sub band is being muted.

㉑ Noise Reduction 2 (Sub band) key: **[NR2/SEL]** (S)

Press to toggle the Noise Reduction 2 for the sub band between active and inactive. {page 6-13}

Press and hold to open or close the **Noise Reduction 2 (Sub Band)** screen. {page 6-14}

㉒ Noise Blanker 2 (Sub band) key: **[NB2/SEL]** (S)

Press to toggle the Noise Blanker 2 for the sub band between active and inactive. {page 6-9}

Press and hold to open or close the **Noise Blanker 2 (Sub Band)** screen. {page 6-10}

㉓ AGC OFF key for Sub band: **[AGC OFF]** (S)

Press to toggle the Automatic Gain Control (AGC) for the sub band between active and inactive. {page 5-5}

㉔ AGC key for Sub band: **[AGC/SEL]** (S)

Press to cycle the speed of the Automatic Gain Control (AGC) for the sub band through Fast, Medium and Slow. {page 5-4}

Press and hold to open or close the AGC screen for the sub band. {page 5-4}

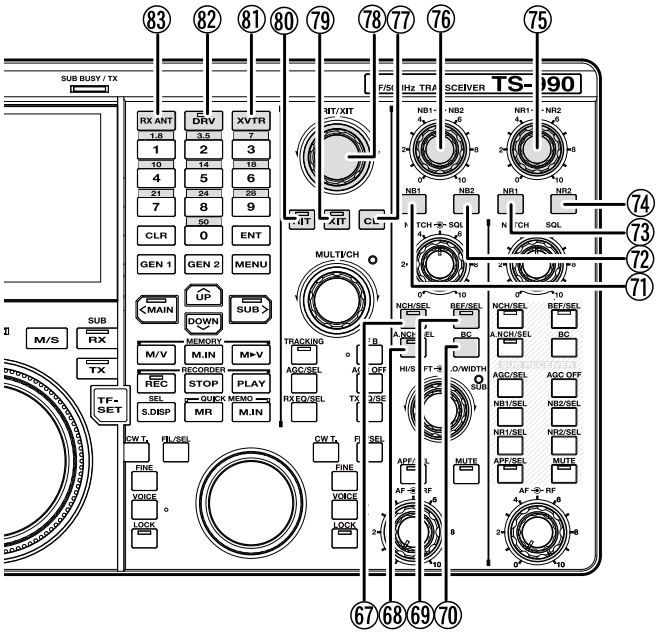
㉕ AGC OFF key for Main band: **[AGC OFF]** (M)

Press to toggle the Automatic Gain Control (AGC) for the main band between active and inactive. {page 5-5}

㉖ AGC key for Main band: **[AGC/SEL]** (M)

Press to cycle the speed of the Automatic Gain Control (AGC) for the main band through Fast, Medium and Slow. {page 5-4}

Press and hold to open or close the **AGC** screen for the main band. {page 5-4}



⑰ Notch Filter (Main band) key: **[NCH/SEL]** (M)
Press to toggle the Manual Notch Filter for the main band between active and inactive. {page 6-10}

Press and hold to toggle the bandwidth for the manual notch filter for the main band between narrow and wide. {page 6-11}

"NCH" (Main band) LED

Lights green while the manual notch for the main band is active. {page 6-10}

⑱ Automatic Notch Filter (Main band) key: **[A.NCH/SEL]** (M)
Press to toggle the Auto Notch Filter between active and inactive. {page 6-11}

Press and hold to open or close the Auto Notch Filter screen. {page 6-11}

"A.NCH" (Main band) LED

Lights green while the auto notch filter for the main band is active. {page 6-11}

⑲ Band Elimination Filter (Main band) key: **[BEF/SEL]** (M)
Press to toggle the Band Elimination Filter for the main band between active and inactive. {page 6-12}

Press and hold to open the Band Elimination Filter screen for the main band. {page 6-12}

"BEF" (Main band) LED

Lights green while the Band Elimination Filter for the main band is active.

⑳ Beat Cancel (Main band) key: **[BC]** (M)
Press to cycle the Beat Cancel for the main band through Beat Cancel 1, Beat Cancel 2 and Off. {page 6-14}

㉑ Noise Blanker 1 (Main band) key: **[NB1]** (M)
Press to toggle the Noise Blanker 1 for the main band between active and inactive. {page 6-9}

㉒ Noise Blanker 2 (Main band) key: **[NB2]** (M)
Press to toggle the Noise Blanker 2 for the main band between active and inactive. {page 6-9}

㉓ Noise Reduction 1 (Main band) key: **[NR1]** (M)
Press to toggle the Noise Reduction 1 for the main band between active and inactive. {page 6-13}

㉔ Noise Reduction 2 (Main band) key: **[NR2]** (M)
Press to toggle the Noise Reduction 2 for the main band between active and inactive. {page 6-13}

㉕ NR1 NR2 (M) controls
NR1 control: Rotate to adjust the level of Noise Reduction 1 for the main band. {page 6-14}

NR2 control: Rotate to adjust the level of Noise Reduction 2 for the main band. {page 6-14}

㉖ NB1 NB2 (M) controls
NB1 control: Rotate to adjust the Noise Blanker 1 level for the main band. {page 6-9}

NB2 control: Rotate to adjust the Noise Blanker 2 level for the main band. {page 6-9}

㉗ Clear key: **[CL]**
Press to clear the RIT and XIT frequencies. {page 5-13}

㉘ RIT/XIT control
Rotate to precisely tune the receive and transmit frequencies. {page 5-13}

The RIT frequency adjusted while "RIT" LED lights green will be activated, and the XIT frequency adjusted while "XIT" LED lights green will be activated.

㉙ XIT key: **[XIT]**
Press to toggle the XIT between ON and OFF. {page 5-13}

"XIT" LED

Lights green while the XIT is active. {page 5-13}

㉚ RIT key: **[RIT]**
Press to toggle the XIT between ON and OFF. {page 5-13}

"RIT" LED

Lights green while the RIT is active. {page 5-13}

㉛ Transverter key: **[XVTR]**
Press to toggle the Transverter between active and inactive. {page 16-33}

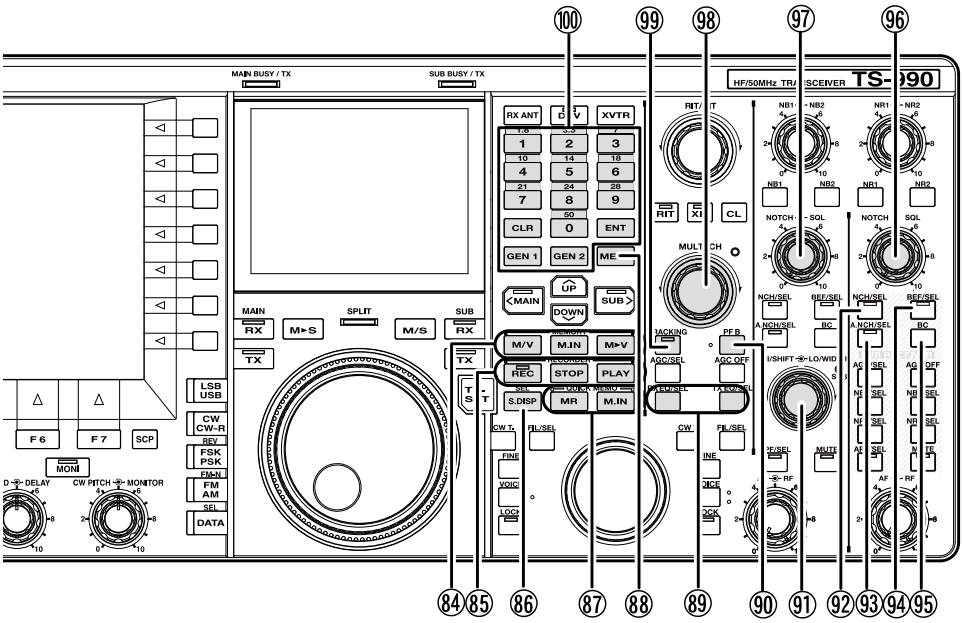
㉜ TX Drive Output key: **[DRV]**
Press to toggle the TX Drive Output between active and inactive. {page 4-21}

"DRV" LED

Lights green while the TX Drive Output is active.

㉝ Receive Antenna key: **[RX ANT]**
Press to toggle the input and output of the receive antenna between active and inactive. {page 4-20} {page 4-21}

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⑧④ Memory keys

[M/V] key

Press to toggle between Memory Channel mode and VFO mode. {page 10-4}

Press and hold to switch between Dual Memory Channel mode and VFO mode. {page 10-4}

[M.IN] key

Press to open the **Memory Channel List** screen. {page 10-7}

[M►V] key

The operating mode configured for the Memory Channel will be copied to the VFO. {page 10-6}

⑧⑤ Recorder keys

[REC] key

Press to start normal recording. Press while recording to pause the recording. {page 13-4} {page 13-5}

Press and hold to start constant recording. Depending on the configuration, the constant recorder function will retain the last 30 seconds audio. {page 13-6}

"REC" LED

Lights red while recording.

[STOP] key

Press to stop recording or playback.

[PLAY] key

Press to play back the latest audio file recorded. Press this key during playback to pause. {page 13-6} {page 13-2}

⑧⑥ [S.DISP/SEL] key

Press to change the display contents for the sub screen. {page 4-4}

Press and hold to switch between the standard display mode and the expanded display mode. {page 4-4}

⑧⑦ Quick Memory keys

[MR] key

Press to toggle the Quick Memory mode between active and inactive. {page 10-8}

Press and hold to clear all the operating data stored in Quick Memory Channels. {page 10-9}

[M.IN] key

Press to save data in Quick Memory Channels. {page 10-8}

⑧⑧ [MENU] key

Press to open the Menu screen. Press again while the **Menu** screen is open to close the **Menu** screen. {page 3-1}

⑧⑨ DSP Equalizer keys

[RXEQ/SEL] key

Press to toggle the RX DSP equalizer between active and inactive. {page 5-6}

Press and hold to open or close the RX Equalizer screen. {page 5-6}

[TXEQ/SEL] key

Press to toggle the TX DSP equalizer between active and inactive. {page 9-9}

Press and hold to open or close the TX Equalizer screen. {page 9-10}

⑨⓪ Programmable Function B key: [PF B]

Press to activate the function assigned to **[PF B]**. The default is "VOICE 3". {page 14-10}

⑨① HI/SHIFT LO/WIDTH controls

HI/SHIFT control

High Cut/Low Cut mode: Rotate to adjust the high cut frequency. {page 6-4}

Shift/Width Mode: Rotate to adjust the shift frequency. {page 6-5}

LO/WIDTH control

High Cut/Low Cut mode: Rotate to adjust the low cut frequency. {page 6-4}

Shift/Width mode: Rotate to adjust the bandwidth. {page 6-5}

"SUB" LED (HI/SHIFT LO/WIDTH controls)

Lights orange while the frequency can be changed using the **HI/SHIFT** and **LO/WIDTH** controls. {page 4-7}

⑫ Notch Filter (Sub band) key: **[NCH/SEL]** (S)
Press to toggle the Manual Notch Filter for the sub band between active and inactive. {page 6-10}

Press and hold to toggle the Manual Notch Filter bandwidth for the sub band between normal and wide. {page 6-10}

"NCH" (Sub band) LED

Lights green while the manual notch for the sub band is active. {page 6-11}

⑬ Automatic Notch Filter (Sub band) key: **[A.NCH/SEL]** (S)
Press to toggle the Auto Notch Filter between active and inactive.

Press and hold to open or close the Auto Notch Filter screen for the sub band. {page 6-11}

"A.NCH" (Sub band) LED

Lights green while the Automatic Notch Filter for the sub band is active.

⑭ Band Elimination Filter key: **[BEF/SEL]** (S)
Press to toggle the Band Elimination Filter for the sub band between active and inactive. {page 6-12}

Press and hold to open or close the Band Elimination Filter screen for the sub band. {page 6-12}

"BEF" (Sub band) LED

Lights green while the Band Elimination Filter for the sub band is active.

⑮ **[BC]** (S)
Press to cycle the Beat Cancel for the sub band through Beat Cancel 1, Beat Cancel 2 and Off. {page 6-14}

⑯ NOTCH SQL (S) control
NOTCH (S) control: Rotate to adjust the notch frequency while the manual notch filter is active. Rotate to adjust the center frequency while the band elimination filter is active. {page 6-10}

SQL (S) control: Rotate to adjust the squelch level for the sub band. {page 4-8}

⑰ NOTCH SQL (M) control
NOTCH (M) control: Rotate to adjust the notch frequency while the manual notch filter for the main band is active. Rotate to adjust the center frequency while the band elimination filter is active. {page 6-10}

SQL (M) control: Rotate to adjust the squelch level for the main band. {page 4-8}

⑱ MULTI/CH control
Rotate to increment or decrement the frequency step while in VFO mode. {page 4-13}

Rotate to increment or decrement the channel number while in Memory Channel mode or Quick Memory Channel mode. {page 10-5}

Rotate to show the next or previous parameter while the menu or a configuration screen appears.

"Multi/Channel" LED

Lights orange when changing the channel number, or when the configuration item or parameter other than the frequency is changed.

⑲ Tracking key: **[TRACKING]**
Press to toggle frequency tracking between active and inactive. {page 5-3}

"TRACKING" LED

Lights green while frequency tracking is active. {page 5-3}

⑳ Numeric and Band Selection Keypad

[ENT] key

Press to enter an operating frequency using the keypad (numeric mode). After entering the frequency, press again to apply the new frequency.

[0 (50)] to [9 (28)]

Press (in numeric mode) to enter a number. Press to enter a number for the shift frequency while in split mode. Press, as the band selection key, to select the frequency band.

[GEN1]

Press to select General Coverage Band 1.

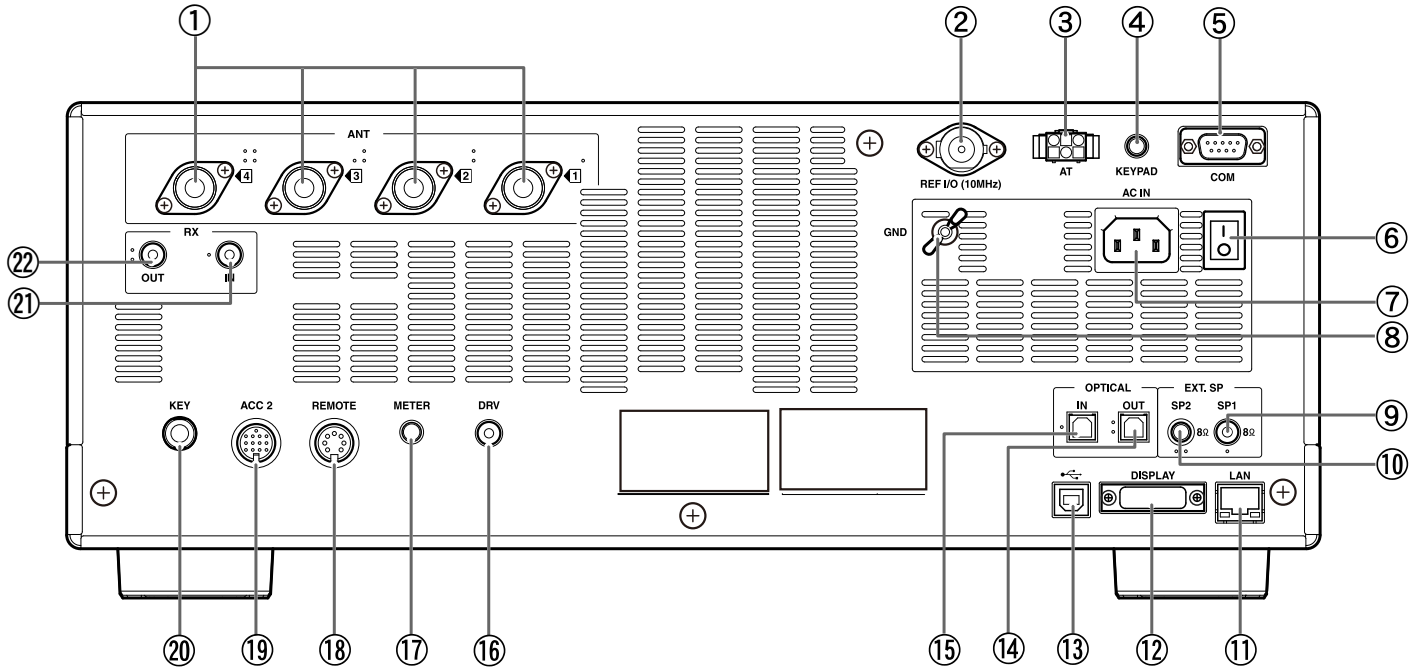
[GEN2]

Press to select General Coverage Band 2.

[CLR]

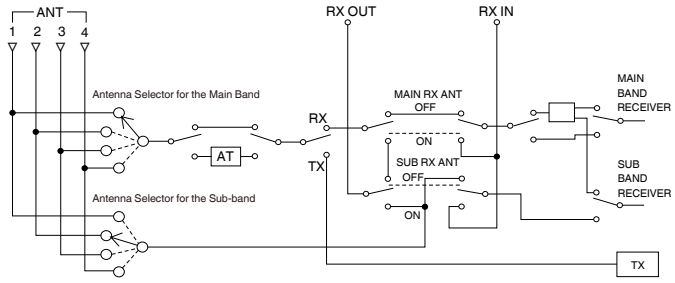
Press to discard an entered value.

REAR PANEL



① ANT 1 to ANT 4 (Antenna 1 to Antenna 4) connectors
For use with 50Ω antenna. These SO-239 / M-type coaxial connectors can connect a maximum of four antennas. {page 1-8}

Refer to the antenna systems conceptual drawing shown below:



② REF I/O (10 MHz) connector
Sends and receives the 10 MHz reference signal. {page 16-22}

③ AT Connector
Connect a control cable for an external antenna tuner. {page 1-8}, {page 1-10}

Refer to the instruction manuals supplied with the antenna tuner for further details.
- Input Impedance: 50Ω
- Input Level: 0 dBm ± 10 dB
- Output Level: 0 dBm

④ KEYPAD jack
You can connect a personalized (self-made) PF keypad to the **KEYPAD** connector. You can assign the desired function to the keypad from the specified functions. {page 16-7}

⑤ COM connector
This is an RS-232C connector for connection to a PC. This enables PC control and memory management. Connects to a PC using a commercially available RS-232C straight cable; do not use a "crossed" type cable. {page 1-5},{page 1-10}

⑥ Main Power (I/O) switch
Shuts down (O) or applies (I) the main power source to the transceiver.

While the main power (I/O) switch is in the "O" position, you cannot start up the transceiver by pressing [⏻] (⏻). {page 4-1}

⑦ AC IN connector
This is the connector for the AC main power source input. Use the supplied AC power cable to connect to a 120 V rating AC outlet (K-Type) or a 220-240 V rating AC outlet (E-Type). Do not use a power cable other than supplied with this product. Do not use or modify K-Type Cable for AC 220 - 240 V Operation. Do not use or modify E-Type Cables for AC 120 V Operation. {page 1-1}

⑧ GND terminal
Connects to ground. Ensure that this terminal has been grounded, to prevent electric shock or equipment interference. {page 1-1}

⑨ EXT SP1 (External Speaker 1) jack

⑩ EXT SP2 (External Speaker 2) jack
Connects to an external speaker. Use only external speakers with an impedance 4Ω to 8Ω. You can configure the audio signal sent to the external speaker using the menu. {page 16-17}

If an external speaker is connected to the **EXT SP1** connector, the audio line to the internal speaker is muted. If an external speaker is connected to the **EXT SP 2** connector, the audio line to the internal speaker will not be muted.

⑪ LAN connector
Connects to a PC and LAN so as to operate with KNS (KENWOOD NETWORK COMMAND SYSTEM) or to automatically correct the clock. {page 1-9}

⑫ DISPLAY connector
Connects to an external display unit. You can mirror the main screen display onto an external monitor. {page 16-18}

The **DISPLAY** connector contains a DVI-I connector which can transfer both digital and analog RGB signals.

To connect to an analog RGB display having a D-sub 15-pin connector, use a commercially available conversion connector.

Note:

- To connect to an external display unit, you must use a DVI cable with a line filter (commercially available). If no snap-on ferrite core is available on the cable, you must snap the line filter, supplied with the transceiver (E-type only), on to the DVI cable.
- Use an external display with 800x600 or 848x480 resolution.

⑬ (USB-B) connector

Connects to a PC. This can be used when the transceiver is remotely controlled using ARCP-990, when the received audio is played using a PC, or when the firmware is being updated. Use a commercially available USB cable with a USB-B type connector. {page 1-5}

⑭ OPTICAL OUT (Optical Digital Audio Output) connector

An audio device with an optical digital input terminal can be connected. {page 16-19}

Sampling Rate/Bit: 48 kHz/ 24 bits

⑮ OPTICAL IN (Optical Digital Audio Input) connector

An audio device with an optical digital output terminal can be connected. {page 16-19}

Sampling Rate/Bit: 48 kHz and 44.1 kHz/24 bits and 16 bits

Note:

- To connect to external equipment, use a commercially available optical cable.

⑯ DRV (Drive Output) terminal

Connects to a transverter or linear amplifier (1 mW typical output level). {page 4-21}, {page 16-33}

⑰ METER connector

Connects to a meter (commercially available). Use a meter with the following specifications:

- Input Impedance: 4.7kΩ
- Open End Voltage: 0 to 5 V

Note:

- The default is 50% of the open end voltage (2.5 V). The output level can be changed in Advanced Menu 2. {page 16-15}

⑱ REMOTE connector

Mates with a linear amplifier, foot switch and other external equipment. Use the supplied 7-pin DIN plug to mate with. {page 1-6}, {page 1-10}

⑲ ACC 2 connector

Connects to an external equipment such as an external terminal. Use the supplied 13-pin DIN plug to mate with. {page 1-8}, {page 1-10}

⑳ KEY jack

Connects to an electronic keyer such as a bug key or electronic keyer, and a PC keyer. Depending on the menu configuration, you can use the internal electronic keyer with a paddle connection. {page 5-19}

㉑ RX IN connector

Connects to an antenna dedicated for reception, an external BPF, a transverter, etc. When active, signals from this connector replace those from ANT1 - ANT4 (for RX only). {page 4-21}

㉒ RX OUT connector

Connects to an external BPF, another receiver, a transverter, etc. Connecting the signal from the **RX OUT** connector to the **RX IN** connector enables reception by the internal receiver.

MICROPHONE (OPTION)

① PTT (Push-to-talk) switch

Hold down this switch to transmit. Release the switch to receive.

② UP/ DOWN keys: **[UP]**/**[DOWN]** (microphone)

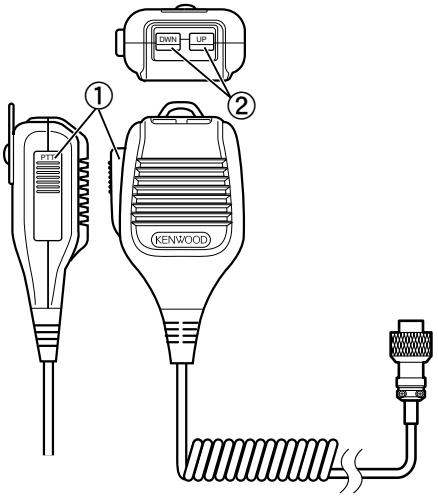
Press to increment or decrement the VFO frequency or select the previous or next items in the following mode.

Press and hold these keys to continuously increment or decrement the parameters. You can assign functions to the keys, as function keys. {page 16-5}

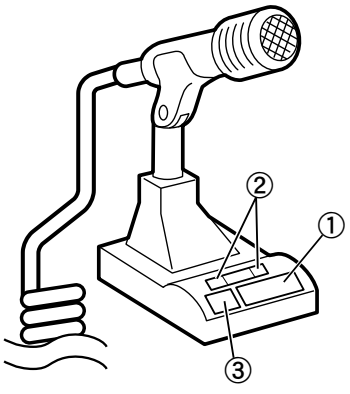
- VFO mode: Press to increment or decrement the VFO frequency.
- Memory Channel Mode; Press to increment or decrement the memory channel number.
- Memory Scroll Mode: Press to increment or decrement the memory scroll number.
- CW Paddle: This function allows you to send CW without using an external key/paddle. The Mic [UP] and Mic [DWN] keys can be used as a manual paddle keyer.
- Menu: Press to show the next or previous parameter.

③ LOCK key **[LOCK]** (MC-60A/MC-90 only)

Press to lock the PTT key in Transmit. Press again to revert to Receive mode.



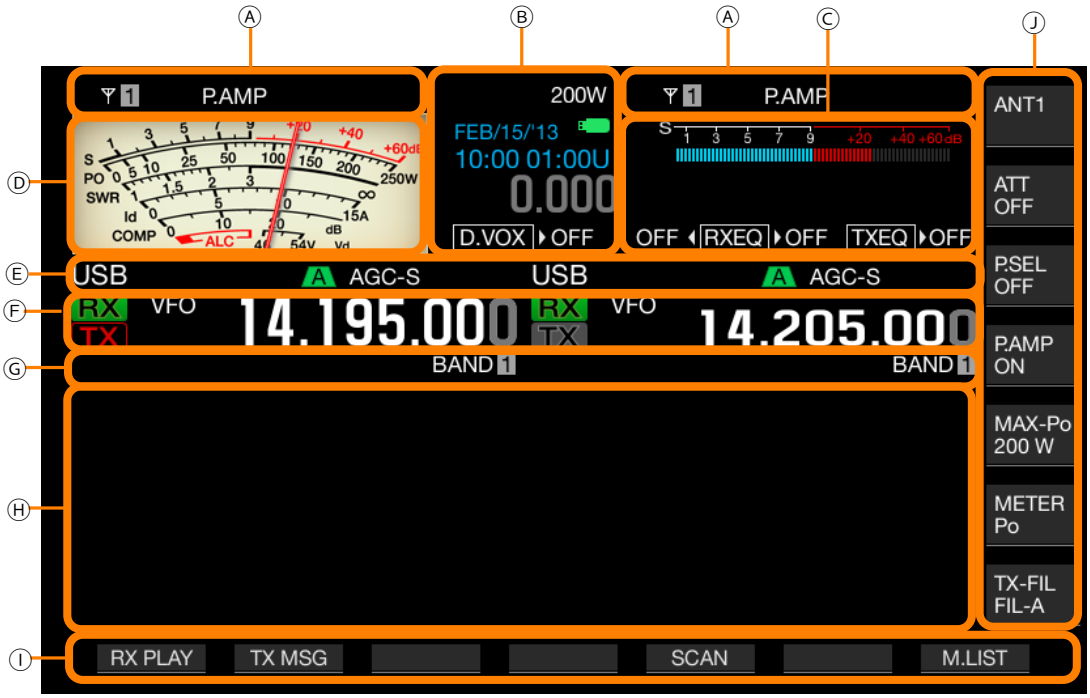
MC-43S



MC-60A/MC-90

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MAIN SCREEN



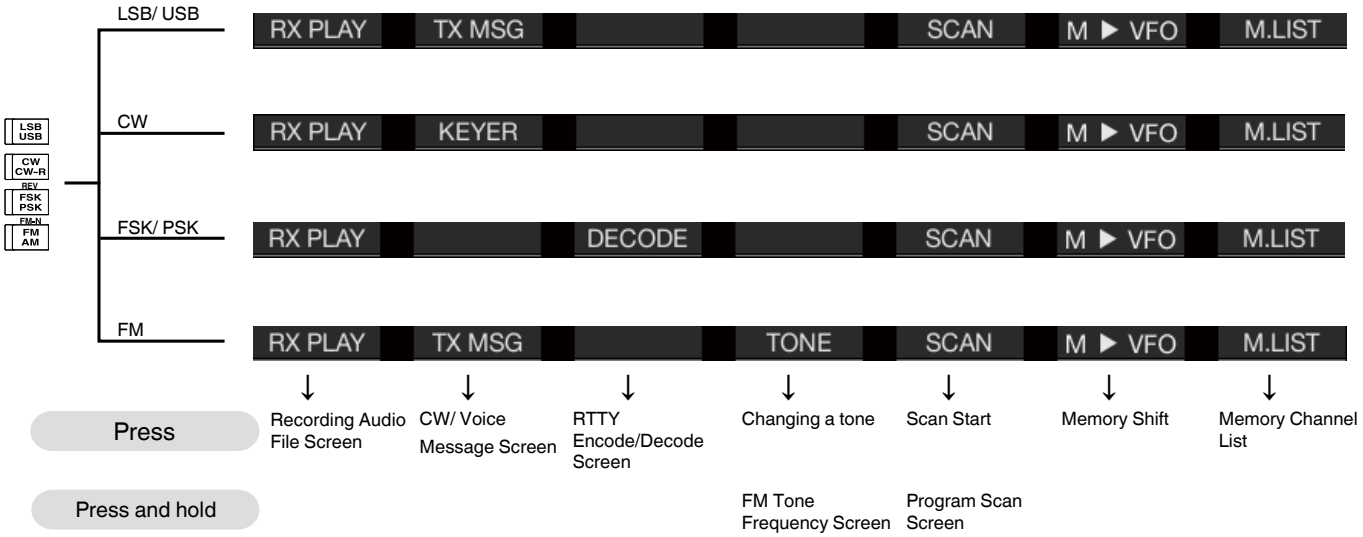
Area	Display	Description	Ref. Page
A	1	Displays the antenna number. The antenna number changes when you change the antenna. Disappears when the transmit signal is sent through the DRV connector to a transverter.	{page 4-20}
	RX	Appears while the antenna dedicated for reception is active.	{page 4-21}
	ATT	Appears if "-6 dB", "-12 dB" or "-18 dB" has been selected for the reception attenuator.	{page 6-1}
	P.AMP	Appears while Receive Preamplifier is active.	{page 5-9}
	NR1 NR2	Appears while Noise Reduction 1 (NR1) is active. Appears while Noise Reduction 2 (NR2) is active.	{page 6-13}
	NB1 NB2 NB1 2	Appears while Noise Blanker 1 (NB1) is active. Appears while Noise Blanker 2 (NB2) is active. Appears while Noise Blanker 1 (NB1) and Noise Blanker 2 (NB2) are active.	{page 6-9}
B	AT T	Appears while the internal antenna tuner is active. "T" blinks while in tuning.	{page 4-21}
	R AT T	Appears while an external antenna tuner or the internal antenna tuner for RX is active. "R" and "T" blinks while tuning.	{page 4-21}
	XVTR	Appears while a transverter is active.	{page 16-33}
	TX TUNE	Appears and disappears alternately while TX Tuning is active.	{page 9-13}
	200W	Displays the transmit power level. Disappears when the transmit signal is sent through the **DRV** connector.	{page 4-17}
	30WPM	Displays the keying speed. When rotating the **KEY SPEED** control, displays the keying speed value (4 to 60 words per minute) in the TX display for two seconds.	{page 5-19}
	FEB/15/'13	Displays the date for the local clock. You can select the display format from the English, US and Japanese.	{page 15-1}
	10:00 01:00U	Displays the clock in the 24-hour format. Left: Displays the time for the local clock. Right: Displays the time for the second clock ("U" is added to the end of the second clock).	{page 15-1}
		Starts blinking when a USB flash drive is connected and lights after the transceiver recognizes the USB flash drive.	{page 12-1}
	RIT	Appears while RIT is active.	{page 5-13}
	XIT	Appears while XIT is active.	{page 5-13}

Area	Display	Description	Ref. Page
B	-4.120	Displays the RIT or XIT frequency in the range from -9.999 kHz to 9.999 kHz.	{page 5-13}
	D.VOX NONE	The status varies depending on the audio source for the transmit audio selected using the Data VOX. OFF: Appears if no source is selected. "ACC 2" appears when the audio source is the **ACC 2** connector. "USB" appears when the audio source is the USB audio line. "OPT." appears when the audio source is the SPD I/F.	{page 9-2}
C	PLAY	Appears during quick replay of audio that was recorded using normal or constant recording.	{page 13-4}
	PAUSE	Appears while quick replay of audio that was recorded using normal or constant recording is paused.	
	REC	Appears during the normal recording.	
		Appears during quick replay of audio after recording and while play of the audio is paused.	{page 13-6}
	TXEQ BB2	Appears followed by the configuration for the TX DSP equalizer. OFF, HB1, HB2, FP, BB1, BB2, C, U1, U2, U3	{page 9-9}
	FLAT RXEQ BB2	Left: Appears according to the configuration of the main band RX DSP Equalizer. OFF, HB1, HB2, FP, BB1, BB2, FLAT, U1, U2, U3 Right: Appears according to the configuration for RX DSP Equalizer for the sub band. OFF, HB1, HB2, FP, BB1, BB2, FLAT, U1, U2, U3	{page 5-6}
		Displays the S-meter dedicated to the sub band.	{page 4-18}
D		Displays the meter dedicated to the main band. • The meter can be displayed as either analog or digital. • Two styles of analog meter can be selected.	{page 4-19}
E	USB	Displays the operating mode in use. Appears in yellow while Auto Mode is active. Displays the mode name and the sub number (D1, D2 and D3) while in the DATA mode.	{page 4-10} {page 4-11}
	NOTCH	Appears while Manual Notch, for which Normal has been configured for the notch bandwidth, is active.	{page 6-10}
	NOTCH W	Appears while Manual Notch, for which Wide has been configured for the notch bandwidth, is active.	{page 6-10}
	BEF	Appears while the Band Elimination Filter is active.	{page 6-12}
	NOTCH	Appears while the Auto Notch Filter is active.	{page 6-11}
	A B C	Displays the selected IF filter.	{page 9-8}
	BC 1	Appears while Beat Canceller 1 (BC1) is active.	{page 6-14}
	BC 2	Appears while Beat Canceller 2 (BC2) is active.	
	AGC OFF	Appears while the AGC is inactive.	{page 5-4}
	AGC-S	Appears while the AGC is in the slow state.	
	AGC-F	Appears while the AGC is in the fast state.	
	AGC-M	Appears while the AGC is in the medium speed.	
	TONE	Appears while the tone function is active.	{page 5-30}
	CT	Appears while the CTCSS is active.	{page 5-33}
	CROSS	Appears while Cross Tone is active.	{page 5-34}
F	TX	Appears while receiving on the transmit band.	{page 5-1}
	TX	Displays the transmitting band. (Only one transmit band for the main band and sub band can be displayed.) Appears while transmitting on the transmit band.	

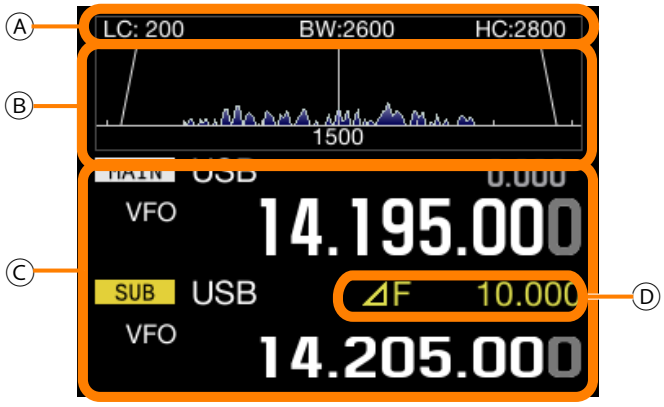
Area	Display	Description	Ref. Page
F	RX	Displays the receiving band.	{page 5-1}
	VFO	Appears while the VFO mode or auto mode frequency is being configured.	{page 4-11}
	E9	Displays the entry history while in VFO mode or in frequency entry mode.	{page 4-15}
	M.CH 01	Appears while transmitting or receiving using the operating information from a memory channel. Displays the memory channel in the range of 00 to 99, P0 to P9 and E0 to E9.	{page 10-4}
	M.CH 01	Appears while transmitting or receiving using the operating information from a dual memory channel. Displays the memory channel in the range of 00 to 99 and E0 to E9.	{page 10-3}
	Q.MR Q1	Appears while in Quick Memory Channel mode. Displays one of the quick memory channel numbers Q0 to Q9.	{page 10-8}
	14.195.000	Displays the current frequency. This example displays the status during fine tuning.	{page 4-12}
G	MEMONAME10	Displays the Memory Channel name.	{page 10-8}
	SCAN-SPDn	Displays the scan speed (not in FM mode)	{page 11-2}
	SCANNING	Appears during program scan, memory scan, or quick memory scan.	{page 11-1}
	SCAN-SLOW	Appears during Program Slow Scan.	{page 11-3}
	CW TUNE	Appears during CW Auto Tune.	{page 5-17}
	BAND 1	Displays the memory band name of the inquired memory number.	{page 10-8}
	L.OUT	Appears if a locked-out channel has been selected.	{page 11-5}
H	Configuration Screen BANDSCOPE	Opens the configuration or **Bandscope** screen. Normally, the display is blank.	{page 7-1}
I	Key Guide (F1 to F7)	Displays the function key names along the bottom edge of the main screen.	{page 4-3}
J	Key Guide (F)	Displays the function key names along the right side of the main screen.	{page 4-3}

Note:

- If displays for the main band are identical to those for the sub band, selecting the main band for operation deactivates the sub band and displays for the sub band gray out.
- The principle display of the key guide is as follows:



SUB-SCREEN



Dual Frequency Display
(Main Band Frequency and Sub-band Frequency)



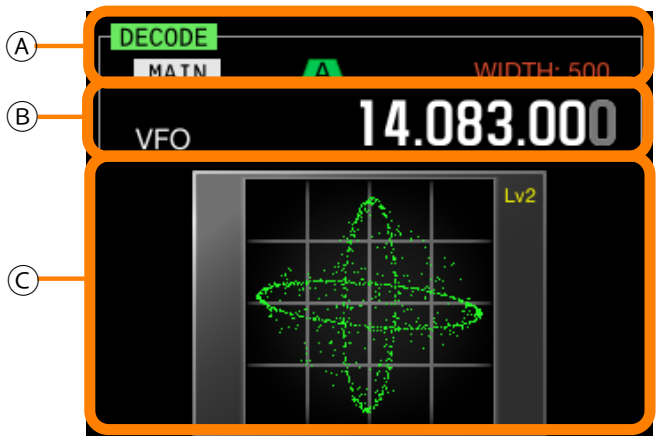
Single Frequency Display
(Main Band Frequency/Dial)

Note:

♦ Pressing **[S.DISP/SEL]** changes the sub screen displays. Refer to "BASIC OPERATIONS" for further details. {page 4-4}

Area	Display	Description	Ref. Page
A	BW:2600 BW:2600 HC:2800	Displays the pass band characteristics of the RX filter. Rotating the **HI/SHIFT** or **LO/WIDTH** control reverses the display numerals (from white on black to black on white) for 2 seconds. WIDTH: Appears while in CW, FSK, PSK, or DATA mode. SHIFT: Appears while in CW, or DATA mode. LC: Appears while in SSB, FM or AM mode. HC: Appears while in SSB, FM, or AM mode. BW: Appears while in SSB, FM, or AM mode.	{page 4-4}
B		Displays the filter width, followed by the low cut or high cut frequency and the shift frequency, as well as the filter type.	{page 4-4}
		Displays the frequency spectra which are fast Fourier transformed (FFT) on the AF stage while transceiver is in the transmit state.	
		Displays the center pointer of the notch frequency. Appears while either the Manual Notch Filter or the Band Elimination Filter is active. Rotating the **NOTCH** control shifts the center pointer of the notch frequency to the left or right.	
		In the center, the pitch frequency is displayed in CW mode - the center frequency is displayed in all other modes.In CW mode, the frequencies of the pass bandwidth appears appear at both outer edges. If the passband of the filer for the shift operation is wider than the display area, a triangle appears.	
C	MAIN / SUB	Shows the selected band, either the main band or the sub band.	{page 4-7}
	USB	Displays the operating mode in use. Appears in yellow while Auto Mode is active. Displays the mode name and the sub number (-D1, -D2 and -D3) while in the DATA mode.	{page 4-10}
	RIT or XIT	Appears coupled with the frequency while either RIT or XIT is active.	{page 5-13}
	M.SCR	Displays while scrolling the memory channels.	{page 10-4}
	M.CH 01	Appears while transmitting or receiving using the operating information from a memory channel.	{page 10-4}
	M.CH 01	Appears while in Dual Memory Channel mode.	{page 10-4}
	Q.MR Q1	Appears while in Quick Memory Channel mode.	{page 10-8}
	VFO	Appears while in VFO mode.	{page 10-4}
	00	Shows E0 to E9 in the entry history display, 00 to 99 for M.CH or M.SCR, and Q0 to Q9 for Quick Memory Channel as the channel number.	{page 10-8}
D	ΔF 10.000	Displays the frequency difference between the main band frequency and the sub band frequency. Appears while in Split mode.	{page 5-1}
E		Displays a dial. (Displays while only main band frequency in the standard mode is selected.) Displays the sub band frequency while both the main band frequency and the sub band frequency are displayed.	{page 4-4}

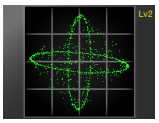
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X-Y Scope



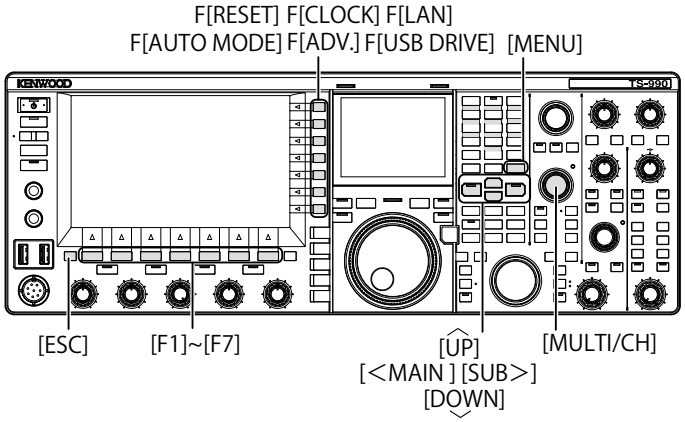
Vector Scope

Area	Display	Description	Ref. Page
A	DECODE	Appears while decoding in RTTY (FSK) or PSK mode.	{page 5-35}
	MAIN SUB	Displays the selected band to decode, either the main band or the sub band.	{page 5-36}
	A B C	Displays the selected IF filter.	{page 9-8}
	WIDTH: XXXX	Displays the pass band width for the IF filter. Rotating the **LO/WIDTH** control reverses the display numerals (from white on black to black on white) for 2 seconds.	{page 6-2}
B	14.195.000	Displays the current frequency.	{page 4-12}
	MAIN / SUB	Shows the selected band, either the main band or the sub band.	{page 4-7}
	M.SCR	Appears while scrolling the memory channels.	{page 10-4}
	M.CH 01	Appears while in Memory Channel mode.	{page 10-4}
	M.CH 01	Appears while in Dual Memory Channel mode.	{page 10-4}
	Q.MR Q1	Appears while in Quick Memory Channel mode.	{page 10-4}
	VFO	Appears while in VFO mode.	{page 10-4}
	00	Displays the channel number, 00 to E9 while in Memory Channel mode or Memory Scroll mode or Q0 to Q9 while in quick Memory mode.	{page 10-8}
C		Displays the X-Y scope. Displays the tracing speed and level of roughness (Level 1 to Level 3) of the X-Y scope.	{page 4-4}
		Displays the vector scope. Displays the type of PSK, either BPSK or QPSK.	{page 4-4}

MENU CONFIGURATIONS

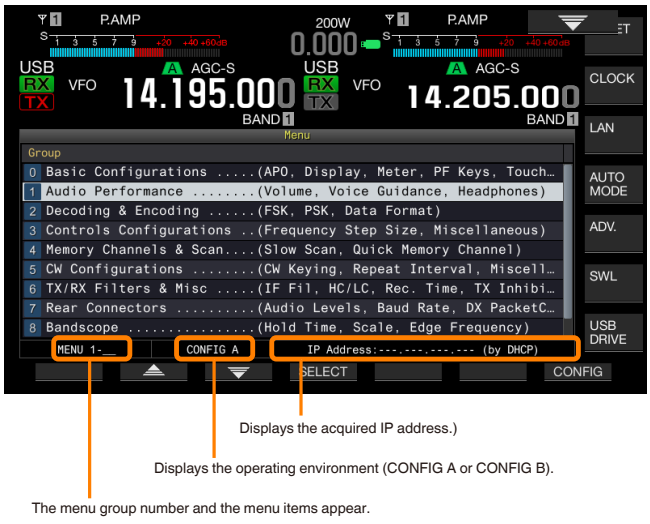
In the **Menu** screen, you can configure and edit various functions of this transceiver as well as change the operating environment.

This transceiver's Menu contains common functions and configurations, along with 5 sub menus categorized for those sub menu groups.



OPENING THE MENU

1 Press **[MENU]** to open the **Menu** screen.



2 Press [▲] (F2) or [▼] (F3) to select a group.

3 Press **[SELECT]** (F4) or **[SUB>]** to display the menu items of the selected group.

4 Press [▲] (F2) or [▼] (F3) to select a menu item.

5 Press **[SELECT]** (F4) or **[SUB>]** to allow editing of the parameter box.
The parameter box becomes active, and the parameter can be changed.

6 Press **[–]** (F4) or **[+]** (F5) to select a parameter.
The parameter for the menu item varies.

7 Press [↩] (F1) to revert to the previous screen.
The selected parameter has determined.

8 Press **[MENU]** to end.

OPENING THE SUB MENU

1 Press **[MENU]** to open the **Menu** screen.

2 Press the function key for the key guide on the right side of the main screen.
Following are the sub menu that appears on the screen.

Sub Menu	Key Guide	Summary of Changes
Reset	**RESET**	A menu which allows you to reset the transceiver to its default state.
Clock	**CLOCK**	A menu which allows you to configure the internal clocks.
LAN	**LAN**	A menu which allows you to configure the connections to your LAN.
AUTO MODE	**AUTO MODE**	A menu which allows you to configure the upper and lower limit frequencies.
Advanced	**ADV.**	An advanced menu that allows detailed advanced configurations including connections to external devices.
SWL	**SWL**	A key which activates and displays “Short Wave Listener” style horizontal dials with a vertical meter.
USB Flash Drive	**USB DRIVE**	A menu which allows you to manage a USB flash drive.

COMMON OPERATION IN THE MENU SCREEN

- Pressing **[MENU TOP]** (F) reverts to the **Menu** screen.
- Press [▲] (F2) or [▼] (F3) to scroll through the menu groups.
- Each menu can be selected with the operation below.
  - Rotate the **[MULTI/CH]** control.
  - Press [▲] (F2) or [▼] (F3).

  Press **[UP]** or **[DOWN]**.
- The parameter for the menu item with an editable parameter box can be selected as follows:
  - Rotate the **[MULTI/CH]** control.
  - Press **[UP]** or **[DOWN]**.
  - Press **[–]** (F4) or **[+]** (F5).
  - Press [◀] or [▶].
  - Press the **[UP]** or **[DOWN]** (microphone).
- Pressing and holding **[(RESET)]** (F1) reverts the parameters to their defaults.

CLOSING THE MENU

If you finish the configuration or edit in the Menu screen, or if you wish to finish the operation during the menu item configuration, follow the procedure below. The **Menu** screen closes, the normal screen reappears.

1 Press **[MENU]** or **[ESC]**.

Note:

- All configurations in the **Menu** screen can be reset to the default parameters. {page 16-4}
- Menu contents, such as the menu item name and default parameters, are subject to change due to design change and innovations.
- During configuration of the screen saver or the power-on message, pressing **[MENU]** does not close the **Menu** screen.

SWITCHING THE OPERATING DATA BETWEEN CONFIG A AND CONFIG B

Parameters configured in the menu and various configurations for operation are jointly called the operating environment. The transceiver has CONFIG A and CONFIG B as two separate environments. Both contain the same configuration items, allowing you to configure them individually. For example, CONFIG A might be configured for DX hunting and CONFIG B for rag-chewing, and you can quickly switch from one to another.

1 Press **[MENU]** to open the **Menu** screen.

2 Press **[CONFIG]** (F7).

3 Press **[OK]** (F4) to switch CONFIG A to CONFIG B.
After changing the configuration, you can immediately operate the transceiver with the new configuration enabled. Pressing **[CANCEL]** (F7) reverts to the **Menu** screen.

Note:

- The current status of the operating environment, either "CONFIG A" or "CONFIG B", appears on the status bar of the **Menu** screen. Also, the operating environment data can be stored to or read from a USB flash drive. {page 12-1}
- Following are the configurations that are common to CONFIG A and CONFIG B.
  - Baud rate for the COM port
  - Baud rate for the USB port
  - The number of quick memories
- The [MR] (Quick Memory) function {page 10-8} includes some operating environment parameters. Changes made to CONFIG A or CONFIG B here will clear the QM operating environment and then switch to the new operating environment.

MENU ITEMS

Basic Configurations (Group 0)					
Menu	Display	Configuration	Range	Default	Reference Page
Display					
0-00	Color Display Pattern (Main Screen)	The background color pattern for the main screen	Type 1, Type 2, Type 3	Type 1	4-5
0-01	Color Display Pattern (Sub Screen)	The background color pattern for the sub-screen	Type 1, Type 2, Type 3, Same as Main	Same as Main	4-5
0-02	Font Style (Frequency Display)	Font style to be applied to the frequency display	Font 1, Font 2, Font 3	Font 1	4-5
0-03	Dial Color Pattern	The background color pattern for the sub-screen dial	Type 1, Type 2	Type 1	4-6
0-04	Screen Saver	Pattern of the screen saver	Off, Type 1, Type 2	Off	16-1
0-05	Screen Saver Wait Time	Wait time until the screen saver activates	Preview (5 [sec]), 5, 15, 30, 60 [min]	Preview (5 [sec])	16-2
0-06	Screen Saver Message	A message embedded in the screen saver	A maximum of 10 alphanumeric characters	TS-990	16-2
0-07	Power-on Message	A message appearing during power up	A maximum of 15 alphanumeric characters	HELLO	16-1
Meter					
0-08	FM Mode S-meter Sensitivity	S-meter sensitivity in FM mode	Low, High	High	5-29
0-09	Meter Response Speed	ANALOG METER RESPONSE SPEED	1 to 4	3	4-19
0-10	Meter Display Pattern	Display pattern for a meter	Type 1, Type 2, Type 3	Type2	4-18
Key					
0-11	Meter Display Peak Hold	METER PEAK-VALUE HOLD	Off, On	On	4-19
0-12	Long Press Duration of Panel Keys	Duration for a long press of the panel keys	200 to 2000 [ms] (in steps of 100 [ms])	500 [ms]	16-5
0-13	Touchscreen Tuning	Touchscreen Tuning function (Main display)	Off, On	On	16-3
0-14	Operating Band (High/Low & Shift/Width Controls)	Selection of band for the **High/Low** and **Shift/Width** controls	Main and Sub Bands, Main Band only	Main and Sub Bands	16-4
0-15	PF A: Key Assignment	Assignment of the programmable function to **[PF A]**	Refer to the programmable function key list.	VOICE 2	16-6
0-16	PF B: Key Assignment	Assignment of the programmable function to **[PF B]**	Refer to the programmable function key list.	VOICE 3	16-6
0-17	VOICE (Main Band): Key Assignment	Assignment of the programmable function to **[VOICE]** (M)	Refer to the programmable function key list.	VOICE1 (Main Band)	16-6
0-18	VOICE (Sub Band): Key Assignment	Assignment of the programmable function to **[VOICE]** (S)	Refer to the programmable function key list.	VOICE1 (Sub Band)	16-6
0-19	External PF 1: Key Assignment	Assignment of the programmable function to **[PF 1]** (Keypad)	Refer to the programmable function key list.	Message Memory CH1	16-7
0-20	External PF 2: Key Assignment	Assignment of the programmable function to **[PF 2]** (Keypad)	Refer to the programmable function key list.	Message Memory CH2	16-7

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Basic Configurations (Group 0)					
Menu	Display	Configuration	Range	Default	Reference Page
0-21	External PF 3: Key Assignment	Assignment of the programmable function to **[PF 3]** (Keypad)	Refer to the programmable function key list.	Message Memory CH3	16-7
0-22	External PF 4: Key Assignment	Assignment of the programmable function to **[PF 4]** (Keypad)	Refer to the programmable function key list.	Message Memory CH4	16-7
0-23	External PF 5: Key Assignment	Assignment of the programmable function to **[PF 5]** (Keypad)	Refer to the programmable function key list.	Message Memory CH5	16-7
0-24	External PF 6: Key Assignment	Assignment of the programmable function to **[PF 6]** (Keypad)	Refer to the programmable function key list.	Message Memory CH6	16-7
0-25	External PF 7: Key Assignment	Assignment of the programmable function to **[PF 7]** (Keypad)	Refer to the programmable function key list.	Message Memory CH7	16-7
0-26	External PF 8: Key Assignment	Assignment of the programmable function to **[PF 8]** (Keypad)	Refer to the programmable function key list.	Message Memory CH8	16-7
0-27	Microphone PF 1: Key Assignment	Assignment of the programmable function to **[PF 1]** (microphone)	Refer to the programmable function key list.	MAIN	16-7
0-28	Microphone PF 2: Key Assignment	Assignment of the programmable function to **[PF 2]** (microphone)	Refer to the programmable function key list.	TX (Sub Band), (Split Frequency)	16-7
0-29	Microphone PF 3: Key Assignment	Assignment of the programmable function to **[PF 3]** (microphone)	Refer to the programmable function key list.	SUB	16-7
0-30	Microphone PF 4: Key Assignment	Assignment of the programmable function to **[PF 4]** (microphone)	Refer to the programmable function key list.	M▶V (Memory)	16-7
0-31	Microphone DOWN: Key Assignment	Assignment of the programmable function to **[DOWN]** (Microphone)	Refer to the programmable function key list.	DOWN Key (Microphone)	16-7
0-32	Microphone UP: Key Assignment	Assignment of the programmable function to **[UP]** (Microphone)	Refer to the programmable function key list.	UP Key (microphone)	16-7
0-33	Automatic Power Off	APO (Automatic Power Off)	Off/ 60/ 120/ 180 [min]	Off	15-7

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1-00	Beep Volume	Beep Volume	Off or 1 to 20 (in steps of 1)	10	16-5
1-01	Voice Message Volume (Play)	Volume level during playback of a Voice Message	Off or 1 to 20 (in steps of 1)	10	13-3
1-02	Sidetone Volume	Volume level of the sidetone	Linked with Monitor Control, Off, or 1 to 20 (in steps of 1)	Linked with Monitor Control	5-16
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1-03	Voice Guidance Volume	Volume for Voice Guidance	Off or 1 to 20 (in steps of 1)	10	14-1
1-04	Voice Guidance Speed	Selecting the Voice Guidance Speed	1 to 4 (in steps of 1)	1	14-1
1-05	User Interface Language (Voice Guidance & Messages)	The language applied to Voice Guidance and Message displays	English, Japanese	English	14-1
1-06	Automatic Voice Guidance	Enabling the Automatic Voice Guidance	On, Off	Off	14-2
Headphones					
1-07	Headphones Mixing Balance	Mixing balance for a set of headphones	0 to 10 (in steps of 1)	10	4-23
1-08	Headphones Left/Right Reverse	Reversing the left and right position of the headphones	Off, On	Off	4-23

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Menu	Display	Configuration	Range	Default	Reference Page
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2-00	FFT Scope Averaging (RTTY Decode)	Averaging in the FFT scope (RTTY Decode)	0 to 9 (in steps of 1)	0	5-38
2-01	RX UOS	RX Unshift On Space	Off, On	On	5-42
2-02	Newline Code	Type of newline code (RX)	CR+LF, All	All	5-43
2-03	Diddle	Diddle	Off, Blank Code, Letters Code	Blank Code	5-43
2-04	TX UOS	TX Unshift On Space	Off, On	On	5-44
2-05	Automatic Newline Insertion	Automatic insertion of a newline code	On, Off	On	5-44
FSK key					
2-06	FSK Spacing	Bandwidth for the FSK shift	170, 200, 425, 850 [Hz]	170 [Hz]	5-46
2-07	FSK Keying Polarity	Polarity of the FSK keying	Off, On	Off	5-47
2-08	FSK Tone Frequency	Tone frequency for FSK	1275, 2125 [Hz}]	2125 [Hz]	5-46
PSK Decode					
2-09	FFT Scope Averaging (PSK Decode)	Averaging in the FFT scope (PSK Decode)	0 to 9 (in steps of 1)	0	5-52
2-10	PSK AFC Tuning Range	Tuning range for PSK AFC	±15, ±8 [Hz]	±15 [Hz]	5-54
2-11	PSK Tone Frequency	Tone frequency for PSK	1.0, 1.5 2.0 [kHz]	1.5 [kHz]	5-60
Common					
2-12	RTTY/PSK Log File Format	Log file format for RTTY and PSK logs	html, txt	txt	5-51
2-13	RTTY/PSK Time Stamp	Timestamp for the RTTY and PSK logs	Off, Time Stamp, Time Stamp+Frequency	Time Stamp + Frequency	5-59
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3-01	SSB/CW/FSK/PSK Mode Frequency Step Size (Multi/Channel Control)	Frequency step size of the **Multi/ Channel** control for use in SSB, CW, SK and PSK modes	0.5, 1, 2.5, 5, 10 [kHz]	5 [kHz]	4-13
3-02	AM Mode Frequency Step Size (Multi/ Channel Control)	Frequency step size of the **Multi/ Channel** control for use in AM mode	5, 6.25, 10, 12.5, 15, 20, 25, 30, 50, 100 [kHz]	5 [kHz]	4-13
3-03	FM Mode Frequency Step Size (Multi/ Channel Control)	Frequency step size of the **Multi/ Channel** control for use in FM mode	5, 6.25, 10, 12.5, 15, 20, 25, 30, 50, 100 [kHz]	10 [kHz]	4-13
3-04	Frequency Step Size (Up/Down Keys)	Frequency step size for the Up and Down keys	100, 500 1000 [kHz]	1000 [kHz]	4-14
3-05	9 kHz Step in AM Broadcast Band (Multi/ Channel Control)	Frequency step size of the **MULTI/CH** control for the BC band (AM mode)	Off, On	Off (K-type) On (E-type)	4-14
3-06	Tuning Control (Main): Number of Steps per Revolution	The number of steps per revolution of the **Tuning** (M) control	250. 500, 1000 [Step]	In steps of 1000	4-12
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6-02	Time-out Timer	Maximum continuous transmit time (time-out timer)	Off, 3, 5, 10, 20, 30 [min]	Off	9-14
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6-10	VOX Voice Delay (Except Microphone)	Voice Delay Time (other than for the microphone line) while the VOX is active	Off, Short, Medium, Long	Medium	9-5

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7-10	ACC 2: Audio Output Level (Main Band)	Output level of the main band audio signal from the **ACC 2** connector	0 to 100 (in steps of 1)	50	16-20
7-11	ACC 2: Audio Output Level (Sub Band)	Output level of the sub band audio signal from the **ACC 2** connector	0 to 100 (in steps of 1)	50	16-20
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7-14	Audio Output Type (Rear Connectors)	Audio output from the rear panel connectors	All, Received Audio Only	All	16-6
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8-01	TX Audio Waveform Display	TX AF Waveform display (Sub screen)	On, Off	On	9-13
8-02	Bandscope Maximum Hold	Bandscope Peak Hold	Off, 10 [s], Continuous	10 [s]	7-7
8-03	Marker Offset Frequency (SSB Mode)	Marker offset frequency in SSB mode	Off (Carrier Point), 300, 400, 500, 600, 700, 800, 1000, 1500, 2210 [Hz]	500 [Hz]	7-3
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Bandwidth					
8-05	Fixed Mode LF Band Lower Limit (min. 0.03 MHz)	Selecting the lower limit frequency for the LF Band in Fixed mode (min. 0.03 MHz)	0.030.000 [MHz] to 0.295.000 [MHz] (in steps of 0.001 [MHz])	0.130.000 [MHz]	7-5
8-06	Fixed Mode LF Band Upper Limit (max. 0.300 MHz)	Selecting the upper limit frequency for the LF Band in Fixed mode (max. 0.300 MHz)	0.035.000 [MHz] to 0.300.000 [MHz] (in steps of 0.001 [MHz])	0.140.000 [MHz]	7-5
8-07	Fixed Mode MF Band 1 Lower Limit (min. 0.300 MHz)	Selecting the lower limit frequency for the MH1 Band in Fixed mode (minimum 0.300 MHz)	0.300.000 [MHz] to 0.517.000 [MHz] (in steps of 0.001 [MHz])	0.470.000 [MHz]	7-5
8-08	Fixed Mode MF Band 1 Upper Limit (max. 0.522 MHz)	Selecting the upper limit frequency for the MF1 Band in Fixed mode (maximum 0.522 MHz)	0.305.000 [MHz] to 0.522.000 [MHz] (in steps of 0.001 [MHz])	0.480.000 [MHz]	7-5
8-09	Fixed Mode MF Band 2 Lower Limit (min. 0.522 MHz)	Selecting the lower limit frequency for the MF2 Band in Fixed mode (minimum 0.522 MHz)	0.522.000 [MHz] to 1.700.000 [MHz] (in steps of 0.001 [MHz])	0.750.000 [MHz]	7-5
8-10	Fixed Mode MF Band 2 Upper Limit (max. 1.705 MHz)	Selecting the upper limit frequency for the MF2 Band in Fixed mode (maximum 1.705 MHz)	0.527.000 [MHz] to 1.705.000 [MHz] (in steps of 0.001 [MHz])	1.250.000 [MHz]	7-5
8-11	Fixed Mode 1.8 MHz Band Lower Limit (min. 1.705 MHz)	Selecting the lower limit frequency for the 1.8 MHz Band in Fixed mode (minimum 1.705 MHz)	1.705.000 [MHz] to 1.995.000 [MHz] (in steps of 0.001 [MHz])	1.800.000 [MHz]	7-5
8-12	Fixed Mode 1.8 MHz Band Upper Limit (max. 2.0 MHz)	Selecting the upper limit frequency for the 1.8 MHz Band in Fixed mode (maximum 2.0 MHz)	1.710.000 [MHz] to 2.000.000 [MHz] (in steps of 0.001 [MHz])	2.000.000 [MHz]	7-5
8-13	Fixed Mode 3.5 MHz Band Lower Limit (min. 2.0 MHz)	Selecting the lower limit frequency for the 3.5 MHz Band in Fixed mode (minimum 2.0 MHz)	2.000.000 [MHz] to 3.995.000 [MHz] (in steps of 0.001 [MHz])	3.500.000 [MHz]	7-5
8-14	Fixed Mode 3.5 MHz Band Upper Limit (max. 4.0 MHz)	Selecting the upper limit frequency for the 3.5 MHz Band in Fixed mode (maximum 4.0 MHz)	2.005.000 [MHz] to 4.000.000 [MHz] (in steps of 0.001 [MHz])	4.000.000 [MHz]	7-5
8-15	Fixed Mode 5 MHz Band Lower Limit (min. 4.0 MHz)	Selecting the lower limit frequency for the 5 MHz Band in Fixed mode (minimum 4.0 MHz)	4.000.000 [MHz] to 5.995.000 [MHz] (in steps of 0.001 [MHz])	5.000.000 [MHz]	7-5
8-16	Fixed Mode 5 MHz Band Upper Limit (max. 6.0 MHz)	Selecting the upper limit frequency for the 5 MHz Band in Fixed mode (maximum 6.0 MHz)	4.005.000 [MHz] to 6.000.000 [MHz] (in steps of 0.001 [MHz])	5.500.000 [MHz]	7-5
8-17	Fixed Mode 7 MHz Band Lower Limit (min. 6.0 MHz)	Selecting the lower limit frequency for the 7 MHz Band in Fixed mode (minimum 6.0 MHz)	6.000.000 [MHz] to 7.995.000 [MHz] (in steps of 0.001 [MHz])	7.000.000 [MHz]	7-5
8-18	Fixed Mode 7 MHz Band Upper Limit (max. 8.0 MHz)	Selecting the upper limit frequency for the 7 MHz Band in Fixed mode (maximum 8.0 MHz)	6.005.000 [MHz] to 8.000.000 [MHz] (in steps of 0.001 [MHz])	7.500.000 [MHz]	7-5
8-19	Fixed Mode 10 MHz Band Lower Limit (min. 8.0 MHz)	Selecting the lower limit frequency for the 10 MHz Band in Fixed mode (minimum 8.0 MHz)	8.000.000 [MHz] to 10.995.000 [MHz] (in steps of 0.001 [MHz])	10.100.000 [MHz]	7-5
8-20	Fixed Mode 10 MHz Band Upper Limit (max. 11 MHz)	Selecting the upper limit frequency for the 10 MHz Band in Fixed mode (maximum 11 MHz)	8.005.000 [MHz] to 11.000.000 [MHz] (in steps of 0.001 [MHz])	10.150.000 [MHz]	7-5
8-21	Fixed Mode 14 MHz Band Lower Limit (min. 11 MHz)	Selecting the lower limit frequency for the 14 MHz Band in Fixed mode (minimum 11 MHz)	11.000.000 [MHz] to 14.995.000 [MHz] (in steps of 0.001 [MHz])	14.000.000 [MHz]	7-5

8-22	Fixed Mode 14 MHz Band Upper Limit (max. 15 MHz)	Selecting the upper limit frequency for the 14 MHz Band in Fixed mode (maximum 15 MHz)	11.005.000 [MHz] to 15.000.000 [MHz] (in steps of 0.001 [MHz])	14.500.000 [MHz]	7-5
8-23	Fixed Mode 18 MHz Band Lower Limit (min. 15 MHz)	Selecting the lower limit frequency for the 18 MHz Band in Fixed mode (minimum 15 MHz)	15.000.000 [MHz] to 19.995.000 [MHz] (in steps of 0.001 [MHz])	18.000.000 [MHz]	7-5
8-24	Fixed Mode 18 MHz Band Upper Limit (max. 20 MHz)	Selecting the upper limit frequency for the 18 MHz Band in Fixed mode (maximum 20 MHz)	15.005.000 [MHz] to 20.000.000 [MHz] (in steps of 0.001 [MHz])	18.200.000 [MHz]	7-5
8-25	Fixed Mode 21 MHz Band Lower Limit (min. 20 MHz)	Selecting the lower limit frequency for the 21 MHz Band in Fixed mode (minimum 20 MHz)	20.000.000 [MHz] to 21.995.000 [MHz] (in steps of 0.001 [MHz])	21.000.000 [MHz]	7-5
8-26	Fixed Mode 21 MHz Band Upper Limit (max. 22 MHz)	Selecting the upper limit frequency for the 21 MHz Band in Fixed mode (maximum 22 MHz)	20.005.000 [MHz] to 22.000.000 [MHz] (in steps of 0.0010 [MHz])	21.500.000 [MHz]	7-5
8-27	Fixed Mode 24 MHz Band Lower Limit (min. 22 MHz)	Selecting the lower limit frequency for the 24 MHz Band in Fixed mode (minimum 22 MHz)	22.000.000 [MHz] to 25.995.000 [MHz] (in steps of 0.001 [MHz])	24.890.000 [MHz]	7-5
8-28	Fixed Mode 24 MHz Band Upper Limit (max. 26 MHz)	Selecting the upper limit frequency for the 24 MHz Band in Fixed mode (maximum 26 MHz)	22.005.000 [MHz] to 26.000.000 [MHz] (in steps of 0.001 [MHz])	24.9900.000 [MHz]	7-5
8-29	Fixed Mode 28 MHz Band Lower Limit (min. 26 MHz)	Selecting the upper limit frequency for the 28 MHz Band in Fixed mode (minimum 26 MHz)	26.000.000 [MHz] to 29.995.000 [MHz] (in steps of 0.001 [MHz])	28.000.000 [MHz]	7-5
8-30	Fixed Mode 28 MHz Band Upper Limit (max. 30 MHz)	Selecting the upper limit frequency for the 28 MHz Band in Fixed mode (maximum 30 MHz)	26.005.000 [MHz] to 30.000.000 [MHz] (in steps of 0.001 [MHz])	28.500.000 [MHz]	7-5
8-31	Fixed Mode 50 MHz Band Lower Limit (min. 30 MHz)	Selecting the upper limit frequency for the 50 MHz Band in Fixed mode (minimum 30 MHz)	30.000.000 [MHz] to 59.995.000 [MHz] (in steps of 0.001 [MHz])	50.000.000 [MHz]	7-5
8-32	Fixed Mode 50 MHz Band Upper Limit (max. 60 MHz)	Selecting the upper limit frequency for the 50 MHz Band in Fixed mode (maximum 60 MHz)	30.005.000 [MHz] to 60.000.000 [MHz] (in steps of 0.001 [MHz])	50.500.000 [MHz]	7-5

USB (Group 9)					
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USB Keyboard					
9-00	Send Message by Function Keys (USB Keyboard)	Key assignment to the PF keys on the USB keyboard	Off, On	Off	16-11
9-01	Keyboard Language (USB Keyboard)	The language applied to the USB keyboard	Japanese, English (US), English (UK), French, French (Canadian), German, Portuguese, Portuguese (Brazilian), Spanish, Spanish (Latin American), Italian	English (US)	16-10
9-02	Repeat Delay Time (USB Keyboard)	USB Keyboard Key-repeat delay time	1 to 4 (in steps of 1)	2	16-11
9-03	Repeat Speed (USB Keyboard)	Configuring the key-repeat speed for the USB keyboard	1 to 32 (in steps of 1)	1	16-11

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Menu Reset	Resetting the Menu configurations	16-4
Memory Channel Reset	Resetting the Memory Channel configurations	
VFO Reset	Resetting the VFO configurations	
Standard Reset (Clock, TX Inhibit and Transmit Power Upper Limit will not be reset)	Resetting the standard configurations	
Full Reset	Resetting all configurations	

CLOCK MENU ITEMS

Menu	Display	Configuration	Range	Default	Reference Page
Date and Time					
00	Date (Local Clock)	Date of the local clock	Year: '13 (2013) to '99 (2099) Month: JAN, FEB. MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC Day: 1 to 31	Year: "12 Month: JAN Day: 01	15-1
01	Time (Local Clock)	Clock of the local clock	00:00 to 23:59 (Hour: 00 to 23, minute: 00 to 59)	00:00	15-1
02	Timezone (Local Clock)	Time zone of the local clock	UTC -14:00 to UTC ±00:00 to UTC +14:00 (in steps of 15 min.)	UTC +00:00	15-2
03	Time zone (Secondary Clock)	Time zone of the secondary clock	UTC -14:00 to UTC ±00:00 to UTC +14:00 (in steps of 15 min.)	UTC +00:00	15-2
04	Secondary Clock Identification Letter	Identification letter for the secondary clock	One letter (A to Z)	U	15-2
05	Date Display Format	Display format for the date	MMM/ DD/ 'YY, DD/ MMM/ 'YY, 'YY/ MMM/ DD	MMM/ DD/'YY	15-2
Automatic Time Correction (1)					
00	Clock Correction using the NTP Server	Automatic clock correction using the NTP Server	Off, On	Off	15-4
01	NTP Server Address	NTP Server Address	A maximum of 50 alphanumeric characters	(Blank)	15-3

LAN MENU ITEMS

Menu	Display	Configuration	Range	Default	Reference Page
00	DHCP	DHCP	Off, On	On	16-12
01	IP Address	IP Address	1.0.0.0 to 223.255.255.255	192.168.1.100	16-13
02	Subnet Mask	Subnet Mask	0.0.0.0 to 255.255.255.252	255.255.255.0	
03	Default Gateway	Default Gateway	1.0.0.0 to 223.255.255.255	blank	
04	Primary DNS Server	Primary DNS server	1.0.0.0 to 223.255.255.255	blank	
05	Secondary DNS Server	Secondary DNS server	1.0.0.0 to 223.255.255.255	blank	
06	MAC Address	MAC Address	-	Unique for each transceiver	16-13
07	Administrator ID	Administrator ID	A maximum of 8 alphanumeric characters	admin	16-14
08	Administrator Password	Administrator Password	A maximum of 8 alphanumeric characters	Kenwood	16-14

ADVANCED MENU ITEMS

Menu	Display	Configuration	Range	Default	Reference Page
0	Indication Signal Type (Main Band)	Output signal type (main band) to an external meter	Automatic, TX Power, ALC, Drain Voltage (Vd), Compression Level (COMP), Current (Id), SWR	Automatic	16-15
1	Indication Signal Type (Sub Band)	Output signal type (sub band) to an external meter	TX Power, ALC, Drain Voltage (Vd), Compression Level (COMP), Current (Id), SWR	ALC	16-16
2	Output Level (Main Band)	Output signal level (main band) to an external meter	0 to 100 [%] (in steps of 1)	50 [%]	16-16
3	Output Level (Sub Band)	Output signal level (sub band) to an external meter	0 to 100 [%] (in steps of 1)	50 [%]	16-16
4	REF I/O Connector Configuration	Configurations for the REF I/O connector	Off, Output, Input	Off	16-22
5	Reference Oscillator Calibration	Frequency calibration for the reference oscillator	-255 to +255 (in steps of 1)	0	18-1
6	Bandwidth (Additional Roofing Filter)	Bassband width of the additional roofing filter	Off, 300 to 3500 [Hz] (in steps of 100 [Hz])	Off	16-22
7	Attenuation (Additional Roofing Filter)	Attenuation of the additional roofing filter	-20 to 0 to +20 (in steps of 1)	0	16-23
8	TX Power Down with Transverter Enabled	Transmit power deduction while the transverter is enabled	Off, On	On	16-33
9	TX Hold After Antenna Tuning	Transmit hold time after completing the antenna tuning	Off, On	Off	4-23
10	Antenna Tuner during RX	Antenna tuner behavior while receiving	Off, On	Off	4-22
11	Linear Amplifier Control (HF Band)	Linear Amplifier Control for use in the HF band	Off, Active High, Active High + Relay Control, Active High + Relay & TX Delay Ctrl, Active Low, Active Low + TX Delay Control	Off	16-31
12	Linear Amplifier Control (50 MHz Band)	Linear Amplifier Control for use in the 50 MHz band	Off, Active High, Active High + Relay Control, Active High + Relay & TX Delay Ctrl, Active Low, Active Low + TX Delay Control	Off	16-32
13	Microphone Gain (FM Mode)	Microphone gain in FM mode	1 to 100 (in steps of 1)	50	5-28
14	PKS Polarity Reverse	Reversion of the PKS polarity	Off, On	Off	16-29
15	TX Inhibit While Busy	Transmit inhibit while in the busy state	Off, On	Off	16-28
16	CTCSS Unmute for Internal Speaker (Main Band)	Muting the CTCSS tone (Main band)	Mute, Unmute	Mute	16-23
17	CTCSS Unmute for Internal Speaker (Sub Band)	Muting the CTCSS tone (Sub band)	Mute, Unmute	Mute	16-23
18	MSQ Logic State	Selecting the MSQ Logic	Low, Open	Low	16-24
19	SSQ Logic State	Selecting the SSQ Logic	Low, Open	Low	16-24
20	MSQ Reverse Condition	Reversing conditions of the MSQ logic state	Off, Busy, Sql, Send, Busy-Send, Sql-Send	Sql	16-24
21	SSQ Reverse Condition	Reversing conditions of the SSQ logic state	Off, Busy, Sql, Send, Busy-Send, Sql-Send	Sql	16-24
22	Standby State Low Power Consumption	Standby Power Saving	Off, On	Off (K-Type) On (E-type)	4-2
23	Cooling Fan Control after Shutdown	Cooling fan behavior after shutdown	Off, On	Off	4-2
24	MSQ/ PKS Pin Assignment (COM Connector)	Pin assignment of MSQ/PKS to the COM connector	Off, On	Off	16-25
25	External Display	Output to the external display	Off, On	On	16-18
26	Resolution (External Display)	Video Signal Resolution	800x600, 848x480	800x600	16-18
27	Touchscreen Calibration	Touchscreen calibration	-	-	16-3
28	Software License Agreement	Software License Agreement	-	-	IV
29	Important Notices concerning Free Open Source	Method to obtain the open source software used in this transceiver	-	-	IV
30	About Various Software License Agreements	Licensing of the software used in this transceiver, under the GPL/LGPL	-	-	IV

LIST OF USB MENU ITEMS

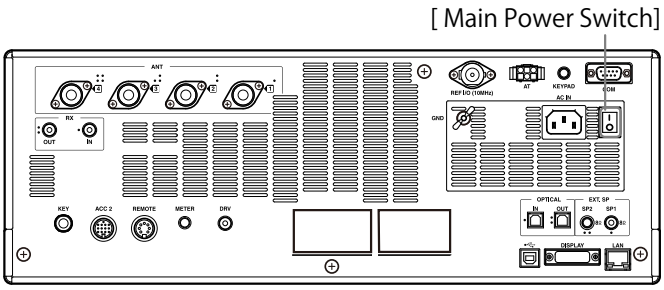
Display	Configuration	Reference Page
Read Configuration Data	Reading the transceiver configuration data	12-2
Save Configuration Data	Saving the transceiver configuration data	12-2
USB Flash Drive Formatting	Formatting the USB flash drive	12-1
Safe Removal of USB Flash Drive	Safe removal of a USB flash drive	12-1

TURNING THE TRANSCEIVER ON

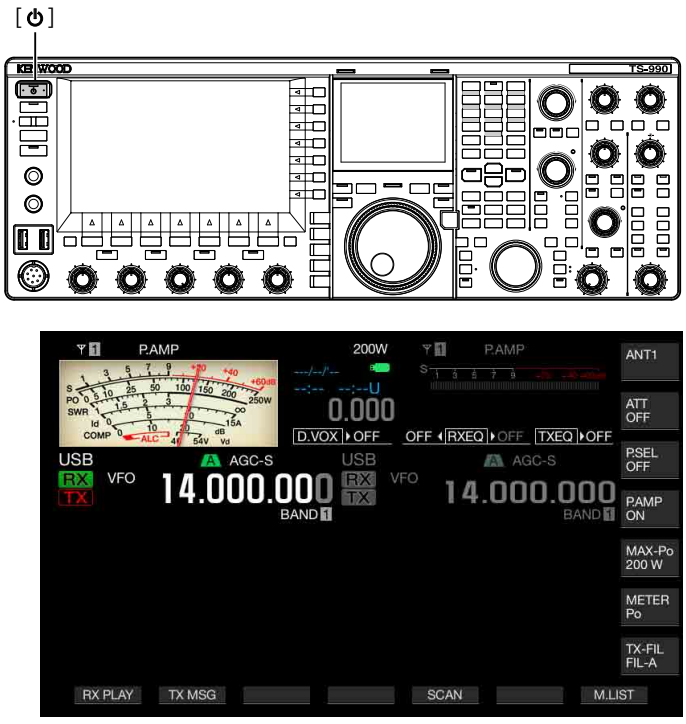
Prior to switching the main power (I/O) ON, read carefully through "INSTALLING AND CONNECTING THE TRANSCEIVER" and be sure that the transceiver and external devices have been correctly installed and connected. {page 1-1}

Positions of the front panel controls are not influenced by switching the main power (I/O) ON or OFF or by turning the transceiver power (⏻) ON or OFF. However, an unintentional event, such as very loud volume audio, may take pace so the **PWR** control, **[AF]** (M) control, and **[AF]** (S) control must be fully rotated counterclockwise, before pressing the main I/O power switch or the [⏻].

1 Press the main **I/O** power switch located on the rear panel, to the "I" (ON) to source the power to the transceiver.
The "⏻" LED on the front panel lights orange and the status of the transceiver, before it was previously turned OFF, is retained in the transceiver. The transceiver retains the status of the **[⏻]**, ON or OFF, when the main power **I/O** switch is pressed down to the "O" position so the transceiver starts up with the same status of the **[⏻]** when the main I/O power switch is pressed to the "I" position next time.



2 Press **[⏻]** on the front panel to turn the transceiver power (⏻) ON.
The "⏻" LED lights green after blinking orange. The startup screen appears and then the normal operating screen appears.



PRECAUTION

- When the transceiver power (⏻) is first turned ON, be sure that you set the clock (your local time) for the first time. The clock is utilized for time stamping of various types of the files. Also, timed tasks, such as timer recording, may not be function correctly if the clock is not set.
- Refer to "CLOCK DISPLAY AND TIMER" for the configuration method for the clock. {page 15-1}

Note:

- When the transceiver is switched ON by pressing the main **I/O** power switch, power is sourced from the household AC outlet using the AC cable; it may take time to start up regardless of the configuration in Advanced Menu 22.
- "HELLO" is the default power-on message. You can change this to any text, such as your desired message and your call sign. {page 16-1}
- If the transceiver or the ambient environment is too cold, it may take time for the main screen or the sub screen to brighten.

TURNING THE TRANSCEIVER OFF

The transceiver is equipped with the main I/O power switch on the rear panel and with the **[⏻]** on the front panel.

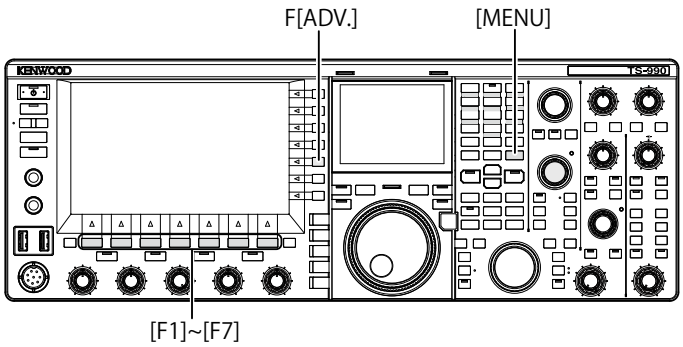
Pressing the main **I/O** power switch to the "O" position removes all power from the transceiver. Pressing **[⏻]** without shutting down the transceiver by pressing the main **I/O** power switch to the "O" position turns the transceiver power (⏻) OFF and places it in the Standby state.

1 Press and hold **[⏻]** on the front panel to turn the transceiver power (⏻) OFF.
A message notifying you of the end of operation appears, and the transceiver enters the standby state. The "⏻" LED on the front panel lights orange.

2 Press the main **I/O** power switch on the rear panel to the "I" position.
The main power from the household AC outlet is shut down.

Note:

- Even after the display disappears after turning the transceiver power (⏻) OFF, the "⏻" LED blinks a few seconds. The transceiver enters the standby state, when the LED starts blinking. While the **[⏻]** is blinking, shutting down the main power (I/O) or disconnecting the AC cable from the household AC outlet may cause the transceiver to malfunction.
- The transceiver has a function (low power consumption mode) that can significantly reduces the power consumption while in the standby state. Refer to **"Standby State Low Power Consumption"** for further details. {page 4-1}
- While the main power (I/O) is shut down, the transceiver power (⏻) cannot be turned ON even with a press of **[⏻]**. A timed task by a programmable timer cannot be activated.
- Even after the transceiver power (⏻) turns OFF, the cooling fan may continue to run until the internal temperature cools down.
- You must first configure the Standby State Low Power Consumption to be active while in the standby state, after the transceiver is turned OFF by pressing **[⏻]**, and the cooling fan control.



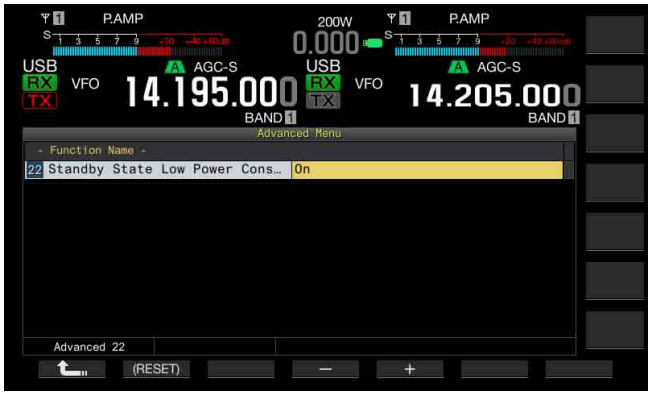
ENABLING THE STANDBY STATE LOW POWER CONSUMPTION

If Standby State Lower Power Consumption is enabled, the power consumption while the transceiver is in the standby state can be reduced to below 0.5 W; however, it may take longer time to start up compared with the same for the normal operation.

1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 22, "Standby State Low Power Consumption".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".

The default is "Off" (K-type) (disabling the Standby State Low Power Consumption) and "On" (E-type). Selecting "On" reduces the power consumption to 0.5 W during the standby state; however, it takes 40 seconds to start up.

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

Note:

- If Standby State Low Power Consumption is enabled, the transceiver cannot accept a PC command. To start up the transceiver using a PC, be sure to disable, in Advanced Menu 22, the Standby State Low Power Consumption.
- 20 W Standby Electricity is consumed even after the transceiver power (⏻) turns OFF and if "Off" has been configured in Advanced Menu 22. Therefore, the cooling fan may run depending on the operating temperature in order to limit the temperature increase of the power supply unit during the standby state. If the rotation of the cooling fan during the standby state for the power supply unit is noticeable, you can select "On" in Advanced Menu 22 not to increase the temperature of the power supply unit. To make the standby state power consumption not exceed 0.5 W, you can enable the Standby State Low Power Consumption, or press the main power switch (I/O) on the rear panel to the "O" position to shut down the electricity. In this case, it takes 40 seconds to start up.

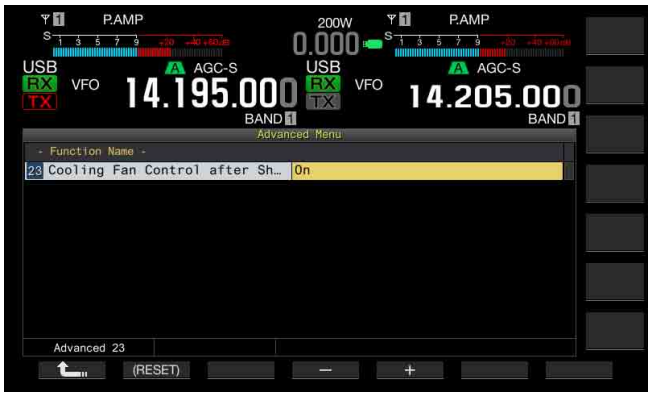
CONTROLLING THE COOLING FAN WHILE IN THE STANDBY STATE

Even after the transceiver power (⏻) is turned OFF (standby state) and the "⏻" LED lights orange, the cooling fan for the final unit can be activated to quickly cool down the final unit.

1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 23, "Cooling Fan Control after Shutdown".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".

The default is "Off" (not activating the cooling fan after the transceiver power (⏻) turns OFF). Selecting "On" allows the cooling fan to run even while the transceiver power (⏻) turns OFF.

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

Note:

- The cooling fan automatically stops when the temperature of the transceiver has decreased.
- If you select "Off" from Menu 22, "Standby State Low Power Consumption", in the Advanced Menu screen, the cooling fan will be reactivated due to any increase in the internal temperature of the transceiver, even after the cooling fan has completely stopped.
- Standby electricity is consumed even after the transceiver power (⏻) has turned OFF. This causes the cooling fan to run unexpectedly.

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COOLING FAN AND TEMPERATURE PROTECTION FOR FINAL UNIT

To protect internal circuits from high temperatures, the transceiver senses the temperature of the final unit regardless of the operation state, either transmitting or receiving, and controls the cooling fan rotation speed for the final unit and the transmit power as described below.

If a thermistor detects a temperature increase in the final unit, the cooling fan at first starts rotating at low speed. If the temperature increases further, the cooling fan rotates at high speed.

If excessively high temperature is detected, the transmit power is limited until the internal temperature cools down.

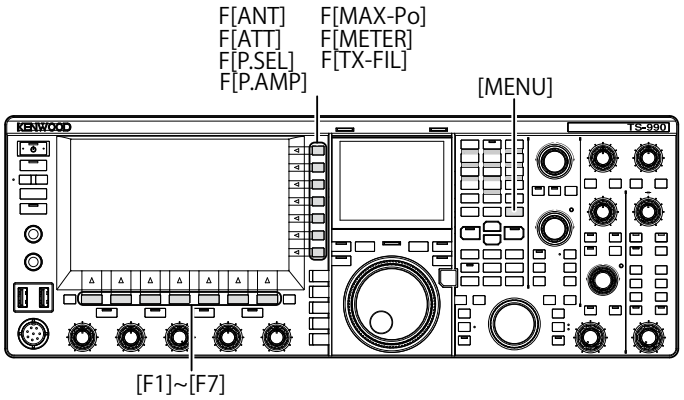
Note:

- If a message notifies you of a detected high temperature, do not shut down the transceiver with a press down of the main **I/O** power switch to the "O" position.
- If the main power (I/O) is shut down, the cooling fan stops, and it may take longer until the transceiver cools down.

MAIN AND SUB SCREEN DISPLAYS

In the main display, the bandscope, waterfall and audio scope in addition to the meter display can be displayed.

A dial, the audio FFT scope (the bandpass spectrum frequency display) and the ΔF value can be displayed on the sub screen.



MAIN SCREEN

After the startup screen that appears when turning the transceiver power (⏻) ON disappears, the same display was retained when the transceiver power (⏻) was turned OFF last time appears.

In this case, pressing **[MENU]** or **[EXTEND]** (F) while **[EXTEND]** (F) is in the key guide compresses the displays to be the compressed mode screen.

As explained below, the function keys located below and right side of the main screen can activate key tasks and change the display for configuration.

Press **[ESC]** while a screen is open to close the screen and revert to the normal operating screen.



Standard Mode Screen



Compressed Mode Screen

■ Function Keys on the bottom of the Main Screen

- **[RXPLAY]** (F1) {page 13-7}

  Press to open the **Recording Audio Files** screen.

- **[TXMSG]** (F2) {page 13-1}

  Press in other than CW, FSK and PSK modes to open the **Voice Message** screen.

- **[KEYER]** (F2) {page 5-21}

  Press in CW mode to open the **CW Message** screen.

- **[DECODE]** (F3) {page 5-35}

  Appears while in FSK or PSK mode. This key does not appear while in other operating modes.

- **[TONE]** (F4) {page 5-31}

  Appears while in FM mode. This key does not appear while in other operating modes.

- **[SCAN]** (F5) {page 11-1}

  Press to start scanning.

- **[M▸V]** (F6) {page 10-6}

  Appears while in the memory channel mode or quick memory channel mode. This key does not appear while in other operating modes. Press to activate the memory shift.

- **[M.LIST]** (F7) {page 10-4}

  Press to open the **Memory Channel List** screen.

■ Function Keys on the right side of the Main Screen

- **[ANT]** (F) {page 4-20}

  Press to switch the antenna configuration.

  Press and hold to open the **Antenna Name** screen.

- **[ATT]** (F) {page 6-1}

  Each time you press the key, the attenuation level of the selected band switches. Press and hold to change the attenuation level for the selected band, in reversed sequence.

- **[P.SEL]** (F) {page 6-1}

  Press to toggle the Preselector between active and inactive.

  Press and hold while Preselector is enabled to open the **Preselector** screen. (Main Band only)

- **[P.AMP]** (F) {page 5-9}

  Press to toggle the Preamplifier for the selected band between active and inactive.

- **[MAX-Po]** (F) {page 4-18}

  Press to cycle the maximum transmit power through On > Off > maximum transmit power value [W].

- **[METER]** (F) {page 4-19}

  Press to cycle the transmit meter through the active meters: Po > SWR > Id > COMP > ALC > Vd (analog meter) SWR > Id > COMP > Vd > TEMP (digital meters) Po > SWR > Id > COMP > ALC > Vd > TEMP (reduced digital meter)

- **[TX-FIL]** (F) {page 9-8}

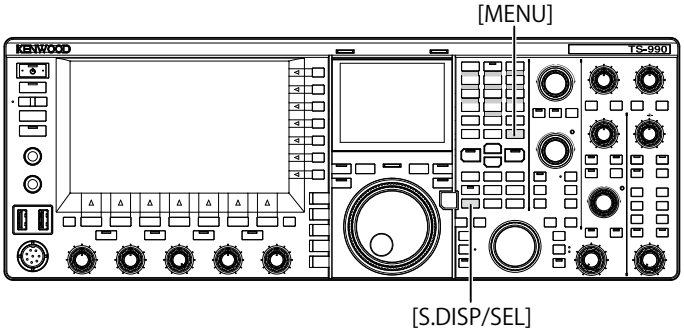
  Press to cycle the transmit filter through FIL-A > FIL-B > FIL-C filters. Press and hold to open the **TX Filter** screen.

Note:

- The function names guided on the main screen vary depending on the functions and configurations.
- Some function keys along the bottom of the main screen do not appear, depending on the functions and configurations.
- Frames and letters for the function keys along the right side of the main screen turn to yellow when the available band is switched to the sub band. Functions that cannot be used for the sub band do not appear.

SUB SCREEN

On the sub screen, pressing **[S.DISP/SEL]** changes various displays, such as the standard mode display and the enhanced display.



■ Switching to the Standard Mode and to the Enhanced Mode

1 Press and hold **[S.DISP/SEL]** to switch to the standard or enhanced mode.
A long press displays or hides a dial on the sub-display.

■ Changing the Display in each mode

1 Press and hold [S.DISP/SEL] to change the display.

In Normal Operation

In the standard mode display:

Each key press cycles the display through the following sequence.

Selected Band Frequency <-> Main band and sub band frequencies

In the enhanced mode display:

Each key press cycles the display through the following sequence.

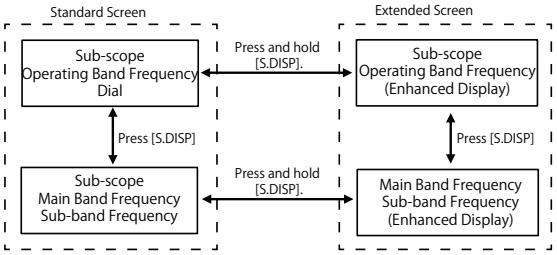
Selected Band Frequency <-> Main Band and sub band frequencies

While the Encode/ Decode Screen appears:

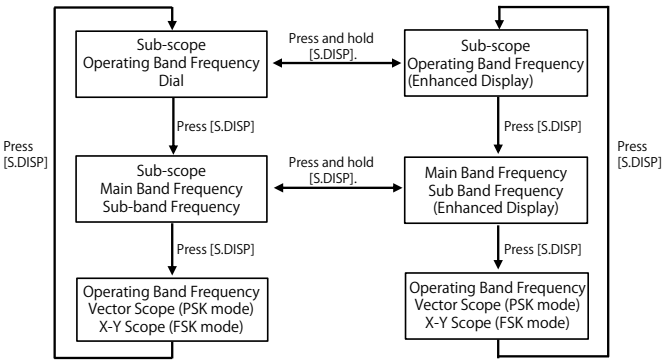
Each key press cycles the display through the following sequence.

The selected band frequency > Main band and sub band frequencies > Band frequency to decode, X-Y scope (FSK mode only), or Band frequencies to decode (PSK mode only) > The selected band frequency

● Normal Operation



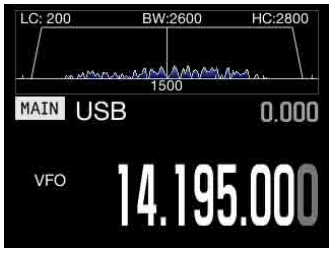
● While the Encode/Decode Screen Opens



▶ Index ▶ Contents



The selected band frequency
Audio Band Scope & Dial Display



The selected band frequency (enhanced)
Audio Band Scope Display



Main Band Frequency & Sub Band Frequency
Audio Scope & Bandscope Display



Main Band & Sub Band



X-Y Scope



Vector Scope

Note:

- A dial does not appear on the sub-screen while the single frequency for normal operation is displayed.
- The X-Y scope appears only if the **RTTY** screen appears on the main screen.
- The Vector scope appears only if the **PSK** screen appears on the main screen.

CONFIGURING THE SCREEN TYPE

The background color or the font type can be changed as desired.

CHANGING THE BACKGROUND COLOR

You can select the background color for the main screen and sub screen from three options.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 00, "Color Display Pattern (Main Screen)", or Menu 01, "Color Display Pattern (Sub Screen)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Type 1", "Type 2", or "Type 3".
"Same as Main" can be configured for Menu 01, "Color Display Pattern (Sub Screen)" allowing the sub-screen to have the same background color as the main screen. The default is "Type 1" for Menu 0-00 and "Same as Main (Main)" for Menu 0-01.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

CHANGING THE DISPLAY FONT

You can select the font type applied to the frequency display from three types.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 02, "Font Style (Frequency Display)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Font 1", "Font 2", or "Font 3".
The default is "Font 1".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

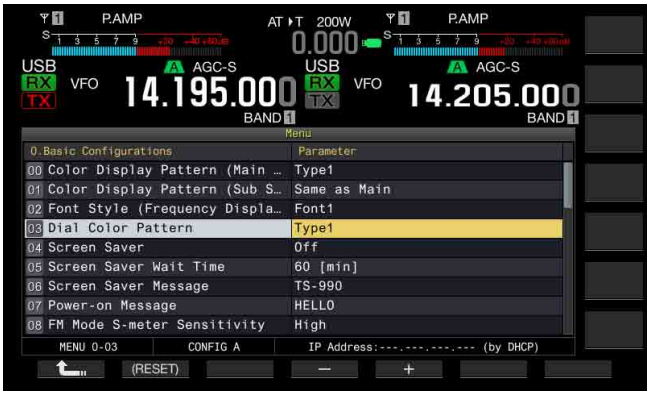
CHANGING THE DIAL COLOR (SUB SCREEN)

You can select the dial color pattern for the sub screen from two patterns.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 03, "Dial Color Pattern".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Type 1" or "Type 2".
The default is "Type 1".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

CAPTURING AND SAVING SCREEN IMAGES

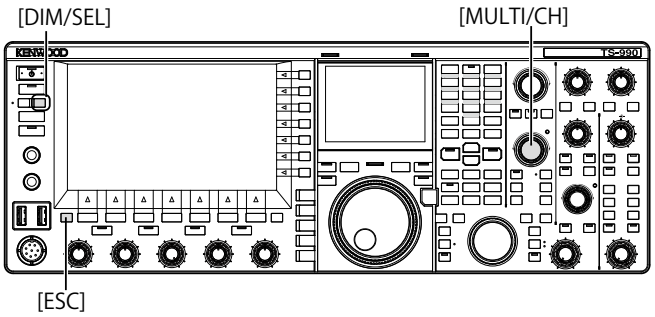
You can capture screen images from the main screen or the sub-screen and save them to a USB flash drive in PNG (.png) format. {page 16-12}

SELECTING THE DIMMER

Dimmer is a function to change the brightness of the screen and LED as you wish.

CHANGING BRIGHTNESS

You can change the brightness of the screens and LEDs using preset dimmer settings (below). For example, you can adjust the brightness to be brighter for daytime operation and darker for nighttime operation.



1 Press **[DIM/SEL]** to switch the dimmer.
Can be selected from “Dimmer 1” to “Dimmer 4”.

ADJUSTING THE DIMMER LEVEL

You can create four preset dimmer settings for each of the main display, sub display, and LEDs. You can then use these preset settings to easily adjust the display and LED brightness while operating the transceiver.

1 Press and hold **[DIM/SEL]** to open the **Dimmer** screen.



2 Press [ ] (F3) or [ ] (F4) to select “Main Display”, “Sub Display”, or “LED”.

3 Press **[-]** (F5) or **[+]** (F6), or rotate the **MULTI/CH** control to adjust the brightness.
Available range is from "5" (dark) to "100" (bright).

4 Press **[DIMMER]** (F2) to switch the dimmer.
Each key press cycles through Dimmer 1 > Dimmer 2 > Dimmer 3 > Dimmer 4 > Dimmer 1.

5 Repeat steps 2 and 3.

Note:

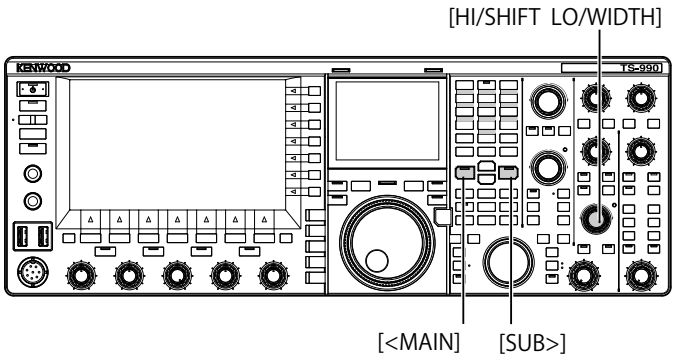
- Pressing and holding **[(RESET)]** (F1) resets the configurations so as to revert to the default.
- Brightness of the "TIMER" LED and the "⏻" LED are fixed while the transceiver power (⏻) turns OFF. The configured brightness does not apply.

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SWAPPING THE OPERATING DATA BETWEEN MAIN BAND AND SUB BAND

There two independent receivers in this transceiver, such as the main band and the sub band. These two receivers can behave separately; hence, you can configure different frequencies and modes for each band. If there is only one key available for the main band and sub band, you can operate the transceiver with the key by swapping the operating band for the main band and sub band.

The frequency displayed on the left side of the main screen is the main band, and the one on the right side is the sub band.



1 Press **[<MAIN]** or **[SUB>]** to select the band to operate.

- Frequency display for the band to operate will be larger in the main screen.
- Main Band: The "MAIN" LED lights green.
- Sub Band: The "SUB" LED lights green.

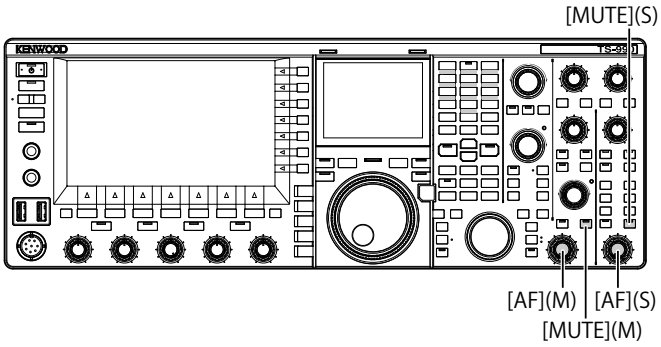


Note:

- The "HIGH/SHIFT LOW/WIDTH" (Sub) LED turns Off upon selection of the main band, and lights orange upon selection of the sub band so as to prevent fault operation.

ADJUSTING THE AF GAIN

You can adjust the speaker volume. Two independent **AF** controls are available for the main band and for the sub band, respectively.



1 Rotate the **AF** (M) or **AF** (S) control.

- Clockwise increases the volume and counterclockwise decreases it.

Note:

- Depending on the configurations for Squelch and CTCSS, no audio sounds even with a rotation of the **AF** control. In such a case, rotate the **SQL** control counterclockwise or deactivate the CTCSS.

MUTING THE RECEIVED AUDIO

You can mute the received audio with a simple key press, rather than by rotating the **AF** control. You can press **[MUTE]** for the main band and the sub band respectively.

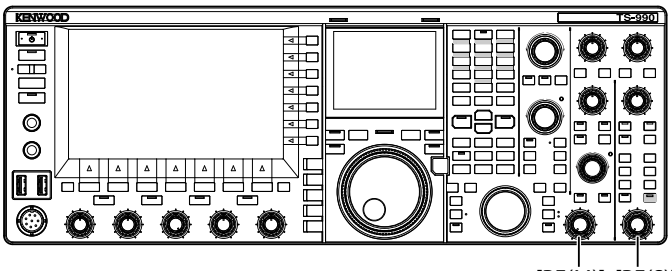
For example, if you are receiving on both the main band and the sub band, but would like to concentrate on listening to the received audio of the station calling on the main band, you can temporarily mute the sub band.

1 Press **[MUTE]** (M) or **[MUTE]** (S) to mute the received audio.

- The "MUTE" (M) or "MUTE" (S) LED light orange.
- Press again to make the received signal audible.

ADJUSTING THE RF GAIN

You can adjust the received sensitivity gain. Two independent **RF** controls are available for the main band and for the sub band, respectively. In normal operation, you can fully rotate the **RF** control counterclockwise. If an external noise or interference by another station is present, rotate the control counterclockwise slightly to decrease the gain and listen to the received audio.



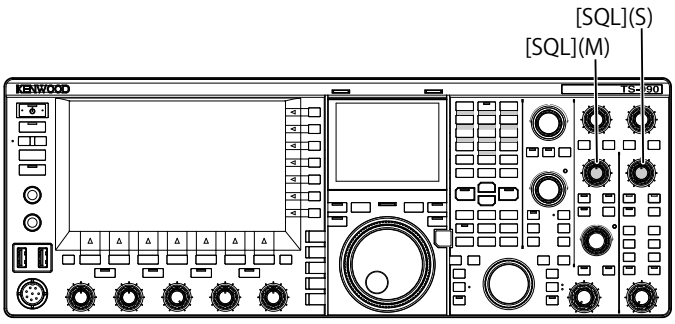
1 Rotate the **RF** (M) or **RF** (S) control to adjust the RF gain.
Rotate the **RF** control counterclockwise and adjust the signal to not be below the peak value range, while viewing the peak value on the S-meter. Signals weaker than this level are attenuated.

Note:

- Depending on the type of antenna and the band conditions, better reception may sometimes be obtained if the control is rotated slightly counterclockwise rather than always positioned fully clockwise.

ADJUSTING THE SQUELCH LEVEL

The threshold level for Squelch, a function to eliminate the audible noise on the frequency where no signal is present, can be adjusted. Two independent **SQL** controls are available for the main band and the sub band, respectively.



1 Rotate the **SQL** (M) or **SQL** (S) control to adjust the squelch level.
- Rotating the SQL control clockwise raises tightens the squelch level and counterclockwise opens it.
- You can rotate the **SQL** control until the squelch noise disappears.

Note:

- The position of the **SQL** control, where noise disappears, varies depending on the signal, temperature, and operating environment.
- The position of the **SQL** control in FM mode, where noise disappears, differs from other modes.

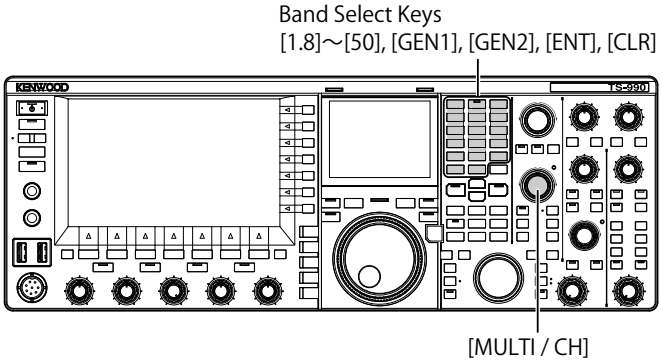
CONFIGURING THE OPERATING BAND

You can select your desired operating band.

The band can be configured for the main band and the sub band, respectively. With the numeric keypad, you can instantly select an amateur band ranging from the 1.8 MHz band to the 50 MHz band and the general band.

The transceiver's band memory function allows you to store up to five configurations for each band, with the last used frequency and operating mode.

This can be convenient if you are in a contest, in order to return the frequency and operating mode to their original states each time you change bands.



1 Press the band keys **[1.8]** to **[50]**, **[GEN1]**, and **[GEN2]** to store the frequency and operating mode.
When you press a key, the transceiver stores the VFO frequency and the status of the operating band at that moment, and then enables the operation of the next memory band. Each time you press a key, the band memory cycles from Band Memory 1 to Band Memory 5. The band memory number appears below the frequency display, on the main screen.

Note:

- Frequencies outside the band memory frequency range cannot be stored.

