14 VOICE GUIDANCE

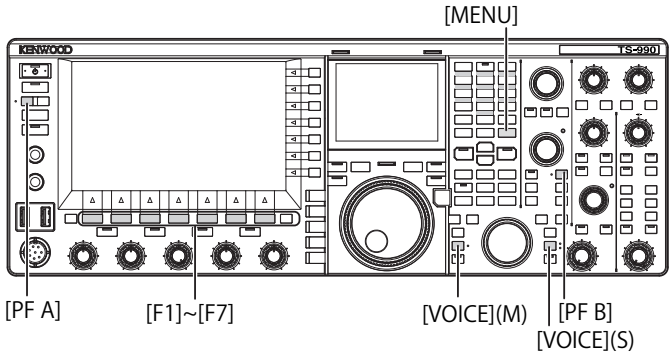
This transceiver has a voice guidance feature which announces the operating status displayed on the screen.

This manual indicates the announced contents of the voice guidance as follows:

As pronounced	The announced content is enclosed in double quotation marks as pronounced.
Numbers and letters	The announced content is generically described as numbers or letters
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 certain operations.

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:

♦ With the transceiver power OFF, press [⏻] while pressing down **[PF A]** to start up the transceiver 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.
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 the 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 the voice guidance.

The following operating data is announced upon an operation in the 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"

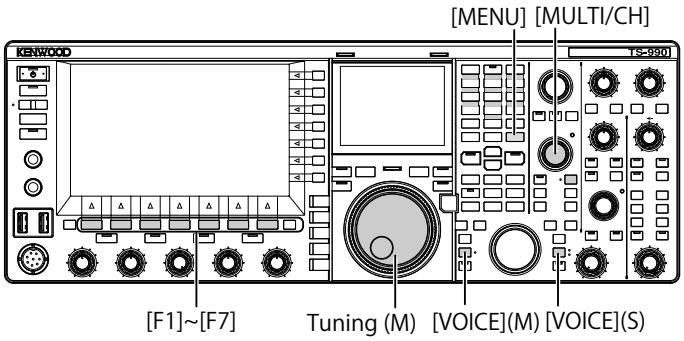
Note:

- 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 the voice guidance.

VOICE 1

Announces the frequency, channel number, contents of various configuration modes, 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 normal conditions, the operating status of the main band is announced.

Note:

- During the announcement pressing the PF key again, to which "Voice 1" is assigned, stops the announcement.
- During the announcement, the announcement stops when the frequency is changed with the Tuning or **MULTI/CH** control.
- Refer to "PF (Programmable Function)" to change the PF key to be assigned. {page 16-6}
- There is no announcement during 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 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 bandwidth	(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
	Bandwidth, 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	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 the 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"
Retrieval of the NTP and time data completed	When the screen opens or **[VOICE1]** is pressed	"Completed"
Retrieval 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?"

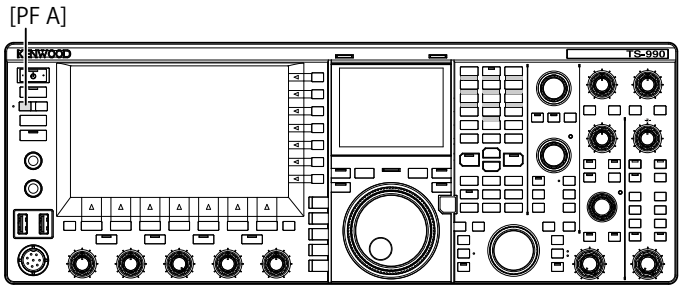
Screen	Operation/Status	Announced Content
Confirming the memory reset	When the screen opens or **[VOICE1]** is pressed	"Memory reset" + "OK?"
Confirming the menu reset	When the screen opens or **[VOICE1]** is pressed	"Menu Reset" + "OK?"
Reset in progress	When the screen opens or **[VOICE1]** is pressed	"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 "List of Functions for Key Assignment" 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 messages 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 the 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 the S meter and power meter are announced. For example, "S5" or "20 dB".



1 Press the PF key to which **[PF A]** or Voice 2 is assigned.
Values of the S meter and power meter are announced.

Note:

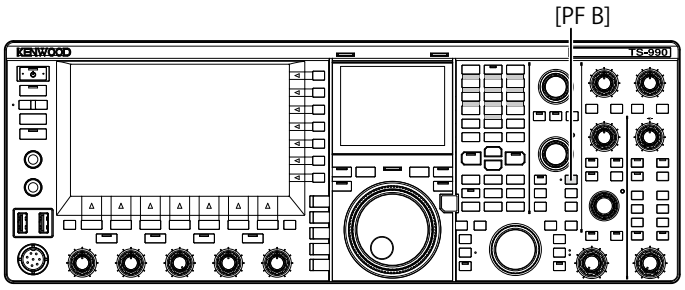
- During the announcement pressing the PF key again, to which "Voice 2" is assigned, stops the announcement.
- Refer to "PF (Programmable Function)" to change the PF key to be assigned. {page 16-6}
- When transmitting in the sub band, the value of the main band power meter is announced.

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:

- During the announcement pressing the PF key again, 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

15 CLOCK DISPLAY AND TIMER

CONFIGURING THE DATE AND TIME

The transceiver has two clocks.

Local Clock

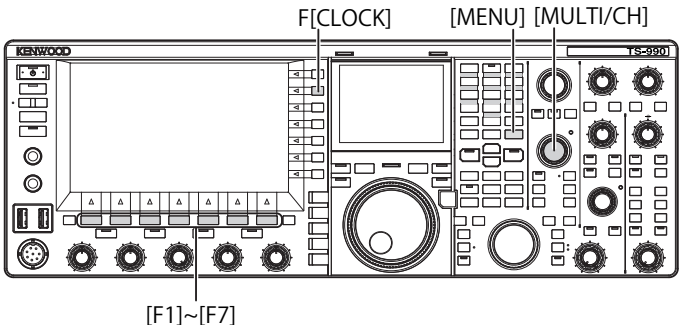
You can configure the expiration timer or the date and time to be used as the time stamp recorded in the data file. The date and time appear on the main screen. The date and time do not appear while using the extended displays, such as the waterfall display, and RTTY.

Secondary Clock

If the Local Clock is configured, the Secondary Clock appears on the right side of the 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). Without configuring the 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

The date and time for the 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 the cursor to the left or 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 the NTP server is enabled, the local clock cannot be configured. {page 15-3}

CONFIGURING THE TIME FOR THE LOCAL CLOCK

The time for the 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 the cursor to the left or 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 the 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 the Local Clock as the time for 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 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 "+09:00".
7 Press [ ] (F1).
8 Press **[MENU]** to exit.

CONFIGURING THE TIMEZONE FOR THE SECONDARY CLOCK

You can configure the timezone for 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 03, "Timezone (Secondary Clock)".
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 timezone for the secondary clock from the available range of "-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".

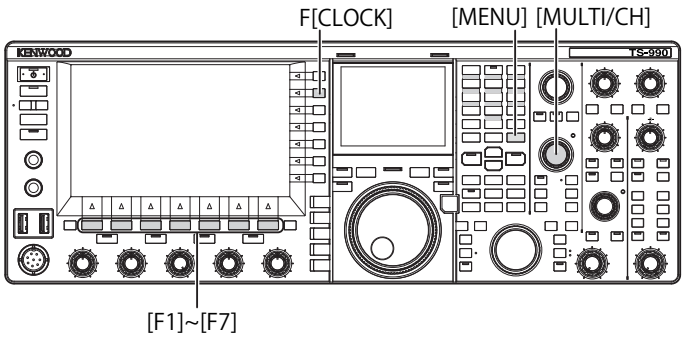
7 Press [ ] (F1).

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 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.

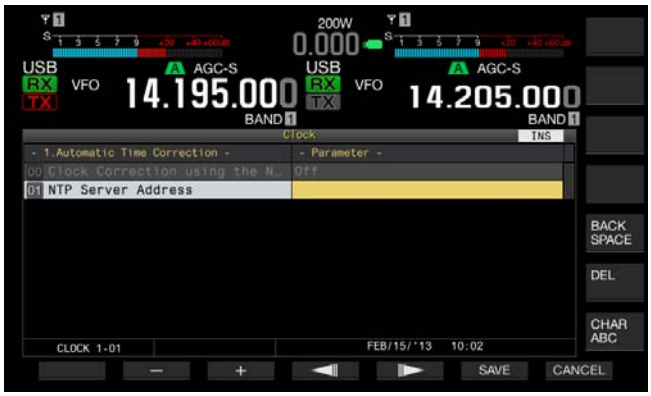
1 Press **[CLOCK]** (F) from the **Menu** screen to open the **Clock** screen.

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 before or after the current 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): 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.

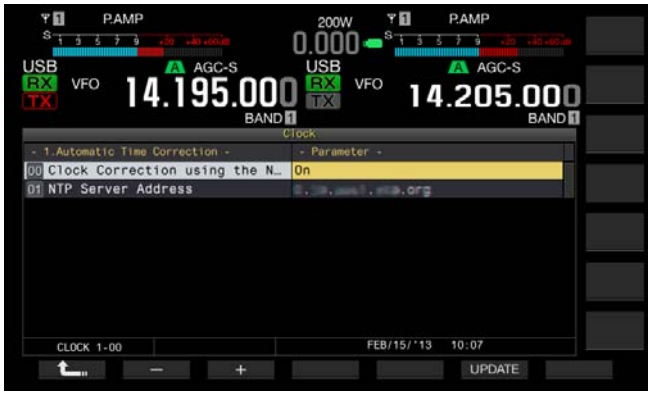
Note:

- 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 (⏻), with 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.

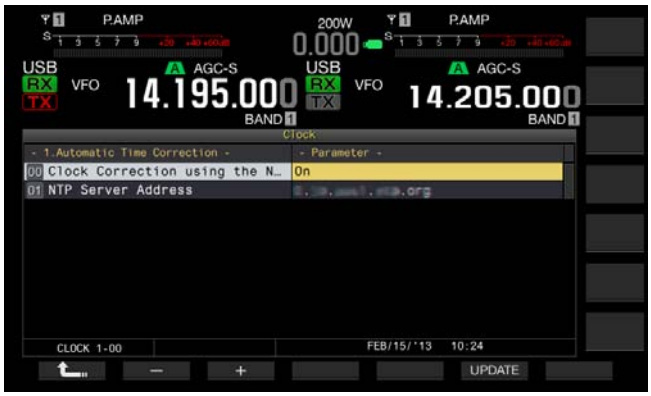
Note:

- 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 with 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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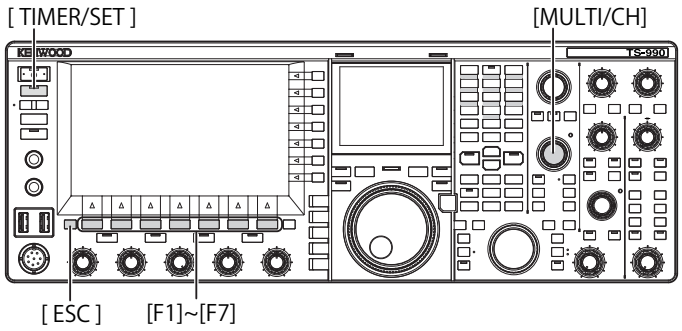


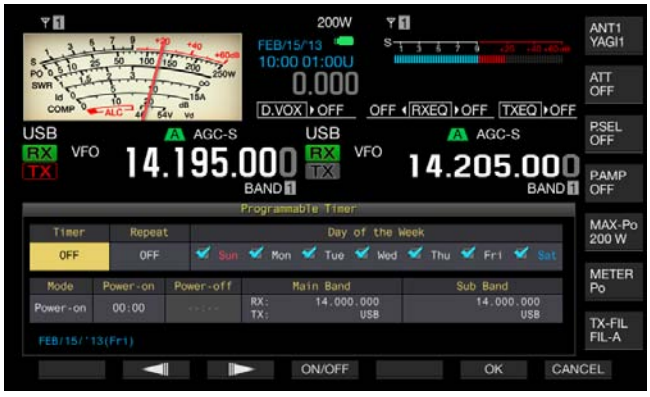
CONFIGURING THE PROGRAMMABLE TIMER

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" allows 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 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 the time for Power Off, and it cannot configured. Power-off: The transceiver power (⏻) turns OFF at the time configured for Power-off. If "Power-off" is selected, "--:--" appears as the time for Power On, and it cannot configured. 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 the 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 the frequency and mode for the main band and sub band when the transceiver starts up, press **[COPY]** (F5) each time the frequency is changed.

5 Press **[OK]** (F6).
- The "TIMER" LED lights green, and 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.

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 the 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 the start of recording, into the ⇻ (USB-A) connector on the front panel. Use a USB flash drive formatted with the transceiver and having sufficient free area.
- 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 the 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.

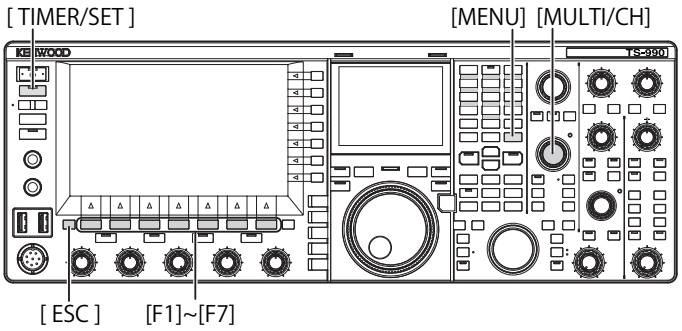
1 Press **[TIMER/SET]**.
- The "TIMER" LED turns Off, and the Sleep Timer or Programmable Timer will temporarily be disabled.
- Press **[TIMER/SET]** again to light the "TIMER" LED, and resume counting down the Sleep Timer and Programmable Timer.

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 the Sleep Timer and the 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:

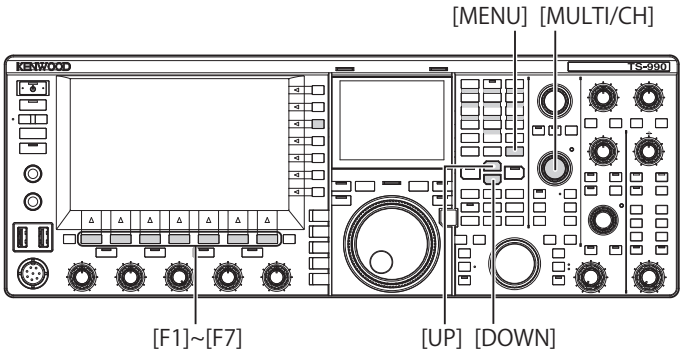
- The timer for the APO continues counting down even during scan.
- The transceiver starts counting down from when a key or a control is last operated.

16 USEFUL FUNCTIONS

This section describes how to configure and operate 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

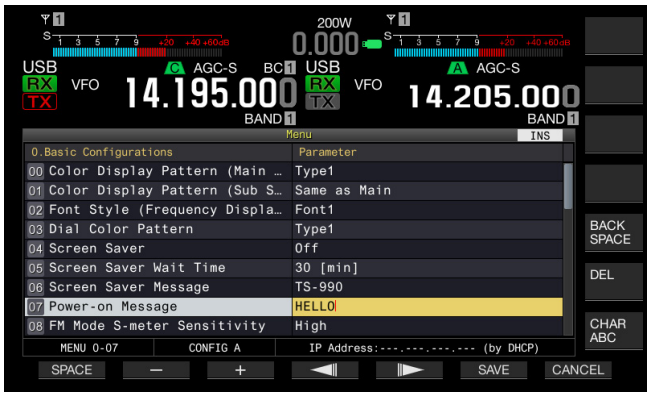
After the transceiver power (⏻) is turned ON, the power-on message appears on the startup screen until the transceiver becomes active. You can configure your desired text string, such as your callsign, as the power-on message.



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 function 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.

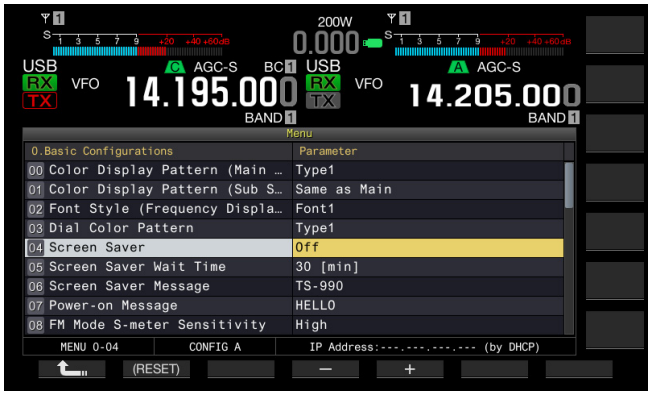
CONFIGURING THE SCREEN SAVER TYPE

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 a control or by receiving a PC command.

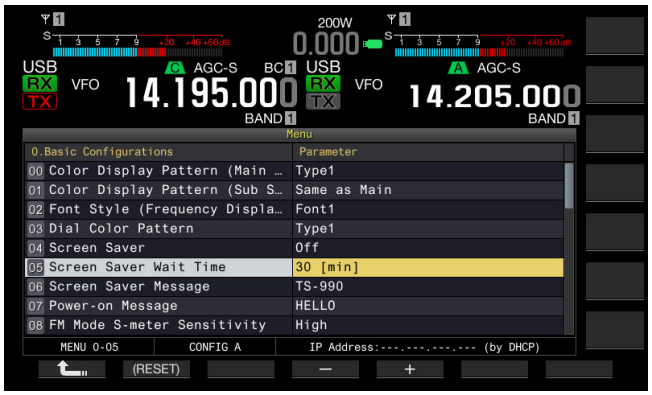
CONFIGURING THE SCREEN SAVER WAIT TIME

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 THE 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 the cursor 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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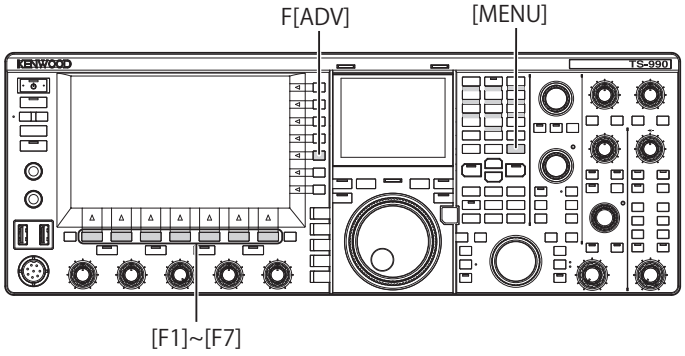
TOUCHING THE SCREEN TO SELECT A FREQUENCY

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.



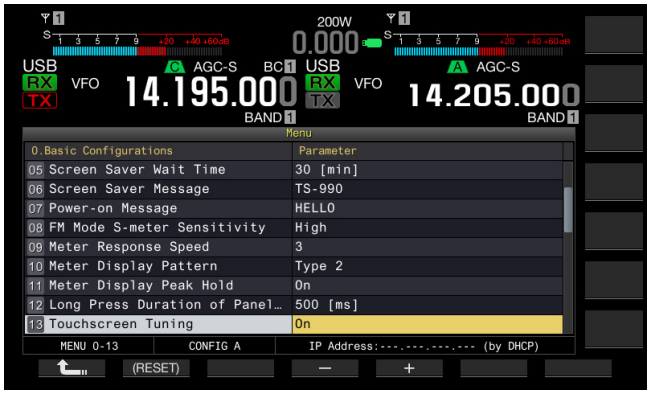
TOUCHING THE SCREEN

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.

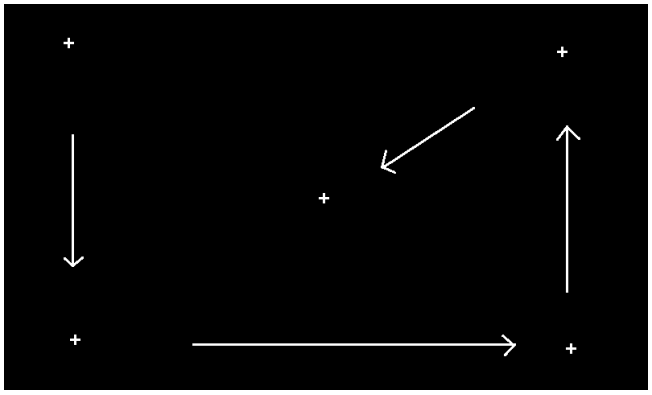
CALIBRATING THE TOUCHSCREEN

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 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.

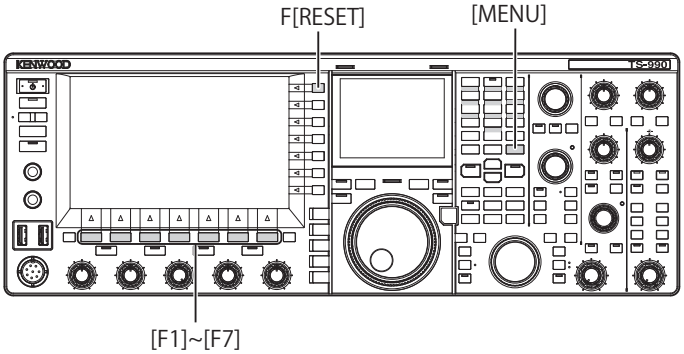
RESET

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 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: Resets 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. 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 their default; hence, the transceiver does not do any voice guidance by Automatic Voice Guidance. {page 14-2}

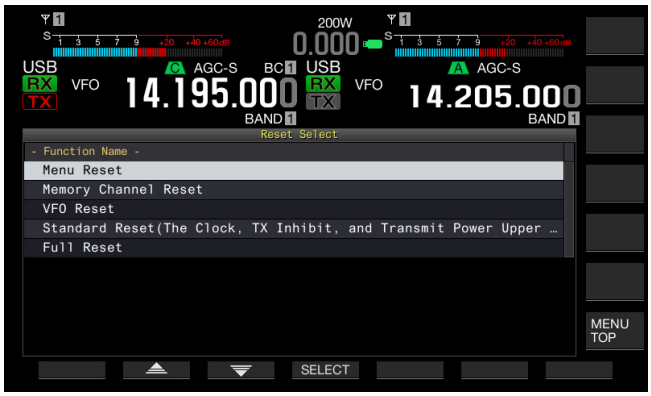


Follow the procedure below to reset the transceiver.

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 the message that prompted you to start the resetting process.

4 Press **[RESET]** (F4).
The transceiver is reset and automatically restarts.

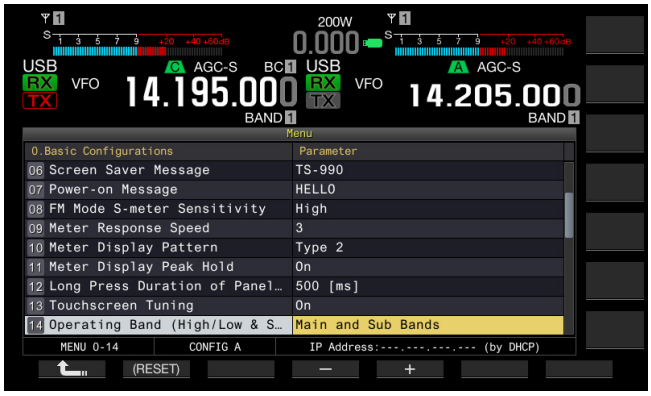
SELECTING THE OPERATING BAND FOR THE HI/SHIFT LO/WIDTH CONTROLS

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 a long key press on the front panel.

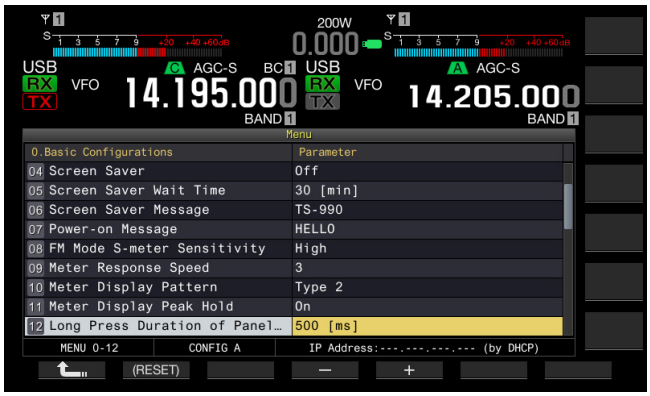
In this manual, the operation to activate such functions or to open the configuration screen is described as "press and hold". Some operations, such as operation using the **PTT** (microphone) switch, are described as "hold down". {page VII}

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.

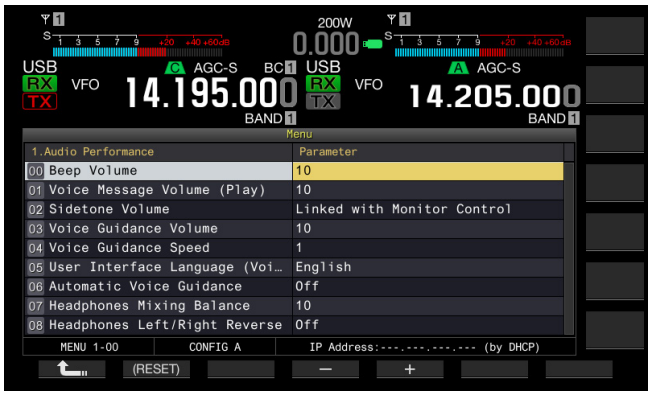
ADJUSTING THE BEEP VOLUME

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 with the received audio and transferred via the SANO and MANO pins of the **ACC 2**, **OPTICAL OUT** and (USB-B) connectors.

MIXING THE BEEPS, ETC. TO THE RECEIVED AUDIO OUTPUT FROM THE REAR PANEL

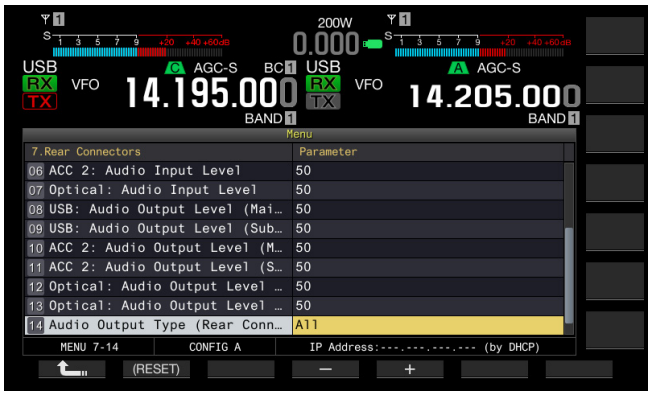
You can configure whether or not the audio emitted by the transceiver will be mixed with the received audio and transferred via the SANO and MANO pins of the **ACC 2**, **OPTICAL OUT** and •⇢ (USB-B) connectors.

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 a distant location and operated using the KNS (KENWOOD NETWORK COMMAND SYSTEM), you can listen for 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, 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.