Index Contents

■ Band Memory Defaults

Band Name and Frequency Range (MHz)	Default (MHz) and Mode				
	Band Memory 1	Band Memory 2	Band Memory 3	Band Memory 4	Band Memory 5
1.8 MHz/ 1.62 to 2.00	1.8/ CW (K-type) 1.83/ CW (E-type)	1.81/ CW (K-type) 1.84/ CW (E-type)	1.82/ CW (K-type) 1.85/ CW (E-type)	1.83/ CW (K-type) 1.81/ CW (E-type)	1.84/ CW (K-type) 1.82/ CW (E-type)
3.5 MHz/ 3 to 4	3.5/ LSB	3.6/ LSB (K-type) 3.55/ LSB (E-type)	3.7/ LSB (K-type) 3.6/ LSB (E-type)	3.8/ LSB (K-type) 3.65/ LSB (E-type)	3.9/ LSB (K-type) 3.7/ LSB (E-type)
7 MHz/ 6.5 to 7.5	7.0/ LSB	7.05/ LSB (K-type) 7.05/ LSB (E-type)	7.1/ LSB (K-type) 7.1/ LSB (E-type)	7.15/ LSB (K-type) 7.15/ LSB (E-type)	7.2/ LSB (K-type) 7.2/ LSB (E-type)
10 MHz/ 10 to 10.5	10.1/ CW	10.11/ CW	10.12/ CW	10.13/ CW	10.14/ CW
14 MHz/ 13.5 to 14.5	14.0/ USB	14.1/ USB	14.15/ USB	14.20/ USB	14.25/ USB
18 MHz/ 18 to 19	18.068/ USB	18.1/ USB	18.11/ USB	18.15/ USB	18.16/ USB
21 MHz/ 20.5 to 21.5	21.0/ USB	21.1/ USB	21.15/ USB	21.2/ USB	21.3/ USB
24 MHz/ 24 to 25	24.89/ USB	24.92/ USB	24.94/ USB	24.96/ USB	24.98/ USB
28 MHz/ 27.5 to 30	28/ USB	28.3/ USB	28.5/ USB	29/ FM	29.3/ FM
50 MHz/ 50 to 54	50/ USB	50.125/ USB (K-type) 50.15/ USB (E-type)	50.2/ USB	51/ FM	52/ FM
General 1/ 0.030 to 60	0.1357/ CW	0.472/ CW	1.000/ AM (K-type) 0.999/ AM (E-type)	5.3305/ USB (K-type) 5.2585/ USB (E-type)	5.4035/ USB
General 2/ 0.030 to 60	2.5/ AM	5.0/ AM	10.0/ AM	15.0/ AM	20.0/ AM

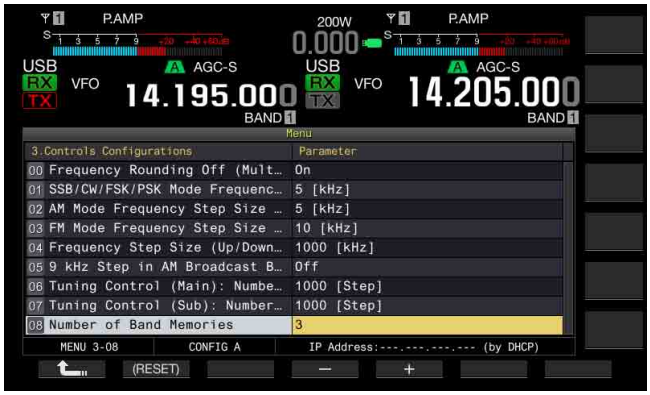
CHANGING THE NUMBER OF BAND MEMORIES

You can change the number of band memories to be applied to the transceiver. The default quantity is 3.

1 Select Group No. 3, "Basic Configurations", from the **Menu** screen.

2 Access Menu 08, "Number of Band Memories".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



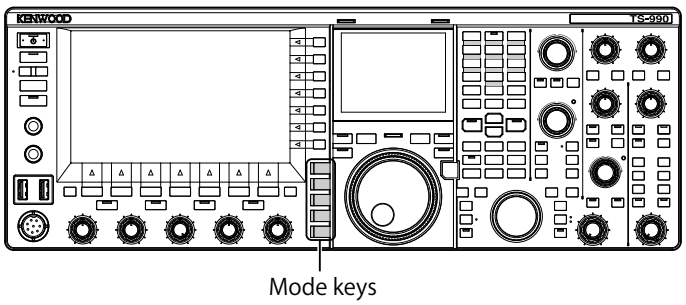
4 Press **[-]** (F4) or **[+]** (F5) to select "1", "3", or "5". The default is "3".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

SELECTING THE OPERATING MODE

The operating mode can be selected. The transceiver can be operated in SSB (LSB/USB), CW (CW-R), FSK (FSK-R), PSK (PSK-R), FM and AM modes.



LSB OR USB MODE

1 Press **[LSB/USB]**.
Each key press toggles the operating mode between LSB and USB modes.



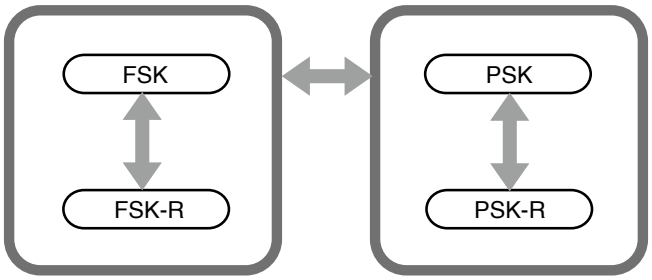
CW/CW-R MODE

1 Press **[CW/CW-R]**.
Each key press toggles the operating mode between CW and CW-R modes.



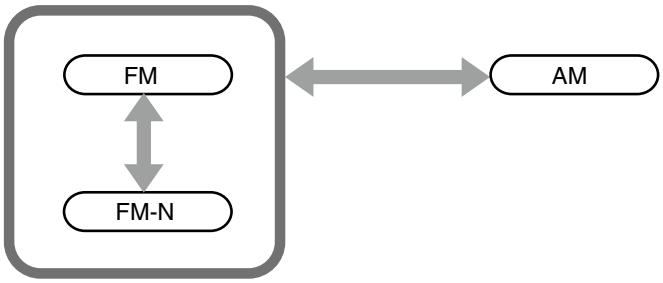
FSK/FSK-R OR PSK/PSK-R MODE

1 Press **[FSK/PSK/REV]**.
Each key press toggles the operating mode between FSK and PSK modes. While in each operating mode, press and hold **[FSK/PSK/REV]** to reverse the operating mode.



FM/AM MODE

1 Press **[FM/AM]**. Each key press toggles the operating mode between FM and AM modes. While in FM mode, press and hold **[FM/AM]** to toggle the FM mode between FM and FM-N (FM Narrow).



CONFIGURING THE DATA MODE

The DATA mode is the operating mode with which you can connect external equipment to the transceiver, enabling communicate in RTTY, PSK31 and other formats.

1 Press one of the mode keys to select FM, AM, or SSB (LSB/USB) mode.

2 Press **[DATA/SEL]**.
Each key press cycles through the following sequence.
(blank) > D1 > D2 > D3 > (blank)

	DATA OFF	DATA1	DATA2	DATA3
In the LSB mode	LSB	LSB-D1	LSB-D2	LSB-D3
In the USB mode	USB	USB-D1	USB-D2	USB-D3
In the FM mode	FM	FM-D1	FM-D2	FM-D3
In the FMN mode	FMN	FM-N-D1	FM-N-D2	FM-N-D3
In the AM mode	AM	AM-D1	AM-D2	AM-D3

PRECAUTION

- Activating the speech processor while in DATA mode may disrupt data communications. {page 9-6}
- The standby method and muting of the audio not used for transmission can be configured for each status, DATA OFF, DATA 1, DATA 2, and DATA 3. {page 5-11}

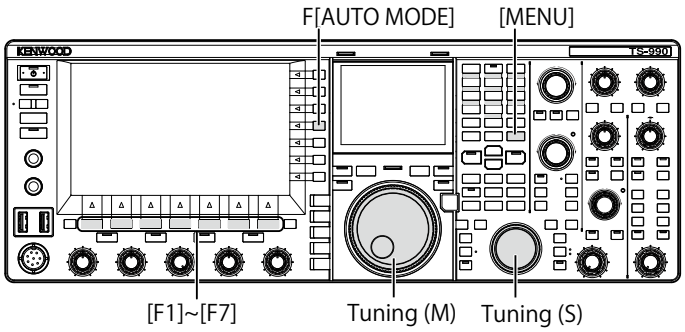
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AUTO MODE

Auto Mode is a convenient function allowing you to automatically switch to the correct operating mode according to your band plan.

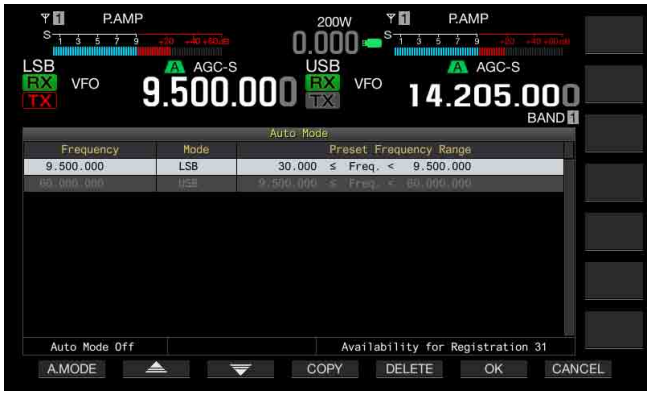
You can preconfigure the auto mode frequency points and the corresponding operating modes. This enables you to automatically switch the operating mode when tuning from one auto mode frequency range into another.

ENABLING/DISABLING AUTO MODE



1 Press **[MENU]**.

2 Press **[A.MODE]** (F1) to open the **Auto Mode** screen.



3 Press **[A.MODE]** (F1) to toggle the Auto Mode between active and inactive.
While Auto Mode is active, the key guide is yellow regardless of whether or not the key is operable. While Auto Mode is inactive, the key guide is white.

4 Press **[OK]** (F6).

5 Press **[MENU]** to exit.

CONFIGURING AUTO MODE FREQUENCY POINTS

You can configure up to 32 auto mode frequency points.

1 Press **[MENU]**.

2 Press **[A.MODE]** (F1) to open the **Auto Mode** screen.

3 Rotate the **Tuning** control to select the frequency point.

4 Press or press and hold one of mode keys to select the mode you wish to store.

5 Press **[COPY]** (F4) to copy the frequency and operating data.
- The selected band frequency point and mode are stored.
- To delete a stored frequency point and mode, press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to select the row to delete, then press **[DELETE]** (F5). The points listed below the deleted point will move up, and the display will refresh.

6 Repeat steps 3 to 5 until frequency and operating data are configured for all points.

7 Press **[OK]** (F6).

8 Press **[MENU]** to exit.

While Auto Mode is active, you can select the operating band automatically assigned to each channel. For normal Amateur Radio use, LSB mode should be selected for SSB frequencies lower than 10.1 MHz and USB mode should be selected for SSB frequencies higher than 10.1 MHz.

The following list shows an example of the configurations for the auto mode frequencies in the HF or 50 MHz bands.

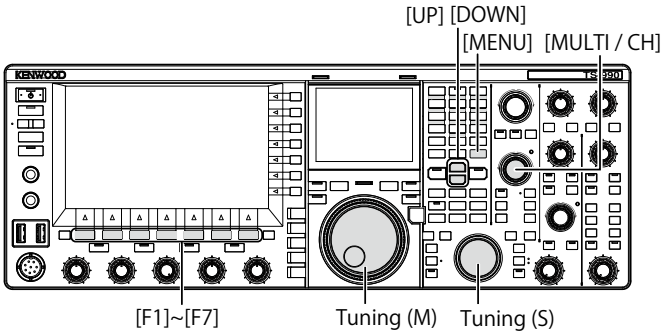
Frequency	Mode	Preset Frequency Range
1.620 MHz	AM	30 kHz ≤ freq. < 1.62 MHz
2.000 MHz	CW	1.62 MHz ≤ freq. < 2.0 MHz
3.500 MHz	LSB	2.0 MHz ≤ freq. < 3.5 MHz
3.525 MHz	CW	3.5 MHz ≤ freq. < 3.525 MHz
10.100 MHz	LSB	3.525 MHz ≤ freq. < 10.1 MHz
10.150 MHz	CW	10.1 MHz ≤ freq. < 10.15 MHz
14.000 MHz	USB	10.15 MHz ≤ freq. < 14.0 MHz
14.070 MHz	CW-R	14.0 MHz ≤ freq. < 14.07 MHz
14.112 MHz	FSK	14.07 MHz ≤ freq. < 14.112 MHz
18.068 MHz	USB	14.112 MHz ≤ freq. < 18.068 MHz
18.110 MHz	CW	18.068 MHz ≤ freq. < 18.11 MHz
21.000 MHz	USB	18.11 MHz ≤ freq. < 21.0 MHz
21.070 MHz	CW	21.0 MHz ≤ freq. < 21.07 MHz
21.125 MHz	FSK	21.07 MHz ≤ freq. < 21.125 MHz
21.150 MHz	CW	21.125 MHz ≤ freq. < 21.15 MHz
24.890 MHz	USB	21.15 MHz ≤ freq. < 24.89 MHz
24.930 MHz	CW	24.89 MHz ≤ freq. < 24.93 MHz
28.000 MHz	USB	24.93 MHz ≤ freq. < 28.0 MHz
28.070 MHz	CW	28.0 MHz ≤ freq. < 28.07 MHz
28.150 MHz	FSK	28.07 MHz ≤ freq. < 28.15 MHz
28.200 MHz	CW	28.15 MHz ≤ freq. < 28.2 MHz
29.000 MHz	USB	28.2 MHz ≤ freq. < 29.0 MHz
30.000 MHz	FM-DATA	29.0 MHz ≤ freq. < 30.0 MHz
50.000 MHz	USB	30.0 MHz ≤ freq. < 50.0 MHz
50.100 MHz	CW	50.0 MHz ≤ freq. < 50.1 MHz
51.000 MHz	USB	50.1 MHz ≤ freq. < 51.0 MHz
52.000 MHz	FM	51.0 MHz ≤ freq. < 52.0 MHz
60.000 MHz	USB	52.0 MHz ≤ freq. < 60.0 MHz

Note:

- No auto mode frequencies above 52.0 MHz are configured. The frequency range of 52.0 MHz ≤ freq < 60.0 MHz is grouped as FM mode.

TUNING THE FREQUENCY

There are another methods to tune the frequency other than the basic methods of rotating the Tuning control or pressing **[UP]** or **[DOWN]** (microphone). This section describes how to select the frequency quickly.



TUNING WITH THE TUNING CONTROL

1 Rotate the **Tuning** (M) or **Tuning** (S) control to increment or decrement the frequency.
   - Rotate it clockwise to increase the frequency and rotate it counterclockwise to decrement the frequency.
   - You can adjust the number of steps per revolution of the **Tuning** control. If Fine Tuning is inactive in SSB, CW or FSK mode, the Tuning control will use 10 Hz per step.
   - With the default of 1000 steps, a single rotation of the Tuning control changes the frequency by 10 kHz.

2 Select Group No. 3, "Basic Configurations", from the **Menu** screen.

3 Access Menu 06, "Tuning Control (Main): Number of Steps per Revolution", or Menu 07, "Tuning Control (Sub): Number of Steps per Revolution".

4 Press **[SELECT]** (F4) to allow editing of the parameter box.



5 Press **[-]** (F4) or **[+]** (F5) to select "250 [Step]", "500 [Step]", or "1000 [Step]".

   The default is “1000” for both Menus 06 and 07.

6 Press **[** ⮌ **]** (F1).

7 Press **[MENU]** to exit.

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USING THE MICROPHONE KEYS

8 Press **[UP]** (microphone) or **[DOWN]** (microphone) to increment or decrement the frequency.

Note:

- Different functions can be assigned to the **[UP]** (microphone) and **[DOWN]** (microphone).

CHANGING THE FREQUENCY

Rotating the **MULTI/CH** control enables you to change the frequency more quickly. The frequency step size can be increased or decreased via the menu.

1 Rotate the **MULTI/CH** control to increment or decrement the frequency.
The default step frequency is "5 kHz" for AM, SSB, CW, FSK and PSK modes and "10 kHz" for FM mode.

CHANGING THE STEP FREQUENCY

1 Select Group No. 3, "Basic Configurations", from the **Menu** screen.

2 Access Menu 01, "SSB/CW/FSK/PSK Mode Frequency Step Size (Multi/Channel Control)", Menu 02, "AM Mode Frequency Step Size (Multi/Channel Control)", or Menu 03, "FM Mode Frequency Step Size (Multi/Channel Control)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On".
You can configure the frequency step size as listed below.

Menu 3-01 (SSB, CW, FSK, PSK mode)
0.5 kHz, 1 kHz, 2. 5 kHz, 5 kHz, 10 kHz

Menu 3-02, "FM mode", and Menu 3-03, "AM mode"
5 kHz, 6. 25 kHz, 10 kHz, 12. 5 kHz, 15 kHz, 20 kHz, 25 kHz, 30 kHz, 50 kHz, 100 kHz

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

ROUNDING OFF THE FREQUENCY

When selecting a frequency using the **MULTI/CH** control, the new frequency may fall between two integer points, thus the frequency will be rounded off to the nearest integer. You can deactivate the rounding off capability of the frequency.

1 Select Group No. 3, "Basic Configurations", from the **Menu** screen.

2 Access Menu 00, "Frequency Rounding Off (Multi/Channel Control)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



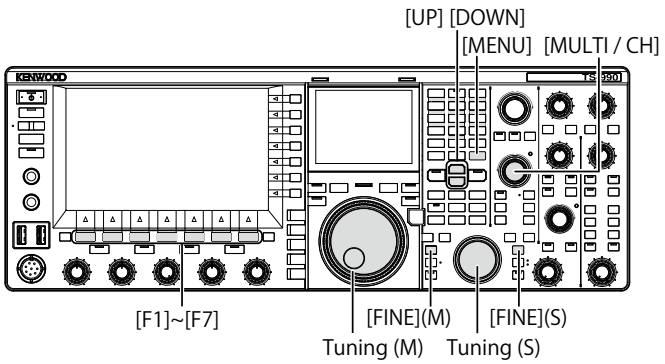
4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "On" (rounding off the frequency per each step). Selecting "Off" does not allow the transceiver to round off the frequency per each step.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

FINE TUNING

You can change the frequency step size of the Tuning control to be 1/10th of the default step size. Fine Tuning enables you to precisely tune the received frequency where it cannot be easily tuned using the default step size.



■ Fine Tuning the Main Band Frequency

1 Press **[FINE]** (M) to toggle the Fine Tuning between active and inactive.

■ Fine Tuning the Sub Band Frequency

1 Press **[FINE]** (S) to toggle the Fine Tuning between active and inactive.

Note:

- While Fine Tuning is inactive, the 1 Hz digit in the frequency display will be grayed out.
- In FM or AM mode, the 10 Hz and 1 Hz digits are normally grayed out. While Fine Tuning is active, the grayed out frequency display is cancelled and all digits, including the 1 Hz digit, appear.

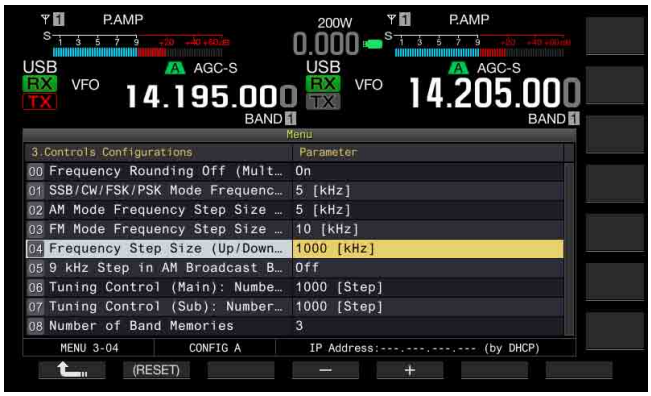
TUNING IN MHZ STEP

1 Press **[UP]** or **[DOWN]** to change the frequency in steps of 1 MHz.
- While holding down the key, the frequency continuously increases or decreases.
- You can change the step size that applies when **[UP]** or **[DOWN]** is pressed.

2 Select Group No. 3, "Basic Configurations", from the **Menu** screen.

3 Access Menu 04, "Frequency Step Size (Up/Down Keys)".

4 Press **[SELECT]** (F4) to allow editing of the parameter box.



5 Press **[-]** (F4) or **[+]** (F5) to select “100 [kHz]”, “500 [kHz]”, or “1000 [kHz]”.
The default is "1000".

6 Press **[** ↩ **]** (F1).

7 Press **[MENU]** to exit.

SELECTING THE STEP FREQUENCY FOR AM BROADCAST LISTENING

When listening to the AM broadcast band ranging from 522 kHz to 1710 kHz, the receive frequency can be changed by rotating the **MULTI/CH** control with 9 kHz frequency step size.

1 Select Group No. 3, "Basic Configurations", from the **Menu** screen.

2 Access 05, "9 kHz Step in AM Broadcast Band (Multi/Channel Control)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select “On” or “Off”.
Selecting “Off” allows you to change the receive frequency at the step frequency configured in Menu 3-03.

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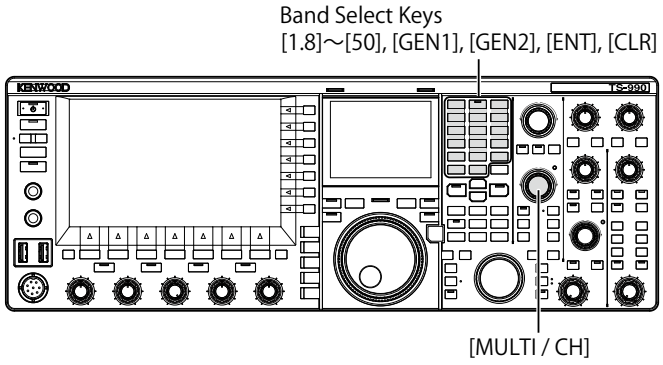
The default is “Off” (K-type) and “On” (E-type).

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

DIRECTLY ENTERING THE FREQUENCY

If your desired frequency is far from the current frequency, directly entering the numbers using the numeric keypad is the fastest method to enter the frequency.



1 Press **[ENT]**.
A series of dashes ("-") appear on the frequency display for the selected operating band.

2 Press the numeric keys to enter a frequency.
- Pressing the numeric key replaces the dashes with the entered number, starting with the leftmost digit.
- To enter 1.82 MHz, pressing **[0/50]**, **[1/1.8]**, **[8/24]**, **[2/3.5]**, and then **[ENT]** completes the entry. Always enter a leading “0” for frequencies below 6MHz.
- Pressing **[CLR]** during the entry aborts the entry, and the VFO frequency before the entry began reappears.





Note:
- The maximum frequency you can enter is 59.99999 MHz for Fine Tuning, you cannot enter 60 MHz.
- Pressing **[ENT]** while entering a frequency fills the remaining digits with 0's.
- If you enter a value outside the transmit and receive frequency range, a beep sounds and the entry will be rejected.
- If the first entered value is from 0 to 5, that digit will automatically be set as the 10 MHz digit; entering a first value from 6 to 9 will set that digit as the 1 MHz digit.
- Even if you enter the 10 Hz digit, "0" will not appear.
- Entering the frequency deactivates the RIT and XIT. However, the respective offset frequencies cannot be released.
- In any mode other than AM and FM mode and when Fine Tuning is disabled, the 10 Hz digit will be the least digit that you can enter, and in AM and FM modes, 100 Hz digit is the least digit you can enter.
- After entering a frequency while in Auto mode, the operating mode automatically changes. {page 4-11}

DISPLAYING THE HISTORY OF THE FREQUENCY ENTRIES

A maximum of the last 10 frequencies entered using the numeric keypad can be stored in the transceiver. To reuse a frequency you previously entered, that frequency can be recalled from the last 10 entered frequencies.

1 Press **[ENT]** to allow you to enter the frequency.
All digits for the frequency are displayed with "-" (dash).

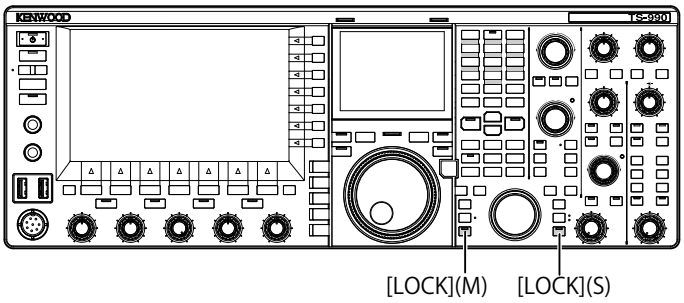
2 Rotate the **MULTI/CH** to display the histories.
- Stored frequencies along with their log numbers appear. The most recent frequency along with the earliest log number appears first.
- Rotate the **MULTI/CH** control clockwise to increase the log number and display the older logs in sequence.

3 Press **[ENT]** to transfer the selected frequency to the VFO.

Note:
- If the frequency was not correctly entered, the entry will not be stored as a last entered frequency.
- If no frequency has been entered, nothing appears as a last entered frequency.
- If you enter a frequency while the auto mode frequency point is being configured, nothing appears as a last entered frequency.
- If you activate the transverter, all frequency logs will be cleared.

USING THE FREQUENCY LOCK

Frequency Lock can lock particular keys and controls so they are not accidentally operated to change the frequency.



■ Locking the Main Band Frequency

1 Press **[LOCK]** (M) to lock the frequency for the main band.
The "LOCK" (M) LED lights orange.

■ Locking the Sub Band Frequency

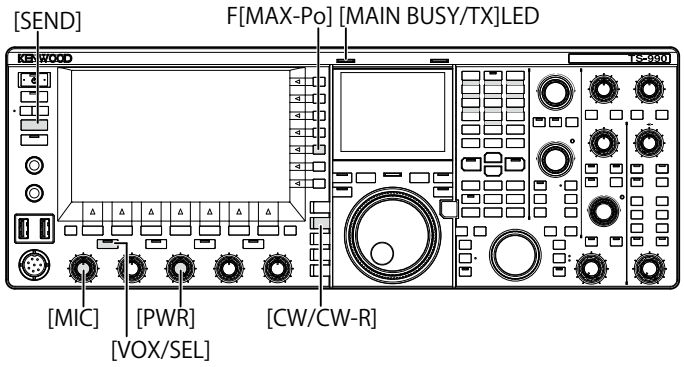
1 Press **[LOCK]** (S) to lock the frequency for the main band.
The "LOCK" (S) LED lights orange.

Following are the keys that are locked while the frequency is being locked. Refer to the following table.

Keys/Controls	Remarks
Tuning (M) and **Tuning** (S) controls	The Tuning (M) control can be rotated during your operation with TF-SET.
MULTI/CH control	During the configuration, rotate to scroll the items you can edit.
[ENT] key	
[M.IN] key	
[SCAN] (F5) key	Can still be used by pressing and holding to open the configuration screen.
[UP] (microphone) and **[DOWN]** (microphone)	Can be used while TF-SET is being operated in VFO mode. Can still be used by pressing **[UP]** (microphone) and **[DOWN]** (microphone) to change a parameter in the Menu. Can still be used by pressing **[UP]** (microphone) and **[DOWN]** (microphone) to "Paddle" if it has been configured for Menu 04 (Paddle (Microphone Up/Down Keys)).
[M/V] key	
[RX] (M) and **[RX]** (S) keys	Can be operated only if the main band frequency is locked.
[TX] (M) and **[TX]** (S) keys	
Band Select Keypad	
[M►VFO] (F), **[M>V]**	
[M>S] key	
[M/S] key	
Mode keys	Press and hold while in FM mode to enter to FM narrow mode.
[FINE] (M) and **[FINE]** (S) key	
[CW T.] (M) and **[CW T.]** (S)	
[Q.MR] key	
[QM.IN] key	
Touchscreen Tuning	
[UP] and **[DOWN]**	
[TRACKING]	Can be operated only if the main band frequency is locked.

TRANSMITTING

AUDIO TRANSMISSION



1 Press down the **[PTT]** (microphone), or press **[SEND]**.
2 Speak into the microphone in your normal voice.
3 Release the **[PTT]** (microphone), or press **[SEND]**.
The transceiver reverts to the receive state.

CW TRANSMISSION

If a keyer or paddle is connected to the transceiver, you can transmit in CW mode.

1 Press **[CW/CW-R]** to select CW mode.
2 Press **[VOL/SEL]** or **[FBK]** to enable the break-in.
3 Operate your keyer or paddle.

Note:
♦ While transmitting, the "TX" LED for the selected band lights.

ADJUSTING THE MICROPHONE GAIN

You can adjust the microphone gain when you transmit in SSB or AM mode.

1 Press down the **[PTT]** (microphone), or press **[SEND]**.
The "MAIN BUSY/TX" LED lights red.
2 Speak into the microphone in your normal voice.
3 Rotate the **MIC** control to adjust the microphone gain.
SSB Mode
Rotate the **MIC** control while speaking into the microphone to adjust the level. The ALC meter display varies depending on the audio level. Adjust the level so as not to exceed the tolerance of the ALC range. {page 4-19}
AM Mode
Rotate the **MIC** control while speaking into the microphone to adjust the level. Adjust the level until the indication in the PWR meter slightly varies by the audio level.
4 Release the **[PTT]** (microphone), or press **[SEND]**.
The "MAIN BUSY/TX" LED light green or turns Off, depending on the configuration for the squelch level.

Note:
♦ For FM mode, configure the microphone gain in Advanced Menu 13, "Microphone Gain (FM Mode)". {page 5-28}

ADJUSTING THE TX POWER

Reduce the transmit power as long as you can make a QSO securely. This prevents you from interfering with or disturbing other stations.

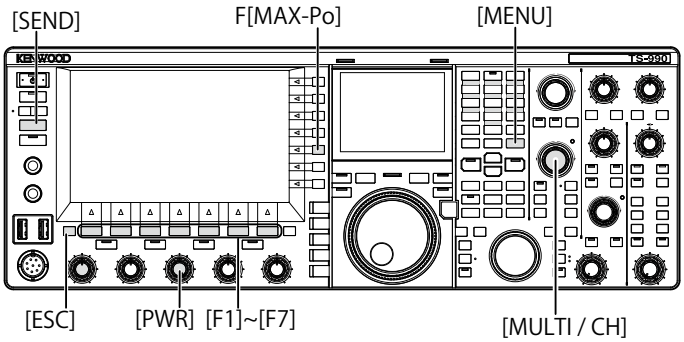
With this transceiver, you can adjust the transmit power even while you are transmitting.

1 Rotate the **PWR** control to adjust the transmit power.
Clockwise increases the transmit power and counterclockwise decreases it. The available transmit power range varies, depending on the band and operating mode. Refer to the following table.

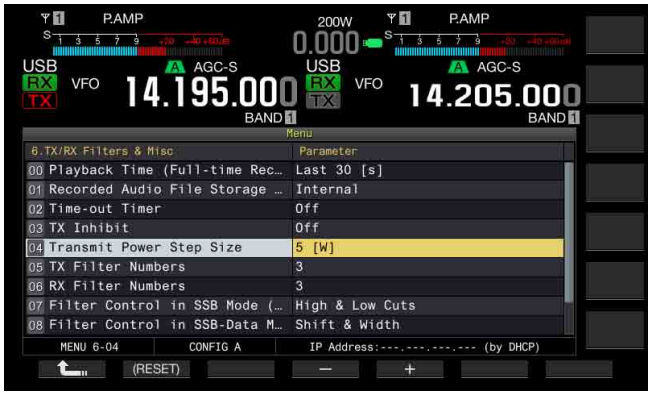
	TS-990S	
	Other than AM	AM
HF Band	5 to 200 [W]	5 to 50 [W]
50 MHz Band	5 to 200 [W]	5 to 50 [W]

PRECISELY ADJUSTING THE TX POWER

You can select the number of steps when you rotate the **PWR** control.



1 Select Group No. 6, "TX/RX Filter & Misc.", from the **Menu** screen.
2 Access Menu 04, "Transmit Power Step Size".
3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "1 [W]", or "5 [W]".
The default is "5 [W]".
5 Press [ ] (F1).
6 Press **[MENU]** to exit.

TRANSMIT POWER LIMITER

You can place a limit on the transmit power of your transceiver. This function prevents the transmit power from exceeding the configured transmit power limit even with further rotation of the PWR control. You can also set a different transmit power limit for the DATA mode.

1 Press **[MAX-Po]** (F) to open the **TX Output Limit** screen.



2 Press **[** ◀ **]** (F4) or **[** ▶ **]** (F5) to highlight a line for a frequency band.

3 Press **[** ▲ **]** (F2) or **[** ▼ **]** (F3) to select the transmit power to be controlled.
As shown below, you can select the item to limit the transmit power.

Max Power Limit
Transmit power limit for normal transmission.

Max Power Limit (DATA)
Enables the configuration for the transmit power limit while in DATA Mode.

TX Tune Power
Enables the configuration for the transmit power limit for the TX Tuning. {page 9-14}

4 Press **[-]** (F6) or **[+]** (F7), or rotate the **MULTI/CH** control to select the limit value for the transmit power.
Press and hold **[(RESET)]** (F1) to revert the limit value for the selected item to the default.

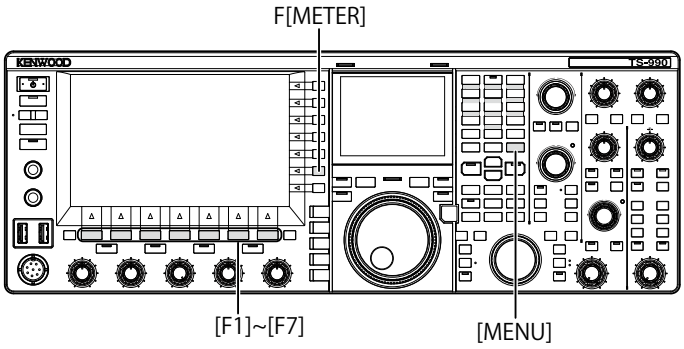
5 Press **[MAX-Po]** (F) or **[ESC]** to exit.

Note:

- If "On" (with the 5 W transmit power reduction enabled) is configured in Advanced Menu 08, "TX Power Down with Transverter Enabled", **[MAX-Po]** (F) on the right side of the main screen and the wattage value on the key guide will disappear when the transverter or drive-out is activated.
- If ANT1 is selected for the transceiver for use with an external antenna tuner, the maximum transmit power is limited to 100 W. Even if greater than 100 W is configured for the transmit limiter, the display on the key guide of **[MAX-Po]** (F) remains as 100 W as well as the display on the main screen (100 W).

METER

The meter for the main band displays the signal as an S-meter while receiving and as the selected meter while transmitting. The meter for the sub band always displays the readout of the S-meter. The meter type for the main band displayed on the main screen can be changed.



CHANGING THE METER TYPE

You can select the meter display pattern, showing the main band status, from a digital pattern or two analog patterns.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 10, "Meter Display Pattern".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Type 1" (Digital), "Type 2" (Analog 1), or "Type 3" (Analog 2).
The default is "Type 2" (Analog 1).

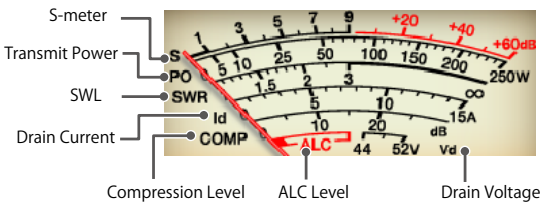
5 Press **[** ↩ **]** (F1).

6 Press **[MENU]** to exit.



Type 1 (Digital Meter)

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Type 2 (Analog 1 Meter)

CHANGING THE TRANSMIT METER

1 Press **[METER]** (F)
Parameters vary according to the meter type:

For Type 1 (Digital Meter)
SWR > Id > Vd > TEMP > SWR

For Type 1 (Digital Meter) and displayed as the compressed mode
Po > SWR > Id > ALC > Vd > TEMP

For Type 2 or Type 3 (Analog Meter)
P0 > SWR > Id > COMP > ALC > VD

P0	Indicates the transmit power. (Indicates the peak transmit power value.)
SWR	Indicates the Standing Wave Ratio showing the antenna impedance matching state.
COMP	Displays the amount of compression of the transmit signal by the speech processor.
ALC	Indicates the voltage in the Automatic Level Control circuit.
Id	Indicates the drain current in the final FET circuit.
Vd	Indicates the drain voltage in the final FET circuit.
TEMP	Indicates the temperature of the internal circuit.





S-meter for the sub band appears on the upper right side of the main display.



S-meter for the sub band

Note:

- If an analog meter is connected to the METER terminal on the rear panel, the signal level can be observed on both the front panel and the external meter. {page 16-15}
- COMP meter can be selected while the Speech Processor is active.

METER PEAK-VALUE HOLD

Indicates the held peak-value in the digital meter.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 11, "Meter Display Peak Hold".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Off" or "On".
The default is “On” (use with Meter Peak Hold). Selecting “Off” disables the Meter Peak Hold. In this case, the peak values remain displayed for the duration below.

Upper Display: 0.5 seconds

Middle and Lower displays: 0.3 seconds (except SWR meter)

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

ANALOG METER RESPONSE SPEED

You can configure the response speed of the needle on the analog meter.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 09, "Meter Response Speed".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select one from "1" to "4".
The default is “3”.

5 Press **[ ]** (F1).

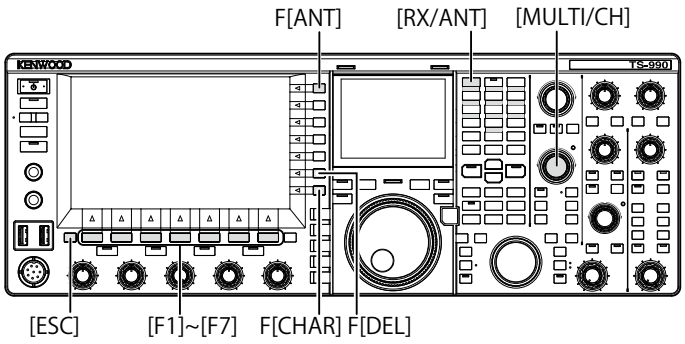
6 Press **[MENU]** to exit.

Note:

- The configured parameter also applies for the vertical meter used in SWL mode.

STORING THE ANTENNA NAME

You can store an antenna name for the connected antenna. If multiple antennas are used, band by band, displaying the antenna name allows you to distinguish which antenna you want to select.



1 Press and hold **[ANT]** (F) to open the **Antenna Name** screen.

2 Press **[ ]** (F2) or **[ ]** (F3), or rotate the **MULTI/CH** control to select the antenna connector to which a name will be given.

3 Press **[NAME]** (F6) to allow editing of the parameter box.



4 Enter the antenna name by pressing the function keys or rotating the **MULTI/CH** control.

A maximum of 5 alphanumeric characters and symbols can be entered.

[SPACE] (F1): Press to enter one space.

[-] (F2) or **[+]** (F3): Press to display the previous or next character.

[ ] (F4) and **[ ]** (F5): Press to move a pointer to the left or right.

[SAVE] (F6): Stores the selected characters.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Changes the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

■ Available Characters and Symbols (A maximum of 5 characters)

Following are the available characters and symbols with “English” selected in Menu 9-01. If you wish to enter the Japanese characters, download the Japanese instruction manual to refer to the available characters and symbols for the Japanese characters.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	E	X	Y	Z			
0	1	2	3	4	5	6	7	8	9					
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z				
!	#	$	%	&	'	(	)	*	+	,	/	:	<	=
>	?	@	[	\	^	_	`	{	|	}	~			
｡	｢	｣	､											

5 Press **[SAVE]** (F6) to save the antenna name.

6 Press **[ESC]** to exit.

CHANGING THE ANTENNA

You can change the antenna connected to the rear panel according to your operating band. Parameters configured for ANT1 to ANT4 and DRV will automatically be saved in the antenna band memory. If you select the same band next time, the same antenna will automatically be selected.

1 Press **[ANT]** (F) to select the antenna.
Each key press cycles the operating mode through the following sequence.

ANT1 > ANT2 > ANT3 > ANT4> ANT1

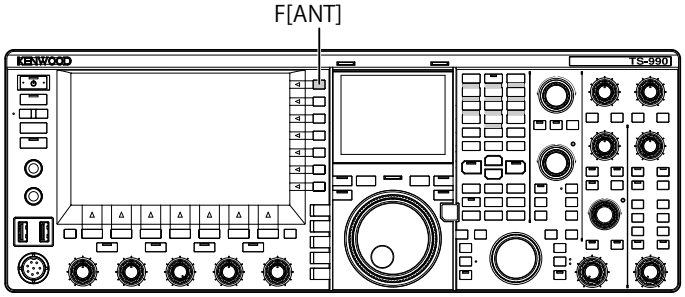
Frequency Range for the Selected Antenna (MHz)	
0.03 to 0.522	10.5 to 14.5
0.522 to 2.5	14.5 to 18.5
2.5 to 4.1	18.5 to 21.5
4.1 to 6.9	21.5 to 25.5
6.9 to 7.5	25.5 to 30.0
7.5 to 10.5	30.0 to 60.0

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RX ANTENNA

You can select an antenna to be dedicated for reception.

To operate the transceiver with an antenna dedicated for reception, such as an HF low band Beverage antenna or a directional loop antenna, you must connect the antenna to the **RX IN** connector on the rear panel.



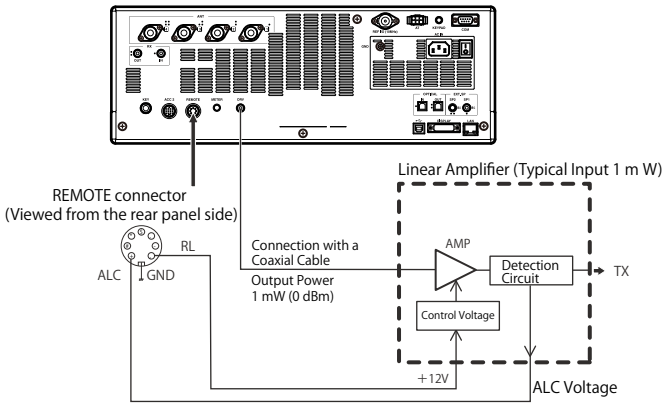
1 Press **[RX ANT]**.
Each key press toggles the antenna for the selected operating band between active and inactive.

While active, "RX" appears on the main screen.

If the same antenna (ANT1 to ANT4) is configured for the main band and sub band, the RX antenna for the deselected band is also changed.

DRIVE OUTPUT (DRV)

The frequency ranges that can be output from the Drive (DRV) jack are 135 kHz (135.700 kHz to 137.799 kHz) and the 1.9 to 50 MHz amateur bands. Output level is 1 mW (0 dBm).



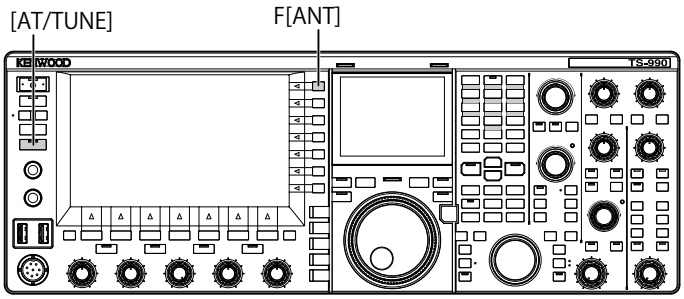
1 Press **[DRV]**.
- The "DRIVE" LED lights green.
- If the transmit signal is sent from the DRV connector, no signal can be transmitted from the **ANT1** to **ANT4** connectors.
- Following the configuration in Advanced Menus 11 (Linear Amplifier Control (HF Band)) and 12 (Linear Amplifier Control (50 MHz Band)), +12 V is sent from pin 7 (RL) of the **REMOTE** connector.
- The PWR meter is inactive while transmitting from the **DRV** connector. The automatic control circuit activated when voltage is applied to pin 6 (ALC), of the **REMOTE** connector, and the status of the automatic control circuit appears on the ALC meter.

Note:
- Be sure that the connection for use with the drive output is in place, as described above.
- Rotate the **PWR** control to reduce the transmit power.

INTERNAL ANTENNA TUNER

As explained in "ANTENNA INSTALLATION AND CONNECTION", you will have the best performance when matching the impedance of the coaxial cable with the antenna. {page 1-1}

To adjust the impedance between the antenna and the transceiver, use an external antenna tuner or the internal antenna tuner.



SECURING THE MATCHING TO THE ANTENNA

1 Select the transmit frequency.

2 Press **[ANT]** (F) to select the antenna.
- Ensure that "ANT 2" has been selected if the internal antenna tuner will be used and if the external antenna has been connected to the **ANT1** connector.
- If the external antenna has been connected to the **ANT1** connector, the internal antenna tuner cannot be used with "ANT1" selected.

3 Press and hold **[AT/TUNE]** to tune.
- The transceiver is placed in CW mode, and tuning begins. The transmit power will be "10 W", the SWR meter will be selected as the transmit meter.
- After the tuning has completed, the blinking ">T" lights. While the antenna tuner is enabled during the reception, the blinking "R>" also lights.
- To stop tuning, press **[AT/TUNE]** again.
- If the Standing Wave Ratio of the antenna is extremely high, such as 10:1 or higher, a Morse code "SWR" alert sounds and the internal antenna tuner turns off.
- Adjust the antenna system to lower the Standing Wave Ratio before tuning again.



4 Ensure that the antenna tuning has completed.
- Upon normal completion of the antenna tuning, a Morse code "T" sounds.
- "R<AT>T" stops flashing on and off, and remains on upon completion of the antenna tuning. The "AT" LED lights.
- If the antenna tuning does not complete in 20 seconds, a Morse code "5" alert sounds. In this case, pressing **[AT/TUNE]** stops the tuning function and returns to receive mode.

Note:
- The internal antenna tuner does not tune outside the licensed transmit frequency range.
- Press and hold **[AT/TUNE]** during transmission to start tuning.
- If 60 seconds lapse and no matching is established, the tuning automatically ends. In this case, the antenna tuner circuit is switched Off, "AT", ">T" and "R<" disappear from the main screen, and the "AT" LED becomes unlit.
- If the antenna tuning does not complete even with the antenna having a Standing Wave Ratio of 3:1 or less, adjust the antenna system to lower the Standing Wave Ratio, then restart the tuning process.
- Even if the antenna tuning completes, there may be cases where the Standing Wave Ratio is not 1:1 or less.
- If ANT1 is selected for the transceiver for use with an external antenna tuner, the maximum transmit power is limited to 100 W. {page 4-21}

PRESET

Results of the tuning in each preset band can be stored in the internal antenna tuner as preset tuning information.

While the internal antenna tuner is active, the preset tuning information corresponding to the current transmit frequency is applied to the internal antenna tuner.

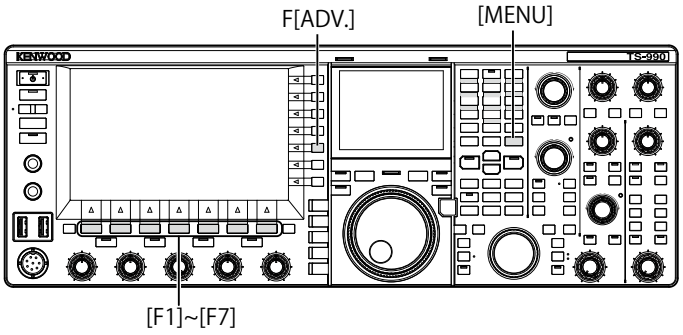
1 Press **[AT/TUNE]**.
- "AT>T" appears on the main screen. "R>" appears while an external antenna tuner is active. The preset tuning information corresponding to the current transmit frequency is applied to the internal antenna tuner.
- If you change the transmit frequency, the preset tuning information followed by the preset band will be automatically configured for the internal antenna tuner.
- To deactivate the internal antenna tuner, press **[AT/TUNE]** again.

Preset Band (MHz) for the Internal Antenna Tuner	
0.03 to 1.85	14.10 to 14.50
1.85 to 2.50	14.50 to 18.50
2.50 to 3.525	18.50 to 21.15
3.525 to 3.575	21.15 to 21.50
3.575 to 3.725	21.50 to 25.50
3.725 to 4.1	25.50 to 29.0
4.1 to 6.9	29.0 to 30.0
6.9 to 7.05	30.0 to 51.00
7.05 to 7.1	51.00 to 52.00
7.1 to 7.50	52.00 to 53.00
7.50 to 10.50	53.00 to 60.0
10.50 to 14.10	

Note:
- Even if the present frequency information is used, factors such as rain on the antenna may increase the Standing Wave Radio. In this a case, tune the frequency again until the Standing Wave Radio drops.

CHANGING THE ANTENNA BEHAVIOR FOR RECEPTION

You can pass received signals through the internal antenna tuner. If the internal antenna tuner is active, reception interference from adjacent frequencies may be reduced.



1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 10, "Antenna Tuner during RX".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "Off" (not using the internal antenna tuner during reception). Selecting "On" allows the use of the internal antenna tuner during reception.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

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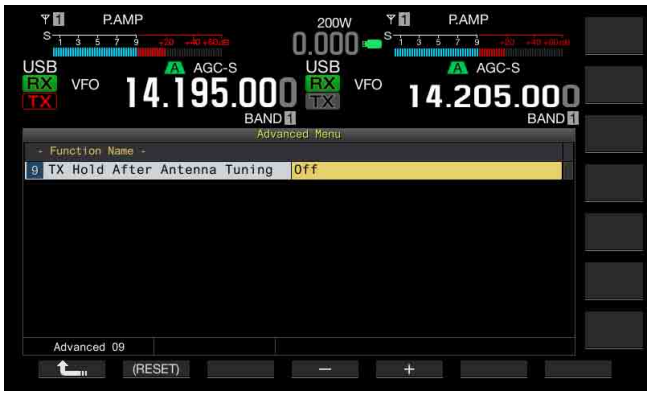
Note:

- If Full Break-in for use in CW mode is active, the antenna tuner for reception can be active regardless of the above configuration.
- If the band for transmission and reception during the Split operation differs, the antenna tuner does not behave regardless of the above configuration.

TRANSMIT HOLD AFTER ANTENNA TUNING COMPLETES

You can continue transmitting even after the antenna tuning completes.

1. Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.
2. Access Menu 09, "TX Hold After Antenna Tuning".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.



4. Press **[-]** (F4) or **[+]** (F5) to select "On".
   The default is "Off".
5. Press [↩] (F1).
6. Press **[MENU]** to exit.

CONFIGURING THE STEREO HEADPHONES OUTPUT

CONFIGURING THE MIX BALANCE OF THE STEREO HEADPHONES OUTPUT

You can adjust the mixing balance of the received audio between the left and right channels, for operation with stereo headphones.

1. Select Group No. 1, "Audio Performance", from the **Menu** screen.
2. Access Menu 07, "Headphones Mixing Balance".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.
4. Press **[-]** (F4) or **[+]** (F5) to configure the mix balance from the available range "0" to "10".
   - The default is "10". The received audio in the main band and the received audio in the sub band are equally distributed.
   - If "0" has been configured for menu 1-07 "Headphones Mixing Balance", the received audio in the main band and the received audio in the sub band are completely separated for the left and right channels.
   - If "Off" has been configured for menu 1-08 "Headphones Left/Right Reverse", the received audio in the main band will be allocated to the left channel, and the received audio in the sub band will be allocated to the right channel.
   - Increasing the configured value causes the level of the audio in one channel mixed with the audio in other channel to also be increased.
5. Press [↩] (F1).
6. Press **[MENU]** to exit.

Note:

- Following the configuration in Menu 1-08, "Headphones Left/Right Reverse", the channel that mainly emits the received audio of the main band can be swapped.

SWAPPING THE RIGHT AND LEFT OUTPUT OF THE HEADPHONES

You can reverse the audio of the **PHONES** jack left and right channels.

1. Select Group No. 1, "Audio Performance", from the **Menu** screen.
2. Access Menu 08, "Headphones Left/Right Reverse".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.



4. Press **[-]** (F4) or **[+]** (F5) to select "Off" or "On".
   Following is the example of configuration when "0" has been configured for Menu, "Headphone Mixing Balance".

Configuration	Left Channel	Right Channel
Off	Received Audio in the Main Band	Received Audio in the Sub Band
On	Received Audio in the Sub Band	Received Audio in the Main Band

5. Press [↩].
6. Press **[MENU]** to exit.

Note:

- The wiring in the headphones jack plug determines whether the right channel audio or the left channel audio sounds from the left or right channels of the headphones.

SIMPLEX OPERATION

In most day to day operation, QSOs are Simplex operations using the same frequency for reception and transmission. For Simplex operation with this transceiver, you will transmit and receive in the main band.

Note:

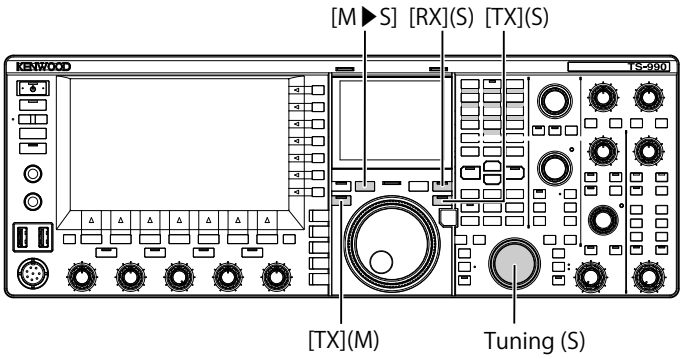
- The reception capability for the main band cannot be disabled.

SPLIT OPERATION

You may use the Split function that allows you to transmit and receive using different frequencies when you make a QSO with the DX-pedition station. For Split operation using this transceiver, you can allocate different frequencies for the main band and sub band; one band is used for transmission and the other band for reception. {page 5-30}

FINDING THE TX FREQUENCY BY ROTATING THE TUNING CONTROL (S)

To directly tune the transmit frequency, follow the instruction below during reception on the main band from the DXer.



1. Press **[M▶S]** to copy the operating frequency and mode for the main band to the sub band.
2. Press **[TX]** (S) to select the sub band enabling you to transmit.
   The "TX" (S) LED lights green and the "SPLIT" LED lights yellow, and you can start the split operation.
3. Tune the sub band frequency with a rotation of the **Tuning** (S) control to be the transmit frequency.
   The sub screen the frequency difference between the main band and sub band appears as ΔF.



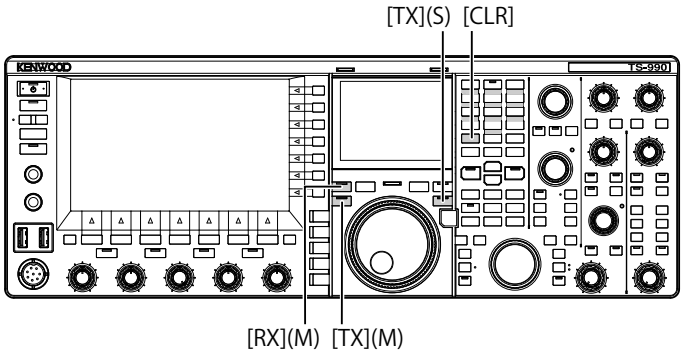


Note:

- Pressing **[TX]** (M) finishes the split operation, and the transceiver reverts to simplex operation.
- To temporarily receive using the transmit frequency, use the TF-SET function.
- Refer to "SUB SCREEN" for details of the display method of the sub screen. {page 4-4}

DIRECTLY ENTERING THE FREQUENCY SPLIT SPECIFIED BY A DXER

To directly enter the difference between the TX and RX frequencies specified by a DXer, follow the instruction below during reception on the main band of a signal from the DXer.



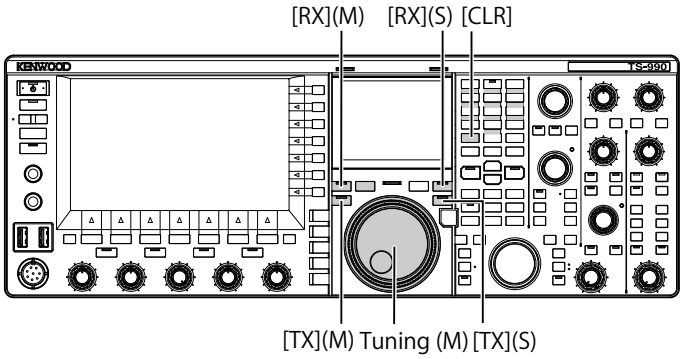
1. Press **[<MAIN]** to enter the main mode.
2. Press and hold **[TX]** (S).
   The "SPLIT" LED lights yellow, each LED on the numeric and band-select keypad also lights. An error will occur if the frequency for the sub band is locked. Do this operation after deactivating the frequency lock.

3 Enter the frequency difference (the “split”) in the order of kHz as specified by the DX station.
- If the frequency specified by the DXer is higher than now, enter the specified frequency in the order of kHz using the numeric and band-select keypad. Conversely, if the specified frequency is lower, a value "0" must be prefixed to the frequency.
- For example, enter a value "5" if you need to increment the frequency by 5 kHz, and enter a value "05" if you need to decrement the frequency by 5 kHz.
- As a result, the "RX" (M) LED and "TX" (S) LED light green and "SPLIT" LED lights yellow, and you can start the split operation. Also, the offset frequency for the main band and sub band frequencies appears on the sub screen as the ΔF value.

Note:
- Pressing **[TX]** (M) switches from split operation to simplex operation.
- To temporarily receive using the transmit frequency, use the TF-SET function. {page 5-2}

ROTATE THE TUNING (M) CONTROL TO SEARCH FOR THE TRANSMIT FREQUENCY.

To directly search for the transmit frequency by rotating the **Tuning** control, follow the instruction below during the reception on the main band of a signal from the DX station.



1 Press and hold **[TX]** (S).
The "SPLIT" LED blinks, each LED on the numeric and band-select keypad also lights. An error will occur if the frequency for the sub band is locked. Do this operation after deactivating the frequency lock.

2 Rotate the **Tuning** (M) control to search for the frequency.
The frequency can be changed even if the main band frequency has been locked.

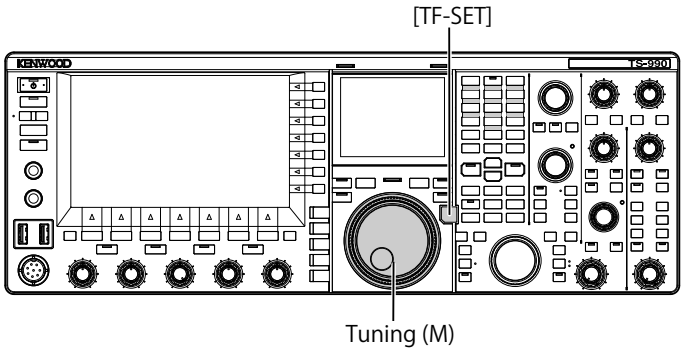
3 Press **[TX]** (S) to end.
- The frequency configured for the main band is also applied to the transmit frequency of the sub band and you can start the split operation.
- The "RX" (M) LED and "TX" (S) LED light, and the “SPLIT” LED blinks. The offset frequency for the main band and sub band frequencies appears on the main screen as the ΔF value.

Note:
- If you wish to cancel the operation when the step 1 above has completed, press either of **[RX]** (M), **[TX]** (M), or **[CLR]**. Also, pressing **[TX]** (M) reverts the operating mode to simplex operation from the split operation.
- To temporarily receive using the transmit frequency, use the TF-SET function. {page 5-2}

SEARCHING WITH TF-SET ENABLED FOR THE TRANSMIT FREQUENCY DURING RECEPTION

While pressing down the **[TF-SET]** key during the Split operation using the sub band, the transmit frequency of the main band can be changed by rotating the **Tuning** (M) control. The status of the frequency can be monitored by changing the frequency to receive.

To facilitate your QSO using the Split operation with a DX station that has been piled up from many stations, use the bandscope and the TF-SET to enable your operation accurate and quick to tune the frequency used by the DX station and the frequency that other stations are not using.



1 Press down **[TF-SET]**.
The status of the transmit frequency can be monitored using the main band.

2 While **[TF-SET]** is pressed down, rotate the **Tuning** (M) or **MULTI/CH** control to increment or decrement the frequency.

3 Release **[TF-SET]** to resume the reception using the main band.
The transceiver resumes reception using the receiving frequency configured for the main band.

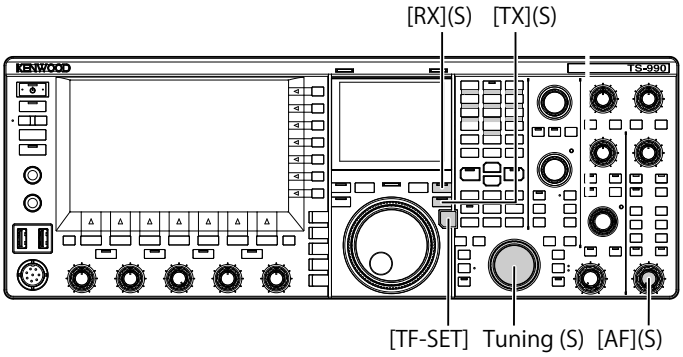
Note:
- While you are pressing down **[TF-SET]**, the frequency displays for the main band and the sub band are reversed.
- You cannot change the frequency even with a rotation of the **Tuning** (S) control while **[TF-SET]** is being pressed down.
- Pressing down **[TF-SET]** while the XIT function for the sub band is active will add the XIT frequency to the displayed frequency for the main band.
- Even if the frequency has been locked, the transmit frequency displayed for the main band can be changed.
- While in Memory Channel Mode, and if a temporary change of a memory channel is enabled, the frequency can be changed by means of the TF-SET.
- While you are pressing down **[TF-SET]**, you cannot change the quick memory channel or clear the memory.

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SIMULTANEOUS MAIN BAND AND SUB BAND RECEPTION

The transceiver has two independent receivers, so that the transceiver can receive on the main band and sub band using different frequencies. For example, while you have a QSO using the transceiver in simplex operation on the main band, you can tune into a sub band frequency that a DX-pedition operator has announced to work on and wait for the DX-pedition operator to come up.

Furthermore, if you wish to call a DX station using Split operation, with the reception in the main band using the frequency occupied by the DX station, you can monitor the transmitted signal by receiving the signal on the sub band.



1 Press **[RX]** (S) to start receiving on two frequencies.
The "RX" (S) LED lights, and the transceiver starts receiving on the sub band; now the transceiver receives using the dual frequencies.

2 Rotate the **AF** (S) control to adjust the AF gain.

3 Rotate the **Tuning** (S) control to tune the receive frequency.

4 Press **[RX]** (M) or **[RX]** (S) to finish the dual frequencies reception.

Note:

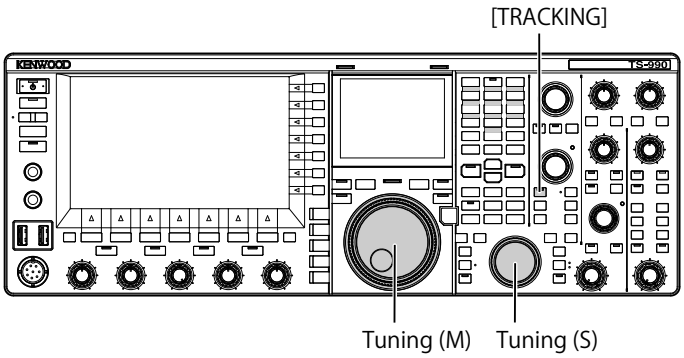
- Pressing **[TX]** (S) starts the Split operation allowing the transceiver to continue reception on the transmit frequency. While you press down **[TF-SET]**, you can monitor the transmit frequency. For reception using two frequencies, the transceiver can receive on the sub band using the transmit frequency while receiving on the main band.

FREQUENCY TRACKING

By rotating the **Tuning** (M) control with the frequency tracking function activated, you can change the main band and sub band frequencies with the difference between the frequencies maintained. Also, rotating the **Tuning** (S) control can change the sub band frequency without changing the main band frequency.

This frequency tracking will be useful, for instance, when different antennas are connected for the main band and sub band allowing you to measure the difference in the signal strengths. The tracking function is particularly effective on the low-frequency bands.

Frequency Tracking can be used while the main band and sub band are in VFO mode. If Frequency Tracking is enabled when the main band and sub band are in different modes, the sub band is placed in the same mode as the main band.



1 Press **[TRACKING]** to enable the Frequency Tracking.

- The operating data of the main band is copied to the sub band, and the “TRACKING” LED lights green. Press **[TRACKING]** again to disable the Frequency Tracking, the "TRACKING" LED turns Off.
- The operating data such as the frequency and the operating mode for the main band is copied to the sub band.
- Rotating the **Tuning** (M) control when the sub band frequency is different from the main band frequency changes both main band and sub band frequencies and retains the same frequency differential.
- If Fine Tuning is enabled in either of the bands, Fine Tuning for the other will also be enabled.
- If the band is swapped, or if the VFO data is recalled from a Memory Channel while in VFO mode, Frequency Tracking will be disabled.
- While Frequency Tracking is active, the scan does not start.

AGC (AUTOMATIC GAIN CONTROL)

AGC is a function that automatically controls the IF Gain so as to absorb variations in the received signal strength.

Following the receiving state or the operating mode (other than FM mode), FAST, MID, or SLOW can be configured for the AGC time constant.

The digital AGC circuit of the transceiver is adjustable to a SLOW, MID, or FAST value ranging from “1” (the quickest) to “20” (the slowest).

In general, a fast time constant is configured for CW and FSK modes where there is a rapid variation in the received signal strength, and a slow time constant is configured for SSB and AM mode where the variation is slower.

Fast time constant is effective for quick tuning when a weak signal is present.

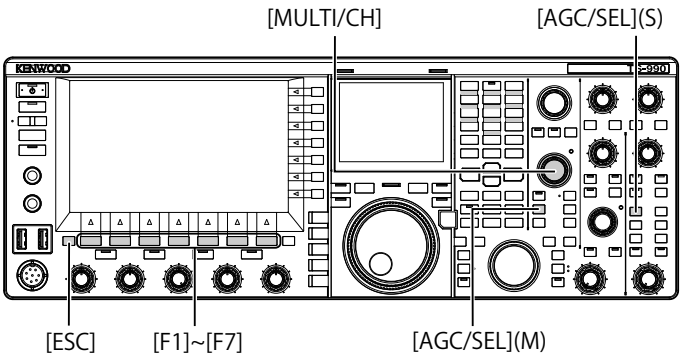
Also, you can disable the AGC. As shown below, a default AGC time constant is set on a mode-by-mode basis.

■ DEFAULTS OF AGC TIME CONSTANT (COMMON TO MAIN BAND AND SUB BAND)

Mode	Time Constant	Display
SSB	SLOW	AGC-S
SSB-DATA	SLOW	
CW	FAST	AGC-F
FSK	FAST	
PSK	FAST	
AM	SLOW	AGC-S
AM-DATA	SLOW	

SELECTING THE AGC TIME CONSTANT

Following are the procedure to switch the AGC time constants of the main band and sub band to “FAST”, “MID” or “SLOW”.



1 Press one of mode keys to select any mode other than FM mode.

2 Press **[AGC/SEL]** (M) or **[AGC/SEL]** (S) to select the AGC time constant.
Each time you press the key, the selection cycles as follows:
FAST > MID > SLOW > FAST

CHANGING THE AGC TIME CONSTANT

Time constant for the main band and sub band can be independently changed from the defaults.

1 Press one of the mode keys to select any mode other than FM mode.

2 Press and hold **[AGC/SEL]** (M) or **[AGC/SEL]** (S) to open the **AGC** screen.



3 Press **[AGC]** (F3), **[AGC/SEL]** (M), or **[AGC/SEL]** (S) to select "FAST", "MID", or "SLOW".

Pressing **[AGC]** (F3), **[AGC/SEL]** (M), or **[AGC/SEL]** (S) while the AGC is disabled for the main band and sub band enables the AGC.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the AGC time constant.

- Selecting "1" enables the slowest AGC time constant, and selecting "20" enables the fastest AGC time constant. The defaults of the AGC time constants for each operating modes are below.

Mode	FAST	MID	SLOW
SSM	9	12	15
SSB-DATA	9	12	14
CW	9	12	14
FSK	7	11	14
PSK	7	11	14
AM	9	13	16
AM-DATA	9	13	16

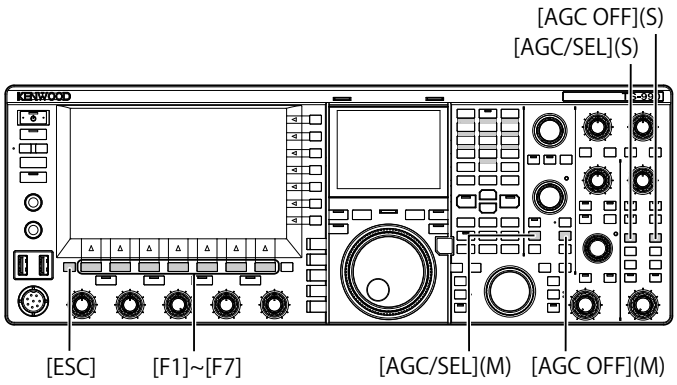
- Press and hold **[(RESET)]** (F1) to reset the selected AGC time constant to the default.

5 Press **[ESC]** to exit.
In FM mode, the **AGC** screen does not open even with a long press of either **[AGC/SEL]** (M) or **[AGC/SEL]** (S).

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COPYING THE AGC TIME CONSTANT CONFIGURATIONS

The AGC time constants configured for “FAST”, “MID” and “SLOW” of the main band can be copied to the sub band. Also, the AGC time constants configured for “FAST”, “MID” and “SLOW” for the sub band can be copied to the main band.



1 Press one of the mode keys to select the mode, other than FM mode, for the main band or sub band to be a copy source.

2 Press and hold **[AGC/SEL]** (M) or **[AGC/SEL]** (S) to open the **AGC** screen.

3 Press **[COPY]** (F7) to copy the parameter for the AGC time constant.
The message prompting you to confirm that the AGC time constants, configured for “FAST”, “MID” and “SLOW” of the main band or sub band can be copied to the other band will appear.

4 Press **[OK]** (F4).
The AGC time constant is copied. Press **[CANCEL]** (F7) to finish the process without copying.



5 Press **[ESC]** to exit.

Note:

- Not only the time constant value but also the time constant value displayed on the **AGC** screen are copied.

DISABLING THE AGC

If the received signal strength is sufficiently high and is stable, you can disable the AGC. In general, disabling the AGC function decreases the RF gain; however, this will facilitate you listening to a weak signal.

Follow the procedure below to disable the AGC for the main band and sub band independently.

PRECAUTION

- Depending on reception conditions, disabling the AGC may cause the audio to be excessively loud, both through the internal speaker and a set of headphones.

1 Press **[AGC OFF]** (M) or **[AGC OFF]** (S) to disable the AGC.
The message prompting you to disable the AGC appears.



2 Press **[OK]** (F4) to disable the AGC.
Pressing **[CANCEL]** (F7) to abort this operation

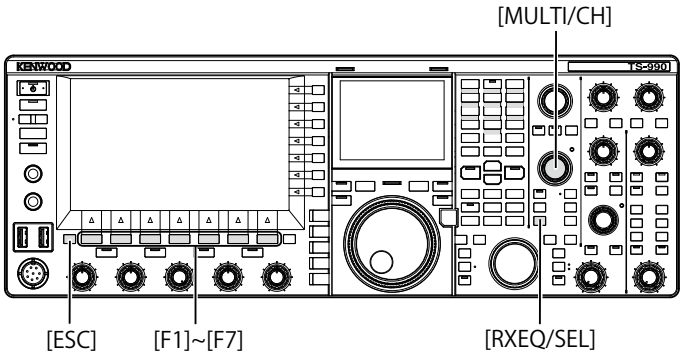


RX DSP EQUALIZER

RX DSP Equalizer allows you to change the desired sound quality by adjusting the frequency characteristics of the received audio. The desired sound quality can be selected from six types of RX DSP Equalizer profiles for the main band and sub band independently. The custom made equalizer characteristics can be configured for User 1 to User 3.

SWITCHING THE RX DSP EQUALIZER ON OR OFF

Each time you press **[RXEQ/SEL]**, you toggle the RX DSP Equalizer between active and inactive.



SELECTING THE EQUALIZER CHARACTERISTICS

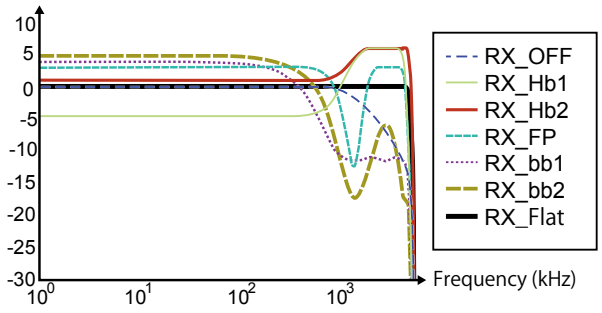
1 Press and hold **[RXEQ/SEL]** to open the **RX Equalizer** screen.
The highlighted equalizer characteristics becomes active.



2 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the desired equalizer characteristics.

■ Available Equalizer Characteristics

Effect	Purpose
High Boost 1	High-pass frequency components are emphasized. This configuration is effective for audio that contains low-pass frequency components.
High Boost 2	High-pass frequency components are emphasized. This configuration provides characteristics that halve the low-pass attenuation level of High Boost 1.
Formant Pass	This configuration attenuates frequency components outside the audio band, thus providing legible characteristics.
Bass Boost 1	Low-pass frequency components are emphasized. This configuration is effective for audio that contains high-pass frequency components.
Bass Boost 2	Low-pass frequency components are emphasized. This configuration provides characteristics that further emphasize the low-pass band, compared with Bass Boost 1.
Flat	The flat characteristics
User 1	You can save your preferred frequency characteristics as User 1, User 2 and User 3. The default characteristic is “Flat”.
User 2	
User 3	

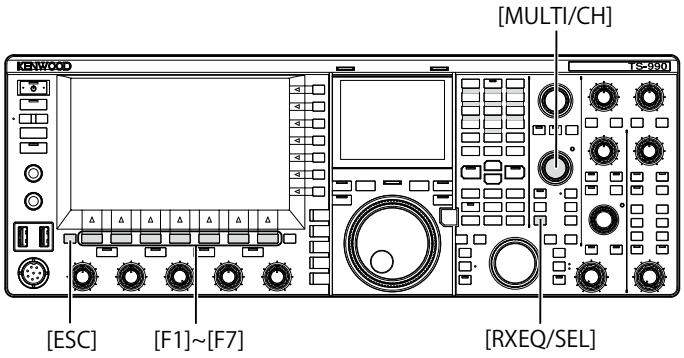


Receive Characteristics Curves

3 Press **[ESC]** to exit.
The selection of the characteristics of the RX DSP equalizer is complete. Pressing and holding **[RXEQ/RX]** also closes the **RX Equalizer** screen.

CUSTOMIZING THE EQUALIZER

You can customize the equalizer characteristics to your desired characteristics. Also, such customized characteristics can be stored as the User Configuration.

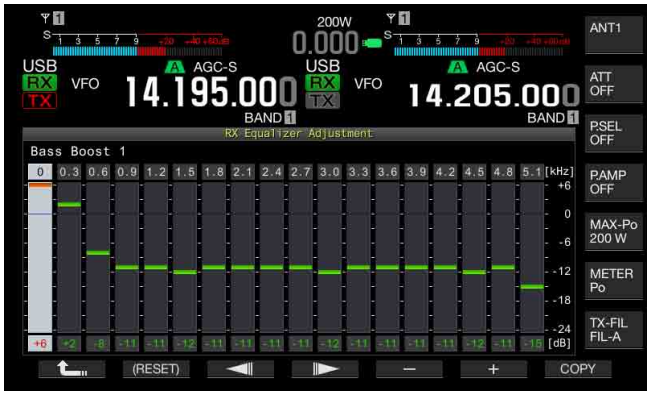


1 Press and hold **[RXEQ/SEL]** to open the **RX Equalizer** screen.

2 Select the target equalizer to be adjusted.

3 Press **[ADJ]** (F4) to open the **RX Equalizer Adjustment** screen.

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4 Press [◀] (F3) [▶] (F4) and select the target frequency to be adjusted.

5 Press **[-]** (F5) or **[+]** (F6), or rotate the **MULTI/CH** control to adjust the frequency level.

6 Press **[ESC]** to exit.
Pressing [↩] (F1) closes the individual **RX Equalizer Adjustment** screen and reverts to the **RX Equalizer** screen.

■ DEFAULT RX DSP EQUALIZER LEVELS [DB]

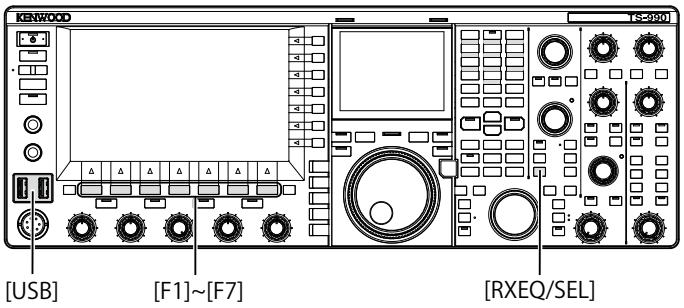
Frequency [Hz]	HB1	HB2	FP	BB1	BB2	FLAT	U1	U2	U3
0	-5	+1	+3	+6	+6	0	0	0	0
300	-4	+1	+3	+2	+4	0	0	0	0
600	-5	+1	+3	-8	-1	0	0	0	0
900	-3	+1	+2	-11	-11	0	0	0	0
1200	+2	+3	-20	-11	-18	0	0	0	0
1500	+5	+5	-24	-12	-18	0	0	0	0
1800	+6	+6	-4	-11	-16	0	0	0	0
2100	+6	+6	+3	-11	-12	0	0	0	0
2400	+6	+6	+3	-11	-8	0	0	0	0
2700	+6	+6	+3	-11	-6	0	0	0	0
3000	+6	+6	+3	-12	-6	0	0	0	0
3300	+6	+6	+3	-11	-6	0	0	0	0
3600	+6	+6	+3	-11	-8	0	0	0	0
3900	+6	+6	+3	-11	-12	0	0	0	0
4200	+6	+6	+3	-11	-16	0	0	0	0
4500	+4	+6	+3	-12	-18	0	0	0	0
4800	-5	+6	-5	-11	-18	0	0	0	0
5100	-24	+6	-24	-11	-17	0	0	0	0

Note:

- Each default equalizer characteristics other than User 1 to User 3 can also be changed in the **RX Equalizer Adjustment** screen. Press and hold **[(RESET)]** (F2) on the **RX Equalizer Adjustment** screen to reset the equalizer characteristics to the defaults.
- If the configured levels for one frequency range of the receive DSP equalizer is widely different from the configured levels for the adjacent frequency ranges, the received audio may not be attenuated as configured.

COPYING CUSTOMIZED EQUALIZER DATA

You can edit the predetermined equalizer characteristics and copy the equalizer data to User 1 to User 3.



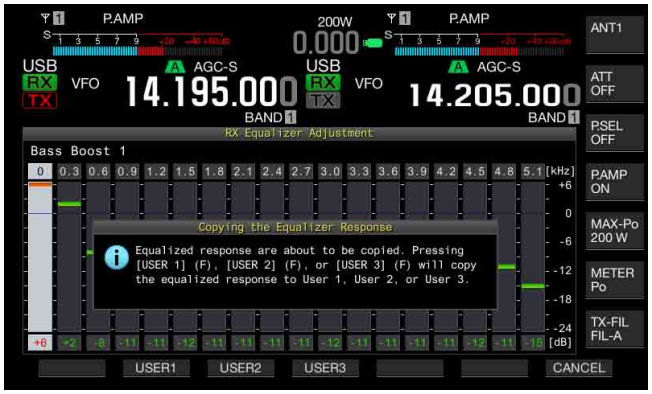
1 Press and hold **[RXEQ/SEL]**.
The **RX Equalizer** screen appears.

2 Press [▲] (F2) or [▼] (F3) to select the equalizer to be stored.
Pressing **[ADJ.]** (F4) on the **RX Equalizer** screen opens the **RX Equalizer Adjustment** screen. The equalizer data can be copied from either of the **RX Equalizer** and **RX Equalizer Adjustment** screens.

3 In the **RX Equalizer** screen, press **[COPY]** (F5) or in the **RX Equalizer Adjustment** screen, press **[COPY]** (F7).
A message prompting you to specify the destination to store the Equalizer Characteristics appears.

4 Press **[USER1]** (F2), **[USER2]** (F3), **[USER3]** (F4) to specify the destination of the copy.

- Copy the equalizer data selected in step 1 to User 1, User 2, or User 3.
- After the copy has completed, the message prompting you to specify the destination to copy the Equalizer Characteristics disappears, and the **RX Equalizer** or **RX Equalizer Adjustment** screen reappears.
- Pressing **[CANCEL]** (F7) terminates the copy of the equalizer data (without copy) and reverts to the **RX Equalizer** or **RX Equalizer Adjustment** screen.



WRITING RX DSP EQUALIZER DATA TO A USB FLASH DRIVE

You can create and save a number of different data files for customized DSP equalizer configurations from which you can select and read your preferred data.

Note:

- Refer to "ABOUT THE USB FLASH DRIVE" for handling details of USB flash drive. {page 12-1}

1 Press and hold **[RXEQ/SEL]** to open the **RX Equalizer** screen.

2 Insert a USB flash drive into the •⇢(USB-A) connector on the front panel.
- Use the USB flash drive which was formatted by this transceiver and have sufficient free memory area.
- When the USB flash drive is recognized, "▬" appears in the main screen.

3 Press **[▲]** (F2) or **[▼]** (F3) to select the equalizer to be stored.

4 Press **[SAVE]** (F7) to save the RX DSP Equalizer data to the USB flash drive.

5 Press **[OK]** (F4).
Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}



Note:

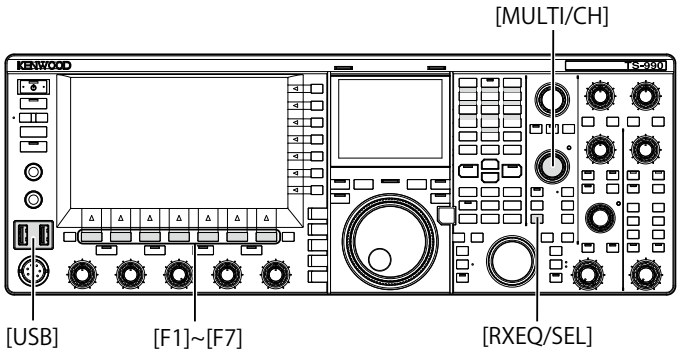
- The saved file is named with the year, month, day, hour, minute and second. The extension ".equ" is applied to the file.
  Example: February 15, 2013, 10:20:30AM: 20130215_102030.equ
- The name of the storage folder is as follows:
  KENWOOD/TS-990/SETTINGS/RX_EQ

READING RX DSP EQUALIZER DATA FROM A USB FLASH DRIVE

Read the configuration data for the TX DSP equalizer from a USB flash drive.

Note:

- Refer to "USING USB FLASH DRIVE" for handling details of USB flash drives. {page 12-1}

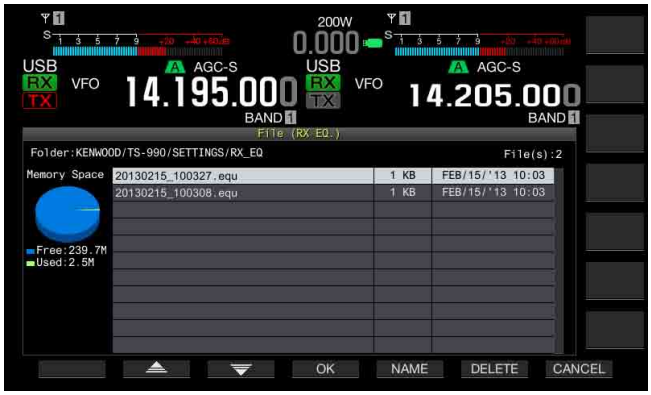


1 Press and hold **[RXEQ/SEL]** to open the **RX Equalizer** screen.

2 Insert the USB flash drive on which the Receive DSP Equalizer Data is stored into the •⇢ (USB-A) connector.
When the USB flash drive is recognized, "▬" appears in the main screen.

3 Press [▲] (F2) or [▼] (F3) to select the preset to save the RX equalizer data.

4 Press **[READ]** (F7) to open the **File** screen.
The **Read Configuration Data** screen opens. Pressing **[CANCEL]** (F7) reverts to the **RX Equalizer** screen without selecting the configuration data.



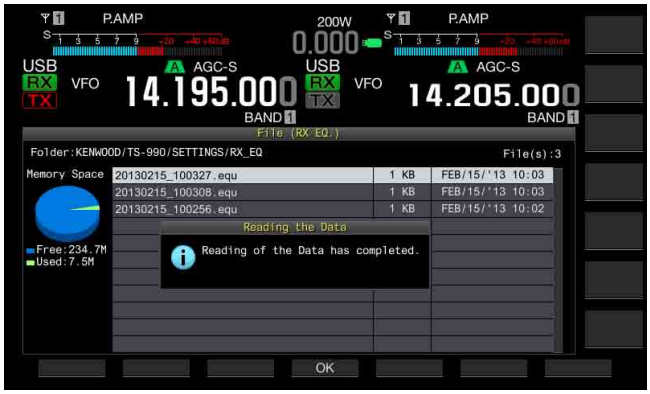
- Also, on pressing **[DELETE]** (F6), a message prompting you to confirm the deletion of the file appears. Press **[CANCEL]** (F7) instead of **[OK]** (F4) to exit without starting the deletion of the configuration data.
- Pressing **[NAME]** (F5) enables you to rename the data. {page 12-4} Pressing **[OK]** (F4) deletes the file.

5 Press **[▲]** (F2) or **[▼]** (F3) and select the RX equalizer data file to be read.
The RX Equalizer data file can also be selected by a rotation of the **MULTI/CH** control.

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6 Select **[OK]** (F4) from the **Read Configuration Data** screen.
- The reading of the RX equalizer data file from the USB flash drive will start. A message notifying you of the processing appears when the reading starts.
- If you press **[CANCEL]** (F7), the **Read Configuration Data** screen closes and the **RX Equalizer** screen appears again without reading the file data.
- A message notifying you of the completion of data reading appears when the RX equalizer data file has been read from the USB flash drive.

7 Press **[OK]** (F4) to end.
- The reading of the RX DSP equalizer data file from the USB flash drive has been completed.
- Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}



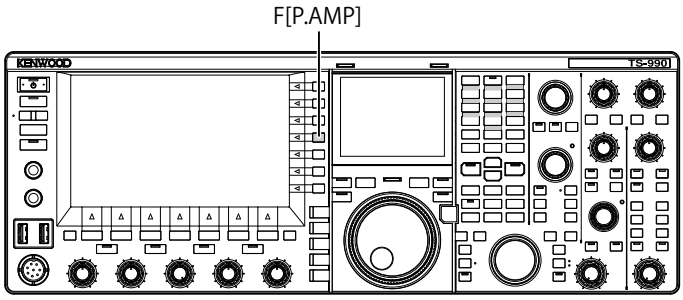
Note:

♦ Even if the type of the RX equalizer data selected at step 3 differs from the type of the RX equalizer data when it was saved, the RX equalizer data saved in the USB flash drive overwrites the selected RX equalizer data.

PREAMP

Preamp automatically switches at 21.5 MHz from a low-gain type preamp to a sensitivity-prioritized high-gain type preamp.

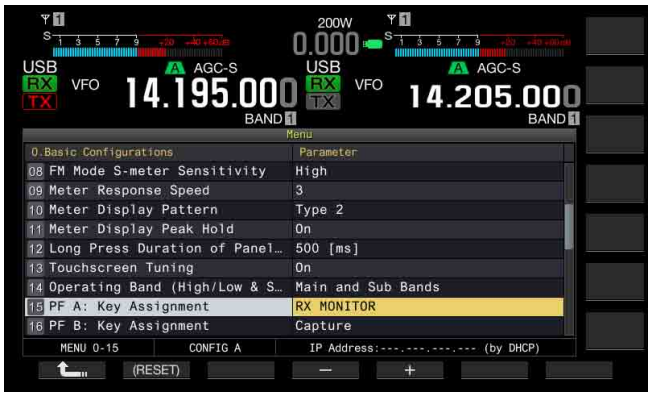
Pressing the **[P.AMP]** (F) key on the submenu located on the right side of the main screen toggles the preamp. Each key press toggles this function between active and inactive. While the preamp is active, "ON" appears on the lower line of the key guide.



RX MONITOR

Weak signals may be interrupted by the squelch opening and closing. Also, you may occasionally wish to monitor the statuses of channels while you are waiting for a CTCSS tone. In such cases, use the RX monitor function to open the squelch temporarily.

You can assign the “RX Monitor” (In Menus 0-15 to 0-32) to a PF key. {page 16-6} While you press down the PF key to which “RX MONITOR” was assigned, the squelch opens and you can monitor the receive frequency. Releasing the PF key deactivates the RX monitor.



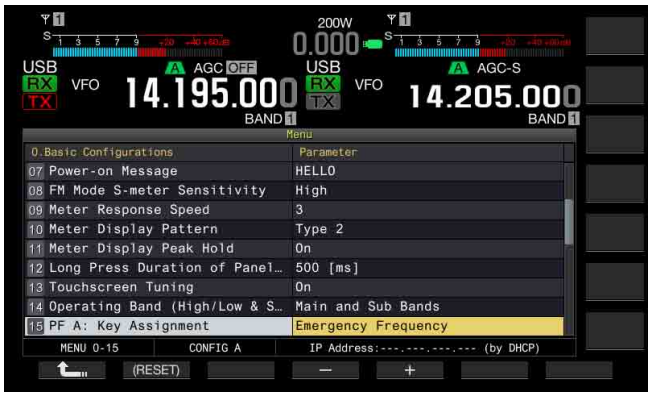
EMERGENCY CALL (K-TYPE ONLY)

Selection 97.401 (d) of the regulations governing amateur radio in the United States permit emergency amateur communications on 5467.5 kHz by stations in or within 92.6 km of the state of Alaska. This frequency is for use only when the immediate safety of human life and/or property are threatened, and is never to be used for routine communications.

1 Select Group No. 1, “Basic Configurations”, from the **Menu** screen.

2 Access Menu 15, “PF A: Key Assignment”, to Menu 32, “Microphone UP: Key Assignment”.

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "Emergency Frequency".

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

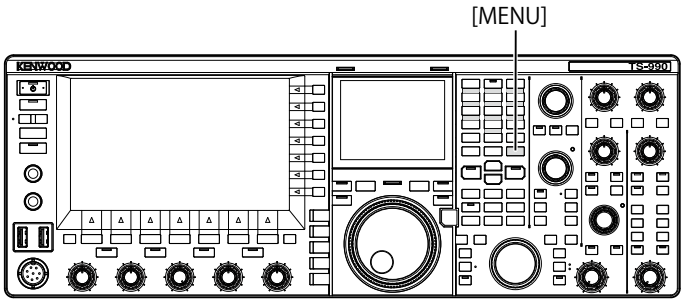
If “Emergency Frequency” is assigned to a PF key in Menus 0-15 to 0-32, you can access the Emergency frequency of 5467.5 kHz with a press of the PF key. {page 16-6}

Note:

- Pressing the PF key preprogrammed as "Emergency Frequency" disables the RIT/XIT functions.
- The transceiver will not access the Emergency Frequency while the transceiver is transmitting, is in use with Voice Message, Recording functions or a CW Message.

SWL MODE

The Trio 9R-59 is a communication-type receiver that took the world by storm in the 1960s. In this mode, a virtual dial pointer sliding horizontally in imitation of the ribbon dial of the 9R-59 appears in the TS-990S main display so that you can enjoy short wave listening in classic style. (SWL)



Follow the procedure below to enter SWL mode.

1 Press **[SWL]** (F) on the **Menu** screen to open the **SWL** screen.

Horizontal ribbon dials have red and yellow pointers.

Pointer (red): Represents the main band frequency.

Pointer (yellow): Represents the sub band frequency.

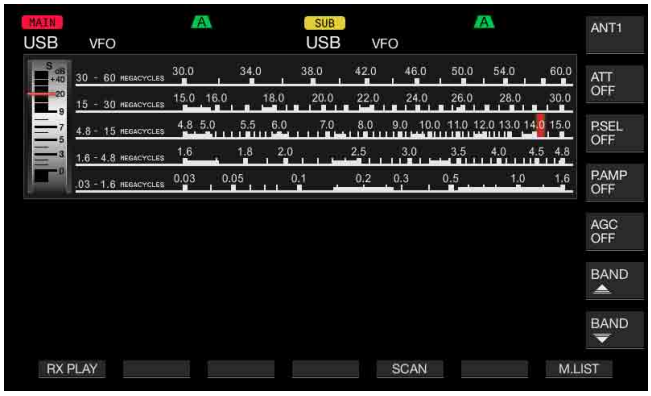
Note:

- The S-meter indicates the signal strength of the main band. Even if "Type 1" (digital meter) is selected in Menu 0-10, this does not apply to SWL mode.
- Press **[AGC]** (F) to change the AGC time constant value. {page 5-4}

Follow the procedure below to exit SWL mode.

2 Press **[MENU]** while the **SWL** screen is open to open the **Menu** screen.

3 Press **[SWL]** (F) to exit.



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In SWL mode, the following functions are restricted.

Function	Status
Transmit	Disabled
Transmission of a voice message	Disabled
Encoding and decoding the RTTY/PSK message	Disabled
Transmission of a CW message	Disabled
Transmit Power Limiter	Disabled
Changing Meter	Disabled
Changing the TX filter type	Disabled
Transverter activation	Disabled
FM tone	Disabled
Antenna tuning	Disabled
Configurations associated with RX equalizer	Can toggle between active and inactive. However, the status, either active or inactive, does not appear.
Configurations associated with TX equalizer	Disabled
Meter display	Dedicated to the main band.

SWITCHING THE BAND WHILE IN SWL MODE

To change the broadcast band while the transceiver is in SWL mode, you can press **[BAND ▲]** (F) or **[BAND ▼]** (F). "nn m" appears while the frequency is within the range of the band. The following table shows broadcast bands that are preset in the transceiver.

Broadcast and Meter Band	Lower limit [kHz]	Upper limit [kHz]	Default [kHz]	and Mode
LW	145	285	145	AM
MW	525	1705	525	
120 m	2300	2495	2300	
90 m	3200	3400	3200	
60 m	4750	5060	4750	
49 m	5900	6200	5900	
41 m	7200	7450	7200	
31 m	9400	9900	9400	
25 m	11600	12100	11600	
21 m	13570	13870	13570	
19 m	15100	15800	15100	
16 m	17480	17900	17480	
15 m	18900	19020	18900	
13 m	21450	21850	21450	
11 m	25670	26100	25670	

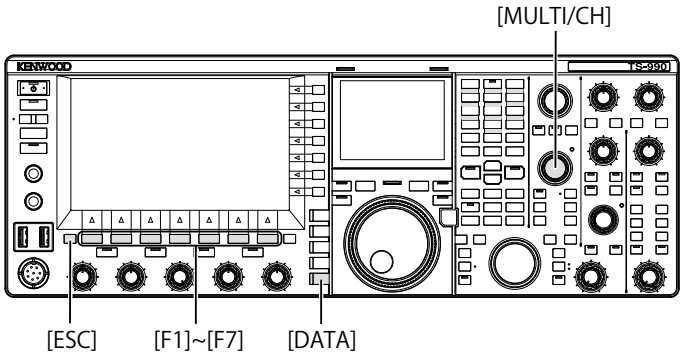
The band divisions configured in the transceiver in SWL mode may differ from general definitions of meter bands.

In SWL mode, you can operate the transceiver as follows:

- RX Play: Pressing **[RX PLAY]** displays the list of the stored audio files.
- Scan: Pressing **[SCAN]** starts a scan. When the scan stops at a frequency, the transceiver starts receiving signals on the frequency.
- Referring to the memory channel list: Pressing **[M.LIST]** displays the memory channel list.

AUDIO SOURCE LINES FOR TX AUDIO

The transceiver incorporates audio source lines, such as microphone, **OPTICAL**, **USB audio**, and **ACC 2** input lines, for a variety of audio signals. You can select one or more of the audio source lines depending on the mode or selected method for transmission.



1 Press and hold **[DATA/SEL]** to open the **Modulation Source** screen.

In the list that appears on this screen, the "lines" represent methods to select the transmit mode and “rows” represents the audio input source.



2 Press [▲] (F2) or [▼] (F3) and select the desired method for transmit mode selection.

3 Press [◀] (F3) or [▶] (F5) to select the row for the audio source.

4 Press **[ON/OFF]** (F6) to toggle the selected audio source between On and Off.

- You can also rotate the **MULTI/CH** control to select "On" or "Off" for the audio source line selected at step 3. If "On" is configured, audio entered from the selected audio source will be transmitted, and if "Off" is configured, the audio from the selected audio source will be muted, and no audio signal will be transmitted.
- Pressing and holding **[(RESET)]** (F1) resets the configurations for the audio source for each transmitting method to the defaults.

5 Press [↩] (F1).

6 Press **[ESC]** to exit.
Configuration for the transmit audio source line has been completed. Keep in mind that the transceiver may transmit unexpectedly depending on the combination of configurations. Furthermore, if the transceiver is connected to a PC or other audio source through the **USB Audio**, **Optical** or **ACC 2** line and while the DATA VOX is active, the transceiver may transmit triggered by audio emitted by the audio source.

Following are the defaults for DATA Off.

Key	MIC	ACC 2	USB Audio	Optical
SEND/PTT	On	Off	Off	Off
DATA SEND (PF)	Off	On	Off	Off

Following are the defaults for DATA 1 to DATA 3.

Key	MIC	ACC 2	USB Audio	Optical
SEND/PTT	On	Off	Off	Off
DATA SEND (PF)	Off	Off	On	On

Note:

- The Audio source for DATA 1 to DATA 3 can be configured individually.
- If audio from a source other than the microphone is enabled and if DATA VOX is enabled, that audio signal will be transmitted. {page 9-2}
- **USB Audio** and **ACC 2** cannot be enabled at the same time as the DATA TX source. When one of the lines is activated, the other line is deactivated.

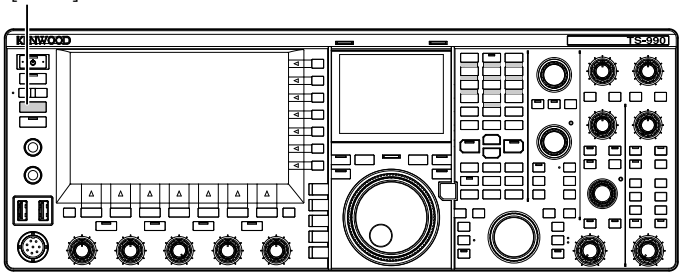
DATA MODE CONFIGURATION

TRANSMISSION BY THE PTT SWITCH, SS PIN AND SEND

You can use the **[PTT]** switch of the microphone, the SS pin of the **REMOTE** connector, or **[SEND]** on the front panel to toggle between the transmit mode and receive mode. Usually, in this operation, audio input from the microphone is transmitted.

- The transceiver continues transmission while you press down the **[PTT]** switch of the microphone.
- The transceiver continues transmission while the SS pin of the **REMOTE** connector is connected the GND.
- Each time you press **[SEND]**, the selection toggles between the transmit mode and receive mode.

[SEND]



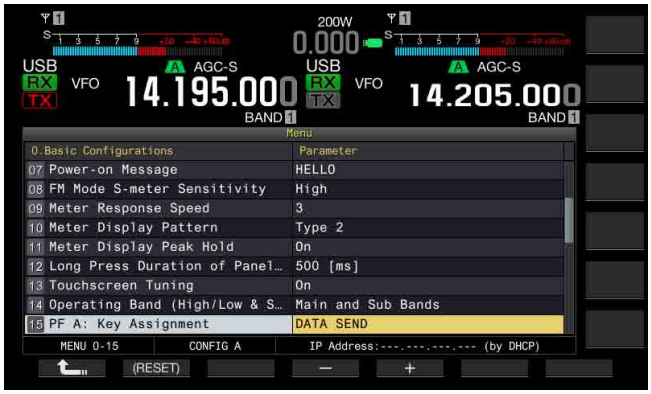
TRANSMISSION WITH DATA PTT OR DATA SEND

Use **[PF A]** or **[PF B]**, to which "DATA SEND" is assigned, or the DATA PTT (on the PKS pin of the ACC 2 connector) to toggle between the transmit mode and receive mode. Refer to "PF (Programmable Function" for further details. {page 16-6}

With this operation, usually audio signals on the **USB Audio** line or the ANI pin of the **ACC 2** connector are transmitted. Different audio source can be specified.

This function is convenient when you send audio or data from external devices.

- The transceiver continues transmission while the DATA PTT (the PKS pin of the **ACC 2** connector) is connected to the GND.
- Press a PF key, to which "DATA SEND" is assigned, to toggle between the transmit mode and receive mode.



Note:

- If "On" is configured for DATA VOX, you can automatically transmit. {page 9-2}

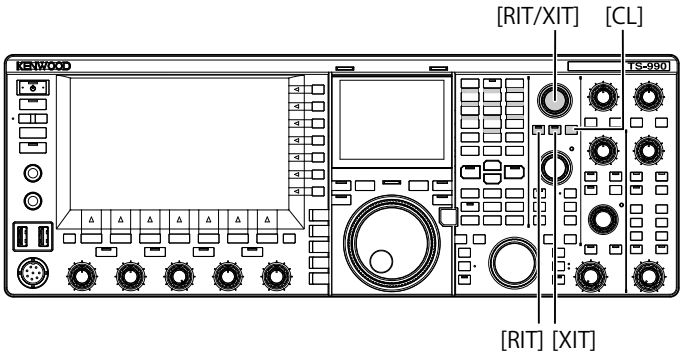
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RIT/XIT FUNCTIONS (FINE-TUNING FUNCTIONS FOR TRANSMIT AND RECEIVE FREQUENCIES)

RIT (FINE-TUNING OF RECEIVE FREQUENCIES)

RIT is a function that fine-tunes the receive frequency in steps of 10 Hz up to ±9.999 kHz without changing the transmit frequency. Use this function if the transmit frequency of the station with which you are working fluctuates.

If the FINE mode is active, the RIT offset frequency can be adjusted in steps of 1 Hz. RIT functions in the same manner on all modes while the VFO or memory channel mode is in use.



1 Press **[RIT]**.
The "RIT" LED lights, and the RIT offset frequency appears.

2 Rotate the **RIT/XIT** control.
The RIT receive frequency can be fine-tuned.

To clear the RIT offset frequency, press **[CL]**. The RIT offset frequency instantly reverts to zero.

3 Press **[RIT]** to exit.
You can disable the RIT. The current receive frequency reverts to the previous receive frequency in step 1.

Note:

- The **RIT** control operates on the receive frequency for the main band.

XIT (FINE-TUNING OF TRANSMIT FREQUENCIES)

XIT is a function that fine-tunes the transmit frequency in steps of 10 Hz up to ±9.999 kHz without changing the receive frequency. If the FINE mode is active, the XIT offset frequency is adjusted in steps of 1 Hz.

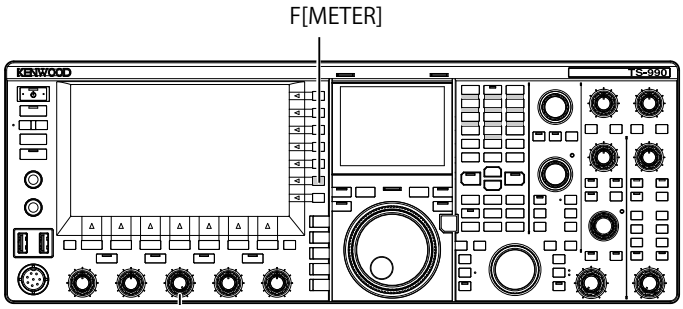
1 Press **[XIT]**.
The "XIT" LED lights, and the XIT offset frequency appears.

2 Rotate the **RIT/XIT** control.
- The XIT transmit frequency can be fine-tuned.
- To clear the XIT offset frequency, press **[CL]**. The XIT offset frequency instantly reverts to zero.

3 Press **[XIT]** to exit.
XIT is deactivated. The current transmit frequency reverts to the previous transmit frequency in step 1.

CONFIGURING THE CARRIER LEVEL

The carrier level for use in CW, FSK, PSK, or AM mode can be adjusted.



1 Press **[METER]** (F) to display the ALC meter.

2 Press one of the mode key to enter CW, FSK, PSK, or AM mode, then start transmitting.

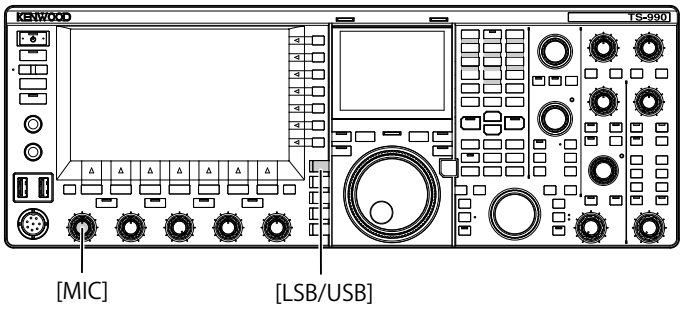
3 While observing the ALC meter, rotate the **CAR** control to adjust the carrier level for use in CW, FSK, PSK, or AM mode.

Note:

- Adjust the carrier levels so that they will not exceed the zone of the ALC meter.
- For FSK mode, carrier level must be adjusted enabling the ALC to control. For use in AM and PSK modes, carrier level must be adjusted until a pointer in ALC meter starts swinging.
- For SSB and FM modes, the carrier level is fixed regardless of the position of the control.

ADJUSTING THE MICROPHONE GAIN

Microphone Gain for use in SSB and AM modes can be adjusted by observing the ALC meter.



1 Select the desired band and frequency.
Selects the desired band and frequency.

2 Press **[LSB/USB]** to select LSB mode or USB mode, or press **[FM/AM/FM-N]** to select AM mode.

3 Press down the **PTT** (microphone).
The transceiver enters a transmit state.

4 Speak into the microphone in your normal voice.

5 Rotate the **MIC** control to adjust the microphone gain.
In SSB mode, Microphone Gain must be adjusted until the audio level does not exceed the ALC meter zone. In AM mode, microphone gain must be adjusted until the pointer in the ALC meter moves slightly on voice peaks.

6 Release **PTT** (microphone).
The transceiver reverts to the receive state.



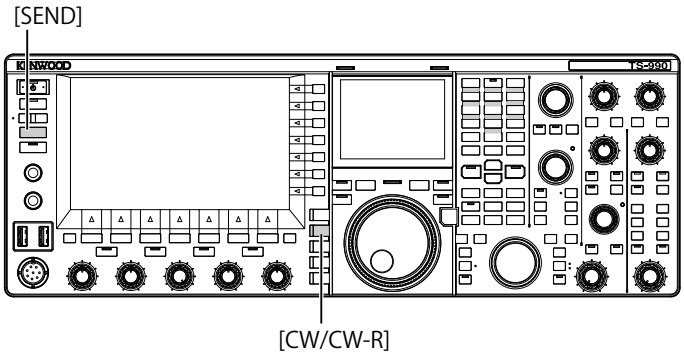
Note:

- Speak into the microphone in your normal voice. If the microphone is too close to your mouth or your voice is too loud, signal distortion may occur and cause the received audio in receiving transceiver to be unclear.
- Refer to "Speech Processor" for the details of the speech processor. {page 9-6}
- If you use a microphone with a built-in AF amplifier, you must carefully adjust the output level of the microphone not to be too high.
- For use in FM mode, configure the microphone gain in Advanced Menu 13, "Microphone Gain (FM Mode)".

OPERATION IN CW MODE

CW mode ensures reliable communication even if the operating conditions are bad. Under Unfavorable conditions, CW communication is as reliable as communication in new digital modes.

The transceiver incorporates a multi-functional electronic keyer. Refer to "ELECTRONIC KEYER" for further details. {page 5-18}



1 Select the desired band and frequency.
Selects the desired band and frequency.

2 Press **[CW/ CW-R]** to select CW mode.

3 Press **[SEND]** to transmit.

4 Manipulate the electronic keyer or paddle to send Morse code, and rotate the **MONITOR** control to adjust the sidetone volume, allowing you to monitor your CW signal while transmitting. You can adjust the sidetone pitch frequency.

5 Press **[SEND]**, after sending the Morse code, to finish.
The transceiver enters the receive mode.

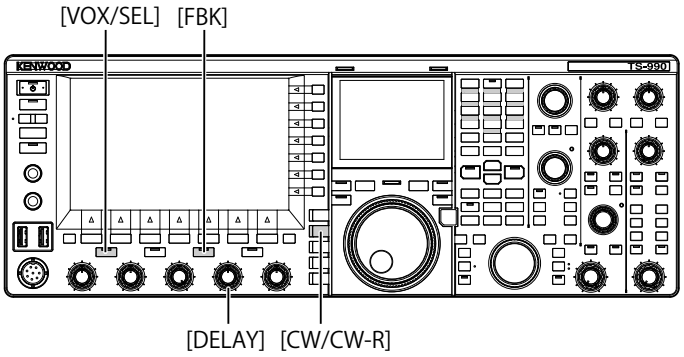
Note:

- The sidetone volume can be fixed. {page 5-16}

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CW BREAK-IN

Break-in is a convenient function in CW mode that places the transceiver into transmit when the key contacts close and reverts the transceiver to receive when the key contacts open. Two break-in modes are available, i.e., full break-in and semi break-in modes.



FULL BREAK-IN

The transceiver enters the receive mode simultaneously with the key released. The transceiver enters the receive mode even during the very short time between a dot and dash of Morse code. Therefore, for example, you will know the band condition immediately if there is sudden interference while transmitting.

1 Press **[CW/ CW-R]** to select CW mode.

2 Press **[FBK]** to enable the Full Break-in.
The "FBK" LED lights.

3 Manipulate the electronic keyer or paddle.
The transceiver alternates between transmission and reception automatically between dots and dashes.

Note:

- If you use a linear amplifier in combination with the transceiver, be sure that the linear amplifier is capable of full break-in. If you do not know whether the linear amplifier is capable of the function or if the linear amplifier does not correspond to the function, operate the transceiver in semi break-in mode.
- Full Break-in and Semi Break-in cannot be used at the same time.

SEMI BREAK-IN

The transceiver does not revert to a receive state immediately after the key is released. Instead, the transceiver remains in a transmit for a configured delay time before reverting to the receive state. Semi break-in is useful to prevent the sound of reception immediately after the key is released, or to connect a linear amplifier to the transceiver.

1 Press **[CW/ CW-R]** to select CW mode.

2 Press **[VOX/SEL]** to enable the Semi Break-in.
The "VOX" LED lights.

3 Manipulate the electronic keyer or paddle.
The transceiver enters the transmit mode on the first key-down and doesn't revert to receive on key-up until the configured delay time has passed.

4 Rotate the **DELAY** control to adjust the delay time after a key-up.
Rotating the **DELAY** control counterclockwise reduces the delay time and clockwise increases the delay time.

Note:

- Use Semi Break-in if the linear amplifier connected to the transceiver is not capable of Full Break-in.

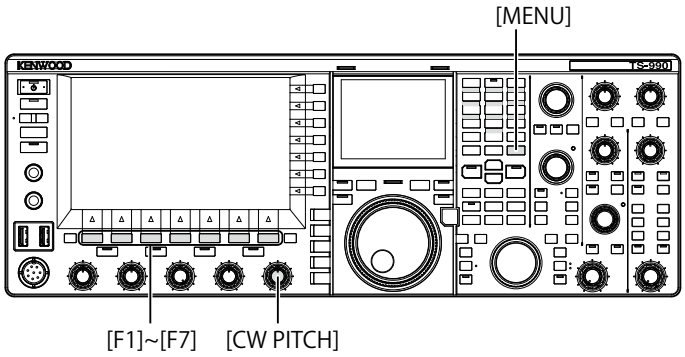
ADJUSTING THE SIDETONE AND PITCH FREQUENCY

You can hear the tone from the speaker of the transceiver when you press down the key while in CW mode. This tone is called sidetone. You can monitor your Morse code transmission by listening to the tone. While Break-in or other transmit capabilities are disabled, you can use the tone to practice keying.

In CW mode that require the direct keying of the carrier, a BFO (beat frequency oscillator) is required to convert the carrier into audible sound. The difference in frequency between the BFO and carrier is audible as a beat sound. The difference in frequency is called receive pitch.

The sidetone and receive pitch are the same in frequency.

You can turn the **CW PITCH** control to adjust the frequency of the sidetone to your preference.
The adjustable frequency range is between 300 and 1100 Hz, and turning the **CW PITCH** control clockwise increases the frequency and counterclockwise decreases the frequency.



ADJUSTING THE SIDETONE VOLUME

1 Select Group No. 1, "Audio Performance", from the **Menu** screen.

2 Access Menu 02, "Sidetone Volume".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[–]** (F4) or **[+]** (F5) to select "Linked with Monitor Control", "Off", or "1" to "20".

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

Note:

- The sidetone volume is used to adjust the playback sound level of CW messages, and neither the sidetone level nor playback sound level can be changed with the **AF** control.

CW RISE TIME

The CW signal rise time is a period required for the output waveform of the CW signal to reach its maximum from when the key is pressed down. The default value (6 [ms]) is suitable to low- to mid-speed keying. Select "4 [ms]", "2 [ms]", or "1 [ms]" for high-speed keying.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 14, "CW Rise Time".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[–]** (F4) or **[+]** (F5) to select "1 [ms]", "2 [ms]", "4 [ms]", or "6 [ms]".
The default is "6 [ms]".

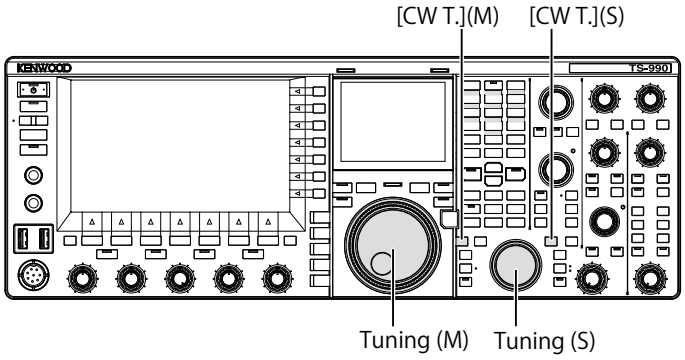
5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

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AUTO ZERO-IN (CW AUTO TUNE)

If you wish to have a QSO in CW mode with another CW station, use this function so that the transmit frequency of your station will automatically be tuned to the receive frequency of the other station.



1 Rotate the **Tuning** control and make rough adjustments so that you can hear the received CW.

2 Press **[CW T]** (M) or **[CW T]** (S) to enable the Auto Zero-in (CW Auto Tune).
- "CW TUNE" blinks on the main screen.
- The transmit frequency is automatically tuned to the receive frequency, and the receive signal pitch is tuned to the sidetone and receive pitch frequency.
- The Auto Zero-in (CW Auto Tune) disappears from the main screen when the transmit frequency has zeroed in on the receive frequency. If the transmit frequency cannot automatically be zeroed in (CW Auto Tune), the frequency reverts to the previous frequency.

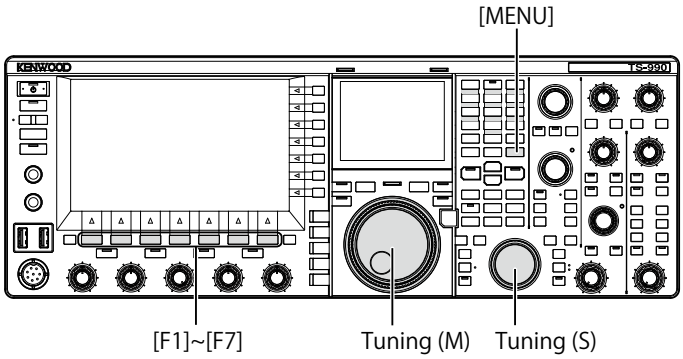


Note:

- If you use the Auto Zero-in (CW Auto Tune), you can tune into a frequency within ±50 Hz of the receive frequency from the station you wish to call.
- The transceiver may not be able to zero in automatically (CW Auto Tune) if the CW keying speed of the station you are communication to is too slow or the signal strength of the station is weak or if there is interference.
- If RIT is active, the Auto Zero-in (CW Auto Tune) works on the frequency shifted with RIT.
- The range where the Auto Zero-in (CW Auto Tune) functions varies depending on the receive conditions.
- While the **Bandscope** or **Waterfall** screen is open, Auto Zero-in (CW Auto Tune) can function by touching the screen longer than the time configured in Menu 0-12, "Long Press Duration of Panel Keys".

CARRIER FREQUENCY OFFSET WHEN CHANGING FROM SSB MODE TO CW MODE

If you receive a CW signal from a station and you wish to have a QSO with the station while you are operating the transceiver in SSB mode, you have to change the mode to CW. In that case, you need to rotate the **Tuning** control slightly for a carrier frequency offset. Using this function will automatically correct the frequency.



1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 06, "Carrier Frequency Offset (SSB Mode to CW Mode)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select “On” or “Off”.
The default is “Off” (not correcting the frequency). Selecting “On” allows the transceiver to correct the frequency.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

AUTOMATICALLY CHANGING MODE FROM SSB FOR CW TRANSMISSION

When you key your straight key, paddle or electronic keyer while in SSB mode, the transceiver changes to CW mode automatically. The transceiver automatically changes from USB to CW or from LSB to CW-R.

When the transceiver enters CW mode from SSB mode, a carrier frequency offset remains active regardless of whether "Frequency Offset (SSB Mode to CW Mode)" is disabled. Therefore, if you receive a CW signal from a station while you are in SSB mode and you wish to have a QSO with that station, you can call the station in CW mode by just manipulating the paddle or electronic keyer.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 05, "Automatic CW TX with Keying in SSB Mode".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select “On” or “Off”.
The default is “Off” (not automatically sending a CW). Selecting “On” allows the transceiver to automatically send a CW.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- If the transceiver is in Split operation it cannot automatically transmit while in SSB mode.
- If Break-in (VOX) is enabled in CW mode, key-down with an electronic keyer or paddle automatically transmits a CW message in SSB mode.

ELECTRONIC KEYER

The transceiver incorporates an electronic keyer that can be operated by connecting a paddle to the PADDLE jack on the front panel. Depending on how you configure the menu, you can use the electronic keyer like a bug key (semi-automatic electronic keyer). You can connect a straight key (electronic straight keyer) to the PADDLE jack as well.

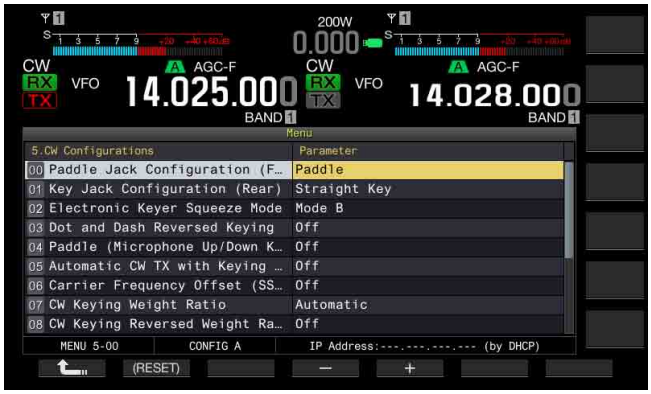
SELECTING THE KEYER TYPE FOR THE PADDLE JACK

You can select the device to be connected to the PADDLE jack.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 00, "Paddle Jack Configuration (Front)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Straight Key", "Paddle", or "Paddle (Bug Key Mode)".
The default is "Paddle".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

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SELECTING THE KEYER TYPE FOR THE KEY JACK

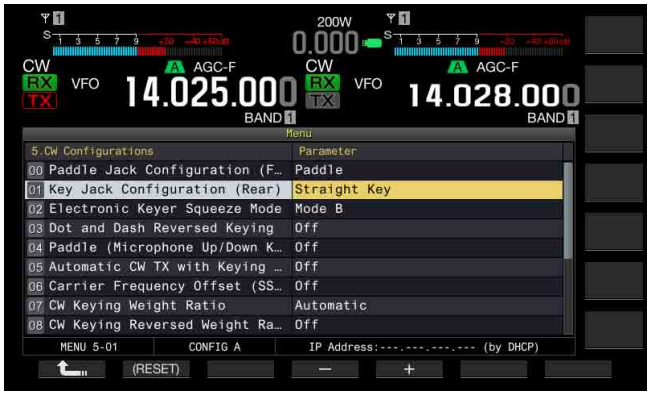
For CW operation without using the built-in electronic keyer, connect a straight key, a bug key, an external electronic keyer or a PC keyer to the **KEY** jack. Depending on how you configure the menu, you can connect a paddle to the **KEY** jack and use the built-in electronic keyer instead.

Follow the procedure below to select the device connected to the **KEY** jack on the rear panel.

Note:

- If you connect an external electronic keyer or PC keyer to the Transceiver, ensure that it has a shielded cable with the positive polarity on the cable inner.

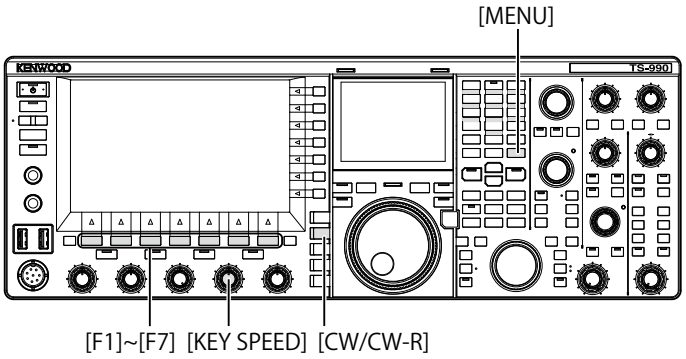
1. Select Group No. 5, "CW Configurations", from the **Menu** screen.
2. Access Menu 01, "Key Jack Configuration (Rear)".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.



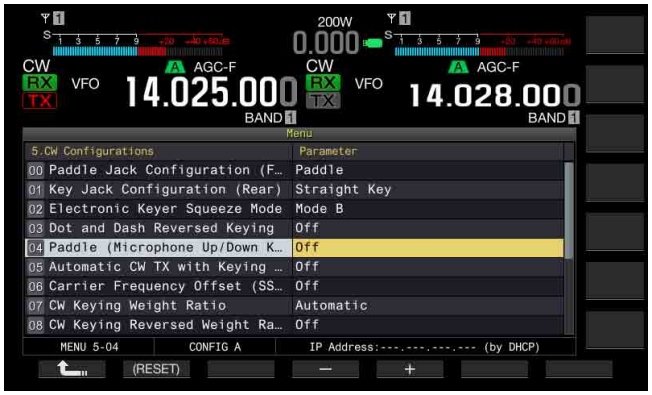
4. Press **[-]** (F4) or **[+]** (F5) to select "Straight Key", "Paddle", or "Paddle (Bug Key Mode)".
   The default is "Straight Key".
5. Press [ ] (F1).
6. Press **[MENU]** to exit.

MICROPHONE PADDLE MODE

You can send CW by using the **[UP]** and **[DOWN]** (microphone) keys as a paddle.



1. Select Group No. 5, "CW Configurations", from the **Menu** screen.
2. Access Menu 04, "Paddle (Microphone Up/Down Keys)".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.



4. Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
   The default is "Off" (not paddling using a microphone).
   Selecting "On" allows you to paddle using the microphone.
5. Press [ ] (F1).
6. Press **[MENU]** to exit.

Note:

- In Microphone Paddle mode, the paddling response slows down compared with normal paddling.

ADJUSTING THE KEYING SPEED

You can adjust the keying speed of the electronic keyer as you wish.

In order to transmit accurate CW messages, it is necessary to adjust the speed appropriately according to your own capability. It is recommended that if possible you adjust your keying speed as close as possible to that of the station you wish to have a QSO with.

1. Press **[CW/ CW-R]** to select CW mode.
2. Rotate the **KEY SPEED** control to adjust the keying speed.
   - The keying speed can be adjusted in a range from 4 wpm to 60 wpm (20 letters to 300 letters per minute).
   - Rotating the **KEY SPEED** control clockwise increases the speed and rotating the **KEY SPEED** control counterclockwise decreases the speed.
   - The keying speed appears in place of the transmit power on the main screen for two seconds after the **KEY SPEED** control is operated.

Note:

- While rotating the **KEY SPEED** control, the keying speed appears on the main screen. {page 2-11}
- The bug key mode completes the dot.

CHANGING THE WEIGHTING

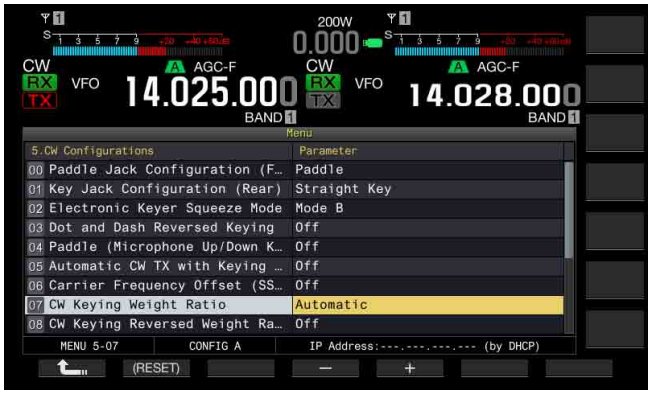
The electronic keyer allows automatic changing of the dot and dash weighting. Weighting represents the ratio of the dash time against the dot time.

You can select "Auto Weight", which automatically changes the ratio in response to the keying speed, or "Manual Weighting", which fixes the ratio regardless of the keying speed. If you select a speed in a range from "2.5" (1:2.5) to "4.0" (1:4), the ratio of dot time to dash time will be fixed regardless of the keying speed.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 07, "CW Keying Weight Ratio".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Automatic" or the fixed rations from "2.5" to "4.0".
The default is "Automatic".

5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

Note:

♦ If "Automatic" is selected for the weighting, the following weight ratios apply.

KEYING SPEED [WPM]	Weight
4 to 24	1:2.8
25 to 44	1:3.0
45 to 60	1:3.2

WEIGHT REVERSE

If "Automatic" is selected for the weighting, increasing the keying speed also extends the weight ratio. The Weighting ratio can be reduced according to the configuration in the Menu.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 08, "CW Keying Reversed Weight Ratio".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select “On” or “Off”.
The default is “Off” (disabling the Weight Reverse). Selecting “On” allows the transceiver to reduce the weighting ratio.

5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

Note:

♦ If "Automatic" is selected for the weighting, the following weight ratios apply.

KEYING SPEED [WPM]	Weight
4 to 24	1:3.2
25 to 44	1:3.0
45 to 60	1:2.8

REVERSING THE DOT AND DASH KEYING

Without rewiring the electronic keyer, you can swap the paddle dot and dash generation to suit the preference or dominant hand of the operator.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 03, "Dot and Dash Reversed Keying".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select “On” or “Off”.
The default is “Off” (not Reversing the dot and dash).
Selecting “On” allows the transceiver to Reverse the dot and dash.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

♦ This configuration will apply to to the paddle connected to the **PADDLE** and **KEY** jack and to the microphone paddle mode.

OPERATING MODES OF ELECTRONIC KEYER

You can select the desired operating mode (Iambic A or Iambic B) of the electronic keyer.

MODE A

If both paddles are open, the paddles terminate code generation after generating a code element (dot or dash). The memory for dots and dashes are is in the static state.

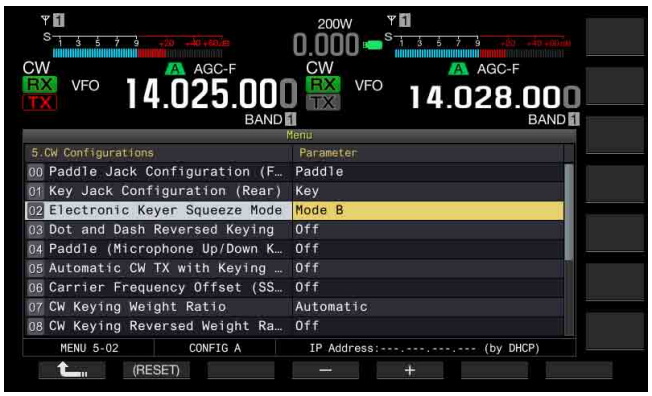
MODE B

If both paddles are open, the transceiver sends an additional dash after the last dot or an additional dot after the last dash sent by the operator. The memory for dots and dashes is in the dynamic state.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 02, "Electronic Keyer Squeeze Mode".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Mode A" or "Mode B".
The default is "Mode B".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

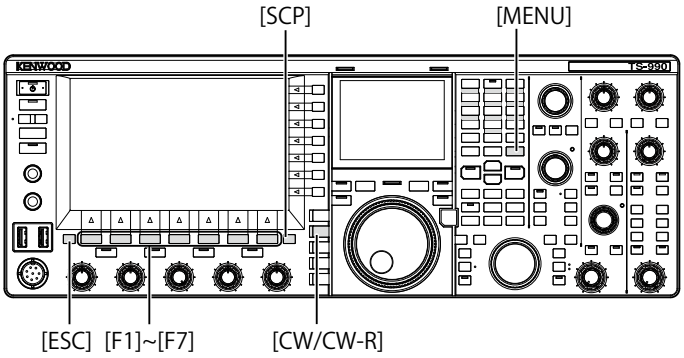
CW MESSAGE MEMORY

The transceiver has eight memory channels in which CW messages can be stored. The message text can be entered not only by manipulating the paddle but also by operating the transceiver or with the USB keyboard.

You can store text strings that can be repeatedly transmitted in contests or other occasions.

CHANGING THE ENTRY METHOD OF CW MESSAGES

You can select the desired entry method of CW messages (i.e., paddle keying or text entry).



1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 10, "CW Message Entry".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Text String" or "Paddle".
The default is "Paddle".

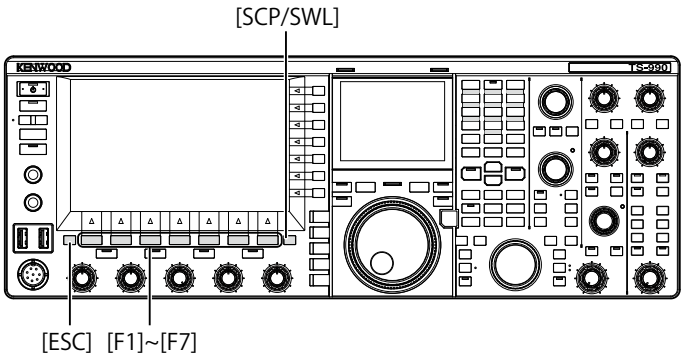
5 Press [ ] (F1).

6 Press **[MENU]** to exit.

STORING CW MESSAGES WITH TEXT ENTRY

After reviewing the status of Menu 5-10 to confirm "Text String" has been selected for the entry method of CW messages, you can follow the procedure below to store each CW message. You can store CW messages in channel 1 through channel 8.

Be sure that the transceiver is in CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.



1 Press **[CW/ CW-R]** to select CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.
While the "TX" (M) LED is unlit, **[KEYER]** (F2) does not appear in the Key Guide. Press **[CW/ CW-R]**.



3 Press and hold **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4), **[CH4]** (F5), **[CH5]** (F2). **[CH6]** (F3). **[CH7]** (F4), or **[CH8]** (F5) to select the channel to which a CW message will be stored.

- Each time you press **[MORE]** (F1), the key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4) and **[CH4]** (F5), and the key guide for **[MORE]** (F1), [ ] (F2), [ ] (F3), **[REPEAT]** (F4), **[DELETE]** (F5) and **[NAME]** (F6) alternately appears.
- Each time you press **[NEXT]** (F7), a key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4) and **[CH4]** (F5), and the key guide for **[MORE]** (F1), **[CH5]** (F2), **[CH6]** (F3), **[CH7]** (F4), **[CH8]** (F5) and **[NEXT]** (F7) alternately appears.

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4 Use the function keys, the **MULTI/CH** control or a USB keyboard to enter a CW message.

- A maximum of 50 alphanumeric characters and symbols can be configured. The default is "On".

  [SPACE] (F1): Press to enter a space.

  [-] (F2)/**[+]** (F3): Displays the previous character or the next character.

  [◀] (F4) and **[▶]** (F5): Press to move the cursor to the left or right.

  [BACK SPACE] (F): Press to delete the character to the left of the cursor.

  [DEL] (F): Press to delete the character to the right of the cursor.

  [CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

  ABC (upper case) > abc (lower case) > !"# (symbols) > ABC (upper case)
- Pressing **[CANCEL]** (F7) reverts to the **CW Message** screen without storing the message.



Note:

- If "%N" is entered and stored as a part of CW message, this will be substituted with the contest number and sent.
- The continual code such as "AR" or "BT" will be a text string from the character entered subsequent to "~" to a space.
- The following alphanumeric characters and symbols can be entered.

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	1	2	3	4	5	6	7	8	9			
/	?	.	,	‘	(	)	:	=	+	-	_	"
@	~	%	<	>						Space		

5 Press **[SAVE]** (F6) to store a CW message.

6 Press **[ESC]** to exit.

MANIPULATING THE PADDLE TO STORE CW MESSAGES

After reviewing the status of Menu 5-10 whether "Paddle" has been selected for the entry method of CW messages, you can follow the procedure below to store each CW message.

You can store CW messages in channel 1 through channel 8.

1 Press **[CW/ CW-R]** to select CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.
In any transmit mode other than CW mode, **[KEYER]** (F2) does not appear in the key guide. Press **[CW/CW-R]**.

3 Press and hold **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4), **[CH4]** (F5), **[CH5]** (F2), **[CH6]** (F3), **[CH7]** (F4), or **[CH8]** (F5) to select the channel to which a CW message will be stored.

- A message notifying you of the storing of the CW message appears.
- If no channel to which a CW message will be stored appears on the key guide, press **[MORE]** (F1). An alternate key guide will appear.
- Each time you press **[NEXT]** (F7), a key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4) and **[CH4]** (F5), and the key guide for **[MORE]** (F1), **[CH5]** (F2), **[CH6]** (F3), **[CH7]** (F4), **[CH8]** (F5) and **[NEXT]** (F6) alternately appears.
- Pressing **[CANCEL]** (F7) during the standby state reverts to the CW Message screen without storing the message.



4 Key the paddle and store the CW messages.
During the paddle keying, a screen displays the progress of CW message entry. Continue paddle keying and store the CW messages. While storing the CW messages, the percentage memory usage appears the main screen.

5 Press **[STOP]** (F4) to finish storing a CW message.

- The **CW Message** screen reappears.
- If the memory becomes full while storing the CW messages and the memory usage reaches 100%, the entry of the CW messages in progress ends.

6 Press **[ESC]** to exit.

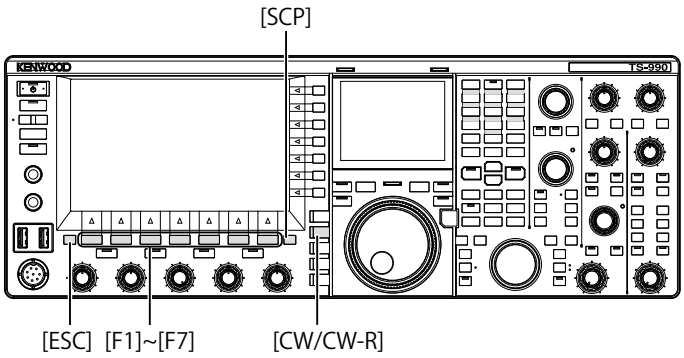
Note:

- In a channel where no CW message is stored, the channel number will be grayed out.
- If you do not manipulate a paddle after the editing of a CW message begins, nothing will be stored in that channel.
- If "Straight Key" is selected for the **PADDLE** or **KEY** jack, no CW message can be stored. A CW message must be stored by manipulating a paddle.

NAMING THE CW MESSAGES (WITH PADDLE KEYING ONLY)

If you store CW messages by means of paddle keying, you do not know the contents of the CW messages stored in the respective channels. Therefore, naming each message stored enables you to distinguish the contents of the entry.

After reviewing the status of Menu 5-10 whether "Paddle" has been selected for the entry method of CW messages, you can follow the procedure below to name each CW message. The names of CW messages are given to channel 1 through channel 8.



1 Press **[CW/ CW-R]** to select CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.
In any transmit mode other than CW mode, **[KEYER]** (F2) does not appear in the key guide. Press **[CW/CW-R]**.

3 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select a channel to which a CW message is stored.
If **[▲]** (F2) and **[▼]** (F3) are unavailable in the key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[NAME]** (F6) to allow editing of the parameter box.



5 Use the function keys, the **MULTI/CH** control or a USB keyboard to enter a name of the CW message.

- A maximum of 20 alphanumeric characters and symbols can be configured.

  [SPACE] (F1): Press to enter a space.

  [-] (F2) and **[+]** (F3): Press to display the previous character or the next character.

  [◀] (F4) and **[▶]** (F5): Press to move a pointer to the left or to the right.

  [BACK SPACE] (F): Press to delete the character to the left of the cursor.

  [DEL] (F): Press to delete the character to the right of the cursor.

  [CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

  ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

- Pressing **[CANCEL]** (F7) reverts to the **CW Message** screen without storing the name of the CW message.

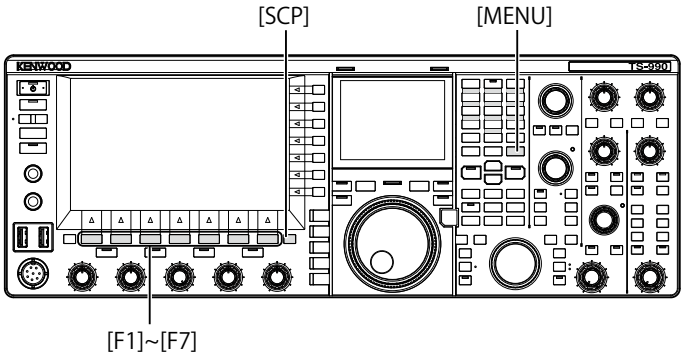
6 Press **[SAVE]** (F6) to store the name of the CW message.

7 Press **[ESC]** to exit.

SELECTING THE CHANNEL NUMBER TO SAVE THE CONTEST NUMBER FORMAT (TEXT ENTRY ONLY)

The channel number where you wish to save the contest number while in CW mode can be selected. If the contest number format consists of a three-digit sequential number starting with 001, the contest number increases by 1 each time you transmit a fixed phrase from the channel that you have selected.

Be sure that the transceiver is in CW mode, and you can follow the procedure below. The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.



1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 13, "Channel Number (Count-up Message)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

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4 Press **[-]** (F4) or **[+]** (F5) to select "Off", or "Channel 1" to "Channel 8".
The default is "Off".

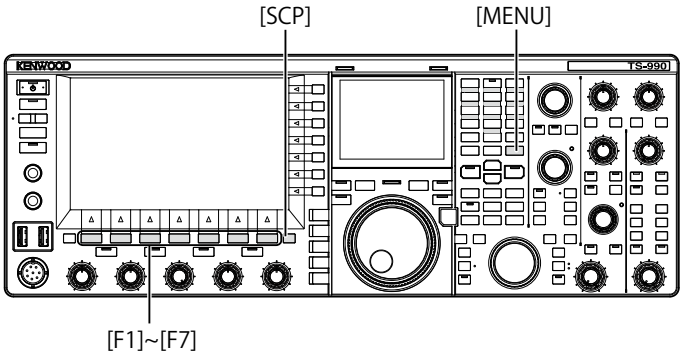
5 Press [ ] (F1).

6 Press **[MENU]** to exit.

SELECTING THE CONTEST NUMBER FORMAT (TEXT ENTRY ONLY)

If a CW message containing "%N" is sent, it is possible to replace numbers such as "1", "9", "0" with alphabetical letters such as "A", "N", "O" (or "T") to send the contest number in the Morse code format.

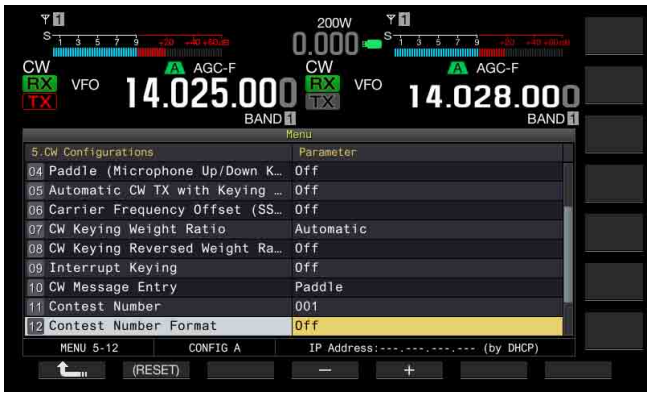
Be sure that the transceiver is in CW mode, and you can follow the procedure below. The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.



1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 12, "Contest Number Format".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[–]** (F4) or **[+]** (F5) to select "Off", "190 to ANO", "190 to ANT, "90 to NO", or "90 to NT".
The default is "Off".

Example of Coding

Parameters	Text String to be sent as a Contest Number	Output code
190 to ANO	190	ANO (•– –• ––)
190 to ANT		ANT (•– –• –)
90 to NO	90	NO (–• ––)
90 to NT		NT (–• –)

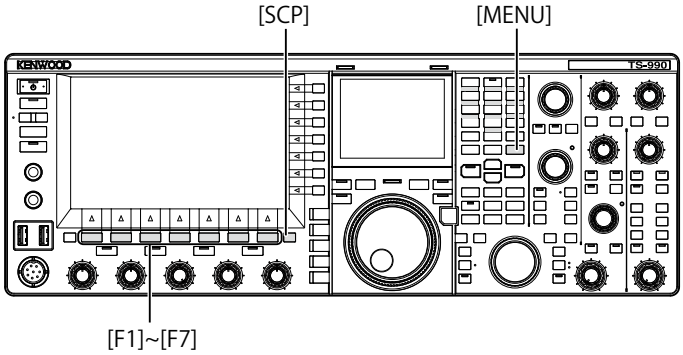
5 Press [ ] (F1).

6 Press **[MENU]** to exit.

CONFIGURING THE FIRST CONTEST NUMBER (TEXT ENTRY ONLY)

If the contest number format consists of a three-digit sequential number (the 001 format), you can configure the first contest number to start from.

Be sure that the transceiver is in CW mode, and you can follow the procedure below. The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.



1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 11, "Contest Number".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select the contest number from "001" to "9999".
- While you press down **[-]** (F4) or **[+]** (F5) for 2 seconds or more, the contest number continuously increases or decreases at high speed.
- You can rotate the **MULTI/CH** control to increase or decrease the contest number.
- The default is "001".

5 Press [ ] (F1).

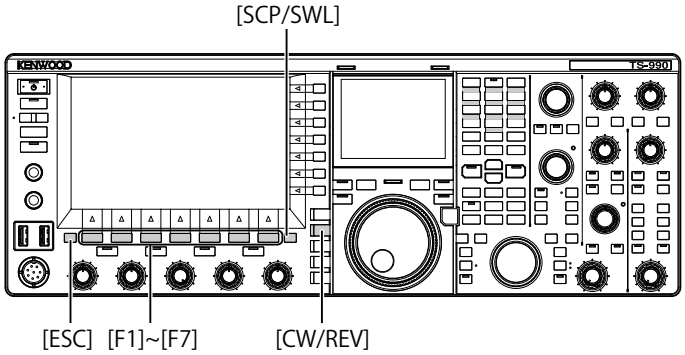
6 Press **[MENU]** to exit.

Note:

♦ 0s presenting in the first and second digits may not be deleted even when the contest number from 001 to 099 is displayed, or during the playback or transmission.

DECREMENTING THE CONTEST NUMBER (TEXT ENTRY ONLY)

If a contest QSO fails even if you have sent the contest number, the next contest number that you will send will be decremented by 1.



1 Press **[CW/ CW-R]** to select CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.



3 Press **[NEXT]** to select a channel group containing a channel to decrement (-1) the contest number.

- "NUM" appears for the channel number to which the contest number is stored.
- Each time you press **[NEXT]** (F7), a key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4) and **[CH4]** (F5), and the key guide for **[MORE]** (F1), **[CH5]** (F2), **[CH6]** (F3), **[CH7]** (F4), **[CH8]** (F5) and **[NEXT]** (F6) alternately appears.
- For the selection method of a channel group, refer to step 3 of "CHANGING THE ENTRY METHOD OF CW MESSAGES". {page 5-22}



4 Press **[-1]** (F6) to decrement the contest number by 1.

5 Press **[ESC]** to exit.

Note:

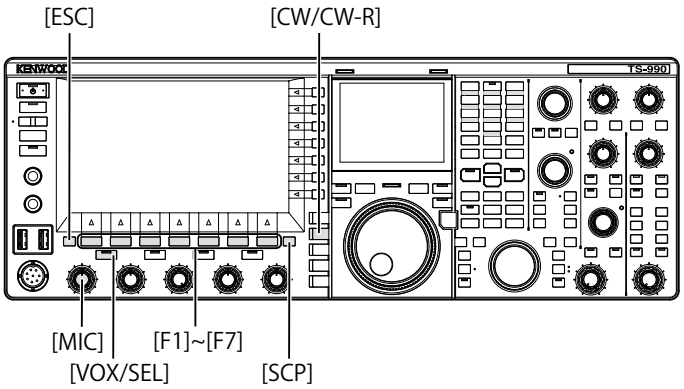
- If "Off" is configured for Menu 5-13, "Channel Number (Count-up Message" of if a CW message is entered with a paddle, **[-1]** does not appear on the key guide.

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PLAYING AND TRANSMITTING A CW MESSAGE

You can play and transmit the stored CW message .

The displays on the **CW Message** screen and the key guide for function keys **[F1]** to **[F7]** for a case when "Paddle" has been configured for Menu 5-10, "CW Message Entry", are different from those for a case when "Text String" has been configured. This manual describes the case if "Paddle" has been configured; however, the operating procedure is identical. You must first store a CW message before you can play or transmit it.



1 Press **[CW/ CW-R]** to select CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.



If the key guides for **[F1]** to **[F7]** appear as **[MORE]** (F1), **[▲]** (F2), **[▼]** (F3), **[REPEAT]** (F4), **[DELETE]** (F5) and **[NAME]** (F6), press **[MORE]** (F1) to alternate the key guide between the key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4), **[CH4]** (F5) and **[NEXT]** (F7) and the key guide for **[MORE]** (F1), **[CH5]** (F2), **[CH6]** (F3). **[CH7]** (F4), **[CH8]** (F5) and **[NEXT]** (F7).

3 Press **[VOX/SEL]** or **[FBK]** to disable the Break-in so as to play a CW message.
To transmit a CW message, you must enable the Break-in. The "VOX/SEL" or "FBK" LED lights while Break-in is active, and turns off while Break-in is inactive.

4 Press one of **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4), **[CH4]** (F5),**[CH5]** (F3). **[CH6]** (F4), **[CH7]** (F5) and **[CH8]** (F6) to select the desired CW message.
The transceiver starts playing or transmitting. To terminate the operation, press **[STOP]** (F5).

5 Press **[ESC]** to exit.

Note:

- If anything other than “Off” has been configured for Menu 5-13 “Channel Number (Count-up Message)”, the contest number increments as soon as the playback or transmission of a CW message of the selected channel ends.
- If "On" has been configured for Menu 5-09 "Interrupt Keying", paddling pauses the playback or transmission of a CW message. When you finish paddling, the transceiver resumes the playback or transmission of the CW message from the portion where the playback or transmission has paused.
- If "Off" has been configured for Menu 5-09 "Interrupt Keying", paddling pauses the playback or transmission of a CW message.
- To transmit without using the Break-in, press **[SEND]** at step 3 alternately.

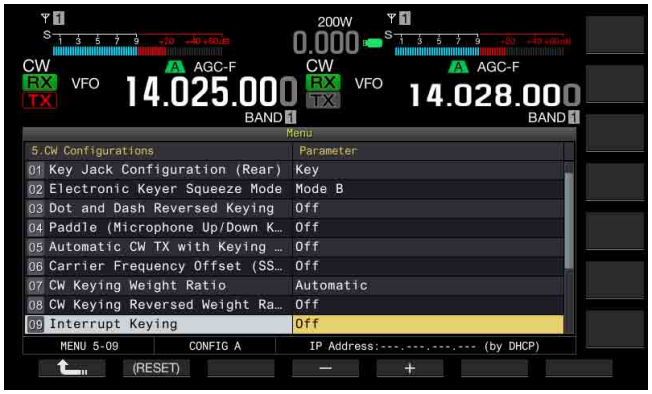
INTERRUPTING THE KEYING

If you paddle during the playback or transmission of the CW message, the transceiver stops playing or transmitting the CW message and you can insert your own CW text.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access the menu 09 "Interrupt Keying".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off"
The default is “Off” (not interrupting the keying). Selecting “On” allows you to interrupt the keying.

5 Press **[↩]** (F1).

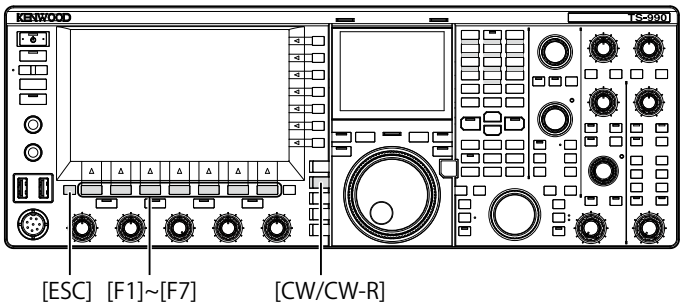
6 Press **[MENU]** to exit.

Note:

- When you stop sending your own text, the paused transmission of the CW message resumes.

DELETING CW MESSAGES

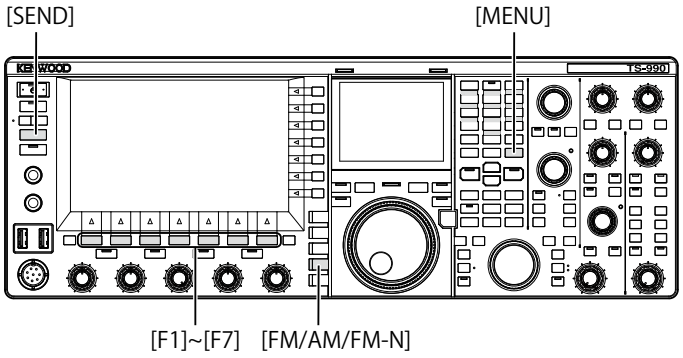
Follow the procedure below to delete the CW messages stored in Channel 1 through Channel 8.



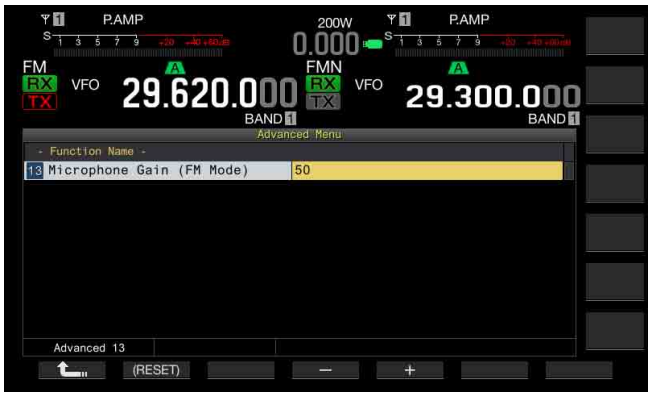
1 Press **[CW/ CW-R]** to select CW mode.
2 Press **[KEYER]** (F2) to open the **CW Message** screen.
3 Select the target channel to delete the CW message.
For the selection method of channel numbers, refer to step 3 in "CHANGING THE ENTRY METHOD OF CW MESSAGES". {page 5-22}
4 Press and hold **[(DELETE)]** (F5) to delete the CW message.
5 Press **[ESC]** to exit.

ADJUSTING THE MICROPHONE GAIN FOR FM MODE OPERATION

High quality audio and less interference from noise are the advantages of FM operation. The TS-990S enables you to communicate in FM mode on the 29 MHz and 50 MHz bands in both simplex and, over longer distances, in repeater modes.



1 TUNING THE FREQUENCY
2 Press **[FM/AM/FM-N]** to enter FM mode.
3 Press **[ADJ.]** (F) from the **Menu** screen.
4 Access the Advanced Menu 13 "Microphone Gain (FM Mode)".
5 Press **[SELECT]** (F4) to allow editing of the parameter box.



6 Press **[SEND]** or press down the **[PTT]** (microphone).
The transceiver enters the transmit mode, and the level meter appears.
7 Speak into the microphone in your normal voice.
8 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to adjust the microphone gain.
- You should adjust the peak value of the level meter not to exceed the zone.
- Available range is "1" to "100". The default is "50".

9 Press **[SEND]** or release the **PTT** (microphone).
The transceiver is placed into the receive state.
10 Press [ ] (F1).
11 Press **[MENU]** to exit.

Note:

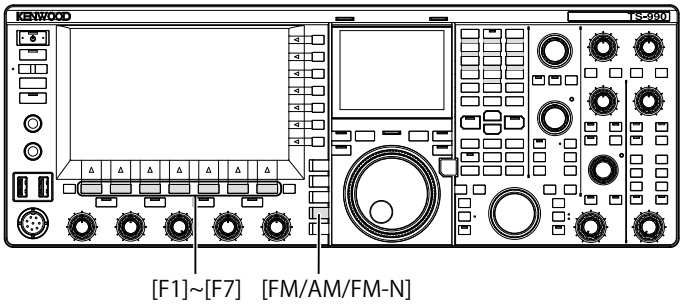
- If you use a low-sensitive microphone such as the MC-90, you should increase the microphone gain.
- If you use a low-sensitive microphone, enabling the Speech Processor may increase the modulation level.

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FM NARROW OPERATION

While operating in FM mode, you can change the bandwidth to narrow. The following table shows the occupied frequency bandwidth and the maximum modulation level. Selecting FM Narrow to match the deviation level of other stations can avoid or eliminate any distortion of the received audio and any denterioration of the communication legibility.

Mode	Occupied Frequency Bandwidth	Maximum Modulation Level
FM Wide	16 kHz or lower	±5 kHz or lower
FM Narrow	10 kHz or lower	±2.5 kHz or lower



1 Press **[FM/AM/FM-N]** to enter FM mode.

2 Press and hold **[FM/AM/FM-N]** to enter the FM Narrow mode.



REDUCING THE DEFLECTIONS OF THE S-METER FOR USE IN FM-MODE

You can configure the sensitivity of the S-meter to be used in FM mode by selecting either "High", allowing the S-meter to function in the same manner as that for past HF transceivers, or "Low", which reduces the S-meter sensitivity by an expansion of the dynamic range. Selecting "Low" to reduce the S-meter sensitivity enables the deflection of the S-meter to be as the same deflection as the S-meter used in other modes.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 08, "FM Mode S-meter Sensitivity".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



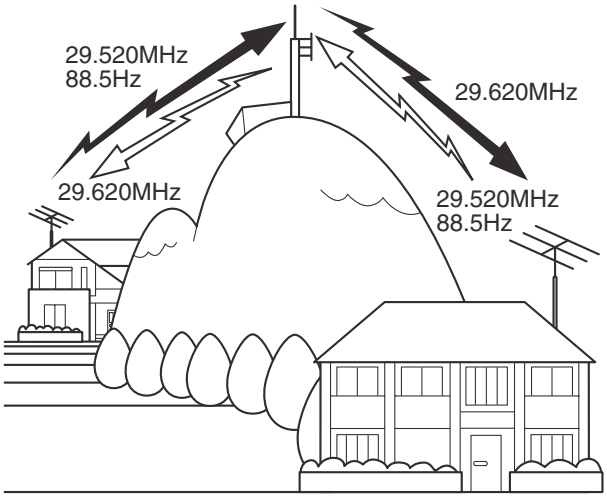
4 Press **[–]** (F4) or **[+]** (F5) to select "Low".
The default is "High"

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

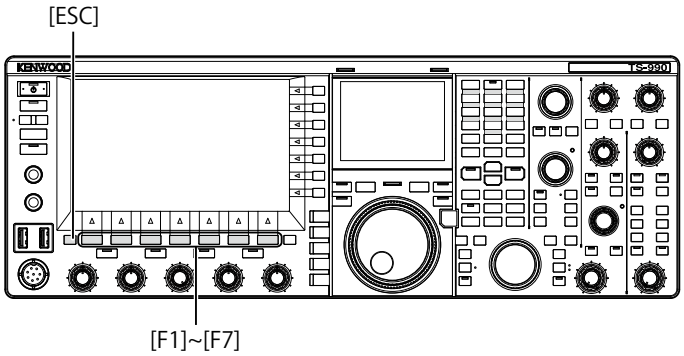
FM REPEATER OPERATION

To operate the transceiver in repeater mode, set the transceiver to Split mode for use in FM mode and set the tone signal to ON.

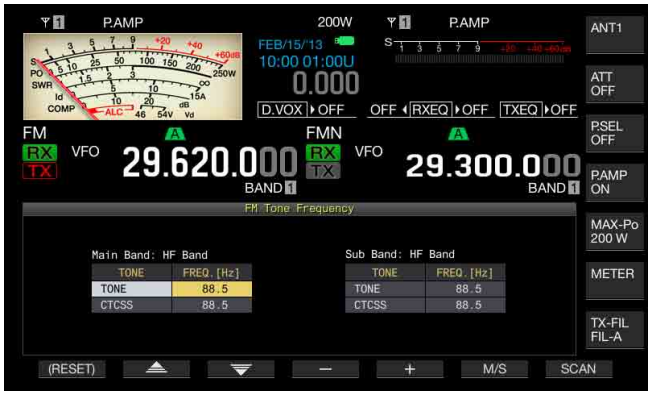


CONFIGURING THE TONE FREQUENCY

You can change the tone frequency.



1 Press and hold **[TONE]** (F4) while in FM mode to open the **FM Tone Frequency** screen.



2 Press **[M/S]** (F6) to select either main band or sub band.
The parameter box for the frequency (FREQ. [Hz]) is activated.

3 Press [▲] (F2) or [▼] (F3) to select "TONE".

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the tone frequency.

5 Press **[ESC]** to exit.

Note:

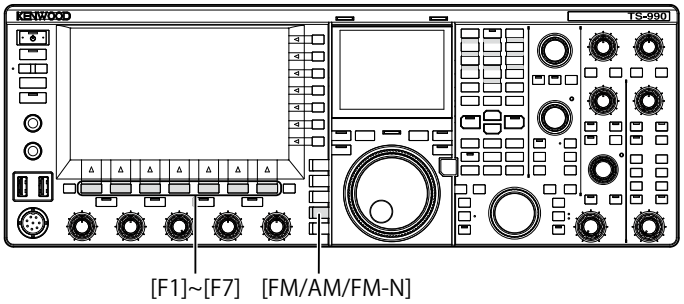
- If you press and hold **[(RESET)]** (F1), the selected tone frequency reverts to the default (88.5 Hz).

Tone Frequency						
67.0	88.5	114.8	151.4	177.3	203.5	250.3
69.3	91.5	118.8	156.7	179.9	206.5	254.1
71.9	94.8	123.0	159.8	183.5	210.7	1750.0
74.4	97.4	127.3	162.2	186.2	218.1	
77.0	100.0	131.8	165.5	189.9	225.7	
79.7	103.5	136.5	167.9	192.8	229.1	
82.5	107.2	141.3	171.3	196.6	233.6	
85.4	110.9	146.2	173.8	199.5	241.8	

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SELECTING THE TONE

Follow the procedure below to change the type of tone signal after selecting the main band or sub band.



1 Press **[FM/AM/FM-N]** to enter FM mode.

2 Press **[TONE]** (F4) to select the tone.
Each time you press the key, the tone signal display cycles as follows: CT (CTCSS) > CROSS > deselected; the main screen display varies as follows: "TONE" > "CT" > "CROSS" > blank (deselected) > "TONE".

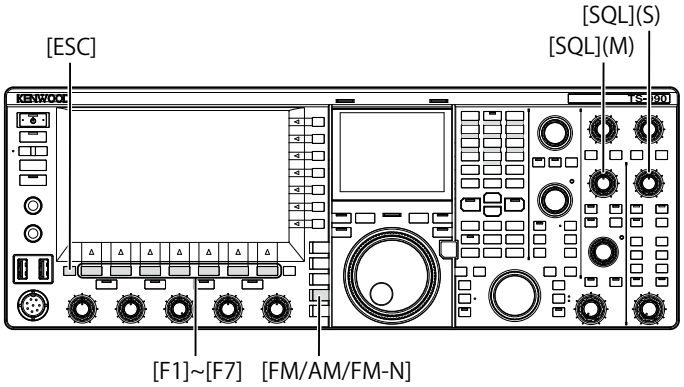


Note:

- If the selected band is dedicated for reception ("TX" LED is unlit), "TONE" is grayed out.
- If the "TX" LED and "RX" LED for the sub band turn Off, "TONE", "CT", and "CROSS" will also be grayed out.

USING THE SCAN TO SEARCH FOR THE TONE FREQUENCY

A tone frequency scan makes it possible to detect the tone frequency contained in the receive signal in FM mode. This function is convenient if you wish to know the tone frequency of a repeater. Follow the procedure below after selecting the main band or sub band.

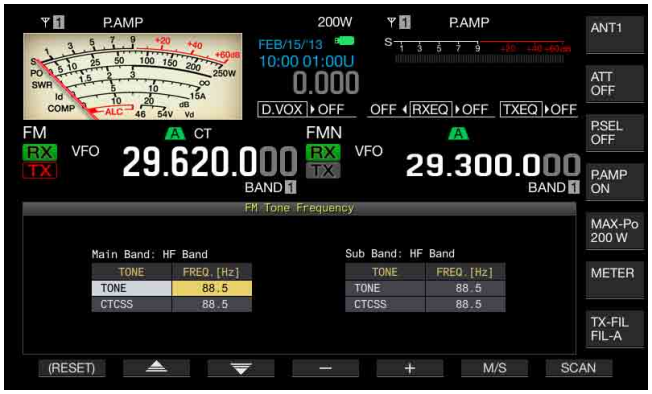


1 Press **[FM/AM/FM-N]** to enter FM mode.



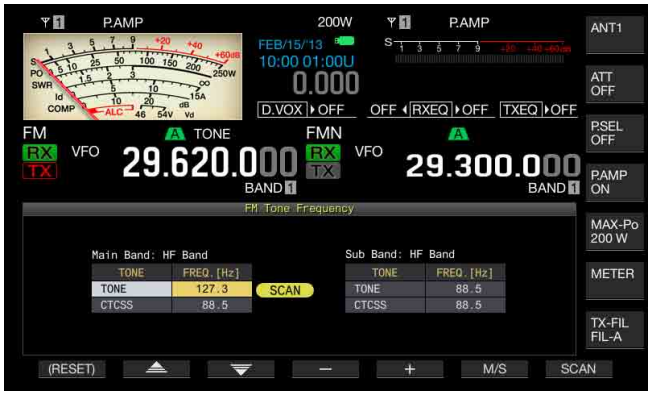
2 Press and hold **[TONE]** (F4) to open the **FM Tone Frequency** screen.

3 Press [▲] (F2) or [▼] (F3) to select "TONE" as a tone type.



4 Press **[SCAN]** (F7) to scan the tone frequency.

- Until the scan ends, "SCAN" appears on the right of the tone frequency.



- As soon as the tone frequency is detected, the scan stops and the frequency appears in the FREQ. [Hz] box.
- The scan starts with a press of **[M/S]** (F6) while the transceiver is in reception in the selected band (the "MAIN BUSY/TX" LED or the "SUB BUSY/TX" LED lights). If the "MAIN BUSY/TX" LED or "SUB BUSY/TX" LED is unlit, rotate the **SQL** control to receive so that the transceiver will be placed in receive mode.
- Press **[M/S]** (F6) if you wish to change the current band (main band or sub band).
- The scan pauses by pressing **[SCAN]** (F7) while scanning the tone frequency. The scan resumes by pressing **[SCAN]** (F7) again.
- The scan pauses if the receive signal breaks off while scanning the tone frequency. The scan automatically restarts when the transceiver detects the receive signal.

5 Press **[ESC]** to exit.

CTCSS OPERATION (FM MODE)

The CTCSS stands for Continuous Tone Coded Squelch System. Add your audio signal with the CTCSS tone frequency predetermined with the station with which you wish to have a QSO. When the CTCSS tone frequency in the receive signal from the other station coincides with the CTCSS tone frequency of your station, the squelch opens and you can hear the audio received.

You can select a desired CTCSS tone frequency and the tone frequency independently, but cannot use the CTCSS and tone simultaneously.

CTCSS Tone Frequency: The squelch opens when the transceiver receives the CTCSS tone to which the same CTCSS tone frequency as that is configured for the transceiver is superimposed A CTCSS tone frequency scan makes it possible to detect the CTCSS tone frequency contained in the receive signal. If the transceiver receives the signal while the CTCSS tone frequency scan is in operation, you will hear the audio of the receive signal regardless of whether the CTCSS tone frequency coincides or not.

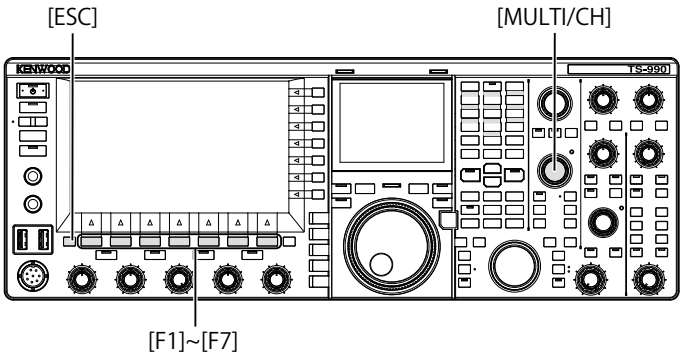
Cross tone: The squelch opens when the CTCSS tone frequency matches during the reception and the tone is transmitted at the configured tone frequency at the time of signal transmission. Different tone can be used for transmission and reception.

Note:

- The squelch opens and you can hear the audio received only if the CTCSS tone frequency in the receive signal coincides with the CTCSS tone frequency configured in the transceiver. Use this function to single out the receive signal from the other station so that unnecessary signals will not be received. Therefore, the use of the CTCSS frequency does not prevent the contents of your call from being monitored by other stations.
- You do not need to configure the tone frequency if you store the configuration for CTCSS tone frequency in a memory channel and retrieve the frequency and operating information from the memory channel. For memory channel configuration, refer to “MEMORY CHANNEL”. {page 10-1} If you use this transceiver as the amateur radio base station of the VoIP, you can configure the received audio to sound from the speaker even if the CTCSS tone frequency does not match. {page 16-23}
- To use a CTCSS tone, the RX Monitor must be assigned to a PF key allowing you to monitor the status of the transmit frequency. {page 16-6}

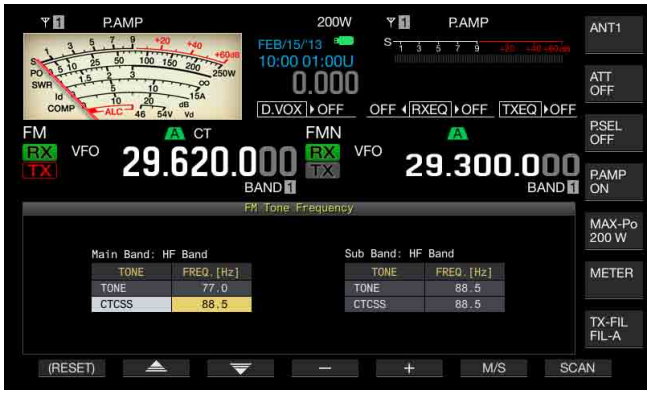
CONFIGURING THE CTCSS TONE FREQUENCY

You can configure the desired CTCSS tone frequency.



1 Press and hold **[TONE]** (F4) to open the **FM Tone Frequency** screen.

2 Press **[M/S]** (F6) to select either main band or sub band.
Parameter box for frequency (FREQ. [Hz] allows you to edit.



3 Press [▲] (F2) or [▼] (F3) to select "CTCSS".

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the CTCSS tone frequency.

5 Press **[ESC]** to exit.

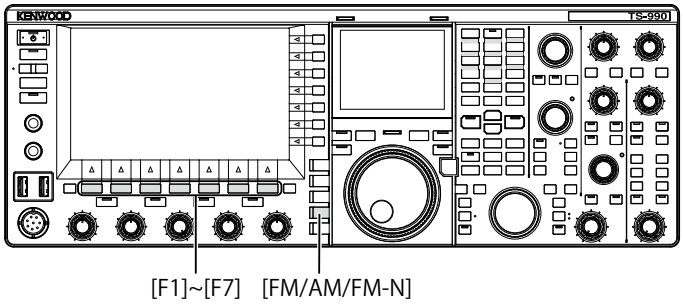
Note:

- If you press and hold **[(RESET)]** (F1), the selected CTCSS tone frequency reverts to the default (88.5 Hz).

CTCSS Tone Frequency (Hz)						
67.0	88.5	114.8	151.4	177.3	203.5	250.3
69.3	91.5	118.8	156.7	179.9	206.5	254.1
71.9	94.8	123.0	159.8	183.5	210.7	
74.4	97.4	127.3	162.2	186.2	218.1	
77.0	100.0	131.8	165.5	189.9	225.7	
79.7	103.5	136.5	167.9	192.8	229.1	
82.5	107.2	141.3	171.3	196.6	233.6	
85.4	110.9	146.2	173.8	199.5	241.8	

SELECTING THE CTCSS TONE

Follow the procedure below to change the type of tone signal after selecting the main band or sub band.



1 Press **[FM/AM/FM-N]** to enter FM mode.

2 Press **[TONE]** (F4) to select CTCSS tone.
Each time you press the key, the tone signal display cycles as follows: CT (CTCSS) > CROSS > deselected; the main screen display varies as follows: "TONE" > "CT" > "CROSS" > blank (deselected) > "TONE".



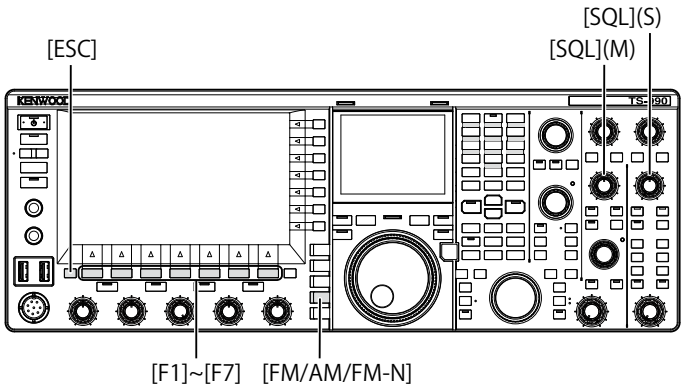
Note:

- If the selected band is dedicated for reception ("TX" LED is unlit), "CT" will be grayed out.
- If the "TX" LED and "RX" LED for the sub band turn Off, "TONE", "CT", and "CROSS" will also be grayed out.

USING THE SCAN TO SEARCH FOR THE CTCSS TONE FREQUENCY

A tone frequency scan makes it possible to detect the CTCSS tone frequency contained in the receive signal in FM mode. This function is convenient if you wish to know the CTCSS tone frequency of a repeater.

Follow the procedure below after selecting the main band or sub band.



1 Press **[FM/AM/FM-N]** to enter FM mode.

2 Press and hold **[TONE]** (F4) to open the **FM Tone Frequency** screen.

3 Press **[▲]** (F2) or **[▼]** (F3) to select "CTCSS" as a tone type.

4 Press **[SCAN]** (F7) to scan the CTCSS tone frequency.
- Until the scan ends, "SCAN" appears on the right of the CTCSS tone frequency.
- As soon as the CTCSS tone frequency is detected, the scan stops and the frequency appears in the FREQ. [Hz] box.
- The scan starts with a press of **[M/S]** (F6) while the transceiver is in reception in the selected band (the "MAIN BUSY/TX" LED or the "SUB BUSY/TX" LED lights).
- If the "MAIN BUSY/TX" LED or "SUB BUSY/TX" LED is unlit, rotate the **SQL** control to receive so that the transceiver will be placed in receive mode.
- Press **[M/S]** (F6) if you wish to change the current band (main band or sub band).
- The scan pauses by pressing **[SCAN]** (F7) while scanning the CTCSS tone frequency. The scan resumes by pressing **[SCAN]** (F7) again.
- The scan pauses if the receive signal breaks off while scanning the CTCSS tone frequency. The scan automatically restarts when the transceiver detects the receive signal.

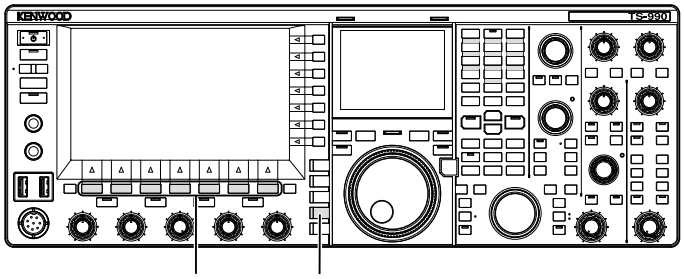
5 Press **[ESC]** to exit.

SELECTING THE CROSS TONE

"Cross Tone" is a function used when you are communicating via a repeater that requires different tones for your transmission (uplink) to the repeater and for your reception (downlink) from the repeater.

Cross tone uses the tone frequency for the transmission and the CTCSS frequency for the reception. The CTCSS frequency activates the tone squelch at the time of signal reception and the tone is sent at the preset tone frequency at the time of signal transmission.

Follow the procedure below to change the type of tone signal after selecting the main band or sub band.



1 Press **[FM/AM/FM-N]** to enter FM mode.

2 Press **[TONE]** (F4) to select CROSS.
Each time you press the key, the tone signal display cycles as follows: CT (CTCSS) > CROSS > deselected; the main screen display varies as follows: "TONE" > "CT" > "CROSS" > blank (deselected) > "TONE".



Note:

♦ If the "TX" LED and "RX" LED for the sub band turn Off, "TONE", "CT", and "CROSS" will also be grayed out.

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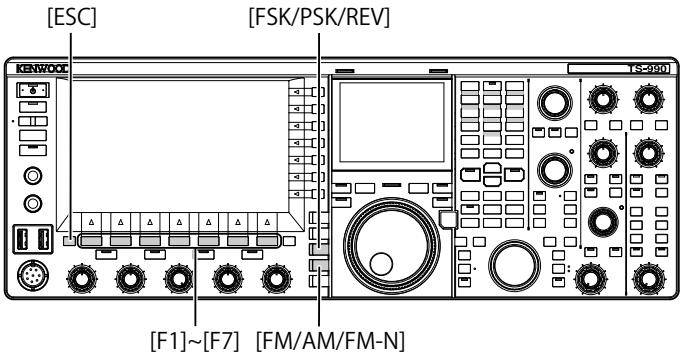
RTTY OPERATION

The transceiver is equipped with an encoder/decoder for RTTY operation. You can use a commercially available USB keyboard in combination with the transceiver in RTTY mode without using any other device. You can also connect an external device, such as a TNC or PC, and operate the transceiver in RTTY mode.

PRECAUTION

- Prior to operation in RTTY mode, you must adjust the carrier level by observing of the ALC meter.

OPENING THE RTTY ENCODE/DECODE SCREEN



1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODER]** (F3) to open the **RTTY Encode/Decode** screen.
Pressing **[XY LEV.]** (F7) changes the refreshing frequency of the Lissajous curve. Changing the refreshing frequency also change the density of the Lissajous curve.



MAIN SCREEN



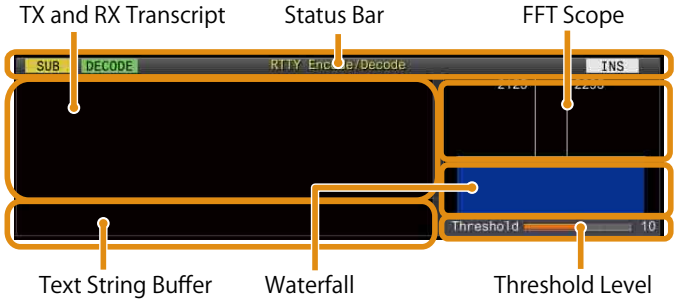
SUB-SCREEN

3 Press **[ESC]** to exit.

Note:

- If a value other than "170 [Hz]" is selected in Menu 2-06, "FSK Spacing", the **RTTY Encode/Decode** screen does not open. {page 5-46}
- Noise Reduction 1, Noise Reduction 2, Beat Cancel 1, Beat Cancel 2, Audio Peak Filter and the RX DSP equalizer do not function for RTTY message decoding.

The **RTTY Encode/Decode** screen has the following layout.

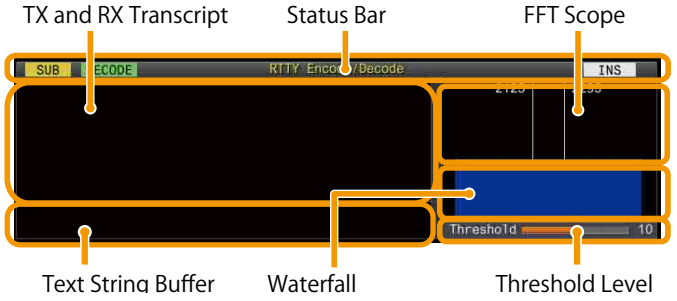


- Status bar: The band name and encode or decode in use appear on the left side and the status (overwriting or insertion) of the text string entry at the time of pressing **[Insert]** on the USB keyboard appears on the right.
- Contents of transmission or reception: The text string transmitted or received appears. Press and hold **[(CLEAR)]** (F4) to delete the text string.
- Buffer of TX text string: The text string to be transmitted appears. Pressing **[PAUSE]** pauses the reception.
- FFT scope: The audio FFT scope is used to check the tuning state visually.
- Waterfall: The spectrum of the receive audio signal is displayed.
- Threshold: Displays the threshold level of the receive signal.

OPERATIONS ON THE RTTY ENCODE/DECODE SCREEN

You can operate the transceiver using the following procedure while the **RTTY Encode/Decode** screen is open.

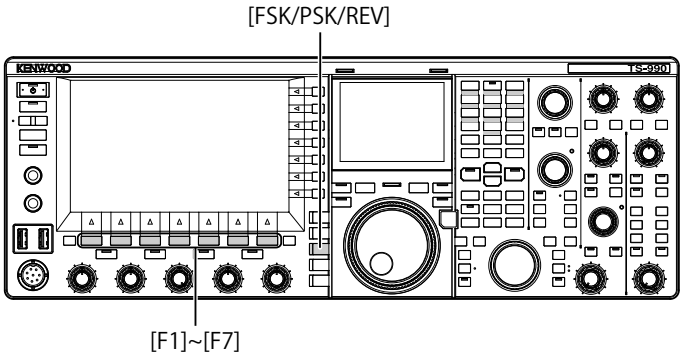
- Pressing the **[Page Up]** or **[Page Down]** key on the USB keyboard scrolls the contents of transmission and reception.
- Press **[EXTEND]** (F7) extends the **RTTY Encode/Decode** screen; it expands vertically.
- The analog meter, if displayed on the main band, changes to the digital meter.
- If you press the key again, the display of the **RTTY Encode/Decode** screen and meter reverts to the previous display.



- Pressing **[PAUSE]** (F3) pauses the text displayed in the **RTTY Encode/Decode** screen. Pressing the key again releases the pausing of the text.
- The text received while pausing is not processed.
- Pressing and holding **[(CLEAR)]** (F4) clears the text displayed in the TX text string.
- Pressing **[MORE]** (F1) alternates the function key guide to another one.

SELECTING MAIN BAND AND SUB BAND FOR RECEPTION (FSK)

You can select decoding either on the main band or on the sub band.



1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODER]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Press **[M/S]** (F2) to select either main band or sub band.



Note:

♦ If the selected decoding object falls under either one of the following conditions, "RX: Reselect FSK" appears in the **RTTY Encode/Decode** screen.

A mode other than RTTY (FSK) is selected.

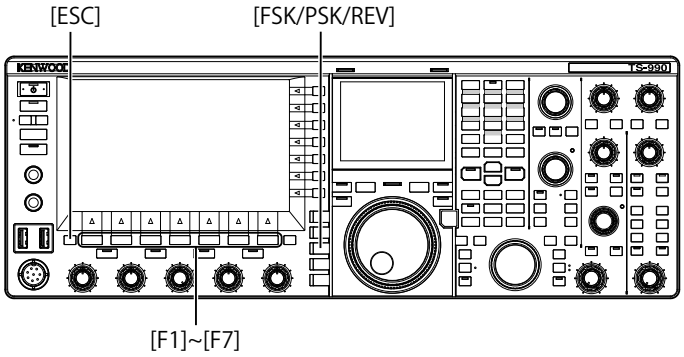
The receive capability for the sub band is disabled when the sub band is selected.



♦ If the transceiver is in any mode other than RTTY (FSK) mode, "TX: Reselect FSK" appears in the **RTTY Encode/Decode** screen. Press **[FSK/PSK/REV]**.

SAVING THE CONTENTS OF RTTY COMMUNICATION

You can save the contents of the communication displayed in the **RTTY Encode/Decode** screen in a USB flash drive.



1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODER]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Insert a USB flash drive into the •⇠(USB-A) connector.

Use a USB flash drive which was formatted by the transceiver.

4 Press **[SAVE]** (F4) to store the contents of QSO.

A message notifying you of the completion of the data saving appears.



If **[SAVE]** (F4) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

5 Press **[OK]** (F4) to end.

Note:

♦ The file name is given using the numbers and underscores representing the time and date, and the extension selected in Menu 2-12, "RTTY/PSK Log File Format", is also added. The data is displayed in the order of the year, underscore, hour, minute, and second.

Example:

Example: In the case of 10:20:30, February 15, 2013: 20130215_102030.txt

♦ A file be saved in the following folder.

KENWOOD/TS-990/DECODE/FSK

♦ Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}

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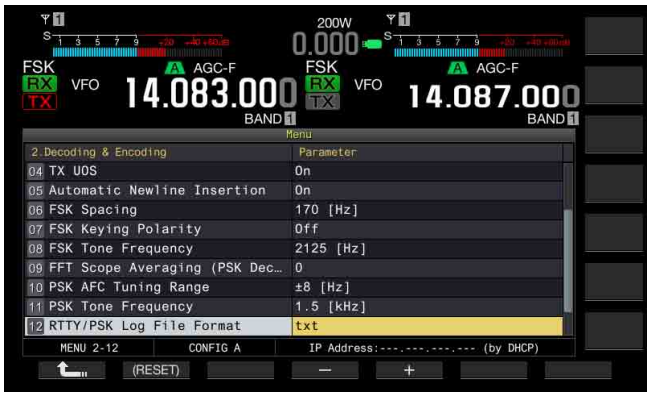
SELECTING THE FILE FORMAT AT THE TIME OF SAVING DATA

You can select the data saving format, either the html format or text format.

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 12, "RTTY/PSK Log File Format".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



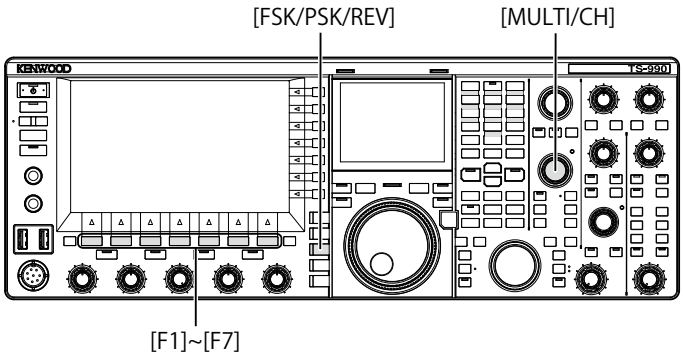
4 Press **[–]** (F4) or **[+]** (F5) to select "html" or "txt".
- The extension is either ".html" or ".txt".
- The default is "txt".

5 Press [ ] (F1).

6 Press **[ESC]** to exit.

ADJUSTING THE RTTY THRESHOLD LEVEL OF RTTY DECODING

The received noise while no signal is present may occasionally be erroneously recognized as a valid character, decoded and displayed. The threshold level should be adjusted to reduce or eliminate this symptom. If there are many erroneous detections due to noise, increment the threshold level.



1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODE]** (F3) to select either main band or sub band.

3 Press **[THLD]** (F5) to allow editing of the threshold level.
The threshold level configuration below the Waterfall display can be changed.



If **[THLD]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to adjust the level.
Pressing and holding **[(RESET)]** (F1) resets the configured parameter to the default. The default is "10".

5 Press [ ] (F1) to exit.

DISPLAYING THE SCOPE TO CHECK RTTY TUNING

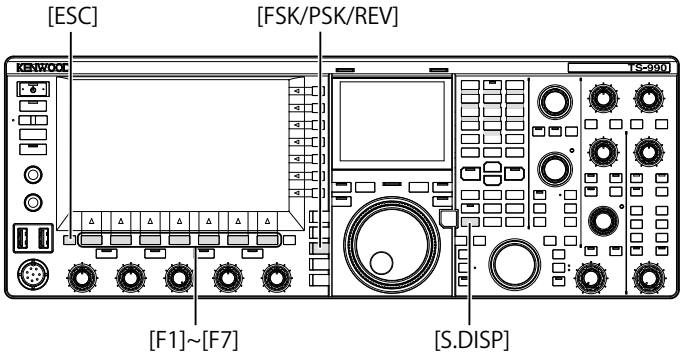
FFT SCOPE

The transceiver is provided with an audio FET scope to observe the tuning condition of the transceiver in RTTY (FSK) mode. The audio FET scope appears in the **RTTY Encode/Decode** screen.

The two vertical lines on the left and right indicate mark and space frequencies. While receiving the signal, adjust the tuning frequency so that the two peaks overlaps the two lines equally.

AVERAGING THE WAVEFORM IN THE FFT SCOPE

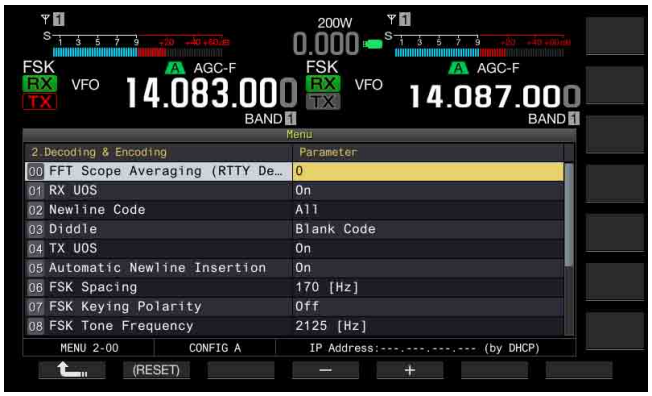
The waveform to be displayed on an FFT scope can be averaged. Waveform averaging will reduce the random noise, allowing you to observe the target signal.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 00, "FFT Scope Averaging (RTTY Decode)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select the desired value from "0" to "9" in the parameter box.
Selecting the larger parameter will display the spectra with the noise component reduced. The default is "0".

5 Press [ ] (F1).

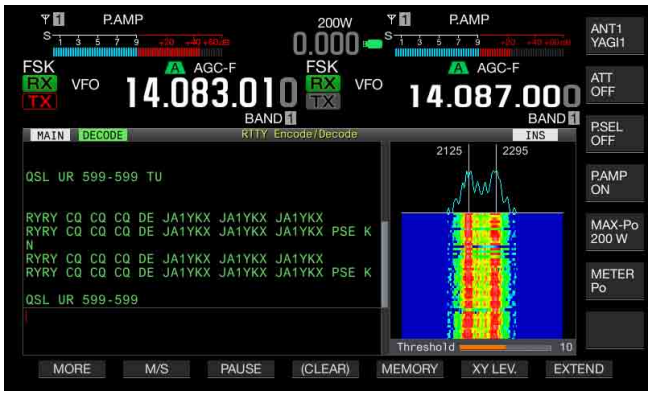
6 Press **[ESC]** to exit.

Note:

♦ Use Fine Tuning if it is not easy to tune. {page 4-14}

WATERFALL

In linking with the audio FFT scope, transition of the frequency components contained in the received audio signal can be displayed.



X-Y SCOPE (SUB-SCREEN)

The tuned status of the signal in RTTY (FSK) mode is displayed as a cross pattern (90 degrees) on the X-Y scope. The cross patterns bisect at right angles when the transceiver is correctly tuned into the signal.

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODER]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Press **[S.DISP/ SEL]** to display the X-Y Scope.



Note:

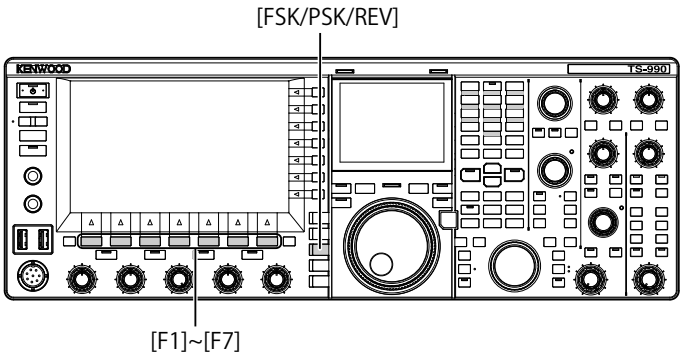
♦ The X-Y scope appears only if the **RTTY Encode/Decode** screen appears on the main screen.

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USING THE USB KEYBOARD TO TRANSMIT A TEXT STRING

You can connect a commercially available USB keyboard to the transceiver to enter and transmit a text string.

TRANSMITTING THE ENTERED TEXT STRING AS ENTERED



1 Connect a USB keyboard to the •⇆(USB-A) connector.

2 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

3 Press **[DECODER]** (F3) to open the **RTTY Encode/ Decode** screen.

4 Press **[F12]** on the USB keyboard to start to transmit.

The "BUSY/TX" LED lights red and "ENCODE" appears on the status bar.



5 Enter the text strings using the USB keyboard.

- The entered text string is placed and displayed in the text string buffer and transmitted as entered.
- Each letter in the text string buffer changes its color in sequence when the letter is transmitted.
- Text strings transmitted are displayed in sequence in the TX and RX Transcript.

6 Press **[F12]** on the USB keyboard to stop transmission.

Note:

♦ If letters not transmitted yet remain in the text string buffer when **[F12]** is pressed at step 6, "WAIT" appears on the status bar. When the entire text string is transmitted, the transceiver enters the receive mode and the "BUSY/TX" LED and "WAIT" are unlit.

STORING TEMPORARILY AND TRANSMITTING THE TEXT STRING IN THE BUFFER

1 Connect a USB keyboard to the •⇆(USB-A) connector.

2 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

3 Press **[DECODER]** (F3) to open the **RTTY Encode/ Decode** screen.

4 Enter the text strings using the USB keyboard.
The entered text string is placed and displayed in the text string buffer.

5 Press **[F12]** of the USB keyboard to send a text string.

- The transceiver transmits the text string accumulated in the text string buffer.
- The "BUSY/TX" LED lights red and "ENCODE" appears on the status bar when the transceiver is in a transmit state.
- Each letter in the text string buffer changes its color in sequence when the letter is transmitted. Each letter transmitted appears sequentially the TX and RX Transcript.

6 Press **[F12]** of the USB keyboard to receive.

Note:

♦ If letters not transmitted yet remain in the text string buffer when **[F12]** is pressed at step 6, "WAIT" appears on the status bar. When the entire text string is transmitted, the transceiver enters the receive mode and the "BUSY/TX" LED and "WAIT" are unlit.

♦ The transceiver enters the receiving mode if **[ESC]** on the USB keyboard is pressed while the text string is being transmitted. Transmission of the text string ends, and any text waiting for transmission in the text string buffer is deleted.

♦ You can add time stamp and frequency information in the transmit and receive data displayed in the TX and RX Transcript.

♦ You can pause the transmission of the text string using the USB keyboard by pressing **[PAUSE]** (F3). Another press of **[PAUSE]** (F3) releases the pause.

♦ The text string temporarily stored in the text string buffer can contain a maximum of 4,300 characters.

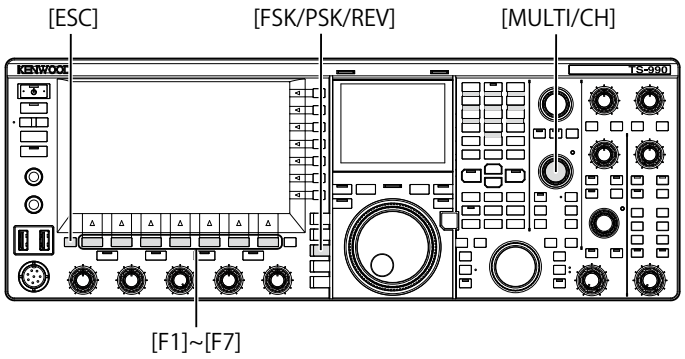
♦ The following alphanumeric characters and signs can be entered from the USB keyboard.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
O	P	Q	R	S	T	U	V	W	X	Y	Z	0	1
2	3	4	5	6	7	8	9	!	“	#	$	&	'
(	)	.	,	-	?	:	;	/	Space		Line Break		

UTILIZING AN RTTY MESSAGE MEMORY

You can save frequently used fixed phases commonly used in RTTY (FSK) mode as RTTY messages in the RTTY message memory. If you configure automatic TX and RX triggers in your messages, you can transmit the RTTY messages with ease. You can store a maximum of eight RTTY messages in channel 1 through channel 8.

STORING MESSAGES



1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODER]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **RTTY Message** screen.



If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[▲]** (F3) or **[▼]** (F4), or rotate the **MULTI/CH** control to select a channel to which a CW message will be stored.

If **[▲]** (F3) and **[▼]** (F4) are unavailable in the key guide, press **[MORE]** (F2).

5 Press **[MSG]** (F5) to allow editing of the message for the selected channel.



6 Use functions keys, the **MULTI/CH** control, or a USB keyboard to enter a text string.

[SPACE] (F1): Press to enter one space.

[-] (F2) and **[+]** (F3): Press to display the previous or next character.

[◀] (F4) and **[▶]** (F5): Press to move the cursor to the left and right.

[SAVE] (F6): Press to store the selected characters.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Changes the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > !"# (symbols) > ABC (upper case)

Available alphanumeric characters and symbols (a maximum of 70 characters)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
O	P	Q	R	S	T	U	V	W	X	Y	Z	0	1
2	3	4	5	6	7	8	9	!	“	#	$	&	'
(	)	.	,	-	?	:	;	/	Space		Line Break		

7 Press **[SAVE]** (F6) to store the edited message.
Pressing **[CANCEL]** (F7) deletes the contents being edited and ends the character entry.

8 Press **[↩]** (F1).

9 Press **[ESC]** to exit.

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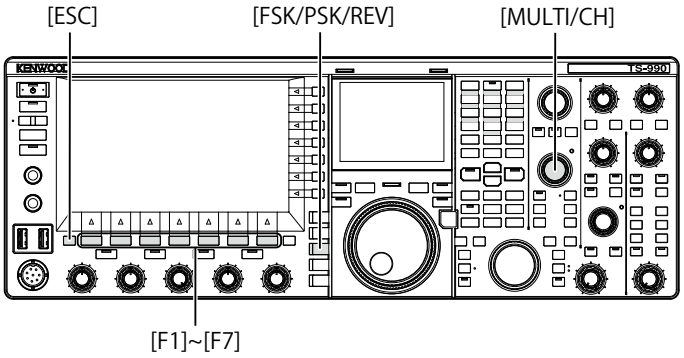
CONFIGURING THE AUTOMATIC TRANSMISSION AND RECEPTION FOR THE RTTY MESSAGE MEMORY

If you select an RTTY message memory channel, you can configure independently for each RTTY message memory channel whether or not the RTTY message is transmitted automatically and whether or not the transceiver enters receive after it's been sent.

Automatic transmit sends the RTTY message as soon as the channel where a RTTY message is stored is selected. The transmit state is maintained even after the entire message is transmitted. Therefore, this function is convenient if you wish to transmit your own text string using a USB keyboard after the RTTY message is transmitted using the RTTY message memory.

Automatic receive is a function to revert to the receive mode after an RTTY message has been sent. Selecting the channel number, that contains an RTTY message to be sent, automatically starts transmitting the RTTY message, or the RTTY message temporarily stored in the buffer for the text string can be sent with a press of **[F12]** of a USB keyboard. The transceiver can automatically enter the receive mode when the RTTY message is transmitted.

A combination of automatic transmission and automatic reception makes it possible to transmit and receive messages automatically.



1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODER]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **RTTY Message** screen.



If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press [▲] (F3) or [▼] (F4), or rotate the **MULTI/CH** control to select a message to be sent automatically.
If [▲] (F3) and [▼] (F4) are unavailable in the key guide, press **[MORE]** (F1).

5 Press **[AUTO.TX]** (F6) to enable the automatic transmission.
Configures the transceiver so that an RTTY message will be automatically transmitted from the corresponding channel when "AUTO TX" appears on the right side of the RTTY message. Even if the "AUTO TX" disappears, the RTTY message for that channel is temporarily stored in the buffer of a text string and will not automatically be sent.



6 Press **[AUTO.RX]** (F7) to enable the automatic transmission.
Configures the transceiver so that the transceiver will revert to a receive state after an RTTY message is transmitted from the corresponding channel when "AUTO RX" appears on the right side of the RTTY message. Even if "AUTO RX" disappears, the transceiver does not revert to the receive mode after the RTTY message for that channel is sent.



7 Press [↩] (F1).

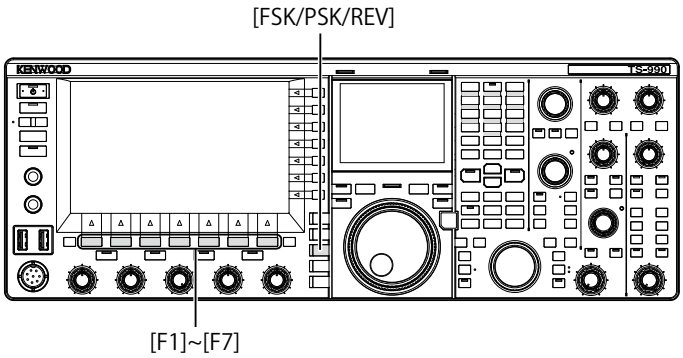
8 Press **[ESC]** to exit.

Note:

- To send the RTTY message for which automatic transmission is enabled, select the channel where the RTTY message is stored. After you confirm that a text string (RTTY message) has been transferred to the buffer of a text string, press **[F12]** of the USB keyboard.
- To place the transceiver in the receive mode after the RTTY message for which automatic reception is disabled, press **[F12]** of the USB keyboard.

CONFIGURING THE AUTOMATIC TRANSMISSION AND RECEPTION USING THE RTTY MESSAGE MEMORY

You can transmit messages entered in the RTTY message memory.



1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODER]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **RTTY Message** screen.



4 Press **[CH1]** (F3), **[CH2]** (F4), **[CH3]** (F5), **[CH4]** (F6), **[CH5]** (F3), **[CH6]** (F4), **[CH7]** (F5), or **[CH8]** (F6) to select the channel for which the message to be sent has been stored.

- The RTTY message in the channel corresponding to the function key is transmitted automatically. The RTTY message will not automatically be transmitted from the channel for which automatic transmission is disabled.
- The key guide for **[F1]** through **[F7]** are the key guide for configuration, including [ ] (F1), **[MORE]** (F2), [ ] (F3), [ ] (F4), **[MSG]** (F5), **[AUTO.TX]** (F6), and **[AUTO.RX]** (F7). In this case, press **[MORE]** (F2) so that the key guide will alternate between the key guide for [ ] (F1), **[MORE]** (F2), **[CH1]** (F3), **[CH2]** (F4), **[CH3]** (F5), **[CH4]** (F6), and **[NEXT]** (F7) and the key guide for [ ] (F1), **[MORE]** (F2), **[CH5]** (F3), **[CH6]** (F4), **[CH7]** (F5), **[CH8]** (F6), and **[NEXT]** (F7).
- The transceiver enters the receive mode after the RTTY message displayed along with "AUTO RX" on the right side.

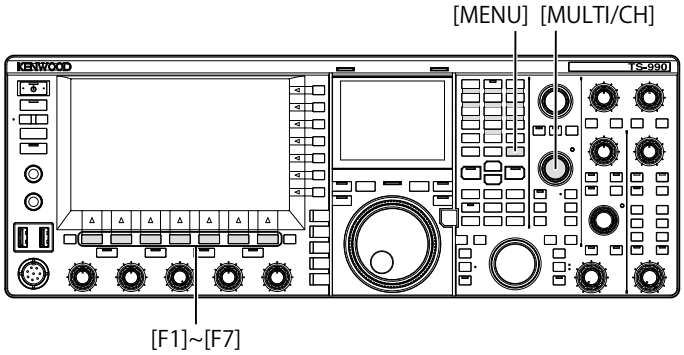
CONFIGURATION FOR RTTY ENCODING AND DECODING

ENABLING THE UOS (UNSHIFT ON SPACE)

If the received RTTY signal contains a space, use this function to decode the letter next to the space forcibly as a letter code (alphabetical letter).

In RTTY, the influence of signal strength or noise causes letter corruption. In order to avoid this problem as much as possible, the function makes it possible to decode the letter after the space as a more frequently used letter code (alphabetical letter).

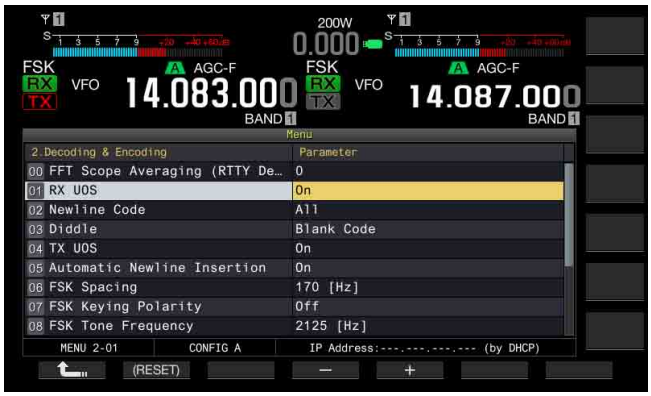
To receive a test string containing numbers andsymbols subsequent to a space, you can disable the UOS function.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 01, "RX UOS".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "On" (encoding a blank letter). Selecting "Off" does not allow the transceiver to encode the blank letter.

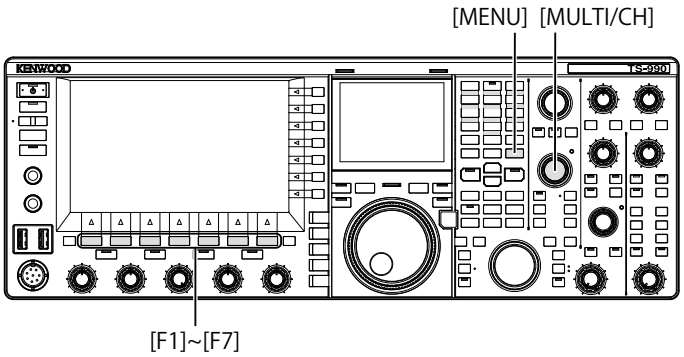
5 Press [ ] (F1).

6 Press **[MENU]** to exit.

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CONFIGURING THE NEWLINE CODE

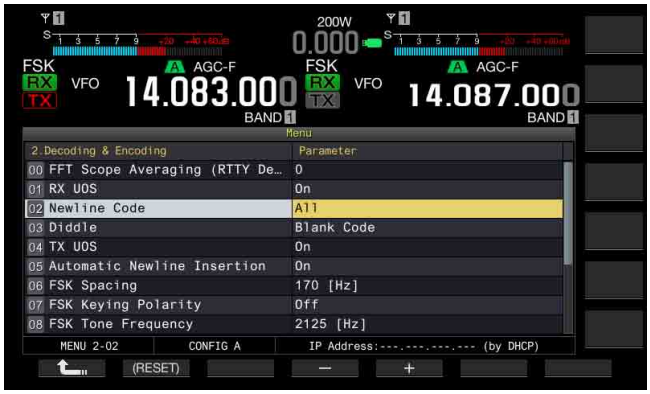
You can configure the newline code used to receive RTTY signals. If "All" is selected, a new line starts whenever the newline code is received. If "CR+LF" is selected, a new line starts only when the CR+LF code is received.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 02, "Newline Code".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



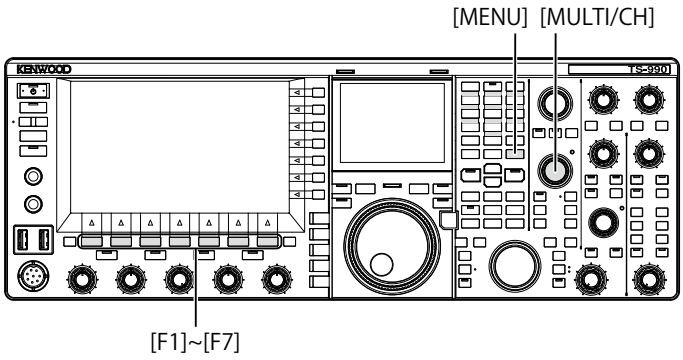
4 Press **[–]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "All" or "CR+LF".
The default is "All".

5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

DIDDLE OPERATION

This function is used to select what code is transmitted when all characters being entered by the operator, or transmitted from a message memory, have been transmitted in RTTY (FSK) mode. You can select to transmit a space or a letter code (alphabetical letter), or no letter will be transmitted.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 03, "Diddle".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



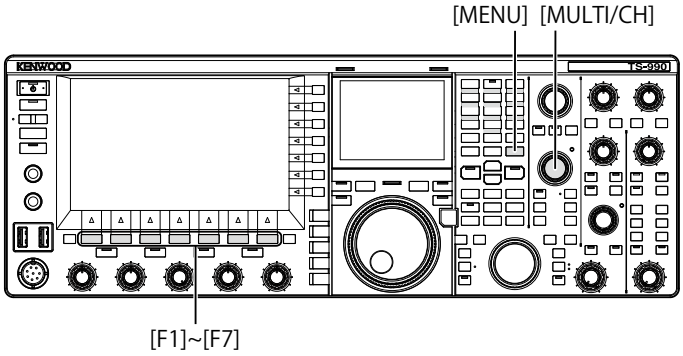
4 Press **[-]** (F4) or **[+]** (F5) to select "Off" (do not send the character code), "Blank Code" (send a blank code), or "Letters Code" (send a letter code).
The default is "Blank Code".

5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

ENABLLING THE ENCODE UOS

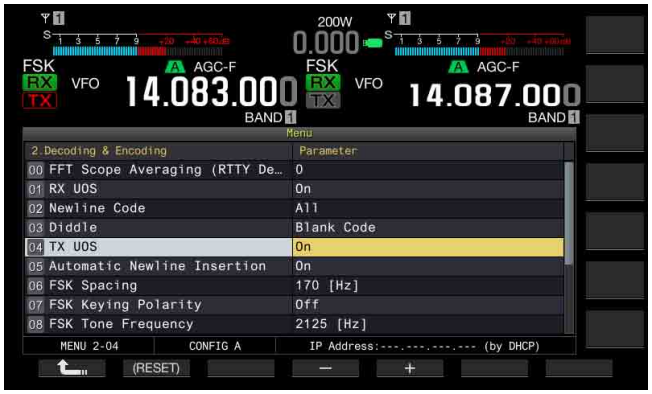
Use this function to transmit a number or symbol following a space during the transmission in RTTY (FSK) mode. Then the receive station recognizes the number or symbol following the space, thus reducing the letter corruption.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 04, "TX UOS".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



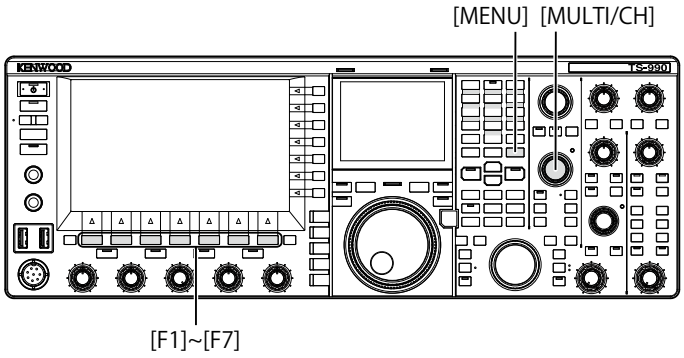
4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is “On” (use with Encode UOS). Selecting “Off” disables the Encode UOS.

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

SENDING THE NEWLINE CODE AT THE START AND END OF TRANSMISSION

The new line code (CR+LF) can be transmitted when the RTTY communication begins and ends. The RTTY message begins and ends with a new line in the decode display of the receiving station making it easier to view the transmitted RTTY message.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 05, "Automatic Newline Insertion".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select “On” or “Off”.
The default is “On” (sending a newline code). Selecting “Off” does not allow the transceiver to send a newline code.

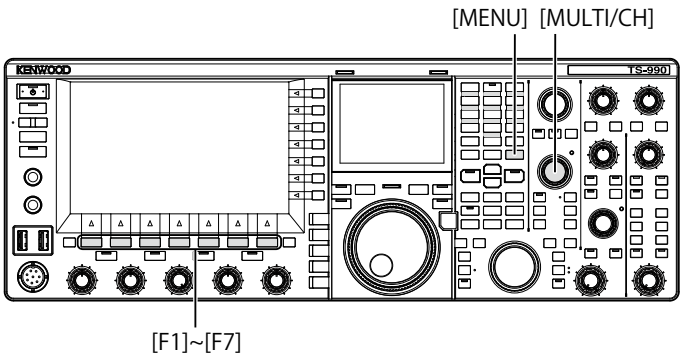
5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

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DISPLAYING THE TIME STAMP

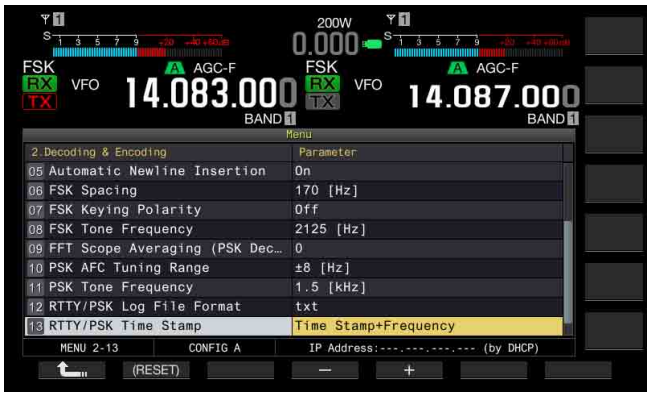
You can display the timestamp whenever transmission and reception alternate. You can display frequency information as well as the timestamp.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 13, "RTTY/PSK Time Stamp".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



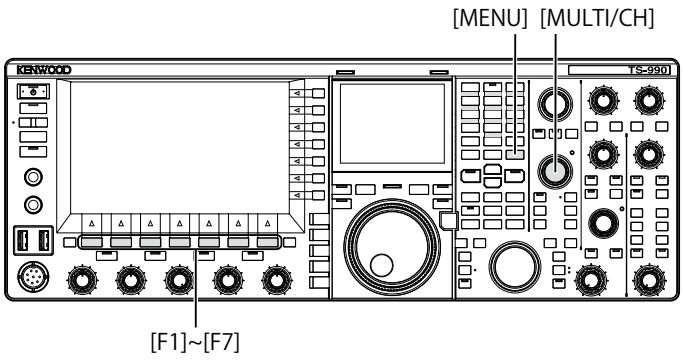
4 Press **[-]** (F4) and **[+]** (F5) to select "Off" (do not display), "Time Stamp" (display the time only), or "Time Stamp + Frequency" (display the time and frequency).
The default is "Time Stamp + Frequency".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

SELECTING THE TIMESTAMP TIME

You can select whether the time configured for the Local Clock or the Secondary Clock is applied to the time displayed for the timestamp.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 14, "Clock (RTTY/PSK Time Stamp)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) and **[+]** (F5) to select"Local Clock" (use the local clock for time stamp) or "Secondary Clock" (use the secondary clock for time stamp).
The default is "Local Clock".

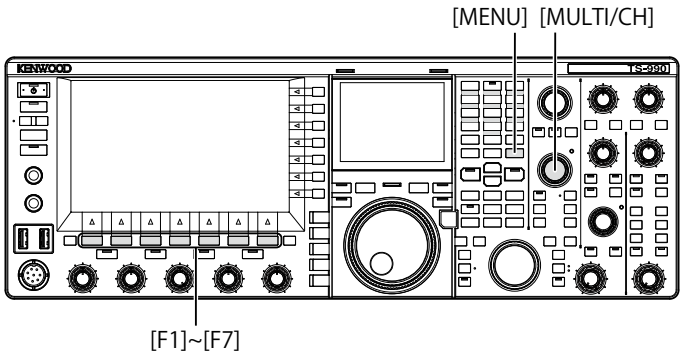
5 Press [ ] (F1).

6 Press **[MENU]** to exit.

RTTY PARAMETERS

CONFIGURING THE MARK FREQUENCY

You can configure the mark signal frequency used for communication in RTTY (FSK) mode. The tone at 1275 Hz is called low tone and the tone at 2125 Hz is called high tone. The high tone is now more often used worldwide.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 08, "FSK Tone Frequency".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



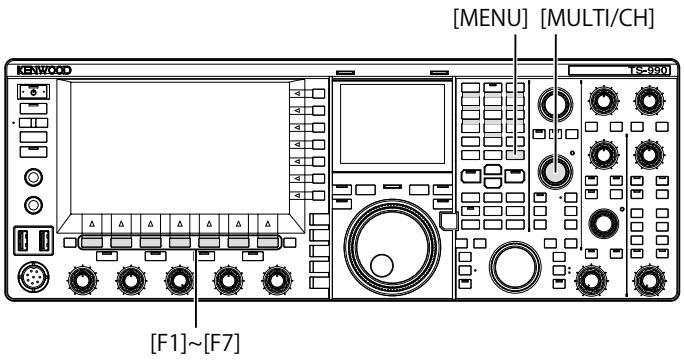
4 Press **[-]** (F4) or **[+]** (F5) to select "1275 [Hz]" or "2125 [Hz]".
The default is "2125 [Hz]".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

CONFIGURING THE RTTY SHIFT WIDTH

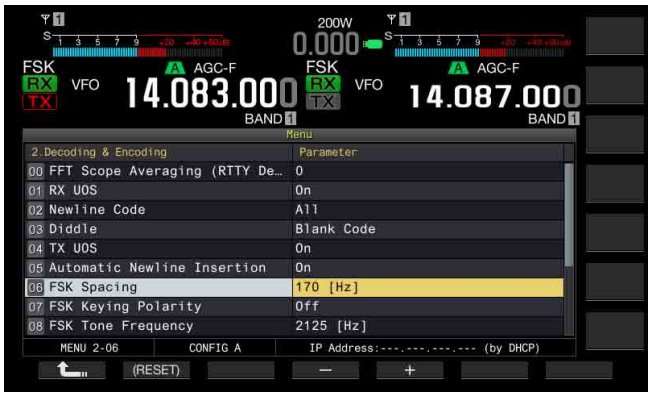
The difference in frequency between the mark signal and the space signal is called shift width. You can configure the shift width for communication in RTTY mode.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 06, "FSK Spacing".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "170 [Hz]", "200 [Hz]", "425 [Hz]", or "850 [Hz]".
The default is "170 [Hz]".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

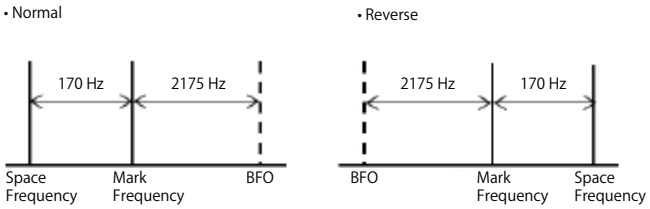
Note:

- You cannot change the RTTY shift width while the **RTTY Encode/ Decode** screen is open.
- To operate in RTTY mode using the built-in demodulator, encoder and decoder, configure “170 [Hz]” for Menu 2-06, “FSK Spacing”.

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REVERSING THE FREQUENCY IN RTTY MODE

If the receive RTTY signal is reversed (the mark and shift signal frequencies are reversed), the RTTY signal cannot be decoded properly. In that case, press and hold **[FSK/PSK/REV]** to reverse the RTTY signal so as to decode the reversed signal.



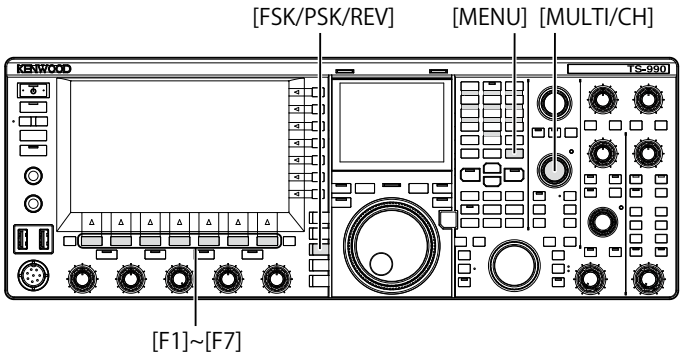
KEYING POLARITY

CONFIGURING THE POLARITY FOR ACC 2 KEYING

If you use an external device for communication in RTTY (FSK) mode, connect its keying signal into pin 2 of the **ACC 2** connector. You can configure the polarity for keying pin 2 (RTK) according to the specifications of the external device.

If you configure “Off” for Menu 2-07, “FSK Keying Polarity”, and short-circuit pin 2 (RTK) to the GND, the transceiver transmits the signal at the mark frequency configured for Menu 2-08, “FSK Tone Frequency”.