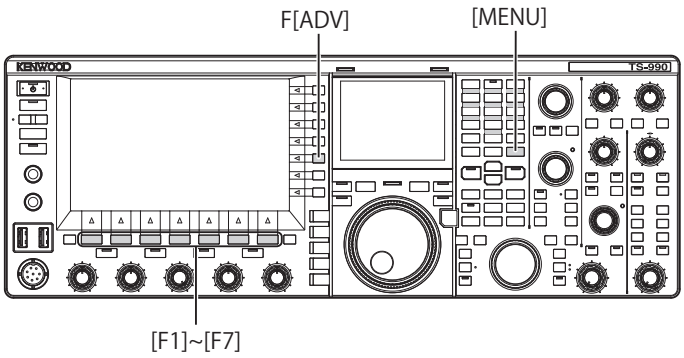
PF KEYS (PROGRAMMABLE FUNCTION KEYS)

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).



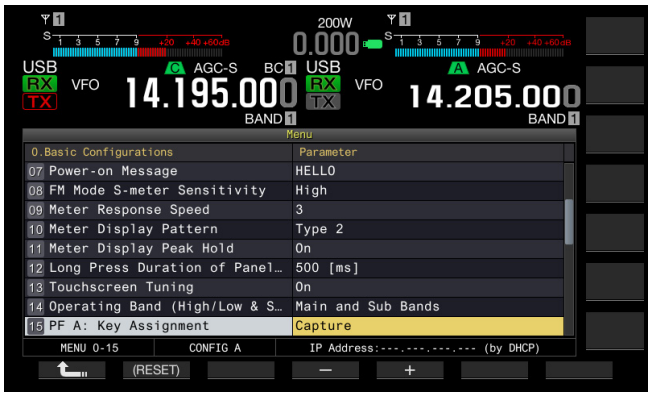
ASSIGNING VARIOUS FUNCTIONS TO THE FRONT PANEL PF KEYS

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 menu 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

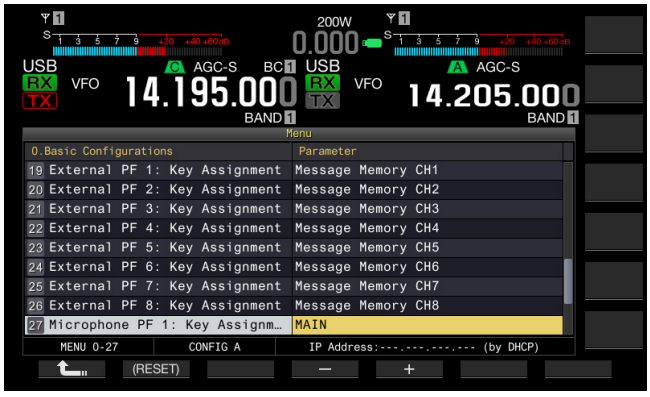
If you connect the microphone or a self-made selector to the **MIC** connector on the front panel, a maximum of six functions can be assigned to the PF keys.

- 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 menu 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.



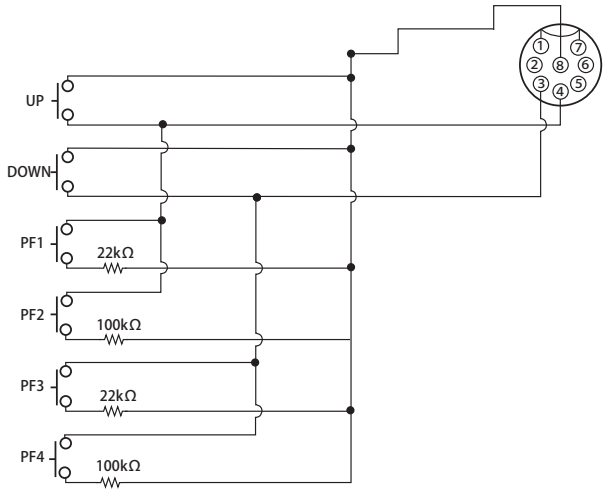
4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the function to be assigned to a PF key.
Refer to the List of Functions for Key Assignment for the defaults of each PF keys. {page 16-8}

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.



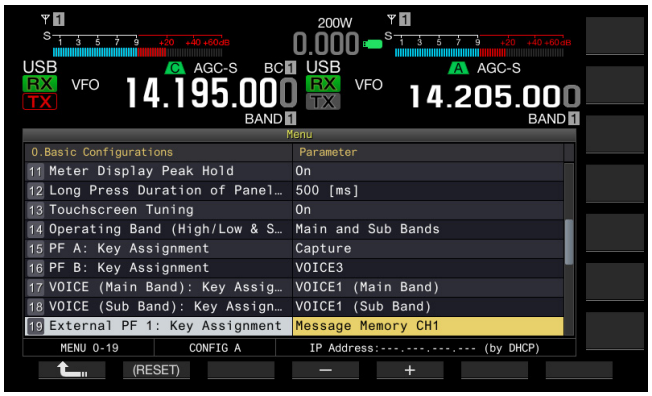
ASSIGNING VARIOUS FUNCTIONS TO THE EXTERNAL PF KEYS

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 menu 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.



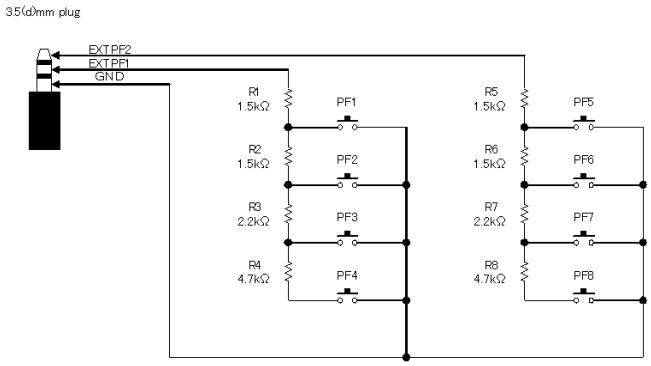
4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the function to be assigned to a PF key.
Refer to the function list for the default settings. {page 16-8}

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 to select Data 1. Press and hold to open the **Modulation Source** screen.
DATA 2/SEL	Press to select Data 2. Press and hold to open the **Modulation Source** screen.
DATA 3/SEL	Press to select Data 3. Press and hold to open 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 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 RX Filter A for the main band. Press and hold to open the **Receive Filter** screen.
FIL B/SEL (Main Band)	Press to select RX Filter B for the main band. Press and hold to open the **Receive Filter** screen.
FIL C/SEL (Main Band)	Press to select 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 respond 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 bandwidth. The transceiver does not respond 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 respond 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 respond 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 respond 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 RX Filter A for the sub band. Press and hold to open the **Receive Filter** screen.
FIL B/SEL (Sub Band)	Press to select RX Filter B for the sub band. Press and hold to open the **Receive Filter** screen.
FIL C/SEL (Sub Band)	Press to select 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 respond 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 bandwidth for the sub band. The transceiver does not respond 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 respond 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 respond 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 respond 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 respond 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 respond 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 respond 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 respond 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 reception, and a value for transmit power during transmission. 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 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, 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, 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, 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, CW message, FSK message, or PSK message stored in channel 4. This is the default for Menu 22, "External PF 4: Key Assignment".
Message Memory CH5	Press to transmit the Voice message, 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, 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 select 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 the 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.

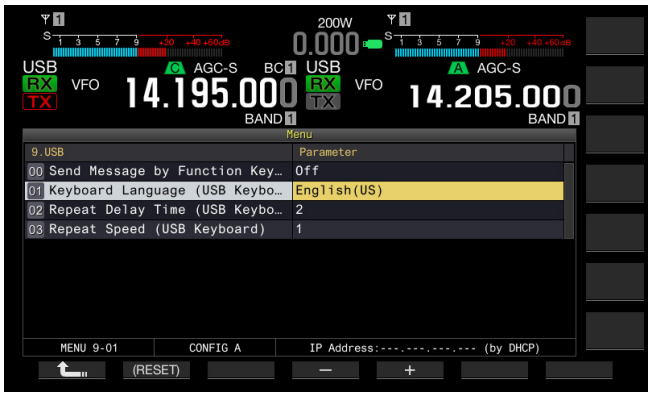
SELECTING THE LANGUAGE FOR THE USB KEYBOARD

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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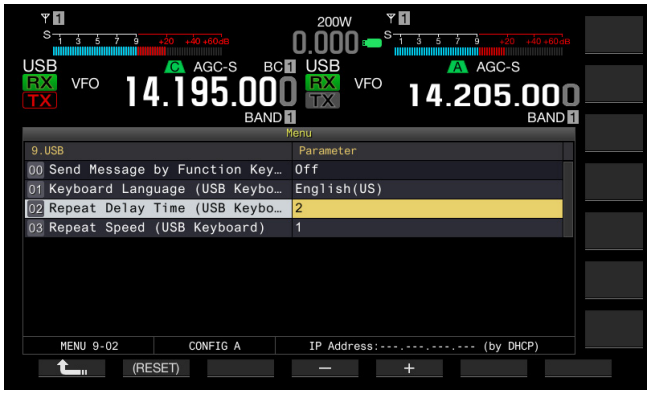
CONFIGURING THE KEY REPEAT DELAY TIME

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 delay time can be selected from "1" to "4".
- The default is "2".

5 Press [ ] (F1).

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

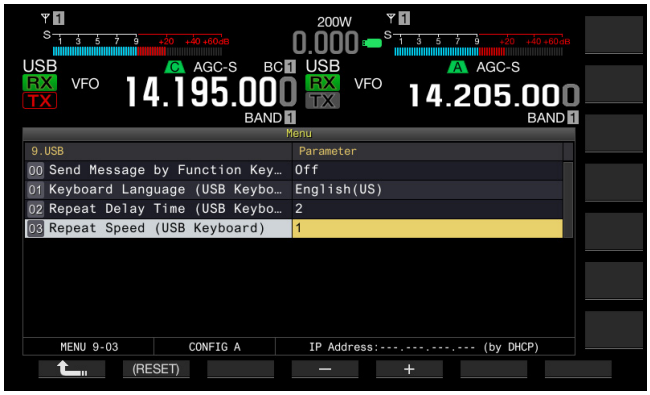
CONFIGURING THE KEYING SPEED

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 the USB keyboard transmits a Voice or 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:

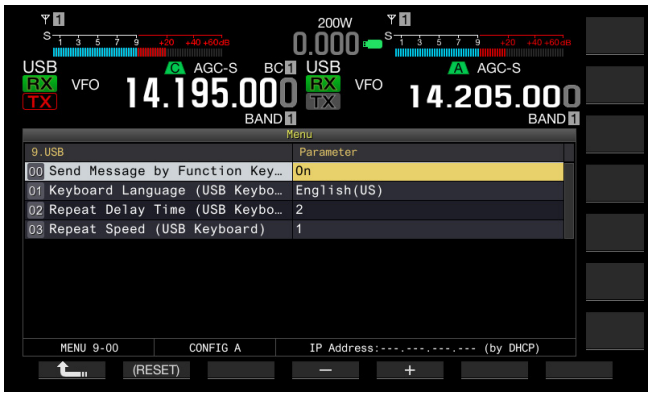
Refer to the following for the method to assign a voice or a text message to the USB keyboard.

- Recording a Voice Message {page 13-1}
- CW Message Memory {page 5-22}
- Utilizing a RTTY Message Memory {page 5-40}
- Utilizing a 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 "On".

5 Press [ ] (F1).

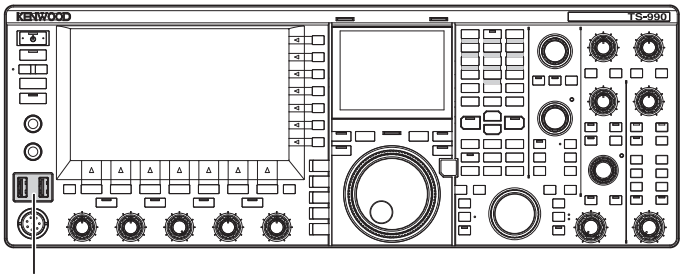
6 Press **[MENU]** to exit.

Note:

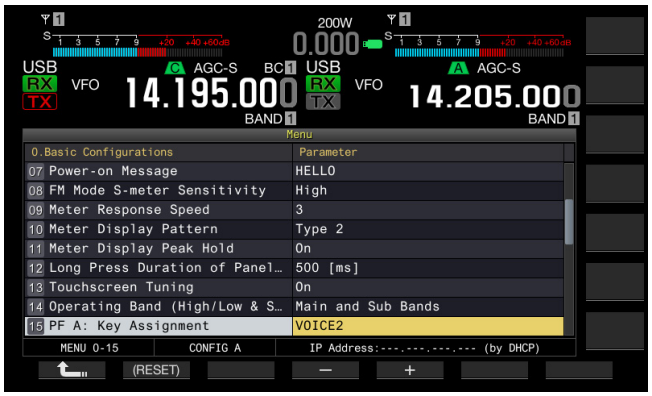
- If two sets of USB keyboards are connected to the transceiver, the transceiver recognizes the USB keyboard connected first.
- You cannot select a channel where no message is stored.
- In FSK or PSK mode, a message can be transmitted following the configuration for the channel where a message is stored.
  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.

♦ 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.

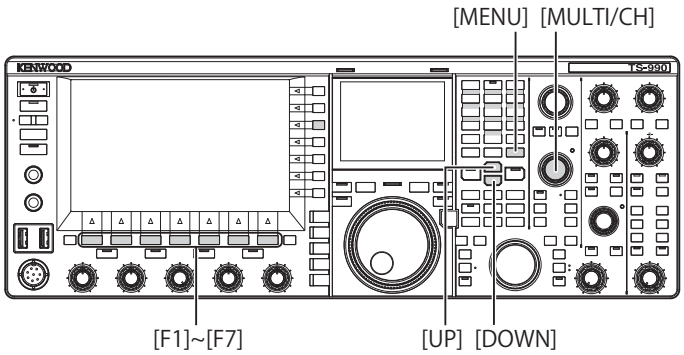
CONFIGURING THE NETWORK

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 the 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.

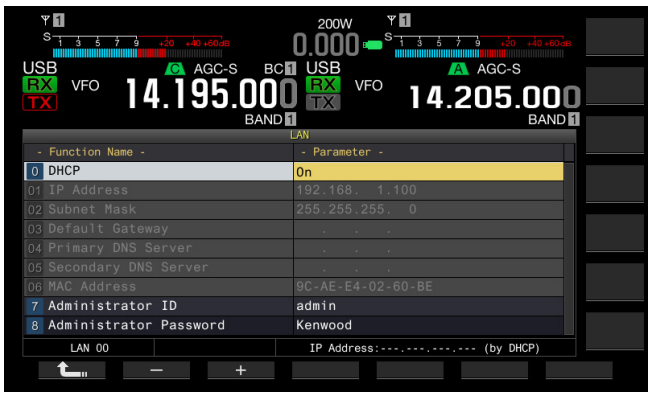


■ Configuring the IP address automatically (using the DHCP)

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 the Internet using a fixed-line broadband, the broadband router contains the DHCP servers in most cases. Refer to the instruction manual supplied with the broadband router 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

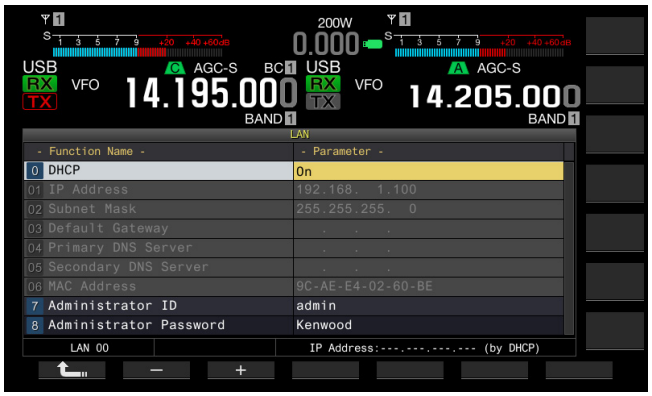
Note:

- 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.

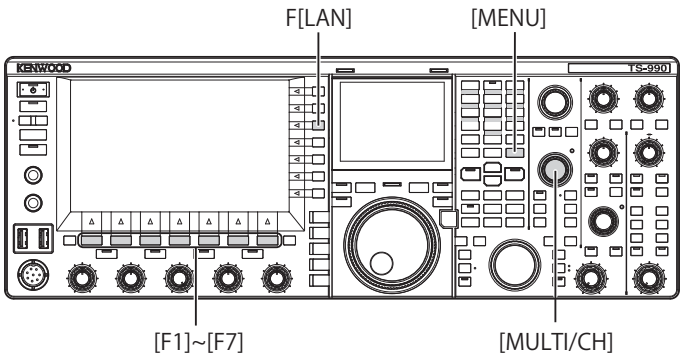


2 Check Menu 06, "MAC Address".
The transceiver's MAC address appears. This menu is only for confirmation; you cannot highlight Menu 06, "MAC Address", or change the configuration.

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.

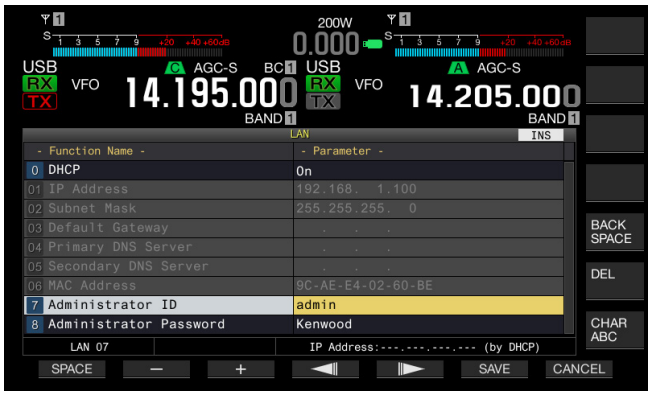


■ Configuring the Administrator ID

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.

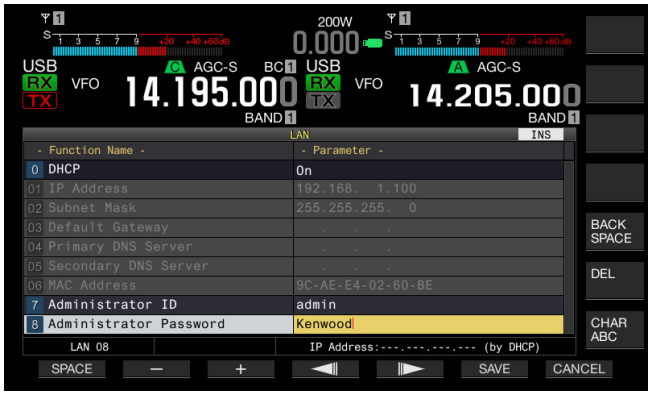
6 Press **[MENU]** to exit.

■ 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 the 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 the 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.

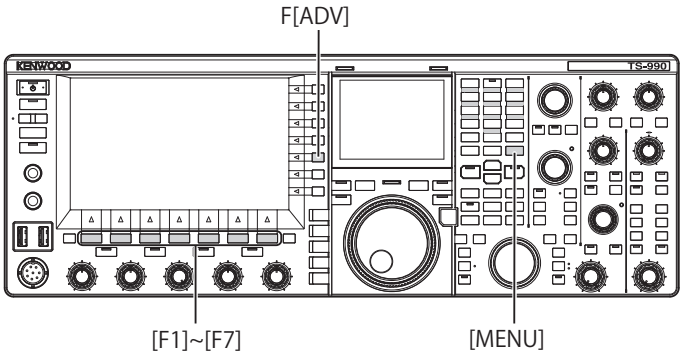
The METER terminal has the following output rating. {page 2-11}

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

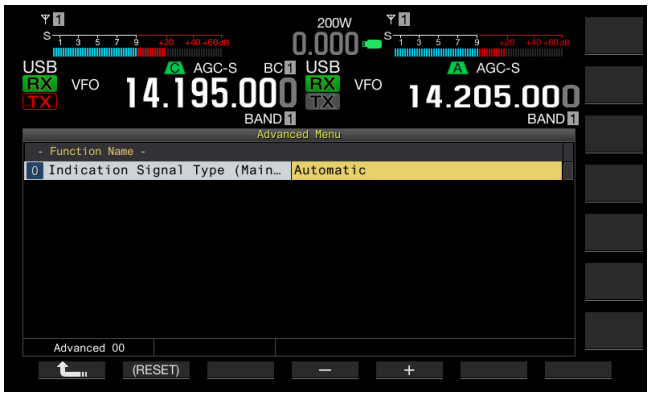
You can configure the signal type of the main band to be transferred to an external meter from the METER terminal.



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.

SWR

The SWR can be transferred.

5 Press [↵] (F1).

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

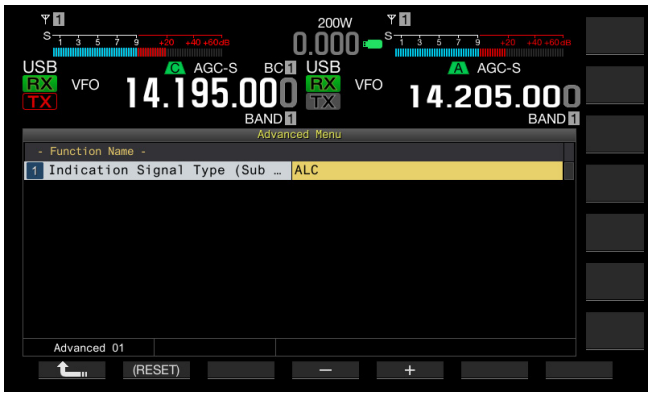
SELECTING THE OUTPUT SIGNAL TYPE OF THE SUB BAND FOR AN EXTERNAL METER

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.

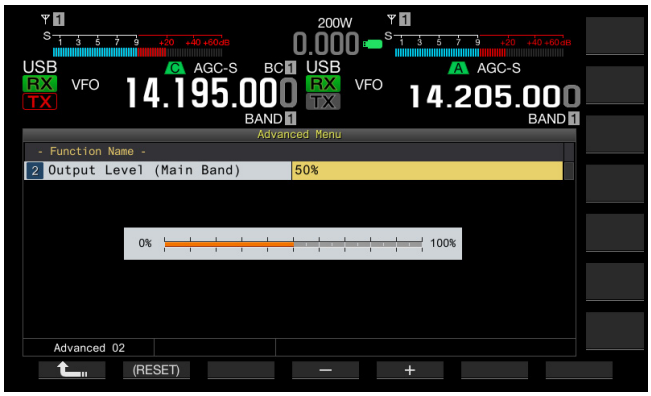
SETTING THE OUTPUT LEVEL OF AN EXTERNAL METER

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 the 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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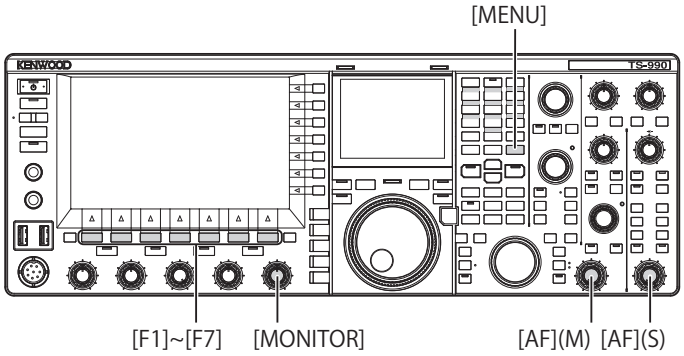
SELECTING THE OUTPUT SIGNAL OF AN EXTERNAL SPEAKER

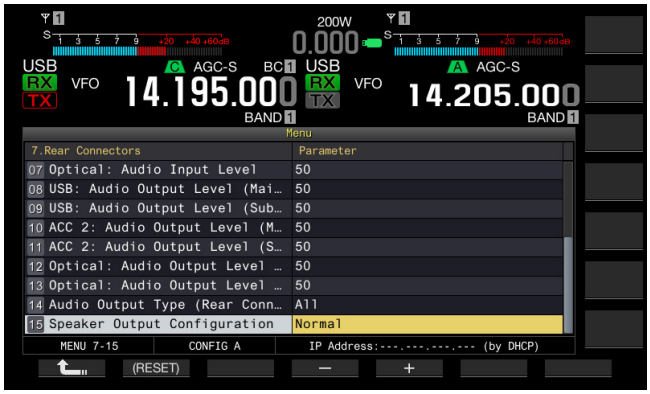
If an external speaker is connected to the **EXT.SP1** and **EXT. SP2** jacks on the rear panel for audio output, you can configure how the audio sounds from the external speaker.



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.

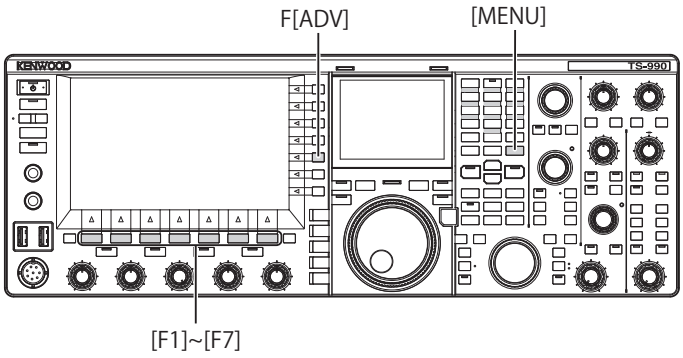
♦ If no external speaker is connected, the mixed audio of the received audio on the main band and that of the sub band will output from an internal speaker.

♦ 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

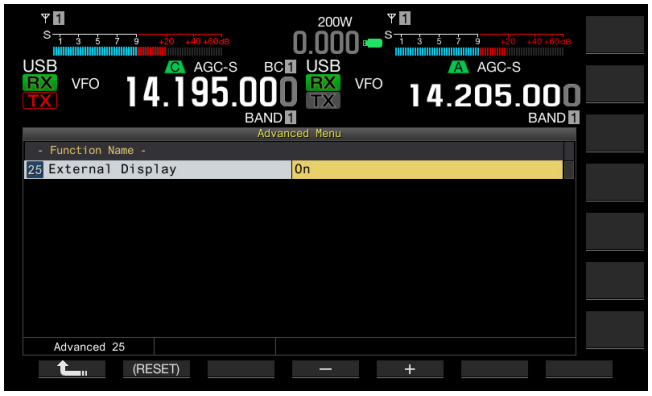
If you connect an external monitor to the **DISPLAY** connector, you can display the main screen image on the external monitor as well.



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 commercially 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 a commercially available DVI analog conversion adapter.

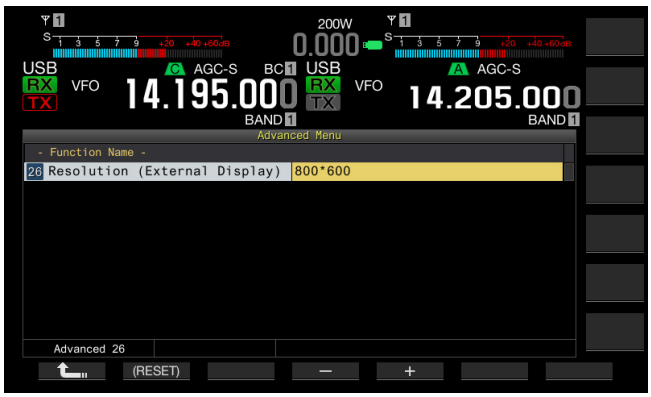
CONFIGURING THE RESOLUTION OF THE EXTERNAL MONITOR

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 the external monitor, the display may disappear until the changed configuration is 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.