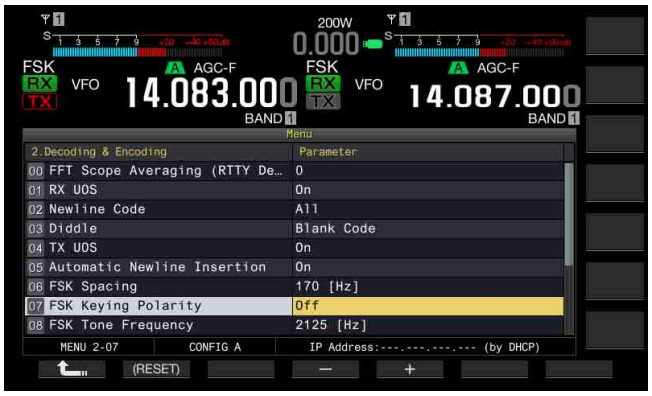
If “On” is configured for Menu 2-07, “FSK Keying Polarity”, the space signal is transmitted and the space signal is shifted from the mark frequency by the shift frequency configured in Menu 2-06 “FSK Spacing”.



1 Select Group No. 2, “Decoding & Encoding”, from the **Menu** screen.

2 Access Menu 07, “FSK Keying Polarity”.

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is “Off” (transmitting at the mark frequency by shorting pin 2 to GND). Selecting “On” allows the transceiver to transmit the space signal shifted for the mark frequency.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

USING AN EXTERNAL DEVICE FOR RTTY MODE OPERATION

You can use an external device and operate the transceiver in RTTY (FSK) mode without using the built-in demodulator, encoder or decoder built in the transceiver. Connect to the transceiver a TNC suitable for RTTY communication or a PC that allows the use of applications for RTTY communication so that you can operate the transceiver in RTTY (FSK) mode.

Refer to the following page for operation examples.

- Connection to a PC {page 1-5}
- Connection to other transceiver with TNC terminal {page 1-7}
- Connection to a TNC, MCP, etc. {page 1-8}

Note:

♦ If the shift width for RTTY mode exceeds 170 Hz, the audio peak filter for the selected band cannot be enabled

AUDIO PEAK FILTER

For operation in RTTY mode with an external device connected to the transceiver, this filter will improve the readability of the RTTY message.

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[APF]** to enable the Audio Peak Filter.
The "APF" LED lights.

Note:

- You cannot enable the Audio Peak Filter until "170 [Hz]" is configured for Menu 2-06, "FSK Spacing".
- Even if Audio Peak Filter becomes active, the Audio Peak Filter does not apply to the internal demodulator.

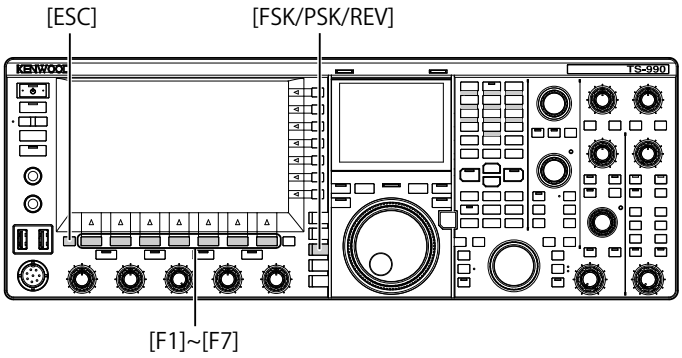
PSK OPERATION

The transceiver incorporates a demodulator, encoder and decoder for PSK31 or PSK63 operation. You can use a commercially available USB keyboard in combination with the transceiver for operation in PSK31 or PSK63 mode. You can also use a PC and software for operation with the transceiver.

PRECAUTION

- For transmission in PSK mode, adjust the drive until the ALC meter just begins to swing. If you use an external device, adjust the audio signal level of the external device so that the ALC meter just begins to swing.

OPENING THE PSK ENCODE/DECODE SCREEN



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[ESC]** to exit.



MAIN SCREEN



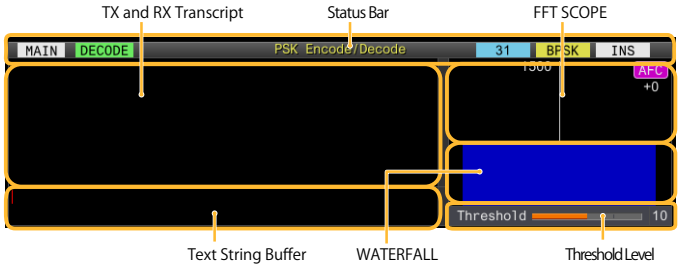
SUB-SCREEN

Note:

- Noise Reduction 1, Noise Reduction 2, Beat Cancel 1, Beat Cancel 2, Audio Peak Filter and the RX DSP equalizer do not function for PSK message decoding.

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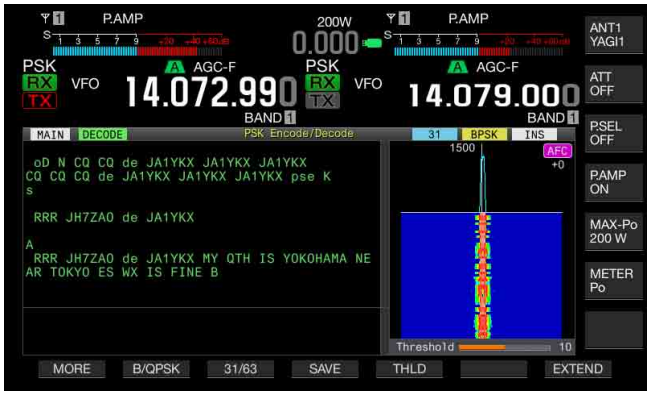
The **PSK Encode/Decode** screen has the following layout.



- Status bar: The band name and encode or decode in use appear on the left side. The status of operation appears on the right side with "31" or "63", "BPSK" or "QPSK". In addition, the status (overwriting or insertion) of the text string entry at the time when **[Insert]** of the USB keyboard is pressed appears.
- Contents of transmission or reception: The text string transmitted or received appears.
- Buffer of TX text string: The text string to be transmitted appears.
- FFT scope: The audio FFT scope is used to check the tuning state visually.
- Waterfall: The spectra transition of the receive audio signal is displayed.
- Threshold: The input level threshold of the receive signal is displayed.

You can operate the transceiver as shown below while the **PSK Encode/Decode** screen is open.

- Pressing the **[Page Up]** or **[Page Down]** key on the USB keyboard scrolls the contents of transmission and reception.
- Pressing **[EXTEND]** (F7) extends the **PSK Encode/Decode** screen vertically.



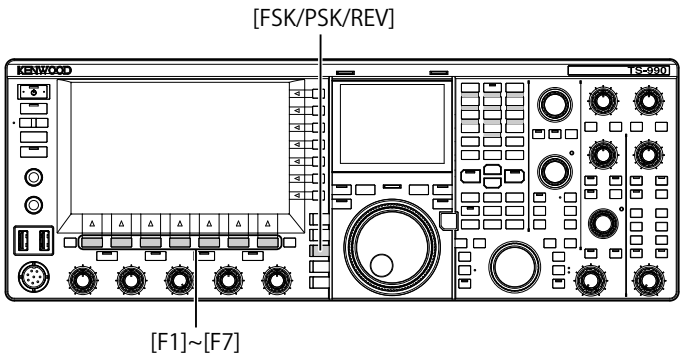
The analog meter, if displayed on the main band, changes to the digital meter.

If you press the key again, the displayed **PSK Encode/Decode** screen and the meter revert to the previous display.

- Pressing **[PAUSE]** (F3) pauses the text displayed in the **RTTY Encode/Decode** screen. Pressing the key again releases the pausing of the text.
- The text received while paused is not processed.
- Pressing and holding **[(CLEAR)]** (F4) deletes the text for transmission and reception displayed in the PSK Encode/Decode screen.
- Pressing **[MORE]** (F1) alternates the function key guide to another one.

SELECTING MAIN BAND AND SUB BAND FOR RECEPTION (PSK)

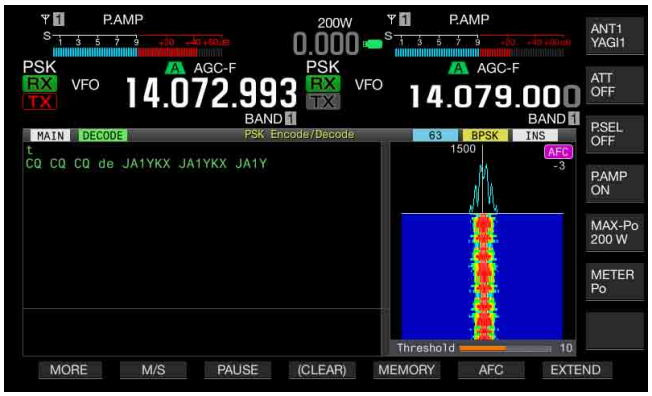
You can select decoding either on the main band or on the sub band.



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[M/S]** (F2) to select either main band or sub band.

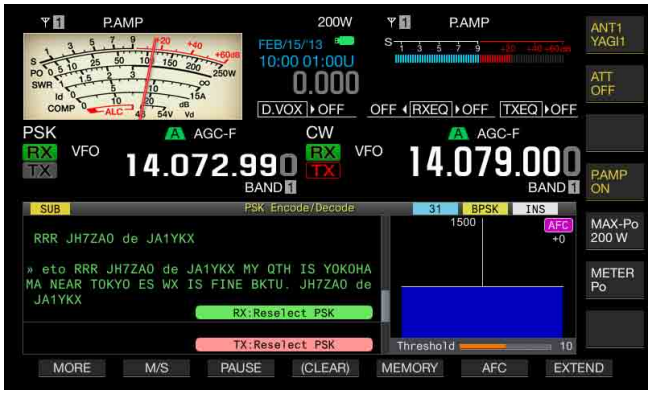


Note:

- If either of the following is the target for decoding you have selected, "RX: Reselect PSK" appears on the **PSK Encode/Decode** screen.
  If any mode other than PSK is selected.
  If the receive capability for the sub band is disabled when the sub band is selected.



- If the transceiver is in any mode other than PSK mode, "TX: Reselect PSK" appears in the **RTTY Encode/Decode** screen. Press **[FSK/PSK/REV]**.

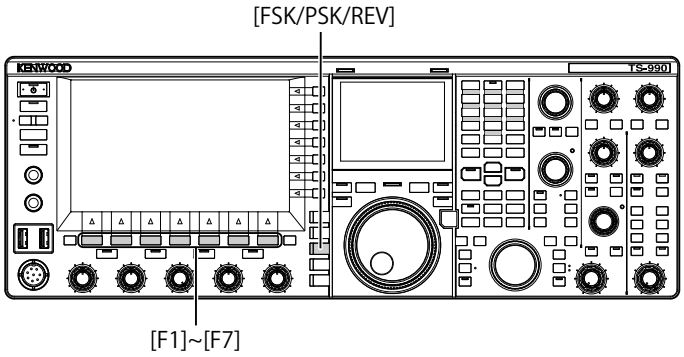


SAVING THE CONTENTS OF PSK COMMUNICATION

You can save the contents of the communication displayed in the **PSK Encode/Decode** screen in a USB flash drive.

Note:

- Refer to "USING USB FLASH DRIVE" for handling details of a USB flash drive. {page 12-1}



1. Press **[FSK/ PSK/ REV]** to enter PSK mode.
2. Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.
3. Insert a USB flash drive onto the •⟷(USB-A) connector.
   Use a USB flash drive which was formatted by the transceiver.
4. Press **[SAVE]** (F4) to store the contents of QSO.
   A message notifying you of the completion of the data saving appears.



If **[SAVE]** (F4) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

5. Press **[OK]** (F4) to end.
   Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}

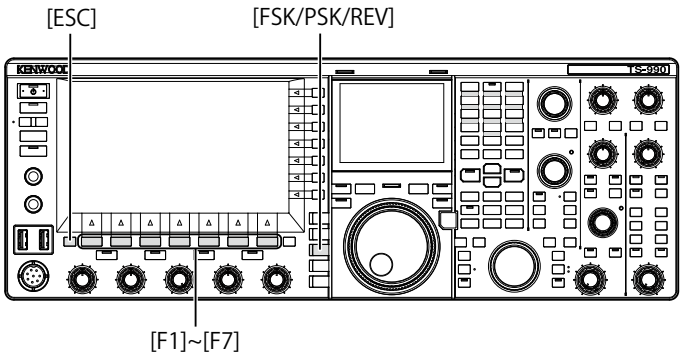
Note:

- The file name is given using the numbers and underscores representing the time and date, and the extension selected in Menu 2-12, "RTTY/PSK Log File Format", is also added. The data is displayed in the order of the year, underscore, hour, minute, and second.
  Example:
  Example: In the case of 10:20:30, February 15, 2013: 20130215_102030.txt
- The name of the storage folder is as follows:
  KENWOOD/TS-990/DECODE/PSK

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SELECTS THE FILE FORMAT AT THE TIME OF SAVING DATA

You can select whether the file is saved in the html format or text format.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 12, "RTTY/PSK Log File Format".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



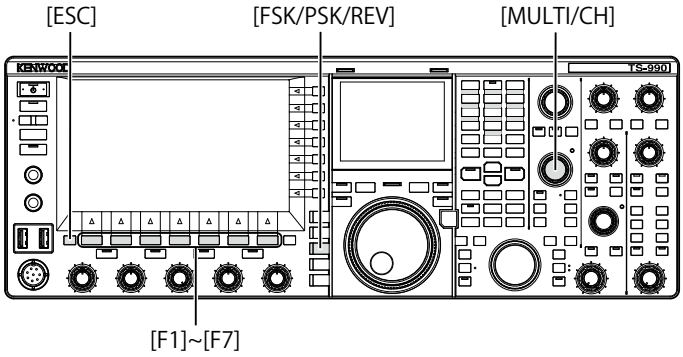
4 Press **[-]** (F4) or **[+]** (F5) to select "html" or "txt".
- The extension is either ".html" or ".txt".
- The default is "txt".

5 Press [ ] (F1).

6 Press **[ESC]** to exit.

ADJUSTING THE RTTY THRESHOLD LEVEL OF PSK DECODING

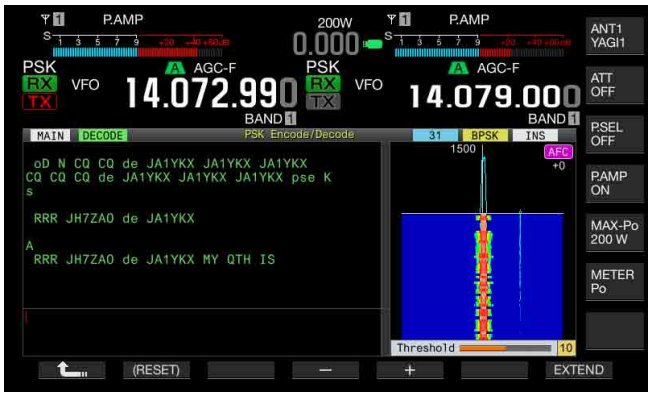
The background noise on a signal when no RTTY data is being received may be erroneously recognized as a letter, causing unnecessary text to be displayed. The threshold level should be adjusted to reduce or eliminate this symptom. If there are many erroneous detections due to noise, increase the threshold level.



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[THLD]** (F5) to allow editing of the threshold level.
- The threshold level configuration below the Waterfall display can be changed.



- If **[THLD]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to adjust the level.
Pressing and holding **[(RESET)]** (F1) resets the configured parameter to the default. The default is "10".

5 Press [ ] (F1).

6 Press **[ESC]** to exit.

DISPLAYING THE SCOPE TO CHECK PSK TUNING

FFT SCOPE

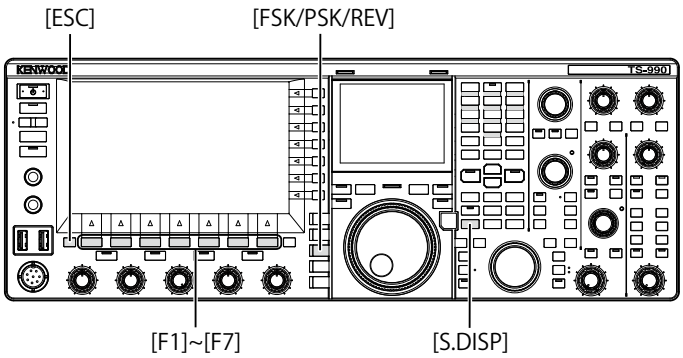
The transceiver is equipped with an audio FET scope allowing you to observe the tuned status of the transceiver in PSK (FSK) mode. The audio FET scope appears in the **PSK Encode/Decode** screen.

If there are multiple signals present in the band, you can tune the target signal to be a 1500 Hz tone.

In PSK mode, you need to make an accurate zero-in. The vector scope appears on the sub screen. By observing the FFT scope and vector scope, you can zero-in on the target signal.

AVERAGING THE WAVEFORM IN THE FFT SCOPE

The waveform to be displayed on an FFT scope can be averaged. Waveform averaging reduces the effects of random noise, allowing you to observe the target signal.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 09, "FFT Scope Averaging (PSK Decode)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select one from "0" to "9".
Increasing the parameter maximizes the noise component. The default is "0".

5 Press [ ] (F1).

6 Press **[ESC]** to exit.

WATERFALL

The **Waterfall** screen uses spectrum linking with the audio FFT scope and displays the transition of frequency components contained in the received audio signal.



VECTOR SCOPE (SUB-SCREEN)

The vector scope displays how the received PSK signal is tuned. This allows you to tune the signal from the station you are in QSO with by observing their waveform on the vector scope.

Follow the procedure below to open the vector scope.

1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[S.DISP/ SEL]** to display the vector scope.



The sub-screen cycles as follows: Vector scope -> Main band frequency and dial -> Main band frequency and sub band frequency -> Vector scope

4 Rotate the **Tuning** control to tune the signal until the traces displayed on the vector scope will be radiate in the correct directions from the center.

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Tuned Correctly (BPSK Mode)



Tuned Correctly (QPSK Mode)



BPSK and QPSK “idle” Signal



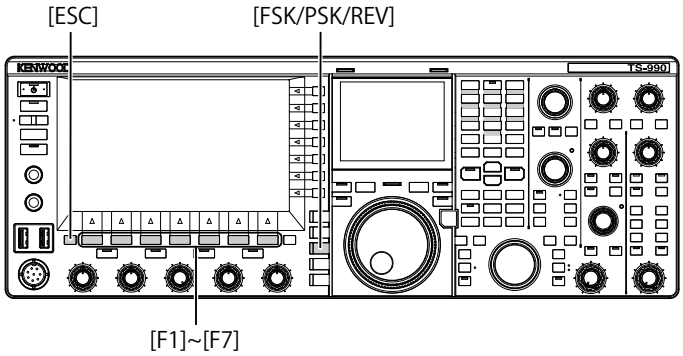
Non-modulated Carrier Signal

Note:

- If the **PSK Encode/Decode** screen is open on the main screen, the **Vector Scope** screen opens by pressing **[S.DISP/SEL]**.
- Use Fine Tuning if it is not easy to tune. {page 4-14}

AFC (AUTOMATIC FREQUENCY CONTROL)

You can use the AFC (automatic frequency control) function to tune the PSK signal you are receiving. The tuning amount can be configured in Menu 2-10, “PSK AFC Tuning Range”.



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[AFC]** (F6) to enable the AFC function.

- "AFC" appears on the upper right side of the **PSK Encode/ Decode** screen. The frequency being corrected with the automatic frequency control appears below "AFC" on the screen.



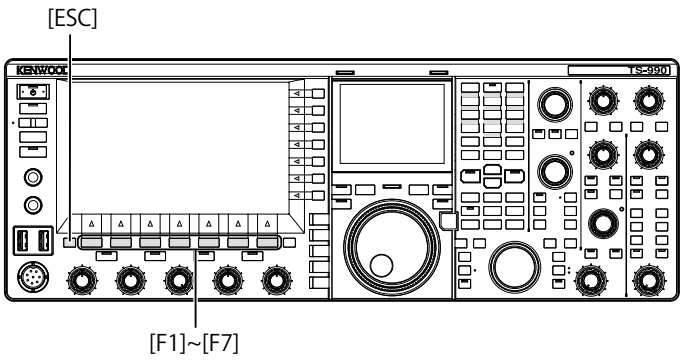
- If **[AFC]** (F6) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.
- Each time you press this key, the FET scope display cycles as follows: Blank > AFC > AFC and NET > Blank

Note:

- If you press and hold **[AFC]** (F6), the difference in frequency between the displayed frequency and the frequency of the PSK signal is added to or subtracted from the displayed frequency.
- If a PSK signal is outside the operating range of the AFC function, the AFC function does not function correctly.
- Even if the PSK signal is present in the operating range of the AFC function, the target signal, if it is weak, may not be correctly tuned.
- The AFC function can be used only with the PSK demodulator.

CONFIGURING THE AFC TUNING RANGE

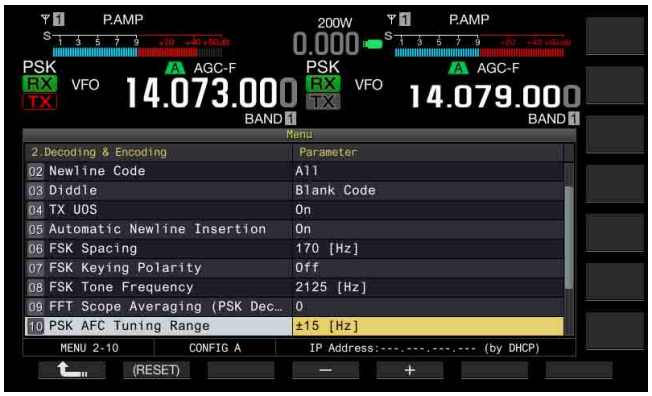
You can use the AFC (automatic frequency control) function to configure the AFC's tuning range.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 10, "PSK AFC Tuning Range".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



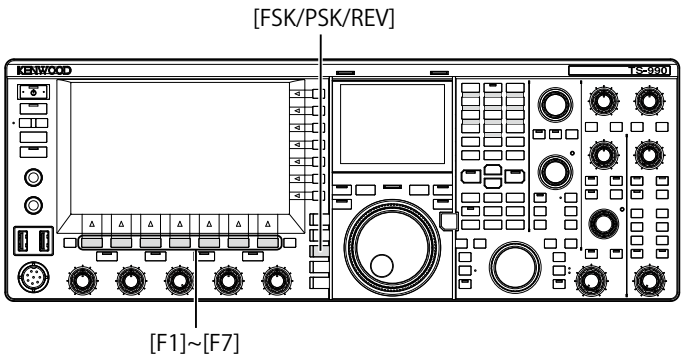
4 Press **[-]** (F4) or **[+]** (F5) to select "±8 [Hz]", or "±15 [Hz]".
The default is "±15 [Hz]".

5 Press [ ] (F1).

6 Press **[ESC]** to exit.

NET

You can transmit by applying the frequency that was automatically tuned with the AFC function while receiving.



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[AFC]** (F6) to select "AFC&NET".
- "AFC" and "NET" light in the FFT scope.

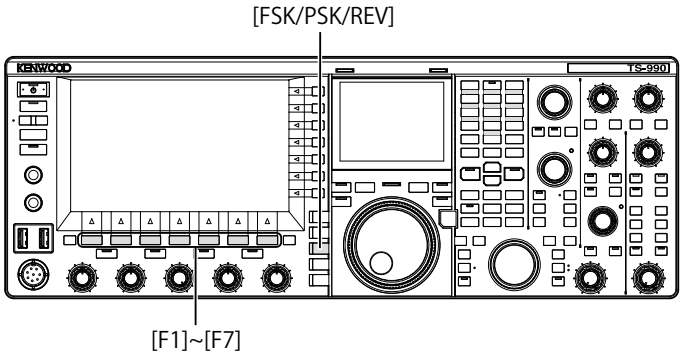


- If **[AFC]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

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SELECTING BPSK OR QPSK

PSK communication is made in either BPSK mode or QPSK mode. The BPSK mode is usually used, but the error correction capability available in QPSK mode enables a higher readability than that for BPSK.



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[B/QPSK]** (F2).

- Toggles between BPSK and QPSK. Toggles the display between "BPSK" and "QPSK" on the right of the status bar.



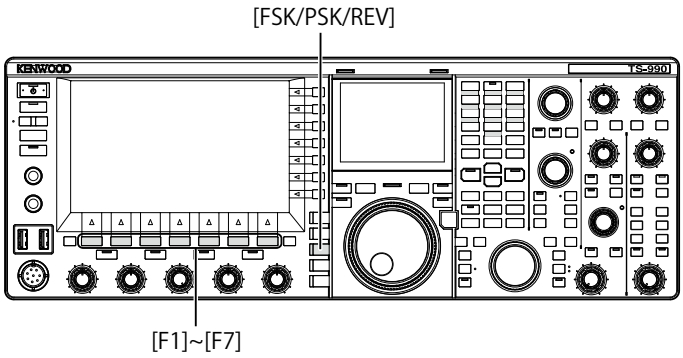
- If **[B/QPSK]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

Note:

♦ In PSK63 mode, the operation is fixed to BPSK.

SELECTING PSK31 OR PSK63

The transceiver can operate in PSK31 and BPSK modes as well as in PSK63, which offers double the transfer rate. Follow the procedure below to select one of them.



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[31/63]** (F3).

- Toggles between BPSK31 and BPSK63 or QPSK31 and BPSK63. Toggles the display between "31" and "63" on the right of the status bar.



- If **[31/63]** (F3) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

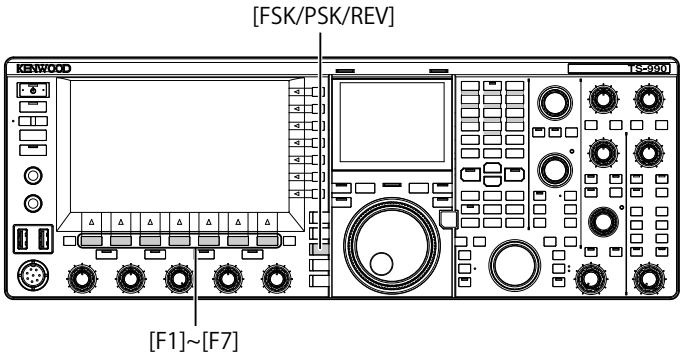
Note:

♦ PSK63 offers you the high speed transmission ratio; however, there is less tolerance of incorrect phase in the carrier wave. Hence, you need to accurately tune.

USING THE USB KEYBOARD TO TRANSMIT A TEXT STRING

You can connect a commercially available USB keyboard to the transceiver to enter and transmit a text string.

TRANSMITTING THE ENTERED TEXT STRING AS ENTERED



1 Connect a USB keyboard to the (USB-A) connector.

2 Press **[FSK/ PSK/ REV]** to enter PSK mode.

3 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

4 Press **[F12]** of a USB keyboard to transmit.
The "BUSY/TX" LED lights red and "ENCODE" appears on the status bar.

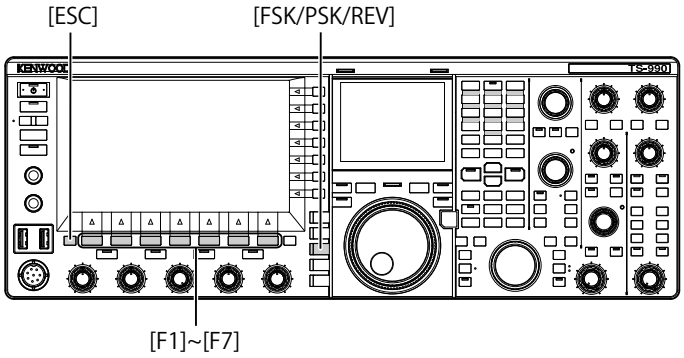
5 Enter the text strings using the USB keyboard.
- The entered text string is placed and displayed in the text string buffer and transmitted as entered.
- Each letter in the text string buffer changes its color in sequence when the letter is transmitted.
- Each letter transmitted appears sequentially in the TX and RX Transcript.

6 Press **[F12]** of a USB keyboard to receive.

Note:

♦ If letters not transmitted yet remain in the text string buffer when **[F12]** is pressed at step 6, "WAIT" appears on the status bar. When the entire text string is transmitted, the transceiver enters the receive mode and the "BUSY/TX" LED and "WAIT" are unlit.

TEMPORARILY STORING AND TRANSMITTING THE TEXT STRING IN THE BUFFER



1 Connect a USB keyboard to the (USB-A) connector.

2 Press **[FSK/ PSK/ REV]** to enter PSK mode.

3 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

4 Enter the text strings using the USB keyboard.
The entered text string is temporarily stored in the text buffer.



5 Press **[F12]** on the USB keyboard to send the text string stored in the buffer.
- The "BUSY/TX" LED lights red and "ENCODE" appears on the status bar when the transceiver is in a transmit state.
- Each letter in the text string buffer changes its color in sequence when the letter is transmitted.



6 Press **[F12]** on the USB keyboard to receive.

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Note:

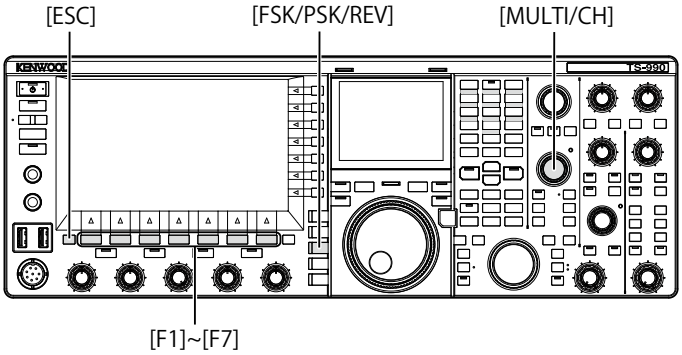
- If letters not transmitted yet remain in the text string buffer when **[F12]** is pressed at step 6, "WAIT" appears on the status bar. When the entire text string is transmitted, the transceiver enters the receive mode and the "BUSY/TX" LED and "WAIT" are unlit.
- The transceiver enters the receiving mode if the **[ESC]** on the USB keyboard is pressed while the text string is being transmitted. The transmission of the text string ends, and any text waiting for transmission in the text string buffer is deleted.
- You can add time stamp and frequency information to the transmit and receive data displayed in the contents of transmission and reception.
- Transmitting the text string using the USB keyboard while the display of transmission and reception can be paused by a press of **[PAUSE]** (F3), another press of **[PAUSE]**(F3) will release it.
- The text string temporarily stored in the text string buffer can contain a maximum of 4,300 characters.
- Following are the available characters and symbols with “English” selected in Menu 9-01. If you wish to enter the Japanese characters, download the Japanese instruction manual to refer to the available characters and symbols for the Japanese characters.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	E	X	Y	Z			
0	1	2	3	4	5	6	7	8	9					
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z				
À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î
Ï	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	Ø	Ù	Ú	Û	Ü	Ý	Þ
à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î
ï	ð	ñ	ò	ó	ô	õ	ö	ø	ù	ú	û	ü	ý	þ
ÿ	ß													
!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
:	;	<	=	>	?	@	[	\	]	^	_	`	{	|
}	~	¡	¢	£	¤	¥	¦	§	¨	©	ª	«	¬	®
¯	°	±	²	³	´	µ	¶	•	¸	¹	º	»	¼	½
¾	¿	No	÷							Space		Line Break		

UTILIZING AN PSK MESSAGE MEMORY

You can save frequently used fixed phases as PSK messages in the memory. If you employ the automatic transmit and receive functions in the message, it can be sent very easily. You can store up to eight messages.

STORING MESSAGES



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **PSK Message** screen.



If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F2). An alternate key guide will appear.

4 Press **[▲]** (F3) or **[▼]** (F4), or rotate the **MULTI/CH** control to select a channel to which a CW message will be stored.
If **[▲]** (F3) and **[▼]** (F4) are unavailable in the key guide, press **[MORE]** (F2).

5 Press **[MSG]** (F5) to allow editing of the message for the selected channel.

6 Use functions keys, the **MULTI/CH** control, or a USB keyboard to enter a text string.

[SPACE] (F1): Press to enter one space.

[-] (F3) or **[+]** (F2): Press to scroll through available letters.

[◀|] (F4) and [|▶] (F5): Press to move the cursor to the left and right.

[SAVE] (F6): Press to store the selected characters.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Changes the character type.

Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

■ Available alphanumeric characters and symbols (a maximum of 70 characters)

Following are the available characters and symbols with "English" selected in Menu 9-01. If you wish to enter the Japanese characters, download the Japanese instruction manual to refer to the available characters and symbols for the Japanese characters.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	E	X	Y	Z			
0	1	2	3	4	5	6	7	8	9					
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z				
À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î
Ï	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	Ø	Ù	Ú	Û	Ü	Ý	Þ
à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î
ï	ð	ñ	ò	ó	ô	õ	ö	ø	ù	ú	û	ü	ý	þ
ÿ	ß													
!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
:	;	<	=	>	?	@	[	\	]	^	_	`	{	|
}	~	¡	¢	£	¤	¥	¦	§	¨	©	ª	«	¬	®
¯	°	±	²	³	´	µ	¶	•	¸	¹	º	»	¼	½
¾	¿	No	÷							Space		Line Break		

- Pressing **[CANCEL]** (F7) deletes the contents being edited and ends the character entry.

7 Press **[SAVE]** (F6) to store the edited message.

8 Press [⮌] (F1).

9 Press **[ESC]** to exit.

CONFIGURING AUTOMATIC TRANSMISSION AND RECEPTION FOR THE PSK MESSAGE MEMORY

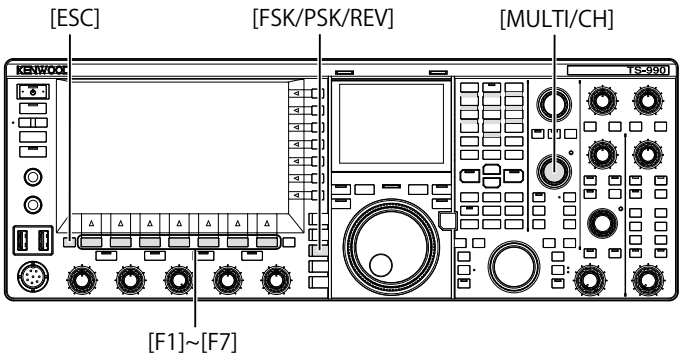
If you select an PSK message memory channel, you can configure independently for each message memory channel whether or not the PSK message is transmitted automatically and whether or not the transceiver enters receive after it's been sent.

Automatic Transmit sends the PSK message as soon as the channel where a PSK message is stored is selected. The transmit state is maintained even after the entire message is transmitted. Therefore, this function is convenient if you wish to transmit your own text string using a USB keyboard after a PSK message is transmitted using the message memory.

Automatic Receive is a function to revert to the receive mode after an PSKY message has been sent.

Selecting the channel number, that contains a PSK message to be sent, automatically starts transmitting the message, or the message temporarily stored in the buffer for the text string can be sent with a press of [F12] of a USB keyboard. The transceiver can automatically enter the receive mode after the PSK message is transmitted.

A combination of automatic transmission and automatic reception makes it possible to transmit and receive messages automatically.



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **PSK Message** screen.

If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press [▲] (F3) or [▼] (F4), or rotate the **MULTI/CH** control to select a channel where a CW message to be sent automatically is stored.

5 Press **[AUTO.TX]** (F6) to enable automatic transmission.



The transceiver can be configured to allow an RTTY message to be transmitted automatically from the corresponding channel when "AUTO TX" appears on the right side of the RTTY message. Even if the "AUTO TX" disappears, the PSK message for that channel is temporarily stored in the buffer for a text string and will not automatically be sent.

6 Press **[AUTO.RX]** (F7) to enable automatic transmission.



You can configure the transceiver so that the transceiver will revert to a receive state after an PSK message is transmitted from the corresponding channel when "AUTO RX" appears on the right side of the PSK message. Even if "AUTO RX"

▶ Index ▶ Contents

disappears, the transceiver does not revert to the receive mode after the PSK message for that channel is sent.

7 Press [ ] (F1).

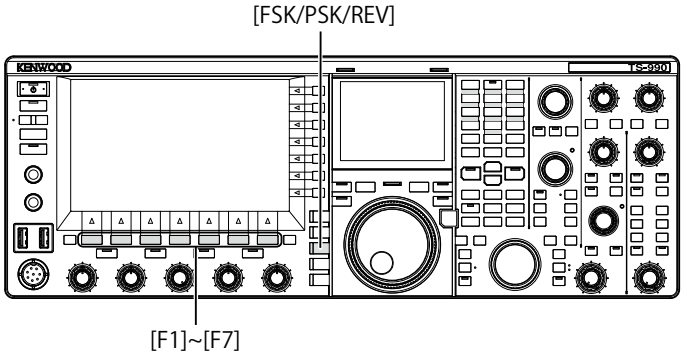
8 Press **[ESC]** to exit.

Note:

- select the channel where the PSK message is stored. After you confirm that a text string (PSK message) has been transferred to the buffer of a text string, press **[F12]** of the USB keyboard.
- To place the transceiver in the receive mode after the PSK message for which automatic reception is disabled, press **[F12]** of the USB keyboard.

SENDING A TEXT STRING STORED IN PSK MESSAGE MEMORY

You can transmit messages entered in the PSK message memory.



1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODER]** (F3) to open the **PSK Encode/ Decode** screen.

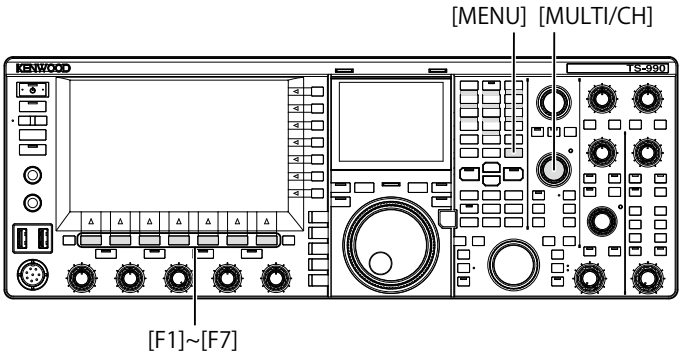
3 Press **[MEMORY]** (F5) to open the **PSK Message** screen.
If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[CH1]** (F3), **[CH2]** (F4), **[CH3]** (F5), **[CH4]** (F6), **[CH5]** (F3), **[CH6]** (F4), **[CH7]** (F5), or **[CH8]** (F6) to select the channel for which the message to be sent has been stored.
- The PSK message will not automatically be transmitted from the channel for which automatic transmission of the PSK message is disabled
- The key guide for **[F1]** through **[F7]** are the key guide for configuration, including [ ] (F1), **[MORE]** (F2), [ ] (F3), [ ] (F4), **[MSG]** (F5), **[AUTO.TX]** (F6), and **[AUTO.RX]** (F7). In this case, press **[MORE]** (F2) so that the key guide will alternate between the key guide for [ ] (F1), **[MORE]** (F2), **[CH1]** (F3), **[CH2]** (F4), **[CH3]** (F5), **[CH4]** (F6), and key guide for **[NEXT]** (F7) and the key guide for [ ] (F1), **[MORE]** (F2), **[CH5]** (F3), **[CH6]** (F4), **[CH7]** (F5), **[CH8]** (F6), and **[NEXT]** (F7).
- The transceiver enters the receive mode after the PSK message displayed along with "AUTO RX" on the right side is sent.

CONFIGURATION FOR PSK ENCODING AND DECODING

DISPLAYING THE TIME STAMP

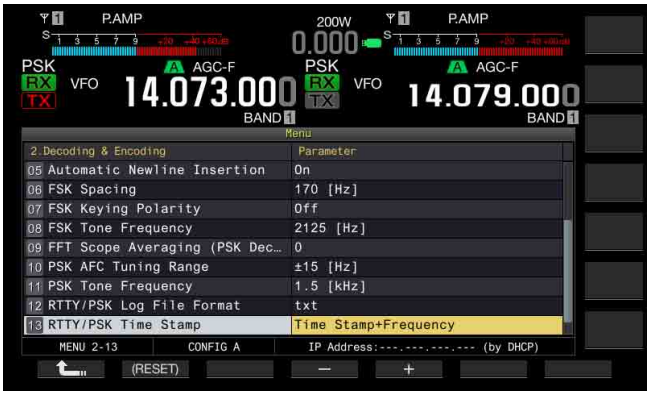
You can display the timestamp whenever transmission and reception alternate. You can display frequency information as well as the timestamp.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 13, "RTTY/PSK Time Stamp".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[–]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select either "Off", "Time Stamp", or "Time Stamp + Frequency".
The default is "Time Stamp + Frequency".

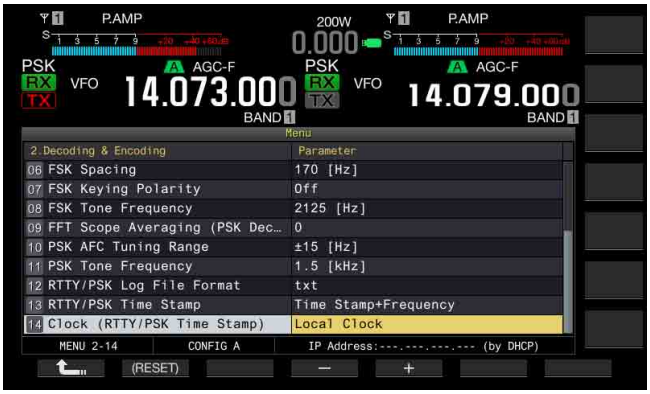
5 Press [ ] (F1).

6 Press **[MENU]** to exit.

SELECTING THE TIMESTAMP TIME

You can select whether the time configured for the Local Clock or the Secondary Clock is applied to the time displayed for the timestamp. Refer to "CLOCK DISPLAY AND TIMER". {page 15-1}

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.
2 Access Menu 14, "Clock (RTTY/PSK Time Stamp)".
3 Press **[SELECT]** (F4) to allow editing of the parameter box.

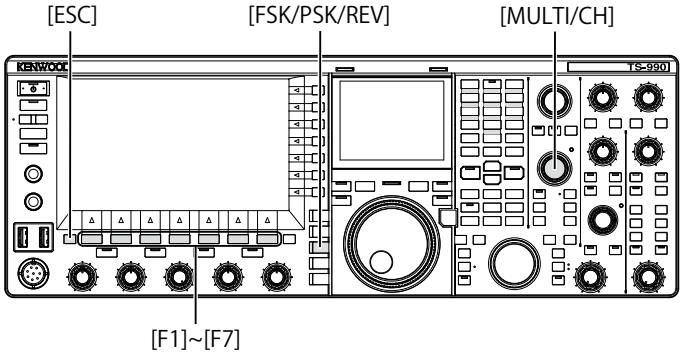


4 Press **[–]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "Local Clock" or "Secondary Clock".
The default is "Lock Clock".
5 Press **[ ]** (F1).
6 Press **[MENU]** to exit.

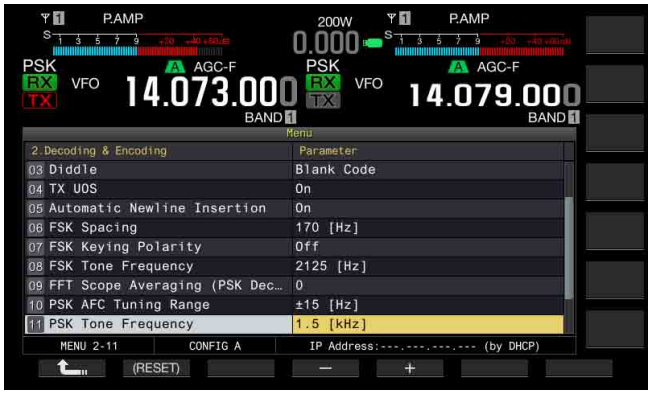
PSK-RELATED CONFIGURATION

CONFIGURING THE PSK TONE FREQUENCY

You can configure the tone frequency for reception in PSK mode.



1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.
2 Access Menu 11, "PSK Tone Frequency".
3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "1.0 [kHz]", "1.5 [kHz]", or "2.0 [kHz]".
The default is "1.5 [kHz]"
5 Press **[ ]** (F1).
6 Press **[ESC]** to exit.

REVERSEING THE PHASE CHANGE DIRECTION IN QPSK

If the received PSK signal is not decoded properly, switch the BFO frequency on the LSB side to that on the USB side and try decoding the signal.

If the BFO frequency for the received PSK signal is Reverseed (the lower sideband and upper sideband frequencies are Reverseed), the PSK signal cannot be decoded properly.

Pressing and holding **[FSK/PSK/REV]** allows the decoding of the Reverse signal.

USING A PC TO COMMUNICATE IN PSK MODE

This is the method of operation in PSK mode using a PC, instead of using the demodulator, encoder, and decoder built in to the transceiver. Connect the transceiver and a PC running applications supporting PSK communication so that you can operate the transceiver in SSB or SSB-DATA mode.

Refer to the following page for operation examples.

- CONNECTION TO A PC {page 1-5}

Note:

♦ In the case of operation in the digital mode such as PSK31 using a PC, you must adjust the audio output level from PC until the ALC meter of the transceiver begins to swing.
Also, you must disable the speech processor. {page 9-6}

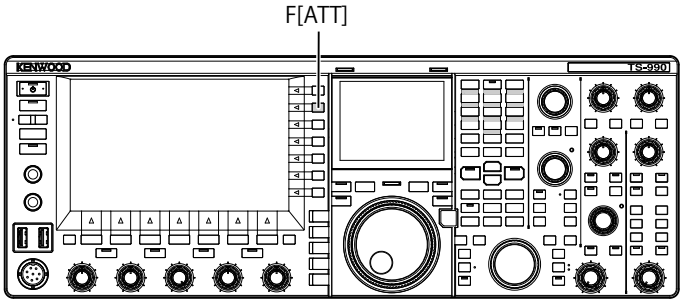
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ATTENUATOR (ATT)

An attenuator is a function that attenuates or reduces the received signal level. When there is a strong signal present near the target signal, attenuating the adjacent signals can reduce or eliminate the interference.

The target signal will also be attenuated; however, this will facilitate you distinguishing the weak signal.

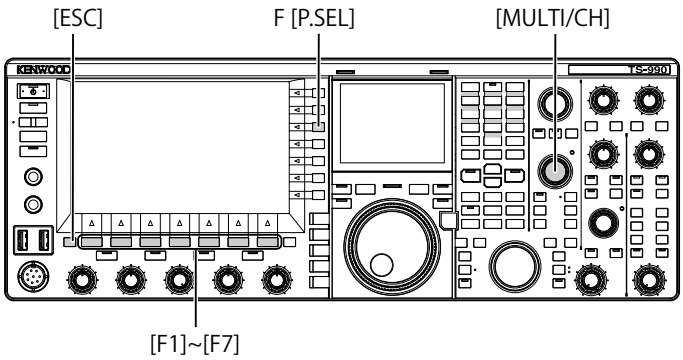
This will help a very strong signal from being distorted. The transceiver is equipped with three levels of attenuation, -6 dB, -12 dB, and -18 dB.



1 **[ATT]** (F) to select the attenuation level of the received signal.
- The attenuation level appears on the key guide displayed on the right side of the main screen.
- Each time you press **[ATT]** (F), the level cycles as follows: OFF > -6 dB > -12 dB > -18 dB > +10 dB > OFF. Each time you press and hold **[ATT]** (F), the attenuation level cycles in the reversed sequence.

PRESELECTOR

Selecting the narrow bandwidth tunable filter attenuates the interfering signal which has 2 to 3 MHz separation from the target frequency, instead of the strong interfering signal in the adjacent frequencies.



1 Select the main band.

2 Press **[P.SEL]** (F) to enable or disable the Preselector. The default is "OFF".



In the key guide **[P.SEL]** (F), the status of attenuator is indicated on the lower line.

While the Preselector is active, the status indicators below show how the operating band is shifted from the center frequency.

◄ON:
The filter bandwidth has been shifted to below the center frequency.

On
The filter bandwidth has been positioned at the center frequency.

ON►:
The filter bandwidth has been shifted to above the center frequency.

Note:
- The Preselector can only be used for the main band.
- Preselector can be used in the 1.8 MHz band, 3.5 MHz band, 7 MHz band, 10 MHz band, 14 MHz band, 18 MHz band, 24 MHz band, and 28 MHz band.
- Preamplifier and Preselector cannot be enabled at the same time. Enabling the Preselector while the Preamplifier is active temporarily disables the Preamplifier. The Preamplifier will be enabled again when the Preselector is disabled.

The center frequency of the narrow bandwidth tunable filter can be selected by moving the Preselector bandwidth.

1 Select the main band.

2 Press and hold **[P.SEL]** (F) while Preselector is enabled to open the **Preselector** screen.



3 Press [◀||] (F4) or [||▶] (F5), or rotate the **MULTI/CH** control to shift the center frequency.

- You can shift and determine the filter position. Pressing **[CENTER]** (F1) places the filter center at the center frequency.
- The default is at the center position.

4 Press **[ESC]** to exit.

Note:

- Pressing **[P.SEL]** (F), when the frequency shifted outside the amateur band while operating in the main band, cannot enable the Preselector.
- "Outside of the Band" appears when the frequency is changed while the Preselector screen is open and when that frequency would shift outside the amateur band. The key guide display will be changed to **[P.SEL OFF]** (F) in place of **[P.SEL]** (F). Pressing **[P.SEL OFF]** (F) disables the Preselector, and the Preselector screen closes.

DSP FILTER

The transceiver was designed with integral digital signal processing (DSP) technologies. Changing the filter bandwidth using the DSP function can help suppress the interference, and reduce the noise level.

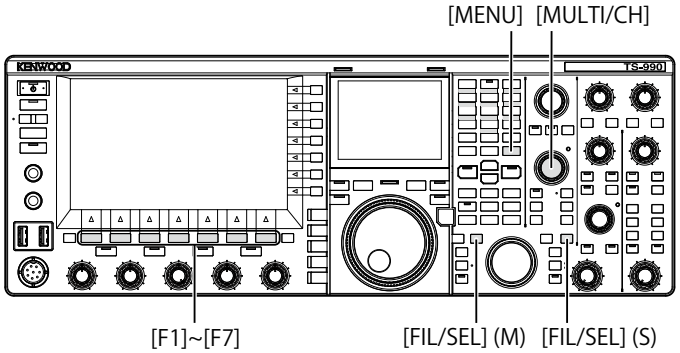
CHANGING THE IF FILTER BANDWIDTH CHARACTERISTICS

SWITCHING THE RX FITER CONFIGURATIONS

The configurations (Types A, B and C) for the IF filters can instantly be switched according to your operating needs.

For example, wide bandwidth characteristics can be configured for A, standard bandwidth characteristics is configured for B, and narrow bandwidth characteristics for use during the contest or with the DX station can be configured for C in advance. To search for a station you wish to communicate, you may select the filter type A with the wide bandwidth configured, and for use during the contest or with the DX station, you may select the filter type C with the narrow bandwidth configured to increasing the readability.

The bandwidth characteristics can be configured by combining the roofing filter, the IF filter and the AF filter, the high frequency cutoff filter and the low frequency cutoff filter, and WIDTH and SHIFT. Also, the RX filter type (Type A, B, or C) can be configured for use in SSB, CW, FSK, PSK, FM, and AM modes respectively.



1 Press **[FIL/SEL]** (M) or **[FIL/SEL]** (S) to switch the receive filter.
Each key press cycles the RX filter type as follows: A > B > C > A.



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Note:

- RX filter type C cannot be selected if "2" is configured for Menu 6-06, "RX Filter Numbers".

CONFIGURING THE NUMBER OF RX FILTERS SELECTABLE

You can configure 3 (for A, B, and C) or 2 (for A and B) for the number of RX filters.

1. Select Group No. 6, "TX/RX Filters & Misc", from the **Menu** screen.
2. Access Menu 06, "RX Filter Numbers".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.

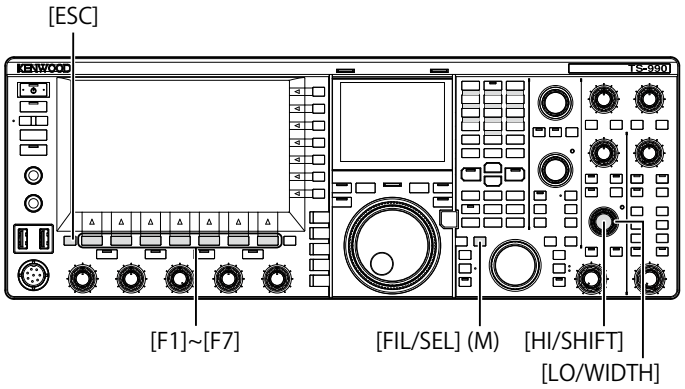


4. Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the filter.
   You can select either "2" or "3". The default is "3".
5. Press **[ ]** (F1).
6. Press **[MENU]** to exit.

SELECTING THE ROOFING FILTER

The roofing filter suppresses strong radio interference signals adjacent to the target signal. The filter selections for the main band are Auto, 270 Hz, 500 Hz, 2.7 kHz, 6 kHz, 15 kHz, and Add (an additional roofing filter).

The sub band is locked to Auto.



1. Select the main band.
2. Press and hold **[FIL/SEL]** (M) to open the **RX Filter** screen.



3. Press **[FILTER]** (F2) or **[FIL/SEL]** (M) to select the receive filter.
   You can select the desired RX filter (A, B, or C).
4. Press **[ROOF]** (F3) to enable to edit the Roof Filter.
5. Subsequently, press **[ROOF]** (F3) to select the pass band width.
   - Each time you press **[ROOF]** (F3), the selection cycles as follows: Auto > 270 > 500 > 2.7 k > 6 k > 15 k > Add > Auto.
   - Each long press of **[ROOF]** (F3) cycles the selection in the reversed sequence. Rotating the **MULTI/CH** control can also change the pass band width.
   - The default is "Auto" for RX filters A, B, and C.
6. Press **[ESC]** to exit.

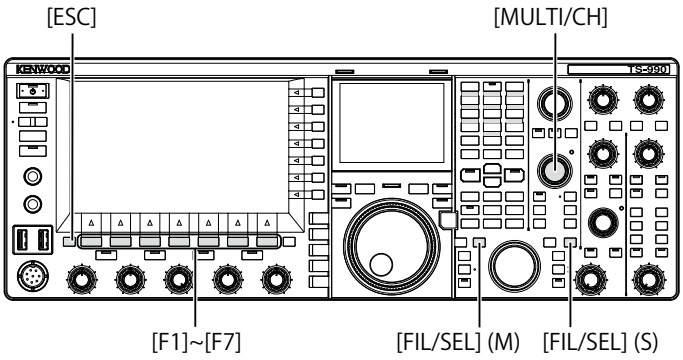
Note:

- The roofing filter, the bandwidth of which is wider than the pass bandwidth of the DSP filter, will be selected if there are any changes in the cutoff frequencies (low and high frequencies), and pass bandwidth and its shift from the center frequency while Auto is selected for the current filter.
- "Add." in the pass bandwidth appears if the additional roofing filter is installed in the transceiver and anything other than "Off" is configured for Advanced Menu 6. {page 16-22}
- While the **RX Filter** screen is open, rotating the **HI/SHIFT** or **LO/WIDTH** control will change the activated cutoff frequencies (low and high frequencies). The cutoff frequencies (low and high frequencies) appear on the **RX Filter** screen.
- In FM mode, 15 kHz will be configured and cannot be changed.

♦ If "Off" is configured for Advanced Menu 06, "Bandwidth (Additional Roofing Filter)", "Add." does not appear as the parameter for pass band width.

SWITCHING THE IF FILTER TYPE

You can select from one of three types of IF filters (Sharp, Medium, and Soft) following the type of interference and the operating environment.



1 Press and hold **[FIL/SEL]** (M) or **[FIL/SEL]** (S) to open the **RX Filter** screen.
The selected band and the mode name while receiving appear, and the selected RX filter (A, B, or C) can be edited.



2 Press **[FILTER]** (F2) or **[FIL/SEL]** (M) or **[FIL/SEL]** (S) to select the receive filter.
- Each press cycles the type of the RX filter through A > B > C). In the main screen, the letter "A", "B", or "C" appears above the frequency display of the selected band.
- The filter type, if appears in the sub-screen, changes according to the RX filter type selected.

3 Press **[IF]** (F4) to enable to edit the IF Filter.

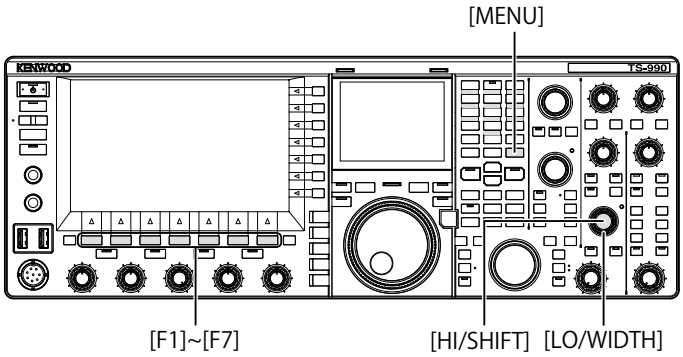


4 Subsequently, press **[IF]** (F4) to select the filter shape.
Each time you press **[IF]** (F4), the selection cycles as follows: Medium > Sharp > Soft > Medium. The default is "Medium".

5 Press **[ESC]** to exit.

CONFIGURING THE BEHAVIOR OF HI/SHIFT AND LO/WIDTH (SSB AND SSB-DATA ONLY)

For use in SSB or SSB-DATA mode, you can configure the cutoff frequencies (low and high frequencies) or passband width and its amount of shift from the center frequency using the **HI/SHIFT** control and **LO/WIDTH** control.



■ Behavior of the HI/SHIFT and LO/WIDTH controls in SSB mode

1 Select Group No. 6, "TX/RX Filters & Misc", from the **Menu** screen.

2 Access Menu 07, "Filter Control in SSB Mode (High/Low and Shift/Width)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select either "High & Low Cut" or "Shift & Width" for the behavior of the control.
The changes of the shift and filter type appear on the **RX Filter** screen. The default is "High & Low Cut".

If "High & Low Cut" is selected:
A value for cutoff frequency (either low or high) will vary.

If "Shift & Width" is selected:
Values for the pass band width and the amount of the shift will vary.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

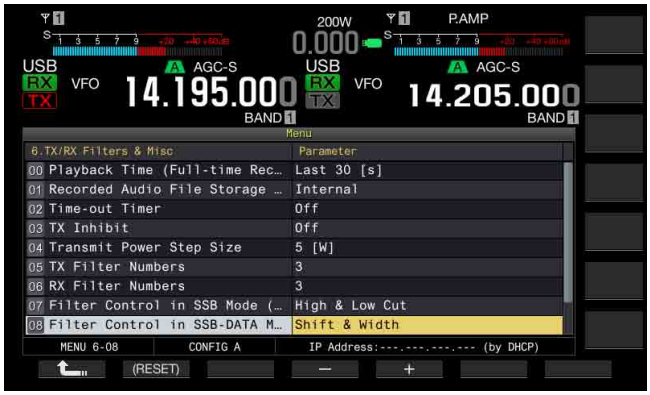
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■ Behavior of the HI/SHIFT and LO/WIDTH controls in SSB-DATA mode

1 Select Group No. 6, "TX/RX Filters & Misc", from the **Menu** screen.

2 Access Menu 08, "Filter Control in SSB-DATA Mode (High/Shift and Low/Width)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select either "High & Low Cut" or "Shift & Width" for the behavior of the control.
The changes of the shift and filter type appear on the **RX Filter** screen. The default is "Shift & Width".

If "High & Low Cut" is selected:
The value of the cutoff frequency (either low or high) will vary.

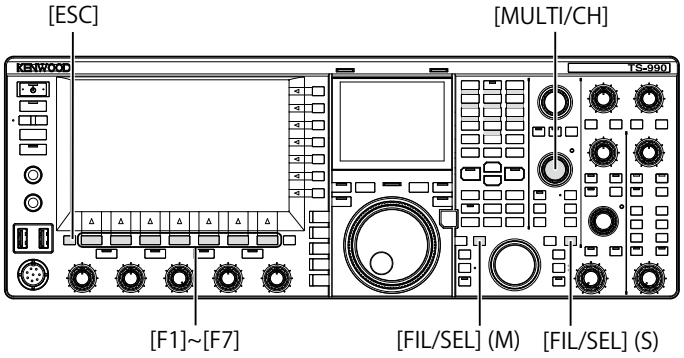
If "Shift & Width" is selected:
Values for the pass band width and the amount of the shift will vary.

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

CHANGING THE AF FILTER TYPE

Like the IF filters, the passband width of audio frequencies can be selected from three types (Narrow, Medium, and Wide).



1 Press and hold **[FIL/SEL]** (M) or **[FIL/SEL]** (S) to open the **RX Filter** screen.
The selected band and the mode name while receiving appear, and the selected RX filter (A, B, or C) will be enabled.



2 Press **[FILTER]** (F2) or **[FIL/SEL]** (M) or **[FIL/SEL]** (S) to select the receive filter.
Each press cycles the RX filter through A > B > C).

3 Press **[AF]** (F5) to enable to edit the AF Filter.

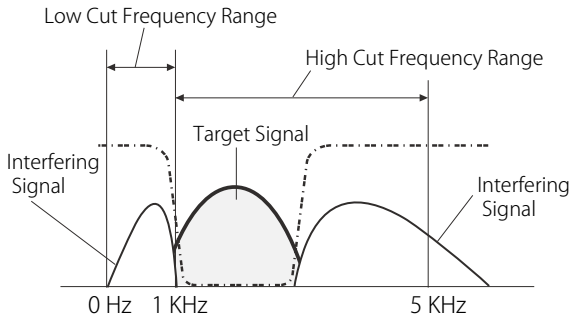
4 Subsequently, press **[AF]** (F5) to select the filter shape.
- Each time you press **[AF]** (F5), the selection cycles as follows: Medium > Wide > Narrow >Medium Rotating the **MULTI/CH** control can also change the filter shape.
- The default is "Medium".

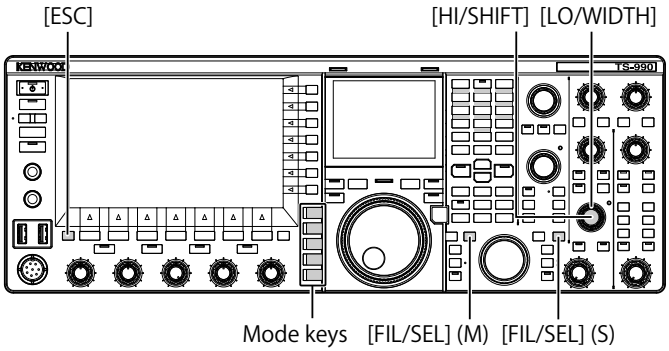
5 Press **[ESC]** to exit.
Pressing **[FIL/SEL]** (M) or **[FIL/SEL]** (S) closes the **RX Filter** screen as well.

CHANGING THE CUTOFF FREQUENCIES (LOW AND HIGH FREQUENCY) TO ADJUST THE PASSBAND WIDTH CHARACTERISTICS

In the SSB, AM, or FM mode, you can modify the passband width of the filter by changing the cutoff frequencies (low and high frequency).

You can change the pass bandwidth so that interference will be outside the bandwidth of the filter.





1 Press one of mode keys to select LSB, USB, FM, or AM mode.

2 Press and hold **[FIL/SEL]** (M) or **[FIL/SEL]** (S) to open the **RX Filter** screen.
The selected band and the mode name while receiving appear, and the selected RX filter (A, B, or C) is activated.

3 Rotate either **HI/SHIFT** or **LO/WIDTH** control.
- Rotating the **HI/SHIFT** control clockwise increases the high cutoff frequency and rotating it counterclockwise decreases the high cutoff frequency.
- Rotating the **LO/WIDTH** control clockwise increases the low cutoff frequency and rotating it counterclockwise decreases the high cutoff frequency.
- The changes of the shift and filter type appear on the **RX Filter** screen.



4 Press **[ESC]** to exit.
Pressing **[FIL/SEL]** (M) or **[FIL/SEL]** (S) closes the **RX Filter** screen.

Note:

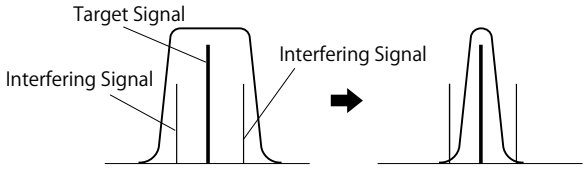
♦ You can view the progress of adjustments while the sub-scope appears on the sub-screen.

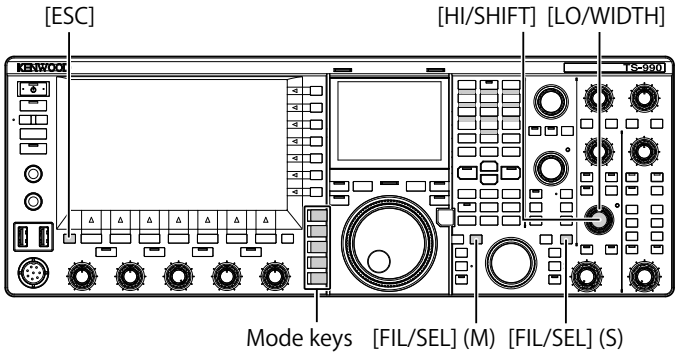
Mode	Cutoff frequency (low) (Hz)		Cutoff frequency (high) (Hz)	
	Range	Default	Range	Default
LSB/USB/FM	0, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000	200	1000, 1200, 1400, 1600, 1800, 2000, 2200, 2400, 2600, 2800, 3000, 3400, 4000, 5000	2800
AM	0, 100, 200, 300	100	2500, 3000, 4000, 5000	5000

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CHANGING THE PASSBAND WIDTH AND SHIFT TO ADJUST PASSBAND CHARACTERISTICS

For use in CW or SSB-DATA mode, you can change the passband width of the DSP filter and its amount of shift from the center frequency. For use in RTTY (FSK) or PSK mode, you can change the passband width. You can change the pass bandwidth so that interference will be outside the bandwidth of the filter.





1 Press a mode key to select CW, LSB-DATA, USB-DATA, FSK, or PSK mode.

2 Press and hold **[FIL/SEL]** (M) or **[FIL/SEL]** (S) to open the **RX Filter** screen.
The selected band and the mode name while receiving appear, and the selected RX filter (A, B, or C) can be edited.



3 Rotate the **LO/WIDTH** control to change the pass band width.
Rotating the control clockwise increases the passband width and counterclockwise decreases the passband width.

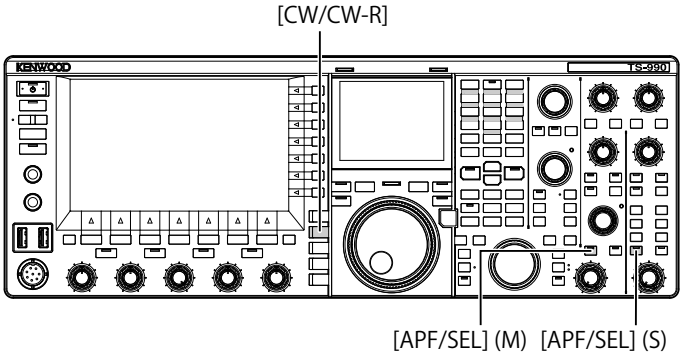
4 Rotate the **HI/SHIFT** control.
Rotating the control clockwise shifts the frequency pass bandwidth higher and counterclockwise shifts the frequency pass bandwidth lower. The frequency range for use in FSK and PSK mode cannot be adjusted.

5 Press **[ESC]** to exit.
Pressing **[FIL/SEL]** (M) or **[FIL/SEL]** (S) closes the **RX Filter** screen.

Mode	Pass Bandwidth (Hz)		Shift Frequency (Hz)	
	Range	Default	Range	Default
CW	50, 80, 100, 150, 200, 250, 300, 400, 500, 600, 1000, 1500, 2000, 2500	500	-800, -750, -700, -650, -600, -550, -500, -450, -400, -350, -300, -250, -200,-150,-100, -50, 0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800	800
DATA	50, 80, 100, 150, 200, 250, 300, 400, 500, 600, 1000, 1500, 2000, 2200, 2400, 2600, 2800, 13000	2600	1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2210	1500
FSK	250, 300, 400, 500, 1000, 1500	500	2210 only	
PSK	50, 80, 100, 150, 200, 250, 300, 400, 500, 600, 1000, 1500	1500	1500 only	

ACTIVATING AUDIO PEAK FILTER FOR USE IN CW MODE

If the readability of a signal is affected by noise or any other interference while receiving in CW mode, passing the receive signal through a bandwidth centered on the CW pitch frequency improves its readability.

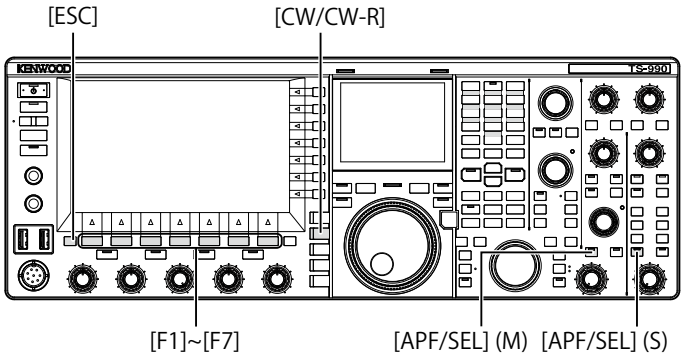


1 Press **[CW/CW-R]** to select CW mode.

2 Press **[APF/SEL]** (M) or **[APF/SEL]** (S).
- Each time you press either one of the keys, the audio peak filter for the selected band toggles between active and inactive. While the audio peak filter is active, the "APF/SEL" (M) or "APF/SEL" (S) LED lights green.
- The audio peak filter for the selected band is disabled by a press of the same key.

CHANGING THE PASSBAND CHARACTERISTICS OF THE AUDIO PEAK FILTER (APF)

You can select the passband width of the audio peak filter from three types, Narrow (80 Hz), Middle (160 Hz), and Wide (320 Hz).



1 Press **[CW/CW-R]** to select CW mode.

2 Press and hold **[APF/SEL]** (M) or **[APF/SEL]** (S) to open the **APF** screen for the selected band.



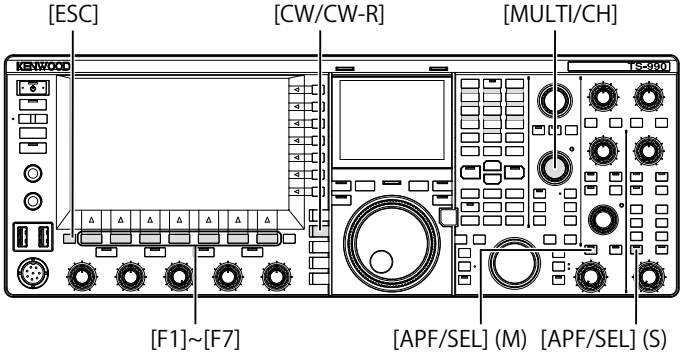
3 Press [▲] (F2) or [▼] (F3) to select the pass band width.
- You can select “Nar (80 Hz)”, “Mid (160 Hz)”, or “Wide (320 Hz)” from available range.
- The default is “Mid (160 Hz)”

4 Press **[ESC]** to exit.
Pressing and holding **[APF/SEL]** (M) or **[APF/SEL]** (S) closes the **APF** screen.

SHIFTING THE PASS BAND OF THE AUDIO PEAK FILTER

You can avoid interference from adjacent frequencies by shifting the passband of the audio peak filter.

The amount of shift for the bassband width is ±200 Hz from the CW pitch frequency.



1 Press **[CW/CW-R]** to select CW mode.

2 Press and hold **[APF/SEL]** (M) or **[APF/SEL]** (S) to open the **APF** screen for the selected band.



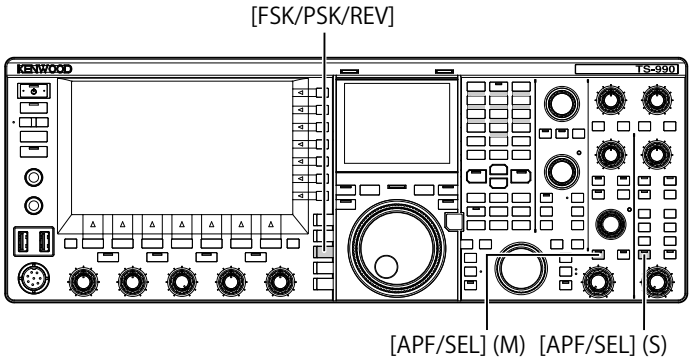
3 Press [◀] (F4) or [▶] (F5), or rotate the **MULTI/CH** control to shift the pass band width.
- The passband width of the selected audio peak filter is shifted above or below the CW pitch frequency.
- The default is "0" (zero shift from the pitch frequency).

4 Press **[ESC]** to exit.
Pressing and holding **[APF/SEL]** (M) or **[APF/SEL]** (S) closes the **APF** screen.

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AUDIO PEAK FILTER WHILE IN FSK MODE

While the transceiver receives a signal in FSK mode, the audio peak filter allows the mark frequency and space frequency each to have a peak, thus reducing the occurrence of garbled characters and increasing the readability of the signal. The audio peak filter supports not only high-tone signals with a mark frequency of 2125 Hz but also low-tone signals with a mark frequency of 1275 Hz. {page 5-46}



1 Press **[FSK/PSK/REV]** to select FSK mode.

2 Press **[APF/SEL]** (M) or **[APF/SEL]** (S) to enable the audio peak filter for the selected band.
While the audio peak filter is active, the "APF/SEL" (M) or "APF/SEL" (S) LED lights green.

Note:

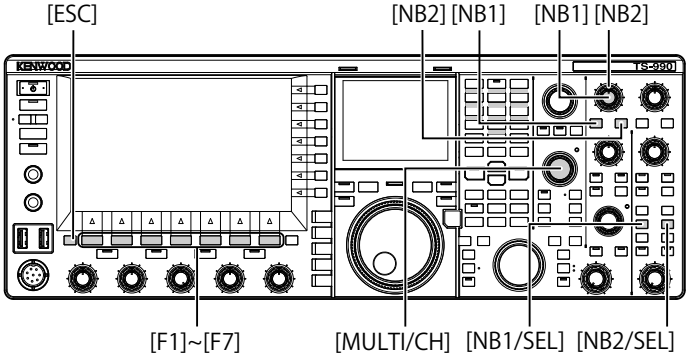
- If the shift width for RTTY mode exceeds 170 Hz, the audio peak filter for the selected band cannot be enabled
- The audio filter for use in FSK mode does not process the signal to be demodulated internally.

NOISE BLANKER

The noise blanker suppresses “crunching” pulse noise. The transceiver incorporates two types of noise blanker; Noise Blanker 1 (NB1) for analog signal processing, and Noise Blanker 2 (NB2) for digital signal processing at the IF stage by means of a DSP. You can select either NB1 or NB2 as desired depending on the noise status. Both can be enabled at the same time.

Note:

- In FM mode, you cannot use Noise Blanker.
- Noise is suppressed more effectively if a larger value is configured, but there may be some effect on the received signal.



■ Activating or deactivating the Noise Blankers for the main band

1 Press **[NB1]** or **[NB2]**.
- Noise Blanker 1 or 2 for the main band is activated or deactivated.
- While Noise Blanker 1 or Noise Blanker 2 is active, "NB1" or "NB2" appears on the upper left side of the main screen. While both Noise Blanker 1 and Noise Blanker 2 are active, "NB1 2" appears on the upper left side of the main screen.
- Pressing the key again deactivates Noise Blanker for the main band.

■ Activating or deactivating the Noise Blankers for the sub band

1 Press **[NB1/SEL]** or **[NB2/SEL]**.
- Noise Blanker 1 or Noise Blanker 2 for the sub band becomes active or inactive.
- While Noise Blanker 1 or Noise Blanker 2 is active, "NB1" or "NB2" appears on the upper left side of the main screen. While both Noise Blanker 1 and Noise Blanker 2 are active, "NB1 2" appears on the upper left side of the main screen.
- To deactivate Noise Blanker 1 or Noise Blanker 2 for the sub band, press the key again.

■ Adjusting the Noise Blanker levels for the main band.

1 Rotate the **NB1** or **NB2** control.
- You can adjust the level of NB1 or NB2.
- Rotating the **NB1** or **NB2** control clockwise suppresses noise.

■ Adjusting the Noise Blanker levels for the sub band.

1 Press and hold **[NB1/SEL]** or **[NB2/SEL]**.
The **Noise Blanker 1 (Sub)** screen or **Noise Blanker 2 (Sub)** screen appears.

Note:

♦ If the transceiver receives the CW signal while Noise Blanker 2 is active, the received audio may be distorted.



2 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to adjust the level.

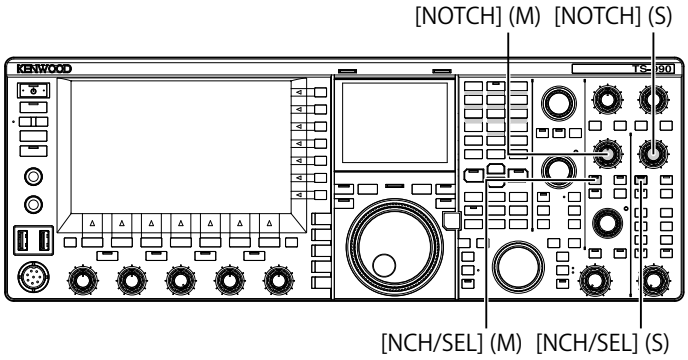
- You can adjust the level of Noise Blanker 1 or Noise Blanker 2.
- The available range is "1" to "10". The default is "6". Noise is suppressed more effectively if a larger value is configured.

3 Press **[ESC]** to exit.
Pressing and holding **[NB1/SEL]** or **[NB2/SEL]** closes the **Noise Blanker 1 (Sub)** screen or **Noise Blanker 2 (Sub)** screen.

MANUAL NOTCH FILTER (SSB, CW, FSK, and PSK)

The manual notch filter is an IF-stage notch filter that suppresses beat interference.

You can use the manual notch filter to eliminate beat noise and catch weak signals or operate the transceiver while checking the status of noise.

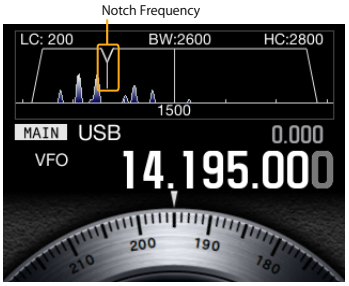


■ Activating or deactivating the Manual Notch filter

1 Press **[NCH/SEL]** (M) or **[NCH/SEL]** (S) to enable the manual notch filter for the selected band.

- The "NCH/SEL" (M) LED or "NCH/SEL" (S) LED lights green. In the main screen, "NOTCH" appears on the upper left side of the frequency display for the selected band.
- The letter "Y" appears to indicate the notch frequency if the filter type is displayed in the sub screen.
- Press the key again to deactivate the manual notch filter for the selected band.





2 Rotate the **NOTCH** (M) or **NOTCH** (S) control.
Adjust the notch frequency to the point where the beat or interference is suppressed. The letter "Y" indicating the notch frequency moves left and right if the filter type appears on the sub-screen.

Note:

♦ The manual notch filter is deactivated if the auto notch filter or band elimination filter is active.

♦ The notch point against an interfering beat cannot be changed even if a pitch and shift is changed after the notch point is determined in CW mode.

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■ Changing the bandwidth of the manual notch filter

Configure Wide or Normal for the stopband width of the manual notch filter. If Wide is configured for the bandwidth, the stopband width of the manual notch filter will be expanded twice as wide as Normal.

1 Press **[NCH/SEL]** (M) or **[NCH/SEL]** (S) to enable the manual notch filter for the selected band.
The manual notch filter for the selected band will be alternated between enabled and disabled.

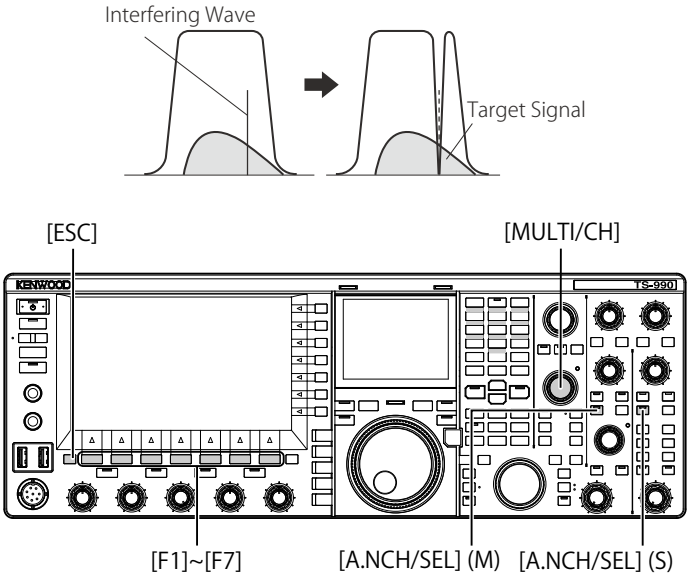
2 Press and hold **[NCH/SEL]** (M) or **[NCH/SEL]** (S) .
- "Normal" or "Wide" is configured for the passband width.
- If "Wide" is selected, "NOTCH W" will appear above the frequency display of the selected band, in the main screen.

Auto Notch Filter (SSB)

If there is a single interfering tone (i.e., a cyclic signal like CW) in the receive bandwidth, the auto notch filter searches for, finds, and suppresses the interfering tone automatically.

This function occasionally slightly suppresses the S-meter readout or the target signal.

If there is a weak interference signal, beat cancellation may be able to eliminate it more effectively.



■ Activating the auto notch filter

1 Press **[A.NCH/SEL]** (M) or **[A.NCH/SEL]** (S) to enable the auto notch filter for the selected band.
- The “A.NCH/SEL” (M) or “A.NCH/SEL” (S) LED lights green.
- In the main screen, "A.NOTCH" will appear above the frequency display of the selected band.
- The auto notch filter for the selected band is deactivated when the corresponding key is pressed again.



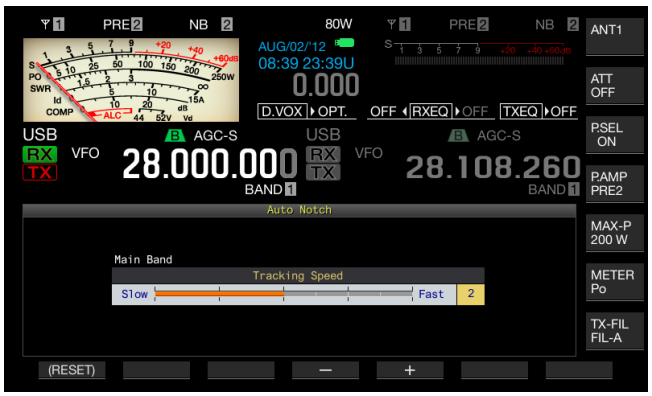
Note:

♦ The auto notch filter is deactivated if the manual notch filter or band elimination filter is active while the auto notch filter is active.

■ Adjusting the tracking speed of the Auto Notch

Adjust the speed of the notch filter to follow the interference according to the changing status of the interfering signal.

1 Press and hold **[A.NCH/SEL]** (M) to open the **Auto Notch** screen.



2 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the level for each frequency band.
Available range is "0" (disable the tracking) and from "1" (slow) to "4" (fast). The default is "2".

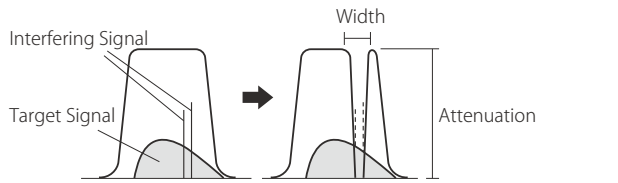
3 Press **[ESC]** to exit.
Pressing and holding **[A.NCH/SEL]** (M) or **[A.NCH/SEL]** (S) closes the Auto Notch screen.

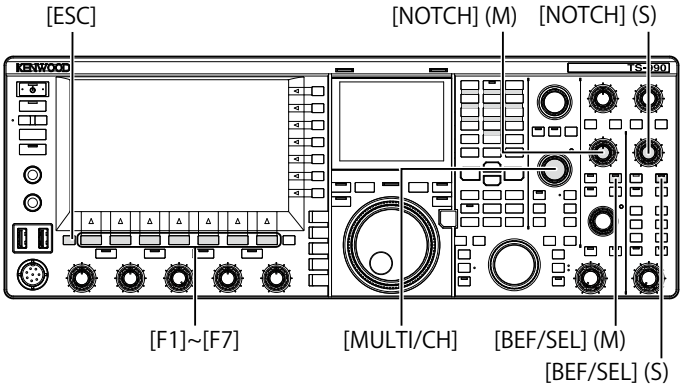
BAND ELIMINATION FILTER

Band Elimination Filter is the notch filter that can change the bandwidth and attenuation at the IF stage.

The stopband bandwidth can be selected from the available range of 300 Hz to 1200 Hz (in steps of 100 Hz) and the amount of attenuation can be selected from the available range of 20 dB to 80 dB (in steps of 20 dB).

If there are two or more interfering signals, you can adjust the stopband bandwidth and attenuation level according to the strength of the interfering signals, thus making the target signal clear.

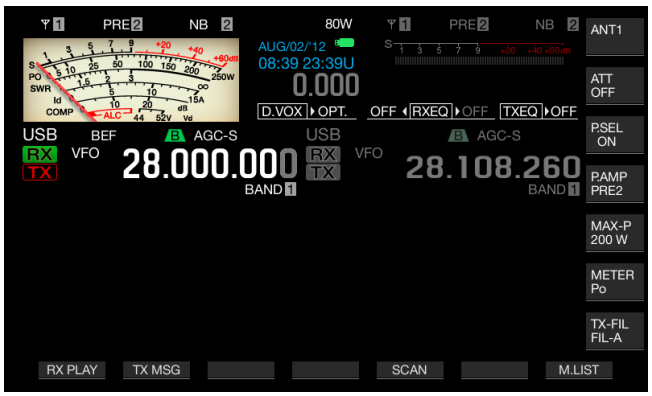




■ Activating or deactivating the Band Elimination Filter.

1 Press **[BEF/SEL]** (M) or **[BEF/SEL]** (S) to enable the band elimination filter for the selected band.

- The "BEF/SEL" (M) LED or "BEF/SEL" (S) LED lights green. In the main screen, "BEF" will appear above the frequency display of the selected band.
- The letter "Y" appears to indicate the notch frequency if the filter type is displayed in the sub screen.
- Press the key again to disable the band elimination filter for the selected band.





2 Rotate the **NOTCH** (M) or **NOTCH** (S) control to adjust the notch filter frequency.
You can adjust the notch frequency to the point where the beat or interference is suppressed. The letter "Y" indicating the notch frequency moves left and right if the filter type appears on the sub-screen.

Note:

- The band elimination filter is deactivated if the manual notch filter or band elimination filter is active.
- The notch point against an interfering beat cannot be changed even if a pitch and shift is changed after the notch point is determined in CW mode.

■ Changing the stopband bandwidth of the Band Elimination Filter

1 Press and hold **[BEF/SEL]** (M) or **[BEF/SEL]** (S) to open the **Band Elimination Filter** screen for the selected band.

2 Press **[▲]** (F2) or **[▼]** (F3) to select "Wide" for the bandwidth.



3 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the stopband width.

- You can select the stopband bandwidth of the band elimination filter.
- Available range is "300" Hz to "1200" Hz (in steps of 100 Hz).
- The default is "400".

4 Press **[ESC]** to exit.
Pressing and holding **[BEF/SEL]** (M) or **[BEF/SEL]** (S) closes the **Band Elimination Filter** screen.

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■ Changing the attenuation level of the Band Elimination Filter

1 Press and hold **[BEF/SEL]** (M) or **[BEF/SEL]** (S) to open the **Band Elimination Filter** screen for the selected band.

2 Press **[▲]** (F2) or **[▼]** (F3) to allow editing of "Depth" (attenuation level).



3 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the amount of attenuation.
- You can select the attenuation level of the band elimination filter.
- Available range is "20" Hz to "80" dB (in steps of 20 dB).
- The default is "40".

4 Press **[ESC]** to exit.
Pressing and holding **[BEF/SEL]** (M) or **[BEF/SEL]** (S) closes the **Band Elimination Filter** screen.

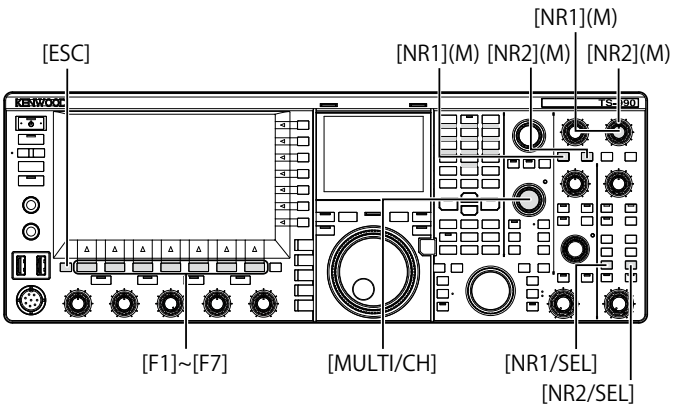
NOISE REDUCTION

The transceiver incorporates two types of noise reduction, i.e., Noise Reduction 1 (NR1) and Noise Reduction 2 (NR2).

With Noise Reduction 1 selected, spectrum subtraction noise reduction filter that attaches importance to readability is activated while the transceiver is receiving an audio signal in SSB, FM, or AM mode. While the transceiver is receiving an audio signal in CW, FSK, or PSK mode, a LSM type noise reduction that emphasizes the periodic signal is activated instead.

This is suitable for communication in CW mode because the SPAC system can function during reception to extract periodic signals using the Noise Reduction 2.

Note:
- When Noise Reduction 1 in SSB, FM, or AM mode is supressing beat signals, wanted signals may also be slightly suppressed. This is a normal action of Noise Reduction 1, and not a failure.
- If Noise Reduction 2 is active while the transceiver is in SSB mode, the readability of the wanted signal may drop or pulse noise or distortion may occur.
- Noise Reduction 2 cannot be used for FM mode.



■ Activating the Noise Reduction for the main band

1 Press **[NR1]** or **[NR2]**.
- Noise Reduction 1 or Noise Reduction 2 for the main band is activated or deactivated.
- While Noise Reduction 1 or Noise Reduction 2 is active, "NR1" or "NR2" appears on the upper left side of the main screen.
- Press the key again to deactivate the noise reduction for the main band.

■ Activating the Noise Reduction for the sub band

1 Press **[NR1/SEL]** or **[NR2/SEL]**.
- Noise Reduction 1 or Noise Reduction 2 for the sub band becomes active or inactive. While Noise Reduction 1 or Noise Reduction 2 is active, "NR1" or "NR2" appears on the upper left side of the main screen.
- Pressing the key again deactivates the noise reduction for sub band.

Note:
- Noise Reduction 1 and Noise Reduction 2 cannot both be enabled at the same time for both main band and sub band.

■ Adjusting the Noise Reduction Levels for the main band

1 Rotate the **NR1** or **NR2** control to adjust the effect level for the Noise Reduction 1 or the time constant for Noise Reduction 2.
Rotating the **NR1** or **NR2** control clockwise suppresses noise.

■ Adjusting the Noise Reduction Levels for the sub band

1 Press and hold **[NR1/SEL]** or **[NR2/SEL]** to open the **Noise Reduction 1 (Sub)** or **Noise Reduction 2 (Sub)** screen.



Noise Reduction 1



Noise Reduction 2

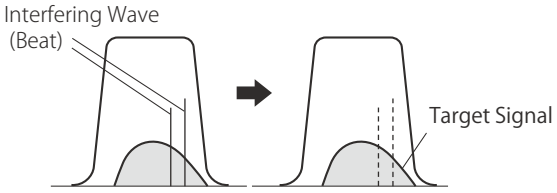
2 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to adjust the effect level for the Noise Reduction 1 or the time constant for Noise Reduction 2.
- Noise is suppressed more effectively if a larger value is configured.
- The available range for Noise Reduction 1 is from "1" to "10". The default is "5". The available range for Noise Reduction 2 is from "2" to "20". The default is "20".

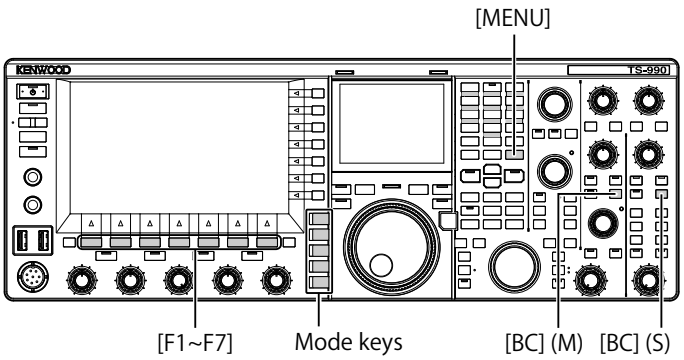
3 Press **[ESC]** to exit.
Pressing and holding **[NR1/SEL]** or **[NR2/SEL]** closes the **Noise Reduction 1 (Sub)** or **Noise Reduction 2 (Sub)** screen.

BEAT CANCELLER (SSB, AM AND FM)

The beat canceller performs digital processing at the AF stage, thus making it possible to suppress a number of periodic interference signals (beat signals) in the receive bandwidth.

You can use the beat canceller for SSB, AM, and FM modes.





1 Press one of the mode keys to select USB, FM, or AM mode.

2 Press **[BC]** (M) or **[BC]** (S) to select the Beat Canceller.
- Each time you press the key, the beat canceller for the selected band cycles as follows: Off > BC1 > BC2 > Off
In the main screen, “BC1” appears above the frequency display of the selected band with Beat Canceller 2 enabled.
- In the main screen, "BC2" appears above the frequency display of the selected band if Beat Canceller 2 is active.
- If BC1 is configured, it suppresses weak or continuous beat signals. If BC2 is configured, it suppresses intermittent beat signals like CW signals.



Note:

♦ Beat Canceller can suppress the overall audible beat; however, the gain of the target signal cannot be recovered by the AGC function. Therefore, if the beat signal is larger than the target signal, use of the manual notch filter, auto notch filter or band elimination filter may activate the AGC function making the target signal clearly.

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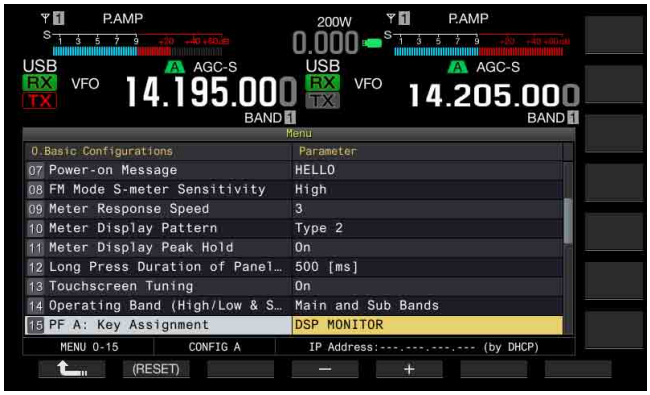
DSP MONITOR

The DSP monitor is a function that temporarily expands the passband width of IF filter and AF filter by means of the DSP filter allowing you to temporarily distinguish the wave status of the waveform while the transceiver receives the particular frequency, for instance during the contest, using the narrow passband width filter.

While pressing down the PF key assigned as the DSP monitor, the passband width can be expanded.

ASSIGNING THE DSP MONITOR TO THE PF KEY

1. Select Group No. 0, "Basic Configurations", from the **Menu** screen.
2. Access Menu 15, "PF A: Key Assignment", to Menu 32, "Microphone UP: Key Assignment".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.



4. Press **[-]** (F3) or **[+]** (F5) to select "DSP MONITOR".
5. Press **[ ]** (F1).
6. Press **[MENU]** to exit.

EXPANDING THE PASSBAND WIDTH OF THE FILTER USING THE DSP MONITOR

1. Press down the PF key assigned as the DSP monitor.
   While pressing down the key, the passband width of the filter expands.

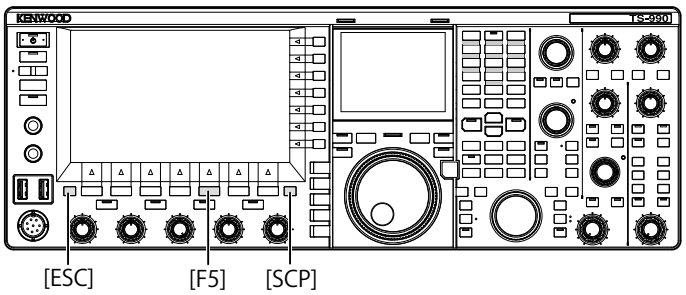




BANDSCOPE

The Bandscope displays the signal strength along the vertical axis and the frequency along the horizontal axis, allowing you to observe the status of the received frequency.

There are two modes available: Center mode, which places the receive frequency at the center of the horizontal axis, and Fixed mode, where the lower limit frequency and upper limit frequency for the displayed band are fixed.

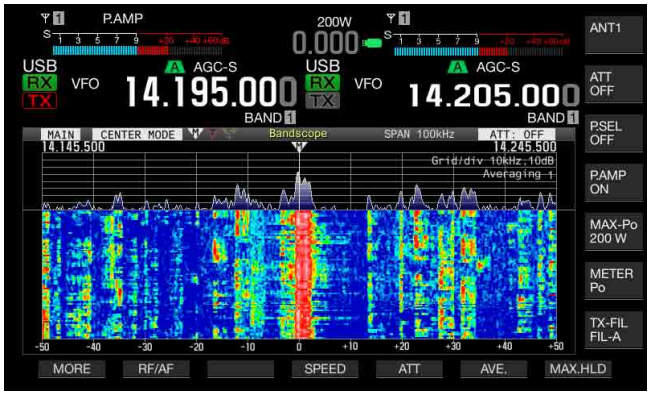


DISPLAYING THE BANDSCOPE

1 Press **[SCP]** to display the bandscope on the main display.

Each time you press **[SCP]**, the screen cycles through Bandscope > Bandscope and Waterfall > No Bandscope Display > Bandscope.





2 Press **[ESC]** to exit.

WATERFALL

Displaying the waterfall below the bandscope allows you to observe the transition of the signal strength in addition to the state of the received signal and its adjacent frequencies.

In the waterfall display, the vertical axis represents elapsed of time and the horizontal axis represents the frequency.

The signal strength is distinguished by its color on the display; white (strong), red to yellow (medium) and green to blue (weak).

The spectrum of the signal strength for the range equivalent to the four times of the red marker appears vertically. The span until the next red marker appears (in other words, waterfall fall speed) can be changed.

While the Waterfall is being displayed, the bandscope height is reduced to one third compared to when only the bandscope is displayed.

Note:

- In Center mode, the waterfall display pauses if the receive frequency is changed.
- In Fixed mode, with the observation of the target signal (vertical trace) displayed on the Waterfall, shift the marker position to tune the signal.

ADJUSTING THE REFERENCE LEVEL

If it is not easy to distinguish the target signal from the noise in the noisy environment or if you observe a weak signal on a quiet band, the reference level for the bandscope can be adjusted to allow you to distinguish the target signal.

1 Press **[REF.LEV]** (F5) to display the current value of the reference level at the center of the **Bandscope** screen.

2 Observe the spectra of the bandscope waveform and waterfall on the **Bandscope** screen, rotate the **MULTI/CH** control to adjust the reference level in the range from -20.0 dB to +20.0 dB.

3 Press **[REF.LEV]** (F5) to finish the adjustment for the reference level.

Note:

- If the target signal cannot be distinguished due to the excessively large input signal even after the reference level has been adjusted, the attenuation level of the bandscope can be changed. {page 7-8}

CONFIGURING THE WATERFALL DISPLAY FALL SPEED

The fall speed of the waterfall display can be configured.

1 Press **[SPEED]** (F4) to select the waterfall speed.
- Each time you press **[SPEED]** (F4), the fall speed cycles through "Speed 1" (60 seconds) > "Speed 2" (20 seconds) > "Speed 3" (8 seconds) > "Speed 1". The default is "Speed 3".
- If **[SPEED]** (F4) is unavailable in the key guide, press **[MORE]** (F1).
- Each long press of **[SPEED]** (F4) cycles the fall speed in the reversed sequence.

CHANGING THE DISPLAY OF THE BANDSCOPE (MAIN BAND AND SUB BAND)

The signal to be displayed in the bandscope can be selected from the main band signal or sub band signal.

Follow the procedure below while the bandscope appears.

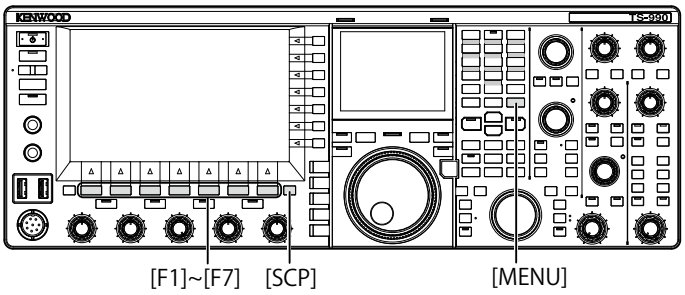
1 Press **[M/S]** (F2) to toggle the selected band between the main band and the sub band.
- Each time you press **[M/S]** (F2), the selection toggles between **[MAIN]** and **[SUB]**. Each time the selection is toggled, the markers for the lower limit frequency displayed on the upper left side of the grid, and the upper limit frequency displayed on the upper right side of the grid will change.
- If **[M/S]** (F2) is unavailable in the key guide, press **[MORE]** (F1).

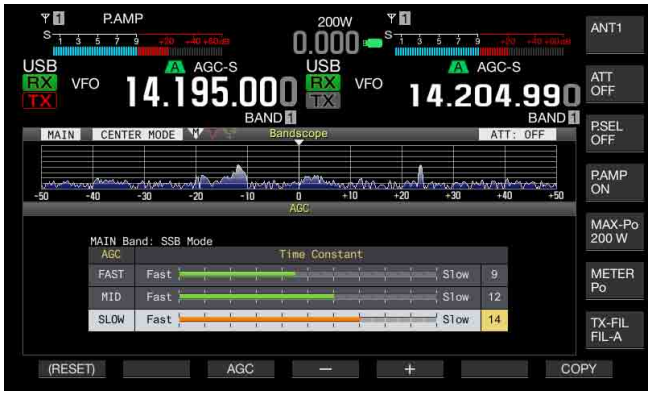


DISPLAYING THE BANDSCOPE AND ANOTHER SCREEN

You can display the bandscope while the **RTTY Encode/Decode** or **PSK Encode/Decode** screen appears, provided that the transceiver is in FSK or PSK mode or the configuration screen is displayed.

Press **[SCP]** to display the **Bandscope** screen with the scale in the vertical direction compressed to 1/3. The **[RF/AF]** (F2), **[ATT]** (F5), or other function keys for the bandscope do not appear along the bottom of the main screen while the bandscope appears coupled with the other screen; hence, you cannot change the configurations for the bandscope.





TOGGLING THE CENTER MODE AND FIXED MODE

There are two modes available, the Center mode which always places the receive frequency at the center of the bandscope, and the Fixed mode which displays fixed lower and upper frequency limits.

Follow the procedure below while the bandscope appears.

1 Press **[CRT/FIX]** (F3) to change the display.
- Each time you press **[MODE]** (F7), the selection toggles between "CENTER MODE" and "FIXED MODE".
- If **[CTR/FIX]** (F3) is unavailable in the key guide, press **[MORE]** (F1).

Note:

♦ In Fixed mode, with the observation of the target signal (vertical trace) displayed on the Waterfall, shift the marker position to tune the signal. This enables you to tune more easier than in Center mode.

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CHANGING THE DISPLAYED FREQUENCY SPAN (CENTER MODE)

You can change the displayed frequency span (the width of the lower limit and upper limit frequencies on the Bandscope screen) while the bandscope is displayed in Center mode.

1 Press **[SPAN]** (F4) to change the frequency display span.

- Each key press cycles the frequency span through 5 kHz > 10 kHz > 20 kHz > 50 kHz > 100 kHz > 200 kHz > 500 kHz > 5 kHz.
- Each long press of **[SPAN]** (F4) cycles the selection in the reversed sequence.
- The selected frequency span appears as "SPAN 50 kHz" on the toolbar of the **Bandscope** screen.
- The default is “50 kHz”.
- If **[SPAN]** (F3) is unavailable in the key guide, press **[MORE]** (F1).



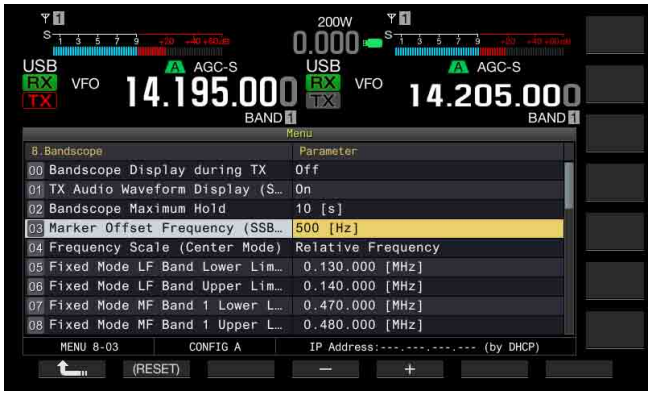
SWITCHING THE MARKER OFFSET FREQUENCY (SSB ONLY)

The marker display location while the bandscope for SSB mode is displayed can be switched to the carrier point which is the same as the frequency display or to a frequency offset from the carrier point.

1 Select Group No. 8, "Bandscope", from the **Menu** screen.

2 Access Menu 03, "Marker Offset Frequency (SSB Mode)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Off (Carrier Point)" or the offset frequency.
The default is "500 [Hz]" (near the peak of the frequency spectra for the typical human vocal). While the bandscope and Waterfall are displayed, placing a marker near the frequency having the strongest level can easily zero-in even in SSB mode. The peak of the frequency spectra may vary or may not be distinguished due to the audio quality of the transmitting station.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- If the bandscope is in Center mode, the frequency which is added by the frequency configured in Menu 8-03 to the carrier point frequency will be the center frequency for USB mode, and the frequency which is subtracted by the frequency configured in Menu 8-03 from the carrier point frequency will be the center frequency for LSB mode. The lower limit frequency and upper limit frequency appear following the center frequency.
- If the bandscope is in Fixed mode, the frequency which is added by the frequency configured in Menu 8-03 to the carrier point frequency will be the marker frequency for USB mode, and the frequency which is subtracted by the frequency configured in Menu 8-03 from the carrier point frequency will be the marker frequency for LSB mode.

SELECTING THE FREQUENCY DISPLAY IN THE GRID (RELATIVE FREQUENCY OR ABSOLUTE FREQUENCY)

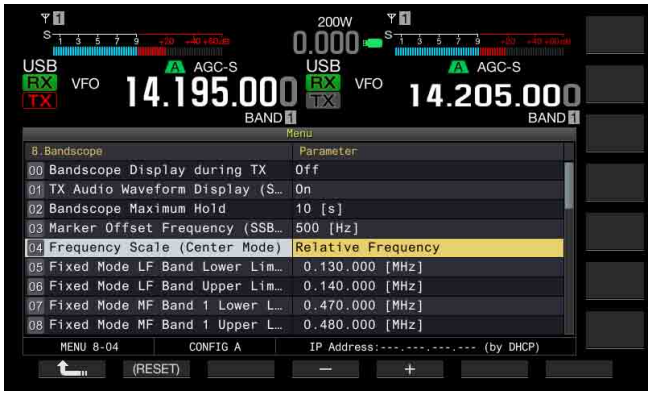
The **Bandscope** screen shows the signal strength in the vertical axis and the frequency in the horizontal axis. This allows you to select the desired frequency to appear under the grid.

If "Off (Carrier Point)" is selected in Menu 8-03, "Marker Offset Frequency (SSB Mode)", the frequency to be displayed below the bandscope for use in Center mode can be switched to the relative frequency from the scope center, i.e. ±25 kHz, or to the absolute frequency.

1 Select Group No. 8, "Bandscope", from the **Menu** screen.

2 Access Menu 04, "Frequency Scale (Center Mode)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Relative Frequency" or "Absolute Frequency" in the parameter box.
The default is "Relative Frequency".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- If anything other than "Off (Carrier Point)"is selected in Menu 8-03, the relative frequency display is applied,and the absolute frequency may not be displayed.
- In Fixed mode, the absolute frequency always appears regardless of the configuration in Menu 8-03.