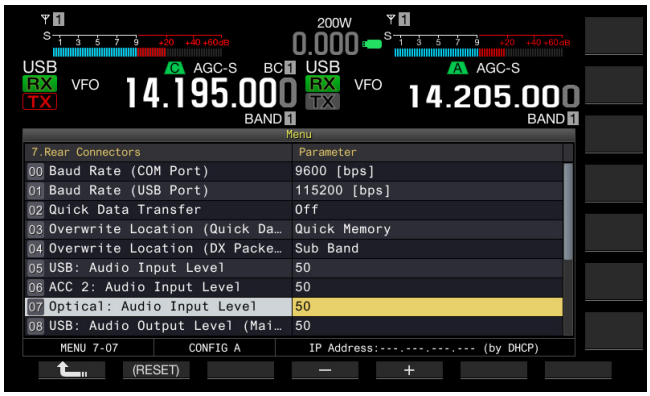
CONFIGURING THE INPUT AUDIO LEVEL

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.

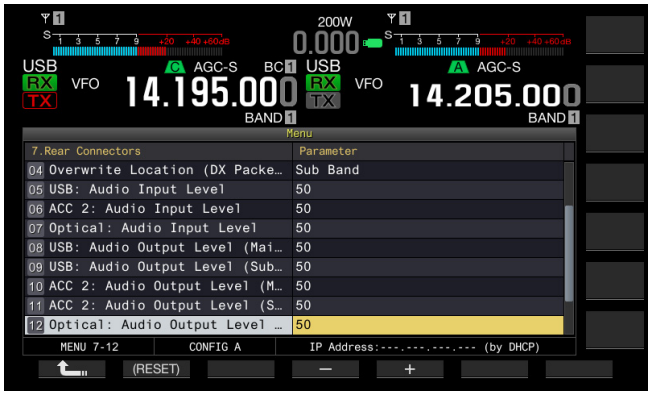
CONFIGURING THE OUTPUT AUDIO LEVEL

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.

SELECTING THE AUDIO OUTPUT FORMAT FROM THE OPTICAL OUT CONNECTOR

You can select the output format of the received audio sent from the **OPTICAL OUT** connector on the rear panel. With the default configuration, the received audio of the main band is an output for the left channel, and the received audio of the sub band is an output for the right channel.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 18, "Optical: Audio Output Configuration".

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

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "Normal", "Reversed", or "Mixed".
The default is "Normal".

5 Press [↩] (F1).

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

Note:

- Output audios vary depending on the parameter as follows.

Parameter	Left Channel	Right Channel
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

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.

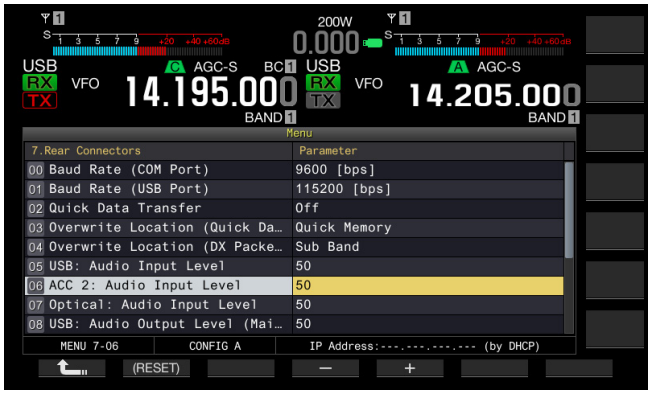
CONFIGURING THE INPUT AUDIO LEVEL

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.

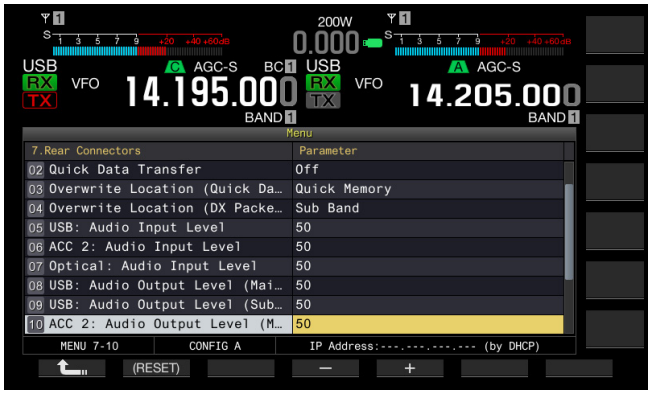
CONFIGURING THE OUTPUT AUDIO LEVEL

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.

SELECTING THE AUDIO OUTPUT FORMAT FROM THE ACC 2 CONNECTOR

You can select the output format of the received audio sent from the **ACC 2** connector on the rear panel. With the default configuration, the received audio of the main band is sent from the MANO terminal, and the received audio of the sub band is sent from the SANO terminal.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 17, "ACC 2: Audio Output Configuration".

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

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "Normal", "Reversed", or "Mixed".
The default is "Normal".

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

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

Note:

♦ Output audios vary depending on the parameter as follows.

Parameter	MANO Terminal	SANO Terminal
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

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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.

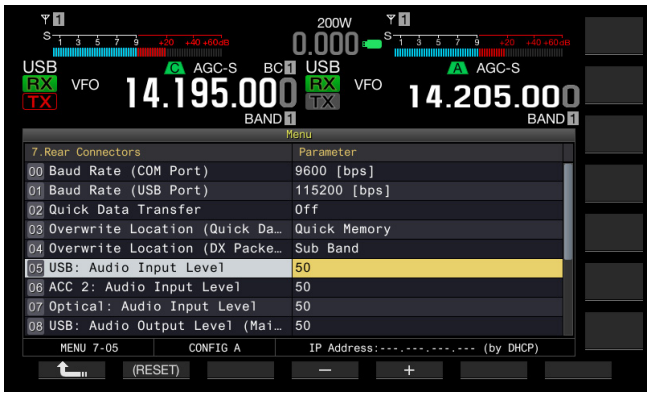
CONFIGURING THE INPUT AUDIO LEVEL

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}

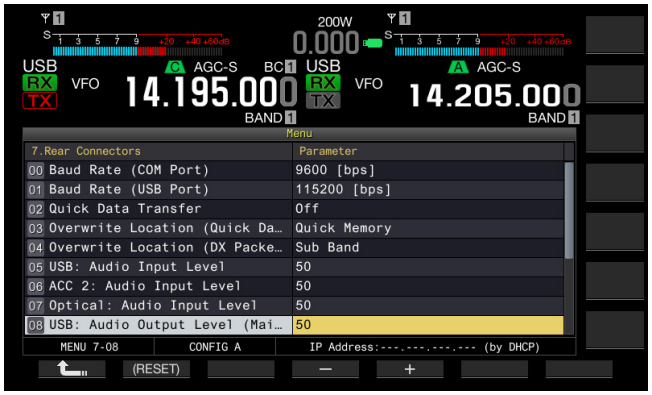
CONFIGURING THE OUTPUT AUDIO LEVEL

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 be individually 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.

SELECTING THE AUDIO OUTPUT FORMAT FROM THE USB CONNECTOR

You can select the output format of the received audio sent from the (USB-B) connector on the rear panel. With the default configuration, the received audio of the main band is an output for the left channel, and the received audio of the sub band is an output for the right channel.

1 Select Group No. 7, "Rear Connectors", from the **Menu** screen.

2 Access Menu 16, "USB: Audio Output Configuration".

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

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "Normal", "Reversed", or "Mixed".
The default is "Normal".

5 Press [ ] (F1).

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

Note:

- Output audios vary depending on the parameter as follows.

Parameter	Left Channel	Right Channel
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

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".

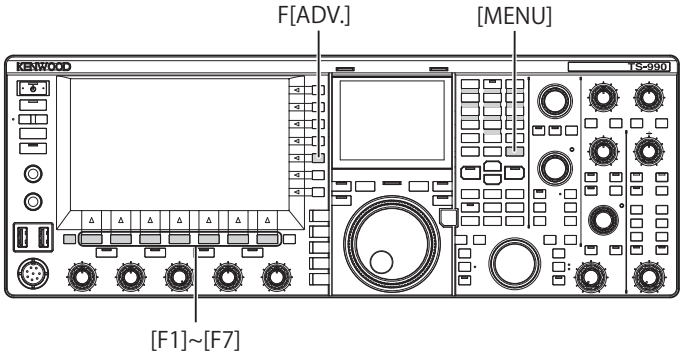
- Impedance : 50Ω

The frequency accuracy can be increased by entering a 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 it to be used as the reference frequency of other transceivers.

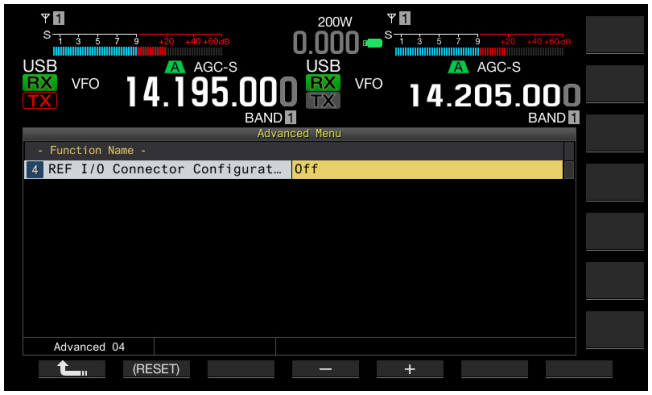
- Output Level : 0dBm



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

2 Access Menu 4, "REF I/O Connector Configuration".

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



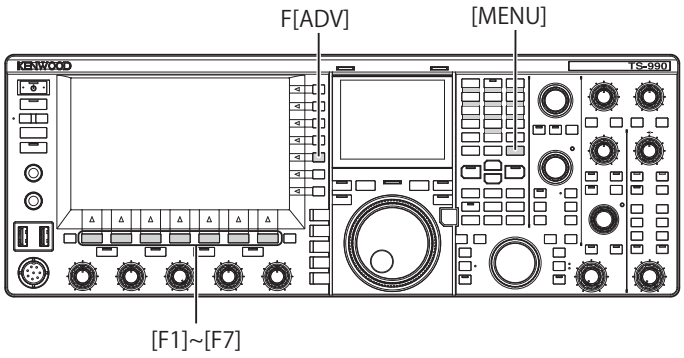
4 Press **[-]** (F4) or **[+]** (F5) to select the behavior of the REF I/O (10 MHz) connector from "Off", "Output", or "Input".
The default is "Off".

5 Press [⮌] (F1).

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

CONFIGURING A PERSONAL ROOFING FILTER (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.



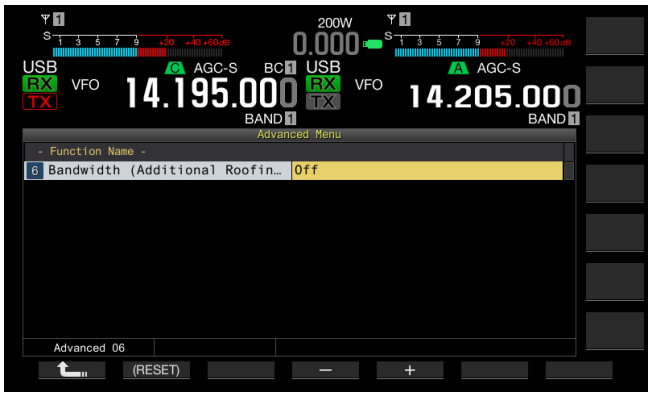
CONFIGURING THE PASSBAND WIDTH

You can configure the passband width 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 passband 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 passband width 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 passband width is selected.
- If anything other than "Off" is configured for the passband 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.

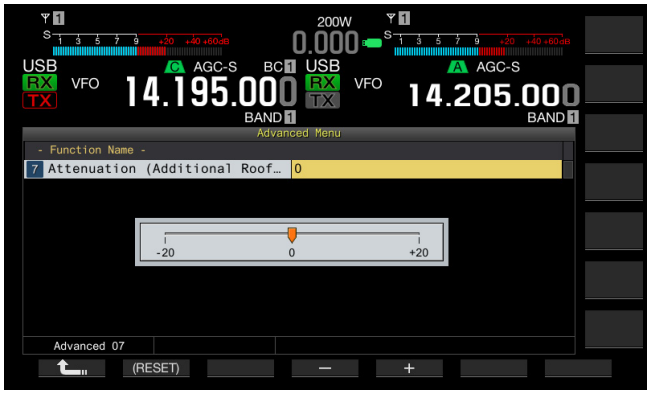
1 Press **[ADV.]** (F) from the **Menu** screen to open the **Advanced Menu** screen.

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.

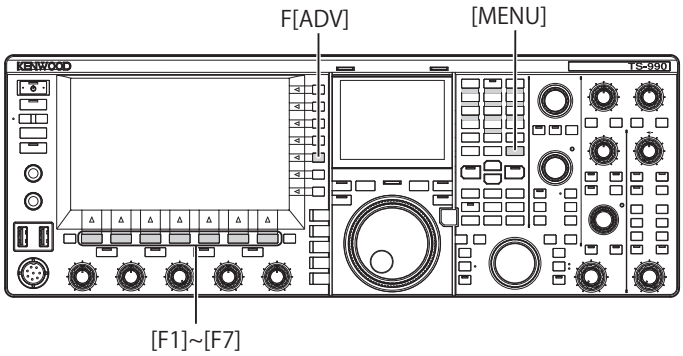
OPERATING THE TRANSCEIVER FOR A VOIP AMATEUR RADIO STATION

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.

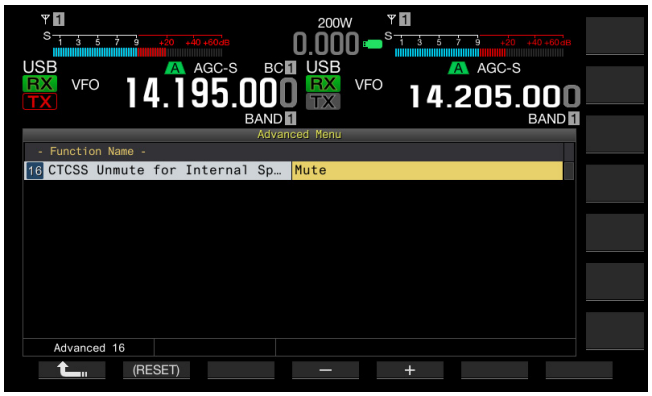
CHANGING THE CTCSS MUTE



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 details of the connector. {page 1-11}

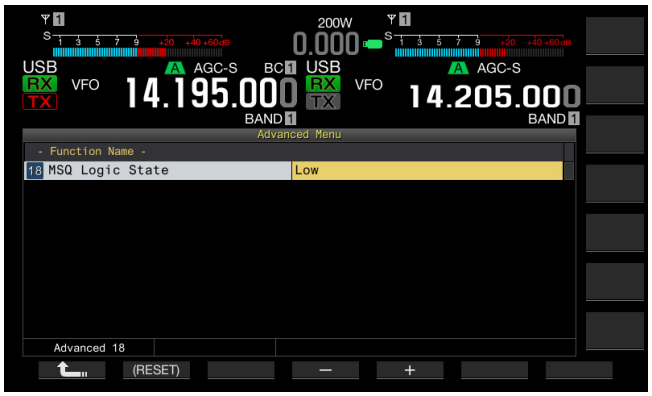
SELECTING THE MSQ/SSQ LOGIC

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 Band), 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.

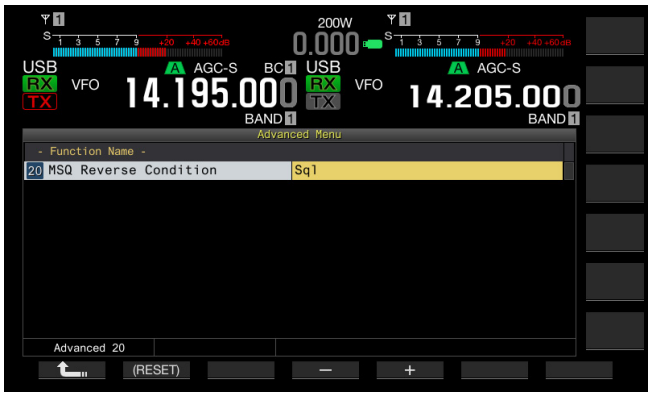
CONFIGURING THE MSQ/SSQ OUTPUT CONDITIONS

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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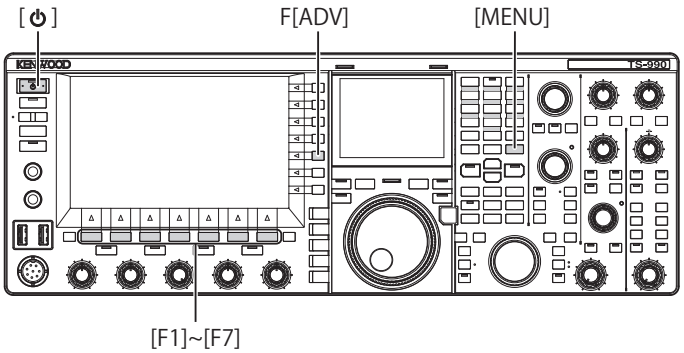
SWITCHING THE COM CONNECTOR PIN ARRANGEMENT

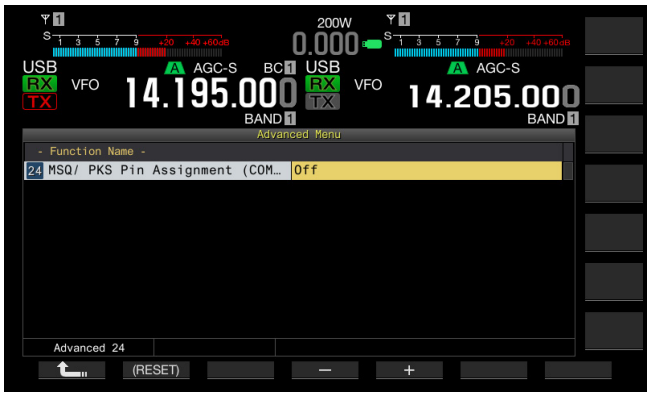
You can configure the RTS/CTS terminals of the **COM** connector on the rear panel allowing it to function in the same manner as the MSQ/PKS terminals of the **ACC 2** connector.



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 signals 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, then 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 Quick Data Transfer using two TS-990S, one must be configured as the master transceiver and the other as the slave transceiver.

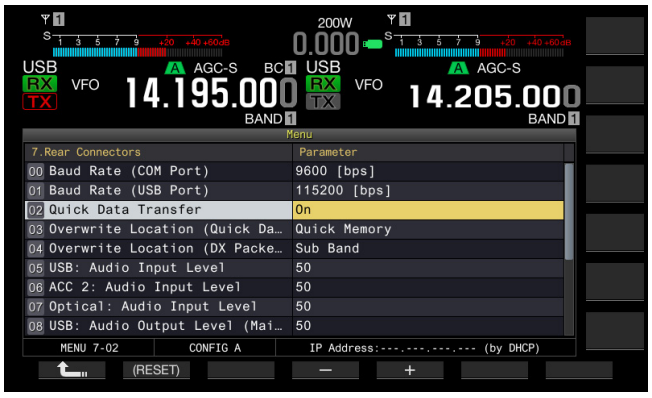
Note:

- During Quick Data Transfer using this transceiver and another 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

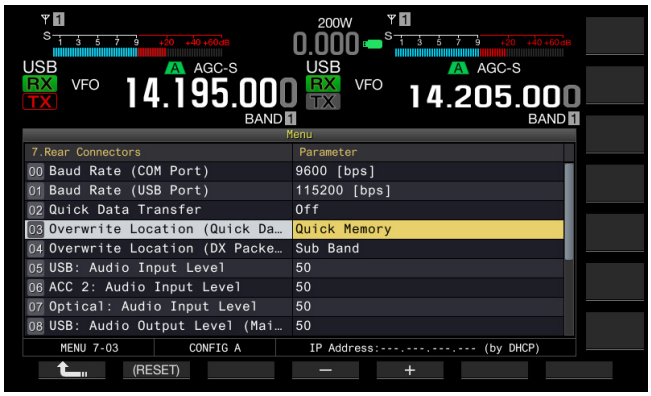
You can operate this transceiver as a slave transceiver that receives the operating data from a master transceiver. The transceiver uses either the VFO or quick memory channel 0 to receive the operating data from the master transceiver.

1 Enable Quick Data Transfer for both this transceiver and the master 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 method 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.

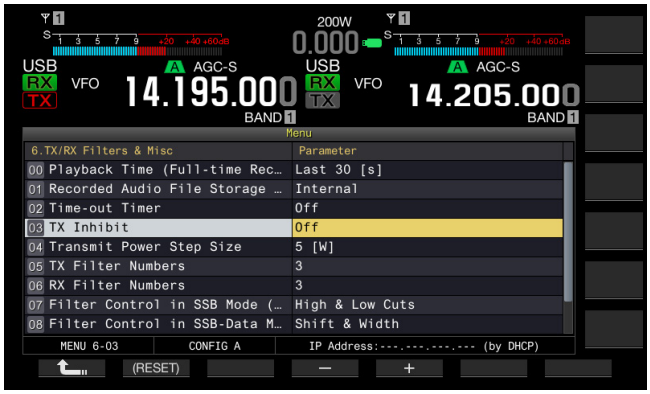
- You want to operate the master transceiver only for reception while two transceivers are in split transfer operation. The transceiver does not practically transmit and no audio sounds even if you attempt to transmit using the master transceiver.
- You do not want the host transceiver to transmit while 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 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

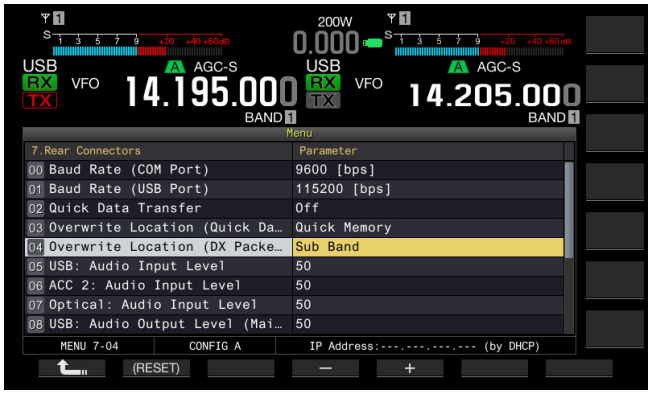
CONFIGURING THE TRANSCEIVER

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 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 the 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

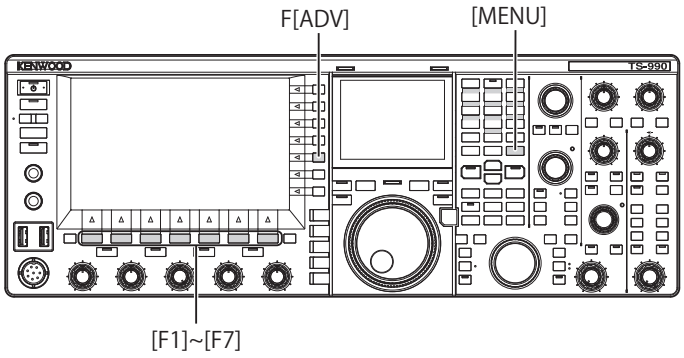
Note:

- 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 connection to the 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)

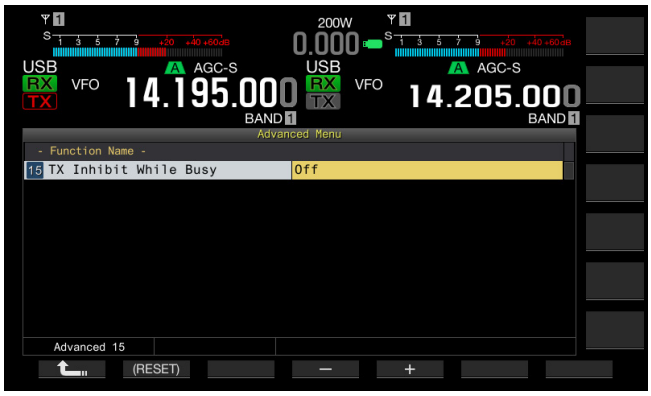
If transmission on the main band is inhibited while the transceiver is busy, the transceiver does not transmit even by pressing the **PTT** switch.



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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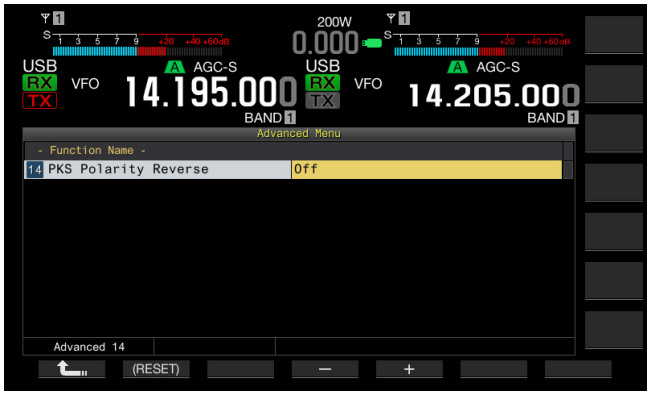
REVERSING THE PKS SIGNAL POLARITY

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

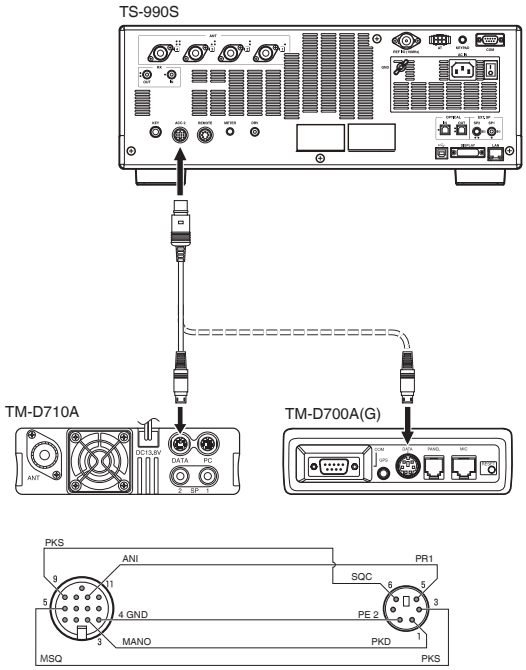
If you have the TM-D710A or TM-D700A (G) transceiver (K-type) with a 6-pin mini DIN connector, you can configure the TS-990S transceiver and the TM-D710A or TM-D700A (G) transceiver as a crossband repeater. The TM-D710A or TM-D700A (G) transceiver will receive signals you transmit from another VHF or 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; 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 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.



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 the 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.

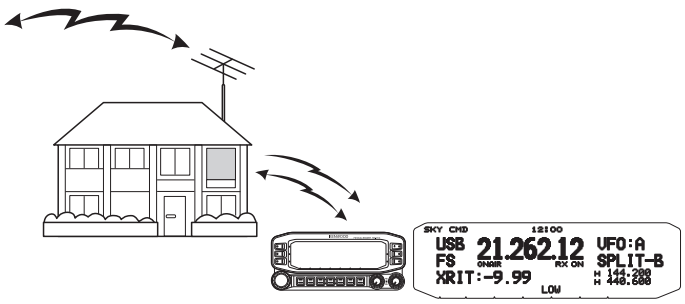
If you have two or more TH-D72A/E, TM-D710A/E, and TM-D700A transceivers, you can perform SKY COMMAND SYSTEM II operation to remotely control the HF/ 50 MHz band of your TS-990S transceiver.