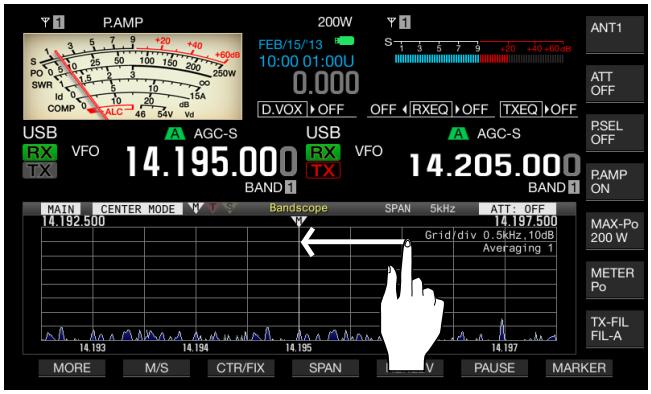
CHANGING THE RECEIVE FREQUENCY USING YOUR FINGERTIP (CENTER MODE)

Simply by touching the **Bandscope** screen with your fingertip, you can change the receive frequency. You can tune a new signal in the bandscope without rotating the **Tuning** control.

The main band frequency will change to the frequency touched by your fingertip if "MAIN" appears on the upper left side of the **Bandscope** screen. Likewise, the sub band frequency will change to the frequency touched by your fingertip if "SUB" appears.

Touching with your fingertip on the left side of the center frequency decrements the center frequency value, and touching with your fingertip on the right side of the center frequency increments the center frequency value.

If "Off" has been configured in Menu 0-13, "Touchscreen Tuning", no frequency can be changed even with a touch with your fingertip. Refer to "TOUCHING THE SCREEN TO SELECT A FREQUENCY" for the configuration method of the touchscreen tuning. {page 4-13}





Note:

- If you feel the screen is incorrectly recognizing the frequency when you touch the screen, you can calibrate the contact spots of the touchscreen. Refer to "CALIBRATING THE TOUCHSCREEN" for further details. {page 16-3}
- In CW mode, touching the screen longer than the time configured for the long key press in Menu 0-12 activates the Auto Zero-in function. {page 5-17}
- In AM and FM modes, if you change the frequency with a touch of the screen, the step frequency of the **MULTI/CH** control configured in Menus 3-02, 3-03, and 3-05 will be applied. {page 4-13}

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CONFIGURING THE LOWER AND UPPER LIMIT

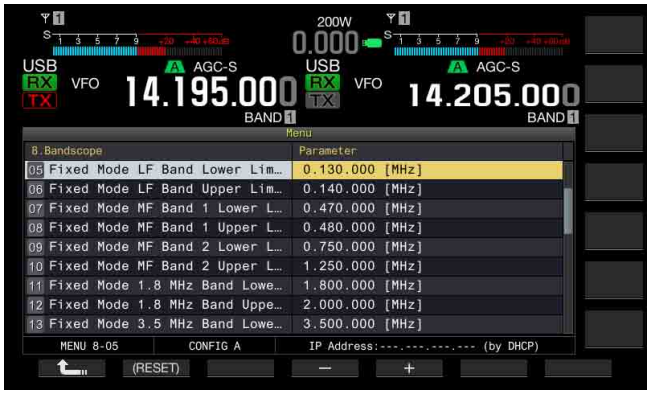
In Fixed mode, you can fix the frequency display range of the bandscope on a band-by-band basis and can display markers for the receive frequency and transmit frequency of your transceiver.

Follow the procedure below to configure the lower limit frequency and upper limit frequency of each band displayed in Fixed mode.

1 Select Group No. 8, "Bandscope", from the **Menu** screen.

2 Access Menu 05, "Fixed Mode LF Band Lower Limit" (min. 0.03 MHz), to Menu 32, "Fixed Mode 50 MHz Band Upper Limit (max. 60 MHz)".
The following list of default configurations shows the lower and upper limit frequencies on a band-by-band basis for each menu.

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



The following list shows the default configurations.

Band	Range [MHz]	Menu	Lower Limit Frequency [MHz]	Menu	Upper Limit Frequency [MHz]
LF	0.030 to 0.300	8-05	0.130.000	8-06	0.140.000
MF1	0.300 to 0.522	8-07	0.470.000	8-08	0.480.000
MF2	0.522 to 1.705	8-09	0.750.000	8-10	1.250.000
1.8 MHz	1.705 to 2.00	8-11	1.800.000	8-12	2.000.000
3.5 MHz	2.00 to 4.00	8-13	3.500.000	8-14	4.000.000
5 MHz	4.00 to 6.00	8-15	5.000.000	8-16	5.500.000
7 MHz	6.00 to 8.00	8-17	7.000.000	8-18	7.500.000
10 MHz	8.00 to 11.00	8-19	10.100.000	8-20	10.150.000
14 MHz	11.00 to 15.00	8-21	14.000.000	8-22	14.500.000
18 MHz	15.00 to 20.00	8-23	18.000.000	8-24	18.200.000
21 MHz	20.00 to 22.00	8-25	21.000.000	8-26	21.500.000
24 MHz	22.00 to 26.00	8-27	24.890.000	8-28	24.990.000
28 MHz	26.00 to 30.00	8-29	28.000.000	8-30	28.500.000
50 MHz	30.00 to 60.00	8-31	50.000.000	8-32	50.500.000

4 Press **[-]** (F4) or **[+]** (F5) to select the lower limit frequency or upper limit frequency from the parameter box.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- The difference between the lower limit frequency and the upper limit frequency is a minimum of 5 kHz and a maximum of 500 kHz. No lower or upper limit frequency can be configured in excess of this range. Also, the minimum step frequency for the lower limit frequency and upper limit frequency is 1 kHz.

APPLYING THE LOWER LIMIT FREQUENCY OR UPPER LIMIT FREQUENCY FOR CENTER MODE TO FIXED MODE

The display frequency range (the lower limit frequency and the upper limit frequency) configured for Center mode can be applied to Fixed mode. This is a convenient function to quickly apply the display area for Center mode to Fixed mode.

1 Press and hold **[CTR/FIX]** (F3).
- The lower limit frequency and upper limit frequency selected for use in Center mode replace the lower limit frequency and upper limit frequency for use in Fixed mode, and the **Bandscope** screen switches to Fixed mode.
- If **[CTR/FIX]** (F5) is unavailable in the key guide, press **[MORE]** (F1).

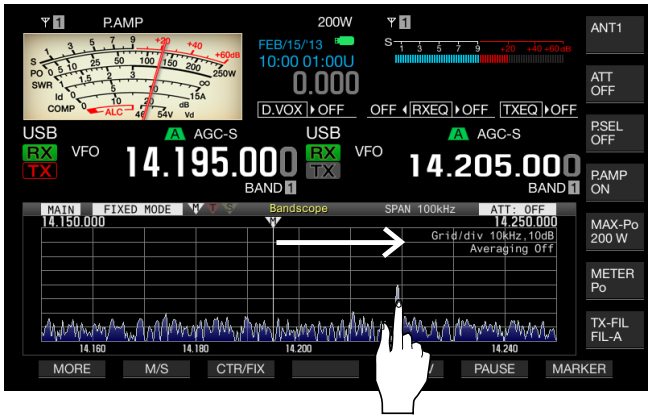
Note:

- If the lower limit frequency and upper limit frequency are in different band, the lower limit frequency and upper limit frequency will not be refreshed and the display does not change to Fixed mode even with a long press of **[CTR/FIX]** (F3).
- When the bandscope is switched from Center mode to Fixed mode with a long press of **[CTR/FIX]** (F3), the lower limit frequency and upper limit frequency will be rounded off so as to fully justify the frequency grids of the bandscope. Therefore, depending on the receive frequency, the marker display position will be shifted for one grid or less from the center.

CHANGING THE RECEIVE FREQUENCY USING YOUR FINGERTIP (FIXED MODE)

As well as Center mode, you can select the target frequency in the **Bandscope** screen using your fingertip to change the frequency into a receive frequency while in Fixed mode.

The main band frequency will change to the frequency touched by your fingertip if “MAIN” appears on the upper left side of the **Bandscope** screen. Likewise, the sub band frequency will change to the frequency touched by your fingertip if “SUB” appears.



Note:

- In CW mode, touching the screen longer than the time configured for the long key press in Menu 0-12 activates the Auto Zero-in. {page 5-17}
- In AM and FM modes, if you change the frequency with a touch of the screen, the step frequency of the **MULTI/CH** control configured in Menus 3-02, 3-03, and 3-05 will be applied. {page 4-13}
- If “Off” has been configured in Menu 0-13, “Touchscreen Tuning”, no frequency can be changed even with a touch with your fingertip. Refer to “TOUCHING THE SCREEN TO SELECT A FREQUENCY” for the configuration method of the touchscreen tuning. {page 16-4} {page 16-3}

DISPLAYING THE MARKERS

Markers indicate the whereabouts of the transmit and receive frequencies in the **Bandscope** screen. The marker for the receive frequency always appears.

In split operation, a transmit frequency can easily be changed by sliding the transmit frequency marker to the desired transmit frequency spot with while viewing the **Bandscope** screen.

■ If the main band is displayed in the **Bandscope** screen

1 Press **[MARKER]** (F7) to alternate the marker display.

- Each time you press this key, the displayed marker cycles as follows:

  Marker for the receive frequency of the main band only > Markers for the receive frequencies of the main band and sub band > Markers for the receive and transmit frequencies of the main band > Markers for the receive frequencies of the main band and sub band and the marker for the transmit frequency > Marker for the receive frequency of the main band only
- If **[MARKER]** (F7) is unavailable in the key guide, press **[MORE]** (F1).



■ With the Sub Band displayed in the Bandscope Screen

1 Press **[MARKER]** (F7) to alternate the marker display.

- Each time you press this key, the displayed marker cycles as follows:

  Marker for the receive frequency of the sub band only > Markers for the receive frequencies of the main band and sub band > Markers for the receive and transmit frequencies of the sub band > Markers for the receive frequencies of the main band and sub band and the marker for the transmit frequency > Marker for the receive frequency of the sub band only
- If **[MARKER]** (F7) is unavailable in the key guide, press **[MORE]** (F1).

Note:

- Frequency markers are distinguished by color as shown below.
  White: Receive frequency in the main band
  Yellow: Receive frequency in the sub band
  Red: Transmit frequency
- Shifting the marker while the Waterfall is displayed extends the marker line to the Waterfall display area. If the marker becomes static, the marker length reverts to the original length after two seconds.

OFF-RANGE MARKERS FOR FREQUENCIES BEYOND THE LOWER AND UPPER LIMITS

While the frequency markers appear on the bandscope and in Fixed mode, if the marked frequency goes beyond the display range of the bandscope, different markers will appear, notifying you that the marked frequency is outside the range of the bandscope.

The ◁ marker will appear on the left side of the **Bandscope** screen if the marked frequency drops below the lower limit frequency and the ▷ marker will appear on the right side if the marked frequency exceeds the upper limit frequency.



Note:

- The off-range markers for frequencies beyond the upper and lower limits are distinguished by color as shown below.
  White: Receive frequency in the main band
  Yellow: Receive frequency in the sub band
  Red: Transmit frequency

SHIFTING THE SCOPE AREA BY IF PLACING THE MARKER NEAR CENTER (FIXED MODE)

If the frequency marker, representing the frequency received in Fixed mode, is on the edge of the display area or outside the display area, touching with your fingertip shifts the frequency marker near the center.

1 Press **[MKR.CTR]** (F4) to shift the marker near the center.

- The scope area shifts with the same frequency width retained in order to display the marker for the selected band near the center (within one grid horizontally from the center).
- If **[MKR.CTR]** (F4) is unavailable in the key guide, press **[MORE]** (F1).

Note:

- The marker cannot shift if the scope range is outside the lower limit frequency and upper limit frequency in a certain amateur band.
- If the lower limit frequency and upper limit frequency are changed with a press of **[MKR.CTR]** (F4), the lower limit frequency and upper limit frequency configured in the menu will be overwritten.

DISPLAYING THE MAXIMUM WAVEFORM VALUE

Indication of the maximum waveform value to be retained and displayed on the **Bandscope** screen enables you to distinguish the status of the signal.

■ Displaying the Peak Values of Waveform

1 Press **[SCP]** to display the bandscope on the main display.

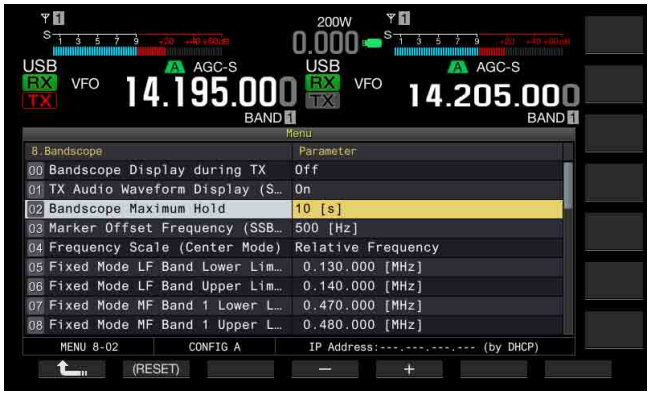
2 Press **[MAX.HLD]** (F7) to toggle the peak value of the waveform between maximized and normal.
If **[MAX.HLD]** (F7) is unavailable in the key guide, press **[MORE]** (F1).

■ Configuring the Waveform Display Type

1 Select Group No. 8, "Bandscope", from the **Menu** screen.

2 Access Menu 02, "Bandscope Maximum Hold".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "10 [s]" or "Continuous" from the parameter box.
- 10 [s]: Retains and displays the maximum waveform value of the last 10 seconds.
- Continuous: Retains and displays the maximum waveform after the bandscope has appeared.
- The default is "10 [s]".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

PAUSING THE WAVEFORM DISPLAY

You can pause the waveform display on the **Bandscope** screen.

1 Press **[PAUSE]** (F5) to pause the displayed waveform.
- "PAUSE" appears while the waveform display is paused.
- If **[PAUSE]** (F6) is unavailable in the key guide, press **[MORE]** (F1).



- Pressing any key other than **[MORE]** (F1) and **[MARKER]** (F7) releases the pause of the waveform display.

AVERAGING THE WAVEFORM DISPLAY ON THE BANDSCOPE

If the waveform display on the bandscope is averaged, the waveform transition on the display becomes gradual, hence intermittent signals such as Morse code can easily be observed.

1 Press **[AVE.]** (F6) to change the averaging level.
- Each key press cycles the averaging level through "Off" (no averaging) > "1" (minimum) > "2" > "3" (maximum) > "Off". The averaging level appears on the upper right side of the grid.
- Pressing and holding **[AVE.]** (F6) cycles the averaging level in the reversed sequence.
- The default is "1".
- If **[AVE.]** (F6) is unavailable in the key guide, press **[MORE]** (F1).

CHANGING THE ATTENUATOR FOR THE BANDSCOPE

If the target signal cannot easily be distinguished on the Bandscope screen due to excessive input signal even after the adjustment of the reference level, change the attenuator for the bandscope to attenuate the bandscope input level.

1 Press **[ATT]** (F5) to select an attenuator.
- Each time you press **[ATT]** (F5), the level cycles as follows: Off > 10 dB > 20 dB > 30 dB. The attenuated value appears on the upper right side of the grid.
- Pressing and holding **[ATT]** (F5) cycles through the attenuation in the reversed sequence.
- The default is "Off".
- If **[ATT]** (F5) is unavailable in the key guide, press **[MORE]** (F1).



Note:

♦ Changing of the attenuation for the bandscope does not influence the receive sensitivity.

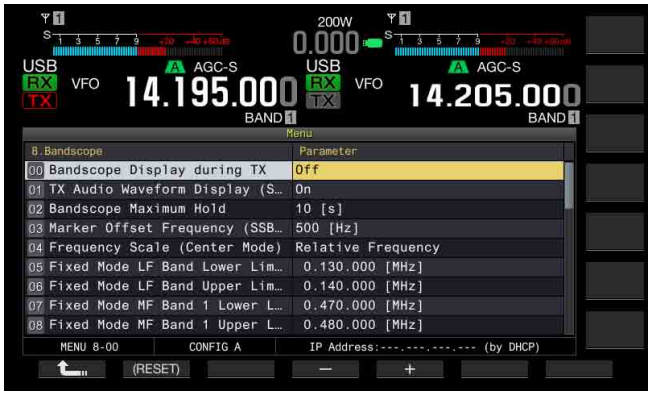
DISPLAYING THE TRANSMISSION SIGNAL WAVEFORM

While transmitting with the bandscope displayed in Center mode, you can select whether or not to display the waveform of the transmit signal.

1 Select Group No. 8, "Bandscope", from the **Menu** screen.

2 Access Menu 00, "Bandscope Display during TX".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select either "On" or "Off" from the parameter box.
The default is "Off".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

♦ In Fixed mode, the transmission signal waveform cannot be displayed.

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Operation Example: SSB Mode

1. Select "500 [Hz]" (near the peak of the frequency spectra for the typical human vocal) in Menu 8-03, "Marker Offset Frequency (SSB Mode)".
2. Press **[SCP]** to display the Bandscope and Waterfall.
3. Press **[CTR/FIX]** (F3) to enter Center mode.
4. Press **[SPAN]** (F4) to select the displayed frequency span from "20 [kHz]" through "100 [kHz]".
5. Press and hold **[CTR/FIX]** (F3) to enter Fixed mode with the displayed frequency span retained.
6. Press **[REF.LEV]** (F5) to adjust the reference level in order to facilitate the signal observation on the Waterfall display.
7. Place a marker for the receive frequency to the position where the signal strength is the strongest so as to zero in.
8. Rotate the **Tuning** control to change the receive frequency until the receive signal is zeroed in.

Operation Example: CW Mode

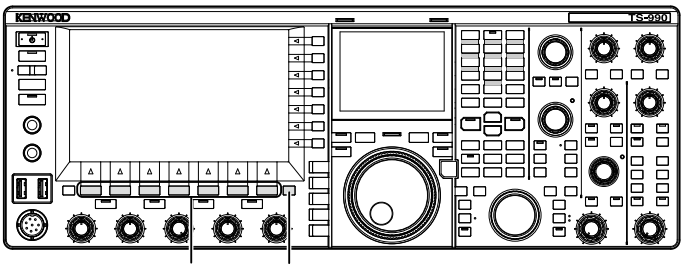
1. Press **[SCP]** to display the Bandscope and Waterfall.
2. Press **[CTR/FIX]** (F3) to enter Center mode.
3. Press **[SPAN]** (F4) to select the displayed frequency span from "5 [kHz]" through "20 [kHz]".
   This helps to distinguish the CW signal.
4. If you wish to observe the weak signal that hardly moves the pointer of the S-meter, select "5 [kHz]" or "10 [kHz]" for the displayed frequency span.
5. Press and hold **[CTR/FIX]** (F3) to enter Fixed mode with the displayed frequency span retained.
6. Place a marker for the receive frequency to the position where the signal strength is the strongest so as to zero in.
   - Pressing **[CW T]** activates the Auto Zero-in (CW Auto Tune).
   - If the receive frequency is changed by long touching with your fingertip on the **Bandscope** screen, Auto Zero-in (CW Auto Tune) is executed without a press of **[CW T]**.

DISPLAYING THE AUDIO SCOPE AND OSCILLOSCOPE

This transceiver has an Audio Scope and oscilloscope, coupled with waterfall capability, allowing you to observe the status of an audio signal. Received and transmitted audio can be displayed using the spectrum and waveforms, to observe the communication quality and status of the audio.

Displaying the waterfall below the Audio Scope allows you to observe the transition of the signal strength in addition to the state of the audio signal.

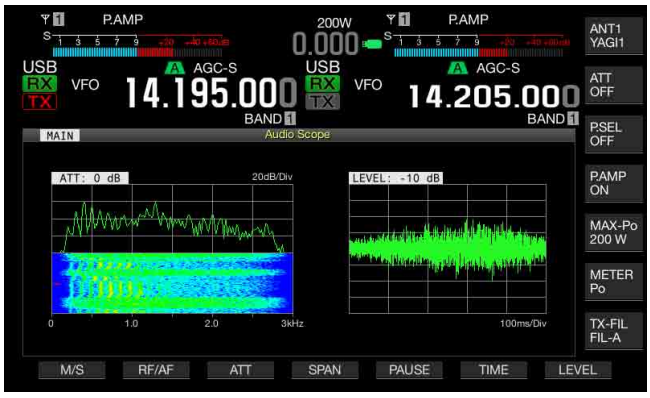
In the waterfall display, the vertical axis represents elapsed time and the horizontal axis represents the frequency. The signal strength distinguished by white (strong), red to yellow (medium) and green to blue (weak) is expressed on the display. The spectrum of the signal strength for the last 9.3 seconds appears vertically. Every 5 seconds, a 2-mm (1/10") long red marker appears on the left side of the waterfall display, showing the lapse of time.



1 Press **[SCP]** to display the **Bandscope** screen.

2 Press **[RF/AF]** (F1) to select either the **Bandscope** screen or the **Audio Scope** screen.

- In the **Audio Scope** screen, the Audio Scope appears on the left side and the oscilloscope appears on the right side.
- If **[RF/AF]** (F2) is unavailable in the key guide for function keys, press **[MORE]** (F1) to alternate the key guide.



3 Press **[ESC]** to exit.

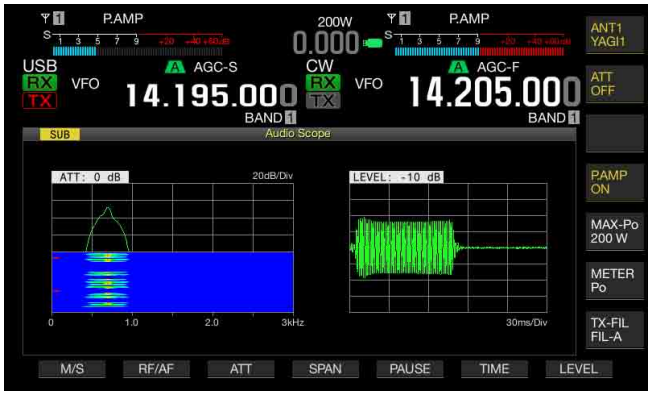
CHANGING THE AUDIO SOURCE FOR THE AUDIO SCOPE

You can select from the received audio for the main band and for the sub band.

1 Press **[RF/AF]** (F2) on the **Bandscope** screen to open the **Audio Scope** screen.
If **[RF/AF]** (F2) is unavailable in the key guide for function keys, press **[MORE]** (F1) to alternate the key guide.

2 Press **[M/S]** (F1) to toggle the selected band between the main band and the sub band.

- Each key press cycles through Received audio in the main band (Mmain band) > Received audio in the sub band (Sub Band) > Received audio in the main band (Main Band).
- The name of the selected band appears. The main band and sub band cannot be replaced while transmitting.



Note:

♦ You can observe the waveform of the transmitting signal while transmitting.

CHANGING THE ATTENUATOR FOR THE AUDIO SCOPE

If the signal level applied to the Audio Scope is excessively high, attenuating the level will reduce the amplitude of the waveform. This optimizes the display on the Audio Scope facilitating you to observe the waveform.

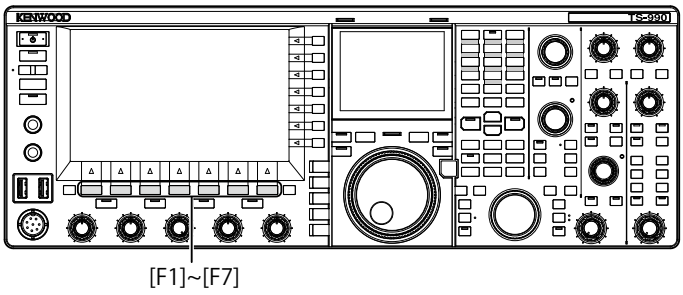
1 Press **[RF/AF]** (F2) on the **Bandscope** screen to open the **Audio Scope** screen.
If **[RF/AF]** (F2) is unavailable in the key guide for function keys, press **[MORE]** (F1) to alternate the key guide.

2 Press **[ATT]** (F3) to select an attenuator.

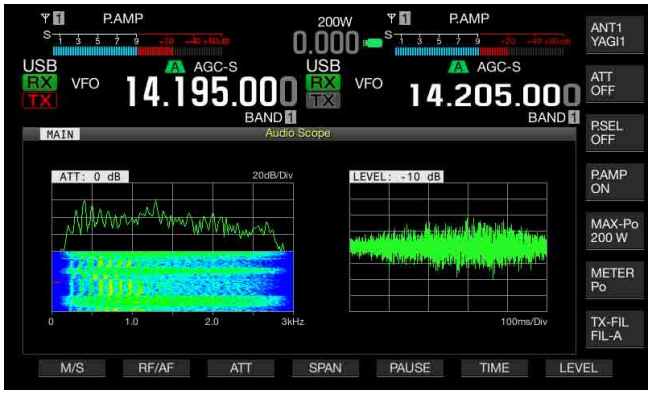
- Each time you press **[ATT]** (F3), the level cycles as follows: 0 dB > 10 dB > 20 dB > 30 dB > 0 db. The attenuation level appears on the upper left side of the grid. The default is "0 dB".
- Each long press of **[ATT]** (F4) cycles the attenuation level in the reversed sequence.

CHANGING THE AUDIO SCOPE FREQUENCY DISPLAY SPAN

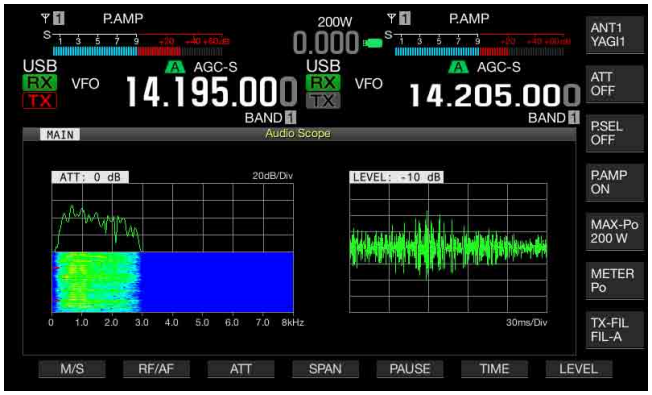
The displayed frequency span for the audio scope can be toggled between 3 kHz and 8 kHz. You can configure the frequency display span following the configuration for the filter bandwidth or the frequency to be observed.



1 Press **[RF/AF]** (F1) on the **Bandscope** screen to open the **Audio Scope** screen.
If **[RF/AF]** (F2) is unavailable in the key guide for function keys, press **[MORE]** (F1) to alternate the key guide.



2 Press **[SPAN]** (F4) to select the frequency display span.
- Each time you press **[SPAN]** (F4), the frequency toggles between 3 kHz and 8 kHz.
- With the frequency display span of 3 kHz, the frequency step size will be 0.5 kHz and the audio scope will appear with six frequency steps in the horizontal direction.
- With the frequency display span of 8 kHz, the frequency step size will be 1 kHz and the audio scope will appear with eight frequency steps in the horizontal direction.
- The default is "3 kHz".

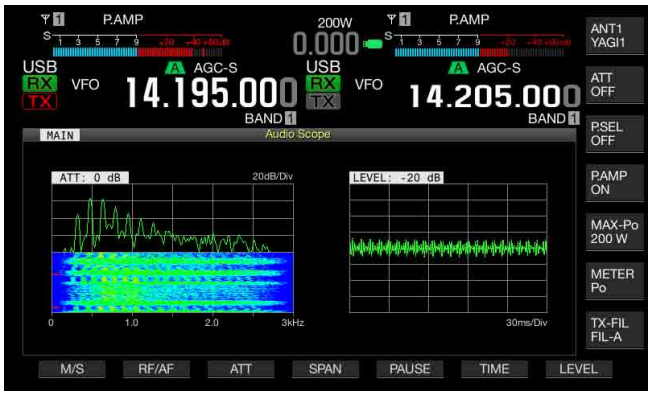


CHANGING THE LEVEL OF THE OSCILLOSCOPE

The amplitude of the waveform will change if the signal level applied to the oscilloscope is changed. Optimizing the amplitude of the waveform into an easy-to-see size will make it easy to observe the waveform.

1 Press **[RF/AF]** (F2) on the **Bandscope** screen to open the **Audio Scope** screen.

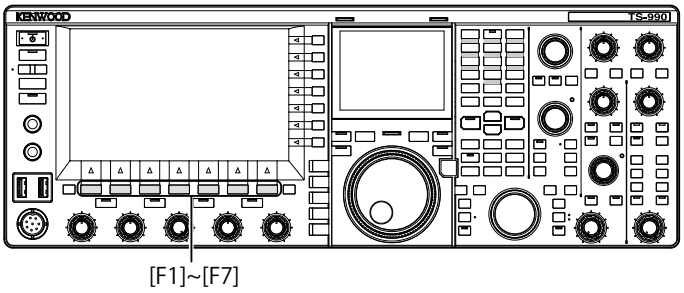
2 Press **[LEVEL]** (F7) to change the signal input level
- Each time you press **[ATT]** (F3), the level cycles through dB > -10 dB > -20 dB > -30 dB > 0 db. The audio signal level applied to the oscilloscope appears on the upper left side of the grid. The default is "0 dB".
- Each long press of **[LEVEL]** (F7) cycles the signal level in the reversed sequence.



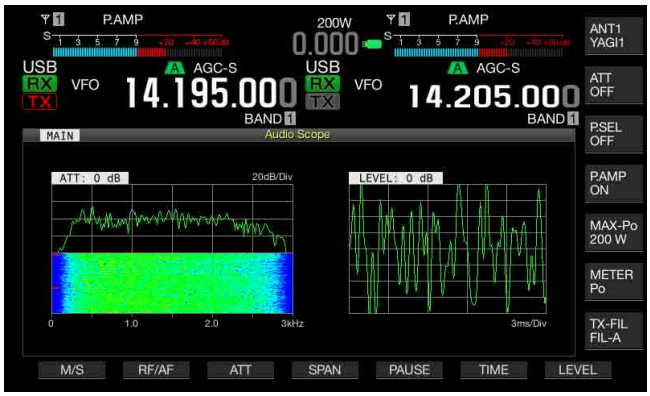
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CHANGING THE SWEEP TIME

If you change the oscilloscope sweep time, the time scale appearing on the oscilloscope changes. Following the conditions of the signal to observe, you can change the sweep time.



1 Press **[RF/AF]** (F2) on the **Bandscope** screen to open the **Audio Scope** screen.
If **[RF/AF]** (F2) is unavailable in the key guide for function keys, press **[MORE]** (F1) to alternate the key guide.



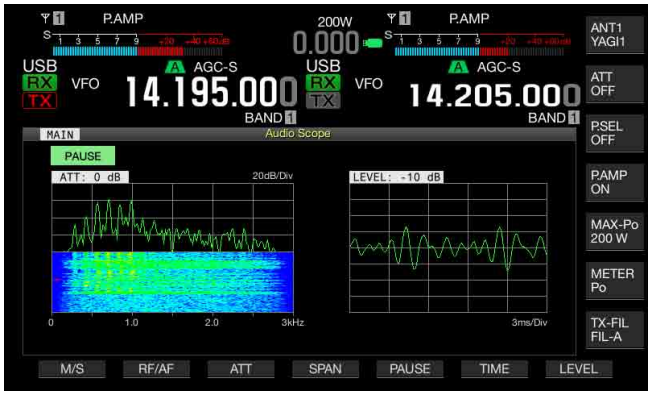
2 Press **[TIME]** (F6) to select the sweep time.
- Each time you press **[TIME]** (F6), the sweep time cycles as follows: 1 ms/Div > 3 ms/Div > 10 ms/Div > 30 ms/Div > 100 ms/Div > 300 ms/Div. The sweep time appears on the lower right side of the grid. The default is “100 ms/Div”.
- Each long press of **[TIME]** (F6) cycles the sweep time in the reversed sequence.

PAUSING THE AUDIO SCOPE AND OSCILLOSCOPE

If the waveform displayed in the **Audio Scope** screen is paused, the paused waveform will be kept on hold until **[PAUSE]** (F5) is pressed again. Pausing the screen allows you to analyze the waveform without interference from the screen continuously refreshing.

1 Press **[RF/AF]** (F2) on the **Bandscope** screen to open the Audio Scope screen.
If **[RF/AF]** (F2) is unavailable in the key guide for function keys, press **[MORE]** (F1) to alternate the key guide.

2 Press **[PAUSE]** (F5) to pause the displayed the waveform.
“PAUSE” appears while the waveform display is paused.



SELECTING THE AUDIO LINE FOR TRANSMISSION

There are audio lines to input the audio signal for transmission to the transceiver. According to your operating mode, you can select the audio line to enter the audio signal.

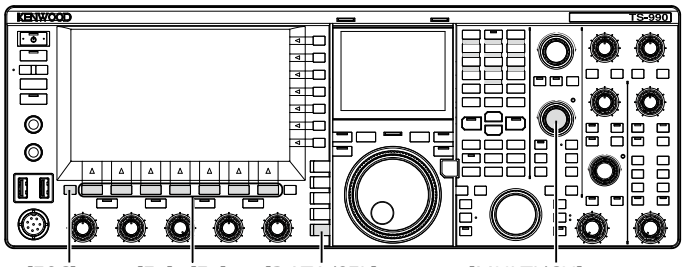
Location	Modulation Source	Overview
Front Panel	MIC	With "MIC" enabled, the voice signal spoken into the microphone is sourced to the transceiver.
Rear Panel	ACC2	With ACC 2 enabled, the audio signal sourced from the device connected to the **ACC 2** connector is processed.
	(USB-B)	With the USB Audio enabled, the audio signal from a PC is sent to the transceiver.
	OPTICAL IN	With OPTICAL enabled, the audio signal from the audio device with the optical digital terminal.

In SSB, USB, FM, FMN and AM modes, each press of **[DATA/SEL]** cycles through "Off" > "Data 1" > "Data 2" > "Data 3" > "Off", and three audio lines for the audio source can be configured.

SELECTING THE AUDIO SOURCE FOR TRANSMISSION BY SEND/PTT

The audio sourced from the **MIC** connector on the front panel of this transceiver or from the **ACC 2**, (USB-B), **OPTICAL IN** connectors can be configured for each transmit method.

- The audio modulation source when the front panel **[SEND]** or the **PTT** (microphone) switch is pressed
- The audio modulation source when the PF key for which "DATA SEND" was configured in Menu 0-15, "PF A: Key Assignment" to Menu 0-32, "Microphone UP: Key Assignment" is pressed



SELECTING THE AUDIO SOURCE TRNASMISSION BY SEND/PTT

The audio sourced from the **MIC** connector on the front panel of this transceiver or from the **ACC 2**, (USB-B), **OPTICAL IN** connectors is transmitted upon a press of **[SEND]** or the **PTT** (microphone) switch is pressed.

1 Press and hold **[DATA/SEL]** to open the **Modulation Source** screen.



2 Press [ ] (F2) or [ ] (F3) to select "SEND/PTT".

3 Press [ ] (F4) or [ ] (F5) to select the audio source.
You can select the audio source to transmit when **[SEND]** or the **PTT** (microphone) switch is pressed.

4 Press **[ON/OFF]** (F5) to enable the audio source.
The following table shows the default settings.

Status of DATA Mode	Modulation Source			
	MIC	ACC 2	USB Audio	OPTICAL
DATA Off	On	Off	Off	Off
DATA 1 to DATA 3	On	Off	Off	Off

5 Press **[ESC]**, or press and hold **[DATA/SEL]** to exit.

Note:

- The audio signal from the audio source will be transmitted by a press of **[SEND]** on the front panel or the **PTT** (microphone) switch.
- Both USB Audio and ACC 2 cannot be enabled at the same time. Enabling one will disable the other.

SELECTING THE AUDIO SOURCE FOR TRANSMISSION BY DATA SEND

You can transmit the audio sourced from the **MIC** connector, **ACC 2**, •⇢(USB-B), or **OPTICAL IN** connector when the PF key for which **[DATA SEND]** was assigned.

1 Press and hold **[DATA/SEL]** to open the **Modulation Source** screen.



2 Press [▲] (F2) or [▼] (F3) to select "DATA SEND".

3 Press [◀] (F4) or [▶] (F5) to select the audio source.
You can select the audio source to be transmitted upon a press of **[DATA SEND]**.

4 Press **[ON/OFF]** (F5) to enable the audio source.
The following table shows the default settings.

Status of DATA Mode	Modulation Source			
	MIC	ACC 2	USB Audio	OPTICAL
DATA Off	Off	On	Off	Off
DATA 1 to DATA 3	Off	Off	On	Off

5 Press **[ESC]**, or press and hold **[DATA/SEL]** to exit.

Note:

- The audio signal from the selected audio source will be transmitted by a press of **[DATA SEND]**. Refer to "CONVENIENT FUNCTIONS" for the method to assign "DATA SEND" to a PF key. {page 16-6}
- Both USB Audio and ACC 2 cannot be enabled at the same time. Enabling one disables the other.

VOX (VOICE-OPERATED TRANSMIT)

VOX is a function that allows you to transmit automatically while you are speaking into a microphone and to revert to the receive state when you stop speaking. After speaking into the microphone, pause momentarily to place the transceiver in the receive state.

Data VOX enables to transmit the data sourced from the connectors other than the **MIC** connector.

SWITCHING VOX (VOICE) ON OR OFF

In SSB, FM and AM modes, you can automatically transmit by simply speaking into the microphone.

1 Press **[VOX/SEL]** to enable or disable the VOX function.
The "VOX" LED lights green while the VOX is active.

Note:

- To transmit with VOX enabled, the audio from a microphone is transmitted regardless of the audio source configuration.
- If the transceiver cannot automatically receive with VOX enabled, reduce the VOX gain, increase the distance between the microphone and speaker or reduce the receive audio volume. Use headphones if the transceiver still cannot automatically receive.

SELECTING OR DISABLING THE AUDIO SOURCE FOR DATA VOX

In SSB, FM, or AM mode, the transceiver can automatically be in the transmit state by entering the minimum level or greater of the data transmit audio from the ANI terminal (**ACC 2** connector on the rear panel) or from •⇢ (USB-A or USB-B), or the **OPTICAL IN** connector. This function is called Data VOX.

Follow the procedure below to change the audio source to be used for Data VOX.

1 Press and hold **[DATA/SEL]** to open the **Modulation Source** screen.



2 Press **[D.VOX]** (F7) to select the audio source for Data VOX.

- Each key press cycles the audio source for Data VOX as follows: Off (no audio source for Data VOX) > ACC 2 > USB Audio > Optical > Off.
- The default is "Off".
- "Off", "ACC 2", "USB" or "OPT." appears on the right side of "D.VOX" on upper side of the main screen.

3 Press **[ESC]**, or press and hold **[DATA/SEL]** to exit.

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Note:

- If the audio source with Data VOX disabled is selected if the transceiver is left connecting to a PC, the transceiver may occasionally be placed in transmit state by the signal from the audio source.
- If you leave the transceiver connected to the audio source, you must disable the audio source for Data VOX.
- If **"DATA VOX"** is assigned to a PF key, the audio source can be changed with a press of the key. {page 16-6}

ADJUSTING THE VOX GAIN

VOX Gain for the VOX function (Voice) allows you to adjust the VOX Gain following the volume of audio sourced from the MIC connector and the ambient noise conditions.

Data VOX for the data allows you to adjust the VOX Gain of the data sourced from the ANI terminal of the **ACC 2** connector and from the ⇔ (USB-A and USB-B) and **OPTICAL IN** connectors on the rear panel.

■ VOX Function (Voice)

VOX will operate correctly if you adjust the VOX gain level so that the audio from the **MIC** but not the ambient noise level keys the transmitter.

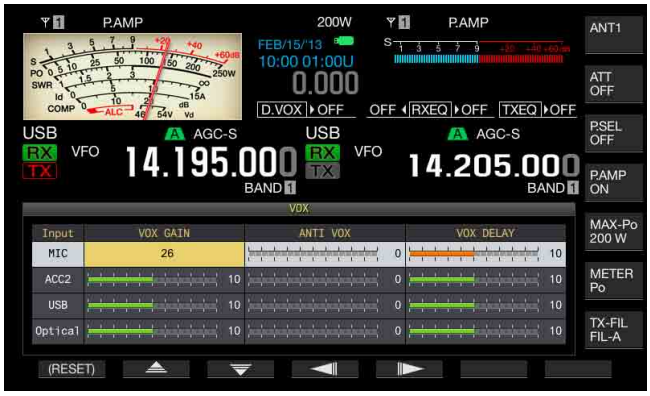
1 Speak into a microphone and rotate the **[VOX GAIN]** control to adjust the VOX gain.
You can adjust the VOX gain enabling the transceiver to reliably transmit each time you speak into the microphone. Rotate the **VOX GAIN** control clockwise to increase the sensitivity level, allowing VOX to recognize even a soft-spoken voice. The VOX function may occasionally be activated by background noise.

Note:

- Pressing and holding **[VOX/SEL]** also opens the **VOX** screen. You can adjust the VOX gain level of a signal input from the **MIC** jack in the range of "0" to "255".
- In this configuration, you can adjust the VOX level for the audio sourced from the **MIC** jack. Even if the audio source is selected for Data VOX in the **Modulation Source** screen, the parameter configured for VOX Gain cannot be applied.

■ Data VOX

1 Press and hold **[DATA/SEL]** to open the **VOX** screen.
In the VOX screen, a line highlights the selected audio source, and a row highlights the selected configuration item.



2 Press [▲] (F2) or [▼] (F3) to select the row for the audio source.
You can select from "ACC 2", "USB" and "Optical" row for the audio line to be adjusted.

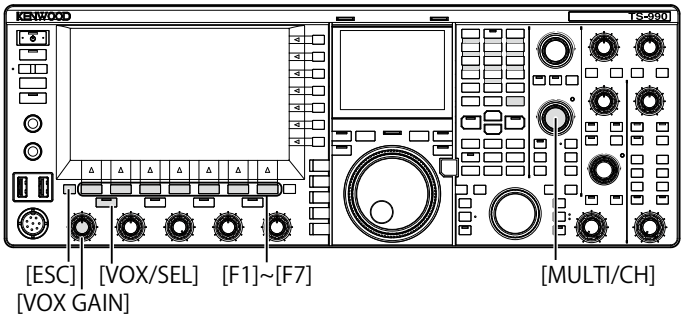
3 Press [◀] (F4) or [▶] (F5) to select the line for "VOX GAIN".

4 Press **[-]** (F6) or **[+]** (F7), or rotate the **MULTI/CH** control to adjust the VOX level.
- Applying the audio signal from the modulation source selected in step 2, you can select the VOX level to allow the transceiver to transmit by receiving an audio signal.
- Available range is "0" to "20" (in steps of 1). The default is "10".

5 Press **[ESC]**, or press and hold **[VOX/SEL]** to exit.

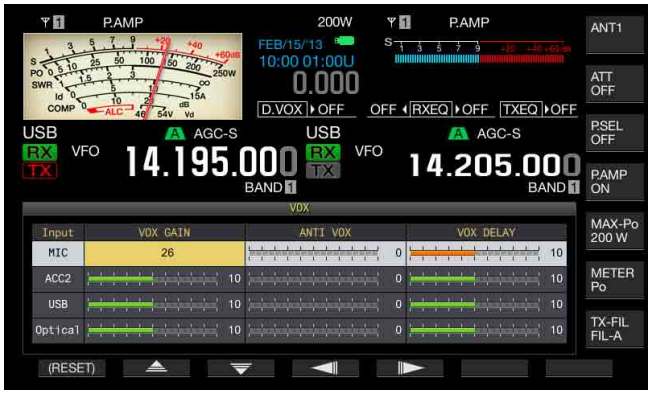
ADJUSTING THE VOX DELAY TIME

There may be times when the transceiver reverts to the receive state during transmission of audio signal and data with the VOX function or when the end of your conversation or data is interrupted and cannot be transmitted. To avoid such problems, reserve the delay time so that the transceiver does not immediately revert to the receive state.



■ VOX Function (Voice)

1 Press and hold **[VOX/SEL]** to open the **VOX** screen.
In the **VOX** screen, a line highlights the selected audio source, and a row highlights the selected configuration item.



2 Press [▲] (F2) or [▼] (F3) to highlight a line for Microphone.
The parameter box becomes active, and the parameter can be changed.

3 Press [◀] (F4) or [▶] (F5) to select the line for "VOX DELAY".
The parameter box becomes active, and the parameter can be changed.

4 While you are speaking into the microphone, press **[-]** (F6) or **[+]** (F7), or rotate the **MULTI/CH** control to adjust the VOX Delay Time.
Adjusts the VOX delay time for when to revert to the receive state after you stop speaking.

Available Range is “Off” or from “1” to “20” (in steps of 1). The default is “10”.

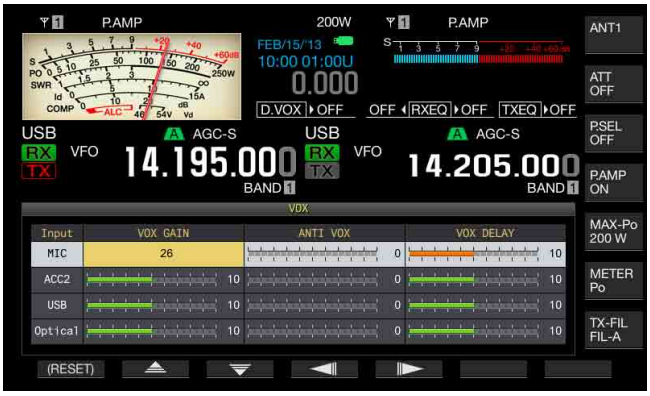
5 Press **[ESC]**, or press and hold **[VOX/SEL]** to exit.

Note:

- Even if the audio source is configured for Data VOX in the **Modulation Source** screen, the same delay time adjusted for the VOX delay time will be applied to the Data VOX delay time.
- The configurations described above does not apply to Data VOX.

■ Data VOX

1 Press and hold **[VOX/SEL]** to open the **VOX** screen.
In the **VOX** screen, a line highlights the selected audio source, and a row highlights the selected configuration item.



2 Press [▲] (F2) or [▼] (F3) to select the row for the audio source.
You can select from “ACC 2”, “USB” and “Optical” row for the audio line to be adjusted.

3 Press [◀] (F4) or [▶] (F5) to select the line for “VOX DELAY”.

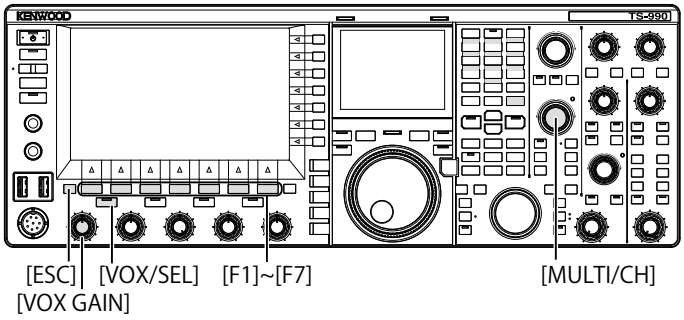
4 Press **[-]** (F6) or **[+]** (F7), or rotate the **MULTI/CH** control to select the delay time.
- Sourcing the audio signal from the audio source selected in step 2, you can adjust the delay time to revert to the receive state after finishing the entry of audio signal.
- Available range is “0” to “20” (in steps of 1). The default is “10”.

5 Press **[ESC]**, or press and hold **[VOX/SEL]** to exit.

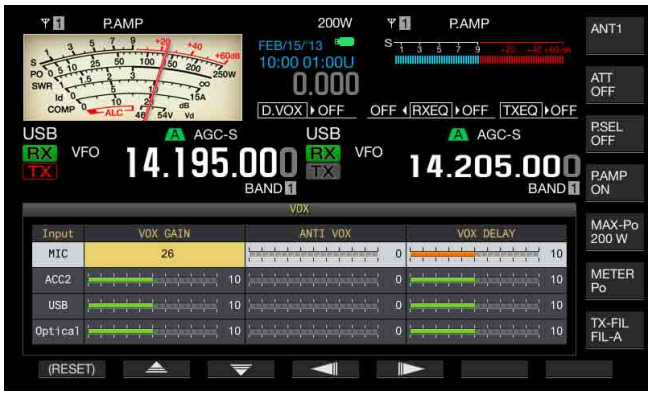
ADJUSTING THE ANTI VOX GAIN LEVEL

While VOX is active, sound from not only the microphone but also from the speaker may cause VOX to start transmitting. The transceiver will transmit if the speaker volume is set too high. Adjust the anti-VOX level based on the sound from the speaker and set a lower limit of audio to activate the VOX function to avoid accidental transmission.

Operations for the VOX function (Voice) and Data VOX are identical.



1 Press and hold **[VOX/SEL]** to open the **VOX** screen.
In the **VOX** screen, a line highlights the selected audio source, and a row highlights the selected configuration item.



2 Press [▲] (F2) or [▼] (F3) to select the row for the audio source.

3 [◀] (F4) or [▶] (F5) to highlight a column for ANTI VOX.
The parameter box becomes active, and the parameter can be changed.

4 Press **[-]** (F6) or **[+]** (F7), or rotate the **MULTI/CH** control to adjust the sensitivity of the Anti VOX Gain.
- Adjust the sensitivity of the anti-VOX level so that the sound from the speaker does not result in transmitting.
- Available range is “0” to “20” (in steps of 1). A smaller value will be more susceptible to the sound of the speaker.
- The following table shows the default settings.
  - MICROPHONE (MIC): 10
  - ACC 2: 0
  - USB: 0
  - OPTICAL: 0

5 Press **[ESC]**, or press and hold **[VOX/SEL]** to exit.

Note:

- If a set of headphones is connected to the **PHONES** connector, the sound from a speaker does not activate the VOX function to transmit regardless of configurations for the audio line and Anti VOX Level.
- Anti VOX Gain for the audio sources other than Data VOX can be adjusted. {page 9-4}

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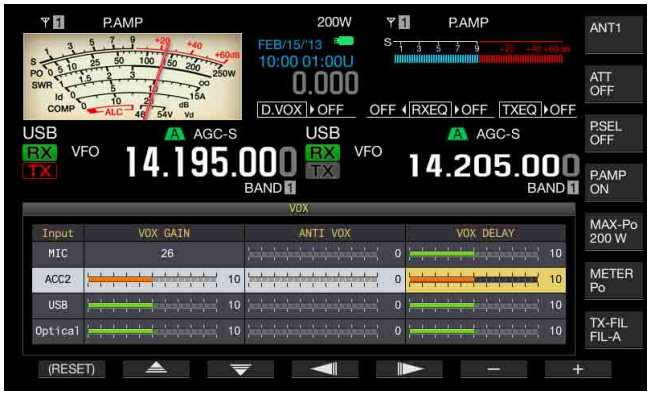
DELAYING THE AUDIO SIGNAL

While using VOX, there is a time lag between the time you start talking on the microphone and the time the transceiver begins transmitting. As a result, speech clipping may occur. To prevent this as much as possible, set a VOX voice delay time (a time lag) to transmit the audio signal after the transceiver is placed into a transmit state.

1 Select Group No. 6, “TX/RX Filters & Misc”, from the **Menu** screen.

2 Access Menu 09, “VOX Voice Delay (Microphone)”.
If anything other than Microphone is configured for the audio source for transmission, you must access to Menu 10, “VOX Voice Delay (Except Microphone)”. {page 9-1}

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



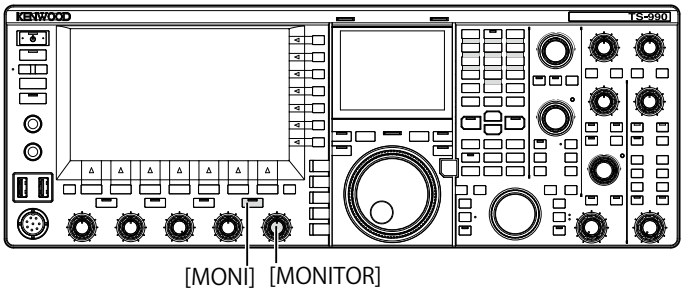
4 Press [▲] (F2) or [▼] (F3) to select the VOX Voice Delay Time.
- Select “Off”, “Short”, “Medium”, or “Long”.
- The default is “Medium”.

5 Press [↵] (F1).

6 Press **[MENU]** to exit.

TX MONITOR

You can monitor the audio during transmission. This function is convenient when you check the effectiveness of the speech processor or TX DSP equalizer. In FSK and PSK modes, you can monitor FSK and PSK signals to be transmitted from the transceiver.



1 Press **[MONI]** to enable or disable the transmit monitor.
The "MONI" LED lights green while the TX monitor is active.

ADJUSTING THE TX MONITOR LEVEL

With this transceiver, you can adjust the monitor level of the transmission audio.

1 Rotate the **MONITOR** control to adjust the volume level of the TX Monitor.

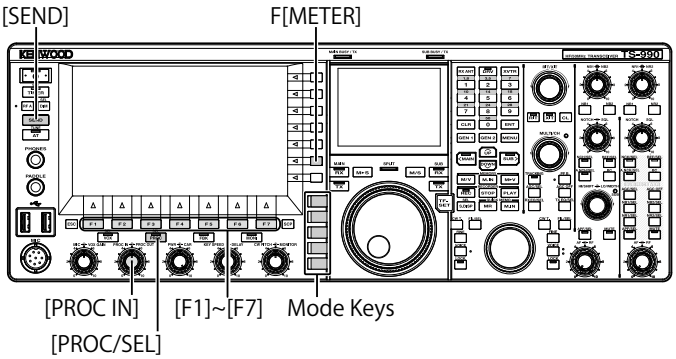
Note:

- In SSB, AM and FM modes, an acoustic feedback may result while the speaker is in use. Use a set of headphones, instead.
- The transmission of the CW message cannot be monitored using the TX monitor. You can monitor a CW transmission using CW sidetone.
- In FM, FSK and BPSK mode, the audio in the TX monitor differs from the audio signal actually transmitted.
- This transceiver has an RF monitor that demodulates the modulated waves while in SSB and AM modes and an AF monitor while in FM, FSK and PSK modes. The audio in the AF monitor differs from the audio actually transmitted.

SPEECH PROCESSOR

In SSB mode, the audio level of the transmitting transceiver reflects the level of the transmit power and propagates to the receiving transceiver; hence, the audio quality degrades on the receiving transceiver. With a speech processor enabled, the signal is compressed by means of the digital signal processing and transmitted after the average transmit power is increased.

In AM and FM modes, the degree of modulation is stabilized regardless of the audio level of the transmitting transceiver, resulting in an improvement in readability.





SPEECH PROCESSOR

1 Press a mode key to select SSB, AM, or FM mode.

2 Press **[PROC/SEL/SEL]** to enable or disable the Speech Processor.
The "PROC/SEL" LED lights green while the speech processor is active.

Note:

♦ The speech processor can function for the audio signal from the ANI terminal of the **ACC 2** connector or from the ⇔ (USB-B) connector on the rear panel.

ADJUSTING THE SPEECH PROCESSOR INPUT LEVEL

1 Press a mode key to select SSB, AM, or FM mode.

2 Press **[PROC/SEL]** to enable or disable the Speech Processor.

3 Press **[METER]** (F) to display the compression level meter (COMP).



Note:

♦ The **[METER/COMP]** (F) key appears only if the speech processor is active (the "PROC" LED is lit).

4 Press **[SEND]**, or press down the **PTT** (microphone) switch.
The transceiver is placed into the transmit state.

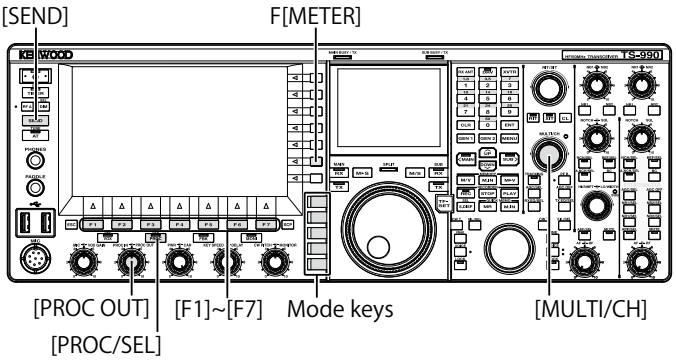
5 While you are speaking into a microphone, rotate the **PROC IN** control to adjust the compression level.
While observing the compression level from the compression level meter (COMP), adjust the input level to the speech processor. The readability will drop if the compression level is excessively high.

Note:

♦ Speech Processor Input Level allows you to adjust the input level of the mixed audio from the audio sourced as configured for Mic Gain and the audio source configured in the **Modulation Source** screen.

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ADJUSTING THE SPEECH PROCESSOR OUTPUT LEVEL



1 Press one of mode keys to enter SSB or AM mode.

2 Press **[PROC/SEL]** to enable or disable the Speech Processor.

3 Press **[METER/ with Meter name]** (F) to select "METER/ALC".

- If "Type 2" or "Type 3" is configured for Meter Type, each key press cycles the key name as follows: "METER/ALC" > "METER/Vd" > "METER/Po" > "METER/SWR" > "METER/Id" > "METER/COMP" > "METER/ALC". Select the "METER/ALC" function key.
- The meter on the main screen will work as a transmit power level meter (ALC).



4 Press **[SEND]**, or press down the **PTT** (microphone) switch.
The transceiver is placed into the transmit state.

5 While you are speaking into a microphone, rotate the **PROC OUT** control to adjust the output level.
You can adjust the output level so that the meter needle will swing more or less.

Note:

- If you excessively increase the output level, the transmit signal may be distorted resulting in the deterioration of the waveform.
- Output level of the speech processor is applied to both the audio entered from a microphone and the audio source configured in the **Modulation Source** screen.
- In FM mode, the output level of speech processor is fixed, and you cannot change the level.

ADJUSTING THE EFFECT OF THE SPEECH PROCESSOR

You can configure how to process the transmit signal with the speech processor. You can select either "Hard", which prioritizes an increase in the mean transmit power in spite of the distortion that may be left in the transmit signal, or "Soft", which has a smaller effect but less distortion may occur.

1 Press and hold **[PROC/SEL]** to open the **Speech Processor Effect** screen.



2 Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to select the desired effect of the speech processor.
You can select "Hard" or "Soft".

3 Press **[ESC]**, or press and hold **[PROC/SEL]** to exit.

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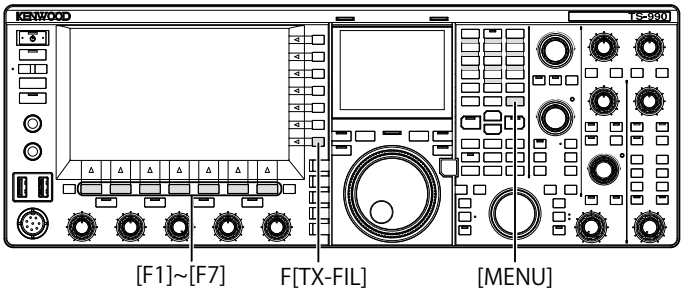
TRANSMIT FILTER

You can configure three different TX filters for operation in SSB, AM, and FM modes, respectively. Change the filter according to your operating status.

For example, if a wide-band TX filter and narrow-band TX filter are installed in the transceiver, you can select the narrow-band TX filter for the readability improvement in DX hunting and contests or the wide-band TX filter for rag-chewing.

Note:

- You can use the TX filter in the manner not to violate the laws and regulations relating to the occupation of the bandwidth in the SSB mode.



SELECTING A TX FILTER

1. Press a mode key to select SSB, AM, FM, SSB-DATA, or FM-DATA mode.
2. Press **[TX-FIL]** (F) to select a TX Filter.
   Each time you press **[TX-FIL]** (F), the filter cycles as follows:
   FIL-A > FIL-B > FIL-C



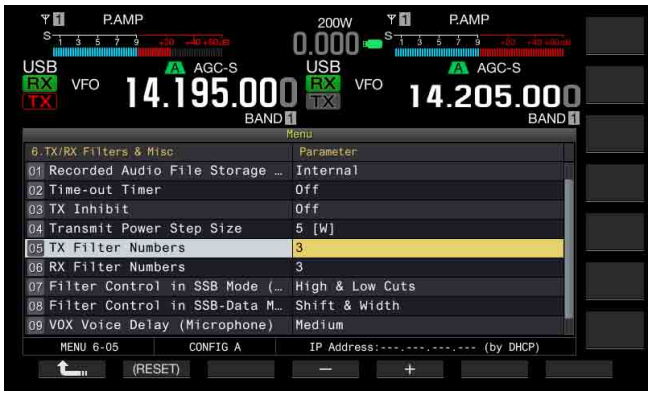
Note:

- If “2” is selected for Menu 6-05, “TX Filter Numbers”, you can select “FIL-A” or “FIL-B”.

CHANGING THE NUMBER OF AVAILABLE TX FILTERS

You can change the number of available TX filters.

1. Select Group No. 6, "TX/RX Filters & Misc", from the **Menu** screen.
2. Access Menu 05, "TX Filter Numbers".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.

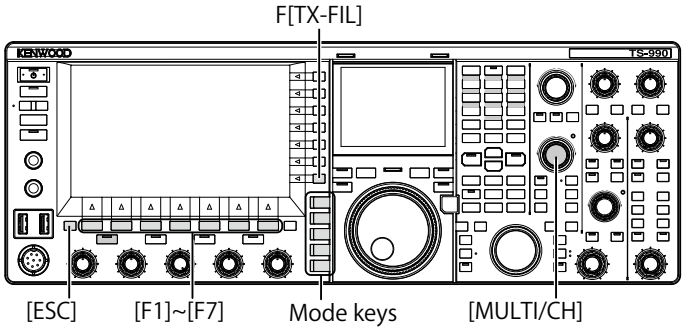


4. Press **[-]** (F4) or **[+]** (F5) to select the number of available TX Filters.
   The default is "3".
5. Press **[ ]** (F1).
6. Press **[MENU]** to exit.

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CHANGING THE BANDWIDTH OF THE TX FILTER

The transceiver is equipped with TX filters A to C. You can change the bandwidth for SSB, AM and FM modes independently. You can select a TX filter optimal to the selected operating mode.



1 Press a mode key to select SSB, AM, FM, SSB-DATA, or FM-DATA mode.

2 Press and hold **[TX-FIL]** (F) to open the **TX Filter** screen.



3 Press **[TX-FIL]** (F2) to select a TX Filter.
Each time you press **[TX-FIL]** (F2), the filter cycles as follows: FIL-A > FIL-B > FIL-C.

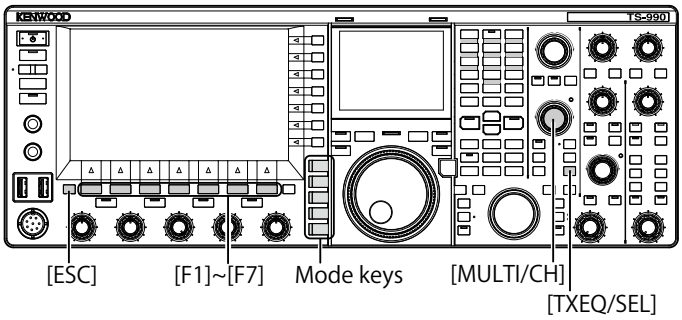
4 Press **[LO/HI]** (F3) to select the cutoff frequency.
You can select the low-cut frequency or the high-cut frequency.

5 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the low cutoff frequency and the high cutoff frequency.
- Each time you press **[-]** (F4) or **[+]** (F5) or rotate the **MULTI/CH** control one step, the bandwidth cycles as follows: Rotate the **MULTI/CH** control counterclockwise to cycle the cutoff frequencies in the reverse sequence.
  Low Cut: 10, 100, 200, 300, 400, 500 Hz
  High Cut: 2500, 2600, 2700, 2800, 2900, 3000, 3500, 4000 Hz
- The default is 300 Hz for the low-cut frequency and 2700 Hz for the high-cut frequency.

6 Press **[ESC]**, or press and hold **[TX-FIL]** (F) to exit.

TX DSP EQUALIZER

The Digital signal processing (DSP) allows you to change the frequency characteristics of the transmitting audio signal. This function makes it possible to correct the frequency characteristics of the microphone and audio transmission quality according to your voice characteristics and preference.



SWITCHING THE TX DSP EQUALIZER ON OR OFF

1 Press a mode key to select SSB, AM, or FM mode.

2 Press **[TXEQ/SEL]** to enable or disable the TX DSP Equalizer.
"TXEQ▷nnn" appears while the TX DSP equalizer is active (refer to the list below for the "nnn" display). "TXEQ▷OFF" appears while the TX DSP equalizer is inactive.
- TXEQ▷HB1: High Boost 1 is selected
- TXEQ▷HB2: High Boost 2 is selected
- TXEQ▷FP: Formant Pass is selected
- TXEQ▷BB1: Bass Boost 1 is selected
- TXEQ▷BB2: Bass Boost 2 is selected
- TXEQ▷C: Conventional is selected
- TXEQ▷U1 - U3: User 1, 2, or 3 is selected



Note:

♦ The TX DSP equalizer will be inactive automatically if the transceiver enters a mode other than SSB, AM or FM.

SELECTING THE FREQUENCY CHARACTERISTICS OF THE TX DSP EQUALIZER

The transceiver is equipped with six types of frequency characteristics for the TX DSP equalizer. In addition, three types of frequency characteristics are available, each of which can be changed according to your preference. Select a frequency characteristic as follows.

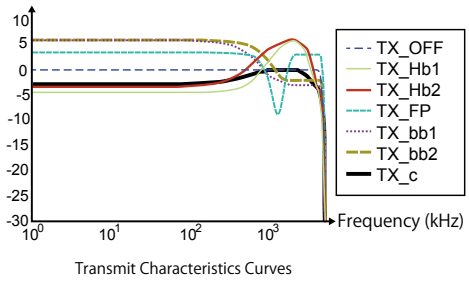
1 Press a mode key to select SSB, AM, or FM mode.

2 Press and hold **[TXEQ/SEL]** to open the **TX Equalizer** screen.



3 Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to select the desired characteristics of the speech processor.
You can select the desired option from the equalizer effects as shown in the table below.

Effect	Purpose
High Boost 1 (High-pass boost 1)	High-pass frequency components are emphasized. This configuration is effective for audio that contains low-pass frequency components.
High Boost 2 (High-pass boost 2)	High-pass frequency components are emphasized. This configuration provides characteristics that halve the low-pass attenuation level of High Boost 1.
Formant Pass (Formant pass)	This configuration attenuates frequency components outside the audio band, thus providing legible characteristics.
Bass Boost 1 (Low-pass boost 1)	Low-pass frequency components are emphasized. This configuration is effective for audio that contains high-pass frequency components.
Bass Boost 2 (Low-pass boost 2)	Low-pass frequency components are emphasized. This configuration provides characteristics that further emphasize the low-pass band, compared with Bass Boost 1.
Conventional (Pseudo-analog characteristics)	The frequency domain ranging from 600 Hz and above is emphasized by 3 dB. This configuration is suitable for communication characteristics that loosely attenuate low-pass frequency components.
User 1 (User Configuration 1)	You can save your preferred frequency characteristics as User 1, User 2 and User 3. The default is the flat characteristics.
User 2 (User Configuration 2)	
User 3 (User Configuration 3)	

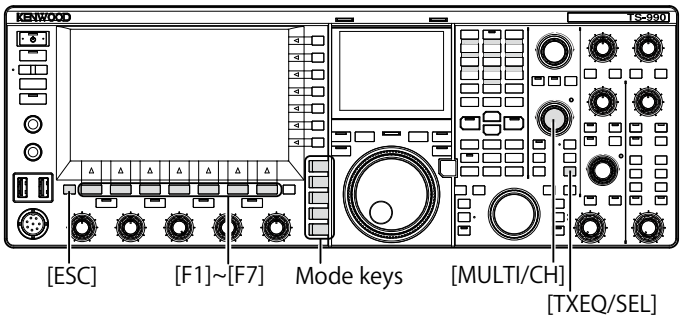


Transmit Characteristics Curves

4 Press **[ESC]**, or press and hold **[TX-FIL]** (F) to exit.

ADJUSTING THE TX DSP EQUALIZER

You can adjust the frequency characteristic using the TX DSP equalizer to reach your preferred audio quality.



1 Select SSB, AM, or FM mode on the transmit mode.

2 Press and hold **[TXEQ/SEL]** to open the **TX Equalizer** screen.



3 Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to select the desired characteristics.

4 Press **[ADJ]** (F4) to open the **TX Equalizer** screen.



5 Press [◀] (F3) or [▶] (F4) and select the

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target frequency to be adjusted.

6 Press **[-]** (F5) or **[+]** (F6), or rotate the **MULTI/CH** control to select the level for each frequency band.
Press and hold **[(RESET)]** (F2) to revert all frequency levels to their defaults.

7 Press **[ESC]**, or press and hold **[TXEQ/SEL]** to exit.
Press [ ] (F1) to revert to the **TX Equalizer** screen.

Note:

- The configurations for other frequency characteristics than User 1 to User 3

COPYING THE CONFIGURATION DATA FOR THE TX DSP EQUALIZER

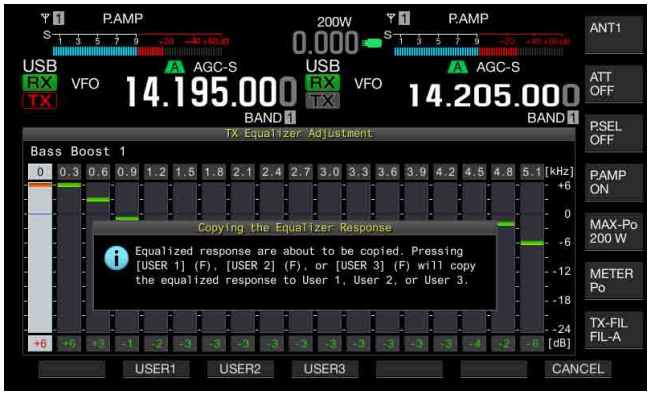
After adjust the TX Equalizer according to your preference, you can copy and save the configuration data as the user.

1 Press and hold **[TXEQ/SEL]** to open the **TX Equalizer** screen.



2 Press [ ] (F2) or [ ] (F3), or rotate the **MULTI/CH** control to select the desired characteristics of the speech processor.

3 Press **[COPY]** (F5) to copy the configuration data.
A message notifying you about how to specify the destination of the copied configuration data appears.



4 Press **[USER1]** (F2), **[USER2]** (F3), or **[USER3]** (F4) to specify the target to copy the configuration data.

- The data copying the configurations for TX DSP equalizer is complete and the **TX Equalizer** screen reappears.
- Pressing **[CANCEL]** (F7) reverts to the **TX Equalizer** screen without reading the configuration data.

In the following procedure, you can edit and copy the configuration data for TX DSP equalizer.

1 Press and hold **[TXEQ/SEL]** to open the **TX Equalizer** screen.

2 Press [ ] (F2) or [ ] (F3), or rotate the **MULTI/CH** control to select the desired characteristics of the speech processor.

3 Press **[ADJ]** (F4) to open the **TX Equalizer** screen.
For the adjustment of the TX DSP equalizer, refer to "ADJUSTING THE TX DSP EQUALIZER". {page 9-10}

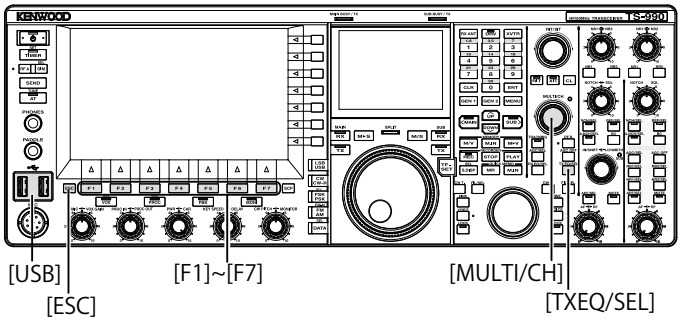
4 Press **[COPY]** (F7) to start a copy.
A message prompting you to ensure the destination of the copy appears.

5 Press **[USER1]** (F2), **[USER2]** (F3), or **[USER3]** (F4) to specify the target to copy the configuration data.

- The data copying the configurations for TX DSP equalizer is complete and the **TX Equalizer** screen reappears.
- Pressing **[CANCEL]** (F7) returns you to the TX Equalizer screen without copying the configuration data.

SAVING THE CONFIGURATION DATA FOR THE TX DSP EQUALIZER

You can write the configuration data for the TX DSP equalizer onto a USB flash drive.



1 Press and hold **[TXEQ/SEL]** to open the **TX Equalizer** screen.

2 Insert a USB flash drive, which has been formatted by the transceiver, into the ⇔ (USB-A) connector.
After the USB flash drive has been correctly recognized, "" appears on the main screen.

3 Press [ ] (F2) or [ ] (F3), or rotate the **MULTI/CH** control to select the desired characteristics of the speech processor.



4 Press **[SAVE]** (F7) to save the configuration data.

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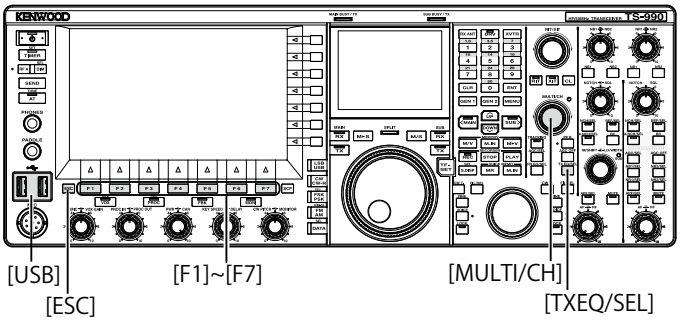
5 Press **[OK]** (F4) to exit.

Note:

- The saved file is named with the year, month, day, hour, minute and second. Also, the extension is ".equ".
  Example: In the case of 30 seconds past 10:20, February 15, 2013, the saved file name would look like: 20130215_102030.equ
- The name of the storage folder is as follows:
  KENWOOD/TS-990/SETTINGS/TX_EQ
- You must remove a USB flash drive after executing the Safe Removal of USB Flash Drive. {page 12-1}

READING THE CONFIGURATION DATA FOR THE TX DSP EQUALIZER

You can read the configuration data for the TX DSP equalizer from a USB flash drive.



1 Press and hold **[TXEQ/SEL]** to open the **TX Equalizer** screen.



2 Insert a USB flash drive, for which data files have been saved, into the •⇆ (USB-A) connector.
Once the USB flash drive is distinguished, the "▭" icon appears at the center top of the main screen.

3 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the type of equalizer to which configuration data read from a USB flash drive will be applied.

4 Press **[READ]** (F6) to open the **File (TX EQ)** screen.

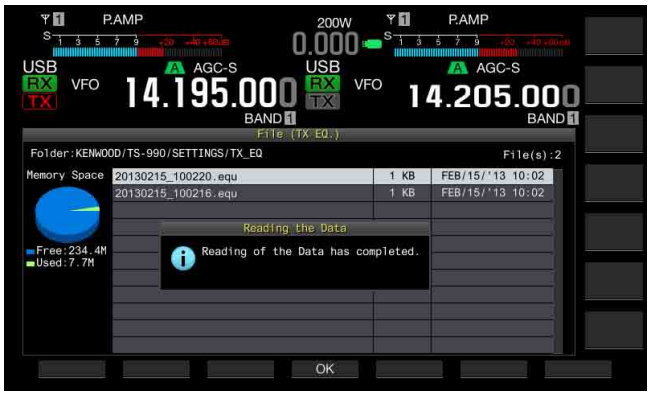
- The File (TQ EQ) screen appears.
- Pressing **[CANCEL]** (F7) returns you to the **TX Equalizer** screen without selecting the configuration data.
- Pressing **[DELETE]** (F6), a message prompting you to ensure the deletion of the file appears. Pressing **[OK]** (F4) deletes the file.
- Pressing **[NAME]** (F5) enables you to rename the configuration data. {page 12-4}



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5 Press [▲] (F2) or [▼] (F5), or rotate the **MULTI/CH** control to select the desired file.

6 Press **[OK]** (F4) to start reading the configuration data.
- A message notifying you of the progress will appear. After the configuration data has been read, another message notifying you that the configuration data has been read will appear.
- Pressing **[CANCEL]** (F7) returns you to the **TX Equalizer** screen without reading the configuration data.



7 Press **[OK]** (F4).

8 Press **[ESC]** to exit.

Note:
- You must remove a USB flash drive after executing the Safe Removal of USB Flash Drive. {page 12-1}
- If TX Equalizer type selected at step 3 differs from the equalizer type linked to the file to be read, the configuration data for TX Equalizer selected at step 3 will be overwritten with the configuration data for TX Equalizer to be read.

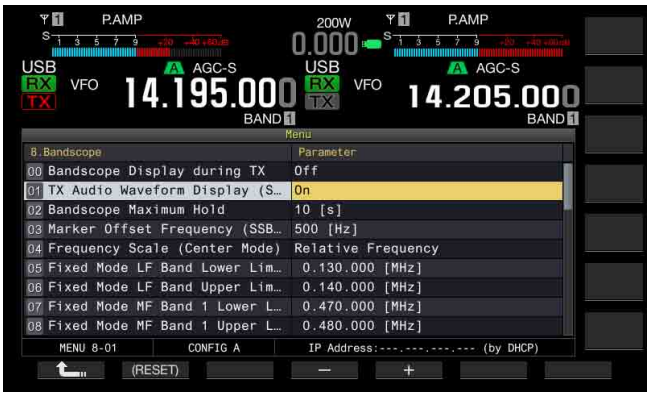
DISPLAYING THE SUBSCOPE DURING TX

You can display the waveform on the subscope also displaying the band width of TX filter while transmitting in SSB, FM, or AM mode. This enables you to observe the status of the transmitting audio.

1 Select Group No. 8, "Bandscope", from the **Menu** screen.

2 Access Menu 01, "TX Audio Waveform Display (Sub Screen)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On" (to display the waveform on a sub scope.
The default is "On".

5 Press [↩] (F1).

6 Press **[MENU]** to exit.



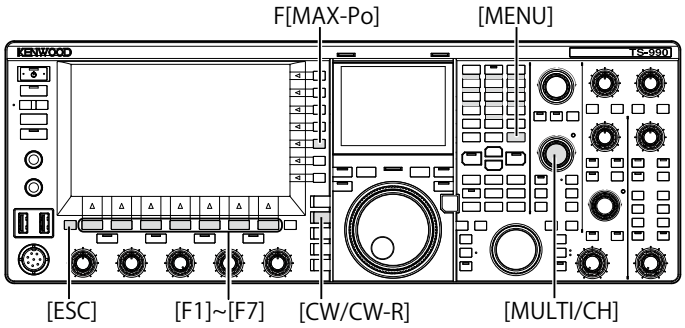
The Sub Scoop with Waveform displayed

Note:
- While in transmitting, the configuration for Menu 8-01 cannot be changed.
- The marker representing the center frequency of the notch filter or the band elimination filter.
- Waveform does not appear on the subscope while an audio scope is active in the main screen.

TX TUNING

This function continuously transmits a carrier at a certain level of output regardless of the current transmission mode. This is useful to adjust an external antenna tuner or linear amplifier.

It will be convenient if TX tuning (TX Tune) has been assigned to a PF key. Refer to "PF (Programmable Function" for further details. {page 16-6}



1 Press the PF key to which TX tuning is assigned.
- A continual carrier in CW mode is transmitted.
- "TX TUNE" appears.
- The meter indication switches to the SWR.

2 Press the PF key to which TX tuning is assigned, again.
Transmission is interrupted and the transceiver reverts to the previous mode.

ADJUSTING THE TRANSMIT POWER FOR TX TUNING

1 Press **[MAX-Po]** (F) to open the **TX Output Limit** screen.



2 Press [◀] (F4) or [▶] (F5) to highlight a line for a frequency band.
The configuration can be changed in the selected line for a frequency band.

3 Press [▲] (F2) or [▼] (F3) to select "TX Tune Power".

4 Press **[-]** (F6) or **[+]** (F7), or rotate the **MULTI/CH** control to select the transmit power.
- The default is "10W".
- Press and hold **[(RESET)]** (F1) to reset the parameter for the selected item to its default.

5 Press **[ESC]** or **[MAX-Po]** (F) to exit.

Note:

♦ Once TX tuning begins, the wattage displayed inside the key guide of **[MAX-Po]** (F) on the right side of the main screen is replaced by the value configured for the transmit power during the TX tuning (TX Tune Power).

TIME-OUT TIMER (TOT)

The Time-out Timer is a function to stop transmission and forcibly place the transceiver into a receive state if the length of time configured for transmitting exceeds the preconfigured length of time.

1 Select Group No. 6, "TX/RX Filters & Misc", from the **Menu** screen.

2 Access Menu 02, "Time-out Timer".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the maximum transmit time.
Available options are "Off", "3 [min]", "5 [min]", "10 [min]", "20 [min]", and "30 [min]". The default is "Off".

5 Press [↩] (F1).

6 Press **[MENU]** to exit.

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10 MEMORY CHANNELS

MEMORY CHANNEL

This transceiver has 120 memory channels and operating data can be configured for each channel.

There are three types of Memory Channels in 120 Memory Channels, and have the channel number from 00 to 99, P0 to P9, and E0 to E9 following the type. The outline of the Memory Channels is as follows:

- 00 to 99: Typical Memory Channels to which you can configure frequently used operating data.
- P0 to P9: Program Memory Channels to which you can configure the frequency range for the programmable VFO or the program scan.
- E0 to E9: Extensive Memory Channels which you can use the same as typical Memory Channels.

There are two types of memory modes for typical Memory Channels and extensive Memory Channels: single-band Memory Channel mode and dual-band Memory Channel mode.

- Single-band Memory Channel mode: Mode to which the information (simplex frequency, etc.) for operation in either the main band or the sub band are configured.
- Dual-band Memory Channel mode: Mode to which the operating data for the operation (split frequency, dual frequencies reception, transmit frequency during split operation) using the main band and the sub band simultaneously can be configured.

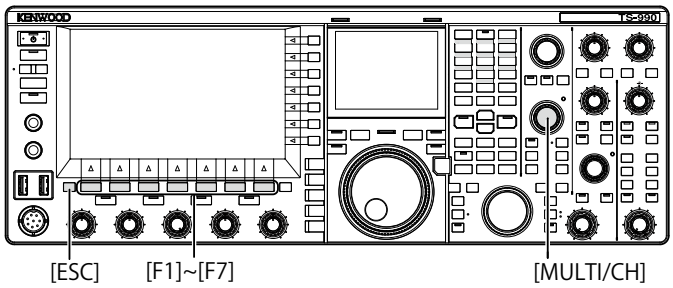
The following data can be configured in each memory channel.

Operating Data	Channel		
	00 to 99	P0 to P9	E0 to E9
RX Frequency	Yes	Yes (Simplex)	Yes
TX Frequency	Yes		Yes
Receive Mode	Yes	Yes (Simplex)	Yes
Transmit Mode	Yes		Yes
Operation category of this transceiver (split operation or dual-band reception)	Yes	No	Yes
Start Frequency	No	Yes	No
End Frequency	No	Yes	No
Tone, CTCSS cross tone	Yes	Yes	Yes
Tone Frequency	Yes	Yes	Yes
CTCSS Frequency	Yes	Yes	Yes
Memory Name	Yes	Yes	Yes
Lockout	Yes	Yes	Yes

DISPLAYING THE MEMORY CHANNEL LIST

The memory channel configurations can be displayed on the **Memory Channel List** screen. In the **Memory Channel List** screen, you can select a channel to configure the operating data or channel to operate.

You can assign a name to a Memory Channel.



You can select a memory channel in the **Memory Channel List** screen.

1 Press **[M/V]** to enter single-band Memory Channel mode or press and hold **[M/V]** to enter dual-band Memory Channel mode.

2 Press **[M.LIST]** (F7) to open the **Memory Channel List** screen.
- The selected Memory Channel is highlighted in white. During the configuration of a Memory Channel, it is highlighted in pink.
- Press **[EXTEND]** (F7) to extend the **Memory Channel** screen. Press **[EXTEND]** (F7) again to revert the screen area to its original size.



3 Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to select a Memory Channel.

4 Press **[ESC]** to exit.

Note:

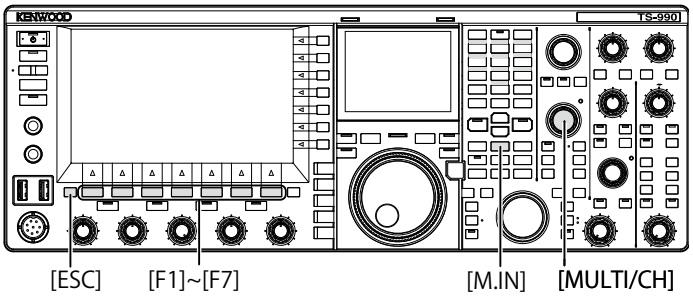
♦ You can view the Memory Channel List in VFO mode without pressing or holding **[M/V]**.

The following operating data appear on the **Memory Channel List** screen.

Items	Description
Channel	The channel code below appears. 00 to 99: Typical Memory Channels P0 to P9: Program Memory Channels E0 to E9: Extensive Memory Channels
Type	The Memory Channel type appears. S: Single-band Memory Channels D: Dual-band Memory Channels P: Program Memory Channels
Frequency 1	You can configure operating data such as the frequency and operating mode to be used in the main band or the sub band for single-band Memory Channels. You can configure the frequency and operating mode to be used as the main band frequency for Dual-band Memory Channels. You can configure the start frequency that specifies the start point of the program and the operating mode for Program Memory Channels.
Frequency 2	Nothing appears for Single-band Memory Channels. You can configure the frequency and operating mode to be used as the sub band frequency for Dual-band Memory Channels. You can configure the end frequency that specifies the end point of the program and the operating mode for Program Memory Channels.
TX/RX Func.	You can view the operating category of the transceiver for Dual-band Memory Channels. Nothing appears for Single-band Memory Channels. SPLIT: Split Operation DUAL RX: Dual-band Receive Operation SPLIT/DUAL: Displayed when receiving with transmit frequency during split operation (TF watch).
NAME	Displays the Memory Channel name.
L.OUT	Displays the lockout status of each Memory Channel. The channels with check marks are not subject to the memory scan.

CONFIGURING THE OPERATING DATA TO A MEMORY CHANNEL

You can configure the operating data to single-band Memory Channels and dual-band Memory Channels.



CONFIGURING THE OPERATING DATA TO A SINGLE-BAND MEMORY CHANNEL

The main band or sub band frequency and the operating mode can be configured in Memory Channels.

1 Select the frequency and operating mode to configure for the selected band.

2 Press **[M.IN]** (Memory) to open the **Memory Channel List** screen.

3 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the Memory Channel to configure the operating data.
Select a Memory Channel from the ranges 00 to 99 and E0 to E9.



4 Press **[M.IN]** (F4) or **[M.IN]** (Memory) to configure the operating data.

- The operating data of the band selected with "Frequency 1" is configured for the Memory Channel and the **Memory Channel List** screen closes.
- Press **[CANCEL]** (F1) or **[ESC]** to close the **Memory Channel List** screen without configuring operating data to a Memory Channel.

Note:

♦ If a Memory Channel with no operating data stored in the selected band is used, no operating data is configured for the single-band Memory Channels.

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CONFIGURING THE OPERATING DATA TO A DUAL-BAND MEMORY CHANNEL

You can configure operating data such as the frequency, operating mode and operating status (split frequency, dual-band receive frequencies, transmit frequency during the split operation) for use with split operation or dual-band reception to a Memory Channel.

1 Configure the frequency, operating mode, and operating status (split operation, dual frequencies reception, TF watch) to the main band and sub band.

2 Press **[M.IN]** (Memory) to open the **Memory Channel List** screen.

3 Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to select the Memory Channel (00 to 99 or E0 to E9) to configure the operating data.



4 Press **[D-M.IN]** (F6) to configure the operating data.

- The operating data is configured for the main band in Frequency 1, for the sub band in Frequency 2 and the operating status is configured for TX/RX Func for the Memory Channels selected at step 3, and then the **Memory Channel List** screen closes.
- Press **[CANCEL]** (F1) or **[ESC]** to close the **Memory Channel List** screen without configuring operating data to a Memory Channel.

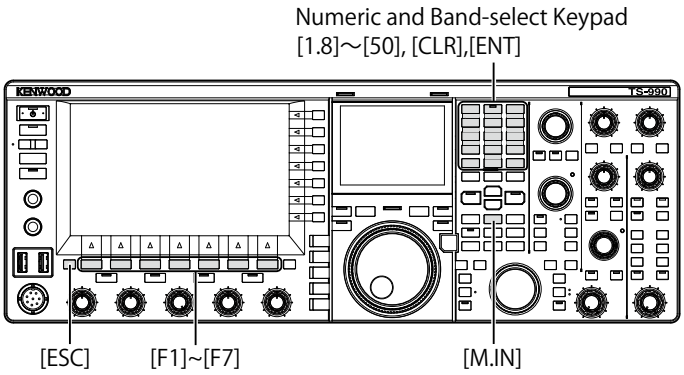
Note:

- Operating data cannot be configured for a Dual-band Memory Channel in the following cases:
- When a Memory Channel with no operating data configured in main band or sub band is used
- When the single-band reception is selected during the simplex operation ("RX" and "TX" in the sub band displays are both grayed out)

CONFIGURING OPERATING DATA BY DIRECTLY ENTERING FREQUENCY

You can configure frequency for Memory Channels or change existing Memory Channel operating data using the numeric and band select keypad.

This is useful when tuning the frequency to the station with a fixed frequency.



1 Press **[M/V]** to enter single-band Memory Channel mode or press and hold **[M/V]** to enter dual-band Memory Channel mode.

2 Rotate the **MULTI/CH** control to select the Memory Channel (00 to 99 or E0 to E9) to configure the operating data.

3 Press **[ENT]** to enable the use of numeric keys.

- Press to turn the backlight for the numeric keypad ON.
- Frequency entry mode is activated for the target band and the numbers in the frequency display are all replaced with "-" (dash).
- Press the mode key to change the operating mode.



4 Press the numeric keys to enter a frequency.

- Enter the number with the numeric key, and the dashes are replaced by the entered number from the uppermost digit. To enter 1.82 MHz, press **[0/50]**, **[1/1.8]**, **[8/24]**, and **[2/3.5]** and then press **[ENT]** to complete the entry.
- Press **[CLR]** to clear the entered number, and the frequency entry ends.

5 Press **[ENT]** to configure the operating data.
The operating data is configured for the Memory Channel selected at step 2.

Note:

- If a frequency is entered directly in a Memory Channel with no operating data configured, the frequency is configured as the operating data of the single-band Memory Channel.
- To enter main band and sub band frequencies in a dual-band Memory Channel, press and hold **[M>V]** to enter the dual-band Memory Channel mode. Enter the frequency to the main band and

then to the sub band.

MEMORY CHANNEL MODE

There are two Memory Channel modes allowing you to use the operating data configured for Memory Channels: Single-band Memory Channel mode and Dual-band Memory Channel mode. You can transmit and receive with operating data diverted from Memory Channels. You can temporarily change the operating data such as the transmit and receive frequencies, the operating mode and tones.

OPERATING IN SINGLE-BAND MEMORY CHANNEL MODE

You can divert the operating data of the Memory Channel configured in the main band or the sub band. The operating data for the Memory Channel configured for "Frequency 1" in the Memory Channel List is diverted.

1 Press **[M/V]** while in VFO mode to enter Single-band Memory Channel mode.
The selected band is switched to the operating data set for Frequency 1 in the Memory Channel List and the corresponding memory channel number appears on the main screen.



2 Press **[M/V]** again to exit Single-band Memory Channel mode.
The transceiver diverts to VFO mode.

OPERATING IN DUAL-BAND MEMORY CHANNEL MODE

The same Memory Channel can be diverted to the main band and sub band at the same time, and the operating status, such as split operation, dual frequencies reception, TF watch, can be stored to a Memory Channel.

You can divert the operating data of the Memory Channels configured for main band and sub band. The operating data for the Memory Channel configured with types "Frequency 1", "Frequency 2", and "TX/RX Func." in the Memory Channel List is diverted.

1 Press and hold **[M/V]** while in VFO mode to enter Dual-band Memory Channel mode.
The operating data is switched to the ones configured in "Frequency 1", "Frequency 2", and "TX/RX Func." in the Memory Channel List for the main band and the sub band, and the corresponding Memory Channel number appears on the main screen reversing the outlined letter to white or black.



2 Press **[M/V]** again to exit Dual-band Memory Channel mode.

3 The transceiver diverts to VFO mode.

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SELECTING A MEMORY CHANNEL

The Memory Channel selected for main band and sub band can be switched individually.

1 Press **[<MAIN]** to select a main band Memory Channel or **[SUB>]** to select a sub band Memory Channel.

2 Press **[UP]** (microphone) or **[DOWN]** (microphone), or rotate the **MULTI/CH** control to select a Memory Channel.



Note:

- In Dual-band Memory Channel mode, the Memory Channels of both bands are switched simultaneously whichever the band is selected.

DIRECTLY ENTERING THE MEMORY CHANNEL NUMBER

The channel number for single-band Memory Channel or dual-band Memory Channel can be selected using the numeric and band select keypad.

1 Press **[<MAIN]** or **[SUB>]** to select a band.

2 Enter the number on the tenths for the Memory Channel with a numeric key.
The number is displayed to the tenths digit for the Memory Channel number of the selected band, and "-" (dash) is displayed to the units digit.

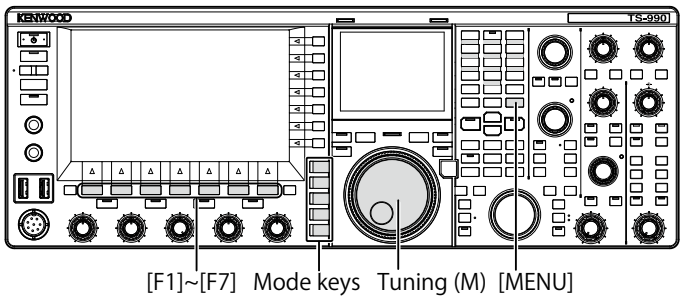
3 Enter the number on the units digit for the Memory Channel with a numeric keypad.
- The operating data for the corresponding channel number is diverted and channel number entry ends.
- Press **[CLR]** to cancel entry and the Memory Channel number entry ends.

Note:

- In Dual-band Memory Channel mode, when the operating data is diverted for a band, the unselected band also receives the data from the same channel number.
- While the Quick Memory Channel is in use, the number of the Quick Memory Channel cannot be configured.

TEMPORARILY CHANGING THE OPERATING DATA

While using operating data configured in Memory Channel, you can temporarily change the frequency and other operating data without changing the operating data.



TEMPORARILY CHANGING FREQUENCY

Change the configuration as follows to temporarily change the frequency.

1 Select Group No. 4, "Memory Channels & Scan", from the **Menu** screen.

2 Access Menu 01, "Temporary Change (Memory Channel Configurations)".



3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select "On".
The default is "Off".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

7 Press **[M/V]** to enter single-band Memory Channel mode or press and hold **[M/V]** to enter dual-band Memory Channel mode.

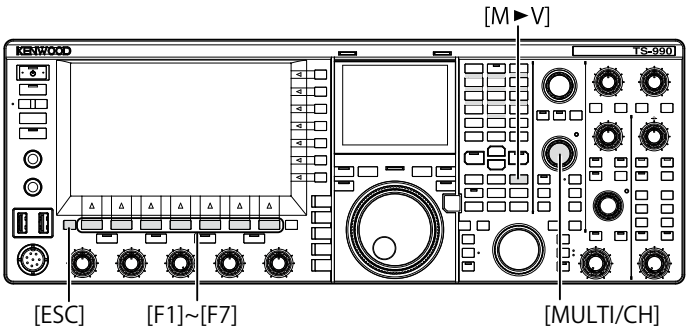
8 Rotate the **Tuning** (M) control to change the frequency.
To configure the changed frequency, configure it to a different Memory Channel. {page 10-2} {page 10-3}

Note:

- For the Program Memory Channels, the operating data configured in the Memory Channel is updated when the frequency or mode is changed regardless of this configuration.
- The operating data related to the operating mode and FM tone can be temporarily changed regardless of this configuration.

COPYING OPERATING DATA FROM THE MEMORY CHANNEL

You can copy the operating data from a Memory Channel to VFO or to another Memory Channel.



MEMORY SHIFT (MEMORY TO VFO)

You can copy the operating data from a Memory Channel to VFO. It is useful when the frequency to be used is similar to the frequency configured in a Memory Channel.

■ Select a Memory Channel and Copy Its Data to VFO.

1 In Memory Channel mode, rotate the **MULTI/CH** control to select a Memory Channel.

2 Press **[M►V]** or **[M ► VFO]** (F6) to copy the operating data to VFO.
- The operating data in the selected Memory Channel is copied to VFO.
- The Memory Channel mode ends and enters to VFO mode.
- If an operating data is changed temporarily, the changed operating data is copied to VFO.
- You cannot copy operating data from a Program Memory Channel to the VFO.
- In Single-band Memory Channel mode, the operating data configured in "Frequency 1" is copied to the VFO of the selected band.
- In Dual-band Memory Channel mode, the operating data configured in "Frequency 1" is copied to the main band, the operating data configured in "Frequency 2" is copied to the sub band, and the operating status in "TX/RX Freq." is copied to VFO.

■ Copy the Memory Channel Data to VFO on the Memory Channel List Screen.

1 Press **[M.LIST]** (F7) to open the **Memory Channel List** screen.

2 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select a Memory Channel.

3 Press **[M►V]** or **[M ► VFO]** (F6) to copy the operating data to VFO.
- When the operating data is copied to VFO, the current operating data in VFO will be cleared.
- The Memory Channel mode ends and enters to VFO mode.
- You cannot copy operating data from a Program Memory Channel to the VFO.
- If "S" appears on the "Type" field in the **Memory Channel List** screen while in VFO mode, the operating data configured in "Frequency 1" is copied to the VFO of the selected band.
- If "D" appears on the "Type" field in the **Memory Channel List** screen while in VFO mode, the operating data configured in "Frequency 1" is copied to the main band, the operating data configured in "Frequency 2" is copied to the sub band, and the operating status in "TX/RX Freq." is copied to VFO.

4 Press **[ESC]** to exit.

COPYING OPERATING DATA FROM ONE MEMORY CHANNEL TO ANOTHER MEMORY CHANNEL (CHANNEL TO CHANNEL)

You can copy the operating data in a Memory Channel to another Memory Channel. It is useful when sorting the order of the configured Memory Channels.

1 Press **[M.LIST]** (F7) to open the **Memory Channel List** screen.

2 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the Memory Channel to copy the operating data.

3 Press **[COPY]** (F6) to copy the operating data.
- If **[COPY]** (F6) is unavailable in the function key guide, press **[MORE]** (F1).
- The Memory Channel to be copied is highlighted in pink.

4 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the Memory Channel to configure the copied operating data.

5 Press **[M.IN]** (F4) to exit.
- The operating data in the Memory Channel selected in step 2 is copied to the Memory Channel selected at step 4.
- Press **[CANCEL]** (F1) or **[ESC]** to exit without copying the operating data.

Note:

♦ You cannot copy the operating data in typical Memory Channels and extensive Memory Channels (00 to 99, E0 to E9) to Program Memory Channels (P0 to P9). You cannot copy in the reverse direction either.

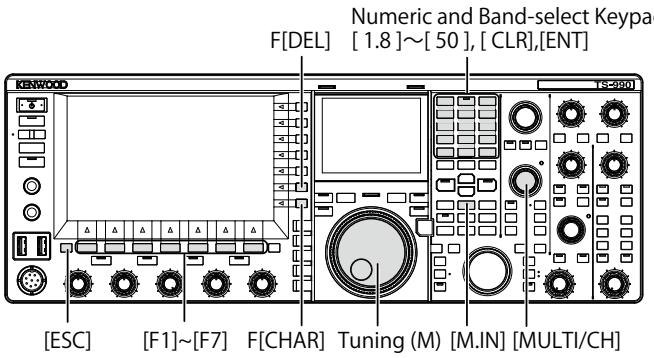
♦ You cannot copy operating data from a Memory Channel with no operating data configured.

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CONFIGURING THE PROGRAM SCAN FREQUENCY RANGE

For the Memory Channel P0 to P9, you can configure the frequency range for the Programmable VFO and the program scan. To change the frequency in a certain range or to activate the scanning process, configure the start frequency and the end frequency in advance.

Refer to the next chapter for details of program scan.



1 In VFO mode, rotate the **Tuning** (M) or **MULTI/CH** control to tune the VFO frequency to the start frequency of scanning.

2 Press **[M.IN]** (Memory) to open the **Memory Channel List** screen.

3 Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to select the Memory Channel (P0 to P9) to configure the frequency range.

4 Press [M.IN] (F4) or [M.IN] (Memory) to configure the start frequency.
The start frequency is saved in "Frequency 1".

5 Rotate the **Tuning** or **MULTI/CH** control to tune the VFO frequency to the end frequency.

6 Press **[M.IN]** (F4) or **[M.IN]** (Memory) to configure the end frequency.
The end frequency is saved in "Frequency 2" and the **Memory Channel List** screen closes.

CLEARING THE MEMORY CHANNEL

You can clear the configured operating data of a Memory Channel.

1 Press **[M.LIST]** (F7) to open the **Memory Channel List** screen.

2 Press [▲] (F2) or [▼] (F3), or rotate the **MULTI/CH** control to select a Memory Channel.

3 Press and hold **[(CLEAR)]** (F4) to clear the operating data.
If **[(CLEAR)]** (F4) is unavailable in the function key guide, press **[MORE]** (F1).

4 Press **[ESC]** to exit.

Note:

- If the operating data in one of the Memory Channels is cleared while operating Memory Channel mode, the Memory Channel has no operating data but with the same channel number.
- To clear all Memory Channels, execute the Memory Channel reset. {page 16-4}

CONFIGURING NAMES FOR MEMORY CHANNELS

You can configure a name for each Memory Channel. You can configure the Memory Channel name with a maximum of 10 alphanumeric characters and symbols.

1 Press **[M.LIST]** (F7) to open the **Memory Channel List** screen.

2 Press [▲] (F2) or [▼], (F3) or rotate the **MULTI/CH** control to select the Memory Channel to be named.

3 Press **[NAME]** (F5) to enable editing of "NAME".
If **[NAME]** (F5) is unavailable in the function key guide, press **[MORE]** (F1).

4 Use function keys, the **MULTI/CH** control, or a USB keyboard to enter the name.
A maximum of 10 characters can be entered.

[SPACE] (F1): Press to insert a space.

[-] (F2)/**[+]** (F3): Press to select a character.

[◀▮] (F4) and [▮▶] (F5): Press to move a pointer to the left or right.

[SAVE] (F6): Press to save the edited characters.

[BACK SPACE] (F): Press to delete a character on the left of the pointer.

[DEL] (F): Press to delete a character on the right of the pointer.

[CHAR] (F): Press to change the character type to be edited. Each time you press **[CHAR]** (F), the character type cycles through

as follows:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)



5 Press **[SAVE]** (F6) to configure the name.
- Press **[CANCEL]** (F7) to revert to the **Memory Channel List** screen without naming the Memory Channel.

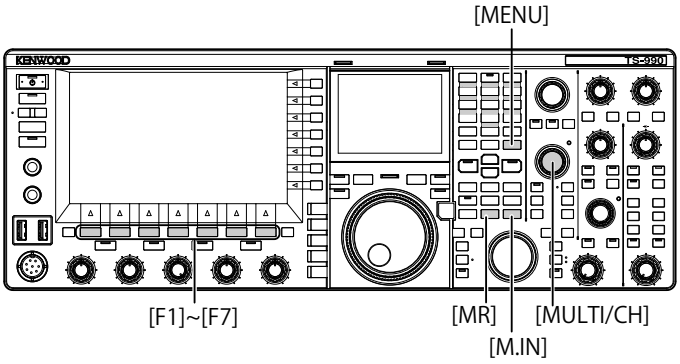
6 Press **[ESC]** to exit.

Note:

- The characters to be entered depends on the keyboard selected in Menu 9-01. {page 16-10}
- You cannot configure a name for Quick Memory Channels. {page 10-8}
- The name can be given to the Memory Channel where the operating data has been stored.

QUICK MEMORY

Quick Memory allows you to quickly and temporarily configure the operating data without specifying a Memory Channel. For instance, it is useful to configure the operating data of the radio station to be communicated in advance when searching in the specific band to search DX.



QUICK MEMORY CHANNELS

Quick Memory Channels can only be diverted during VFO mode operation. You can configure the following operating data for a Quick Memory Channel.

- Frequency and operating mode for the main band
- Frequency and operating mode for the sub band
- Operation category of this transceiver (split operation or dual-frequencies reception)
- RIT and XIT
- RIT/XIT frequencies
- Fine tuning
- Noise blanker
- Noise reduction
- Beat cancel
- Notch
- RX filter

CONFIGURING IN QUICK MEMORY

A maximum of 10 Quick Memory Channels (Q0 to Q9) can be configured for the transceiver. The last saved operating data is configured in Q0. When configuring a new operating data, the one last operating data is moved to Q1 and the new operating data is configured in Q0.

1 Press **[M.IN]** (Quick Memory) to configure the operating data in the Quick Memory Channel.
   - Pressing **[M.IN]** (Quick Memory) while in VFO mode configures the operating data in Channel 0. Pressing **[M/IN]** (Quick Memory) while in Quick Memory Channel mode configures the operating data in the selected Quick Memory Channel.
   - Each time when the new operating data is stored, individual operating data is shifted to the channel with the channel number incremented by 1.

Note:

- If the transceiver is placed in Memory Channel mode in the main band or the sub band, the operating data cannot be configured in Quick Memory Channel even with a press of **[M.IN]** (Quick Memory).
- If the operating data is configured in all the Quick Memory Channels and press **[M.IN]** (Quick Memory), the oldest operating data configured in the Quick Memory Channel (the data with the largest Quick Memory Channel number) is cleared.

RECALLING QUICK MEMORY CHANNELS

You can recall a Quick Memory Channel only when you operate the transceiver in VFO mode.

1 Press **[MR]** (Quick Memory) to recall the operating data in a Quick Memory Channel.
   - The Quick Memory Channel number appears to the main band and sub band.

2 Rotate the **MULTI/CH** control to select a Quick Memory Channel.
   - Pressing **[MR]** (Quick Memory) again exits Quick Memory Channel mode and places the transceiver in VFO mode.



Note:

- When using operating data read from main band or sub band Memory Channel or when no operating data is configured in the Quick Memory Channel, the operating data cannot be read from the Quick Memory Channels even with a press of **[MR]** (Quick Memory).
- You can temporarily change the frequency and other operating data without changing the operating data configured in the Quick Memory Channel. To save the changed operating data, press **[M.IN]** (Quick Memory) to configure in Quick Memory. {page 10-8}

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CONFIGURING THE NUMBER OF QUICK MEMORY CHANNELS

This transceiver has 10 Quick Memory Channels (Q0 to Q9). However, you can adjust the maximum number of available Quick Memory Channels.

1 Select Group No. 4, "Memory Channels & Scan", from the **Menu** screen.

2 Access Menu 00, "Number of Quick Memory Channels".

3 Press **[SELECT]** (F4) to enable editing of the parameter box.



4 Press **[–]** (F4) or **[+]** (F5) to select "3 [ch]", "5 [ch]", or "10 [ch]".
The default is "5 [ch]".

5 Press [⮌] (F1).

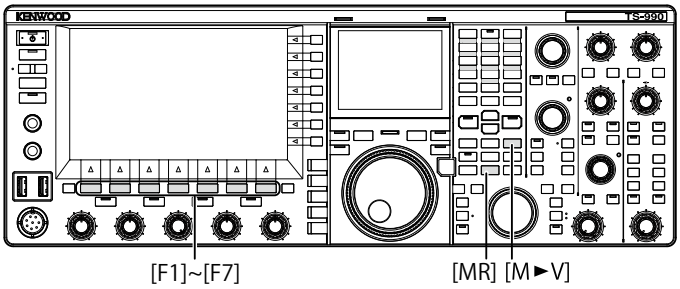
6 Press **[MENU]** to exit.

Note:

♦ When the configuration of Number of Quick Memory Channels is decreased, the oldest operating data is cleared from the Quick Memory Channel (the data with the largest Quick Memory Channel number).

CLEARING QUICK MEMORY CHANNELS

You can clear all operating data configured in Quick Memory Channels.



1 Press **[MR]** (Quick Memory) to call the Quick Memory Channels.

2 Press and hold **[MR]** (Quick Memory).
A message appears prompting you to clear all operating data configured in Quick Memory Channels.



3 Press **[OK]** (F4) to clear the operating data.
- All operating data in the Quick Memory Channel is cleared and VFO mode is selected.
- Press **[CANCEL]** (F7) to close the message without clearing the operating data in the Quick Memory Channels.