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.

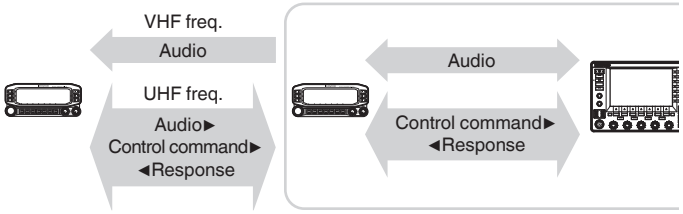
This system allows you, for example, to watch for and hunt DX while washing your car, or to operate the HF transceiver while relaxing in your car, living room, or patio, instead of actually operating inside your shack.

Note:

- Operating 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 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 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 the TS-990S, you need three customized cables. 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, the TS-990S also toggles the operating data between the main band and the 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.

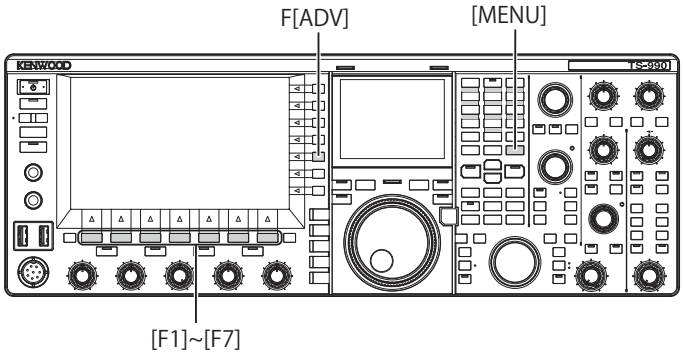
CONTROLLING THE LINEAR AMPLIFIER

While a linear amplifier is in use, you can configure 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.

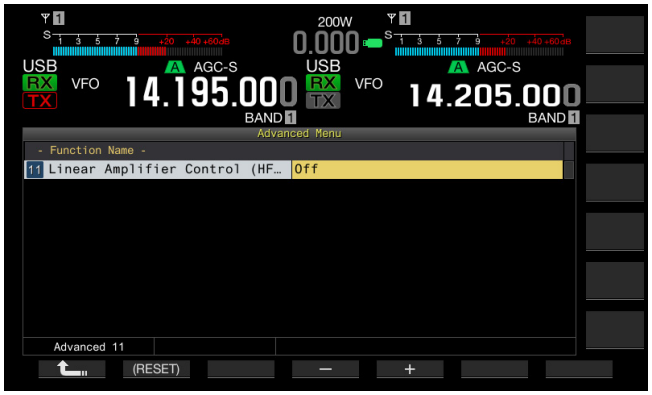
Refer to "INSTALLING AND CONNECTING THE TRANSCEIVER" for details of the connector. {page 1-10}



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

2 Access Advanced Menu 11, "Linear Amplifier Control (HF 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 RL terminal becomes 12 V. (10mA max.)
Active High + Relay Control	While transmitting, the RL terminal becomes 12 V. (10mA max.) The relay terminals (MKE, BRK) are controlled.
Active High + Relay & TX Delay Ctrl	While transmitting, the RL terminal becomes 12 V. (10mA max.) The relay terminals (MKE, BRK) are controlled. The start of transmission is delayed.
Active Low	While transmitting, the RL terminal becomes "Low". (Shorted to GND, 15V 10mA max.)
Active Low + TX Delay Control	While transmitting, the RL terminal becomes "Low". (Shorted to GND, 15V 10mA max.) The start of transmission is delayed.

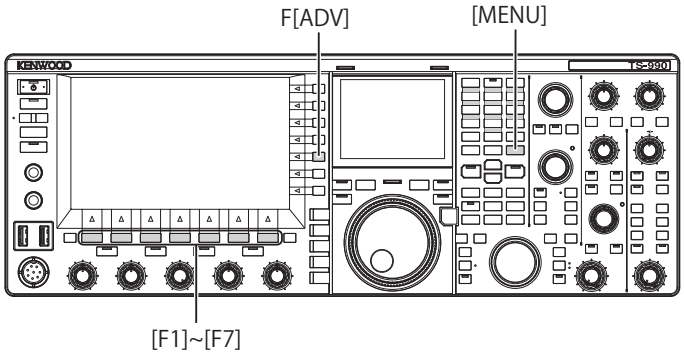
Note:

- If you are not using the control relay, select "Off", "Active High", or "Active Low" to suppress the relay noise.
- To connect a linear amplifier that requires time to change the antenna, select "Active High + Relay & TX Delay Ctrl" or "Active Low + TX Delay Control" 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 in 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.

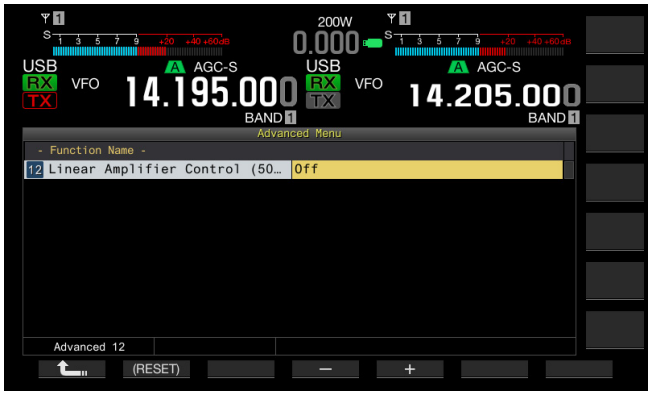
Refer to "INSTALLATION AND CONNECTION" for details of the connector. {page 1-10}



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

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

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

Configuration	Operation
Off	The linear amplifier is not controlled.
Active High	While transmitting, the RL terminal becomes 12 V. (10mA max.)
Active High + Relay Control	While transmitting, the RL terminal becomes 12 V. (10mA max.) The relay terminals (MKE, BRK) are controlled.
Active High + Relay & TX Delay Ctrl	While transmitting, the RL terminal becomes 12 V. (10mA max.) The relay terminals (MKE, BRK) are controlled. The start of transmission is delayed.
Active Low	While transmitting, the RL terminal becomes "Low".(Shorted to GND, 15V 10mA max.)
Active Low + TX Delay Control	While transmitting, the RL terminal becomes "Low". (Shorted to GND, 15V 10mA max.) The start of transmission is delayed.

Note:

- If you are not using the control relay, select "Off", "Active High", or "Active Low" to suppress the relay noise.
- To connect a linear amplifier that requires time to change the antenna, select "Active High + Relay & TX Delay Ctrl" or "Active Low + TX Delay Control" 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 transmission 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.

Index Contents

OPERATING THE TRANSCEIVER AS AN EXCITER OF THE TRANSVERTER

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 ON.

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 a 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 **[DRV]** to enable the transmission via the **DRV** connector.
   The "DRV" LED lights green.

■ To connect to the ANT connector

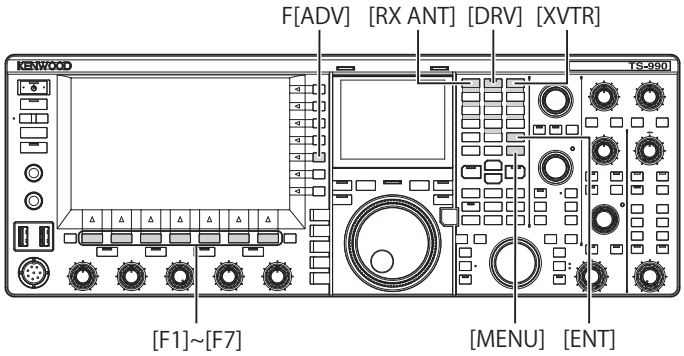
1. Connect the transverter to the **ANT** connector.
2. Press **[RX IN]** to disable the reception via the **RX IN** connector.
   " " appears on the main screen.
3. Press **[DRV]** to disable the transmission via the **DRV** connector.
   The "DRV" LED turns Off.

Note:

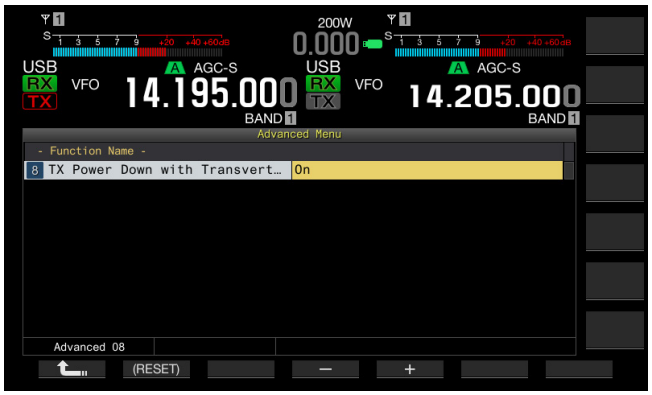
- Selecting the **RX IN** and **DRV** connectors disable transmission and reception using the **ANT** connector.

TRANSMIT POWER REDUCTION WHILE THE TRANSVERTER IS ENABLED

If the transverter is capable of 5 W or more RF input level and if a 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", a 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 in the last digit of the operating frequency in the transceiver disappearing.

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 is displayed on the main screen in units of 10 Hz or 100 Hz.
- In both the main band and the sub band, the displayed frequency can be changed.
- To connect a 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 the **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

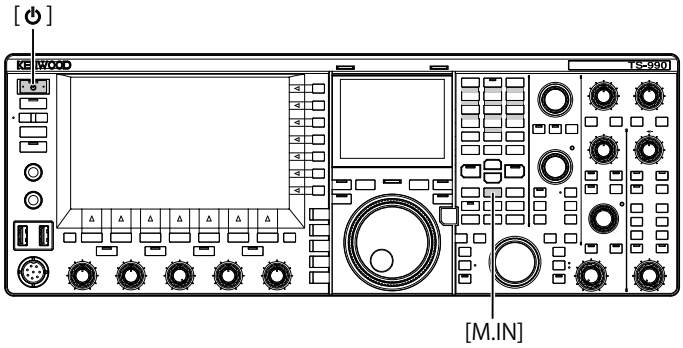
The firmware contained in a zip file and downloaded to a PC can be stored in a USB flash drive, and you can update the firmware by connecting the USB flash drive to the transceiver and processing the updating procedure.

Note:

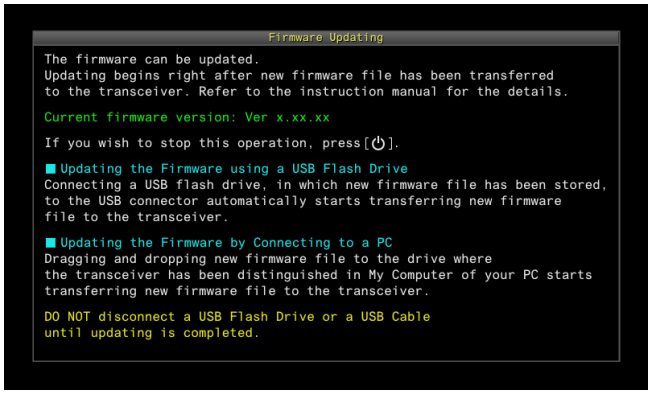
- After the firmware update is started, the firmware used before the firmware update has started cannot be restored even if you terminate the firmware updating.
- Once the firmware has been updated, the firmware installed at the time of purchase cannot be restored, even if you perform a transceiver reset 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 shows the firmware version.



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 zip file must be dragged and dropped without the firmware extracted. The extracted firmware cannot update the transceiver.

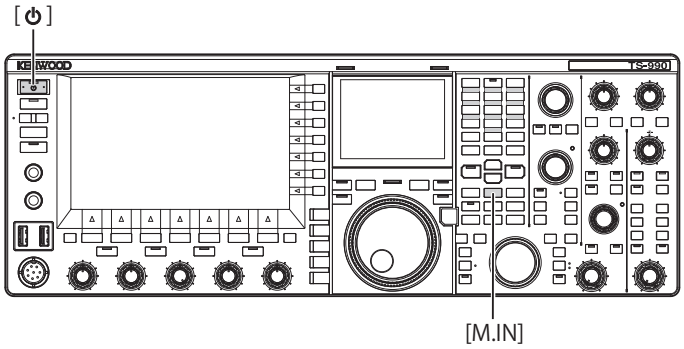
PREPARATION

1 Save the firmware file onto your PC.
The latest firmware can be downloaded from the KENWOOD website.

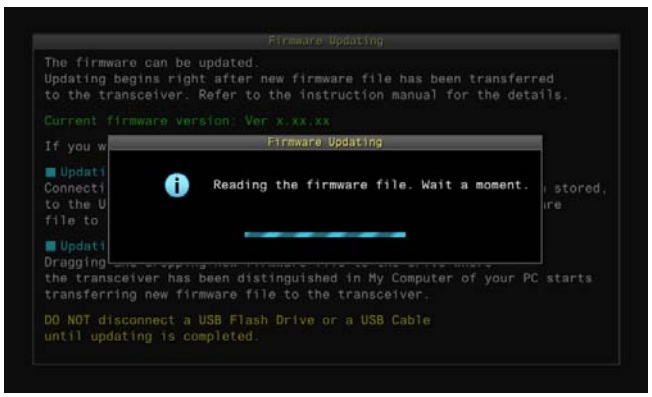
2 Connect a USB cable, extended from your PC, to the ⇐ (USB-B) connector on the rear panel.
You cannot update the firmware if the USB cable extended from your PC is connected to the ⇐ (USB-A) connector on the front panel.