MEMORY SHIFT (QUICK MEMORY TO VFO)

You can copy the operating data of a Quick Memory Channel to VFO.

1 Press **[MR]** (Quick Memory) to recall the Quick Memory Channels.

2 Rotate the **MULTI/CH** control to select a Quick Memory Channel to which the operating data will be copied.

3 Press **[M►V]** or [M ▶ VFO] (F6).
- Operating data in the Quick Memory Channel is copied to VFO and VFO mode is selected.
- If an operating data is changed temporarily, the changed operating data is copied to VFO.

Note:

♦ If the operating data is temporarily changed, the temporarily changed operating data is copied to VFO.

♦ When the operating data is copied to VFO, the operating data copied to VFO until then will be overwritten.

11 SCAN

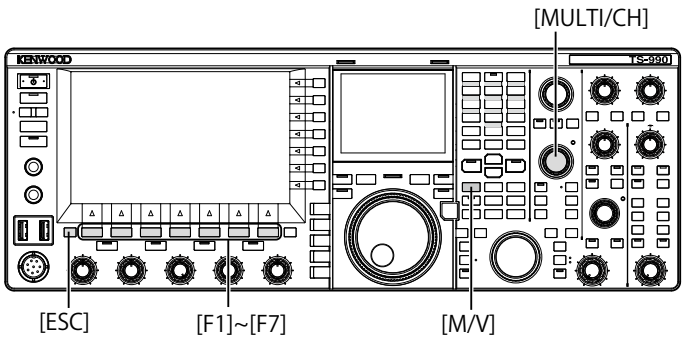
Scan is a function that searches for the availability of a signal by shifting the frequency. This transceiver has the following scans to search for the signal.

Scan Type		Purpose
Normal Scan	Program Scan	Scans on the frequency range stored in the Programmable Memory Channels P0 to P9.
	VFO Scan	Scans on all receive frequency range. If all Programmable Memory Channels are deselected (do not allow scanning), the transceiver does VFO scan, instead of Program Scan.
Scans using Memory Channels	All Channel Scan	Scans on all Memory Channels, 00 to 99, P0 to P9, and E0 to E9.
	Group Scan	Scans on the grouped Memory Channels.
	QUICK MEMORY SCAN	Scans on the Quick Memory Channels.

PROGRAM SCAN

Program Scan scans in the frequency range between the Start frequency and End frequencies configured for the Program Memory Channels P0 to P9.

You can configure the frequency range for Program Scan for Program Memory Channels P0 to P9. A maximum of 10 frequency ranges may be used by the specific station. If the transceiver can be on standby state on the adjacent frequencies, it is easy to tune to the specific station after the specific station starts a QSO using the frequency range.



Note:

- With Program Scan, the transceiver scans on the frequency range between the start frequency and the end frequency of the Programmable Memory Channel, and moves to the next channel after the transceiver finishes the scanning on the specified frequency range.
- Press **[⏻]** while pressing down **[PF A]** when the transceiver power (⏻) turns OFF starts up the transceiver power (⏻) with Auto Voice Guidance enabled.
- The transceiver scans from the lower frequency to the higher frequency. If the end frequency is changed to be lower than the start frequency with a rotation of the **Tuning** or **MULTI/CH** control, the transceiver scans from the higher frequency to the lower frequency.
- The step frequency for scanning is the same frequency step size as that of the **Tuning** control for use in SSB, CW, FSK, and PSK modes, 100 Hz for use in AM mode, and the same frequency step size as that of the **MULTI/CH** control for use in FM mode.
- The scan stops when the transceiver receives a signal during the Program Scan (VFO Scan) in FM mode or during the Memory Scan (All Channel Scan, Group Scan) or the Quick Memory Scan. Refer to "RESUMING THE SCAN" for the conditions to resume scanning. {page 11-6}
- While the transceiver is on stand by, in FM mode, to receive a CTCSS tone, the scan stops only if the received CTCSS tone matches the CTCSS tone configured for the transceiver.
- In FM mode, if the transceiver exceeds the critical squelch level by rotating the **SQL** control clockwise, the scan does not stop even if a signal is present. The squelch level must be set near the critical squelch level.
- If the transceiver receives only using the main band, the transceiver does not scan using the sub band.
- While Frequency Tracking is active, the scan does not start.

STARTING THE PROGRAM SCAN (VFO SCAN)

1. Press **[M/V]** to enter VFO mode.
2. Press **[SCAN]** (F5) to start the Program Scan (VFO Scan).
   Pressing **[SCAN]** (F5) again or pressing **[ESC]** stops Program Scan (VFO Scan).

CONFIGURING THE PROGRAM SCAN (VFO SCAN) FREQUENCY RANGE

You can configure whether the transceiver scans the frequency range specified with the Program Memory Channel (Program Scan), or receive all frequency range (VFO Scan).

Refer to "CONFIGURING NAMES FOR MEMORY CHANNELS" for the configuration of the Program Memory Channel. {page 10-7}

1. Press **[M/V]** to enter VFO mode.
2. Press and hold **[SCAN]** (F5) to open the **Program Scan** screen.



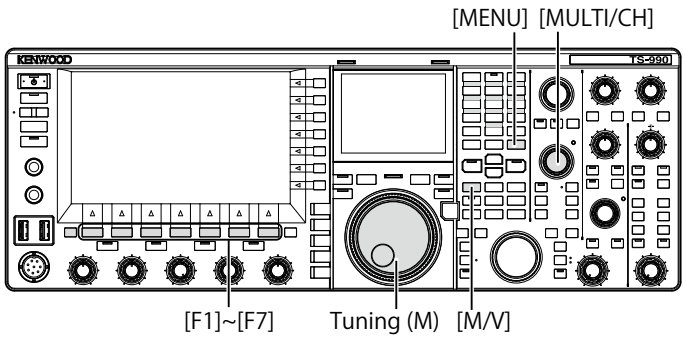
3. Press **[◀]** (F2) or **[▶]** (F3) to select a channel for Program Memory Channel.
4. Press **[■⇆✓]** (F4) to determine whether or not the transceiver scans the Program Memory Channels.
   - Each key press toggles a tick mark between places (allows scanning) or removes (does not allow scanning).
   - To use VFO Scan, all tick marks on all Program Memory Channels must be removed (deselected).
   - Pressing **[SEL.ALL]** (F6) selects and places a tick mark on all Program Memory Channels.
   - Pressing **[CLR.ALL]** (F7) deselects and removes the tick marks from all Program Memory Channels.
5. Press **[ESC]** to exit.

Note:

♦ Configuration examples for Program Scan and VFO Scan:
- Place tick marks to the Program Memory Channels, P1, P3 and P5, and then press **[SCAN]** (F5). The transceiver starts the Program Scan to scan the frequency range stored on each channel.
- Remove all tick marks from all Program Memory Channels, and then press **[SCAN]** (F5). The transceiver starts the VFO Scan to scan all receive frequency ranges.
- A tick mark is removed from a Program Memory Channel to which no operating data has been configured, and you cannot place a tick mark.

CHANGING THE SCAN SPEED

In any mode other than FM mode, you can change the scan time to remain on each frequency for Program Scan (VFO Scan).



1 Press **[-]** (F3) or **[+]** (F4) during the Program Scan (VFO Scan).
The scan speed appears below the frequency display.



The scan time to remain on each channel varies as below.

Display	Time Intervals
SCAN-SPD1	10 ms
SCAN-SPD2	30 ms
SCAN-SPD3	100 ms
SCAN-SPD4	150 ms
SCAN-SPD5	200 ms
SCAN-SPD6	250 ms
SCAN-SPD7	300 ms
SCAN-SPD8	350 ms
SCAN-SPD9	400 ms

Note:

♦ In FM mode, the scan time to retain each frequency during the Program Scan and VFO Scan is fixed to 80 ms, and you cannot change the scan time. However, if the transceiver receives a CTCSS tone, the scan time is extended to 400 ms. In FM mode, "SCANNING" appears in place of the scan speed.

SCAN HOLD

In any mode other than FM mode, changing the frequency with a rotation of the **Tuning** or **MULTI/CH** control during the Program Scan (VFO Scan) stops scanning for five seconds.

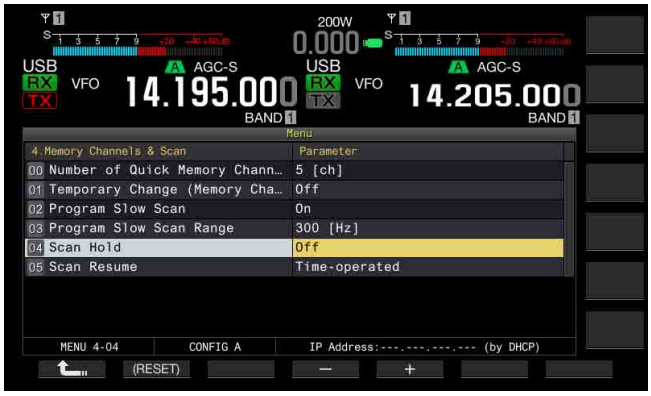
The transceiver can temporarily receive without stopping the scan.

Follow the procedure below to enable the Scan Hold.

1 Select Group No. 4, "Memory Channels & Scan", from the **Menu** screen.

2 Access Menu 04, "Scan Hold".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On".
The default is "Off"

5 Press [↩] (F1).

6 Press **[MENU]** to exit.

If Scan Hold is enabled in Menu 4-04, the transceiver can receive a signal by stopping the Program Scan for five seconds.

7 Press **[SCAN]** (F5) to start the Program Scan (VFO Scan).

8 Rotate the **Tuning** or **MULTI/CH** control to increase or decrease the frequency.
Program Scan (VFO Scan) stops for five seconds. Then, the transceiver resumes the Program Scan (VFO Scan).

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PROGRAM SLOW SCAN

Program Slow Scan is a function that extends, at the preconfigured frequency (frequency point) and its adjacent frequency range, the scan time to remain on each frequency (to slow down the scan) during the Program Scan. If the scan slows down on the certain frequency (frequency points) and its adjacent frequency range, you can carefully watch the traffic status.

Program Slow Scan is a function that extends, at the preconfigured frequency (frequency point) and its adjacent frequency range, the scan time to remain on each frequency (to slow down the scan) during the Program Scan. {page 10-7}

ENABLING OR DISABLING THE PROGRAM SLOW SCAN

To do the Program Slow Scan during the Program Scan, you need to enable the Program Slow Scan in advance.

If the transceiver, during the Program Scan, scans the frequency that is in the frequency range preconfigured for the Program Slow Scan, "SCAN-SLOW" appears on the main screen, and the scan time slows down.

1 Select Group No. 4, "Memory Channels & Scan", from the **Menu** screen.

2 Access Menu 02, "Program Slow Scan".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "On" (enabling the Program Slow Scan). Selecting "Off" does not allow you to execute the Program Slow Scan.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

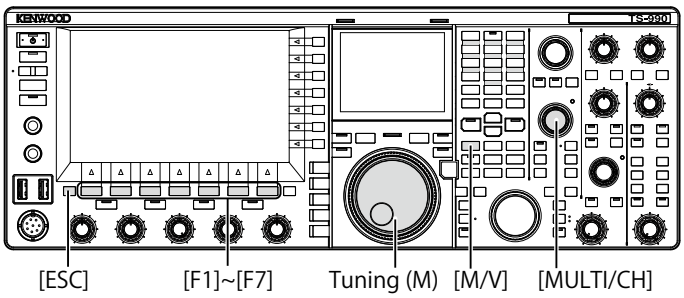
- Select "Off" from Menu 4-02, if you do not use the Program Slow Scan.

CONFIGURING THE PROGRAM SLOW SCAN FREQUENCY RANGE

The frequency point where the scan time is extended during the Program Slow Scan can be configured.

A maximum of five frequency points for each Program Memory Channel,P0 to P9, can be configured.

To configure the frequency point, the frequency range must initially be configured for the Program Memory Channel. {page 10-7}

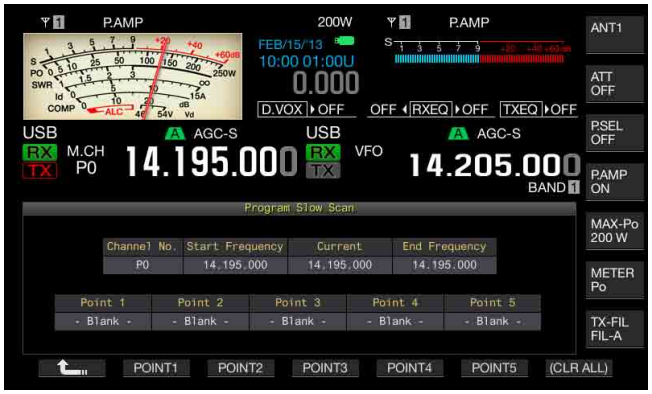


1 Press **[M/V]** to enter Memory Channel mode.

2 Press **[M.LIST]** (F7) to open the **Single Memory Channel List** screen.

3 Press [ ] (F2) or [ ] (F3), or rotate the **MULTI/CH** control to select a Program Memory Channel.

4 Press and hold **[SLW.SCAN]** (F5) to open the **Program Slow Scan** screen.
If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1).



5 Rotate the **Tuning** (M) control to tune the current frequency as the frequency point of the program slow scan.

6 Press one of the function keys **[POINT1]** (F2) to **[POINT5]** (F6) to configure the frequency point.

- Pressing and holding the same function key clears the stored frequency point.
- Pressing and holding the **[(ALL.CLR)]** (F7) clears all frequency points.

7 Press and hold [ ] (F1) to close the **Program Slow Scan** screen.
The transceiver reverts to the **Memory Channel List** screen.

Note:

- If the frequency point has been configured, pressing the corresponding function key, **[POINT1]** (F2) to **[POINT5]** (F6), overwrites the frequency stored for that frequency point.
- The value configured for the frequency point is rounding off to a value below 10 Hz.
- The frequency point cannot be configured for use other than Single Memory Channel Mode. Therefore, **[SLOW.SCN]** (F5) does not appear until the selected band is placed in Program Slow Scan mode.

CONFIGURING THE PROGRAM SLOW SCAN FREQUENCY RANGE

The scan time for Program Scan while the transceiver slows down the scanning on the frequency points for Program Slow Scan and its adjacent frequency range. This adjacent frequency range is called the frequency range, and follow the procedure below to configure the frequency range for the slow scan frequency.

1 Select Group No. 4, "Memory Channels & Scan", from the **Menu** screen.

2 Access Menu 03, "Program Slow Scan Range".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "100 [Hz]", or "200 [Hz]", "300 [Hz]", "400 [Hz]", or "500 [Hz]".
- The default is "300 [Hz]".
- For instance, if "500 [Hz]" is selected, the transceiver slows down the scanning at the frequency point with the ±500 Hz frequency range.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

MEMORY SCAN

Memory Scan enables the transceiver to change the preconfigured Memory Channels at certain time intervals for scanning.

There are two Memory Scans: All Channel Scan that scans all Memory Channels to which the operating data has been stored, and Group Scan that scans the selected and grouped Memory Channels.

STARTING THE SCAN

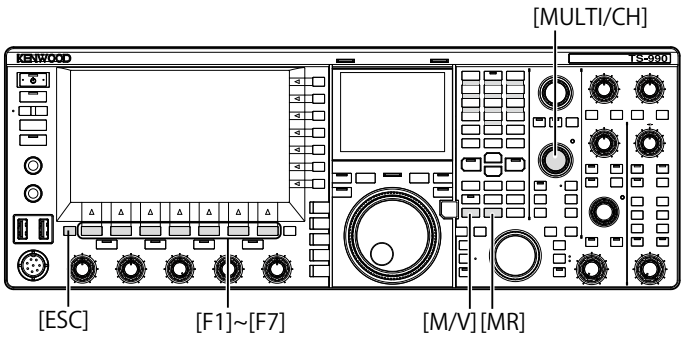
1 Press **[M/V]** while in VFO mode to enter Single-band Memory Channel mode, or press and hold **[M/V]** to enter Dual-band Memory Channel mode.

2 Press **[SCAN]** (F5) to activate the Memory Scan.
- Rotating the **MULTI/CH** control fast-forwards or fast-reverses the scanning sequence.
- Pressing **[SCAN]** (F5) again or pressing **[ESC]** stops the Memory Scan.

Note:

- Memory Scan stops if the transceiver receives a signal on the main band or sub band while in Dual-band Memory Channel mode.
- The scan time for each frequency during the Memory Scan is 400 ms. However, if the transceiver receives a CTCSS tone in FM mode, the scan time is extended to 600 ms. "SCANNING" appears in place of the scan speed.

EXAMPLES OF CONFIGURATIONS FOR THE ALL CHANNEL SCAN AND THE GROUP SCAN



1 Press **[M/V]** while in VFO mode to enter Single-band Memory Channel mode, or press and hold **[M/V]** to enter Dual-band Memory Channel mode.

2 Press and hold **[SCAN]** (F5) to open the **Program Scan** screen.



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3 Press [ ] (F2) or [ ] (F3) to select a Group for Group Scan.

4 Press [ ] (F4), or rotate the **MULTI/CH** control to specify whether or not the transceiver scans the Memory Channels in the grouped Memory Channels.
- Each key press toggles a tick mark between places (allows scanning) or removes (does not allow scanning).
- To start All Channel Scan, place a tick mark on all memory groups.
- Pressing **[SEL.ALL]** (F6) selects and places a tick mark on all Memory Channels.
- Pressing **[CLR.ALL]** (F6) deselects and removes a tick mark on all Memory Channels.

5 Press **[ESC]** to exit.

Note:

♦ If the Memory Group to be scanned has been configured as below, Memory Scan does not start even with the press of **[SCAN]** (F5).
- Tick marks on all Memory Groups are removed (deselected).
- Even if a tick mark is placed on a Memory Group, no operating data is stored on the Memory Channels in this Memory Group.
- Even if a tick mark is placed on a Memory Group, all Memory Channels in this Memory Group are locked out.

♦ The Memory Channels in the Memory Groups are listed below. Combinations of the Group number and Memory Channel numbers.

Group	Memory Channel	Group	Memory Channel
0	00 to 09	6	60 to 69
1	10 to 19	7	70 to 79
2	20 to 29	8	80 to 99
3	30 to 39	9	90 to 99
4	40 to 49	P	P0 to P9
5	50 to 59	E	E0 to E9

♦ Examples of Configurations for the All Channel Scan and the Group Scan
- If you place tick marks on Memory Groups 1 and 5, pressing **[SCAN]** (F5) starts the Group Scan. The Memory Channels in Memory Groups 1 and 5 will be scanned.
- If you place tick marks on all Memory Groups, pressing **[SCAN]** (F5) starts the All Channel Scan.

♦ Even if a tick mark is placed for a Memory Channel (the scan is enabled), the transceiver does not scan the Memory Channel to which no operating data is stored for the Memory Channel in a Memory Group or the Memory channel is locked out.
If the transceiver starts scanning while in Dual Memory Channel mode, the transceiver does not scan the Program Memory Channels P0 to P9.

LOCKING OUT A MEMORY CHANNEL

You can select Memory Channels to be exempted from the Memory Scan.

1 Press **[M.LIST]** (F7) to open the **Memory Channel List** screen.

2 Press [ ] (F2) or [ ] (F3), or rotate the **MULTI/CH** control to select a Memory Channel.

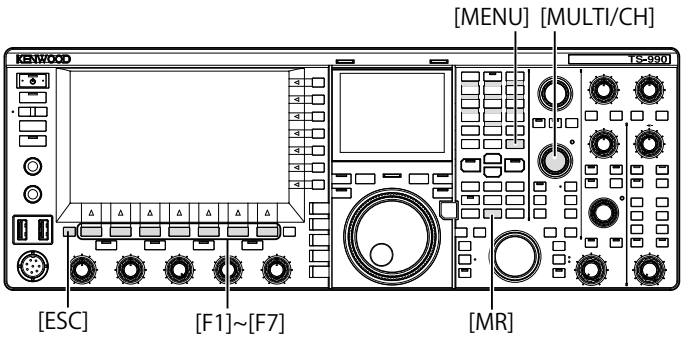
3 Press **[L.OUT]** (F6) to lock out a Memory Channel.
- A tick mark is placed on the section of "L.OUT" of the selected Memory Channel.
- If **[L.OUT]** (F6) is unavailable in the function key guide, press **[MORE]** (F1).
- Pressing **[L.OUT]** (F6) again disables the Lockout for the Memory Channel.



4 Press **[ESC]** to exit.

QUICK MEMORY SCAN

Quick Memory Scan enables the transceiver to change the configured Quick Memory Channels at certain time intervals, to scan.



1 Press **[MR]** (Quick Memory) to read a Quick Memory Channel.



2 Press **[SCAN]** (F6) to start Quick Memory Scan.

- Rotating the **MULTI/CH** control fast-forwards or fast-reverse the scanning sequence.
- Pressing **[SCAN]** (F5) again or pressing **[ESC]** stops Quick Memory Scan.

Note:

- If the transceiver starts the reception in the main band or sub band, the scan stops.
- The scan time for each frequency during the Quick Memory Scan is 400 ms. However, if the transceiver receives a CTCSS tone while in FM mode, the scan time for each frequency is extended to 600 ms.
- During the Quick Memory Scan, "SCANNING" appears in place of the scan speed.

RESUMING THE SCANNING

The scan stops if the transceiver receives a signal during the Program Scan (VFO Scan) while in FM mode or during the Memory Scan or Quick Memory Scan regardless of the operating data.

The conditions to resume scanning after the scanning stops can be configured.

Time-operated:
The scan stops for three seconds upon receipt of a signal. If the reception continues even after three seconds, the scan stops for the three seconds once a signal is received and continues even after three seconds, and again after three seconds.

After then, the transceiver resumes the scanning even if the transceiver continues the scanning. (In other words, the maximum scan stop time while in Time-operated mode is six seconds.)

Carrier-operated:
The scan stops while the transceiver receives a signal. The transceiver resumes scanning two seconds after there is no longer a signal.

1 Select Group No. 4, "Memory Channels & Scan", from the **Menu** screen.

2 Access Menu 05, "Scan Resume".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select either "Carrier-operated" or "Time-operated".
The default is "Time-operated".

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

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ABOUT THE USB FLASH DRIVE

The configuration data for the transceiver or audio data can be stored in a USB flash drive. Also, the configuration data or the audio data stored in the USB flash drive can be read.

Note:

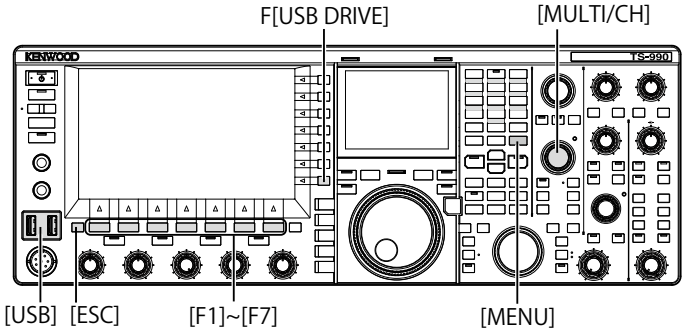
- A USB flash drive is not supplied with this transceiver. You can use a commercially available USB flash drive which conforms to the USB1.1/2.0 (Full Speed) specifications.
- The USB flash drive may not work properly, depending on the type of USB flash drive. Additionally, USB flash drives with the security features mentioned below cannot be used.
  - Virus Check
  - Encryption
  - Password Authentication
  - Fingerprint Authentication
- Do not connect a USB flash drive to the extension cable with a cable length exceeding the 3 m (10 ft).

FORMATTING A USB FLASH DRIVE

To use a USB flash drive, you must format the USB flash drive with this transceiver. The USB flash drive not formatted by this transceiver cannot be recognized by the transceiver.

PRECAUTION:

- If a USB flash drive is formatted with the transceiver, all data files saved in the USB flash drive will be erased. Necessary data must be stored in your PC or other external storage device.



1 Insert a USB flash drive to the ⇐ (USB-A) connector.
"[redacted]" blinks on the main screen, and "[redacted]" lights when the transceiver recognizes the USB flash drive. Wait until the "[redacted]" icon appears.

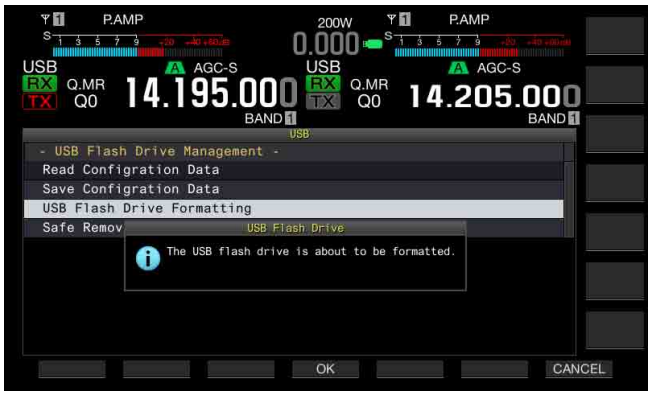


2 Press **[USB DRIVE]** (F) on the Menu screen to open the USB screen.

3 Select "USB Flash Drive Formatting".

4 Press **[SELECT]** (F4) to start formatting.

- A message prompting you the start of the formatting appears.
- Pressing **[CANCEL]** (F7) aborts the procedure without formatting the USB flash drive.



5 Press **[OK]** (F4).
Upon completion of formatting, the **USB** screen reappears.

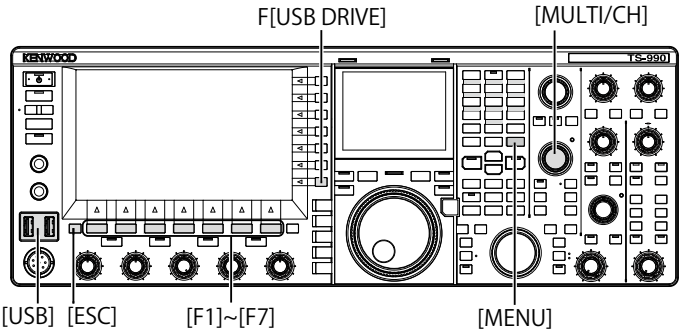
6 Press **[MENU]** to exit.

Note:

- "[redacted]" does not light unless the transceiver properly recognizes the USB flash drive.

SAFELY REMOVING THE USB FLASH DRIVE

To safely remove a USB flash drive from the transceiver, you must follow the procedure below . Otherwise, failure in the safe removal of the USB flash drive may cause damage to USB flash drive, the configuration data file, the audio data file and malfunction of the transceiver.

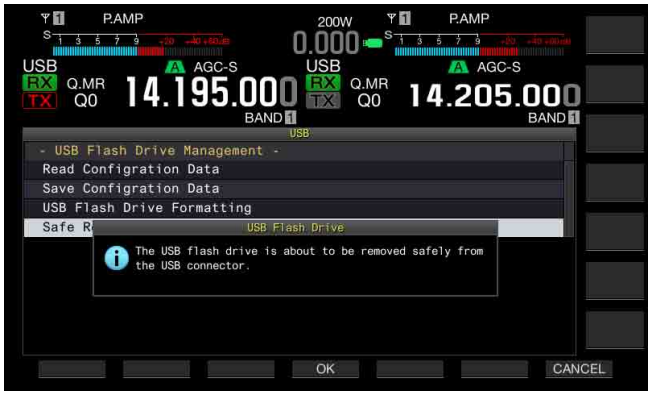


1 Press **[USB DRIVE]** (F) on the Menu screen to open the USB screen.

2 Select **"Safe Removal of USB Flash Drive"**.

3 Press **[SELECT]** (F4) to start the safe removal of USB flash drive.

- A message notifying you of the safe removal of USB flash drive appears.
- Press **[CANCEL]** (F7) to aborts this procedure without Safe Removal of USB Flash Drive executed.



4 Press **[OK]** (F4).
Upon execution of Safe Removal of USB Flash Drive, the **USB** screen reappears.

5 Press **[MENU]** to exit.

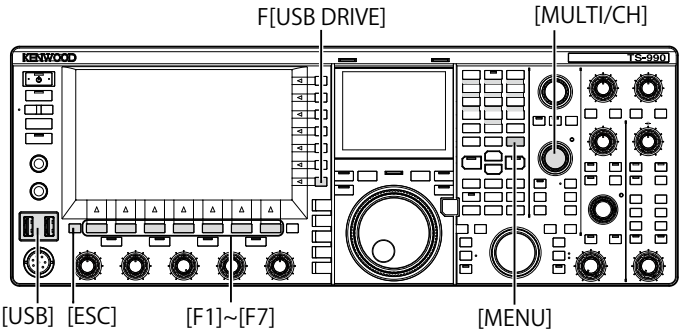
6 Disconnect the USB flash drive.

Note:

- If "Safe Removal of USB Flash Drive" is assigned to a PF key, pressing the PF key executes the Safe Removal of USB Flash Drive, and you can safely remove the USB flash drive. {page 16-6}

SAVING A FILE IN USB FLASH DRIVE

The configuration data and audio data made with this transceiver can be saved in a USB flash drive.



1 Insert a USB flash drive to the (USB-A) connector.
"" blinks on the main screen, and "" lights when the transceiver recognizes the USB flash drive.

2 Press **[USB DRIVE]** (F) on the Menu screen to open the USB screen.

3 Select Menu "Save Configuration Data".

4 Press **[SELECT]** (F4) to start writing the file.

- The message associated with the data writing appears if no USB flash drive is detected.
- Pressing **[CANCEL]** (F7) aborts the procedure without saving the data.



5 Press **[OK]** (F4) to exit.

PRECAUTION:

- Do not remove the USB flash drive while the configuration data file or the audio data file is being saved in the USB flash drive. Also, do not shut down the main power switch (I/O). Otherwise, failure in the safe removal of the USB flash drive may cause damage to the USB flash drive, the configuration data file, the audio data file and malfunction of the transceiver.

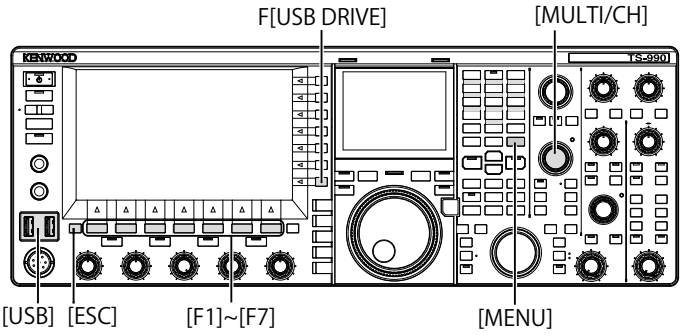
Note:

- An extension of the saved file is ".dat".
- Data files will be saved using a file name consisting of the current date and time ("YYYYMMDD_HHMMSS.dat").
  Example:
  20130215_102030.da1 (the name of a file saved on February 15, 2013 at 10:20:30)
- The path to the saved file will be “KENWOOD/TS-990/SETTINGS/DATA”.
- Prior to store a file in a USB flash drive, be sure the followings.
  - The USB flash drive has been formatted with the transceiver.
  - The USB flash drive must be inserted in place.
  - The USB flash drive must have sufficient memory space available.
  - The USB flash drive must not be write protected or the file system cannot be corrupted.

READING A FILE FROM USB FLASH DRIVE

The configuration data file and the audio data file stored in a USB flash drive can be read with the transceiver. The transceiver can read the configuration data after adding the following configuration data to the readable configuration data.

- Configuration data for the operation environment
- Configuration data associated with CW message
- Configuration data associated with recording
- The audio data associated with audio message



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Prepare a USB flash drive where the target files are stored, and then follow the procedure below.

1 Insert a USB flash drive to the (USB-A) connector.
"" blinks on the main screen, and "" lights when the transceiver recognizes the USB flash drive.

2 Press **[USB DRIVE]** (F) on the Menu screen to open the USB screen.

3 Select Menu "Read Configuration Data".

4 Press **[SELECT]** (F4) to open the File (Configuration Data) screen.
- File names stored in a USB flash drive appear.
- Pressing **[CANCEL]** (F7) aborts the procedure without reading the data.



5 Press [ ] (F2) or [ ] (F3), or rotate the MULTI/CH control to select the desired file.

6 Press **[OK]** to open the **Read Data Option** screen.
Pressing **[CANCEL]** (F7) aborts the procedure without reading the data.



7 Press [ ] (F2) or [ ] (F3), or rotate the **MULTI/CH** control to select the configuration data to be read.

8 Press [ ] to place a tick mark on the left side of the configuration data name.
Each key press places a tick mark (reading the configuration data) or removes the tick mark (not reading the configuration data).

9 Repeat steps 7 and 8 to configure whether or not each configuration data will be read.

10 Press **[OK]** (F4) to start reading of the file.
Upon completion of the reading, a message notifying you the end of configuration data reading appears.

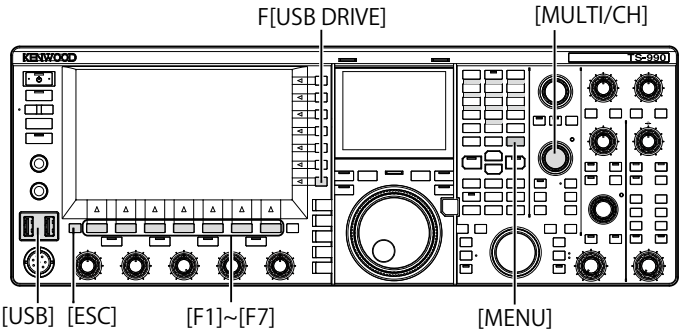
11 Press **[OK]** (F4) to exit.
The transceiver automatically restarts.

PRECAUTION:

♦ Do not remove the USB flash drive while the configuration data file or the audio data file is being read from the USB flash drive. Also, do not shut down the main power switch (I/O). Otherwise, failure in the safe removal of the USB flash drive may cause damage to the USB flash drive, the configuration data file, the audio data file and the malfunction of the transceiver.

DELETING A FILE FROM USB FLASH DRIVE

The configuration data file and the audio data file stored in a USB flash drive can be deleted from the USB flash drive.



Prepare a USB flash drive where the target files are stored, and then follow the procedure below to delete a file.

1 Insert a USB flash drive to the (USB-A) connector.
"" blinks on the main screen, and "" lights when the transceiver recognizes the USB flash drive.

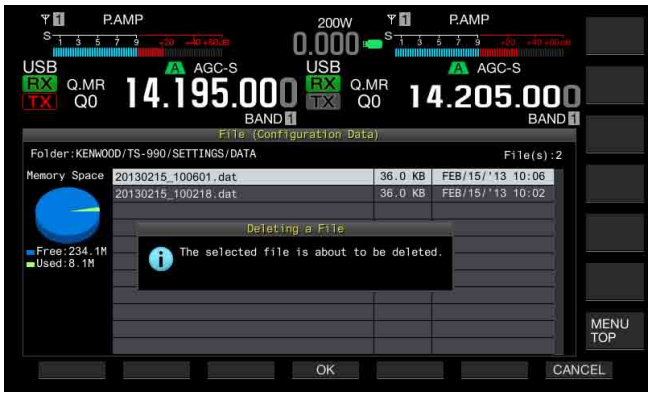
2 Press **[USB DRIVE]** (F) on the Menu screen to open the USB screen.

3 Access Menu "Read Configuration Data".

4 Press **[SELECT]** (F4) to open the File (Configuration Data) screen.
- File names stored in a USB flash drive appear.
- Pressing **[CANCEL]** (F7) aborts the procedure without deleting the file.

5 Press [ ] (F2) or [ ] (F3), or rotate the MULTI/CH control to select the desired file.

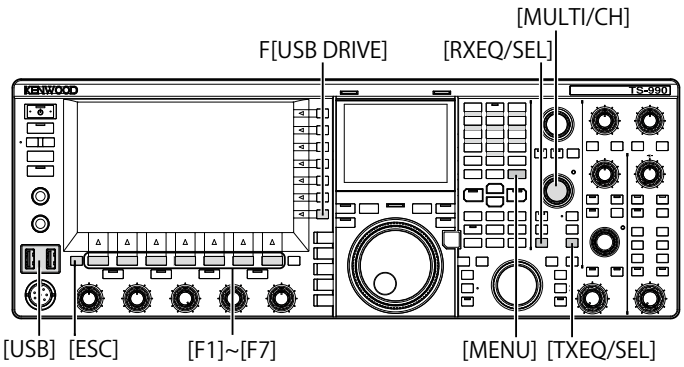
6 Press **[DELETE]** (F6) to delete a file.
A message prompting you to delete a file appears.



7 Press **[OK]** (F4) to exit.
Pressing **[CANCEL]** (F7) aborts the procedure without deleting the file.

CHANGING A FILE NAME IN THE USB FLASH DRIVE

You can change the names of the data files, such as configuration data files, RX DSP equalizer data files, TX DSP equalizer data files, etc., saved in a USB flash drive.



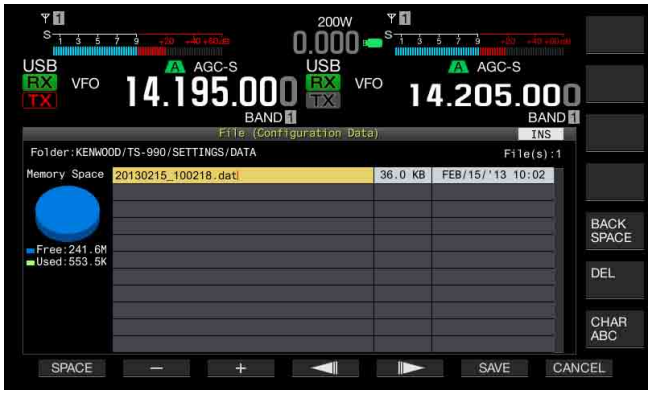
Prepare a USB flash drive where the files to be renamed are stored, and then follow the procedure below to rename.

1 Insert a USB flash drive to the •⇢ (USB-A) connector.
"■" blinks on the main screen, and "■" lights when the transceiver recognizes the USB flash drive.

2 Open the corresponding screen to the file type.
- Configuration Data: Press **[USB DRIVE]** (F) on the **Menu** screen, select "Read Configuration Data", then press **[SELECT]** (F3).
- RX DSP Equalizer: Press **[READ]** (F6) in the **RX Equalizer** screen.
- TX DSP Equalizer: Press **[READ]** (F6) in the **TX Equalizer** screen.
- File names stored in a USB flash drive appear.

3 Press **[▲]** (F2) or **[▼]** (F3) to select a file.

4 Press **[NAME]** (F) to allow file name to be changed.



5 Use the functions keys and the **MULTI/CH** control to edit or enter a text string for the file name.
A maximum of 255 alphanumeric characters and symbols can be entered.

[SPACE] (F1): Press to enter a space.

[-] (F2) and **[+]** (F3): Press to display the previous or next character.

[◀] (F4) and **[▶]** (F5): Press to move a pointer to the left or right.

[SAVE] (F6): Press to store the selected characters.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Press to change the character type. Each time you press **[CHAR]]** (F), the characters cycle through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

6 Press **[SAVE]** (F6) to save a file.
Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the USB screen.

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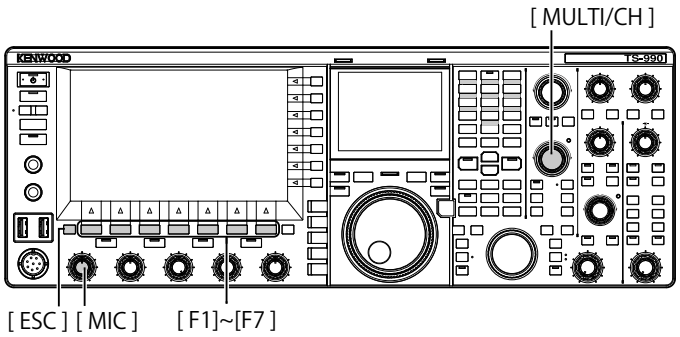
13 VOICE MESSAGE AND AUDIO FILE

This transceiver can record, play, and transmit stylized voice messages, and record and play transmitted and received audio.

RECORDING AND PLAYING VOICE MESSAGE

Voice messages can be recorded in maximum of 6 channels. You can transmit messages recorded using a microphone.

It is useful for DXpedition or contest use when long times of repetitive calling is required, or for adjustment of antenna or transceiver by transmitting a test radio wave. The maximum recording time is 100 seconds. You can record until the total recording time of all channels reaches 100 seconds.



RECORDING A VOICE MESSAGE

You can record voice messages on the voice message channels (TX CH1 to TX CH6).

1 Press a mode key to select SSB, FM, or AM mode.

2 Press **[TX MSG]** (F2) to open the **Voice Message** screen.



3 Press and hold the function key (**[CH1]** (F2) to **[CH6]** (F7) to which the channel is assigned to start recording of the voice message.

- A message prompting you to start recording the voice message appears.
- If **[CH1]** (F2) to **[CH6]** (F7) are unavailable in the function key guide, press **[MORE]** (F1).

4 Press **[REC IN]** (F2) to select the source of the voice message to be recorded.

- Each key press cycles the display through the following sequence: "MIC" (microphone) > "ACC 2" (ACC 2 connector) > "USB" (USB-B connector) > "OPTICAL" (Optical digital input) > "MIC".
- The default is "MIC".



- Rotating the MIC controls adjusts the recording level. Observe the peak recording level with the recording level meter and adjust the recording level so that the peak does not reach the red zone.
- Press **[CANCEL]** (F7) to end recording.

5 Hold down **[REC]** (F4).
While holding down **[REC]** (F4), the voice message is being recorded continuously and its recording time appears.



6 Release **[REC]** (F4) to end the recording and save the voice message.

7 Press **[ESC]** to exit.

Note:

- Recording ends when the recording time expires.
- You cannot continuously record voice messages using multiple channels.
- Recording a new voice message overwrites the saved voice message.

NAMING A VOICE MESSAGE

You can name a recorded voice message.

1 Press a mode key to select SSB, FM, or AM mode.

2 Press **[TX MSG]** (F2) to display the **Voice Message** screen, press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select a channel for which a voice message will be named.
If **[▲]** (F2) or **[▼]** (F3) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

3 Press **[NAME]** (F6) to enable editing of the voice message name.

4 Use function keys, the **MULTI/CH** control, or a USB keyboard to enter the text string for naming.
[SPACE] (F1): Press to enter a space.

[-] (F2)/**[+]** (F3): Press to display the previous or next character.

[◀] (F4)/**[▶]** (F5): Press to move the pointer.

[BACK SPACE] (F): Press to delete a character on the left side of the pointer.

[DEL] (F): Press to delete a character on the right side of the pointer.

[CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

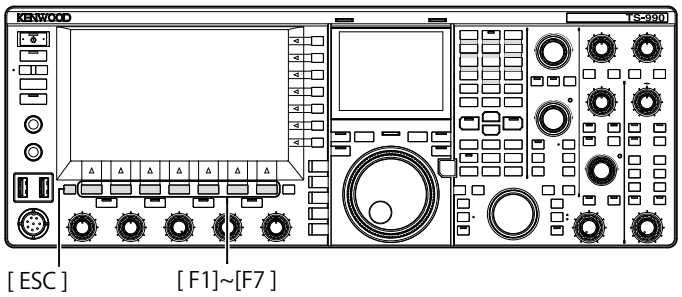
ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !”# (symbols) > ABC (upper case)

5 Press **[SAVE]** (F6) to save the voice message name.
Press [**CANCEL**] (F7) to discard the text string entered and end editing process of the voice message name.

6 Press **[ESC]** to exit.

PLAYING A VOICE MESSAGE

You can play the recorded voice message.



1 Press a mode key to select SSB, FM, or AM mode.

2 Press **[TX MSG]** (F2) to open the **Voice Message** screen.

3 Press **[▲]** (F2) or **[▼]** (F3), or the **MULTI/CH** control to select the voice message channel to be played.
If **[▲]** (F2) or **[▼]** (F3) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[PLAY]** (F4) to play a voice message.
The **Voice Message Play** screen opens.



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You can do the following operations while playing a voice message.

Operation	Action
Hold down **[FF►►]** (F6).	Fast forwards the voice message. Release the key to return to normal play speed.
Hold down **[◄◄REW]** (F2).	Fast rewinds the voice message. Release the key to return to normal play speed.
Press **[IIPAUSE]** (F3).	Pauses the voice message.
Press **[►PLAY]** (F3) while paused	Resume the play from the paused location.
Press **[■STOP]** (F4).	Stops the voice message.
Press **[ESC]**.	The **Voice Message** screen closes and playing of the voice message ends.

ADJUSTING THE VOLUME OF VOICE MESSAGE

You can adjust the volume to play a voice message.

1 Select Group No. 1, "Audio Performance", from the **Menu** screen.

2 Access Menu 01, "Voice Message Volume (Play)"

3 Press **[SELECT]** (F4) to enable editing of the parameter box.



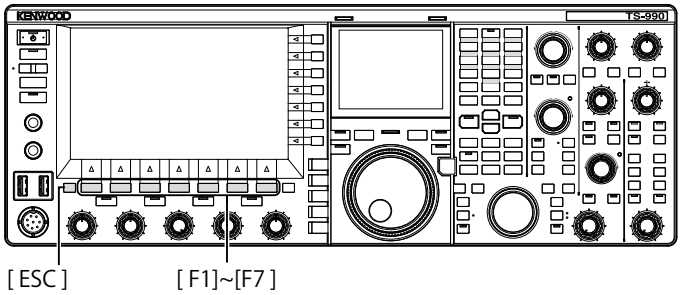
4 Press **[–]** (F4) or **[+]** (F5) to select "Off", the volume level from "1" to "20".
The volume increases as the number increases. Select "Off" to mute the voice message. The default is "10".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

TRANSMITTING A VOICE MESSAGE

You can transmit the recorded voice message while playing.



1 Press a mode key to select SSB, FM, or AM mode.

2 Press **[TX MSG]** (F2) to open the **Voice Message** screen.

3 Press the function key (**[CH1]** (F2) to **[CH6]** (F7)) to be recorded to which the voice message channel number is assigned.
- If **[CH1]** (F2) to **[CH6]** (F7) are unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.
- The **Voice Message Play** screen opens and the voice message is transmitted.



You can do the following operations while playing a voice message.

Operation	Action
Press **[REPEAT]** (F5).	Starts transmitting and the voice message is played repeatedly. Pressing **[REPEAT]** (F5) again stops the repeated play and reverts to the receive mode. You can configure the interval time to repeatedly transmit the voice message. {page 13-2} {page 13-4}
Press **[■STOP]** (F4).	Stops the transmission of a voice message and exits the **Voice Message** screen.
Press **[ESC]**.	The **Voice Message** screen closes and playing of the voice message ends.

CLEARING A VOICE MESSAGE

You can clear a recorded voice message.

1 Press a mode key to select SSB, FM, or AM mode.

2 Press **[TX MSG]** (F2) to open the **Voice Message** screen.

3 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the voice message channel to be cleared.
If **[▲]** (F2) and **[▼]** (F3) are unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press and hold **[(DELETE)]** (F7) to clear the selected voice message.

5 Press **[ESC]** to exit.

CONFIGURING INTERVAL TIME FOR RETRANSMIT

You can configure the interval time to repeatedly play the voice message.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 15, "CW/Voice Message Retransmit Interval Time"

3 Press **[SELECT]** (F4) to enable editing of the parameter box.



4 Press **[–]** (F4) or **[+]** (F5) to select from the range "0 [s]" to "60 [s]".
The default is "10 [s]".

5 Press **[↩]** (F1).

6 Press **[MENU]** to exit.

RECORDING AND PLAYING COMMUNICATION AUDIO

You can record the contents of communications and play the recorded audio with this transceiver.

You can select an internal or external memory (USB) to save the recorded audio file. The following recording functions are available.

Manual Recording

You can record a maximum of 30 seconds of audio data per file to internal memory or a maximum of 9 hours of audio data per file to a USB flash drive.

FULL-TIME RECORDING

A maximum of 30 seconds of the most recent audio is recorded to a file.

TIMER RECORDING (USB FLASH DRIVE ONLY)

Audio is recorded to a USB flash drive according to the configured time and conditions. Refer to "CLOCK DISPLAY AND TIMER" for details on how to perform timer recording. {page 15-1}

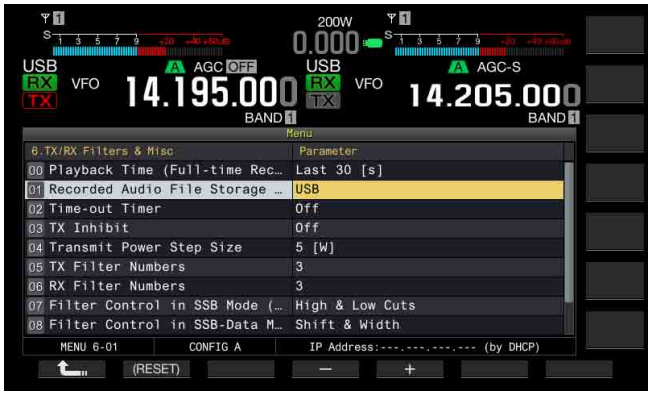
CONFIGURING THE SAVE DESTINATION OF AUDIO FILE

You can configure the save destination of the recorded audio files to either internal memory or USB flash drive.

1 Select Group No. 6, "TX/RX Filter & Misc.", from the **Menu** screen.

2 Access Menu 01, "Recorded Audio File Storage Location".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[–]** (F4) or **[+]** (F5) to select an "Internal" (internal memory) or a "USB" (USB flash drive).
The default is "Internal" (Internal memory).

5 Press **[↩]** (F1).

6 Press **[MENU]** to exit.

Note:

♦ To save on a USB flash drive, insert a USB flash drive into the **(USB-A) connector** before recording. {page 12-1}

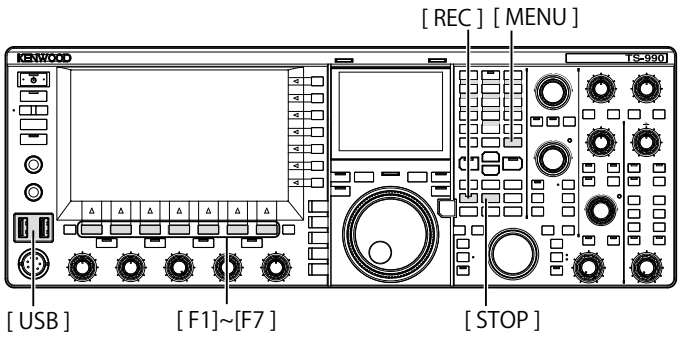
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MANUAL RECORDING

You can start or stop recording of the communications contents to this transceiver with a press of **[REC]** or **[STOP]**. The recording time differs depending on the destination of the saved audio file.

Internal Memory: A maximum of 30 seconds per file (300 seconds in total of the recording time for full-time recording and manual recording)

USB flash drive: A maximum of 9 hours per file



1 Press **[REC]** to start recording.
- "●REC" appears on the main screen and the "REC" LED lights.



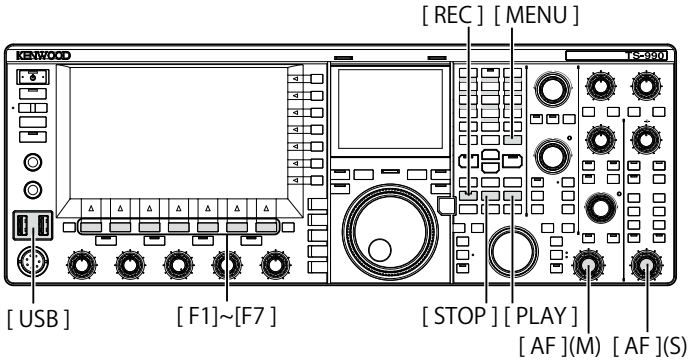
2 Press **[STOP]** to stop recording.
- "●REC" disappears from the main screen and the "REC" LED turns Off.

Note:

- If the remaining memory size becomes insufficient while saving an audio file to internal memory, the audio files with the oldest time stamp will be deleted. You can configure the transceiver so as not to automatically delete the audio file when the remaining memory size becomes insufficient. {page 13-10}
- The audio file stored in the internal memory can be copied to the USB flash drive. {page 12-1}
- While saving an audio file to a USB flash drive, the recording stops when a message appears to notify the available USB flash drive space becomes low.

FULL-TIME RECORDING

Full time recording is the function that allows recording of the audio (communications contents) for the maximum of the last 30 seconds. You can audibly listen to the most recent communication.



CONFIGURING THE MAXIMUM TIME FOR FULL-TIME RECORDING

1 Select Group No. 6, "TX/RX Filter & Misc.", from the **Menu** screen.

2 Access Menu 00, "Playback Time (Full-time Recording)".

3 Press **[SELECT]** (F4) to enable editing of the parameter box.



4 Press **[–]** (F4) or **[+]** (F5) to select "Last 10 [s]", "Last 20 [s]" or "Last 30 [s]".
The default is "Last 30 [s]".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

SAVING AUDIO WITH FULL-TIME RECORDING

1 Press and hold **[REC]**.
- "●REC" blinks for 1 second.
- The most recent audio recorded until **[REC]** is pressed and held, which has the same number of seconds as the maximum recording time configured for the full-time recording, will be stored in the internal memory or USB flash drive.

Note:

- During the manual recording, the transceiver does not operate anything even when pressing **[RX PLAY]** (F1) or **[TX MSG]** (F2).
- While saving an audio file to internal memory, recording stops when the recording time exceeds 30 seconds. If the remaining memory size becomes insufficient, the audio file with the oldest time stamp will be deleted. You can configure the transceiver so as not to automatically delete the audio file when the remaining memory size becomes insufficient. {page 13-10}
- While saving an audio file to a USB flash drive, the recording stops when a message appears to notify the available USB flash drive space becomes low.
- The audio file stored in the internal memory can be copied to the USB flash drive. {page 12-1}

PLAYING AN AUDIO FILE

Plays the audio files saved with manual, full-time or timer recording.

■ Playing the Latest Recorded Audio File

1 Press **[PLAY]** to play the latest audio file.
- "►PLAY" and a progress bar indicating the playing status appear.
- If the **Audio File** screen is open, plays the highlighted audio.



■ Pausing Play

1 Press **[PLAY]** to pause the audio file while playing.
- "IIPAUSE" appears.
- Resumes the playing with a press of **[PLAY]** again.

■ Stopping Play

1 Press **[STOP]** to stop the audio file playing.
- "►PLAY" and the progress bar indicating the playing status disappear.

ADJUSTING THE VOLUME OF VOICE MESSAGE

You can adjust the play volume by rotating the **AF** (M) and **AF** (S) controls.

The received audio in the main band and sub band are recorded in separate audio channels.

The transmitted audio is recorded in both audio channels, so the volume configured with each **AF** control is reflected to both channels.

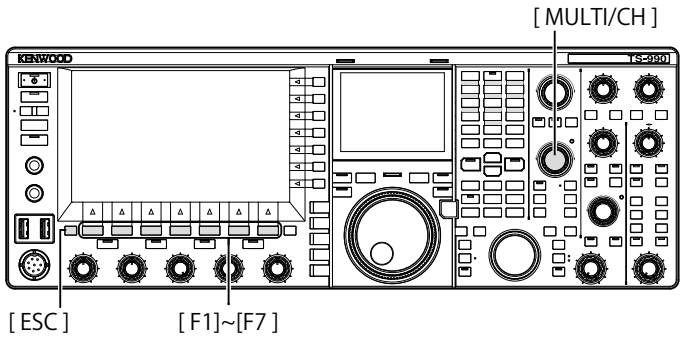
The following can be adjusted by turning the **AF** (M) and **AF** (S) controls.

Recording status	AF (M) control	AF (S) control
With RX in the sub band disabled	• Play volume for received audio in the main band • Play volume for transmitted audio	Play volume for transmitted audio
With RX in the sub band enabled	• Play volume for received audio in the main band • Play volume for transmitted audio	• Play volume for received audio in the sub band • Play volume for transmitted audio

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AUDIO FILES

On the **Audio File** screen, you can operate the transceiver using the audio file stored in the internal memory or USB flash drive.



COPYING AUDIO FILE FROM INTERNAL MEMORY TO USB FLASH DRIVE

You can copy the audio file stored in the internal memory to a USB flash drive.

To use a USB flash drive, insert a USB flash drive in ⇽ (USB-A) and be sure that the transceiver has recognized the USB flash drive.

1 Press **[RX PLAY]** (F1) to open the **Audio File** screen.

2 Press **[INT.MEM]** (F7) to display the **Audio File (Internal)** screen.

3 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the audio file to be saved in USB flash drive.
If **[▲]** (F2) and **[▼]** (F3) are unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[SAVE]** (F4).
- A message prompting you to save the configuration data appears.
- Press **[CANCEL]** (F) to close the **Data Save Confirmation** screen and return to the **Audio File (Internal)** screen.

If **[SAVE]** (F4) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

5 Press **[OK]** (F4) to save the audio file.

6 Press **[ESC]** to exit.

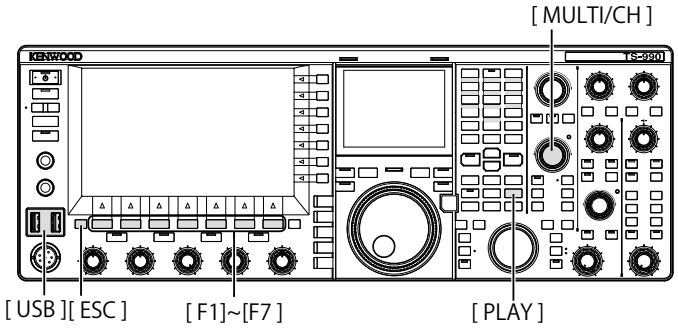
Note:

♦ Prior to remove a USB flash drive, be sure to execute "Safe Removal of the USB Flash Drive" {page 12-1}

PLAYING AN AUDIO FILE

You can play an audio file saved in internal memory or USB flash drive.

To use a USB flash drive, insert a USB flash drive in ⇽ (USB-A) and be sure that the transceiver has recognized the USB flash drive.



1 Press **[RX PLAY]** (F1) to open the **Audio File** screen.

2 Press **[INT.MEM]** (F7) or **[USB MEM]** (F7) to alternate the screen.
- Press **[INT.MEM]** (F7) to open the **Audio File (Internal)** screen.
- Press **[USB MEM]** (F7) to open the **Audio File (USB)** screen.
- If **[INT.MEM]** (F7) or **[USB MEM]** (F7) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.
- If the **Audio File (USB)** screen opens with a press of **[USB MEM]** (F7), pressing **[FOLDER]** (F1) to switch the folder to refer to. The file recorded with the timed task is stored in the TIMER_REC folder and other files are stored in the RX_REC folder.



3 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select an audio file to be played.

4 Press **[PLAY]** (F4) or **[PLAY]** to play the audio file.



Note:

- While the **Audio File (USB)** screen is open, press **[FOLDER]** (F1) to change the folder storing the file.
- The **Audio File (USB)** screen will not appear if no USB flash drive is connected to or correctly recognized by the transceiver.
- Prior to removing a USB flash drive, be sure to execute "Safe Removal of the USB Flash Drive" {page 12-1}

You can do the following operations while playing an audio file.

Operation	Action
Hold down **[FF►►]** (F6).	Fast forwards the audio file. Release the key to return to normal play speed.
Hold down **[◄◄REW]** (F2).	Fast rewinds the audio file. Release the key to return to normal play speed.
Press **[IIPAUSE]** (F3).	Pause the audio file. Press **[PLAY]** (F3) again to resume from the paused location.
Press **[NEXT►►]** (F7).	Plays the audio file (the one before the current file) from the beginning.
Quickly press **[◄◄PREV]** (F1) twice.	Plays the audio file (the one after the current file) from the beginning.
Press **[◄◄PREV]** (F1) once.	Plays the current audio file once more from beginning.
Press **[■STOP]** (F4).	Ends playing the audio file.
Press **[ESC]**.	Closes the **Audio File Play** screen and **Recorded Audio File List** screen.
Rotate the **MULTI/CH** control.	If two or more audio files are saved, you can cue the audio file.

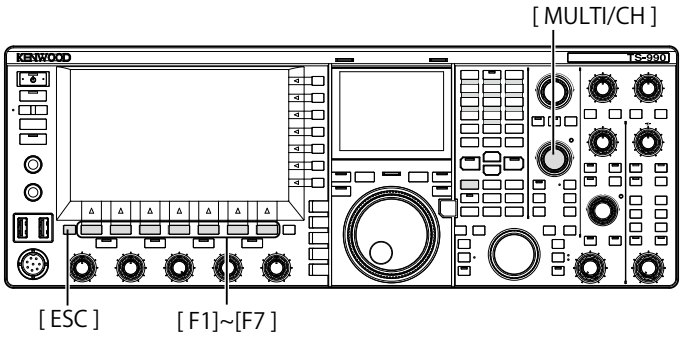
Note:

- Prior to removing a USB flash drive, be sure to execute "Safe Removal of the USB Flash Drive" {page 12-1}.

NAMING AN AUDIO FILE

You can name an audio file saved in internal memory or USB flash drive.

To use a USB flash drive, insert a USB flash drive in ⇻ (USB-A) and be sure that the transceiver has recognized the USB flash drive.



1. Press **[RX PLAY]** (F1) to open the **Audio File** screen.
2. Press **[INT.MEM]** (F7) or **[USB MEM]** (F7) to alternate the screen.
   - Press **[INT.MEM]** (F7) to open the **Audio File (Internal)** screen.
   - Press **[USB MEM]** (F7) to open the **Audio File (USB)** screen.
   - If **[INT.MEM]** (F7) or **[USB MEM]** (F7) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.
   - If the **Audio File (USB)** screen appears with a press of **[USB MEM]** (F7), pressing **[FOLDER]** (F1) switches the folder to refer to. The file recorded with the timed task is stored in the TIMER_REC folder and other files are stored in the RX_REC folder.
3. Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select an audio file to be named.
4. Press **[NAME]** (F5) to enable editing of the audio file name.
   If **[NAME]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.



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5 Use function keys, the **MULTI/CH** control, or a USB keyboard to enter the name.
[SPACE] (F1): Press to enter a space.

[-] (F2) and **[+]** (F3): Press to display the previous or next character.

[ ] (F4)/**[ ]** (F5): Press to move the pointer.

[SAVE] (F6): Press to save the edited characters.

[BACK SPACE] (F): Press to delete a character on the left side of the pointer.

[CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

6 Press **[SAVE]** (F6) to save the file name.
Press **[CANCEL]** (F7) to discard the text string entered and end entering the audio file name.

7 Press **[ESC]** to exit.

Note:

- Prior to removing a USB flash drive, be sure to execute "Safe Removal of the USB Flash Drive" {page 12-1}

DELETING AN AUDIO FILE

You can delete an audio file saved in internal memory or USB flash drive.

To use a USB flash drive, insert a USB flash drive in (USB-A) and be sure that the transceiver has recognized the USB flash drive.

1 Press **[RX PLAY]** (F1) to open the **Audio File** screen.

2 Press **[INT.MEM]** (F7) or **[USB MEM]** (F7) to alternate the screen.
- Press **[INT.MEM]** (F7) to open the **Audio File (Internal)** screen.
- Press **[USB MEM]** (F7) to open the **Audio File (USB)** screen.
- If **[INT.MEM]** (F7) or **[USB MEM]** (F7) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.
- If the **Audio File (USB)** screen appears with a press of **[USB MEM]** (F7), pressing **[FOLDER]** (F1) to switch the folder to refer to the file recorded with the timed task stored in the TIMER_REC folder and other files are stored in the RX_REC folder.

3 Press **[ ]** (F2) or **[ ]** (F3), or rotate the **MULTI/CH** control to select an audio file to be deleted.

4 Press **[DELETE]** (F6).
A message prompting you to delete an audio file appears.

5 Press **[OK]** (F4) to delete an audio file.
Press **[CANCEL]** (F7) to revert to the **Audio File** screen without deleting an audio file.

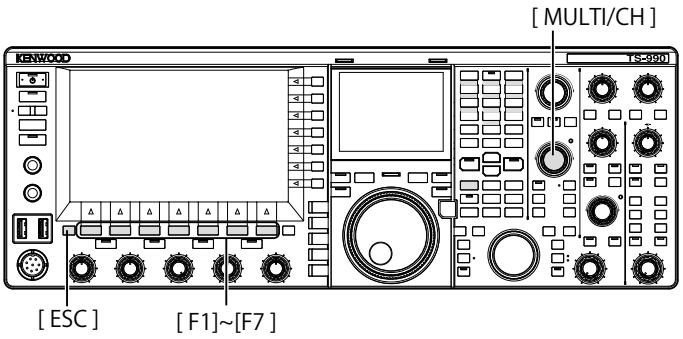
6 Press **[ESC]** to exit.

Note:

- You cannot delete an audio file that is protected.
- Prior to removing a USB flash drive, be sure to execute "Safe Removal of the USB Flash Drive" {page 12-1}

PROTECTING AN AUDIO FILE FROM DELETION (ONLY FOR INTERNAL MEMORY)

If the remaining memory size becomes insufficient while saving an audio file to internal memory, the audio files with the oldest time stamp will be deleted. You can configure the transceiver so as not to automatically delete the audio file when the remaining memory size becomes insufficient.



1 Press **[RX PLAY]** (F1) to open the **Audio File** screen.

2 Press **[INT.MEM]** (F7) to open the **Audio File (Internal)** screen.
If **[INT.MEM]** (F7) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.



3 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select an audio file to be prevented from deleting.
If **[▲]** (F2) or **[▼]** (F3) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[🔒]** (F6) to prevent the file from deleting.
- Press **[🔒]** (F6) again to deselect the protection of the file.
- If **[🔒]** (F6) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

5 Press **[ESC]** to exit.

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14 VOICE GUIDANCE

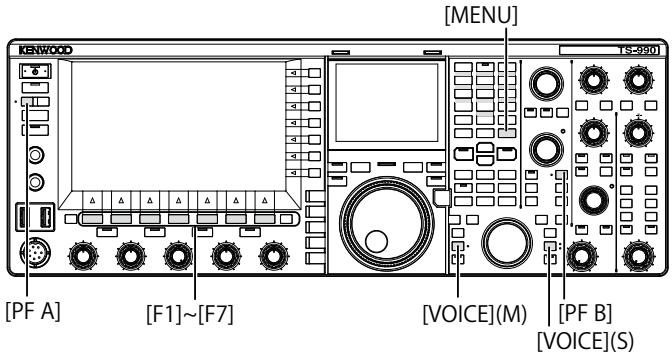
This transceiver has a voice guidance feature which vocally announces the operating status displayed on the screen.

This manual indicates the announced contents of the voice guidance as follows:

As pronounced	The announced content is enclosed in the double quotation marks as pronounced.
Numbers and alphabets	The announced content is generically described as numbers or alphabets
Options	The announced contents are listed in parentheses. Each option is separated with a slash and only one of them is announced.

VOICE GUIDANCE

If you press a PF key to which the voice guidance function is assigned, the current operating status is announced through the built-in speaker.



There are 4 types of voice guidance.

VOICE 1
Announces each frequency and operating status displayed in the main band and the sub band.

The defaults are **[VOICE]** (M) and **[VOICE]** (S).

VOICE 2
Announces the status of the S meter and the power meter.

The default is **[PF A]**.

VOICE 3
Announces the status of the meters selected by a press of **[METER]** (F) except the power meter.

The default is **[PF B]**.

AUTO ANNOUNCE
Announcement is made automatically upon a certain operation or a change of the operating status. The default is "Off".

Note:

- The values announced from Voice 2 and Voice 3 of this transceiver should be referred to as a referential guide of the readout from each meter.
- Refer to the "PF (Programmable Function)" to change the functions assigned to PF keys. {page 16-6}

CONFIGURING THE VOLUME OF THE VOICE GUIDANCE

You can adjust the voice guidance volume. If "Off" is configured for voice guidance volume, the transceiver does not announce the voice guidance even with a press of the PF key.

1. Select Group No.1, " Audio Performance", from the **Menu** screen.
2. Access Menu 03, "Voice Guidance Volume".
3. Press **[SELECT]** (F4) to enable editing of the parameter box.
4. Press **[–]** (F4) or **[+]** (F5) to select "Off", or the volume level in the range from "1" to "20".
   - The volume increases as the number increases.
   - The default is "10".
5. Press [ ] (F1).
6. Press **[MENU]** to exit.

CONFIGURING THE VOICE GUIDANCE SPEED

The announcement speed can be configured.

1. Select Group No. 1, "Audio Performance", from the **Menu** screen.
2. Access Menu 04, "Voice Guidance Speed".
3. Press **[SELECT]** (F4) to enable editing of the parameter box.
4. Press **[–]** (F4) or **[+]** (F5) to select the announcement speed in the range from "1" to "4".
   - The announcement speed increases as the number increases. Depending on the content, it may be difficult to hear the announcement as the announcement speed increases.
   - The default is "1".
5. Press [ ] (F1).
6. Press **[MENU]** to exit.

CONFIGURING THE ANNOUNCEMENT LANGUAGE

You can select either Japanese or English as the announcement language.

1. Select Group No. 1, "Audio Performance", from the **Menu** screen.
2. Access Menu 05, "User Interface Language (Voice Guidance & Messages)".
3. Press **[SELECT]** (F4) to enable editing of the parameter box.
4. Press **[–]** (F4) or **[+]** (F5) to select "English " or "Japanese".
   The default is "English".
5. Press [ ] (F1).
6. Press **[MENU]** to exit.

AUTOMATICALLY ANNOUNCING VOICE GUIDANCE

When voice guidance is enabled, voice guidance is announced automatically upon the certain operation.

1 Select Group No. 1, "Audio Performance", from the **Menu** screen.
2 Access Menu 06, "Automatic Voice Guidance".
3 Press **[SELECT]** (F4) to enable editing of the parameter box.
4 Press **[–]** (F4) or **[+]** (F5) to select "On".
The default is "Off".
5 Press [ ] (F1).
6 Press **[MENU]** to exit.

Note:

♦ Press **[⏻]** while pressing down **[PF A]** when the transceiver power (⏻) turns OFF starts up the transceiver power (⏻) with Voice Guidance enabled.

If auto voice guidance is enabled, announcement is made as follows.

Transceiver Behavior	Key Operation	Announcement
Power (⏻) ON	-	Operating data is announced regardless of the status of the configuration screen. Refer to "Voice 1".
Toggling between VFO mode and Memory Channel mode	**[M/V]**	Refer to "Voice 1".
Memory shift	**[M ► V]** **[M ► VFO]** (F)	Announces the content in VFO mode. Refer to "Voice 1".
Switching to Quick Memory Channel mode	**[MR]**	Announces the content of Quick Memory Channel mode. Refer to "Voice 1".
Switching Memory Channels in Single-band Memory mode	Rotate the **MULTI/CH** control.	"Channel" + Number + (S/D/P/ blank) + Frequency No announcement if the **Memory Channel List** screen is open.
Switching Memory Channels in Dual-band Memory mode	Rotate the **MULTI/CH** control.	("Split") + (RX/TX) + "Channel" + number + (S/D/P/blank) + frequency No announcement if the **Memory Channel List** screen is open.
When frequency is entered with the numeric keypad	**[ENT]**	"Enter"
Channel number is entered with the numeric key	Pressing the numeric key	Number
Switching frequency entry history	Rotate the **MULTI/CH** control.	Frequency
Switching frequency lock	**[LOCK]** (M) **[LOCK]** (S)	"Lock" + (On/Off)
Switching mute function for received audio	**[MUTE]** (M) **[MUTE]** (S)	"Mute" + (On/Off)
Switching split operation	**[TX]** (S) **[TX]** (M)	"Split" + (On/Off)
Entering split frequency	Press and hold **[TX]** (S)	"Split" + "Enter"
Confirming split frequency	The numeric keypad or **[TX]** (S)	"Split" + "TX " + Sub band frequency
Changing the Low Cut frequency	Rotate the **LO/ WIDTH** control	"Low" + frequency
Changing width	Rotate the **LO/ WIDTH** control	"Width" + frequency
Changing the High Cut frequency	Rotate the **HI/ SHIFT** control	"High" + frequency
Changing shift frequency	Rotate the **HI/ SHIFT** control	"Shift" + frequency
Changing transmit power	Rotate the **PWR** control	"TX power" + number
Enabling or disabling the timed task by a timer	**[TIMER]**	"Timer" + (On/Off)
Switching dimmer	**[DIM]**	"D" + 1 digit number
Switching antenna	**[ANT]** (F)	"Antenna" + number
Selecting band direct	Band direct key	Frequency
Using the emergency contact configuration frequency	**[EMERGENCY]** (PF)	"Emergency" + "Frequency"
Switching meter	**[METER]** (F)	Analog: (Power/SWR/ID/ Processor/ALC/VD) "Processor" is announced only if Processor is enabled.
		Digital: (SWR/ID/Processor/VD/ TMP) "Processor" is announced only if Processor is enabled.
		Mini-digital: (Power/SWR/ID/ Processor/ALC/VD/TMP) "Processor" is announced only if Processor is enabled.

Note:

♦ Refer to "Voice 1" for the announcement contents currently displaying the configuration mode. {page 14-3}

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The following operating data is announced with an operation in main band.

Screen Status	Detail Status	Announcement
VFO mode	Simplex mode	Frequency
	Split mode	"Split" + "RX " + Frequency
Memory Channel mode	Single-band Memory mode	"Channel" + Number + (S/D/P/ blank) + Frequency
	Dual-band Memory mode	"Split" + "RX " + "Channel" + Number + (S/D/P/blank) + Frequency
Quick Memory Channel mode	Simplex mode	"Quick" + Number + Frequency
	Split mode	"Split" + "RX" + "Quick" + Number + Frequency
Entering frequency	If no data is entered	"Enter"
	Entering frequency halfway through	Number The digit indicating MHz is announced as "dot" followed by the numbers.
	Selecting the entry history	History frequency To enter the number in the 1st digit of Memory Channel number, the voice guidance announces "Enter" + 1st digit number, and to enter the number in the 2nd digit, it announces 1st and 2nd digit numbers + Frequency or "blank".
Editing split frequency	"SPLIT" LED blinks	"Split" + "Enter"

Note:

- When switching to VFO mode, Memory Channel mode, or Quick Memory Channel mode while receiving the operating data in SWL mode, "SWL" is added at the beginning of voice guidance.

The following operating data is announced upon an operation in sub band.

Screen Status	Detail Status	Announcement
VFO mode	Simplex mode	Frequency
	Split mode	"Split" + "TX" + Frequency
Memory Channel mode	Single-band Memory mode	"Channel" + Number + (S/D/P/ blank) + Frequency
	Dual-band Memory mode	"Split" + "RX" + "Channel" + Number + (S/ D/ P/ Blank) + Frequency
Quick Memory Channel mode	Simplex mode	"Quick" + Number + Frequency
	Split mode	"Split" + "TX" + "Quick" + Number + Frequency
Entering frequency	If no data is entered	"Enter"
	Entering frequency halfway through	Number The digit indicating MHz is announced as "dot" followed by the numbers.
	Selecting the entry history	History frequency
Editing split frequency	"SPLIT" LED blinks	"Split" + "Enter"

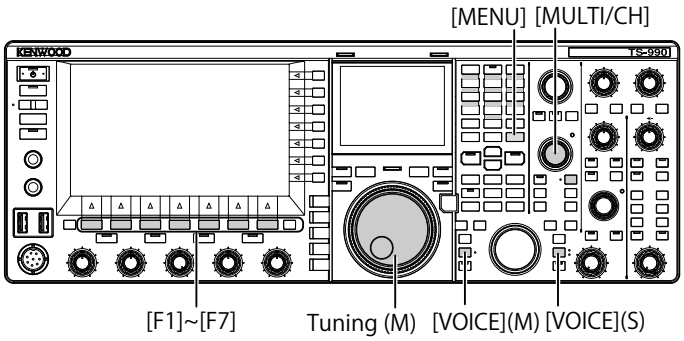
Note:

- When switching to VFO mode, Memory Channel mode, or Quick Memory Channel mode while receiving the operating data in SWL mode, "SWL" is added at the beginning of voice guidance.

VOICE 1

Announces the frequency, channel number, contents of various configuration mode, and menu configurations displayed in the main band and the sub band.

When fine tuning is disabled, the voice guidance announces the digits above 10 Hz for VFO and Memory Channel frequencies. When announcing the number in the MHz digit, "dot" is also announced along with it. When selecting a channel with no operating data in the memory scroll, "blank" is announced.



1 Press the PF key to which **[VOICE]** (M), **[VOICE]** (S) or Voice 1 is assigned.

The operating status is announced. During the configuration on the configuration screen using the main band, the entered parameter is being announced, and in the normal conditions, the operating status of the main band is announced.

Note:

- Pressing again during the announcement the PF key, to which "Voice 1" is assigned, stops the announcement.
- Announcement stops when the frequency is changed with the Tuning or **MULTI/CH** control during the announcement.
- Refer to "PF (Programmable Function)" to change the PF key to be assigned. {page 16-6}
- There is no announcement during the scan.

The following announcements are made upon a press of **[VOICE]** (M) or **[VOICE]** (S). The announced content differs depending on the screen being displayed.

Screen	Operation/Status	Announced Content
Auto Mode	To display a screen	"Auto" + frequency on the top of the list + Mode
	When **[VOICE1]** is pressed	"Auto" + Operating frequency
	Focus shift	Frequency + Mode
	Copying a frequency to list	"Copy" + Frequency + Mode
	Switching On/Off	"Auto" + (On/Off)
ANT name	When the screen opens or **[VOICE1]** is pressed	"Antenna Name" + number
	Focus shift	Number
	Displaying the Antenna Name Entry screen	"Edit"
Preselector	When the screen opens or **[VOICE1]** is pressed	"Preselector" + Value (–20 to +20)
	Shift	Value (–20 to +20)
	Aligning with center	"Center" + Value (0)
AGC	When the screen opens or **[VOICE1]** is pressed	"AGC" + (Fast/Middle/Slow) + Value "AGC" + "Off"
	Changing a value	Value
	Switching the AGC speed	(Fast/Middle/Slow) + Value
AGC copy	When the screen opens or **[VOICE1]** is pressed	"Copy" + "OK?"
AGC disabled	When the screen opens or **[VOICE1]** is pressed	"AGC" + "Off" + "OK?"
Equalizer	When the screen opens or **[VOICE1]** is pressed	(RX/TX) + "Equalizer" + (HB1/HB2/FP/BB1/BB2/F/C/U1/U2/U3)
	Focus shift	(HB1/HB2/FP/BB1/BB2/F/C/U1/U2/U3)
Equalizer configuration	When the screen opens or **[VOICE1]** is pressed	(RX/TX) + "Equalizer " + "Adjust"
	Focus shift	(0/0.3/0.6/0.9/1.2/1.5/1.8/2.1/2.4/2.7/3.0/3.3/3.6/3.9/4.2/4.5/4.8/5.1) + (+/-) + "dB", or "0 dB"
	Changing a value	(+/-) + Value + "dB" (does not announce "plus minus" in the case of 0 dB)
	Initializing	No announcement
Copying the equalizer configuration	When the screen opens or **[VOICE1]** is pressed	"Copy" + "OK?"
Reading the equalizer data	When the screen opens or **[VOICE1]** is pressed	"Read" + "OK?"
Reading a file	When the screen opens or **[VOICE1]** is pressed	"File list" + "RX" + "Equalizer"
	When the screen opens or **[VOICE1]** is pressed	"File list" + "TX" + "Equalizer"
	When the screen opens or **[VOICE1]** is pressed	"File list" + "Data"
	Focus shift	Year + Month + Date + Time
	When the screen opens or **[VOICE1]** is pressed	"Clear" + "OK?"
	Editing a name	"Edit"
Selecting the data block to be read (DATA)	When the screen opens or **[VOICE1]** is pressed	"Read" + "Data" + "Select"
	Focus shift (Environment dependent)	"ENV" + (On/Off)
	Focus shift (CW)	"CW message" + (On/Off)
	Focus shift (Recording)	"Record" + "Message" + (On/Off)
		"Message" + "Record" + (On/Off)
	Focus shift (Voice Message)	"Voice Message" + (On/Off)
	Switching On/Off	(On/Off)
Processing	When the screen opens or **[VOICE1]** is pressed	"Please wait" (No voice guidance while reading using RXEQ and TX EQ)
Data load complete	When the screen opens or **[VOICE1]** is pressed	"Completed"
Verify data save (RXEQ)	When the screen opens or **[VOICE1]** is pressed	"Save" + "OK?"
Saving the data	When the screen opens or **[VOICE1]** is pressed	"Completed"

Screen	Operation/Status	Announced Content
The audio source to be transmitted	When the screen opens or **[VOICE1]** is pressed	"Modulation source" + (Microphone PTT/Data PTT)
	Changing the transmit method	(Microphone PTT/Data PTT)
	Switching the audio source	(Microphone/ACC2/USB/Optical)
	Switching On/Off	(On/Off)
	When to reset to the defaults	No announcement
	Toggling the Data VOX between On and Off	"Data box" + (Off/ACC2/USB/Optical)
VOX level configuration	When the screen opens or **[VOICE1]** is pressed	(VOX gain/Anti-VOX gain/VOX ready) + (Microphone/ACC2/USB/Optical) + Value
	Switching the audio source	(Microphone/ACC2/USB/Optical)
	Switching a parameter to be configured	(VOX gain/Anti-VOX gain/VOX ready)
	Increasing/decreasing configuration value	Value (No voice guidance for MIC VOX value)
	Reset to the defaults	No announcement
Transmit power limit	When the screen opens or **[VOICE1]** is pressed	(TX power limit/TX power limit data/TX tune) + (1.8/3.5/5/7/10/14/18/21/24/28/50) + "MHz" + Value
	Selecting transmit power type	(TX power limit/TX power limit data/TX tune)
	Selecting band	(1.8/3.5/5/7/10/14/18/21/24/28/50) + "MHz"
	Increasing/decreasing transmit power	Value
	Reset to the defaults	No announcement
Speech processor effect type	When the screen opens or **[VOICE1]** is pressed	"Processor" + (Soft/Hard)
	Selecting an effect	(Soft/Hard)
Transmit filter	When the screen opens or **[VOICE1]** is pressed	"TX" + "Filter" + (A/B/C) + (High/Low) + Value
	Transmit filter switch operation	(A/B/C)
	HICUT/LOCUT switching operation	(High/Low)
	Switching the cutoff frequency	Value
	Reset to the defaults	No announcement
CW Message (Paddle version)	When the screen opens or **[VOICE1]** is pressed	"CW" + "Message"
	When the editing screen opens or **[VOICE1]** is pressed	"Channel" + Number + "Repeat" + "Blank"
	Switching a repeat	"Repeat" + (On/Off)
	Switching a channel	Number
	Switching a playback list	No announcement
	Delete	No announcement
	Editing a channel name (Including when **[VOICE1]** is pressed)	"Edit"
CW Message (Paddle) save pending	When the screen opens or **[VOICE1]** is pressed	No announcement
Save a CW Message	When **[VOICE1]** is pressed	No announcement
CW Message (Text version)	When the screen opens or **[VOICE1]** is pressed	"CW" + "Message"
	When the screen opens or **[VOICE1]** is pressed	"Channel" + Number + "Repeat" + "Blank" + (Number/Contest number)
	Switching a repeat	"Repeat" + (On/Off)
	Switching a channel	Number
	Switching a playback list	No announcement
	Delete	No announcement
	Subtracting the contest number	Contest number
	Editing a channel name (Including when **[VOICE1]** is pressed)	"Edit"
RTTY	When the screen opens or **[VOICE1]** is pressed	"RTTY" + "Communication"
PSK	When the screen opens or **[VOICE1]** is pressed	"PSK" + "Communication"

Screen	Operation/Status	Announced Content
RTTY/PSK message	When the screen opens or **[VOICE1]** is pressed	(RTTY/PSK) + "Message"
	When the screen opens or **[VOICE1]** is pressed	"Channel" + Number + "Auto" + (TX/RX)
	Switching a channel	Number
	Switching the automatic transmit	"Auto" + "TX" + (On/Off)
	Switching auto receive	"Auto" + "RX" + (On/Off)
	Editing a message (Including when **[VOICE1]** is pressed)	Editing a message
FM tone	When the screen opens or **[VOICE1]** is pressed	(Main/Sub) + (Tone/CTCSS) + Frequency
	Switching a tone type	(Tone/CTCSS)
	Changing the frequency	Frequency
	Starting the Tone/CTCSS scan	(Tone/CTCSS) + Scan
	Ending the tone CTCSS scan	Frequency
	Switching a band (Focused band)	(Main/Sub)
Receive a filter	When the screen opens or **[VOICE1]** is pressed	"RX filter" + (A/B/C) + (R/IF/AF) + Value
	Switching a filter	(A/B/C)
	Switching to a roofing filter	(Auto/270 Hz/500 Hz/2.7 kHz/6 kHz/15 kHz/Additional)
	Switching the IF filter shape	(Medium/Soft/Sharp)
	Switching the audio filter band width	(Medium/Wide/Narrow)
Audio peak filter	When the screen opens or **[VOICE1]** is pressed	"APF" + (Narrow/Middle/Wide)
	Focus shift	(Narrow/Middle/Wide)
NB1/NB2/NR1/NR2 level (Sub-and)	When the screen opens or **[VOICE1]** is pressed	"Noise blanker" + 1 + Value "Noise blanker" + 2 + Value "Noise reduction" + 1 + Value "Noise reduction" + 2 + Value
	Reset to the defaults	No announcement
	Switching configured value	Value
Configuring auto notch tracking speed	When the screen opens or **[VOICE1]** is pressed	"Auto Notch" + "Tracking" + Value
	Reset to the defaults	No announcement
	Switching configured value	Value
Band eliminate filter	When the screen opens or **[VOICE1]** is pressed	"Band elimination filter" + (Width/Depth) + Value
	Band Width, Extent configuration	(Width/Depth)
	Switching configured value	Value
	Reset to the defaults	No announcement
Bandscope	When the screen opens or **[VOICE1]** is pressed	"Bandscope 1"
Bandscope and Waterfall	When the screen opens or **[VOICE1]** is pressed	"Bandscope 2"
Audio scope	When the screen opens or **[VOICE1]** is pressed	Audio scope
Memory Channel List	When the screen opens or **[VOICE1]** is pressed	"Memory List" + Number + (S/D/P/blank) Only when write destination is selected: (Memory in) + Number + (S/D/P/blank)
	Focus shift	Number + (S/D/P/blank)
	Saving or pasting the data	No announcement
	Programmable start frequency entry (End frequency entry)	"End frequency" + Used frequency
	Clearing the channel data	No announcement
	Switching the lockout	"Lockout" + (On/Off)
Confirming clear all for Quick Memory	When the screen opens or **[VOICE1]** is pressed	"Quick Memory" + "Clear" + "OK?"
Memory scan group configuration	When the screen opens or **[VOICE1]** is pressed	"Memory Scan" + "Group" + Number + (On/Off)
	Focus shift	Number + (On/Off)
	Switching On/Off	(On/Off)
	Switching all On/Off	"Select all" "Clear all"

Screen	Operation/Status	Announced Content
Program scan range configuration	When the screen opens or **[VOICE1]** is pressed	"Program Scan" + "Channel" + Number + (On/Off)
	Focus shift	Number + (On/Off)
	Switching On/Off	(On/Off)
	Switching all On/Off	"Select all" "Clear all"
Configuring program slow scan point	When the screen opens or **[VOICE1]** is pressed	"Program Slow Scan" + Operating frequency
	When configuring point frequency	No announcement
	Clear all	"Clear all"
Voice Message	When the screen opens or **[VOICE1]** is pressed	"Voice" + "Message"
	When the editing screen opens or **[VOICE1]** is pressed	Channel with nothing saved: "Message" + Number + "Blank" Channel with Voice Message saved: "Message" + Number + "Repeat"
	Switching channel to be edited	The channel where no operating data is stored: Number + "Blank" Channel with Voice Message saved: Number + (Repeat)
	Switching a repeat	"Repeat" + (On/Off)
	Delete	No announcement
	Saving a name (Including when **[VOICE1]** is pressed)	"Edit"
Waiting for a voice message recording	When the screen opens or **[VOICE1]** is pressed	"Record" + (Microphone/ACC2/USB/Optical)
	Switching the audio source	(Microphone/ACC2/USB/Optical)
Recording file (Built-in)	When the screen opens or **[VOICE1]** is pressed	"Audio file"
	Lock On or Off	"Lock" + (On/Off)
	Focus shift	Year (2012 to 2099) + Month + Date + Hour (Date and time when a file was created)
	Switching a key list	No announcement
	Switching folder	Same as when a screen was opened.
	Confirming the audio file delete (Including when **[VOICE1]** is pressed)	"Clear" + "OK?"
	Editing the file name	"Edit"
	Confirmation of the operating data storage to USB flash drive (Including when **[VOICE1]** is pressed)	"Save" + "OK?"
Recording file (USB Flash Drive)	When the screen opens or **[VOICE1]** is pressed	When accessing audio file: "Audio file" + "USB" When accessing timer recorded audio file: "Audio file" + "USB" + "Timer"
	Focus shift	Year + Month + Date + Time
	Switching a key list	No announcement
	Switching folder	Same as when a screen was opened.
	Confirming the audio file delete (Including when **[VOICE1]** is pressed)	"Clear" + "OK?"
	Editing a name	"Edit"
LAN Menu	When the screen opens or **[VOICE1]** is pressed	"Run" + "Menu" + Number + Selected value
	Switching the configuration item	Number + Selected value
	Starting editing configurations, Focus shift, Entering configuration value	Focus location value
	Switching the configuration item (Address related)	Number + Value +"dot" + Value +"dot" + Value +"dot" + Value
	Switching the configuration item (ID/Pass related)	Number
	Starting editing configurations, Focus shift (Address related)	Focus location value
	Entering the configuration value (Address related)	Entered parameter
	Selecting the parameter (Address related)	Selected value
CLOCK menu	To display a screen	"Clock" + "Menu" + "Group" + Number
	Selecting a group	Number

Screen	Operation/Status	Announced Content
CLOCK Menu (Group)	When the screen opens or **[VOICE1]** is pressed	"Clock" + "Menu" + Number + Value
	Selecting an item	Number + Value
	Editing configurations (including when **[VOICE1]** is pressed)	"Edit"
	Starting configuration	No announcement
	Changing configuration value	Value
Retrieving the NTP date and time data	When the screen opens or **[VOICE1]** is pressed	"Clock update"
Retrieving of the NTP and time data completed	When the screen opens or **[VOICE1]** is pressed	"Completed"
Retrieving of the NTP and time data failed	When the screen opens or **[VOICE1]** is pressed	"Error" + Number
TIMER	When the screen opens or **[VOICE1]** is pressed	"Program timer" + Selected value, or "Sleep Timer" + Selected value
	Selecting timer type	Same as when opening screen
Programmable Timer	When the screen opens or **[VOICE1]** is pressed	"Programmable Timer" + "Timer" + (On/Off) "Programmable Timer" + "Repeat" + (On/Off) "Programmable Timer" + Day of the Week + (On/Off) "Programmable Timer" + "Mode" + (On/Off/Both/Record) "Programmable Timer" + "Start" (Hour) + Value "Programmable Timer" + "Start" (Minute) + Value "Programmable Timer" + "End" (Hour) + Value "Programmable Timer" + "End" (Minute) + Value "Programmable Timer" + "Main" + Frequency + "Sub" + Frequency
	Focus shift	"Timer" + (On/Off) "Repeat" + (On/Off) Day of the Week + (On/Off) Mode + (On/Off/Both/Record) "Start" (Hour) + Value "Start" (Minute) + Value "End" (Hour) + Value "End" (Minute) + Value "Main" + Frequency + "Sub" + Frequency
	When a parameter is entered	Entered value
Menu	When the screen opens or **[VOICE1]** is pressed	"Menu" + "Group" + Number
	Selecting a group	"Group" + Number
Menu (Group)	When the screen opens or **[VOICE1]** is pressed	"Menu" + Number + Number + Selected value
	When menu is selected	Number + Selected value
	When starting editing parameter (Including when **[VOICE1]** is pressed)	"Edit"
	When a parameter is selected	No announcement
	When changing configuration value	Selected value
	[GROUP▲]	"Group" + Number
	[GROUP▼]	"Group" + Number
USB flash drive menu	When the screen opens or **[VOICE1]** is pressed	"USB" + "Menu" + (Read/Save/Initialize/Remove)
	When a parameter is selected	(Read/Save/Initialize/Remove)
Confirming the format	When the screen opens or **[VOICE1]** is pressed	"Initialize" + "OK?"
Safe Removal of USB flash drive	When the screen opens or **[VOICE1]** is pressed	"Remove" + "OK?"
	When Safe Removal of USB flash drive is executed	"Please wait"
Safe Removal of USB Flash Drive and Completion of Formatting	When the screen opens or **[VOICE1]** is pressed	"Completed"
Reset Menu	When the screen opens or **[VOICE1]** is pressed	(Menu Reset/Memory Channel Reset/VFO Reset/Standard Reset/Full Reset)
Confirmation of the standard configurations	When the screen opens or **[VOICE1]** is pressed	"Standard Reset" + "OK?"
Confirming the full reset	When the screen opens or **[VOICE1]** is pressed	"Full Reset" + "OK?"
Confirming the VFO reset	When the screen opens or **[VOICE1]** is pressed	"VFO reset" + "OK?"

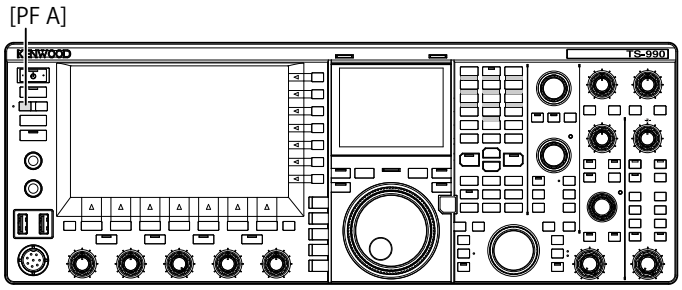
Screen	Operation/Status	Announced Content
Confirming the memory reset	When the screen opens or **[VOICE1]** is pressed	"Memory reset" + "OK?"
Confirming the menu reset	When the screen opens or **[VOICE1]** is pressed	"Menu Reset" + "OK?"
Reset in progress	When the screen opens or **[VOICE1]** is pressed	"Please wait"
Extended menu item display	When the screen opens or **[VOICE1]** is pressed	"Advanced Menu" + Number (2 digits)
Advanced Menu Adjustment screen	When the screen opens or **[VOICE1]** is pressed	Number + Value
	Changing the configuration value	Value
Adjusting the touch panel (Main Screen)	When the screen opens or **[VOICE1]** is pressed	"Touch Screen" + "Calibration"
Touch panel adjustment completed	When the screen opens or **[VOICE1]** is pressed	"Completed"
Advanced menu License display	When the screen opens or **[VOICE1]** is pressed	"License"
Error/Warning message	When the screen opens or **[VOICE1]** is pressed	(Error/Warning) + Number
Message (Excluding the Configuration for Emergency Contact Frequency screen)	When the screen opens or **[VOICE1]** is pressed	"OK?"
When displaying the Emergency Contact Frequency screen	When the screen opens or **[VOICE1]** is pressed	"Emergency" + "Frequency"

Note:

- Refer to "PF key configurations" for options when configuring PF keys. {page 16-8} Menu numbers and Memory Channel numbers are announced even when the leading digit is "0".
- When various errors, warnings, or information messages appear while displaying the configuration screen, the contents of various errors, warning, or information message are announced.
- When reading an equalizer file while pressing **[RXEQ]** or **[TXEQ]**, "Please wait" is not announced.
- The microphone VOX gain value is not announced.
- When announcing frequency value in VFO mode, the displayed values are announced from the upper digit. The separators for MHz are announced as "dot".

VOICE 2

When a key to which "Voice 2" is assigned is pressed, the values of S meter and power meter are announced. For example, announced as "S5" or "20 dB".



1 Press the PF key to which **[PF A]** or Voice 2 is assigned
Values of S meter and power meter are announced.

Note:

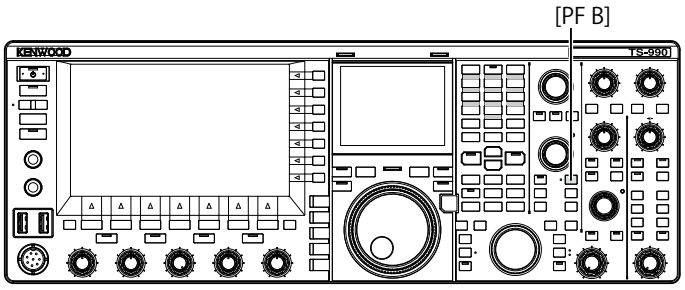
- Pressing again during the announcement the PF key, to which "Voice 2" is assigned, stops the announcement.
- Refer to "PF (Programmable Function)" to change the PF key to be assigned. {page 16-6}
- When transmitting in the sub band, the value of main band power meter is announced.

The following contents are announced by Voice 2.

S meter		Power meter TS-990S	
Level	Announced Content	Level	Announced Content
0	S 0	0	P 0
1 to 4	S 1	1 to 4	P 5
5 to 8	S 2	5 to 8	P 10
9 to 12	S 3	9 to 16	P 25
13 to 16	S 4	17 to 24	P 50
17 to 20	S 5	25 to 30	P 75
21 to 24	S 6	31 to 36	P 100
25 to 28	S 7	37 to 42	P 125
29 to 32	S 8	43 to 48	P 150
33 to 36	S 9	49 to 54	P 175
37 to 41	10 dB	55 to 60	P 200
42 to 47	20 dB	61 to 64	P 225
48 to 52	30 dB	65 to 70	P 250
53 to 58	40 dB	-	-
59 to 64	50 dB	-	-
65 to 70	60 dB	-	-

VOICE 3

Press the PF key, to which "Voice 3" is assigned, to announce the value of the meter.



1 Press the key to which [PF B] or Voice 3 is assigned.
The value of the meter when the key was pressed is announced.

Note:

- Pressing again during the announcement the PF key, to which "Voice 3" is assigned stops the announcement.
- Refer to "PF (Programmable Function)" to change the PF key to be assigned. {page 16-6}
- The value of the digital meter is announced even when **[VOICE3]** is pressed while an analog meter is displayed.
- If the power meter is displayed while an analog meter or digital meter is displayed, the value of the power meter is announced by pressing **[VOICE3]**.
- Pressing **[VOICE3]** while a voice message is on the midway to start recording or while the Microphone Gain is being adjusted using Advanced Menu 13 emits the readout of the level meter (FM).

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The following contents are announced in Voice 3.

SWR meter		COMP meter		ALC meter	
Level	Announced Content	Level	Announced Content	Level	Announced Content
0 to 4	R 1.0	0	C 0 dB	0	A 0
5 to 15	R 1.5	1 to 9	C 5 dB	1 to 2	A 1
16 to 24	R 2.0	10 to 19	C 10 dB	3 to 4	A 2
25 to 31	R 2.5	20 to 34	C 15 dB	5 to 6	A 3
32 to 36	R 3.0	35 to 50	C 20 dB	07 to 8	A 4
37 to 42	R 4.0	51 to 57	C 25 dB	9 to 10	A5
				11 to 12	A 6
43 to 47	R 5.0	58 to	C over	13 to 14	A 7
48 to	R over	-	-	15 to 16	A 8
-	-	-	-	17 to 18	A 9
-	-	-	-	19 to 20	A 10
-	-	-	-	21 to 22	A 11
-	-	-	-	23 to 24	A 12
-	-	-	-	25 to 26	A 13
-	-	-	-	27 to 28	A 14
-	-	-	-	29 to 30	A 15
-	-	-	-	31 to 32	A 16
				33 to 34	A 17
				35 to	A over

Level meter/FM Microphone gain	
Level	Announced Content
0	L 0
1 to 2	L 1
3 to 4	L 2
5 to 6	L 3
7 to 8	L 4
9 to 10	L 5
11 to 12	L 6
13 to 14	L 7
15 to 16	L 8
17 to 18	L 9
19 to 20	L 10
21 to 22	L 11
23 to 24	L 12
25 to 26	L 13
27 to 28	L 14
29 to 30	L 15
31 to 32	L 16
33 to 34	L 17
35 to	L over

ID meter		TEMP meter		VD meter	
Level	Announced Content	Level	Announced Content	Level	Announced Content
0 to 10	I 2.5	0 to 25	T low	to 46	V low
11 to 20	I 5	26 to 60	T mid	47 to 48	V 46
21 to 35	I 7.5	61 to 70	T high	49 to 51	V 47
36 to 47	I 10	-	-	52 to 54	V 48
48 to 60	I 12.5	-	-	55 to 56	V 49
61 to	I 15	-	-	57 to 59	V 50
-	-	-	-	60 to 61	V 51
-	-	-	-	62 to 64	V 52
-	-	-	-	65 to 66	V 53
-	-	-	-	67 to	V high

CONFIGURING THE DATE AND TIME

The transceiver has two clocks.

Local Clock

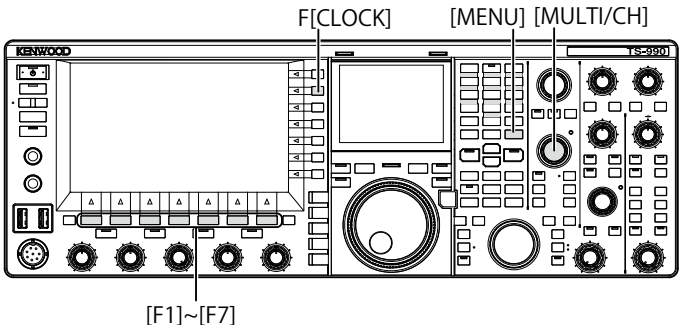
You can configure the expiration timer or the date and time to be used as the time stamp recorded in the data file. The date and time appear on the main screen. The date and time do not appear while using the extended displays, such as the waterfall display, and RTTY.

Secondary Clock

If the Local Clock is configured, the Secondary Clock appears on the right side of Local Clock.
For example, this will allow you to distinguish the time of your frequent contacts located in timezones other than your own.

Note:

- When the transceiver power (⏻) is first turned ON, be sure that you configure the clock (your local time) at first. Without configuring clock, the timer recording cannot be configured.
- Indication of the Local Clock and the Secondary Clock cannot be turned off.



CONFIGURING THE DATE FOR THE LOCAL CLOCK

Date and time for Local Clock to be displayed on the main screen and used as a time stamp of the file can be configured.

1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.
2 Access Menu 00, "Date and Time".
3 Press **[SELECT]** (F4).
4 Access Menu 00, "Date (Local Clock)".
5 Press **[EDIT]** (F4) to allow editing of the parameter box.



6 Use the function keys and the **MULTI/CH** control to select the date.
[-] (F2), **[+]** (F3), **MULTI/CH** control: Displays the previous parameter or the next parameter.
[◀▮] (F4) and **[▮▶]** (F5): Press to move a pointer to the left or to the right.

7 Press **[OK]** (F6).
Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **Clock** screen.

8 Press **[MENU]** to exit.

Note:

- The date and time displayed on the parameter box in the **Clock** screen follows the configuration for the display format.
- If automatic time correction by means of NTP server is enabled, the local clock cannot be configured. {page 15-3}

CONFIGURING THE TIME FOR THE LOCAL CLOCK

The time for Local Clock to be displayed on the main screen and can be configured.

1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.
2 Access Menu 00, "Date and Time".
3 Press **[SELECT]** (F4).
4 Access Menu 01, "Time (Local Clock)".
5 Press **[EDIT]** (F4) to allow editing of the parameter box.



6 Use the numeric and band select keypad, function keys and the **MULTI/CH** control to configure the time.
[-] (F2), **[+]** (F3), **MULTI/CH** control: Displays the previous parameter or the next parameter.
[◀▮] (F4) and **[▮▶]** (F5): Moves a pointer to the left or to the right.
Pressing the numeric keypad enters the number corresponding to the key.

7 Press **[OK]** (F6).
Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **Clock** screen.

8 Press **[MENU]** to exit.

CONFIGURING THE TIMEZONE FOR THE LOCAL CLOCK

You can configure the timezone of Local Clock to be displayed on the main screen. The time calculated based on the time configured here will be displayed on the right side of Local Clock as the time for Secondary Clock.

1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.
2 Access Menu 00, "Date and Time".
3 Press **[SELECT]** (F4).
4 Access Menu 02, "Timezone (Local Clock)".
5 Press **[SELECT]** (F4) to allow editing of the parameter box.



6 Press **[-]** (F2), **[+]** (F3), or rotate the **MULTI/CH** control to select the timezone for Local Clock.
The default is "+00:00".
7 Press [ ] (F1).
8 Press **[MENU]** to exit.

CONFIGURING THE TIMEZONE FOR THE SECONDARY CLOCK

You can configure the timezone for Secondary Clock.

1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.
2 Access Menu 00, "Date and Time".
3 Press **[SELECT]** (F4).
4 Access Menu 03, "Timezone (Secondary Clock)".
5 Press **[SELECT]** (F4) to allow editing of the parameter box.



6 Press **[-]** (F2) or **[+]** (F3), rotate the **MULTI/CH** control to select the time zone for the secondary clock from the available range from "-14:00" to "+00:00" to "+14:00".
The default is "+00:00"
7 Press [ ] (F1).
8 Press **[UPDATE]** (F6) to confirm whether the time has been updated.
The transceiver begins to communicate to the NTP server, and the date and time configured for the transceiver will be updated. After the correction has completed, a message notifying you of the end of communications appears.
9 Press **[MENU]** to exit.

CONFIGURING AN IDENTIFICATION LETTER FOR THE SECONDARY CLOCK

You can configure an alphabetical letter for the identification letter of the Secondary Clock.

1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.
2 Access Menu 00, "Date and Time".
3 Press **[SELECT]** (F4).
4 Access Menu 04, "Secondary Clock Identification Letter".
5 Press **[SELECT]** (F4) to allow editing of the parameter box.



6 Press **[-]** (F2) or **[+]** (F3), or rotate the **MULTI/CH** control to select the identification letter.
The default is "U" which is an abbreviation for UTC (Universal Time Coordinated).
7 Press [ ] (F1).
8 Press **[MENU]** to exit.

CONFIGURING THE DATE DISPLAY FORMAT

The date display format can be configured.

1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.
2 Access Menu 00, "Date and Time".
3 Press **[SELECT]** (F4).
4 Access Menu 05, "Date Display Format".
5 Press **[SELECT]** (F4) to allow editing of the parameter box.

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6 Press **[-]** (F2) or **[+]** (F3), or rotate the **MULTI/CH** control to select the display format of the date.
The default is "MMM/DD/'YY".

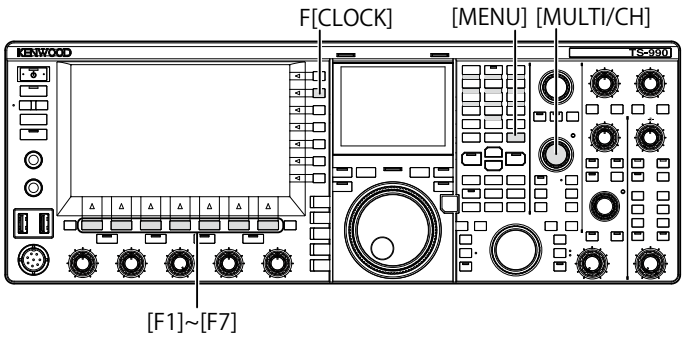
7 Press [ ] (F1).

8 Press **[MENU]** to exit.

CORRECTING THE CLOCK WITH NTP (NETWORK TIME PROTOCOL)

The NTP server can be utilized to automatically correct the clock of the transceiver. The time information acquired from the NTP server can be reflected to an internal clock.

The following needs to be configured to utilize the NTP.



- Connect a LAN cable to the transceiver and to a network such as a home-based LAN. {page 1-9}

  To utilize the NTP Server via the WAN, you must allow the communication using the Network Time Protocol Port (No. 123). To utilize a home-based broadband router, open port No. 123 of the broadband router.

- Configure the network information for the transceiver.

  The network and IP address must be configured for the transceiver. Refer to "CONFIGURING THE NETWORK" for the configuration method. {page 16-12}

- The NTP Server address must be configured for the transceiver.

  The address of the NTP Server which has been configured for the Local Clock must be configured for the transceiver. Refer to "CONFIGURING THE NTP SERVER" for the configuration method. {page 15-3}

Note:

- The NTP may not be used under some firewall systems.
- Refer to the instruction manual supplied with the broadband router for the configuration method of the broadband router.

CONFIGURING THE NTP SERVER ADDRESS

You can configure the NTP Server address for the transceiver.

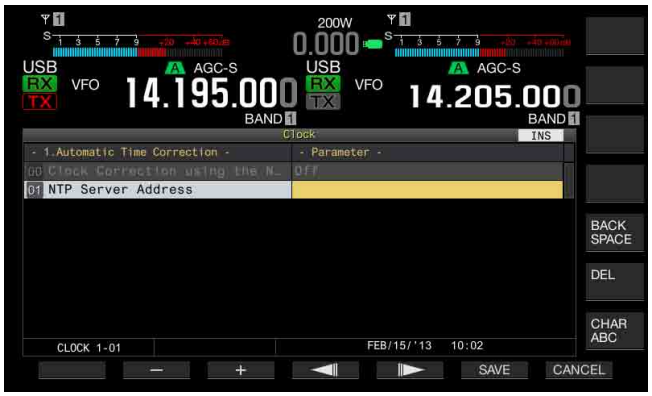
1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.

2 Access Menu 01, "Automatic Time Correction".

3 Press **[SELECT]** (F4).

4 Access Menu 01, "NTP Server Address".

5 Press **[EDIT]** (F4) to allow editing of the parameter box.



6 Use the function keys and the **MULTI/CH** control to enter the NTP server address.

[SPACE] (F1): Press to enter one space.

[-] (F2)/**[+]** (F3): Press to display the character one before or after the current character.

[ ] (F4) and [ ] (F5): Press to move a pointer to the left or to the right.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Deletes the character to the right of the cursor.

[CHAR] (F): Changes the character type. Each key press cycles the displayed character through the following sequence.

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

7 Press **[SAVE]** (F6).

- The entered address of the NTP server is saved.
- Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **Clock** screen.

8 Press **[MENU]** to exit.

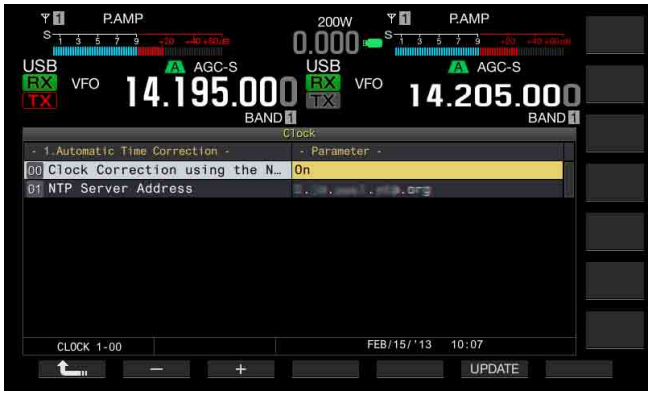
Note:

- Depending on the line conditions and NTP server itself, the response time from the NTP server may vary.
- Search using the keywords “NTP server” for the NTP server address.

ENABLING OR DISABLING THE AUTOMATIC TIME CORRECTION

Automatic Time Correction enables automatic communications to the NTP Server to correct the date and time configured for transceiver clocks.

1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.
2 Access Menu 01, "Automatic Time Correction".
3 Press **[SELECT]** (F4).
4 Access Menu 00, "Clock Correction using the NTP Server".
5 Press **[SELECT]** (F4) to allow editing of the parameter box.



6 Press **[-]** (F2) or **[+]** (F3) to select "On" or "Off" of the automatic time correction.
Selecting "On" allows the transceiver to automatically communicate, when the transceiver power is turned On (⏻), to the NTP server to correct the date and time of the clocks. If the transceiver power (⏻) remains turned ON, it corrects the date and time every 24 hours. The default is "Off".
7 Press [ ] (F1).
8 Press **[MENU]** to exit.

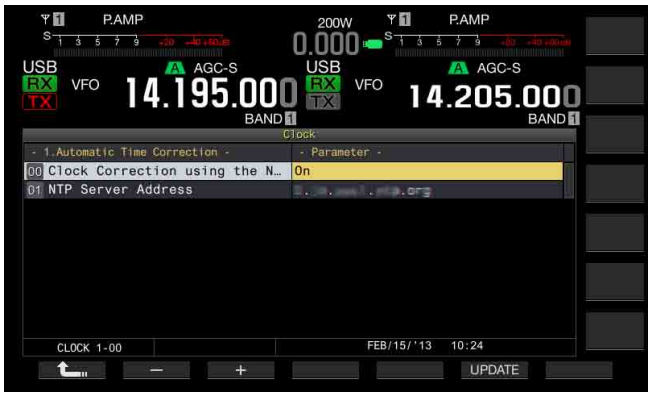
Note:

- The transceiver acquires the time information from the NTP service when the transceiver power (⏻) is turned On or every 24 hours during continued operation.
- You must ensure that all configurations associated with the NTP server have been done and you can manually correct the clock with an access to the NTP server, prior to enabling the automatic time correction for first time.

MANUAL CLOCK CORRECTION

You can connect the transceiver to the NTP Server as desired to correct the date and time configured for transceiver clocks.

1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.
2 Access Menu 01, "Automatic Time Correction".
3 Press **[SELECT]** (F4).



4 Press **[UPDATE]** (F6) to correct the time.
The transceiver begins to communicate to the NTP server, and the date and time configured for the transceiver will be corrected. After the correction has completed, a message notifying you of the end of communications with the NTP server appears.
5 Press **[MENU]** to exit.

Note:

- Avoid frequent access to the NTP server to manually correct the time.

TIMER

The transceiver is equipped with a timer, allowing you to use a timed task with one of the following timers. In the **Programmable Timer** screen, frequencies and the operating mode displayed on the main band and the sub band can instantly be copied.

Power On (Programmable Timer)

With the transceiver power (⏻) turned OFF, the timer task turns the transceiver power (⏻) ON at the configured time.

Power Off (Programmable Timer)

With the transceiver power (⏻) turned ON, the timer task turns the transceiver OFF at the configured time.

Power On and Power Off (Programmable Timer)

The timed task configured for Power On and Power Off can be reserved.

Timed Recording (Programmable Timer)

The transceiver stores the received audio onto the USB flash drive during the time between the time configured for Power-on and the time configured for Power-off.

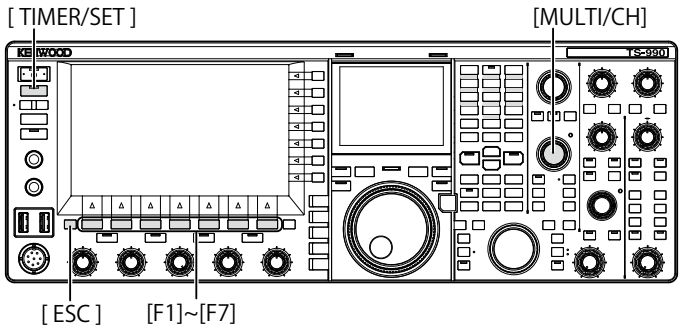
Sleep Timer (Timer)

The transceiver power (⏻) turns OFF after the configured time lapse.

APO (Automatic Power Off) (Menu 0-33)

If a key or control is not operated until the configured time elapses, the transceiver power (⏻) turns OFF.

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CONFIGURING THE PROGRAMMABLE TIMER

Time to turn the transceiver power (⏻) ON or OFF or the timed task for Programmable Timer can be configured.

1 Press and hold **[TIMER/SET]** to open the **Timer** screen.



2 Press [▲] (F2) or [▼] **(F3)** to select "Programmable Timer".

3 Press **[EDIT]** (F4) to open the **Programmable Timer** screen.



4 Use the function keys and the **MULTI/CH** control to configure the Programmable Timer.

Menu Item	Method of Configuration
Timer	Press **[ON/OFF]** (F4) to toggle the timed task by a timer between active and inactive. Selecting "ON" enables the timer. Selecting "OFF" disables the timer.
Repeat	Press **[ON/OFF]** (F4) to toggle the timed repeat by a timer between active and inactive. Selecting "ON" allow you to repeat the timed task as configured. Selecting "OFF" does not allow you to repeat the timed task as configured.
Day of the Week	Press [◀] (F2), [▶] (F3), or [■ ⇆ ✓] (F4) to select and to enable or disable the day of the week when the timed task by a timer will be executed. The timer will be used with the selected day of the week.
Mode	Press **[MODE]** (F4) to select the timer task. Power-on: The transceiver turns ON at the time configured for Power-on. If "Power-on" is selected, "--:--" appears as time for Power Off, and you cannot configure. Power-off: The transceiver power (⏻) turns OFF at the time configured for Power-off. If "Power-off" is selected, "--:--" appears as time for Power On, and you cannot configure. Both: The transceiver power (⏻) turns ON at the time configured for Power-on and OFF at the time configured for Power-off. Record: The transceiver stores the received audio onto a USB flash drive during the time between the time configured for Power-on and the time configured for Power-off.
Power-on/ Power-off	Pressing **[-]** (F4), **[+]** (F5) or the numeric and band selection keypad, or rotating the **MULTI/CH** control can configure the time to turn the transceiver power (⏻) ON and OFF. The time can be configured in the range of "00:00" to "23:59".
Main Band/ Sub band	Press **[COPY]** (F5) to copy the frequency and the operating band information for the main band and sub band when the transceiver is turned ON by a timer. Placing the main band and sub band in VFO mode and then pressing **[COPY]** (F5) can copy the frequency and the operating band information. Even if you can change the configuration for main band Even if the main band or sub band is highlighted, [▲] (F2), [▼] (F3) and the numeric keypad can be pressed, and the **Tuning** (M) and **MULTI/CH** control can be rotated to change the frequency displayed on the upper side of the Program Timer screen. To change the configurations for frequency and mode for the main band and sub band when the transceiver starts up, press **[COPY]** (F5) each time when the frequency is changed.

5 Press **[OK]** (F6).
- The "TIMER" LED lights green, the timed task by a timer will be enabled. A message notifying you of the end of the configuration appears.
- Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **Clock** screen.

6 Press **[OK]** (F6).
Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **Clock** screen.

7 Press **[ESC]** to exit.

8 If the timer except for the power-off timer is active,

press **[⏻]** to turn the transceiver power (⏻) OFF.
transceiver power (⏻) OFF.

Note:

- Prior to copying with a press of **[COPY]** (F5), at step 5, the operating data which has been stored in a Memory Channel, press **[M▶V]** to transfer the operating data in the Memory Channel to VFO.
- Even if the current time passes the configured time when you press **[OK]** (F6) at step 6, the time will be configured as it is.
- For the recording timer, there should be at latest one minute time difference between the record start time (Power-on time) and the record end time (Power-off time).
- You can configure the recording timer for a maximum of four hours.
- Even when the time configured for Power-on has already been past when **[OK]** (F6) was pressed at step 6, the time for Power-on will be configured.
- If timed recording is enabled, insert a USB flash drive, prior to start of recording, onto the ⇻ (USB-A) connector on the front panel. The USB flash drive formatted with the transceiver and having sufficient free area must be inserted.
- Timed recording cannot be started if the transceiver power (⏻) is turned OFF.
- If the transceiver power (⏻) turns OFF, the "TIMER" LED blinks one minute before the timer recording begins, and the transceiver power (⏻) cannot turn ON even with a press of **[⏻]**.
- With the timed recording enabled, a message appears three minutes and one minute before start of the timed recording, if the transceiver power (⏻) is not turned OFF. Press [⏻] to turn the transceiver power (⏻) OFF.
- During the timed recording, the "⏻" LED lights orange. The "⏻" LED lights red when the timed recording ends.
- If you wish to abort the timed recording after the "TIMER" LED starts blinking until the timed recording begins, press [⏻] for four seconds.
- During the timed recording, no other operation can be processed until the timed recording ends. To abort the timed recording, press [⏻] and press and hold **[(BREAK)]** following the instruction displayed.

TEMPORARILY DISABLING THE TIMER TASK

You can disable timer tasks or the Programmable Timer. Following are the timer tasks for which countdown of the timer can temporarily be paused.

- Transceiver Power (⏻) OFF at the time configured for Power-off
- Start of the timed recording
- Transceiver Power (⏻) OFF using the Sleep Timer

Pressing **[TIMER/SET]** after the countdown of the timer or program timer has paused resumes the countdown of the timer or program timer. Also, if the timer task is inactive, the timed task will not function until the clock reaches the next time configured for Power-on.

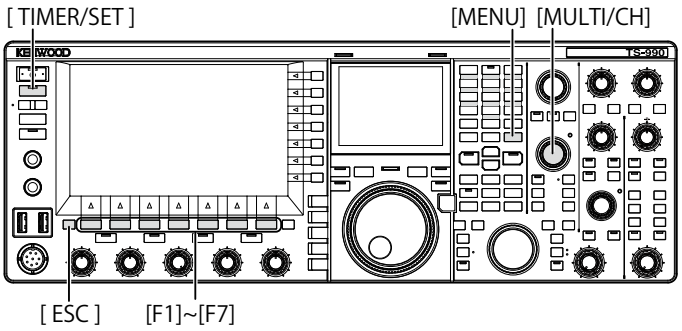
1 Press **[TIMER/SET]**.
- The "TIMER" LED turns Off, and the Sleep Timer or Programmable Timer will temporarily be disabled.
- Press **[TIMER/SET]** again to light the "TIMER" LED, and resume counting down the Sleep Timer and Programmable Timer.

Note:

- Even if the Timer and Programmable Timer are temporarily disabled, configurations for the Timer and Programmable Timers will be retained.
- If the Programmable Timer is temporarily disabled while the Sleep Timer is counting down, the Sleep Timer will also be temporarily disabled.

SLEEP TIMER

The Sleep Timer is a function that turns the transceiver power (⏻) OFF upon lapse of the configured length of time.



CONFIGURING THE SLEEP TIMER

1 Press and hold **[TIMER/SET]** to open the **Timer** screen.

2 Press [▲] (F2) or [▼] (F3) to select "Sleep Timer".

3 Press **[EDIT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or the **MULTI/CH** control to select "Off" to turn the transceiver power (⏻) OFF or the time until the transceiver power (⏻) will be turned OFF.
- You can select the length of time until the transceiver power (⏻) will be turned OFF from "OFF" (do not turn the transceiver power (⏻) OFF), "5", "10", "15", "30", "60", "90", and "120" [min]. The default is "Off".
- Pressing and holding **[(CLEAR)]** (F1) resets the time configured for the Sleep Timer to its default.

5 Press **[OK]** (F6).
- The "TIMER" LED lights green, and the Sleep Timer starts counting down.
- Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **Clock** screen.

6 Press **[ESC]** to exit.

Note:

- A message notifying you that the transceiver power (⏻) is about to be turned OFF appears three minutes before and one minute before the transceiver power (⏻) turns OFF.

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DISABLING THE POWER-OFF BY THE SLEEP TIMER

The timed power-off (⏻) can be disabled even after the Sleep Timer has started counting down. If Sleep Time is temporarily disabled, the transceiver power (⏻) does not turn OFF even when the configured time elapses.

1 Press **[TIMER/SET]**.
The "TIMER" LED turns Off, and the timed power-off (⏻) by Sleep Timer will be disabled. The Sleep Timer continues to count down; however, the transceiver power (⏻) does not turn OFF even when the Sleep Timer expires.

Pressing **[TIMER/SET]** again before the Sleep Timer expires causes the Sleep Timer to resume counting down from the remaining time.

Note:

- A press of **[TIMER/SET]** again disables or enables both Sleep Timer and Programmable Timer.

APO (AUTOMATIC POWER OFF)

APO is a function that turns the transceiver power (⏻) OFF if no key or control is operated for the configured time. One minute before the transceiver power (⏻) turns OFF, a Morse codes "CHECK" sounds from the speaker.

1 Select Group No. 00, "Basic Configurations", from the Menu screen.

2 Access Menu 33, "Automatic Power Off".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F2) or **[+]** (F3) to select "OFF" or the length of time until the transceiver (⏻) turns OFF.
You can select the length of time until the transceiver power (⏻) will be turned OFF from "OFF" (do not turn the transceiver power (⏻) OFF), "60", "120", and "180" [min]. The default is "Off".

5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

Note:

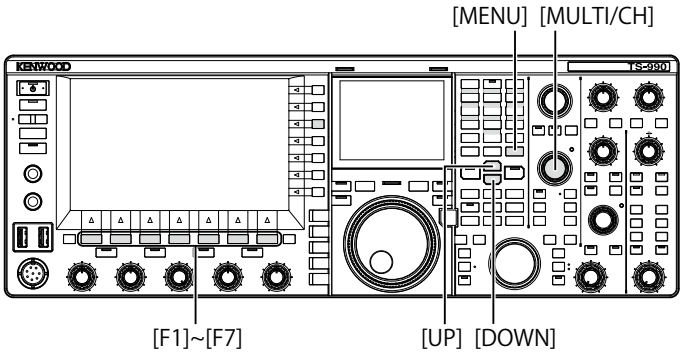
- A timer for the APO continues counting down even during the scan.
- The transceiver starts counting down from when a key or a control is last operated.

16 USEFUL FUNCTIONS

This section describes how to configure and operating convenient and useful functions such as configuring function keys and the input and output levels of the rear panel connectors.

CONFIGURING THE POWER-ON MESSAGE

After the transceiver power (⏻) is turned ON, the power-on message appears on the startup screen until the transceiver becomes active. You can configure your desired text string, such as your callsign, as the power-on message.



1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 07, "Power-on Message".

3 Press **[EDIT]** (F4) to allow editing of the parameter box.



4 Use the functions keys and the **MULTI/CH** control to edit or enter a text string.
A maximum of 15 alphanumeric characters and symbols can be configured. The default is "HELLO"

[SPACE] (F1): Press to enter a space.

[-] (F2)/**[+]** (F3): Press to display the previous character or the next character.

[◀‖] (F4) and [‖▶] (F5): Press to move the cursor to the left or right.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

5 Press **[SAVE]** (F6) to save the text string.
Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **Menu** screen.

6 Press **[MENU]** to exit.

CONFIGURING THE SCREEN SAVER

If no operation is performed for the duration configured for the Screen Saver Wait Time, the screen saver activates on the main screen and sub-screen.

There are two screen savers available in the transceiver. Selecting "Type 2" for Screen Saver, the desired text can be displayed on the main screen and sub screen.

CONFIGURING THE SCREEN SAVER TYPE

You can configure which screen saver to use. Type 1 displays product images, and Type 2 displays your desired text string across the main screen and sub screen.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 04, "Screen Saver".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select the type of screen saver.
Available parameters are "Off", "Type 1", and "Type 2". The default is "Off".

5 Press [↩] (F1).

6 Press **[MENU]** to exit.

Note:

♦ The screen saver will be disabled by any transceiver operation such as a press of a key, a rotation of the control or by receiving a PC command.

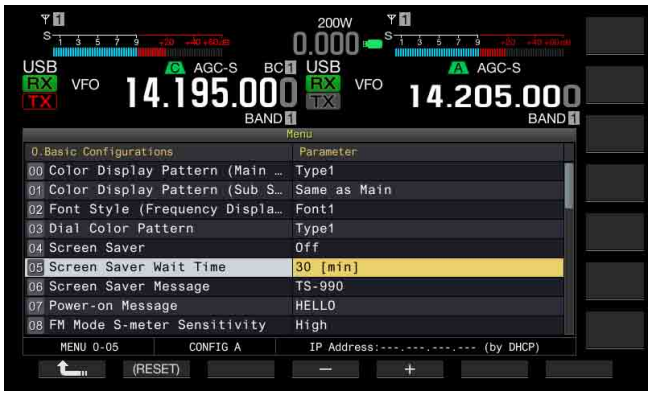
CONFIGURING THE SCREEN SAVER WAIT TIME

You can configure the length of time from when you operate the transceiver last until the time when the screen saver activates.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 05, "Screen Saver Wait Time".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to configure the wait time until the screen saver will be activated.
You can select from "Preview [5 sec]" (displaying the screen saver for five seconds to preview), "5 [min]", "30 [min]", or "60 [min]".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

CONFIGURING THE TEXT STRING FOR SCREEN SAVER

You can configure the text string if you select Type 2 for the Screen Saver. While the screen saver is active, the entered text string moves freely across the main screen and the sub-screen.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 06, "Screen Saver Message".

3 Press **[EDIT]** (F4) to allow editing of the parameter box.



4 Use the function keys and the **MULTI/CH** control to edit or enter a text string.
You can enter a maximum of 10 characters.

[SPACE] (F1): Press to enter a space.

[-] (F2)/**[+]** (F3): Press to display the previous character or the next character.

[ ] (F4) and [ ] (F5): Press to move a pointer to the left or right.

[BACKSPACE] (F): Press to delete the character to the left of the cursor.

[CHAR] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

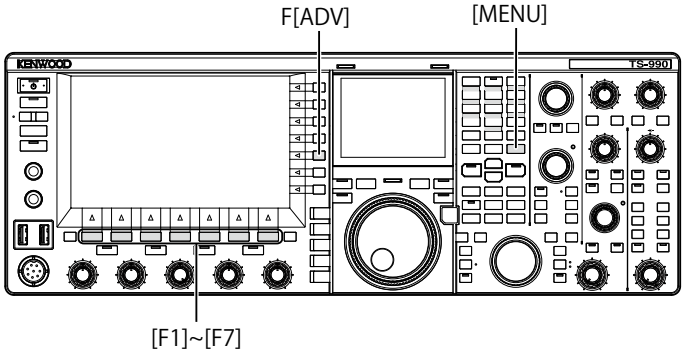
5 Press **[SAVE]** (F6) to save the text string.

6 Press **[MENU]** to exit.

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TOUCHING THE SCREEN TO SELECT A FREQUENCY

By touching the bandscope or waterfall on the main screen with your finger, you can quickly select the receive frequency or center frequency to be observed.



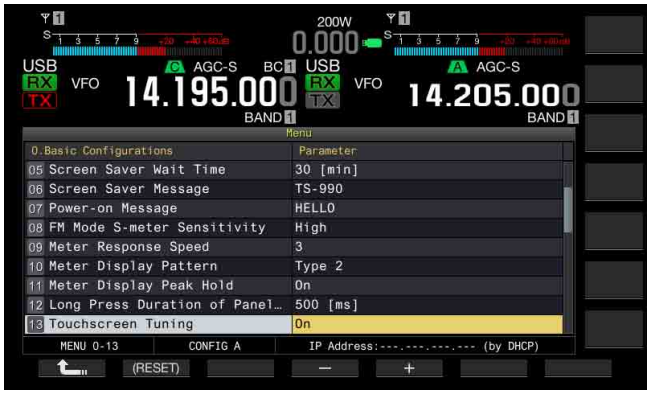
TOUCHING THE SCREEN

You can select the frequency by touching the main screen. To avoid any operations due to accidentally touching the screen, you can disable Touch Screen Tuning.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 13, "Touchscreen Tuning".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On".
The default is "On".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

CALIBRATING THE TOUCHSCREEN

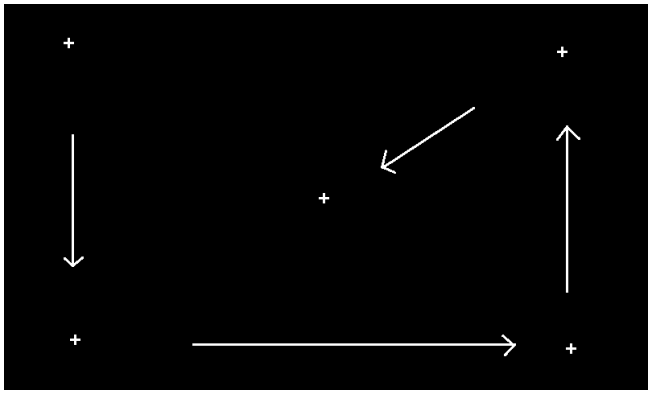
If you feel the screen is falsely recognizing the frequency when you touch the screen, you can calibrate the contact spots of the touchscreen. If falsely recognizing is prominent as the time goes by, you can adjust the touchscreen.

1 Press **[ADV]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 27, "Touchscreen Calibration".



3 Touch the "+" marks that appear on the **Main** screen, in sequence.
The "+" mark appears in sequence at the four corners and the center of the main screen. After touching the "+" marks at the four corners and the center, in sequence, the Touchscreen Calibration completes and the Advanced Menu screen reappears.



Note:

- Touchscreen Calibration cannot be terminated. Ensure that you have touched the "+" marks at all four corners and the center of the main screen.
- If Touchscreen Calibration in progress is terminated due to an unexpected contingency such as electrical power failure, just recalibrate the screen.

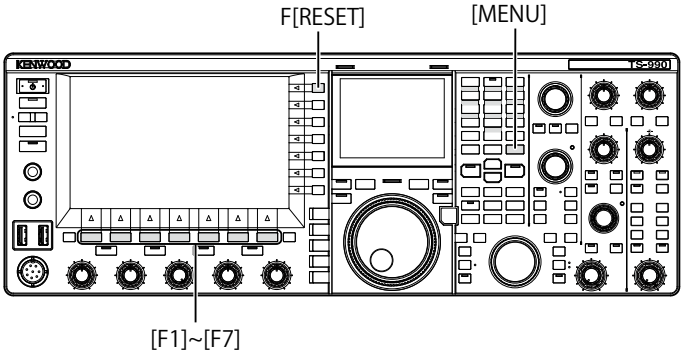
RESET

The configuration data stored in the transceiver can easily be saved in other memory devices. Additionally, to delete the operating data stored in the transceiver memory and to store new operating data, you can select the intended reset from the five reset types.

- Menu Reset: Resets all parameters on the **Menu** screen to their defaults.
- Memory Channel Reset: Resets the configuration data for the memory channels and quick memory channels.
- VFO Reset: Resets all operating data in the VFO.
- Standard Reset: Reset all operating data except the configuration data for the Clock, Transmit Power Limiter, and TX Inhibit.
- Full Reset: Resets all configuration data in the transceiver to their defaults.

Note:

- The configuration data for memory channels, quick memory channels, all data on the menu, preset values for the antenna tuner, auto-mode frequency data, and various levels will not be reset.
- Once any reset begins, the data will be cleared. You must reset the transceiver after the configuration data has been stored in another storage device.
- In Menu 1-06, the default for Automatic Voice Guidance is "Off". Activating any reset other than Memory Channel Reset and VFO Reset will reset Menu 1-06 to the default; hence, the transceiver does not do any voice guidance by Automatic Voice Guidance. {page 14-2}

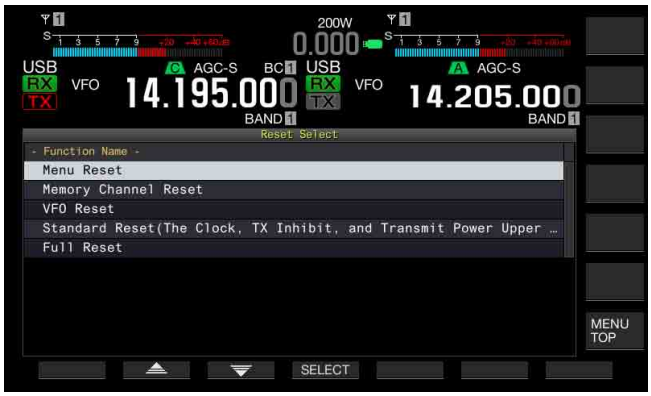


Follow the procedure below to reset the transceiver.

1 Press **[RESET]** (F) on the **Menu** screen to open the **Reset** screen.

2 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select a reset type.
Press **[MENU TOP]** (F) to close the **Reset Configuration Data** screen and display the **Menu** screen.

3 Press **[SELECT]** (F4).



- A message prompting the start of the reset appears.
- Pressing **[CANCEL]** (F4) does not start the resetting process and closes a message that prompted you to start the resetting process.

4 Press **[RESET]** (F4).
The transceiver is reset and automatically restarts.

SELECTING THE OPERATING BAND FOR THE HI/SHIFT ⊙ LO/WIDTH CONTROLS

Using the **HI/SHIFT** ⊙ **LO/WIDTH** control, you can adjust the cutoff frequencies (low and high) and the passband width and shift. You can configure whether to adjust the main band or both the main band and the sub band.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 14, "Operating Band (High/ Low & Shift/ Width Controls)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Main and sub bands" or "Main Band only".
The default is "Main and sub bands".

5 Press **[↩]** (F1).

6 Press **[MENU]** to exit.

Note:

- If "Main Band only" is selected, the "SUB" LED on the right of the **HI/SHIFT** ⊙ **LO/WIDTH** controls does not light. In this case, rotating the **HI/SHIFT** ⊙ **LO/WIDTH** controls increases or decreases the value for the HI/SHIFT and LO/WIDTH.

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CONFIGURING THE LENGTH OF TIME FOR KEY LONG PRESS

In this transceiver, with your key press on the front panel, the transceiver immediately behaves or enters another state. Also, there are functions and the configuration screen that cannot be enabled, activated or displayed without your long key press on the front panel.

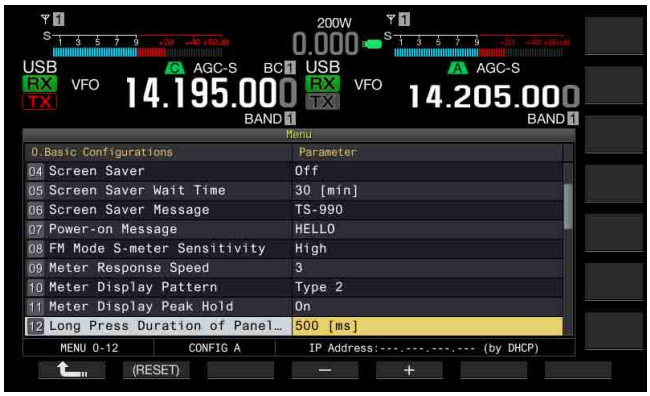
In this manual, the operation to activate such functions or to open the configuration screen is described as "press and hold". Some operations, such as operation using the **PTT** (microphone) switch, are described as "hold down". {page VII}

You can configure the duration from when you press a key until the corresponding function is activated or enabled or until the configuration screen opens. The duration configured here will be applied to all operations described as "press and hold" in this manual.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 12, "Long Press Duration of Panel Keys".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the long key press duration.
- The available parameters are from "200 [ms]" to "2000 [ms]" (in steps of 100 [ms]".
- The default is "500".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

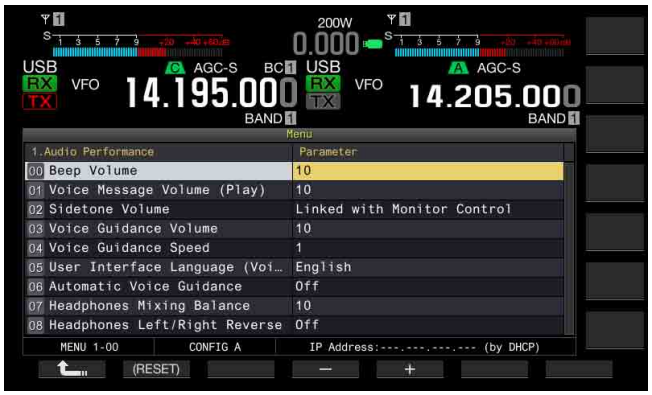
ADJUSTING THE BEEP VOLUME

The transceiver beeps upon a key press or function acknowledgement. The transceiver does not beep if "Off" has been selected in Menu 1-00.

1 Select Group No. 1, "Audio Performance", from the **Menu** screen.

2 Access Menu 00, "Beep Volume".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the beep volume level.
- The available parameters are "Off" or from "1" to "20" (in steps of 1).
- The default is "10".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

♦ You can configure in Menu 7-14, "Audio Output Type (Rear Connectors)", whether or not the audio emitted by the transceiver will be mixed to the received audio and transferred via the SANO and MANO pins of **ACC 2**, **OPTICAL OUT** and (USB-B) connectors.

MIXING THE BEEPS, ETC. TO THE RECEIVED AUDIO OUTPUT FROM THE REAR PANEL

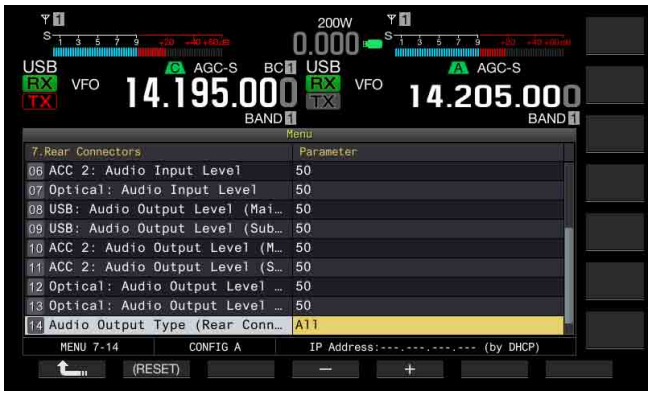
You can configure whether or not the audio emitted by the transceiver will be mixed to the received audio and transferred via the SANO and MANO pins of **ACC 2**, **OPTICAL OUT** and •⇢ (USB-B) connectors.

If the beeps, voice guidance and error tones audible from the transceiver are mixed with the received audio, and, for instance, if the transceiver is installed at the distant location and operated using the KNS (KENWOOD NETWORK COMMAND SYSTEM), you can listen to such responses to the command or error tones of the unattended transceiver.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 14 "Audio Output Type (Rear Connectors)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "All" (mixing the audio) or "Received Audio Only".
The default is "All".

5 Press [⮌] (F1).

6 Press **[MENU]** to exit.

Note:

- If "All" is configured in Menu 7-14, the transceiver transfers the beeps, voice guidance, audio in the voice message memory, the recorded audio and sidetones from the rear panel connectors.
- If you intend to decode the digital modulated signal using an external device, select "Received Audio Only" for this function.

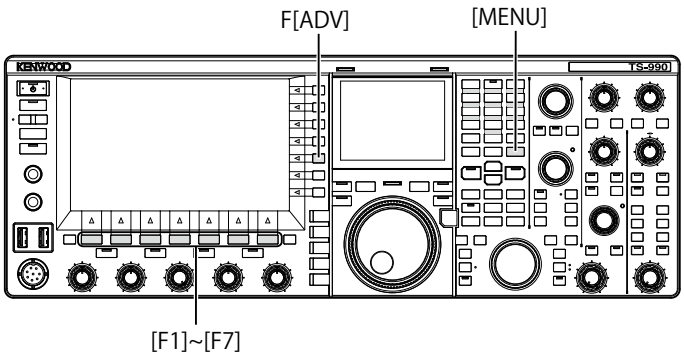
PF KEYS (PROGRAMMABLE FUNCTION KEYS)

You can assign various functions of the transceiver to the PF keys. If you assign a frequently used function or menu to the PF key, you can activate that function or select the menu by pressing the PF key.

Frequently used functions, such as access to the **Menu** screen, can be assigned to the front panel keys and the memory channels. For details, refer to the list of programmable functions. {page 16-8}

You can allocate functions to the following PF keys:

- Front panel: [PF A], [PF B], [VOICE] (M), and [VOICE] (S)
- Microphone: [PF 1] to [PF 4], [DOWN], and [UP].
- External equipment (self-made PF keys): [PF 1] (External) to [PF 8] (External).



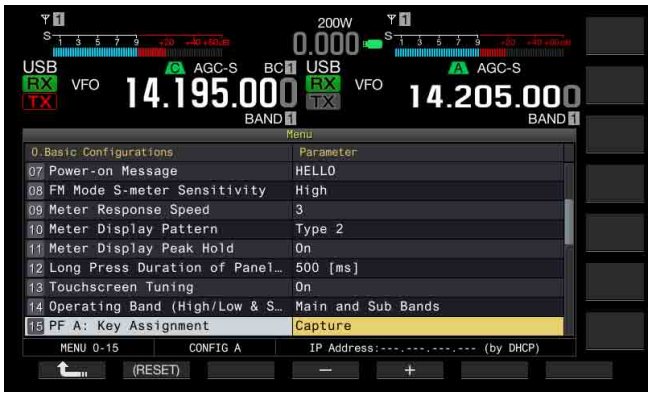
ASSIGNING VARIOUS FUNCTIONS TO THE FRONT PANEL PF KEYS

You can assign various functions to the four PF keys on the front panel.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access the desired one from Menu 15, "PF A: Key Assignment", to Menu 18, "VOICE (Sub Band): Key: Key Assignment".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the function to be assigned to a PF key.
The front panel has four PF keys. Refer to the List of Functions for Key Assignment for the defaults of each PF keys. {page 16-8}

5 Press [⮌] (F1).

6 Press **[MENU]** to exit.

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ASSIGNING VARIOUS FUNCTIONS TO THE MICROPHONE PF KEYS

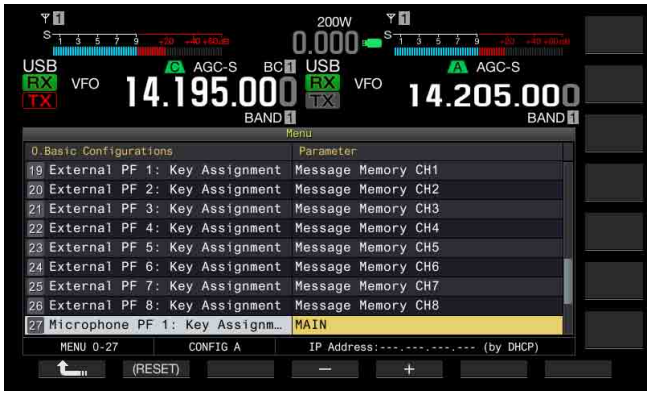
If you connect the microphone or the self-made selector to the **MIC** connector on the front panel, a maximum of six functions can be assigned to the PF keys.

- MC-43S: [DOWN] and [UP]
- MC-47: [PF 1] to [PF 4], [DOWN], and [UP]
- MC-60A: [DOWN] and [UP]
- MC-90: [DOWN] and [UP]

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access the desired one from Menu 27, "Microphone PF 1: Key Assignment", to Menu 32, "Microphone UP Key: Key Assignment".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



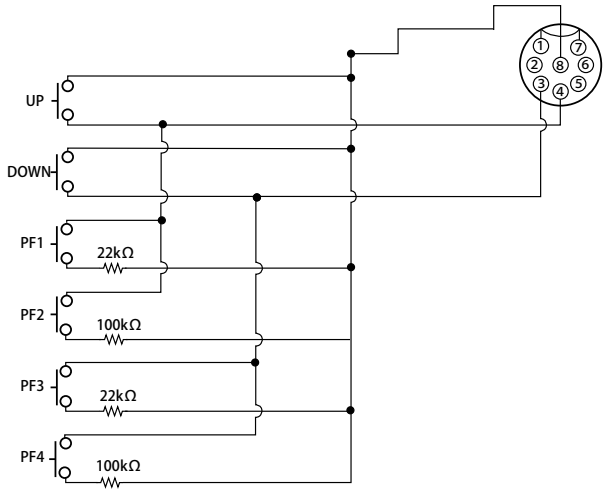
4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the function to be assigned to a PF key.
Refer to the List of Functions for Key Assignment for the defaults of each PF keys. {page 16-8}

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- The MC-47 microphone has been discontinued and is no longer available.
- When making your own selector, refer to the circuit diagram below.



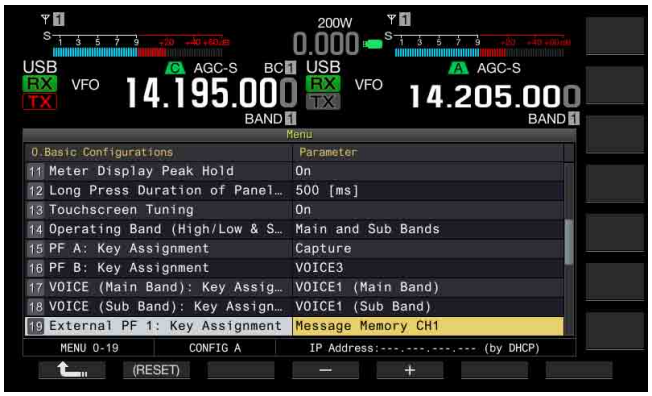
ASSIGNING VARIOUS FUNCTIONS TO THE EXTERNAL PF KEYS

You can connect a self-made selector to the KEYPAD jack on the rear panel.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access the desired one from Menu 19, "External PF 1: Key Assignment", to Menu 26, "External PF 8: Key Assignment".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



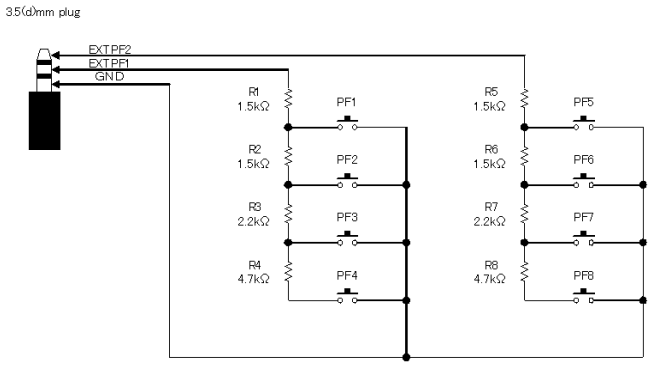
4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the function to be assigned to a PF key.
Refer to the function list for the default settings. {page 16-8}

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- When making your own PF keypad, refer to the circuit diagram below.



List of Functions for Key Assignment

Parameter	Operation and activation of function assigned
MENU 0-00 to MENU 9-03	Press to access a menu ranging from 0-00 to 9-03. For details, refer to "Menu". {page 3-2}
AT/AT TUNE	Press to tune the signal using and via the internal antenna tuner or leave the signal not tuned by bypassing (through) the internal antenna tuner. Press and hold to begin tuning the internal antenna tuner.
VOX/SEL	Press to toggle the VOX function between active and inactive. Press and hold to open the **VOX Level** screen.
PROC/SEL	Press to toggle the Speech Processor between active and inactive. Press and hold to open the **Speech Processor** screen.
ANT1	Press to select ANT 1.
ANT2	Press to select ANT 2.
ANT3	Press to select ANT 3.
ANT4	Press to select ANT 4.
DATA 1/SEL	Press this key to select Data 1. Press and hold to open the **Modulation Source** screen.
DATA 2/SEL	Press this key to select Data 2. Pressing and holding this key opens the **Modulation Source** screen.
DATA 3/SEL	Press this key to select Data 3. Pressing and holding this key opens the **Modulation Source** screen.
RX (Main Band)	Press to place the transceiver, with the dual band in the receive state, in the receive state using the single band.
TX (Main Band)	Press to allow the transceiver to transmit using the main band frequency (Simplex).
M>S	Press to copy the operating data such as the main band frequency and operating mode to the operating data for the sub band.
M/S	Press to toggle the reception capability for the sub band between active and inactive.
RX (Sub Band)	Press to toggle the dual-band watch (reception) between ON and OFF.
TX (Sub Band)/ (Split Frequency)	Press to configure the transmit functions to the sub band frequency and place the transceiver in the split mode. Press and hold to enable the configuration for split frequency. This is the default for Menu 28, "Microphone PF 1: Key Assignment".
TF-SET	While **[TF-SET]** is pressed down, the transceiver receives on the transmit frequency.
MAIN	Press to select the main band. This is the default for Menu 27, "Microphone PF 2: Key Assignment".
SUB	Press to select the sub band. This is the default for Menu 29, "Microphone PF 3: Key Assignment".
M/V (Memory)	Each time you press this key, the operating mode toggles between Memory Channel mode and VFO mode.
M.IN (Memory)	Press to toggle the memory scroll mode between active and inactive.
M>V (Memory)	The operating data configured for the Memory Channel will be copied to the VFO. This is the default for Menu 30, "Microphone PF 4: Key Assignment".
REC (Recorder)/ Full-time REC	Each time you press this key, normal recording starts. Press and hold to start constant recording.
STOP (Recorder)	Press to stop recording or playback.
PLAY (Recorder)	Press to play back the latest audio file recorded in normal or constant recording mode. Press this key during playback to pause.

Parameter	Operation and activation of function assigned
S.DISP/SEL	Each time you press this key, the display contents for the sub-screen changes. Each time you press and hold this key, the highlighted display toggles between active and inactive.
MR/SEL (Quick Memory)	Each time you press this key, the Quick Memory mode toggles between active and inactive. Press and hold to clear all the operating data stored in Quick Memory Channels.
M.IN (Quick Memory)	Press to save data in Quick Memory Channels.
CW T. (Main Band)	Press to activate CW auto tuning for the main band.
FIL A/SEL (Main Band)	Press to select the RX Filter A for the main band. Press and hold to open the **Receive Filter** screen.
FIL B/SEL (Main Band)	Press to select the RX Filter B for the main band. Press and hold to open the **Receive Filter** screen.
FIL C/SEL (Main Band)	Press to select the RX Filter C for the main band. Press and hold to open the **Receive Filter** screen.
AGC SEL (Main Band)	Press to open the **AGC** screen for the main band. The transceiver does not behave even if you press and hold this PF key.
AGC SLOW (Main Band)	Press to select "Slow" for the Automatic Gain Control speed for the main band.
AGC MID (Main Band)	Press to select "Medium" for the Automatic Gain Control speed for the main band.
AGC FAST (Main Band)	Press to select "Fast" for the Automatic Gain Control speed for the main band.
AGC OFF (Main Band)	Press to disable the Automatic Gain Control for the main band.
NCH SEL (Main Band)	Press to select either narrow or wide for the notch filter band width. The transceiver does not behave even if you press and hold this PF key.
A.NCH SEL (Main Band)	Press to open the **Auto Notch Filter** screen. The transceiver does not behave even if you press and hold this PF key.
BEF SEL (Main Band)	Press to open the **Band Elimination Filter** screen for the main band. The transceiver does not behave even if you press and hold this PF key.
APF SEL (Main Band)	Press to open the **Audio Peak Filter** screen for the main band. The transceiver does not behave even if you press and hold this PF key.
MUTE (Main Band)	Press to mute the audio for the main band.
CW T. (Sub Band)	Press to start CW auto tuning for the sub band.
FIL A/SEL (Sub Band)	Press to select the RX Filter A for the sub band. Press and hold to open the **Receive Filter** screen.
FIL B/SEL (Sub Band)	Press to select the RX Filter B for the sub band. Press and hold to open the **Receive Filter** screen.
FIL C/SEL (Sub Band)	Press to select the RX Filter C for the sub band. Press and hold to open the **Receive Filter** screen.
AGC/SEL (Sub Band)	Press to open the **AGC** screen for the sub band. The transceiver does not behave even if you press and hold this PF key.
AGC SLOW (Sub Band)	Press to select "Slow" for the Automatic Gain Control speed for the sub band.
AGC MID (Sub Band)	Press to select "Medium" for the Automatic Gain Control speed for the sub band.
AGC FAST (Sub Band)	Press to select "Fast" for the Automatic Gain Control speed for the sub band.
AGC OFF (Sub Band)	Press to disable the Automatic Gain Control for the sub band.
NCH SEL (Sub Band)	Press to select either narrow or wide for the notch filter band width for the sub band. The transceiver does not behave even if you press and hold this PF key.
A.NCH/SEL (Sub Band)	Press to open the **Auto Notch Filter** screen. The transceiver does not behave even if you press and hold this PF key.
BEF SEL (Sub Band)	Press to open the **Band Elimination Filter** screen for the sub band. The transceiver does not behave even if you press and hold this PF key.

Parameter	Operation and activation of function assigned
NB1 SEL (Sub Band)	Press to open the **Noise Blanker 1 (Sub Band)** screen. The transceiver does not behave even if you press and hold this PF key.
NB2 SEL (Sub Band)	Press to open the **Noise Blanker 2 (Sub Band)** screen. The transceiver does not behave even if you press and hold this PF key.
NR1 SEL (Sub Band)	Press and hold to open the **Noise Reduction 1 (Sub Band)** screen for the sub band. The transceiver does not behave even if you press and hold this PF key.
NR2 SEL (Sub Band)	Press and hold to open the **Noise Reduction 2 (Sub Band)** screen for the sub band. The transceiver does not behave even if you press and hold this PF key.
APF/SEL (Sub Band)	Press to open the **Audio Peak Filter** screen for the sub band. The transceiver does not behave even if you press and hold this PF key.
MUTE (Sub Band)	Press to mute the audio of the sub band.
VOICE 1 (Main Band)	Press to enable the voice guidance of the main band frequency. This is the default for Menu 17, "VOICE (Main Band): Key Assignment".
VOICE 2	Press to emit a voice guidance, such as a value for the signal strength of the selected band during the receive, and a value for transmit power during the transmit. This is the default for Menu 15, "PF A Key: Key Assignment".
VOICE 3	Press to emit a voice guidance, such as a value of the selected with **[METER]** (F). The transceiver does not emit the voice guidance during the reception. This is the default for Menu 16, "PF B Key: Key Assignment".
VOICE 1 (Sub Band)	Press to enable the voice guidance of the sub band frequency. This is the default for Menu 18, "VOICE (Sub Band): Key Assignment".
DSP MONITOR	While you are holding down this key, the passband width of the IF filter is expanded to maximum.
RX MONITOR	While you are holding down this key, the squelch opens.
TX TUNE	Press to start the TX tuning.
DATA SEND	Press to transmit the signal entered via the modulation source (rear panel) configured for each audio source.
SEND	Press to place the transceiver into a transmit state. Press again to revert the transceiver to the original state.
DATA VOX/SEL	Each time you press this key, the modulation line cycles as follows: Off > ACC 2 > USB > OPT. Press and hold to open the **Modulation Source** screen.
Message Memory CH1	Press to transmit the Voice message, the CW message, FSK message, or PSK message stored in channel 1. This is the default for Menu 19, "External PF 1: Key Assignment".
Message Memory CH2	Press to transmit the Voice message, the CW message, FSK message, or PSK message stored in channel 2. This is the default for Menu 20, "External PF 2: Key Assignment".
Message Memory CH3	Press to transmit the Voice message, the CW message, FSK message, or PSK message stored in channel 3. This is the default for Menu 21, "External PF 3: Key Assignment".
Message Memory CH4	Press to transmit the Voice message, the CW message, FSK message, or PSK message stored in channel 4. This is the default for Menu 22, "External PF 4: Key Assignment".

Parameter	Operation and activation of function assigned
Message Memory CH5	Press to transmit the Voice message, the CW message, FSK message, or PSK message stored in channel 5. This is the default for Menu 23, "External PF 5: Key Assignment".
Message Memory CH6	Press to transmit the Voice message, the CW message, FSK message, or PSK message stored in channel 6. This is the default for Menu 24, "External PF 6: Key Assignment".
Message Memory CH7	Press to transmit the CW message, FSK message, or PSK message stored in channel 7. This is the default for Menu 25, "External PF 7: Key Assignment".
Message Memory CH8	Press to transmit the CW message, FSK message, or PSK message stored in channel 8. This is the default for Menu 26, "External PF 8: Key Assignment".
Contest Number Decrement	Press to subtract the contest number by one. (CW Mode)
SWL	Press to place the transceiver into SWL mode.
RF Scope	Press to display the bandscope.
AF Scope	Press to display the audio scope.
Waterfall	Press to display the waterfall.
Extended Memory Channel	Press to invoke the Extended Memory Channel.
Down Key (Microphone)	Press to operate the transceiver in the same manner as when the **[DOWN]** key of the optional microphone is pressed. This is the default for Menu 31, "Microphone DOWN: Key Assignment".
Up Key (Microphone)	Press to operate the transceiver in the same manner as when the [UP] key of the optional microphone is pressed. This is the default for Menu 32, "Microphone UP: Key Assignment".
Capture	Press to capture the screen images in the main screen and the sub-screen and save them as image files to a USB flash drive.
Safe Removal of the USB Flash Drive	Press to execute Safe Removal of the USB Flash Drive
Emergency Frequency	Press to call using the frequency allocated to notify the emergency call frequency on the main band.
Off	Nothing is activated.

PC CONTROL

The ARCP-990 radio control program, ARHP-990 radio host program, ARUA-10 USB audio control program, or PC commands can be used to control the transceiver or use a PC speaker or microphone.

This section describes only a selection method for the baud rate of the COM/USB port used for PC control. For preparation and operation methods, refer to the help information or a list of PC commands.

The applications as above, virtual COM port driver and the manual for PC protocol command can be downloaded from the Web site below. The virtual COM port driver is required to control the transceiver via a USB port using the PC protocol command. {page 1-5}

http://www.kenwood.com/i/products/info/amateur/software_download.html

SELECTING THE BAUD RATE OF THE COM/USB (REAR PANEL) PORT

Follow the procedure below to select the baud rate of the COM/USB port used for PC control.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 00, "Baud Rate (COM Port)" (COM), or Menu 01, "Baud Rate (USB Port)" (USB).

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the baud rate.
Select the baud rate from 4800, 9600, 19200, 38400, 57600, and 115200 [bps] The default is "9600 [bps]" for the COM port and "115200 [bps]" for the USB port.

5 Press **[⮌]** (F1).

6 Press **[MENU]** to exit.

Note:

- If you select a baud rate of 38400, 57600, or 115200 bps, select the fastest baud rate possible for the RS-232C port of your PC.
- If you use the ARCP-990, select the fastest possible transfer rate.
- To display the bandscope while the transceiver is remotely controlled using ARCP-990 and ARHP-990, high speed communication speed is mandatory. Connect the home-based LAN to the LAN connector on the rear panel.

CONFIGURING THE USB KEYBOARD

Connecting a USB keyboard to the (USB-A) port on the front panel facilitates your operation. You can transmit or play back voice messages assigned to function keys or enter text from the USB keyboard and transmit the text string in FSK or PSK mode.

If a USB keyboard is connected to the transceiver, you can enter a text string. The key repeat behavior while a key on the USB keyboard is pressed down can be configured.

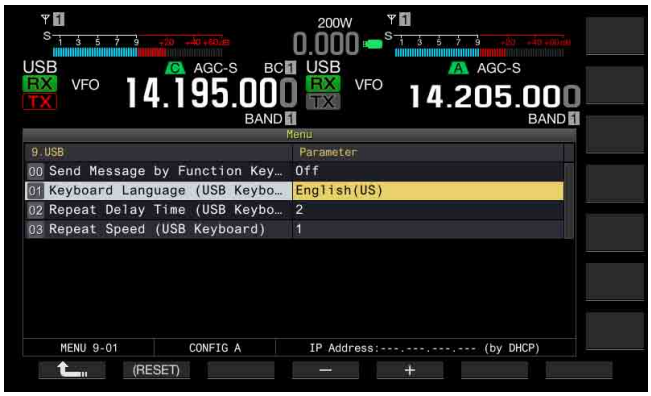
SELECTING THE LANGUAGE FOR THE USB KEYBOARD

You can configure the type of USB keyboard to be connected to the transceiver (the language or region).

1 Select Group No. 9, "USB", from the **Menu** screen.

2 Access Menu 01, "Keyboard Language (USB Keyboard)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the language.

- The keyboard type can be selected from the languages and regions below.
  Japanese, English (US), English (UK), French, French (Canadian), German, Portuguese, Portuguese (Brazilian), Spanish, Spanish (Latin American), and Italian
- The default is "English (US)".

5 Press **[⮌]** (F1).

6 Press **[MENU]** to exit.

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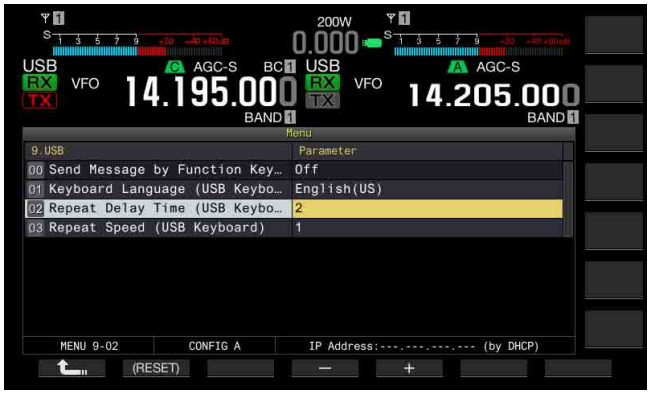
CONFIGURING THE KEY REPEAT DELAY TIME

You can configure the delay time until the key repeat begins.

1 Select Group No. 9, "USB", from the **Menu** screen.

2 Access Menu 02, "Repeat Delay Time (USB Keyboard)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select the delay time.
- The key repeat speed can be selected from "1" to "4".
- The default is "2".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

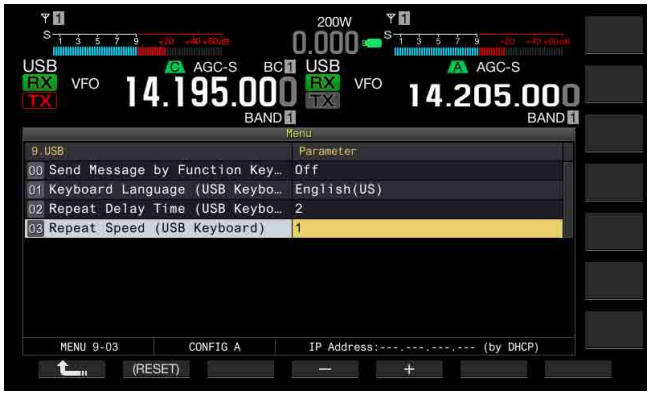
CONFIGURING THE KEYING SPEED

You can configure the keying speed for the USB keyboard.

1 Select Group No. 9, "USB", from the **Menu** screen.

2 Access Menu 03, "Repeat Speed (USB Keyboard)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the key repeat speed.
- The key repeat speed can be selected from "1" to "32".
- The default is "1".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

ENABLING USING USB KEYBOARD TO SEND A MESSAGE

If the transceiver is configured as described below, pressing a PF key on a USB keyboard transmits a Voice or the text message.

- The transmission of a message using a USB keyboard is enabled:
- "Voice" or "Message" is assigned to a PF key on a USB keyboard:

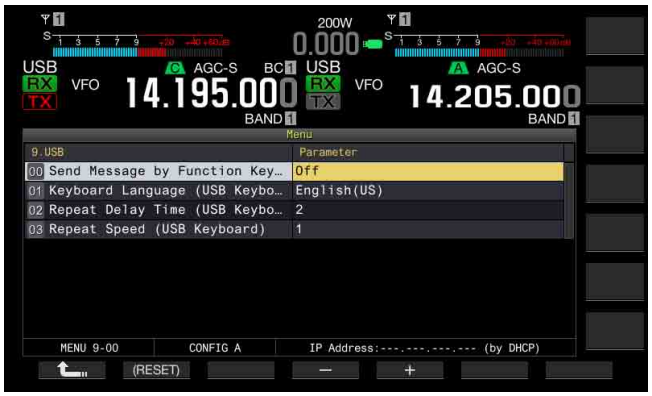
Refer to the following for the method to assign a voice or a text message to the USB keyboard.

- Recording a Voice Message {page 13-1}
- CW Message Memory {page 5-22}
- Utilizing an RTTY Message Memory {page 5-40}
- Utilizing an PSK Message Memory {page 5-57}

1 Select Group No. 9, "USB", from the **Menu** screen.

2 Access Menu 00, "Send Message by Function Keys (USB Keyboard)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On".
The default is "Off".

5 Press [ ] (F1).

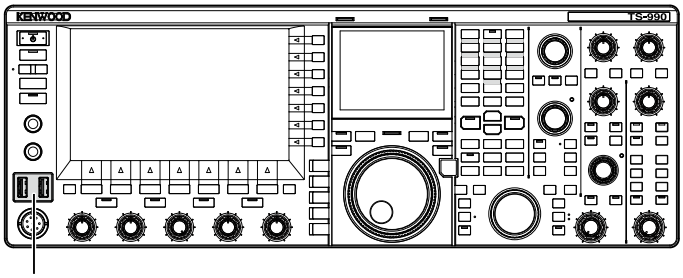
6 Press **[MENU]** to exit.

Note:

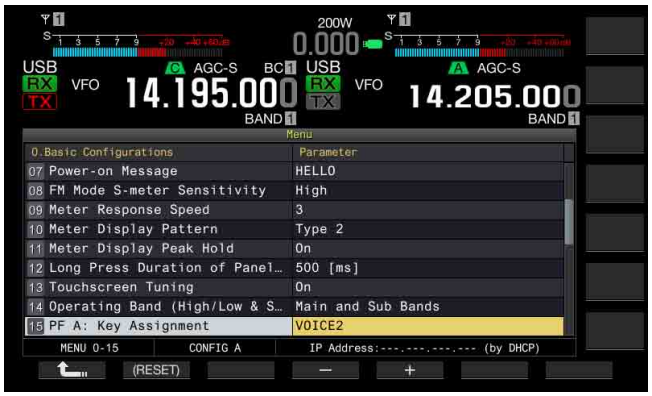
- Even if two sets of USB keyboards are connected to the transceiver, the transceiver recognizes the USB keyboard connected first.
- You cannot select a channel where no message is stored.
- In FSK or PSK mode, a message can be transmitted following the configuration for the channel where a message is stored.
  In FSK or PSK mode, a message can be transmitted while the **RTTY Encode/Decode** screen is open.

CAPTURING AND SAVING SCREEN IMAGES

You can capture screen images from the main screen or the sub-screen and save them to a USB flash drive in PNG (.png) format.



1 Assign "Capture" to any of the PF keys.
For configuration, refer to PF key (Programmable Function Key). {page 16-6}



2 Insert a USB flash drive into the ⇐ (USB-A) connector on the front panel.
"▭" appears on the main screen.

3 Press **[Capture]** (PF).

- The screen images of the main screen and the sub-screen are saved as image files in the USB flash drive. The save directory is KENWOOD/TS-990/CAPTURE.
- Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}

Note:

- The file is saved under the following names:
  Year, month, day_time m.png: Screen image of the main screen
  Year, month, day_time s.png: Screen image of the sub-screen
  Example:
  20130215_102030m.png
  (Image of the main screen saved at 10:20:30 on February 15, 2013)
- If you save the captured image to the USB flash drive, ensure the following:
  - The USB flash drive has been formatted with the transceiver.
  - The USB flash drive must be inserted in place.
  - The USB flash drive must have sufficient memory space available.
  - The USB flash drive must not be write protected or the file system is not corrupted.
- You can press **[Print Screen]** on a USB keyboard to capture and save the image.
- It may be a case that the image caption does not complete quickly.
- While the screen saver is active, you cannot capture the screen image.
- Failing to capture the image results in an error tone to sound.
- It may take a long time to store the image file in the USB flash drive after the image is captured. Executing Safe Removal of the USB Flash Drive, a message requesting you to wait until the captured image file will successfully be saved in the USB flash drive.

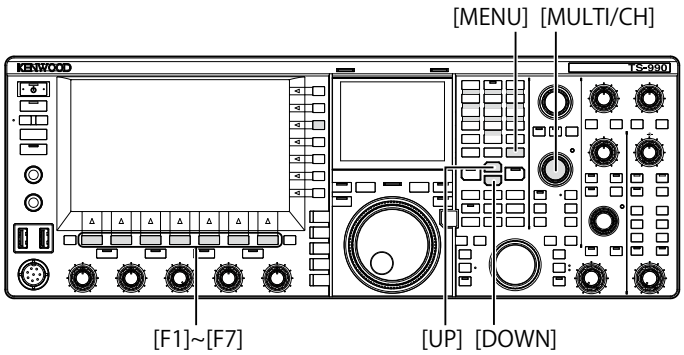
CONFIGURING THE NETWORK

If you operate the transceiver remotely from the KNS (KENWOOD NETWORK COMMAND SYSTEM), configure the IP Address, Administrator ID, and Password. Also, you must configure for network so as to correct the time after accessing the NTP server.

Use an Ethernet (LAN) cable (straight type) and connect the transceiver to the LAN. To access the transceiver from the LAN, log into the transceiver with the configured ID and password.

CONFIGURING THE IP NETWORK

DHCP stands for dynamic host configuration protocol, which is used to obtain network information (information on the IP address, DNS server, gateway, and others) from the DHCP server. You can obtain the IP address manually or use the DHCP and configure the IP address.

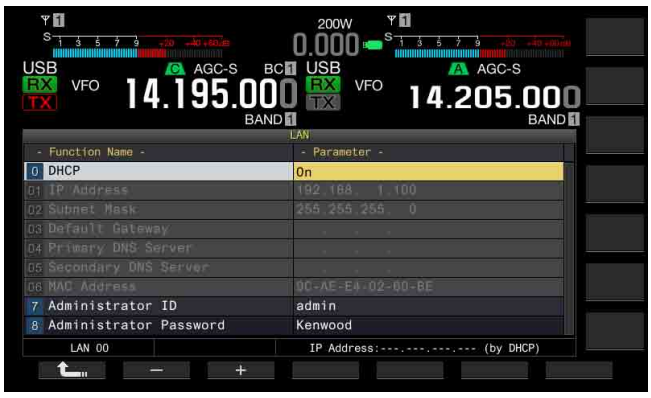


■ Configuring the IP address automatically (using the DHCP)

1 Press **[LAN]** (F) on the **Menu** screen to open the **LAN** screen.

2 Access Menu 00, "DHCP".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F2) or **[+]** (F3) to select "On" (use the DHCP).
The default is "On".

5 Press [⮌] (F1).

6 Press **[MENU]** to exit.

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Note:

- In the operating environment where the transceiver is connected to Internet using the fixed-line broadband, the broadband router contains the DHCP servers in most of cases. Refer to the instruction manual supplied with the broadband router in use for the details of the DHCP server.

■ Configuring the IP address manually (without using the DHCP)

1 Press **[LAN]** (F) on the **Menu** screen to open the **LAN** screen.

2 Access Menu 00, "DHCP".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F2) or **[+]** (F3) to select "Off" (does not use the DHCP).

5 Press [ ] (F1).

6 Press [ ] (F2) or [ ] (F3) to access Menu 01, "IP Address".

7 Press **[EDIT]** (F4).

8 Press **[-]** (F2), **[+]** (F3), or a key on the numeric and band select keypad, or rotate the **MULTI/CH** control to highlight the three-digit number.

9 Press [ ] (F4) or [ ] (F5) to highlight the next three-digit number.
Repeat steps 8 and 9 to configure the IP address.

10 Press **[OK]** (F6).

11 Press [ ] (F2) or [ ] (F3) to access Menu 02, "Subnet Mask".
Repeat steps 3 to 10 to configure the subnet mask. Similarly, you must configure the default gateway, primary DNS server, and secondary DNS server.

Summary of Changes	Range	Default
DHCP	Off, On	On
IP Address	1.0.0.0 to 223.255.255.255	192.168.1.100
Subnet Mask	0.0.0.0 to 255.255.255.252	255.255.255.0
Default Gateway	1.0.0.0 to 223.255.255.255	blank
Primary DNS Server	1.0.0.0 to 223.255.255.255	blank
Secondary DNS Server	1.0.0.0 to 223.255.255.255	blank

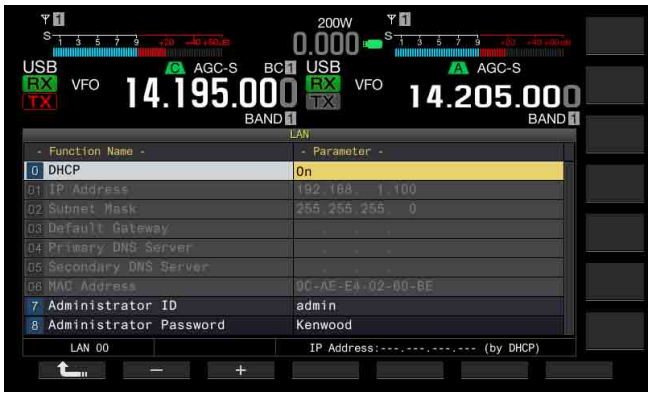
Note:

- The transceiver does not conform to IPv6.
- The transceiver can accept the ICMP response, such as PING.
- The transceiver conforms to the 100 Base-TX Ethernet communication. Use a commercially available category 5 (CAT5) equivalent or better cable.
- If you use a hub or broadband router, connect a commercially available straight-type cable.
- Connect the cable after the transceiver and the device to be connected are turned OFF.
- If the IP address is automatically acquired, you cannot configure the IP address in an environment where no DHCP server is used.
- If the IP address is automatically acquired, the IP address, subnet mask, default gateway, primary DNS server, and secondary DNS server are grayed out and you cannot enter parameters.
- If the IP address is automatically acquired and configured for the transceiver, the address configured for the corresponding IP address configuration item will appear.
- If the DHCP is active, the parameters can be renewed. If no address is acquired, the address will be left blank.
- The address may not always be acquired immediately after the DHCP is activated.
- The IP address configured while the DHCP is inactive will appear when the DHCP is activated.

CHECKING THE MAC ADDRESS

You can check the transceiver's MAC address, which is required when operating the transceiver from a LAN.

1 Press **[LAN]** (F) on the **Menu** screen to open the **LAN** screen.

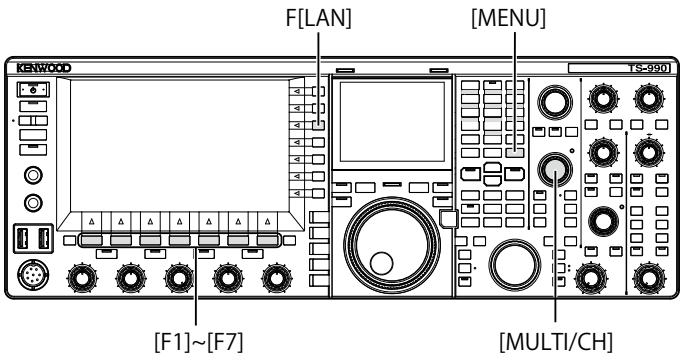


2 Check Menu 06, "MAC Address".
The transceiver's MAC address appears. This menu is only for confirmation; you cannot highlight Menu 06, "MAC Address", or change the configuration.

3 Press **[MENU]** to exit.

CONFIGURING THE NETWORK ADMINISTRATOR

If you operate the transceiver via a LAN, it is necessary to configure the LAN administrator ID and password.

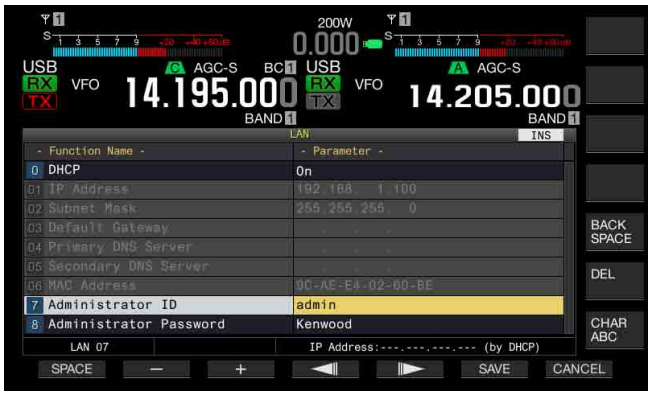


■ Configuring the Administrator ID

1 Press **[LAN]** (F) on the **Menu** screen to open the **LAN** screen.

2 Access Menu 07, "Administrator ID".

3 Press **[EDIT]** (F4) to allow editing of the parameter box.



4 Use the functions keys and the **MULTI/CH** control to edit the administrator ID.

You can configure the administrator ID with a maximum of 8 alphanumeric characters. The default is "admin".

[SPACE] (F1): Press to enter a space.

[-] (F2)/**[+]** (F3): Press to display the previous character or the next character.

[◀] (F4) and **[▶]** (F5): Press to move the cursor to the left or right.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

5 Press **[SAVE]** (F6) to save the text string.

Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **LAN** screen.

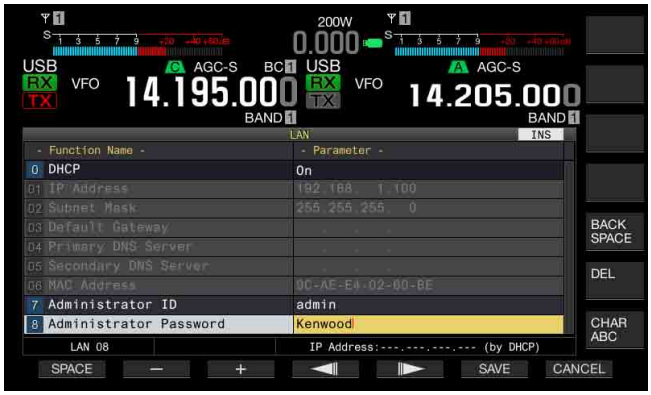
6 Press **[MENU]** to exit.

■ Configuring the password

1 Press **[LAN]** (F) on the **Menu** screen to open the **LAN** screen.

2 Access Menu 08, "Administrator Password".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Use the functions keys and the **MULTI/CH** control to edit the administrator ID.

Enter the password using a maximum of 8 alphanumeric characters. The default is "Kenwood".

[SPACE] (F1): Press to enter a space.

[-] (F2)/**[+]** (F3): Press to display the previous character or the next character.

[◀] (F4) and **[▶]** (F5): Press to move the cursor to the left or right.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

5 Press **[SAVE]** (F6) to save the text string.

Pressing **[CANCEL]** (F7) clears the entered parameter and reverts to the **LAN** screen.

6 Press **[MENU]** to exit.

Note:

- The ID and password are case sensitive.
- To remotely control the transceiver by connecting to a home network using ARCP-990 Radio Control Program and ARHP-990 Radio Host Program, you must also configure the ID and password, which were configured for the transceiver, for ARCP-990 and ARHP-990. For details, refer to the help texts attached to the ARCP-990 and ARHP-990.
- If you used the transceiver connected to a home network, configure 60000 (fixed) for the port number and use TCP for the protocol.
- You cannot use a ";" (semicolon) or 0x80 or any of the following characters for the Administrator ID or password.

CONFIGURING THE OUTPUT TO AN EXTERNAL METER

Connecting an analog meter (commercially available) to the **METER** connector on the rear panel enables you to display the levels of signals transmitted or received on the main band and the sub band. The signal type to the main band and the sub band can be configured independently.

Follow the procedure below to select the type of signal to be transferred to an external meter while transmitting. Signal strength is the signal type to be transferred to an external meter while transmitting.

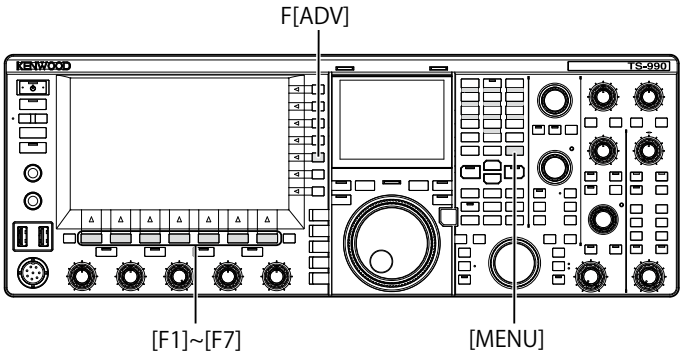
The METER terminal has the following output rating. {page 2-10}

Voltage 0 V to 5 V (no load)

Input Impedance: 4.7kΩ

SELECTING THE OUTPUT SIGNAL TYPE OF THE MAIN BAND FOR AN EXTERNAL METER

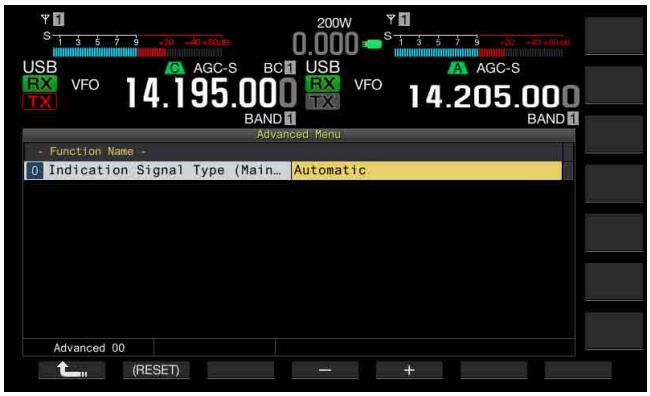
You can configure the signal type of the main band to be transferred to an external meter from the METER terminal.



1 Press **[ADV]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Advanced Menu 00, "Indication Signal Type (Main Band)" 'External Meter 1).

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the signal format.
The following signal types are used. The default is "Automatic".

Automatic

The S-meter level while receiving or a value or the signal level displayed in the key guide **[METER]** (F) can be transferred from the METER terminal. In any case, the temperature status detected from the protective circuit of the transceiver cannot be transferred.

TX Power

The transmit power level can be transferred.

ALC

The signal level for the ALC circuit can be transferred.

Vd (Drain Voltage)

The drain voltage value of the power amplification (FET) element can be transferred.

COMP (Compression Level)

Displays the level of the audio signal emphasis by a speech processor.

ID (Current)

The drain current of the power amplification (FET) element can be transferred.

SWL

The SWR can be transferred.

5 Press [↵] (F1).

6 Press **[MENU]** to exit.

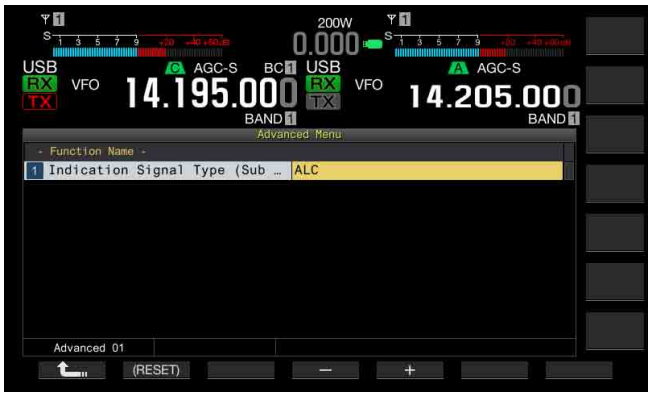
SELECTING THE OUTPUT SIGNAL TYPE OF THE SUB BAND FOR AN EXTERNAL METER

You can configure the signal type of the sub band to be transferred to an external meter from the METER terminal.

1 Press **[ADV]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Advanced Menu 01, "Indication Signal Type (Sub Band)" 'External Meter 2).

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the signal format.
The following signal types are used. The default is "ALC".

TX Power

The transmit power level can be transferred.

ALC

The signal level for the ALC circuit can be transferred.

Vd (Drain Voltage)

The drain voltage value of the power amplification (FET) element can be transferred.

COMP (Compression Level)

Transfers the level of the audio signal emphasis by a speech processor.

ID (Current)

The drain current of the power amplification (FET) element can be transferred.

SWR

The SWR can be transferred.

5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

Note:

♦ The S meter level of the sub band while receiving is transferred, and the sub band signal can be transferred in the configured signal type upon transmit using the main band or sub band.

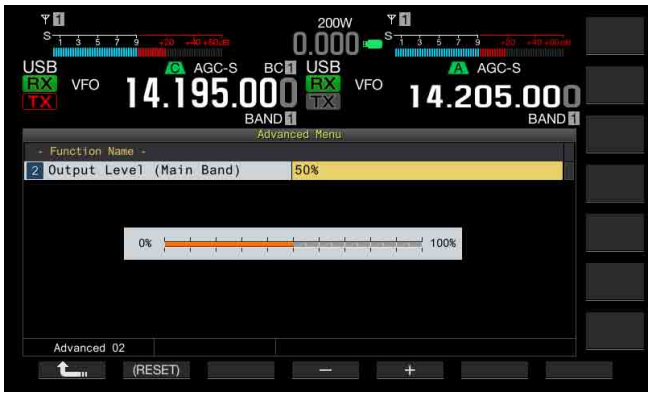
SETTING THE OUTPUT LEVEL OF AN EXTERNAL METER

The level of signal output can be configured for the main band and the sub band independently, according to the ratings of the external meter connected to the METER terminal.

1 Press **[ADV]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Advanced Menu 02, "Output Level (Main Band)" (external meter 1), or Advanced Menu 03, "Output Level (Sub Band)" (external meter 2).

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the output level.
Set the level in a range of 1% to 100% (in steps of 1%). The default is "50% (2.5 V)".

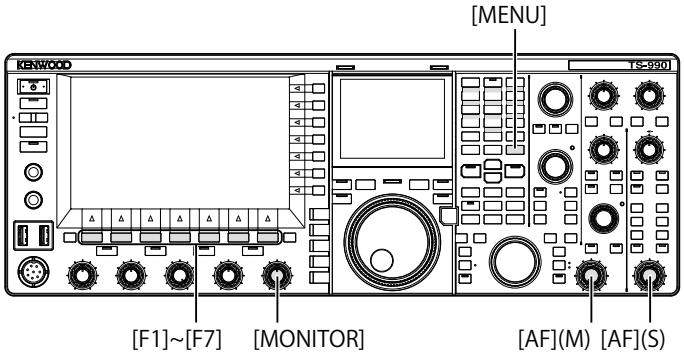
5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

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SELECTING THE OUTPUT SIGNAL OF AN EXTERNAL SPEAKER

If an external speaker is connected to the **EXT.SP1** and **EXT. SP2** jacks on the rear panel for audio output, you can configure how the audio sounds from the external speaker.



1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 15, "Speaker Output Configuration".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select the signal output method.
The available parameters are "Normal", "Reversed", or "Mixed".

The default is "Normal".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

♦ The following audio sounds if the external speaker is connected to the **EXT. SP2** jack.

Choices	Audio from EXT. SP1	Audio from EXT. SP2
Normal	Received audio of the main band	Received audio of the sub band
Reversed	Received audio of the sub band	Received audio of the main band
Mixed	Mixed audio of the receive signals of the main band and the sub band.	Mixed audio of the receive signals of the main band and the sub band.

♦ If no external speaker is connected to the **EXT. SP1** jack, the audio will output from an internal speaker.

♦ The following types of audio will output from the built-in speaker.

Received audio of the sub band	Built-in speaker (EXT. SP1 output without any connection to EXT. SP2)	Remarks
Off	Received audio of the main band	Rotate the **AF** (M) control to adjust the volume.
	Beep	The volume can be configured in the **Menu** screen.
	TX monitor sound	Rotate the **AF** (M) control to adjust the volume.
	Sidetone	Configure the volume in the **Menu** screen or rotate the **MONITOR** control to adjust the volume.
On	Mixed audio of the receive signals of the main band and the sub band.	Rotate the **AF** (M) control to adjust the main band volume. Rotate the **AF** (S) control to adjust the sub band volume.
	Beep	The volume can be adjusted in the **Menu** screen.
	TX monitor sound	Rotating the **MONITOR** control adjusts the volume.
	Sidetone	Configure the volume in the **Menu** screen or rotate the **MONITOR** control to adjust the volume.

♦ Unless two waves are received simultaneously (dual-band reception) or the transceiver is receiving using the transmit frequency on the sub band (a TF reception), the same audio (the received audio of the main band) can be sent from the **EXT. SP1** and **EXT. SP2** jacks.

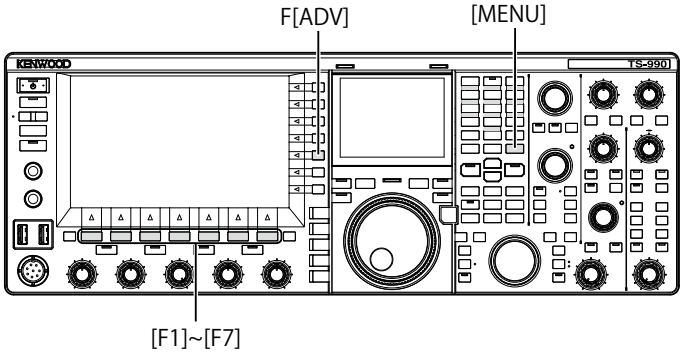
♦ If no external speaker is connected, the mixed audio of the received audio on the main band and that of the sub band will output from an internal speaker.

♦ If an external speaker is connected only to the **EXT. SP1** jack, the audio line to the built-in speaker is muted and the mixed audio of the received audio of the main band and that of the sub band will output from an external speaker.

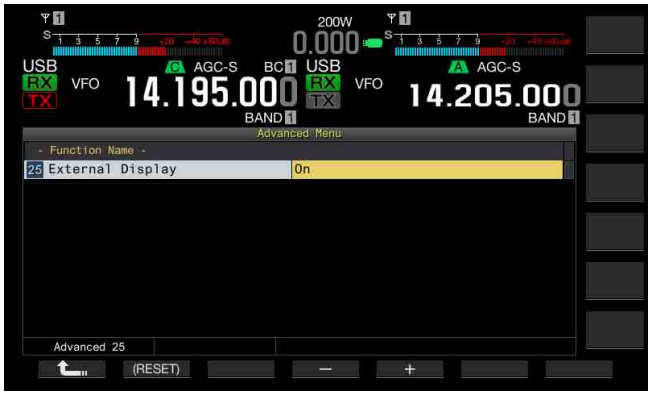
♦ If an external speaker is connected to the **EXT. SP2** jack, a beep, the TX monitor sound, and the sidetone can be transferred from both the **EXT. SP1** and **EXT. SP2** jacks.

DISPLAYING THE MAIN SCREEN CONTENTS ON AN EXTERNAL MONITOR

If you connect an external monitor to the **DISPLAY** connector, you can display the main screen image on the external monitor as well.



1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.
2 Access Menu 25, "External Display".
3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On".
The default is "On".
5 Press [ ] (F1).
6 Press **[MENU]** to exit.

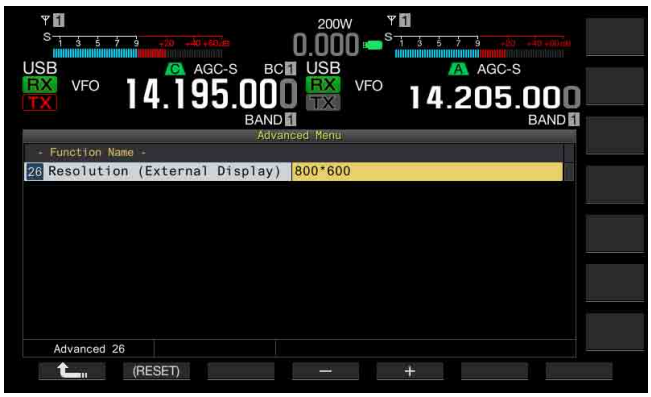
Note:

- Connect the transceiver with an external monitor using a commercial available DVI cable.
- Depending on the specifications of the external monitor, the display cannot be traced correctly when the transceiver power (⏻) turns ON.
- To enter the video signal to an external monitor using the VGA connector, use the commercially available DVI analog conversion adapter.

CONFIGURING THE RESOLUTION OF THE EXTERNAL MONITOR

You can configure the resolution of the external monitor connected to the **DISPLAY** connector.

1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.
2 Access Menu 26, "Resolution (External Display)".
3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select the resolution.
Available parameters are "800x600" and "848x480". The default is "800 x 600".
5 Press [ ] (F1).
6 Press **[MENU]** to exit.

Note:

- If you change the resolution of an external monitor, the display may disappear until the changed configuration will be applied.

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CONFIGURING THE I/O SIGNALS FOR THE OPTICAL DIGITAL CONNECTOR

If you connect an external device, such as a PC, to the **OPTICAL IN** and **OPTICAL OUT** connectors on the rear panel, you can configure the level of signals modulated or reproduced in the external device or the level of signals processed in an equalizer.

From the **OPTICAL OUT** connector, the main band received audio is available on the left channel, and the sub band received audio is available on the right channel.

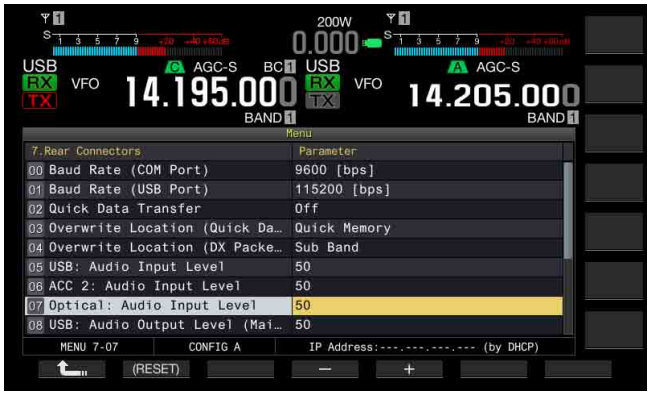
CONFIGURING THE INPUT AUDIO LEVEL

If you connect an external device to the **OPTICAL IN** terminal on the rear panel, you can configure the audio signal input level.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 07, "Optical: Audio Input Level".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate **MULTI/CH** control to select the input level from the available range between "0" and "100".
The default is "50".

5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

Note:

- You can configure the desired input audio according to the transmission method. {page 9-1}
- If you assign Data Send to a PF key, you can transmit the signal from the configured modulation line. {page 9-1}
- The **OPTICAL IN** connector conforms to the sampling frequency of 44.1 kHz and 48 kHz, and to the number of bits of 16 bits and 24 bits.

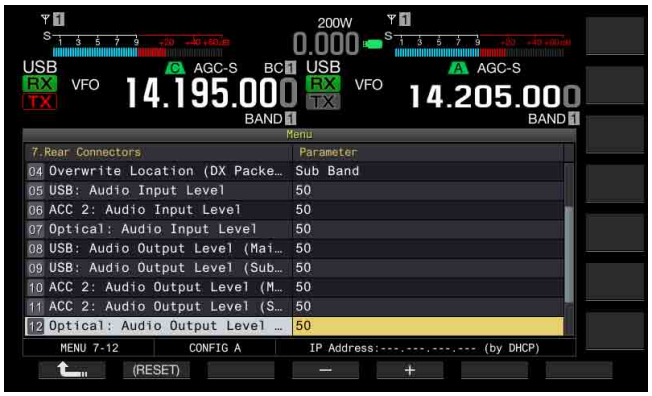
CONFIGURING THE OUTPUT AUDIO LEVEL

If you connect an external device to the **OPTICAL OUT** terminal on the rear panel, you can configure the audio signal output level.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 12, "Optical: Audio Output Level (Main Band)" or Menu 13, "Optical: Audio Output Level (Sub Band)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) and **[+]** (F5), or rotate the **MULTI/CH** control to select the audio signal output level for the main band from the available range between "0" and "100".
The default is "100".

5 Press **[** ⮌ **]** (F1).

6 Press **[MENU]** to exit.

Note:

- The **OPTICAL OUT** connector conforms to the sampling frequency of 48 kHz, and to the number of bits of 24 bits.

CONFIGURING THE I/O SIGNALS FOR THE ACC 2 CONNECTOR

If you connect an external device to the **ACC 2** connector on the rear panel, you can configure the audio signal input level.

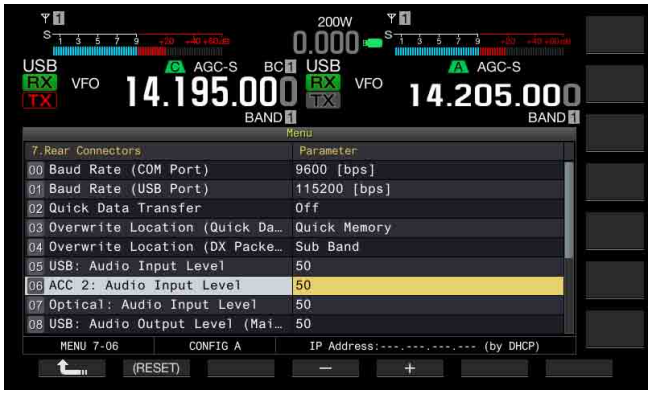
CONFIGURING THE INPUT AUDIO LEVEL

You can configure the audio signal input level from the **ACC 2** connector on the rear panel.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 06, "ACC 2: Audio Input Level".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) and **[+]** (F5), or rotate **MULTI/CH** control to select the input level from the available range between "0" and "100".
The default is "50".

5 Press **[** ↩ **]** (F1).

6 Press **[MENU]** to exit.

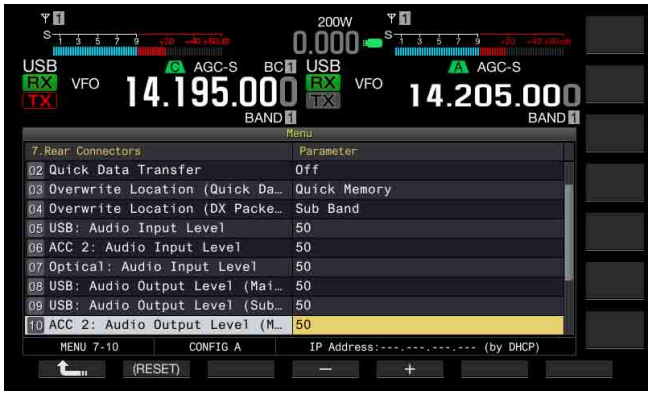
CONFIGURING THE OUTPUT AUDIO LEVEL

If you connect an external device to the **ACC 2** connector on the rear panel, you can configure the audio signal output levels of the main band and sub band independently.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 10, "ACC 2: Audio Output Level (Main Band)" or Menu 11, "ACC 2: Audio Output Level (Sub Band)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) and **[+]** (F5), or rotate the **MULTI/CH** control to select the audio signal output level for the main band from the available range between "0" and "100".
The default is "50".

5 Press **[** ↩ **]** (F1).

6 Press **[MENU]** to exit.

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CONFIGURING THE I/O SIGNALS FOR THE USB CONNECTOR

If you connect an external device to the (USB-B) connector on the rear panel, you can configure the audio signal input level.

From the (USB-B) connector, the main band received audio is available on the left channel, and the sub band received audio is available on the right channel.

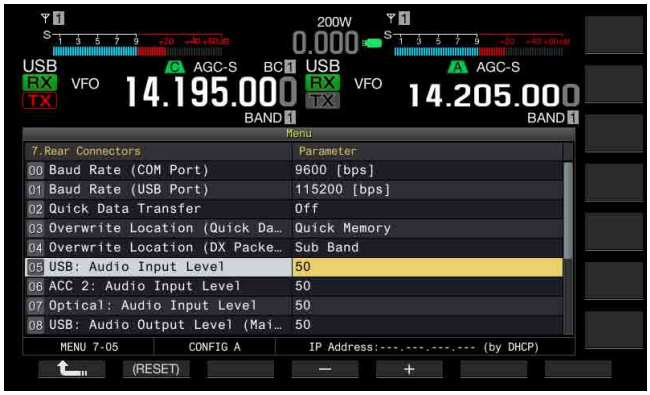
CONFIGURING THE INPUT AUDIO LEVEL

You can configure the audio signal input level to the (USB-B) connector on the rear panel.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 05, "USB: Audio Input Level".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate **MULTI/CH** control to select the input level from the available range between "0" and "100".
The default is "50".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- You can configure the desired input audio according to the transmission method. {page 9-1}
- If you assign Data Send to a PF key, you can transmit the signal from the configured modulation line. {page 9-1}

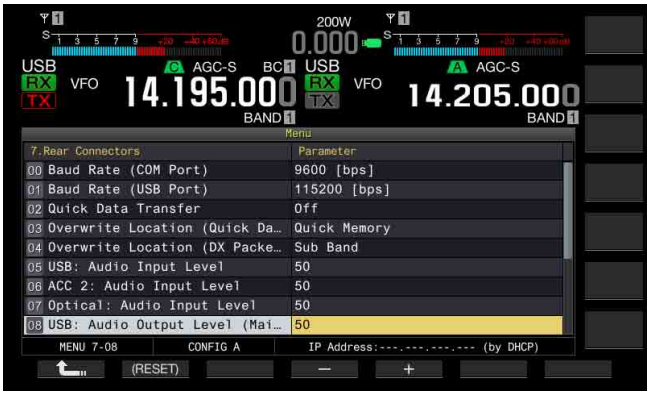
CONFIGURING THE OUTPUT AUDIO LEVEL

You can configure the audio signal output level from the (USB-B) connector on the rear panel. If connected, the output signal level for the main band and the sub band can individually be configured.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 08, "USB: Audio Output Level (Main Band)" or Menu 09, "USB: Audio Output Level (Sub Band)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate **MULTI/CH** control to select the audio signal output level for the main band from the available range between "0" and "100".
The default is "100".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- If the OS in your PC is Windows Vista or later, select "2 Channels" from the Control Panel > Hardware and Sound > Sound > Recording > Microphone (USB Audio CODEC) > Advanced.

CONFIGURING THE REF I/O CONNECTOR

The behavior of the REF I/O (10 MHz) connector on the rear panel can be selected from "Off", "Input", and "Output".

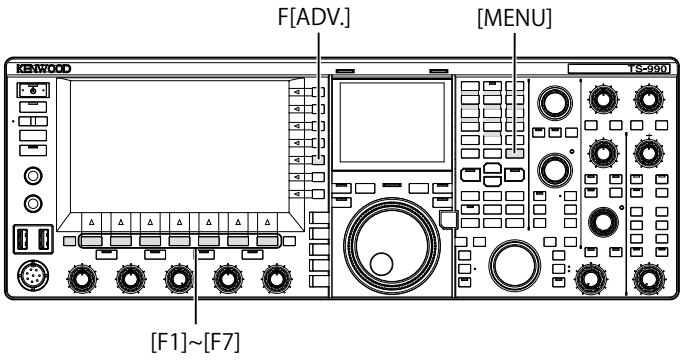
- Impedance : 50Ω

The frequency accuracy can be increased by entering the sufficiently accurate reference signal to the transceiver and by using the signal as the reference frequency.

- Input Level : 0dBm ± 10dB

Also, sourcing the reference frequency of the transceiver via the REF I/O (10 MHz) connector enables to be used as the reference frequency of other transceiver.

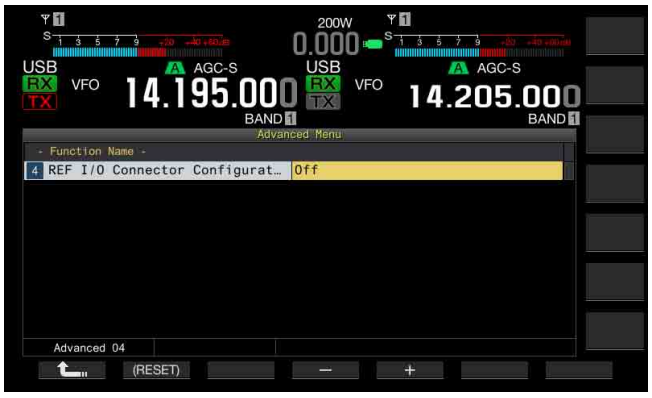
- Output Level : 0dBm



7 Press **[ADV.]** (F) from the Menu screen to open the Advanced Menu screen.

8 Access Menu 4, "REF I/O Connector Configuration".

9 Press **[SELECT]** (F4) to allow editing of the parameter box.



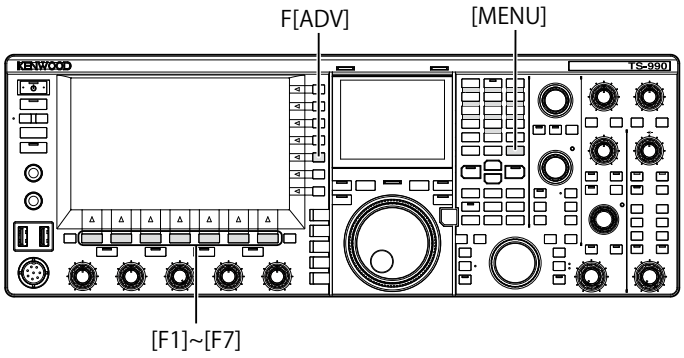
10 Press **[-]** (F4) or **[+]** (F5) to select the behavior of the REF I/O (10 MHz) connector from "Off", "Output", or "Input".
The default is "Off".

11 Press **[⮌]** (F1).

12 Press **[MENU]** to exit.

CONFIGURING FOR THE ROOOFING FILTER ADDED BY YOU (MAIN BAND ONLY)

If you add a roofing filter, you can configure the passband width and attenuation of the roofing filter according to the specifications of the roofing filter.



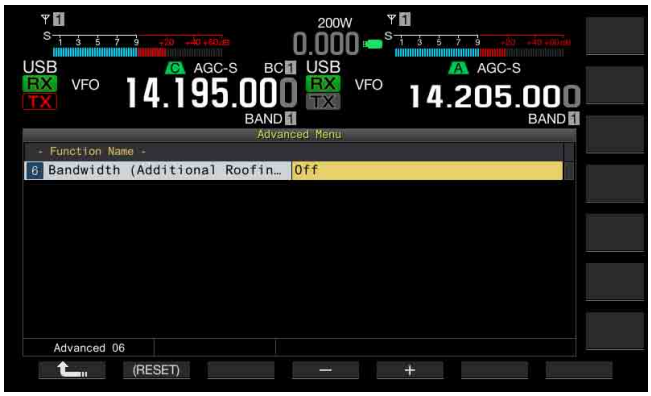
CONFIGURING THE PASS BANDWIDTH

You can configure the pass bandwidth according to the specifications of the roofing filter that you have added.

1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Advanced Menu 06, "Bandwidth (Additional Roofing Filter)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the pass band width.
You can select "Off" or "300 [Hz]" to "3500 [Hz]" for the passband width. The default is "Off". If you do not add a roofing filter, do not change the parameter from the default ("Off").

5 Press **[⮌]** (F1).

6 Press **[MENU]** to exit.

Note:

- As of February 2013, no optional roofing filters will be available from KENWOOD.
- If you select "Auto" for the roofing filter on the **RX Filter** screen, a roofing filter with a pass bandwidth wider than that of the DSP filter is selected. If there are two or more roofing filters, including the one that you add satisfying the conditions, the roofing filter with the narrowest pass bandwidth is selected.
- If anything other than "Off" is configured for the pass band width, you can select "Add." for the line for "Roof" in the **RX Filter** screen.

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CONFIGURING THE ATTENUATION

You can configure the attenuation level according to the specifications of the roofing filter that you have added.

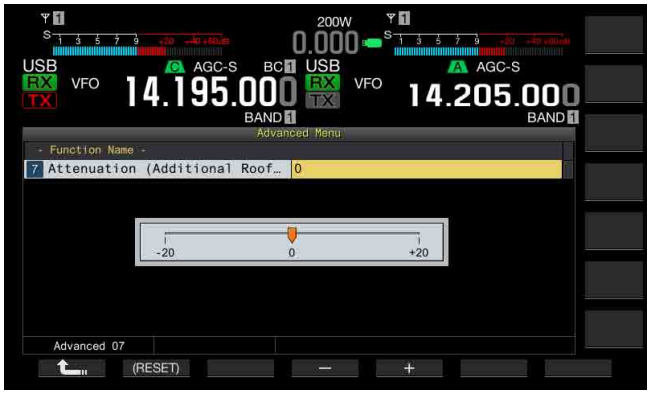
1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 07, "Attenuation (Additional Roofing Filter)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the attenuation level ranging from "-20" to "+20".
You can configure the attenuation level of the roofing filter that you have added according to the specifications of the roofing filter. The default is "0".

Match the S-meter reading of the added roofing filter with the A-meter reading of the built-in roofing filter.



5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

♦ As of February 2013, no optional roofing filters will be available from KENWOOD.

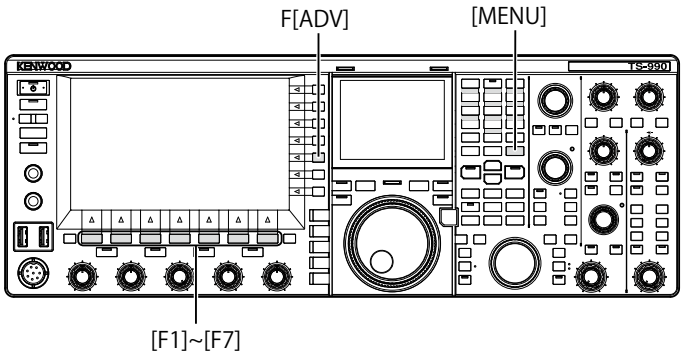
OPERATING THE TRANSCEIVER FOR A VOIP AMATEUR RADIO STATION

If you operate the transceiver for a VoIP amateur radio station, select "SQL" from Advanced Menus 20 and 21, "MSQ/SSQ Output Conditions".

If you use CTCSS as well, to avoid sending noise or unnecessary signals from the station to the Internet, select "Unmute" from Advanced Menus 16 and 17, "Muting the CTCSS tone".

All received audio will then sound from the speaker regardless of the matching status of the CTCSS frequency. The received signal is transferred from the ACC 2/USB port only if the CTCSS frequency matches.

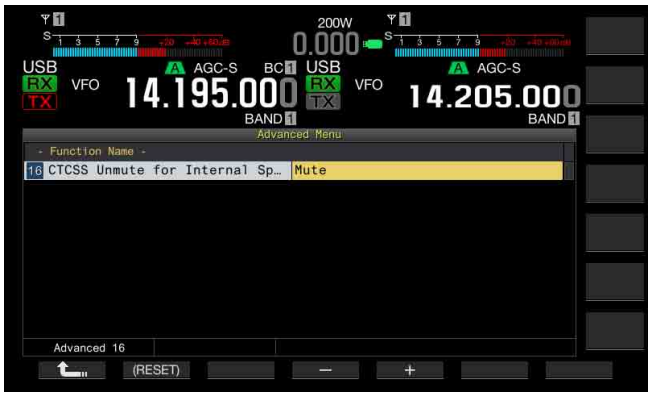
CHANGING THE CTCSS MUTE



1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 16, "CTCSS Unmute for Internal Speaker (Main Band)", or Menu 17, "CTCSS Unmute for Internal Speaker (Sub Band)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select either "Mute" or "Unmute".
The default is "Mute" for both the main band and the sub band.

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

CONFIGURING THE SQL CONTROL SIGNAL

If you connect an external device, such as a TNC or PC, to the **ACC 2** connector on the rear panel, you can configure the **SQL** control signal condition with the MSQ pin and SSQ pin of the **ACC 2** connector.

Refer to "INSTALLING AND CONNECTING THE TRANSCEIVER" for the details of connector. {page 1-11}

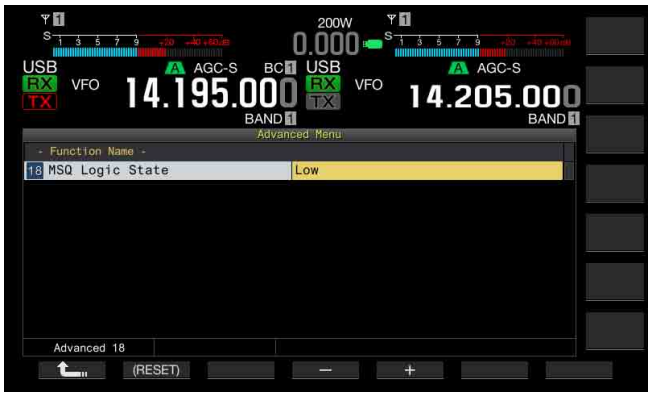
SELECTING THE MSQ/SSQ LOGIC

You can configure the logic of the **SQL** control signal of the MSQ pin and SSQ pin.

1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 18, "MSQ Logic State" (Main band), or Menu 19, "SSQ Logic State" (Sub Band).

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Low" or "Open".
The default is "Low" for both the main band and the sub band.

5 Press [⮌] (F1).

6 Press **[MENU]** to exit.

Note:

♦ The VoIP application installed in a PC detects the busy state even after the transceiver power (⏻) has turned OFF, select "Open" for Menu 18, "MSQ Logic State" (Main Land), or Menu 19, "SSQ Logic State" (Sub Band). As well, you must configure the logic of the busy state detection in the VoIP application to be the same as the transceiver configurations.

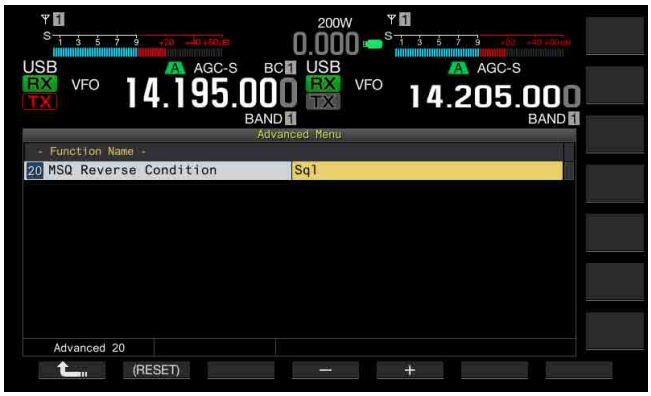
CONFIGURING THE MSQ/SSQ OUTPUT CONDITIONS

You can configure the method to change the conditions of the **SQL** control signal transferred from the MSQ pin and SSQ pin.

1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 20, "MSQ Reverse Condition" (Main band), or Menu 21, "SSQ Reverse Condition" (Sub Band).

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the signal output conditions.
Available parameters are "Busy", "Sql", "Send", "Busy-Send", "Sql-Send", and "Off". The default is "Sql" for both the main band and the sub band.

5 Press [⮌] (F1).

6 Press **[MENU]** to exit.

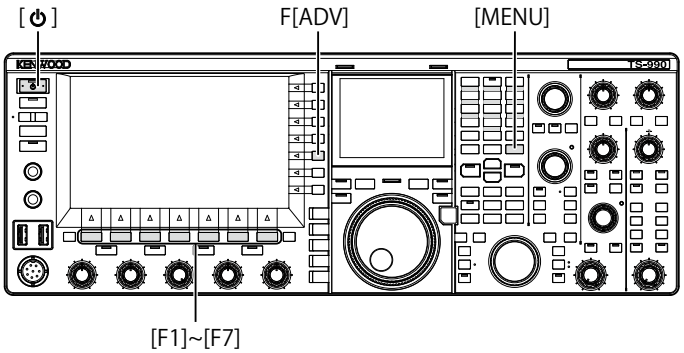
The SQL control signal is transferred from the MSQ pin and SSQ pin for the main band and sub band independently.

Configured Value	Operation
Off	Fixed at low (inactive).
Busy	The SQL control signal becomes high (active) regardless of the matching status of the received CTCSS frequency.
Sql	If the CTCSS signaling is active, the SQL control signal becomes high (active) when the received CTCSS frequency coincides with the CTCSS frequency configured for the transceiver. If the CTCSS signaling is inactive, the SQL control signal becomes high (active) when the CTCSS frequency is received, regardless of the matching status of the received CTCSS frequency.
Send	The SQL control signal becomes high while the transceiver is transmitting.
Busy-Send	The SQL control signal becomes high while the transceiver is transmitting and receiving.
Sql-Send	If "Sql" and "Send" are configured, the SQL control signal becomes high.

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SWITCHING THE COM CONNECTOR PIN ARRANGEMENT

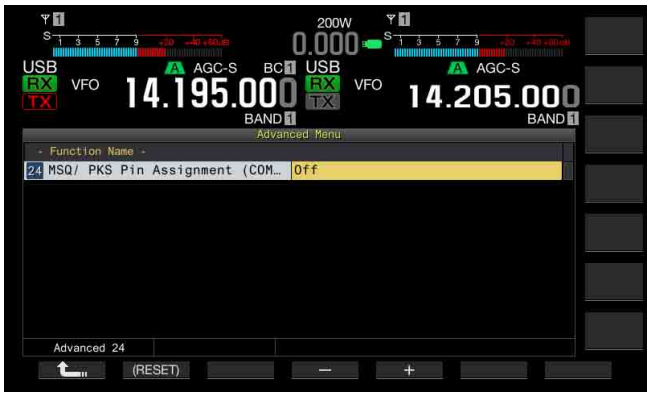
You can configure the RTS/CTS terminals of the **COM** connector on the rear panel allowing it to function in the same manner as the MSQ/PKS terminals of the **ACC 2** connector.



1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 24, "MSQ/PKS Pin Assignment (COM Connector)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off" to determine the pin behavior.
The default is "Off".

Off: The COM connector is normal (CTS/RTS mode).
The **COM** connector processes the RTS signal and CTS signal.

On: The COM connector is in MSQ/PKS mode.
The signal on the RTS and CTS pins of the **COM** connector are replaced with the MSQ and PKS signals, respectively.

A message confirming the **COM** connector behavior appears.

5 Press **[OK]** (F4).

6 Press [⮌] (F1).

7 Press **[MENU]** to exit.

8 Press **[⏻]** to turn the transceiver power (⏻) OFF, press **[⏻]** again to turn the transceiver power (⏻) ON.

The output signals for each configuration behaves as follows:

	COM Terminal on the rear panel		PC
CTS/ RTS (Default)	TxD	→	RxD
	RxD	←	TxD
	RTS	→	CTS
	CTS	←	RTS
	GND		GND
MSQ/ PKS	No function	→	RxD
	No function	←	TxD
	MSQ	→	CTS
	PKS	←	RTS
	GND		GND

Note:

- The revised configurations cannot be enabled until the transceiver is restarted.
- If "On" is configured for the MSQ/PKS Pin Assignment, you cannot control the transceiver using the ARCP-990 and ARHP-990 or by PC commands sent via the **COM** connector.
- If "Off" is configured for the MSQ/PKS Pin Assignment, the transceiver transmits when the PKS pin of the **ACC 2** connector is shorted to GND.
- The I/O level of the audio varies depending on the sound device connected. If the audio I/O level does not match the transceiver, use Menus 7-06, 7-10, and 7-11 to change the audio I/O level on the **ACC 2** connector. {page 16-20}
- The squelch signal of the sub band cannot be transferred.

QUICK DATA TRANSFER

You can transfer the operating data such as the receive frequency and operating mode to a transceiver that is connected to this transceiver. This function is useful to transfer the operating data such as the receive frequency to another transceiver during two-person operation of the transceiver in a contest.

You can transfer operating data to the following transceiver model names. For the connection methods, refer to "CONNECTING TO AN APPLICABLE TRANSCEIVER (QUICK DATA TRANSFER)". {page 1-5}

- TS-990 Series
- TS-590 Series
- TS-480 Series
- TS-2000 Series
- TS-570 Series
- TS-870S

If the operating data is transferred using Quick Data Transfer, connect the master transceiver to the slave transceiver using a cross cable. The same baud rate, stop bit, and transferring target for the Quick Data Transfer must be configured for both master and slave transceivers.

For the Quick Data Transfer using two TS-990S, one must be configured as the master transceiver and the other as the slave transceiver.

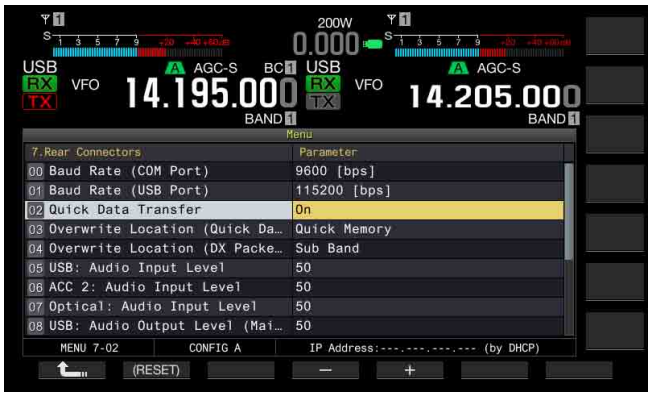
Note:

- During the Quick Data Transfer using this transceiver and other transceiver, some functions may not be used due to the differences of the specifications.

TRANSFERRING THE OPERATING DATA TO THE SLAVE TRANSCEIVER

Follow the procedure below to operate the transceiver as a master transceiver, to transfer the operating data to the slave transceiver.

1 Enable Quick Data Transfer for both the master transceiver and the slave transceiver.
Select "On" in the Menu 7-02, "Quick Data Transfer." To enable the data transfer of another transceiver, refer to the instruction manual supplied with that transceiver.



2 Place the transceiver into VFO mode and configure the operating frequency and operating mode.

3 Press **[M.IN]** (Quick Memory) on this transceiver.
The displayed operating data is registered with quick memory channel 0 of this transceiver and transferred to the slave transceiver. While the RIT function of the transceiver is active, the offset frequency is added to the transferring receive frequency.

RECEIVING THE OPERATING DATA FROM THE MASTER TRANSCEIVER

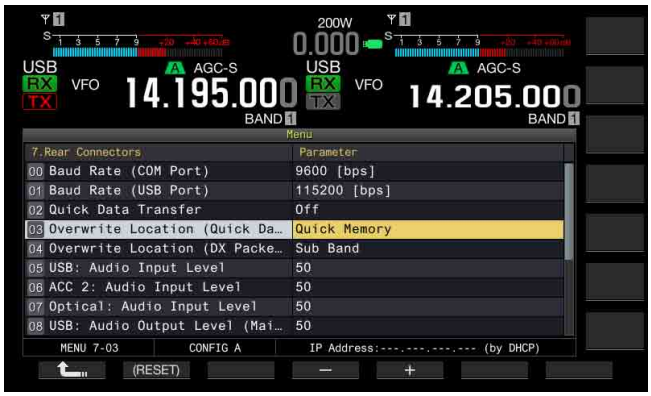
You can operate this transceiver as a slave transceiver that receives the operating data from a master transceiver. The transceiver uses either the VFO or quick memory channel 0 to receive the operating data from the master transceiver.

1 Enable Quick Data Transfer for both this transceiver and the slave transceiver.
Select "On" in the Menu 7-02, "Quick Data Transfer."
For the configuration of the Quick Data Transfer of the master transceiver, refer to the instruction manual for that transceiver.

2 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

3 Access Menu 03, "Overwrite Location (Quick Data Transfer)" of the transceiver.

4 Press **[SELECT]** (F4) to allow editing of the parameter box.



5 Press **[-]** (F4) or **[+]** (F5) to select "VFO" or "Quick Memory".
The default is "Quick Memory".

6 Press **[ ]** (F1).

7 Press **[MENU]** to exit.

8 Transmit the operating data from the master transceiver.
For the transferring of the operating information from the master transceiver, refer to the instruction manual for that transceiver.

Note:

- To prevent erroneous operations of both the master transceiver and the slave transceiver, turn the master transceiver and slave transceiver OFF and ON again after completing their configurations.
- To use the transceiver only for reception all the time, select "On" for Menu 6-03, "TX Inhibit", to disable the transmission capability, in order to prevent erroneous transmission.
- If the slave transceiver receives the operating data using the operating frequency (VFO) which has been configured as the Simplex frequency, the operating band for both master and slave transceivers are overwritten with the received operating data. "Off" should be configured for the RIT and XIT of the slave transceiver.
- If the slave transceiver receives the operating data using the operating frequency (VFO) which has been configured as the Simplex frequency, the received operating data overwrites the operation data for transmission. "Off" is configured in the XIT of the slave transceiver, but the RIT remains unchanged.
- If any transceiver other than TS-990S is used as a slave transceiver, the operating data is transferred as the VFO-A (Simplex) to Quick Memory 0 channel. by the Quick Data Transfer.

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INHIBITING TRANSMISSION

This function prevents erroneous transmissions. If this function is enabled, the transceiver cannot transmit even when pressing the **PTT** (microphone) switch.

No received audio sounds while the **PTT** switch is being pressed.

Transmission can be inhibited in the following cases.

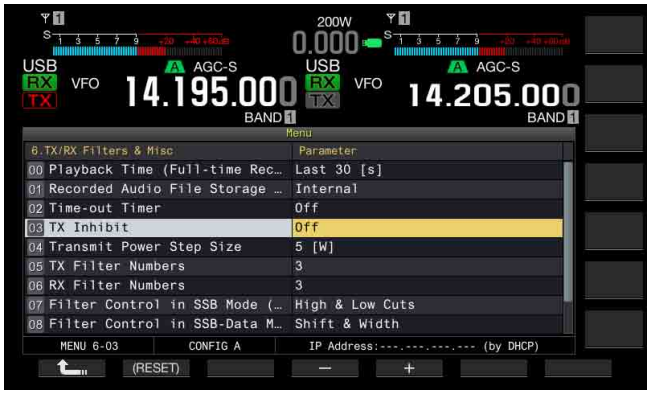
- You want to operate the master transceiver only for reception while two transceivers are in split transfer operation. The transceiver does not practically transmit and no audio sounds even if you attempt to transmit using the master transceiver.
- You do not want the host transceiver to transmit while the KENWOOD NETWORK COMMAND SYSTEM (KNS) is in use for the PC control of this transceiver.

Follow the procedure below to enable the Transmit Inhibit.

1 Select Group No. 6, "TX/RX Filter & Misc.", from the **Menu** screen.

2 Access Menu 03, "TX Inhibit".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On".
The default is "Off".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Note:

- Received audio is muted while the signal level at the SS terminal of the **ACC 2** connector is in the low state, while TX Inhibit is active. Received audio is muted since the signal level at the SS terminal remains in the low state while pressing down the **PTT** switch.
- If TX Inhibit is enabled, you cannot tune using an antenna tuner.
- To use the transceiver only for reception all the time, select "On" for this configuration to disable the transmission capability in order to prevent the transceiver from erroneously transmitting.

DX PACKETCLUSTER TUNE

You can perform the DX PacketCluster tuning while the transceiver is connected to another transceiver. You can connect the transceiver to the following applicable transceivers:

- TM-D710A/E
- TM-D700A/E (G version or later)
- TH-D72A/E

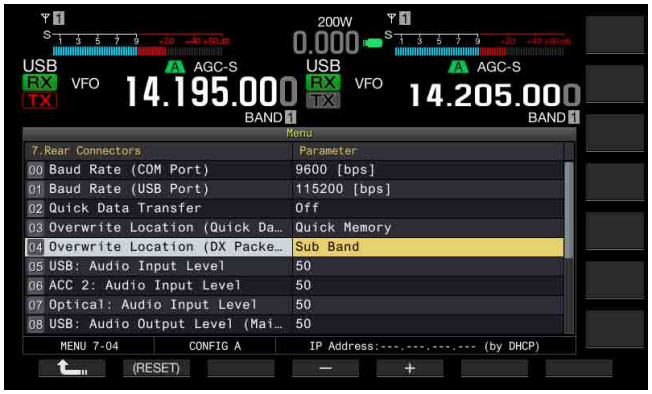
CONFIGURING THE TRANSCEIVER

If DX PacketCluster data is transferred to the transceiver, configure the reception of the DX PacketCluster data using the operating frequency (VFO) of the selected band or the operating frequency (VFO) in the sub band.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 04, "Overwrite Location (DX PacketCluster Tuned Data)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "Operating Band" or "Sub Sand".
The default is "Sub Band".

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

RECEIVING DX PACKETCLUSTER DATA USING THE CONNECTED TRANSCEIVER

Follow the instructions below to operate the transceiver which is connected to this transceiver.

1 Select the APRS or Navitra mode to receive DX PacketCluster data.

2 Display the DX PacketCluster and point the cursor to the frequency you want to tune.

3 Press a key that executes to transfer the value for frequency selected at step 2.
If the frequency is in the range that the transceiver can configure, the operating frequency (VFO) will be configured according to the received packet cluster data.

- TM-D710A/E, RC-D710: TUNE key
- TM-D700A/E: MHz key
- TH-D72A/E: MENU key

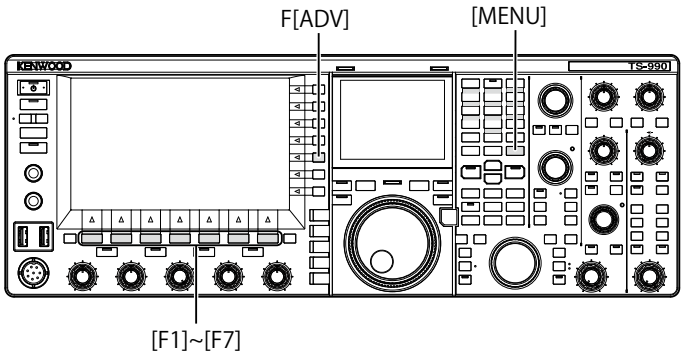
Note:

- The operating frequency for the transceiver is overwritten with the received data sent from the compatible transceiver.
- In VFO mode, the operating frequency (VFO) in use will be overwritten. In Memory Channel Mode, the last used operating frequency (VFO) will be overwritten.
- The DX packet cluster data cannot be transferred to the transceiver automatically.
- This function can be used with TM-D700A/E Version G or later.
- Refer to "INSTALLATION AND CONNECTION" for the connection to TM-D710A/E, RC-D710 and TM-D700A/E. {page 1-7}
- Refer to the instruction manual supplied with TH-D72A/E for details of the connection to the TH-D72A/E.
- The TM-D700A/E has been discontinued and is no longer available.

CONTROLLING EXTERNAL EQUIPMENT

INHIBITING THE TRANSMISSION DURING BUSY (SQUELCH OPENING)

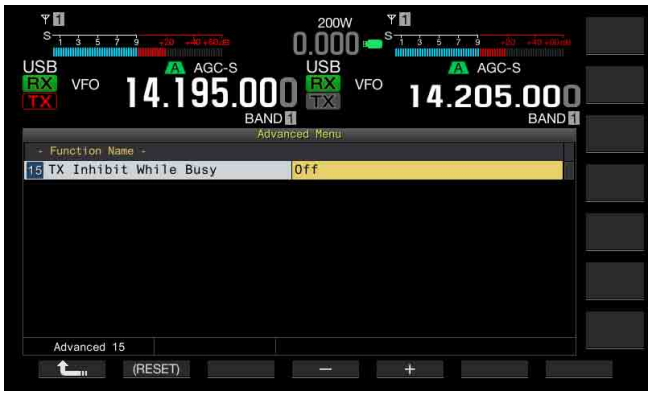
If transmission on the main band is inhibited while the transceiver is busy, the transceiver does not transmit even by pressing the PTT switch.



1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Menu 15, "TX Inhibit While Busy".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On".
The default is "Off".

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

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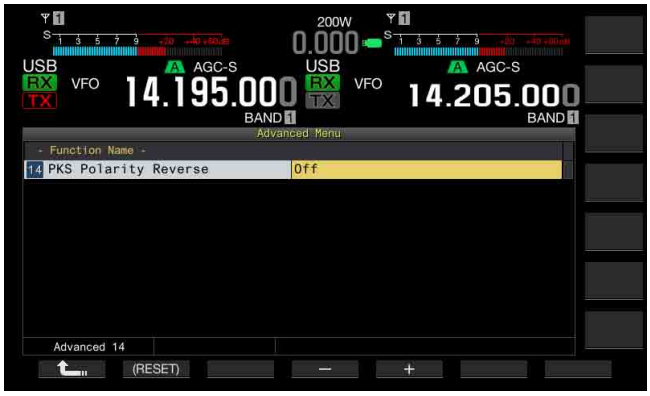
REVERSING THE PKS SIGNAL POLARITY

The transceiver enters the transmit state if the PKS terminal is shorted to GND. You can invert the polarity according to the device to be connected.

1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Advanced Menu 14, "PKS Polarity Reverse".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5) to select "On".
The default is "Off".

5 Press [↩] (F1).

6 Press **[MENU]** to exit.

Note:

- If the inversion of the PKS signal polarity is disabled, the transceiver is placed into a transmit state by shorting the PKS pin of the **ACC 2** connector to GND.
- If the inversion of the PKS signal polarity is enabled, the transceiver is placed into a transmit state by applying a voltage of 3 V to 5 V to the PKS pin of the **ACC 2** connector.

CROSSBAND REPEATER

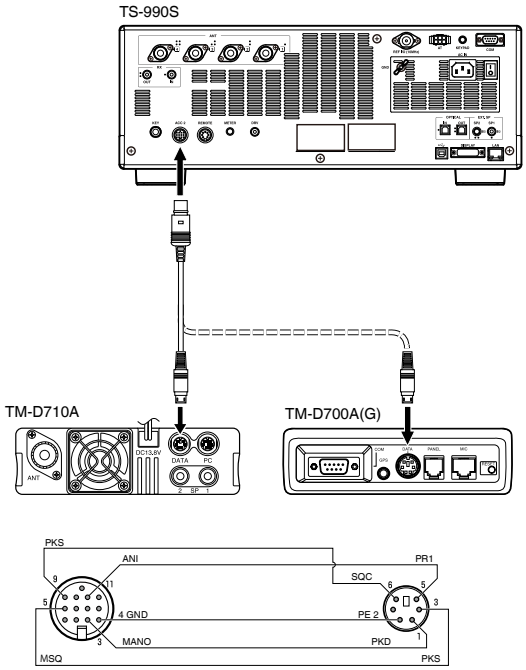
If you have the TM-D710A or TM-D700A (G) transceiver (K-type) with a 6-pin mini DIN connector, you can configure the TS-990S transceiver and the TM-D710A or TM-D700A (G) transceiver as a crossband repeater. The TM-D710A or TM-D700A (G) transceiver will receive signals you transmit from another VHF or UHF transceiver when both transceivers are configured to have the same frequency. The signal is then routed to the TS-990S transceiver and retransmitted on the frequency you have configured for the TS-990S transceiver. Likewise, signals received on the TS-990S transceiver are routed to the TM-D710A or TM-D700A (G) transceiver and retransmitted to the transceiver you have with you, allowing you to hear the received call in a distant location.

Note:

- For the repeater function to operate, the squelch levels of both transceivers (TS-990S and the TM-D710A or TM-D700A (G) transceiver) must be adjusted properly so that no background noise can be heard; the transmission is controlled by monitoring the squelch status only.
- Crossband Repeater can function only on the main band.
- Refer to the instruction manual supplied with the TM-D710A or TM-D700A (G) transceiver for connection, configuration and operation.
- This function can be used with the TM-D700A transceiver with the firmware version G2.0 or later.

PREPARATION

You can connect two transceivers with a DIN 13-pin and mini DIN 6-pin cable as shown below.



Then, be sure that "On" has been configured for both Advanced Menus 14, "PKS Polarity Reverse", and 15, "TX Inhibit While Busy". Refer to "INHIBITING THE TRANSMISSION DURING BUSY (SQUELCH OPENING)" and "REVERSING THE PKS SIGNAL POLARITY" for the configuration methods.

OPERATION

The crossband repeater function uses two frequency bands to receive and transmit signals. When a signal is received on one band, it is retransmitted on the other band.

1 Select the transmit and receive frequencies in VHF and UHF ranges for the TM-D710A or TM-D700A (G) transceiver.

2 Be sure that the “PTT” icon is visible on the crossband repeater frequency of the TM-D710A or TM-D700A (G) transceiver.

3 Select the same frequency for the terminal transceiver.

4 Select a HF/ 50 MHz frequency on the TS-990S transceiver.

5 Adjust the squelch threshold level so that audio lines for both the TS-990S and TM-D710A or TM-D700A (G) transceiver will mute.

6 Access Menu Nos 7-06, "ACC 2: Audio Input Level", and 7-10, "ACC 2: Audio Output Level", to optimize the input and output audio level via the **ACC 2** connector by pressing **[-]** (F4) or **[+]** (F5).

7 To quit the FM repeater operation, access Advanced Menus 14, "PKS Polarity Reverse", and 15, "TX Inhibit While Busy". Refer to "INHIBITING THE TRANSMISSION DURING BUSY (SQUELCH OPENING)" and "REVERSING THE PKS SIGNAL POLARITY" and select "Off" by pressing **[-]** (F4) or **[+]** (F5).

SKY COMMAND SYSTEM II

SKY COMMAND SYSTEM II allows you to remotely control the TS-990S transceiver from a separate location.

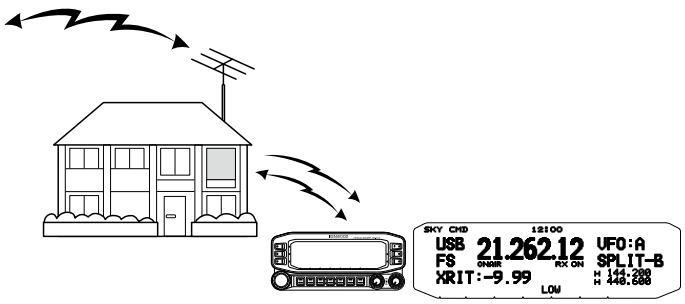
If you have two or more TH-D72A/E, TM-D710A/E, and TM-D700A transceivers, you can perform SKY COMMAND SYSTEM II operation to remotely control the HF/ 50 MHz band of your TS-990S transceiver.

You will use one transceiver (TH-D72A/E, TM-D710A/E, or TM-D700A) as a remote control unit, called a “Commander”. The other VHF/UHF transceiver (TH-D72A/E, TM-D710A/E, or TM-D700A) with the TS-990S transceiver is called the “Transporter”. This TH-D72A/E, TM-D710A/E, or TM-D700A transceiver will function as an interface between the Commander (a remote control unit) and the HF/ 50 MHz band of the TS-990S transceiver.

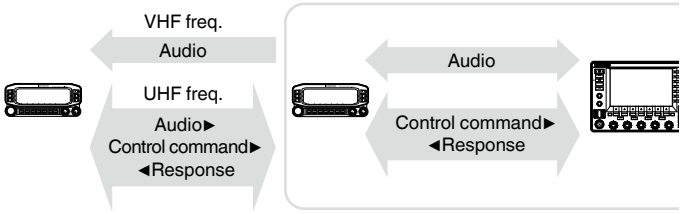
This system allows you, for example, to watch for and hunt DX while washing your car, or to operate the HF transceiver while relaxing in your car, living room, or patio, instead of actually operating inside your shack.

Note:

- Operating of SKY COMMAND SYSTEM II may not be permitted in certain countries. Check your local laws before operating.
- Refer to the instruction manual supplied with the TH-D72A/E, TM-D710A/E or TM-D700A (G) transceiver for connection, configuration and operation.
- This function can be used with the TM-D700A transceiver with the firmware version G2.0 or later.



SKY COMMAND SYSTEM II DIAGRAM



PREPARATION

Although you can use the TH-D72A/E, TM-D710A/E, or TM-D700A transceiver as a “Commander” (an external remote control unit), the following procedure shows how to configure your TS-990S and TH-D72A/E, TM-D710A/E, or TM-D700A transceiver as a “Commander”.

■ Starting SKY COMMAND SYSTEM II operation

After you have completed the configuration of the following, you can start SKY COMMAND SYSTEM II operation. Without programming these parameters, you cannot use SKY COMMAND SYSTEM II.

TS-990S + TH-D72A/E, TM-D710A/E OR TM-D700A (G) (TRANSPORTER) CONFIGURATION

1 Configure the TH-D72A/E, TM-D710A/E, or TM-D700A as a “Transporter” and connect all necessary cables to the TS-990S transceiver.

2 Select a frequency (HF/ 50 MHz band) on the TS-990S transceiver.

3 On the TS-990S, be sure that "9600 [bps]" has been configured in Menu 7-00, "Baud Rate (COM Port)".
Refer to "SELECTING THE BAUD RATE OF THE COM/ USB (REAR PANEL) PORT" for the configuration method. {page 16-10}

4 On the TS-990S, be sure that "Off" has been configured in Advanced Menu 24, "MSQ/ PKS Pin Assignment (COM Connector)".

5 Select the same and common communication parameters as those configured for the TH-D72A/E, TM-D710A/E, or TM-D700 transceiver.

6 Configure and start the Transporter mode on the TH-D72A/E, TM-D710A/E, or TM-D700A transceiver.

Note:

- For the SKY COMMAND SYSTEM II operation, use the main band for operation. You cannot control the operation in the sub band.
- To connect the TH-D72A/E, TM-D710A/E, or TM-D700A transceiver to TS-990S, you need three cables customized by you. Refer to the instruction manual supplied with the respective transceiver for the wiring diagram.
- On the TS-990S, SKY COMMAND SYSTEM II cannot control the Dual Channel Memory. You can do only Simplex operation using Memory Channel.
- The transceiver power cannot be turned ON or OFF while in Standby State Low Power Consumption.
- Each time a "Commander" toggles between VFO A and VFO B, TS-990S also toggles the operating data between the main band and sub band.
  Even if the "Commander" toggles between VFO A and VFO B resulting to swap the operating data of the "Commander", "VFO A" always appears on the display of the "Commander".
  In Split operation, VFO A is used for reception and VFO B is used for transmission.

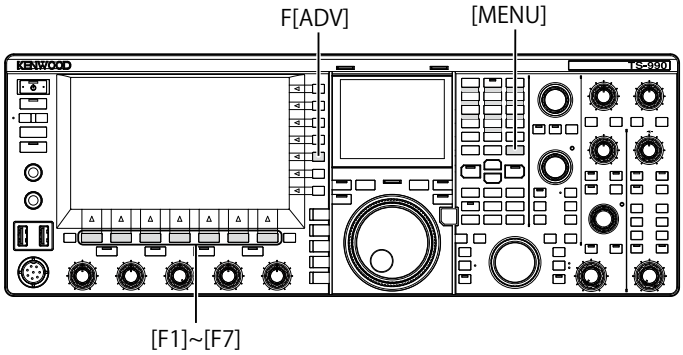
CONTROLLING THE LINEAR AMPLIFIER

While a linear amplifier is in use, you can control the linear amplifier control signal and transmission delay.

CONTROLLING THE LINEAR AMPLIFIER FOR OPERATION IN THE HF BAND

To connect the linear amplifier to the REMOTE connector on the rear panel and to operate in the HF band, you can configure to enable or disable the control signal state and the transmission delay time.

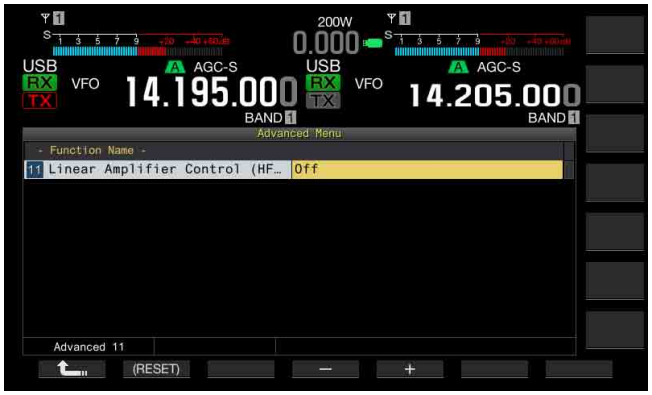
Refer to "INSTALLING AND CONNECTING THE TRANSCEIVER" for the details of connector. {page 1-10}



1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Advanced Menu 11, "Linear Amplifier Control (HF MHz Band)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the linear amplifier control method.
The available parameters are as follows: The default is "Off".
Off, Active High, Active High + Relay Control, Active High + Relay & TX Delay Ctrl, Active Low, and Active Low + TX Delay Control

5 Press [ ] (F1).

6 Press **[MENU]** to exit.

Configuration	Operation
Off	The linear amplifier is not controlled.
Active High	While transmitting, the TXSW terminal becomes 12 V.
Active High + Relay Control	While transmitting, the TXSW terminal becomes 12 V. The relay is controlled.
Active High + Relay & TX Delay Ctrl	While transmitting, the TXSW terminal becomes 12 V. The relay is controlled. The start of transmission is delayed.
Active Low	While transmitting, the TXSW terminal is shorted to GND.
Active Low + TX Delay Control	While transmitting, the TXSW terminal is shorted to GND. The start of transmission is delayed.

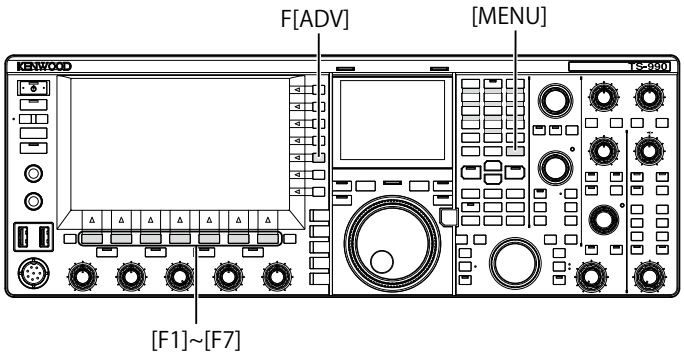
Note:

- If you are not using the control relay, select "Off" or "Active High" to suppress the relay noise.
- To connect the TL-922 or a linear amplifier that requires time to change the antenna, select "Active High + Relay & TX Delay Ctrl" from Advanced Menu 11, "Linear Amplifier Control (HF Band)".
- If you configure "Active High + Relay & TX Delay Ctrl" in Advanced Menu 11, "Linear Amplifier Control (HF Band)", the relay functions when the transceiver starts transmitting. If the transceiver switches from the receive state to the transmit state, a delay time applied until the start of transmission is added. Also, it normally takes 10 ms to start transmitting after the signal processing on the transmit circuit; however, considering the operation with the linear amplifier, the transmit delay time needs to be extended to 25 ms. The transmit delay time is not added to operate the transceiver in CW full break-in mode.

CONTROLLING THE LINEAR AMPLIFIER AT 50 MHz

To connect the linear amplifier to the **REMOTE** connector on the rear panel and to operate in the 50 MHz band, you can configure to enable or disable the control signal state and the transmission delay time.

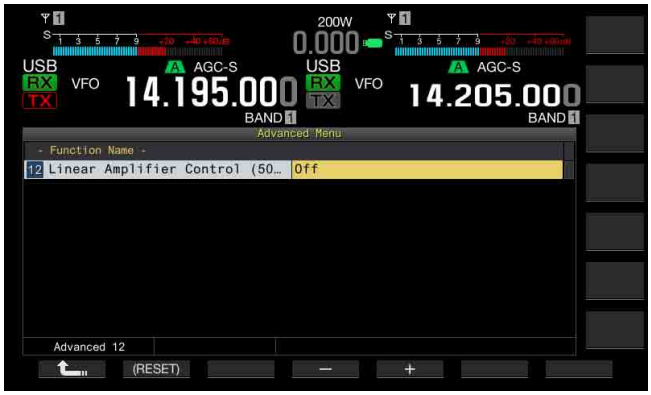
Refer to "INSTALLATION AND CONNECTION" for the details of connector. {page 1-10}



1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

2 Access Advanced Menu 12, "Linear Amplifier Control (50 MHz Band)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.



4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the control method.
The available parameters are as follows: The default is "Off".

Off, Active High, Active High + Relay Control, Active High + Relay & TX Delay Ctrl, Active Low, and Active Low + TX Delay Control

For the TL-922 or Other Linear Amplifier

You can perform operations by selecting "Active High + Relay & TX Delay Ctrl".

5 Press **[ ]** (F1).

6 Press **[MENU]** to exit.

Configuration	Operation
Off	The linear amplifier is not controlled.
Active High	While transmitting, the TXSW terminal becomes 12 V.
Active High + Relay Control	While transmitting, the TXSW terminal becomes 12 V. The relay is controlled.
Active High + Relay & TX Delay Ctrl	While transmitting, the TXSW terminal becomes 12 V. The relay is controlled. The start of transmission is delayed.
Active Low	While transmitting, the TXSW terminal is shorted to GND.
Active Low + TX Delay Control	While transmitting, the TXSW terminal is shorted to GND. The start of transmission is delayed.

Note:

- If you are not using the control relay, select "Off" or "Active High" to suppress the relay noise.
- To connect the TL-922 or a linear amplifier that requires time to change the antenna, select "Active High + Relay & TX Delay Ctrl" from Advanced Menu 12, "Linear Amplifier Control (50 MHz Band)".
- If you configure "Active High + Relay & TX Delay Ctrl" in Advanced Menu 12, "Linear Amplifier Control (50 MHz Band)", the relay functions when the transceiver starts transmitting. If the transceiver switches from the receive state to the transmit state, a delay time applied until the start of transmission is added. In many cases, it takes 10 ms until the beginning of transmit after the signal processing in the transmit circuitry. In the operation other than CW Full Break-in, changing the menu configuration extends the response time to be 25 ms (45 ms for SSB, FM and AM modes). The transmit delay time is not added to operate the transceiver in CW full break-in mode.

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OPERATING THE TRANSCEIVER AS AN EXCITER OF THE TRNASVERTER

This is a convenient function when this transceiver is used coupled with a transverter which can convert the operating frequency of this transceiver to another frequency. Refer to the instruction manual supplied with the transverter for details on how to connect to the transverter.

Note:

- If you use a transverter, some functions of the transceiver cannot be used.

PRECAUTION:

- Turn the main power switch (I/O) of the transceiver and transverter OFF, then connect the transceiver to the transverter. Be sure that the transceiver is properly connected to the transverter, and then turn the main power switch (I/O) of the transceiver and transverter.

CONNECTING THE TRANSVERTER TO THE TRANSCEIVER

There are two methods to connect the transceiver to the transverter: Connection via the **ANT** connector (TX and RX, the fixed 5 W transmit power), and connection via the **RX IN** connector (RX input) and **DRV** connector (Drive output). Either of the connections can change the displayed frequency of the transceiver to the operating frequency display of the transverter.

If the signal exceeding 5 W is entered from the ANT connector to the transverter, you must also select "Off" in Advanced Menu 08, "TX Power Down with Transverter Enabled", to disable the capability to limit the transmit power to 5 W.

■ To connect to the RX IN and DRV connectors

1. Connect the transverter to the **RX IN** and **DRV** connectors.
2. Press **[RX IN]** to enable the reception via the **RX IN** connector.
   "RX" appears on the main screen.
3. Press **[RX IN]** to enable the transmission via the **DRV** connector.
   The "DRV" LED lights green.

■ To connect to the ANT connector

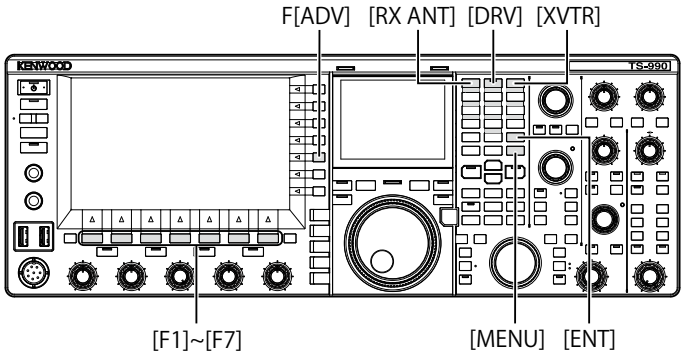
1. Connect the transverter to the **ANT** connector.
2. Press **[RX IN]** to disable the reception via the **RX IN** connector.
   " " appears on the main screen.
3. Press **[DRV]** to disable the transmission via the **DRV** connector.
   The "DRV" LED turns Off.

Note:

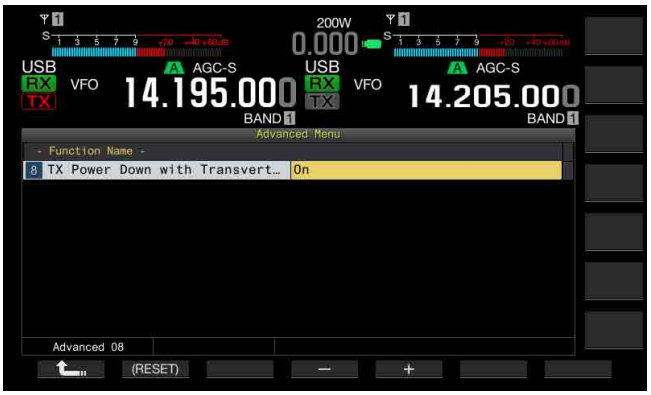
- Selecting the **RX IN** and **DRV** connectors disable the transmission and reception using the **ANT** connector.

TRANSMIT POWER DEDUCTION WHILE THE TRANSVERTER IS ENABLED

If the transverter is capable of 5 W or more RF input level and if the signal exceeding 5 W is entered from the ANT connector to the transverter, you need to select "Off" (do not fix the transmit power to 5 W) for the transmit power down while the transverter is in operation.



1. Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.
2. Access Advanced Menu 08, "TX Power Down with Transverter Enabled".
3. Press **[SELECT]** (F4) to allow editing of the parameter box.



4. Press **[-]** (F4) or **[+]** (F5) to select "Off".
   The default is "On".
5. Press [ ] (F1).
6. Press **[MENU]** to exit.

PRECAUTION:

- If "Off" is selected for Advanced Menu 08, "TX Power Down with Transverter Enabled", the maximum of 200 W electrical power is supplied to the device connected to the **ANT** connector. This may cause the connected device to be damaged or fail.

DISPLAYING THE OPERATION FREQUENCY ON THE TRANSVERTER

While the transverter is active, the last digit of the frequency display disappears, and the operating frequency to be configured for the transverter appears.

1 Rotate the Tuning control to select the operating frequency of the exciter (this transceiver).
The transverter converts and generates this frequency. You must select the frequency to be within the range you can transmit.

2 Press **[XVTR]** to enable the transverter.
"XVTR" appears on the main screen, and the frequency that can be configured appears on the transverter.

3 Press **[XVTR]** again.
The transverter will be disabled.

Note:

- Even if the transverter is enabled, the frequencies to be displayed on the **Memory Channel List** screen and bandscope are the frequencies that have been configured for the transceiver.
- While the **SWL** screen is open, the transverter cannot be enabled.
- If the operating frequency to be configured for the transverter is not configured for the transceiver, activating the transverter results the last digit of the operating frequency in the transceiver disappears.

CONFIGURING THE FREQUENCY USING THE TRANSVERTER

Follow the procedure below to convert the operating frequency of the transceiver using the transverter.

1 Press **[XVTR]** to enable the transverter.
"XVTR" appears on the main screen.

2 Press **[ENT]** to allow you to enter the frequency.

3 Use the numeric and band selection keypad to enter the transmit frequency for the transverter.

4 Press **[ENT]** to determine the entry.
The transceiver displays the output frequency of the transverter in place of the actual operating frequency.

Note:

- The operating frequency for the transverter cannot be entered without using the numeric and band selection keypad.
- If you change the frequency after you enter it using a numeric keypad, the frequency of the transverter may exceed "4.294.967.2" or fall below 30 kHz. In these cases, the frequency may not be displayed correctly.
- The frequency step size that can be changed in the transverter is 10 Hz or 100 Hz; hence, the frequency is displayed in steps of 10 Hz or 100 Hz on the main display.
- In both main band and sub band, the displayed frequency can be changed.
- To connect the transverter which has a standby terminal or ALC output, use the **REMOTE** connector.

Operation Example: Operation with 28 MHz Signal Entered to the Transverter for 430 MHz

1 Connect the transverter for 430 MHz to the transceiver.

2 Tune the receive frequency for the transceiver to be "28.000.000".

3 Press **[XVTR]** to enable the transverter.

4 Press **[ENT]** for the numeric and band selection keypad.

5 Subsequently, enter "430.000.00", then press **[ENT]**.

6 Rotate **Tuning** or **MULTI/CH** control to select the frequency.

17 FIRMWARE UPDATING

ABOUT FIRMWARE UPDATING

The transceiver firmware can be updated as desired. Updating the firmware may improve the functionality or add new functions.

The latest firmware can be downloaded from the KENWOOD website.

http://www.kenwood.com/i/products/info/amateur/software_download.html

UPDATING THE FIRMWARE

There are two methods to update the firmware as described below.

FIRMWARE UPDATING WITH A PC CONNECTED

The firmware can be updated by connecting the transceiver to your PC.

FIRMWARE UPDATING USING A USB FLASH DRIVE

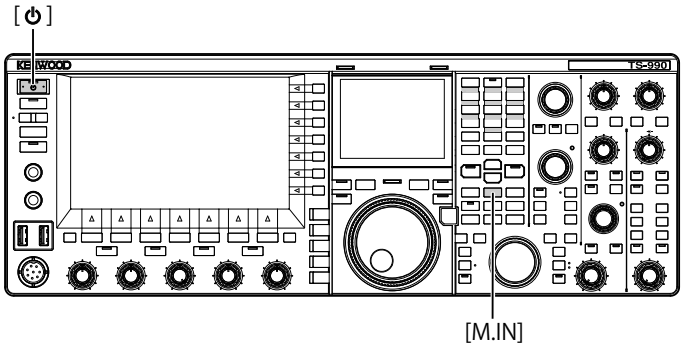
The firmware contained in the zipped file and downloaded to a PC can be stored in a USB flash drive, and you can update the firmware by connecting the USB flash drive to the transceiver and processing the updating procedure.

Note:

- After the firmware update is once started, the firmware used before the firmware update has started cannot be restored even if you terminate the firmware updating.
- Once the firmware has been updated, the firmware installed at the time of purchase cannot be restored, even if you perform a transceiver reset from the **Reset** screen.

VERIFYING THE FIRMWARE VERSION

Before you begin updating the firmware, verify your current transceiver firmware version. While the transceiver power (⏻) is turned OFF, the "⏻" LED lights orange. While the transceiver is in this state, you can verify the firmware version as described below.



1 Hold down **[M.IN]** (Memory), then press **[⏻]**.
After startup,the **Firmware Update** screen appears, and the firmware version can be viewed.



2 Press **[⏻]**.
The firmware updating is terminated, and the **Firmware Update** screen closes.

FIRMWARE UPDATING WITH A PC CONNECTED

PRECAUTION:

- Do not shut down the transceiver with the main power switch (I/O) during the firmware updating.
- The firmware in the zipped file must be dragged and dropped without the firmware extracted. The extracted firmware cannot update the transceiver.

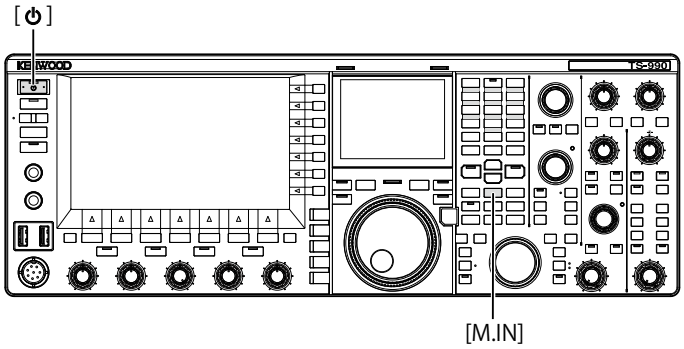
PREPARATION

1 Save the firmware file onto your PC.
The latest firmware can be downloaded from the KENWOOD website.

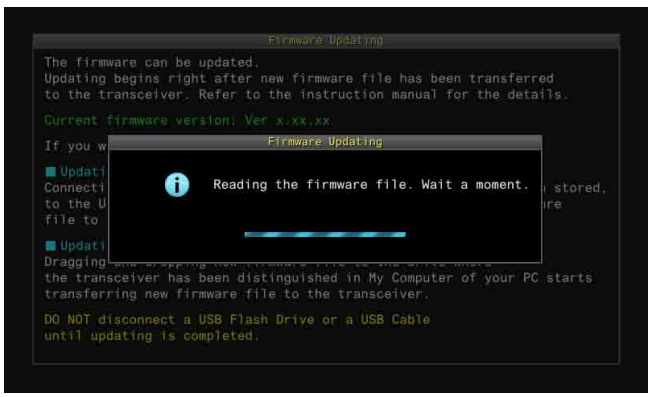
2 Connect a USB cable, extended from your PC, to the ⇐ (USB-B) connector on a rear pane.
You cannot update the firmware if the USB cable extended from your PC is connected to the ⇐ (USB-A) connector on a front panel.

YOUR OPERATION FOR THE TRANSCEIVER AND YOUR PC

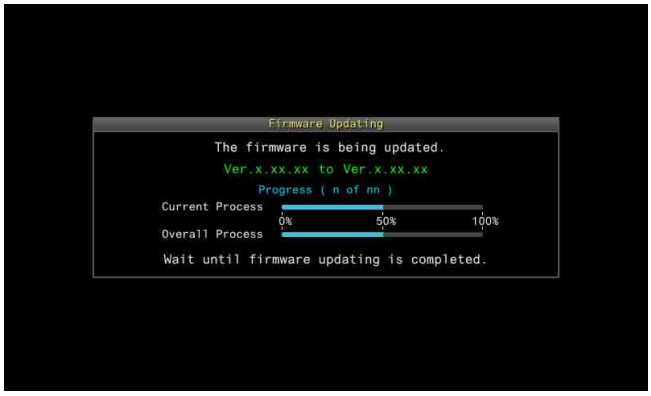
While the transceiver power (⏻) is turned OFF, the "⏻" LED lights orange. With the transceiver in this standby state, follow the procedure below to update the firmware.

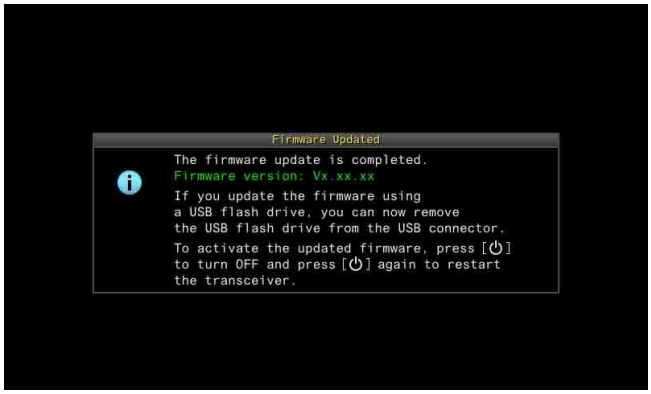


1 Hold down **[M.IN]** (Memory), then press **[⏻]**.
The transceiver starts up with the **Firmware Update** screen after the start screen appears. You can verify the transceiver firmware version. Upon detection of the transceiver by your PC, the transceiver is distinguished as a removable memory device and "TS-990" appears under My Document > removable memory device.



2 Drag and drop the data file containing the firmware onto the "TS-990" removable memory device.
The file copy status appears on your PC, and the firmware updating progress bar appears on the main screen.
Upon completion of the data transfer from your PC to the transceiver, the transceiver automatically starts updating.
Upon completion of the firmware updating, "The firmware update is completed" appears on the main screen.





3 Press **[⏻]** to turn the transceiver power (⏻) OFF.

4 Press **[⏻]** again.
The transceiver restarts with the new firmware enabled.

Note:

- The transceiver is recognized at step 1 as a USB flash drive. After the firmware update completes, folders and files in the memory area.
- The firmware cannot be updated even if a PC and the **COM** connector was connected using RS-232C
- If a message notifying you of an occurrence of the update failure appears during the firmware updating, refer to the troubleshooting. {page 18-4}
- It may happen to take 30 minutes to update the firmware.

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FIRMWARE UPDATING USING A USB FLASH DRIVE

PRECAUTION:

- Do not shut down the transceiver with the main power switch (I/O) during the firmware updating. Also, do not disconnect the USB flash drive from the ⇐ (USB-A) connector.

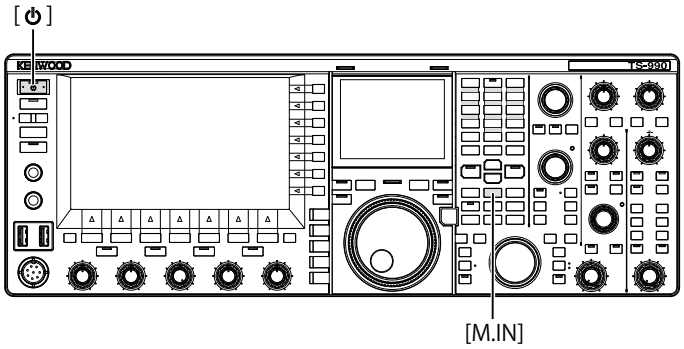
PREPARATION

1 Save the firmware file onto your PC.
The latest firmware can be downloaded from the KENWOOD website.

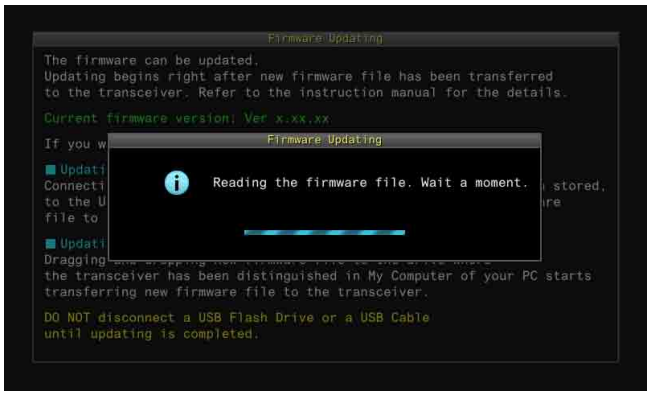
2 Save the firmware file to a USB flash drive.
- You must store the zipped file containing the firmware in the proper root folder of the USB flash drive, otherwise the firmware cannot be updated.
- The firmware will be distributed in the zipped format. Store the firmware as a zip file on the USB flash drive.

YOUR OPERATION FOR THE TRANSCEIVER AND YOUR PC

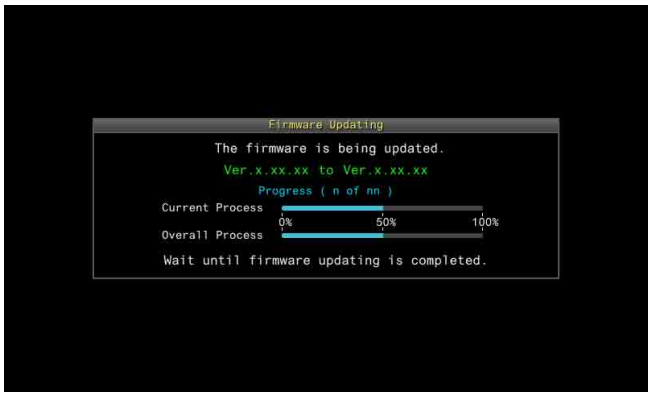
While the transceiver power (⏻) is turned OFF, the "⏻ " LED lights orange. With the transceiver in this standby state, follow the procedure below to update the firmware.

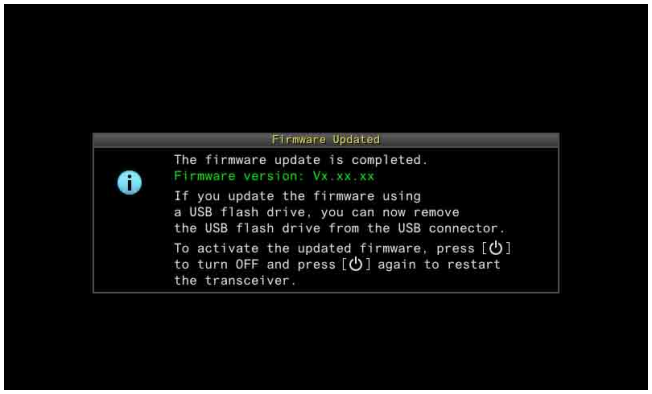


1 Hold down **[M.IN]** (Memory), then press **[⏻]**.
The transceiver starts up with the **Firmware Update** screen after the start screen appears. You can verify the transceiver firmware version



2 Insert the USB flash drive containing the firmware data file to the ⇐ (USB-A) connector on a front panel.
The firmware updating progress bar appears on the main screen. Upon completion of the firmware updating, "The firmware is completed" appears on the main screen.





3 Press **[⏻]** to turn the transceiver power (⏻) OFF.

4 Disconnect the USB flash drive.

5 Press **[⏻]** again.
The transceiver restarts with the new firmware enabled.

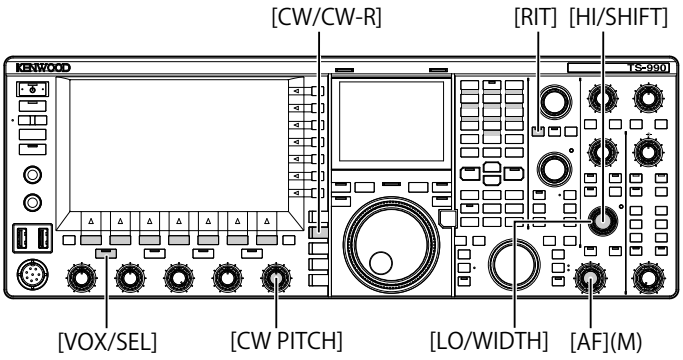
Note:

- If a message notifying you of an occurrence of the update failure appears during the firmware updating, refer to the troubleshooting. {page 18-4}
- Depending on the number of CPUs necessary for the firmware update, the time necessary for updating may vary. It can take 20 to 30 minutes to update the firmware.

CALIBRATING THE INTERNAL REFERENCE FREQUENCY

The internal reference frequency of the transceiver was properly calibrated at the factory. However, if the reference frequency needs to be calibrated due to any reason such as use across the ages, the internal reference frequency can be calibrated by receiving the standard wave signal such as VVWH (Hawaii), VVH (Colorado), BPM (Xian), or others.

At first, follow the procedure described below to enable the transceiver to receive the standard wave signal. The procedure below describes the procedure when the pitch frequency is 700 Hz.



1 Press **[CW/ CW-R]** to select CW mode.

2 Press **[RIT]** to disable the RIT function.
The "RIT" LED turns Off.

3 Press **[VOL/SEL]** to enable the break-in.
- If the semi break-in is enabled, press **[VOX/SEL]** to disable the semi break in.
- If the full break-in is enabled, press **[VOX/SEL]** to disable the full break in.
- The "VOX" LED turns Off.

4 Rotate the **AF** control to select the 12 o'clock position.

5 Rotate the **CW PITCH** control to adjust the pitch to be legible.
You can rotate the **CW PITCH** control until the pitch frequency, displayed on the sub-scope center with the sub-screen, reaches 700 Hz.

6 Rotate the **LO/WIDTH** control or the **HI/SHIFT** control.
You can rotate the **HI/SHIFT** control until the shift frequency (SHIFT), displayed on the sub-scope with the sub-screen, reaches a value of 0, and the **LO/WIDTH** control until the bandwidth (WIDTH) reaches a value of 1000.



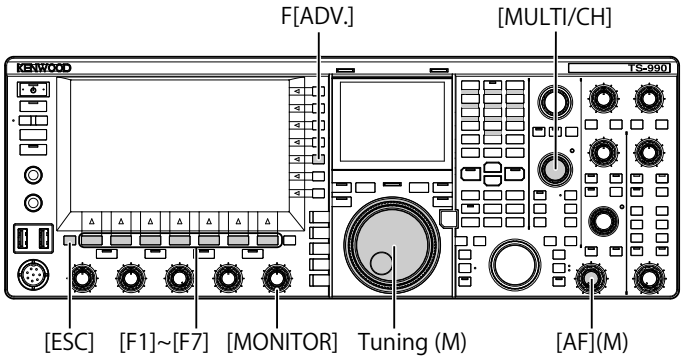
SUB-SCREEN

Note:

♦ Refer to "CONFIGURING THE REF I/O CONNECTOR" for the configuration of the REF I/O connector. {page 16-22}

CALIBRATION PROCEDURE

After the calibration is completed, follow the procedure below to configure the internal reference frequency.



1 Receive a standard wave signal on the main band.
To receive the 10 MHz standard wave signal, rotate the **Tuning** control to select exactly "10.000.00".

The 700 Hz beat sounds.

$$f_{AF} = \frac{f_{display\ [MHz]}}{15.6\ [MHz]} \times \Delta f_{reference} + 700_{[Hz]}$$

$\Delta f_{reference}$: Shifts from Reference Frequency

The received beat can be audible on the CW pitch frequency.

2 Press **[ADV.]** (F) from the Menu screen to open the Advanced Menu screen.

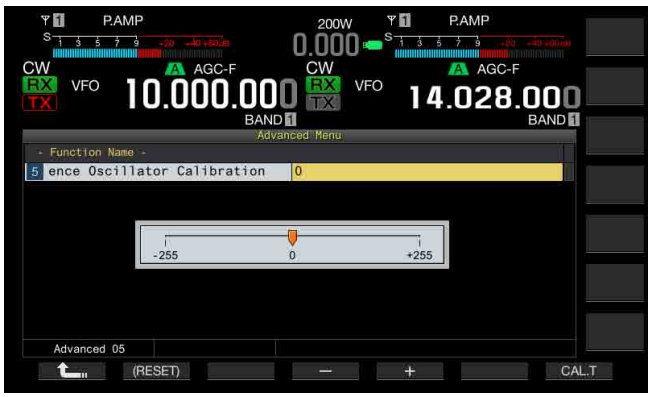
3 Access Menu 05, "Reference Oscillator Calibration".

4 Press **[SELECT]** (F4) to allow editing of the parameter box.

5 Hold down **[CAL.T]** (F7).
The 700 Hz sidetone for calibration is generated. The double-beat occurs due to the difference of two frequencies by the sidetone and the received audio crossing each other.

If the double-beat cannot be heard clearly, rotate the **AF** control to adjust the received audio level or the **MONITOR** control to adjust the sidetone audio level.

$$f_{sidetone} = 700_{[Hz]} \pm 8_{[ppm]} (700 \pm 0.006_{[Hz]})$$



6 Press **[-]** (F4) or **[+]** (F5).
- You can press **[-]** (F4) or **[+]** (F5) until the interval of the double-beat caused by the received beat and the sidetone is maximized to make the double-beat inaudible. In this case, the frequency difference between the received audio and the sidetone is minimized.
- You can also rotate the **MULTI/CH** control for the calibration. Pressing and holding **[(RESET)]** (F2) resets the transceiver to its default configuration.

7 Release **[CAL.T]** (F7).

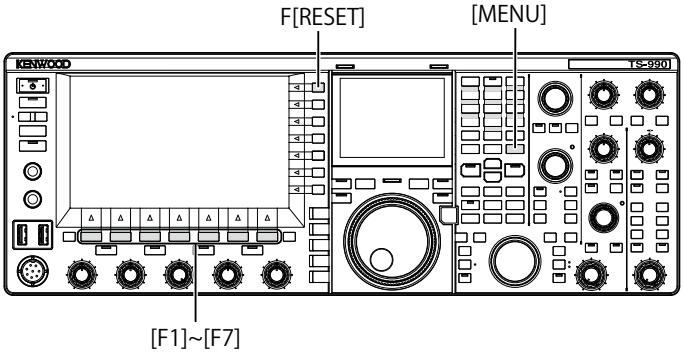
8 Press **[ESC]** to exit.

Note:
- If the signal for calibration is outside the level of the exterior reference signal, ranging from -10 dBm to +10 dBm, or the frequency accuracy, 10 MHz ±10 ppm, the internal reference frequency may not be correctly calibrated.

RESETTING ALL CONFIGURATIONS

You can reset all configuration data in the transceiver to their defaults.

Note:
- Once any reset begins, the data will be cleared. You must reset the transceiver after the configuration data has been stored in another storage device.

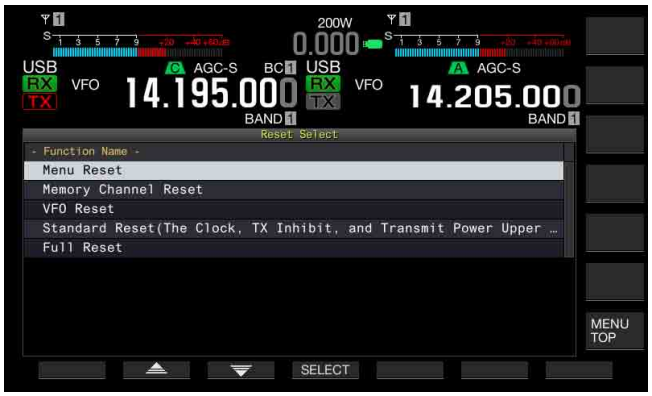


Follow the procedure below to fully reset the transceiver.

1 Press **[RESET]** (F) from the **Menu** screen to open the RESET screen.

2 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the full reset.
Press **[MENU TOP]** (F) to exit the **Reset Configuration Data** screen and display the **Menu** screen.

3 Press **[SELECT]** (F4).



- A message prompting the start of the Full Reset appears.
- Pressing **[CANCEL]** (F4) to clear the message prompting you to start Full Reset, without starting the Full Reset.

4 Press **[SELECT]** (F4).
The transceiver is reset and automatically restarts.

REPLACING THE FUSE FOR AN EXTERNAL ANTENNA TUNER

There is a 4 A fuse employed in the external antenna tuner circuit. If a fuse blows, determine the cause then correct the problem. Then, replace the blown fuse with a new fuse supplied with the transceiver.

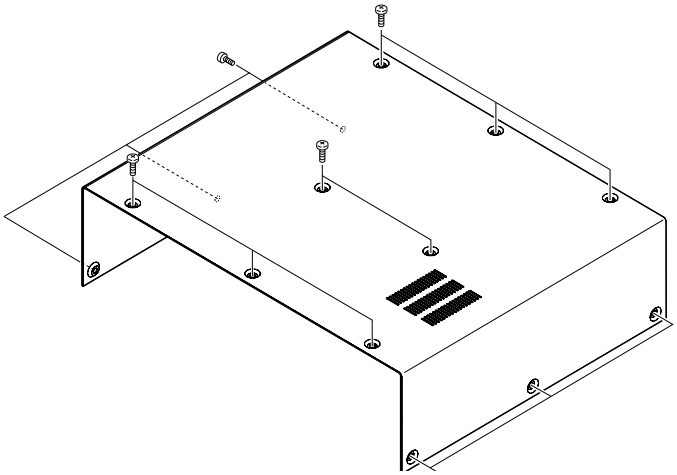
If the fuse blows again even after replacing it with a new fuse, disconnect the AC power cord and contact a KENWOOD service center.

PRECAUTION
- The supplied 4 A fuse is the fuse to be used for the external antenna tuner. Do not use a fuse with a different rating.

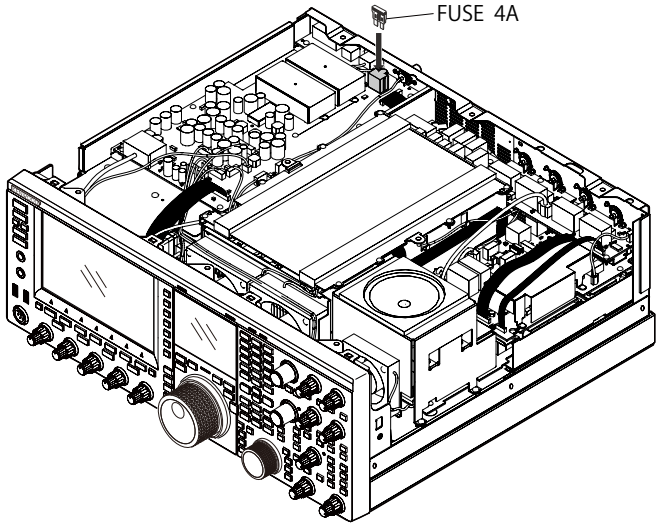
HOW TO REPLACE THE FUSE

1 Disconnect the AC power cable from the transceiver.

2 Unscrew the screws on the upper case and detach the upper case.



3 Replace the fuse as shown in the illustration.



4 Attach the upper case and tighten the screws.

Note:
- Pay attention not to lose the screws removed during this process.
- The edge of the chassis and case can be sharp. Use caution to prevent accidental injury.

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NOTICE CONCERNING INTERNAL BEAT

On some particular frequencies along the amateur band an internal beat may occur due to the frequency configuration. This is not a failure. Following are the examples of the internal beat. (Frequency may vary depending on the operating mode.)

In the following examples, "Main" represents the displayed frequency of the main band, and "Sub" represents the displayed frequency of the sub band. In some examples the selected transmitting band is also a factor in generating an internal beat..

INTERNAL BEAT OCCURRED IN THE MAIN BAND

- In combination of the main band range from 18.068 MHz to 18.150 MHz and the sub band range from 14.104 MHz to 14.350 MHz, and the transceiver transmits on the sub band.
  Example: Main 18.100 MHz and Sub 14.200.28 MHz
- In combination of the main band range from 28.199 MHz to 28.765 MHz and the sub band range from 28.000 MHz to 29.700 MHz.
  Example: Main 28.200 MHz and Sub 28.003.40 MHz
- In combination of the main band range from 50.753 MHz to 51.453 MHz and the sub band range from 14.000 MHz to 14.350 MHz.
  Example: Main 50.760 MHz and Sub 14.004.97 MHz
- In combination of the main band range from 52.028 MHz to 53.361 MHz and the sub band range from 50.000 MHz to 54.000 MHz.
  Example: Main 52.030 MHz and Sub 50.006.75 MHz

INTERNAL BEAT OCCURRED IN THE SUB BAND

- In combination of the sub band range from 3.769 MHz to 3.839 MHz and the main band range from 14.000 MHz to 14.350 MHz, and the transceiver transmits on the main band.
  Example: Sub 3.775 MHz and Main 14.014.57 MHz
- In combination of the sub band range from 10.100 MHz to 10.150 MHz and the main band range from 1.852 MHz to 1.902 MHz.
  Example: Sub 10.110 MHz and Main 1.862.00 MHz
- In combination of the sub band range from 7.000 MHz to 7.174 MHz and the main band range from 14.002 MHz to 14.350 MHz, and the transceiver transmits on the main band.
  Example: Sub 7.050 MHz and Main 14.095.90 MHz
- In combination of the sub band range from 14.000 MHz to 14.350 MHz and the main band range from 28.500 MHz to 28.850 MHz.
  Example: Sub 14.010 MHz and Main 28.510.60 MHz
- In combination of the sub band range from 21.000 MHz to 21.450 MHz and the main band range from 51.996 MHz to 52.446 MHz.
  Example: Sub 21.010 MHz and Main 52.006.51 MHz
- In combination of the sub band range from 21.448 MHz to 21.450 MHz and the main band range from 14.000 MHz to 14.006 MHz, and the transceiver transmits on the main band.
  Example: Sub 21.450 MHz and Main 14.005.52 MHz
- In combination of the sub band range from 29.248 MHz to 29.698 MHz and the main band range from 21.000 MHz to 21.450 MHz.
  Example: Sub 29.250 MHz and Main 21.003.00 MHz
- In combination of the sub band range from 50.246 MHz to 51.246 MHz and the main band range from 1.800 MHz to 2.000 MHz.
  Example: Sub 50.250 MHz and Main 1.802.21 MHz
- In combination of the sub band range from 52.634 MHz to 52.834 MHz and the main band range from 18.068 MHz to 18.168 MHz.
  Example: Sub 52.640 MHz and Main 18.071.10 MHz

OTHER COMBINATIONS

The internal beat occurs while the transceiver receives, using the sub band, on the frequency which has the first IF frequency of 73.095 MHz. (Depending on the frequency of the sub band, the internal beat may also occur on the sub band.

Example:

- Sub 50.010 MHz and Main 28.298.28 MHz

SPURIOUS ON THE BANDSCOPE (WATERFALL)

A signal which has no correlation to the received signal may appear on the bandscope (waterfall). This may occur due to the frequency selection and is not a failure. The spurious signal display may be reduced by adjusting the attenuator and the reference level of the bandscope.

Example:

- The frequency which has ±24 kHz separation from the receive frequency
- The frequency which has ±150 kHz separation from the receive frequency
- (The spurious may differ depending on the receiving band or the operating mode.)
- While the transceiver is receiving an internal beat

THE LIST OF ERROR MESSAGES

An error message appears when the transceiver detects any failure or abnormality. A problem can be cured following the description on the error message. If reading of "Troubleshooting" is required on the error message or if you cannot cure the problem, refer to the List of Error Messages and Troubleshooting.

ID	Message	Outline and What to do
0017	Configurations for the Local Clock have not been completed. (ERR: 0017) Associated functions cannot be used until the timer configurations have been completed.	Appears when you attempt to activate the Program Timer without configuring the local clock. The local clock can be configured in the CLOCK menus 00 to 03.
001F	Connection to an NTP server has failed. (ERR: 001F) Ensure that the NTP server address and the network have been correctly configured.	Appears when the date and time data cannot be acquired from an NTP server. Follow the instruction given on an error message.
0025	A file is invalid. (ERR: 0025)	Appears when an error was detected from a file when the RX Equalizer, TX Equalizer or configuration data is stored.
0026	An error occurred while a file was being read from a USB flash drive. (ERR: 0026)	Appears when an error was detected from a file when the RX Equalizer, TX Equalizer or configuration data stored in the USB flash drive is read.
0040	A failure in detecting the firmware file will terminate the firmware updating process. (ERR: 0040) The termination of the firmware update may be caused by the following: • The firmware file is not stored in the specified folder. • The USB flash drive is not in the specified format. The USB flash drive must be formatted in the **USB Flash Drive Management** screen. • The newer version firmware has already been applied to the transceiver. • The firmware file is not legitimate. Restart the transceiver and then execute the firmware update again from the beginning.	Appears if any failure was detected while reading the firmware file. Follow the instruction given on an error message.
0041	A failure in detecting the firmware file will terminate the firmware updating process. (ERR: 0041[xxx]) Refer to the list of messages in the instruction manual.	Appears if any failure was detected while writing the firmware file. Update the transceiver firmware again. If writing of the transceiver repeatedly fails, note the error message number (ERR: 0040) and the number enclosed with the angle brackets ([xxx]) and contact the KENWOOD service center.
0043	A USB flash drive cannot be detected. (ERR: 0043) Failure to detect the USB flash drive may be caused by the following. • The USB flash drive is not correctly connected to a USB connector. • The USB flash drive is not in the specified format. The USB flash drive must be formatted in the **USB Flash Drive Management** screen.	Appears if no USB flash drive is detected. Follow the instruction given on an error message.
0044	The current sourced from the USB connector exceeds the upper limit value. (ERR: 0044) Remove the USB device and then restart the transceiver.	Appears when over current is detected from the USB connector. Disconnect the unused USB devices.
0045	An error occurs while a file is being written to an internal memory area or a USB flash drive. (ERR: 0045)	The occurred error might be caused by one or more of the following causes. • As a result of the storing of the multiple files at a time, the same name might be given to the multiple files. • You attempted to store files exceeding the maximum file numbers that can be stored in the transceiver (255 files). • Any error was detected while writing a file.
0048	PLL unlock was detected. (ERR: 0048 [xxx]) Refer to the list of messages in the instruction manual.	Appears when an PLL unlock was detected. Full Reset is required. Still the PLL unlock is detected, note the error message number (ERR: 0048), and contact the KENWOOD service center.
0050	Abnormal cooling fan behavior has been detected. Refer to "Troubleshooting" in the instruction manual. (ERR: 0050) Transmission capability is disabled while this error message appears on the main screen.	Appears when an error was detected from a cooling fan. If an error message does not disappear even after the transceiver cools down, note the error message number (ERR: 0050), and contact the KENWOOD service center.
0051	Very high temperature has been detected in the power supply unit. Refer to "Troubleshooting" in the instruction manual. (ERR: 0051) The transceiver cannot transmit until the transceiver cools down. DO NOT turn the transceiver main power OFF, and leave the transceiver until it cools down.	Appears when an error was detected from the power supply unit. Keep activating the cooling fan without shutting down the main power (I/O). If an error message does not disappear even after the transceiver cools down, note the error message number (ERR: 0051), and contact the KENWOOD service center.
0052	Overheating has been detected in the power supply unit. Refer to "Troubleshooting" in the instruction manual. (ERR: 0052) The transceiver power (⏻) will soon be turned OFF in n seconds to prevent the transceiver from being overheated.	Appears when an error was detected from the power supply unit. The transceiver turns OFF. Keep activating the cooling fan without shutting down the main power (I/O). If this error message frequently appears, note the error message number (ERR: 0052), and contact the KENWOOD service center.

ID	Message	Outline and What to do
0059	Failure in Deleting of a File. (ERR: 0059)	Appears when deletion of a file fails. Be sure that the USB flash drive is the write protected.
005 A	No reference signal has been detected. (ERR: 005A) Ensure that the reference signal has been sourced to the REF I/O (10 MHz) connector.	Appears when the reference signal from the external source cannot be detected. Be sure that the signal is present to the REF I/O connector and that the signal level is sufficient.
005 B	Safe Removal of USB Flash Drive was failed. (ERR: 005B) The data file may not be stored onto the USB flash drive. Remove the USB flash drive after the main power (I/O) is shut down.	Appears if the safe removal of USB flash drive fails. Follow the instruction given on an error message.
005C	An abnormal transmit signal has been detected. Refer to the list of messages in the instruction manual. (ERR: 005C) Transmission capability is disabled while this message appears.	Appears when over current is detected from the transmitter. This may be solved by shutting down the main power (I/O) or executing the Full Reset. If this error message frequently appears, note the error message number (ERR: 005), and contact the KENWOOD service center.
005D	The selected file cannot be read by this transceiver with the earlier version firmware installed. (ERR: 005D) Update the transceiver firmware using the latest version of the firmware.	Appears if the transceiver attempt to read the configuration data which was created by the transceiver with newer firmware installed than that has been installed onto this transceiver. The file can be read after updating the transceiver firmware to be the latest.
005E	Corruption of the data was detected. (ERR: 005E) Executing the Full Reset will initialize the transceiver to the defaults. Press **[OK]** (F) to start the Full Reset.	Appears when any damage is detected from the data for backup. Press **[OK]** (F) to start the Full Reset.
0060 to 0063	A DSP error was detected. (ERR: 0060 to 0063) Refer to the list of messages in the instruction manual.	Appears when an error was detected from a DSP used for reception and transmission on the main band. This may be solved by shutting down the main power (I/O) or executing the Full Reset. If this error message frequently appears, note the error message number (ERR: 0060 to 0063), and contact the KENWOOD service center.
0064 to 0067	A DSP error was detected. (ERR: 0064 to 0067) Refer to the list of messages in the instruction manual.	Appears when an error was detected from a DSP used for reception on the sub band. This may be solved by shutting down the main power (I/O) or executing the Full Reset. If this error message frequently appears, note the error message number (ERR: 0064 to 0067), and contact the KENWOOD service center.
0068, 0069, 006A, 006B	A DSP error was detected. (ERR: 0068, 0069, 006A, 006B) Refer to the list of messages in the instruction manual.	Appears when an error was detected from a DSP used for the bandscope. This may be solved by shutting down the main power (I/O) or executing the Full Reset. If this error message frequently appears, note the error message number (ERR: 0068, 0069, 006A, 006B), and contact the KENWOOD service center.
	An insolvable error occurs. Shut down the transceiver with the main power switch (I/O), and then restart the transceiver after a while.	An exceptional error occurs and the system stops. Shut down the main power switch (I/O). Update the transceiver firmware using the latest version of the firmware. If this error message repeatedly appears, contact the KENWOOD service center.

THE LIST OF WARNING MESSAGES

A warning message appears if there is any false operation or when the transceiver detects any failure or abnormality. A problem can be cured following the description on the warning message. If reading of "Troubleshooting" is required on the warning message or if you cannot cure the problem, refer to the List of Warning Messages and Troubleshooting.

ID	Message	Overview
0012	Memory available for recording is insufficient. (WR: 0012)	Appears when the remaining memory size is insufficient to store an audio file for the voice recording.
000F	This audio file cannot be reproduced. (WR: 000F)	Appears when you attempt to play the audio file that the transceiver cannot play.
0018	The Programmable Timer is about to start recording the received audio. (WR: 0018) The recording cannot begin if the transceiver has been turned OFF. Turn the transceiver OFF and connect a USB flash drive.	Appears three minutes and one minute before the timer recording begins. Follow the instruction given on an error message.
0019	The Programmable Timer is about to turn the transceiver OFF. (WR: 0019)	Appears three minutes and one minute before the transceiver power (⏻) turns OFF by the Off Timer.
001 A	The Sleep Timer is about to turn the transceiver OFF. (WR: 001A)	Appears three minutes and one minute before the transceiver power (⏻) turns OFF by the Sleep Timer.
001 B	Recording by the Programmable Timer. (WR: 001B) To continue recording, press **[⏻]** to turn the transceiver OFF. To stop recording, press and hold **[(BREAK)]** (F).	Appears when you attempt to turn the transceiver power (⏻) On with a press of **[⏻]** during the timer recording.
0046	Due to insufficient memory or forbidding of the data storage to the USB flash drive, the data storing process was terminated. (WR: 0046) Ensure that there is sufficient memory and that data storage has been enabled.	Appears when the remaining memory size of the USB flash drive is insufficient or the write protected during the writing of the audio file to the USB flash drive.
0047	High temperature has been detected in the transmitter. Refer to "Troubleshooting" in the instruction manual. (WR: 0047) To prevent the transmitter from being damaged, the transmit power has been reduced to 5 W.	Appears when the transmit power is reduced to 5 W due to detection of high temperature. Refer to "COOLING FAN AND TEMPERATURE PROTECTION FOR FINAL UNIT". {page 4-3}
004 B	Selects the days of the week. (WR: 004B)	Appears if no day of the week is configured while the Program Timer is being configured.
004D	A maximum of 4 hours of recording time can be configured. (WR: 004D) Ensure that the Power-on Time and Power-off time are appropriate.	Appears if you attempt to configure the recording time exceeding four hours when you configure the Program Timer.
004E	The same clock time cannot be configured for both the Power-on Time and Power-off Time. (WR: 004E) Ensure that the Power-on Time and Power-off time are appropriate.	Appears if the time to turn the transceiver power (⏻) On is identical to the time to turn the transceiver power Off.
004F	Very high temperature has been detected in the transceiver. Refer to "Troubleshooting" in the instruction manual. (ERR: 004F) The transceiver cannot transmit until the transceiver cools down.	Appears when high temperature is detected and the transmission is prohibited. Refer to "COOLING FAN AND TEMPERATURE PROTECTION FOR FINAL UNIT". {page 4-3}
0057	Failure in formatting of a USB flash drive has been detected. (WR: 0057) The failure may be caused by one or more of the following: • The write protected USB flash drive is connected to a USB connector. • The USB flash drive is not correctly connected to a USB connector. The security-protected USB flash drive is connected to a USB connector.	Appears when formatting of USB flash drive fails. • You attempt to format the USB flash drive while the transceiver is distinguishing the USB flash drive (an icon blinks). If the formatting fails, remove the USB flash drive following the procedure of "Safe Removal of USB Flash Drive", and then format the USB flash drive following the procedure of "USB Flash Drive Formatting".

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TROUBLESHOOTING

Prior to requesting any after-sales service, read through the following list to troubleshoot common problems.

SYMPTOMS ENCOUNTERED DURING RECEPTION AND TRANSMISSION

Symptom	Common Problem	What to do	Ref. Page
Screens do not appear correctly during the power up (⏻).	A microprocessor is erroneously active.	Reset the transceiver.	{page 16-4}
Cannot receive even if the antenna is connected to the transceiver. The RX sensitivity is low.	The Squelch is open.	Adjust the **SQL** control. If the transceiver is used with a TNC, be sure that the DCD LED on the TNC does not light.	{page 4-8}
	The attenuator is active.	Disable the attenuator.	{page 6-1}
	The preamplifier is active.	Disable the preamplifier.	{page 5-9}
	Wrong antenna was selected. The RX ANT is active.	Reselect the antenna. Be sure that the RX ANT is inactive.	{page 4-21}
	Cannot tune even if the antenna tuner is active.	Press and hold **[AT/TUNE]** to tune. Or, stop the antenna tuning.	{page 4-21}
	The gain was reduced by the **RF** control.	Rotate the **RF** control fully clockwise.	{page 4-8}
	The center frequency of the preselector is deviated.	Reset the center frequency of the preselector to the default.	{page 6-1}
	Configuration for transverter is incorrect.	Be sure that the transverter is correctly configured (if the transverter is active), and is properly working.	{page 16-33}
	The transverter is active.	If the transverter is active, be sure that the transverter properly works.	{page 16-33}
	The additional filter has been enabled even though the additional filter is not installed onto the transceiver.	Review the configuration for the additional filter.	{page 16-22}
	The bandwidth for the preselector is deviated.	Readjust the preselector (main band only).	{page 6-1}
The received signal cannot correctly be demodulated.	The selected operating mode is inappropriate.	Select other operating mode.	{page 4-10}
	The AGC function was configured inappropriately.	Configure the AGC function again.	{page 5-4}
The frequency cannot be changed even with a rotation of the **RIT** or **XIT** control.	The RIT/XIT function is active.	Press **[RIT]** or **[XIT]**.	{page 5-13}
The treble and bass of the received audio in SSB mode are excessively filtered.	Configurations for the RX DSP filter do not match the operating environment.	Change the configurations.	{page 6-2}
The audio is distorted.	The AGC function is active.	Enable the AGC function, or adjust the RF gain with the **RF** control.	{page 5-4}
	The audio level is high due to the position of the **AF** control.	Rotate the **AF** control to adjust the volume level.	{page 4-7}
No audio sounds from the speaker.	The **AF** control is excessively rotated counterclockwise.	Rotate the **AF** control clockwise.	{page 4-7}
	The **SQL** control is excessively rotated clockwise.	Rotate the **SQL** control counterclockwise.	{page 4-8}
	A set of headphones is connected.	Disconnect the headphone.	{page 1-2}
	CTCSS tone is enabled in FM mode.	Deactivating CTCSS	{page 5-31}
	The audio line is muted.	Unmute the audio line.	{page 4-7}
	An external speaker is not correctly connected nor configured.	Disconnect the external speaker, or review the connection to and configuration for the external speaker.	{page 1-3}
With the stereo headphone, the audio sounds from one channel.	In Menu 1-07, configuration for the mixing balance specifies only one channel.	Review the configuration for Menu 1-07.	{page 4-23}
In FM mode, the performance of S meter is dull.	Sensitivity of S meter is low.	Select "High" for S meter sensitivity in Menu 0-08.	{page 5-29}

Symptom	Common Problem	What to do	Ref. Page
No transmission. Low transmit power level.	Incomplete connection of the microphone connector.	Connect the microphone securely to the **Microphone** connector.	{page 1-3}
	Poor connection of the antenna connector.	Connect the antenna securely to the **ANT 1** to **ANT 4** connector.	{page 1-1}
	The microphone gain is low.	Adjust the microphone gain using the **MIC** control.	{page 4-17}
	The transmit power is minimized.	Adjust the transmit power using the **PWR** control.	{page 4-17}
	The temperature protection activates.	Stop transmitting to cool down the transceiver.	{page 4-3}
	Carrier level is too low.	Rotate the **CAR** control to adjust until the ALC meter readout indicates the appropriate range.	{page 5-13}
	Output level from the speech processor is too low.	Rotate the **PROC IN**, **PROC OUT**, or **MIC** control to adjust until the ALC meter readout indicates the appropriate range.	{page 9-6}
	The selected audio source for transmission and the audio source entered to the transceiver are different.	Review the audio source to be modulated.	{page 5-11}
	Drive Output (DRV) is active.	Press **[DRV]** to disable Drive Output.	{page 4-21}
	A microphone is not correctly connected.	Review the connection.	{page 1-3}
	Keyer or paddle is not correctly connected.	Review the connection.	{page 1-3}
	Any peripheral device is not correctly connected.	Review the connection.	{page 1-2}
The transceiver does not transmit. The **PWR** meter is inactive.	The **PTT** switch is left and locked as On while a stand microphone is in use.	Unlock the **PTT** switch.	{page 2-10}
	The frequency is off band.	Select the frequency from the amateur band.	{page 4-8}
	TX Inhibit is active.	Disable the TX Inhibit in Menu 6-03.	{page 16-27}
While in transmission in SSB or AM mode, the background noise with no voice is high.	The microphone gain is too high.	Transmit your voice with observing the ALC meter and adjust the microphone gain to slightly activate the Automatic Level Control.	{page 5-14}
	Input level of the speech processor is high.	Rotate the **PROC IN** control to adjust until the COMP meter readout indicates the appropriate range.	{page 9-6}
The VOX function does not behaves.	The VOX gain level is too low.	Adjust the VOX gain level.	{page 9-3}
	The VOX gain level is too high.	Adjust the Anti VOX Gain level.	{page 9-4}
The transmission begins even without any operation.	The VOX function is enabled, the VOX Gain Level is not appropriate.	Disables the VOX function, or adjust the VOX Gain level.	{page 9-2}
	The audio source entered from the rear panel terminals is too high.	Decrease the entered signal level.	{page 2-9}
	The audio signal is entered from the connector which has been enabled as the audio source for transmission, and the same audio source is specified for Data VOX.	Disable the Data VOX, or review the configurations for audio source then adjust the VOX Gain level.	{page 9-2}
You received a report from other station that your audio was distorted or clipped.	The microphone gain is too high.	With the transmit monitor function, or with having other station monitoring, adjust the microphone gain.	{page 4-17}
	Input level of the speech processor is high.	With the transmit monitor function, or with having other station monitoring, adjust the input level of the speech processor.	{page 9-6}
The linear amplifier does not behave.	Poor connection to the **REMOTE** connector.	Connect the amplifier securely to the **REMOTE** connector.	{page 1-6}
	The audio source selected for Data VOX and the entered audio source are different or the input signal level is low.	Review the configuration for Data VOX and input signal level.	{page 9-2}
	The control relay of the linear amplifier is disabled.	Select "Active High + Relay Control" for the linear amplifier control from Advanced Menu 11.	{page 16-31}
While operating in CW mode using the linear amplifier, the Standing Wave Ratio momentary degrades or the Automatic Level Control abnormally activates to increase the transmit power.	The linear amplifier, such as TL-922, is designed to gradually increase the transmit power.	Configure the linear amplifier by selecting "Active High + Relay & TX Delay Ctrl" from Advanced Menu 11 and operate the transceiver in Semi Break-in mode.	{page 16-31}
AT-300 does not behaves.	AT-300 was connected to anything other than the **ANT 1** connector.	Connect AT-300 to the **ANT 1** connector.	{page 1-8}
	A fuse in the transceiver is blown.	Ensure that the fuse is genuine so as to be replaced after the cause of the problem has been corrected.	{page 18-2}
Modulation is insufficient (FM mode).	The microphone gain is low.	Review the configuration for Microphone Gain in Advanced Menu 13.	{page 5-28}

Symptom	Common Problem	What to do	Ref. Page
The transmit power cannot exceed 100 W (TS-990S only).	AT-300 is in use.	While the AT-300 is in use, the transmit power is limited to 100 W.	{page 1-8}
	The transmit power is limited to 100 W by Max Power Limit.	Review in the **Transmit Power** screen the transmit power limit for normal transmission.	{page 4-18}
The transceiver retain the transmission even after the AT Tune has completed.	The transmission retain function when the AT Tune has completed is enabled.	Disable the transmission retain function when the AT Tune has completed in Advanced Menu 9.	{page 4-23}
Frequencies for the main band and sub band jointly vary.	Frequency tracking is enabled.	Disable the frequency tracking.	{page 5-3}
The frequency cannot be changed even with a rotation of the **Tuning** control.	Fine Tuning is enabled.	Disable the Fine Tuning.	{page 4-14}
VFO Scan will not start.	Program Scan has been configured, instead.	Deselect all to disable configurations for Memory Channels P0 to P9 on the **Program Scan** screen.	{page 11-1}
Memory Scan will not start.	No data is configured for the Memory Channels.	Configure the Memory Channels.	{page 10-2}
Group Scan does not start.	No data has been configured for the Memory Channels in the group.	Configure the Memory Channels in the group.	{page 11-1}
	All Memory Channels in a group are locked out.	Unlock the Memory Channels to be scanned.	{page 11-5}
The transceiver scans the limited channels during Memory Scan.	The channels not scanned allow the Group Memory Scan.	Deselect the Group.	{page 11-1}
Voice Guidance does not automatically start.	Auto Voice Guidance is disabled.	Enable the Auto Voice Guidance.	{page 14-2}
The transceiver does not automatically emit the Voice Guidance after the Full Reset.	Voice Guidance is disabled in Menu 1-06.	With the transceiver power (⏻) OFF, press **[⏻]** while you are pressing down the **[PF A]**, or select anything other than "Off" in Menu 1-06.	{page 14-2}
It takes time to power up.	You started up the transceiver by pressing the main power switch (I/O) or after you connect the AC power cable.	In such cases, even if Standby State Low Power Consumption is disabled, it may take time to power up.	{page 4-2}
	The transceiver is in Standby State Low Power Consumption mode.	Disable the Standby State Low Power Consumption in Advanced Menu 22.	{page 4-2}
The cooling fan runs even after the transceiver power turns OFF.	Temperature on the final unit or the power supply unit is high.	Cooling Fan remains running if the Cooling Fan while the transceiver power turns OFF is enabled and temperature on the final unit and the power supply unit is high.	{page 4-3}
The "TIMER" LED blinks and you cannot turn the transceiver ON.	Timed task by a timer is in preparation to activate the timed task.	Wait until the timed task by a timer will activate. Press and hold **[⏻]** for four seconds to cancel the timed task by a timer.	{page 15-5}
Timed task by Program Timer cannot be activated.	The main power (I/O) is shut down.	To use a timer, the main power switch (I/O) must remain in the "I" position.	{page 4-1}
	The USB flash drive cannot be distinguished.	To use the timer recording function, use the USB flash drive which was formatted by this transceiver and has the sufficient remaining memory size.	{page 12-1}
	Timed task by a timer cannot be activated.	Be sure that the timed task by a timer is properly in process so that the timed task by a timer is not temporarily suspended (the "TIMER" LED turns Off) by you pressing **[TIMER/SET]** after the time task by a timer has been set.	{page 15-5}
The frequency cannot be configured for Program Timer.	The transceiver is in Memory Channel mode for the main band or sub band.	Select VFO mode for both main band and sub band in order to do configuration in the **Timer** screen.	{page 10-4}
The **HI/LO** control cannot be used.	Disabled with the menu configuration.	Select "Main and Sub Bands" in Menu 0-14.	{page 16-4}
The received audio sounds from one channel in a PC (the PC is connected to the transceiver with a USB cable).	There is low volume level of the received audio sent from the USB terminal of the transceiver or the audio entered to the microphone terminal of a PC.	Refer the chapters 16 to 19 to configure the transceiver itself and the level of the microphone terminal of the PC.	{page 16-1}
	Monaural is configured in a PC for the microphone.	If the OS in your PC is Windows Vista or later, select “2 Channels” from the Control Panel > Hardware and Sound > Sound > Recording > Microphone (USB Audio CODEC) > Advanced.	

Symptom	Common Problem	What to do	Ref. Page
The received audio sounds from one channel in a PC (the PC is connected to the **ACC 2** connector).	Monaural is configured in a PC for the microphone.	If the OS in your PC is Windows Vista or later, select “2 Channels” from the Control Panel > Hardware and Sound > Sound > Recording > Microphone > Advanced.	
The **Firmware Updating** screen remains appeared and the transceiver does not start up.	The transceiver firmware cannot be detected.	Update the transceiver firmware again. If the same symptom appears even after the firmware is written to the transceiver, note the three-digit number that appears on the lower right side of the main screen and contact the KENWOOD service center.	{page 17-1}

SYMPTOMS ENCOUNTERED IN ASSOCIATION WITH DATA COMMUNICATIONS, PC AND NETWORK

Symptom	Common Problem	What to do	Ref. Page
Errors and retries are more likely to occur while transmitting in AFSK mode.	The AF signal output level from the TNC is too high and the modulated signal will be distorted.	Decrease the TNC output level in order not to exceed the ALC zone.	{page 16-20}
	The audio input sensitivity from the **ACC 2** connector of the transceiver does not match the entered signal.	Adjust, using Menu 7-06, the audio input sensitivity of the **ACC 2** connector not to exceed the ALC zone,	{page 16-20}
	The modulated signal was distorted due to the loop interference by the high frequency signal. 1 The antenna Standing Wave Ratio is too high. 2 The high frequency signal is induced to the transceiver from an antenna. 3 The audio input sensitivity of the **ACC2** connector is too high, so that the high frequency signal loops.	Measure the anti-looping. 1 Retry the antenna matching. 2 Change the grounding from the antenna, the transceiver, and the TNC. 3 Decrease, using Menu 7-05, the audio input sensitivity of the **ACC 2** connector.	{page 16-20}
Audio signal entered to the data communications port cannot be transmitted.	The transceiver is in the Transmit state with a press of **[PTT]** or **[SEND]**.	Place the PKS terminal in the **ACC 2** connector into the active state or press **[PF]** preprogrammed as Data Send to transmit.	{page 1-11}
	The audio level from the data communications connector is too low.	Decrease the audio signal output level of the equipment connected to the transceiver, or increase the audio signal input level using Menus 7-05 and 7-06.	{page 16-20}
More errors are likely to occur while receiving in FSK mode.	The received audio cannot be decoded since the audio output level from the ACC 2 connector does not match the input level for the TNC and MCP.	Deselect the audio output level from the **ACC 2** connector, from Menu 7-10.	{page 16-20}
	Multi-path distortion and short-interval phasing occur (it is not always best to have the receive signal strength as the strongest strength).	In the case of a beam antenna, you can seek the position where the error is unlikely to occur by changing the antenna direction.	
There is no communication to ARCP-990 using the COM port.	The baud rate is inappropriate.	Be sure that the baud rate configured for TS-990S and ARCP-990 is consistent.	{page 16-10}
	CTS/RTS are not properly assigned in the COM port.	Configure the pin assignment of the COM connector in Advanced Menu 24.	{page 16-25}
There is no communication to ARCP-990 using the USB port.	No driver is installed onto a PC.	Download the driver software from the KENWOOD web site and install it onto your PC.	{page 16-10}
	The baud rate is inappropriate.	Be sure that the baud rate configured for TS-990S and ARCP-990 is consistent.	{page 16-10}
If a PC is connected to the transceiver using a USB cable, the larger COM port number is assigned to a PC.	If the KENWOOD transceiver, such as TH-D72A/E, TS-590S, TS-990S, is connected to the port which is different from the last used USB port, the OS assigns the new COM port number.	Keep connecting the KENWOOD transceiver to a PC using a USB cable, and delete the unnecessary COM port number from "Device manager" of your PC. Refer to the Web Site below. http://www.kenwood.com/i/products/info/amateur/vcp_e.html	
The time cannot be corrected with an NTP server.	An IP address cannot be acquired.	Be sure that "On" is selected for DHCP. Be sure that the DHCP server is enabled in the broadband router and working properly.	{page 16-12}
	No NTP server address has been configured.	Enter the NTP Server address.	{page 15-3}
	The NTP information cannot be transfered from WAN.	Open the port on the communications devices such as a broadband router not to shut down the port to be used for the communication to an NTP server.	{page 1-9}
	No LAN cable is connected.	Be sure that the LAN cable is properly connected.	{page 1-9}
No date and time can be configured.	Automatic time correction is enabled.	Disable the automatic time correction.	{page 15-4}

Symptom	Common Problem	What to do	Ref. Page
The USB flash drive cannot be distinguished.	The USB flash drive is not formatted by this transceiver.	Format the USB flash drive using this transceiver.	{page 12-1}
	Poor connection	Connect the USB flash drive again.	{page 1-3}
	The USB flash drive has the security capacity.	This transceiver does not accept the USB flash drive having the security capability.	{page 12-1}
	A USB flash drive deems to be damaged.	Use a PC to check whether the USB flash drive connected to the transceiver properly works.	
	The USB flash driver does not conform to the standard.	Use the USB flash drive which conforms to the standard.	{page 12-1}
	More than one USB flash drives are connected.	The first USB flash drive which was distinguished by the transceiver can be used.	
	The file system in the USB flash drive is corrupted.	Format the USB flash drive using this transceiver.	{page 12-1}
A file cannot be stored in the USB flash drive.	The USB flash drive is the write protected.	Disable the write protected capability.	
	The USB flash drive is not formatted by this transceiver.	Format the USB flash drive using this transceiver.	{page 12-1}
	Poor connection	Connect the USB flash drive again.	{page 1-3}
	The USB flash drive has the security capacity.	This transceiver does not accept the USB flash drive having the security capability.	{page 12-1}
	A USB flash drive deems to be damaged.	Use a PC to check whether the USB flash drive connected to the transceiver properly works.	
	The USB flash driver does not conform to the standard.	Use the USB flash drive which conforms to the standard.	{page 12-1}
	The file system in the USB flash drive is corrupted.	Format the USB flash drive using this transceiver.	{page 12-1}
	In sufficient remaining memory size	Use the USB flash drive which has sufficient free memory area.	
	There are too many files in a folder.	No more than 255 files can be stored in a single folder. Store a file after deleting unnecessary files.	{page 12-3}
	The file name in the file to be stored already exists in the destination.	The same file name exists when you attempt to store the file. Do not use the already used file name.	{page 12-4}
Formatting of a USB flash drive was failed.	You attempt to format the USB flash drive while "[redacted]" is blinking, and the formatting was failed.	Remove the USB flash drive following the procedure of "Safe Removal of USB Flash Drive", and then connect and format the USB flash drive again.	{page 12-1}
Safe Removal of USB Flash Drive was failed.	Failure was occurred by any reason.	Press the main power switch (I/O) to the "O" position to shut down, then remove a USB flash drive. Depending on the status of data processing by this transceiver, some data may not be stored to a USB flash drive.	{page 4-1}
No image is displayed on an external monitor.	The external display output is disabled.	Select "On" for the external monitor output in Advanced Menu 25.	{page 16-18}
No image is displayed on an external monitor during the power up.	Depending on the specifications of your external monitor, the delay until the display may occur when the transceiver power (⏻) turns ON.	Wait until the start up screen closes.	{page 16-18}
"[redacted]" blinks a few minutes.	The transceiver does not distinguish the USB flash drive.	Format the USB flash drive using this transceiver.	{page 12-1}
The received audio sounds from one channel in a PC (the PC is connected to the transceiver with a USB cable or to the **ACC 2** connector).	Monaural is configured in a OS for the microphone.	If the OS of a PC is Windows Vista or later, select "2 Channels" from the Control Panel > Hardware and Sound > Sound > Recording > Microphone (USB Audio CODEC) > Advanced.	

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SYMPTOMS ENCOUNTERED DURING RECORDING AND PLAYING

Symptom	Common Problem	What to do	Ref. Page
The message appears when [⏻] is pressed during the timer recording.	Timer recording is in process.	Press and hold **[(BREAK)]** (F4) to abort the timer recording and allow the transceiver to be operable. To continue the timer recording, press [⏻].	{page 15-5}
As a result of the timer recording, no sound is audible from the recorded file.	Mute was active during the timer recording.	Be sure that the mute is inactive during the timer recording. While the muting capability is active, the received audio cannot be recorded.	{page 4-7}
Voice message cannot be recorded.	The audio source is not configured as desired.	Be sure that the audio source is correct and the input signal level is appropriate.	{page 13-1}
The repeat interval of the voice message does not function.	You attempt to use the repeat interval only for playing of the voice message.	The repeat interval can function only when the voice message is played during the transmission. This does not function only for playing.	{page 13-3}
	Repeating is disabled.	Enable the repeating for the channel you wish to repeat.	{page 13-3}
The received audio can be recorded only for 30 seconds.	The received audio is recorded to the internal memory.	Use the USB flash drive to store the received audio.	{page 12-1}
	Full time recording is selected.	The maximum recording time for the Full time recording is 30 seconds despite of the destination.	{page 13-5}
WAV file cannot be played.	The audio file has different file format than what the transceiver can play.	The transceiver can play the audio file with the following format. Number of channels: 2, Number of bit: 16, sampling frequency: 16 kHz	
Audio file cannot be deleted.	The file is the delete protected.	Cancel the delete protection.	{page 13-10}
The volume to play (reception) is small.	Rotate the **AF** (M) control counterclockwise.	Rotate the **[AF]** (M) control clockwise to adjust.	{page 4-7}
The volume to play (transmission) is small.	Rotate the **AF** (S) control counterclockwise.	Rotate the **[AF]** (S) control clockwise to adjust.	{page 4-7}
No signal is entered from the **OPTICAL IN** connector.	The sampling rate of the transceiver does not march the sampling rate of the sourcing device.	The sampling frequency for the entered signal is 44.1 kHz and 48 kHz, the number of bit is 24 or 16.	{page 2-9}
No signal is entered from the **OPTICAL OUT** connector.	The sampling rate of the transceiver does not march the sampling rate of the target device.	The sampling frequency for the signal to be transferred is 48 kHz, the number of bit is 24.	{page 2-9}

19 MISCELLANEOUS

PRIME OPTIONAL ACCESSORIES

HS-5
Open-air Headphones



HS-6
Light Weight Headphones



SP-990
External Speaker



MC-43S
Hand Microphone



MC-60A
Desktop Microphone



MC-90
Desktop Microphone



Note:

- Optional accessories that can be used along with this transceiver may from time to time added or discontinued. Refer to the KENWOOD web site and catalog for the details of the optional accessories.

DEDICATED APPLICATIONS

ARCP-990
Radio Control Program



ARHP-990
Radio Host Program



Note:

- ARCP-990 Radio Control Program and ARHP-990 Radio Host Program can be downloaded from the following web site.
  http://www.kenwood.com/i/products/info/amateur/software_download.html

PRODUCT SPECIFICATIONS

General		
Frequency range (Transmitter)	160m band	1.8 ~ 2.0 MHz (K-type), 1.81 ~ 2.0 MHz (E-type)
	80m band	3.5 ~ 4.0 MHz (K-type), 3.5 ~ 3.8 MHz (E-type)
	60m band *5	5.1675, 5.25 ~ 5.45 MHz (K-type), 5.25 ~ 5.45 MHz (E- type)
	40m band	7.0 ~ 7.3 MHz (K-type), 7.0 ~ 7.2 MHz (E-type)
	30m band	10.1 ~ 10.15 MHz
	20m band	14.0 ~ 14.35 MHz
	17m band	18.068 ~ 18.168 MHz
	15m band	21.0 ~ 21.45 MHz
	12m band	24.89 ~ 24.99 MHz
	10m band	28.0 ~ 29.7 MHz
	6m band	50.0 ~ 54.0 MHz (K-type), 50.0 ~ 52.0 MHz (E-type)
Frequency range (Receiver) *1		0.13 ~ 30 MHz, 50 ~ 54 MHz VFO: Continuous 30 kHz ~ 60 MHz
Mode		A1A (CW), A3E (AM), J3E (SSB), F3E (FM), F1B (FSK), G1B (PSK)
Frequency stability		Within ±0.1 ppm, 0°C ~ +50°C (32°F~122°F)
Antenna impedance		50 Ω
Antenna tuner load range		16.7Ω ~ 150Ω
Standard voltage		AC 120 V (60 Hz) (K-type), AC 220-240 V (50/60 Hz) (E-type)
Supply voltage range		AC 90 V ~ 132 V/ 180 V ~ 264 V *2
Power consumption	At transmit (maximum)	720 VA or less (K-type), 840 VA or less (E-type)
	At receive (no signal)	120 VA or less (K-type), 200 VA or less (E-type)
Usable temperature range		0℃ ~ +50℃ (32°F~122°F)
Dimensions	Without projection	W460 x H165 x D400 mm (W18.11 x H6.50 x D15.75 in)
	Include projection	W460 x H182 x D449 mm (W18.11 x H7.17 x D17.68 in)
	At front leg up position	front panel: H201 mm (H7.91 in), rear panel: H173 mm (H6.81 in)
Weight		Approx. 24.5 kg (54.01 lbs)

Transmitter		
Output power	CW/SSB/FSK/PSK/FM (AM)	200 W (50 W)
Modulation		SSB: Balanced, AM: Low Power, FM: Reactance
Maximum frequency deviation (FM)		wide: ±5 kHz or less, narrow: ±2.5 kHz or less
Spurious emissions		HF (Harmonics): -60 dB or less HF (others): -50 dB or less 50 MHz: -66 dB or less
Carrier suppression		-60 dB or less
Unwanted sideband suppression		-60 dB or less
Transmit frequency response		Within -6 dB (300 ~ 2700 Hz)
Microphone impedance		600 Ω
XIT variable range		±9.999 kHz

Receiver				
Circuit type		Main	Sub1 *3	Sub2 *4
		Double superheterodyne	Double superheterodyne	Triple superheterodyne
Intermediate frequency	1st IF	8.248 MHz	11.374 MHz	73.095 MHz
	2nd IF (FM)	24 kHz/ (455 kHz)	24 kHz	10.695 MHz
	3rd IF (FM)	-	-	24 kHz/ (455 kHz)
Sensitivity (Typcal)	SSB, CW, FSK, PSK (S/N 10 dB)	0.5 µV (0.13 ~ 0.522 MHz) 4 µV (0.522 ~ 1.705 MHz) 0.2 µV (1.705 ~ 24.5 MHz) 0.13 µV (24.5 ~ 30 MHz) 0.13 µV (50 ~ 54 MHz)		
	AM (S/N 10 dB)	6.3 µV (0.13 ~ 0.522 MHz) 32 µV (0.522 ~ 1.705 MHz) 2 µV (1.705 ~ 24.5 MHz) 1.3 µV (24.5 ~ 30 MHz) 1.3 µV (50 ~ 54 MHz)		
	FM (12 dB SINAD)	0.22 µV (28 ~ 30 MHz) 0.22 µV (50 ~ 54 MHz)		
Image Rejection Ratio (50 MHz)		70 dB (60 dB) or less		
IF Rejection Ratio		70 dB or less		
Selectivity	SSB (LO: 200/ HI: 2800 Hz)	2.4 kHz or more (-6 dB) 4.4 kHz or less (-60 dB)		
	CW, FSK, PSK (WIDTH: 500 Hz)	500 Hz or more (-6 dB) 1.2 kHz or less (-60 dB)		
	AM (LO: 100/ HI: 3000 Hz)	6.0 kHz or more (-6 dB) 12 kHz or less (-50 dB)		
	FM	12 kHz or more (-6 dB) 25 kHz or less (-50 dB)		
XIT variable range		±9.999 kHz		
Notch filter attenuation		60 dB or more (Auto), 70 dB or more (Manual)		
Beat cancel attenuation		40 dB or more		
Audio output		1.5 W or more (8Ω)		
Audio output impedance		8Ω		

*1 MAIN BAND: Spec. guaranteed in amateur band 160m through 6m
*2 The AC power cable supplied with the product is only suitable for AC 120V (K-type) or AC 220V-240V (E-type).
Do not use or modify K-Type Cable for AC 220 - 240 V Operation.
Do not use or modify E-Type Cables for AC 120 V Operation.
*3 In 160m/80m/40m/20m/15m Amateur bands, IF band width 2.7 kHz or less (SSB, CW, FSK, PSK)
*4 Except in above *3
*5 60m band: Refer to applicable Amateur Radio regulations to your country.

Internal beat may occur during amateur radio band reception depending on combination of main band and sub Spurious signal other than reception signal may also appear on the bandscope (waterfall view).

Note:

- Measured values are subject to the measuring method stipulated by Japan Amateur Radio Industries Association.
- Specifications are subject to change due to technical development.

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