YOUR OPERATION FOR THE TRANSCEIVER AND YOUR PC

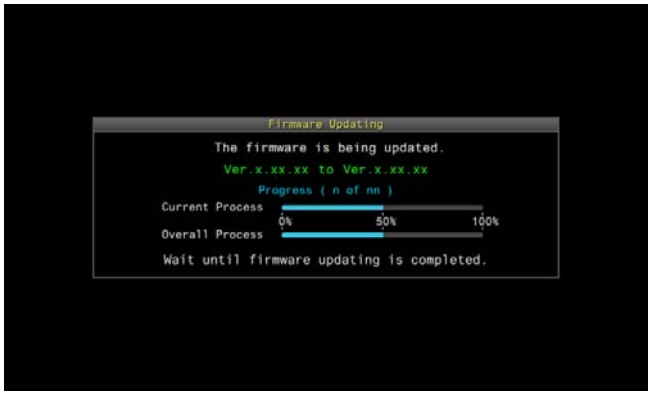
While the transceiver power (⏻) is turned OFF, the "⏻" LED lights orange. With the transceiver in this standby state, follow the procedure below to update the firmware.

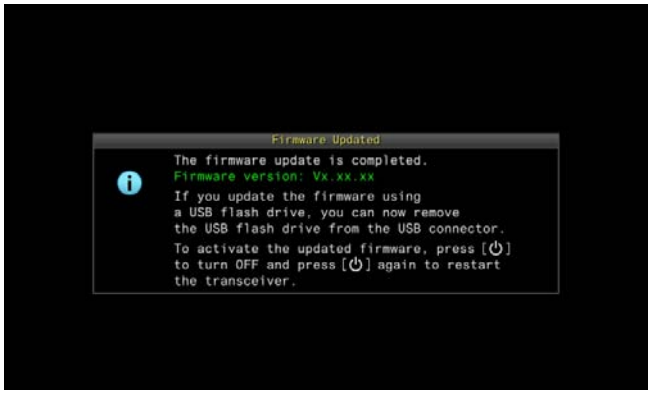


1 Hold down **[M.IN]** (Memory), then press **[⏻]**.
The transceiver starts up with the **Firmware Update** screen after the start screen appears. You can verify the transceiver firmware version. Upon detection of the transceiver by your PC, the transceiver is distinguished as a removable memory device and "TS-990" appears under My Document > removable memory device.



2 Drag and drop the zip 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 an RS-232C.
- If a message notifying you of an occurrence of the update failure appears during the firmware updating, refer to troubleshooting. {page 18-4}
- Depending on the number of CPUs being updated, the time necessary for updating may vary. It can take 20 to 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 remove the USB flash drive from the •⇆ (USB-A) connector.

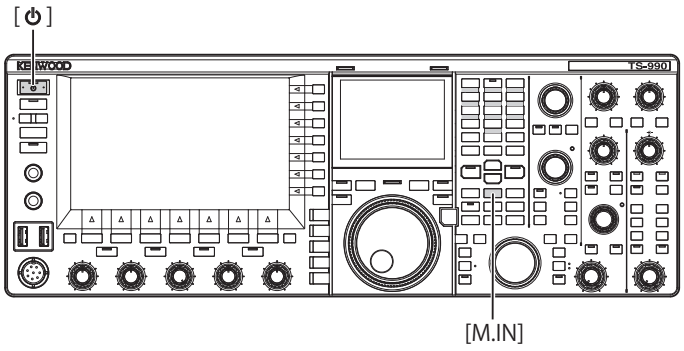
PREPARATION

1 Save the firmware file onto your PC.
The latest firmware can be downloaded from the KENWOOD website.

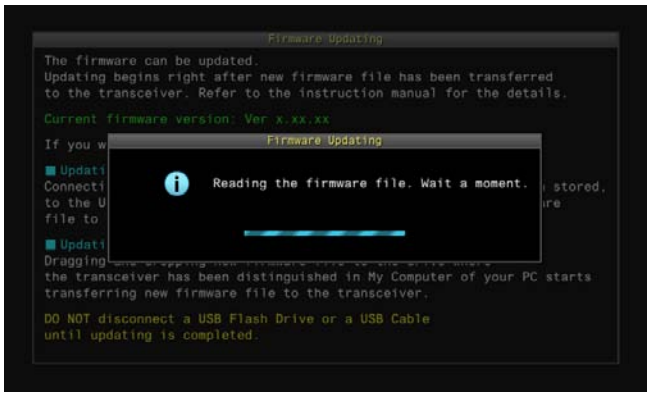
2 Save the firmware file to a USB flash drive.
- You must store the zip file containing the firmware in the root folder of the USB flash drive, otherwise the firmware cannot be updated.
- The firmware is distributed in zip format. Store the firmware as a zip file on the USB flash drive without extracting the zip file.

YOUR OPERATION FOR THE TRANSCEIVER AND YOUR PC

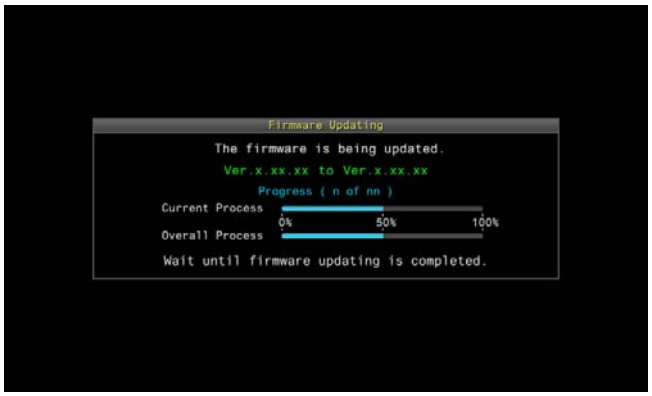
While the transceiver power (⏻) is turned OFF, the "⏻ " LED lights orange. With the transceiver in this standby state, follow the procedure below to update the firmware.

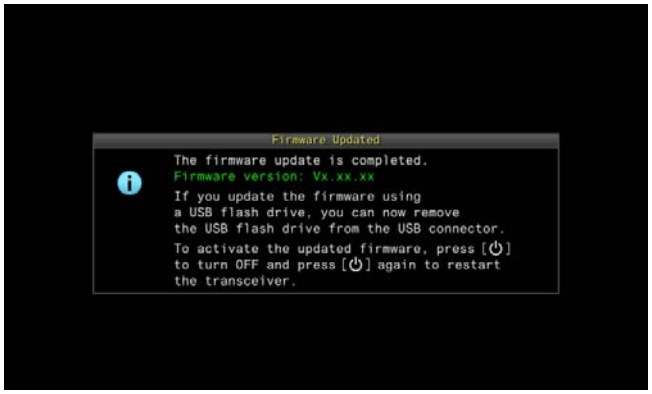


1 Hold down **[M.IN]** (Memory), then press **[⏻]**.
The transceiver starts up with the **Firmware Update** screen after the start screen appears. You can verify the transceiver firmware version



2 Insert the USB flash drive containing the firmware data file into the •⇆ (USB-A) connector on the 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 Remove the USB flash drive.

5 Press **[⏻]** again.
The transceiver restarts with the new firmware enabled.

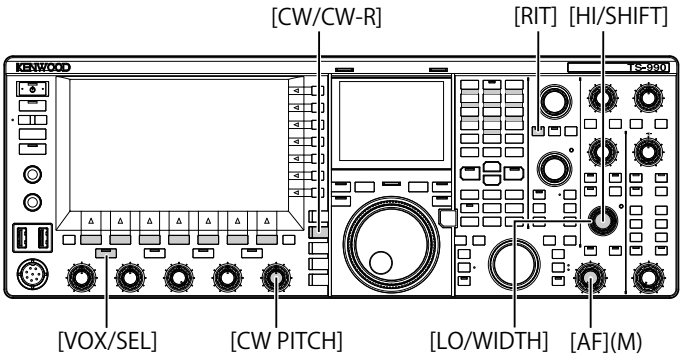
Note:

- If a message notifying you of an occurrence of the update failure appears during the firmware updating, refer to troubleshooting. {page 18-4}
- Depending on the number of CPUs being updated, 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 extended use, the internal reference frequency can be calibrated by receiving a 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.

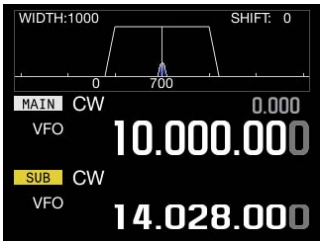
2 Press **[RIT]** to disable the RIT function.
The "RIT" LED turns Off.

3 Press **[VOL/SEL]** to enable break-in.
- If semi break-in is enabled, press **[VOX/SEL]** to disable semi break in.
- If full break-in is enabled, press **[VOX/SEL]** to disable 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.



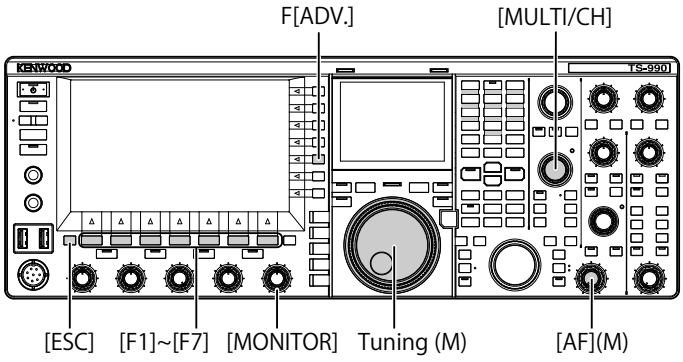
SUB-SCREEN

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 complete, 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.

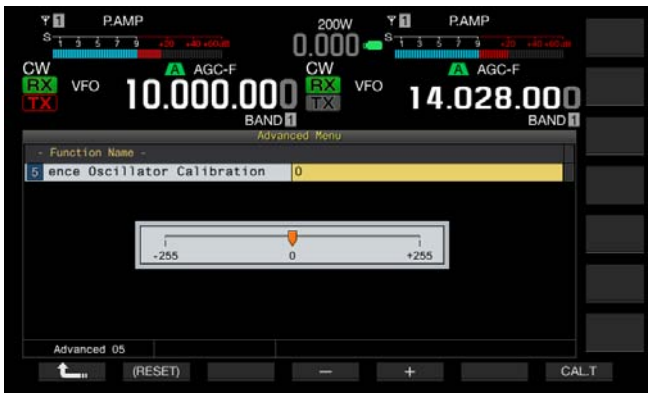
3 Access Menu 05, "Reference Oscillator Calibration".

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. A 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).

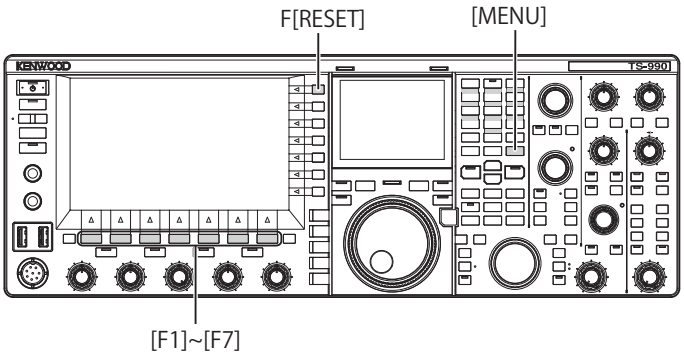
8 Press **[ESC]** to exit.

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. Reset the transceiver after the configuration data has been stored in another storage device.

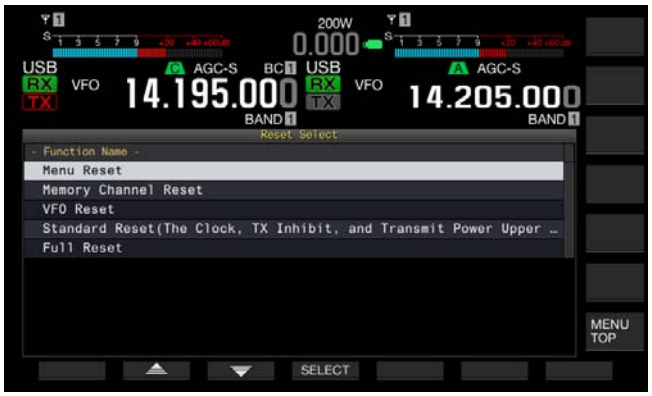


Follow the procedure below to fully reset the transceiver.

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) clears 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.

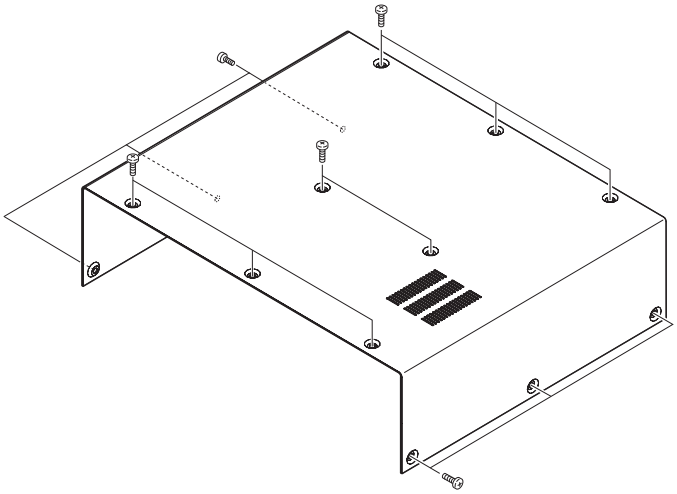
If the fuse blows again even after replacing it with a new fuse, disconnect the AC power cord and contact a KENWOOD service center.

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.

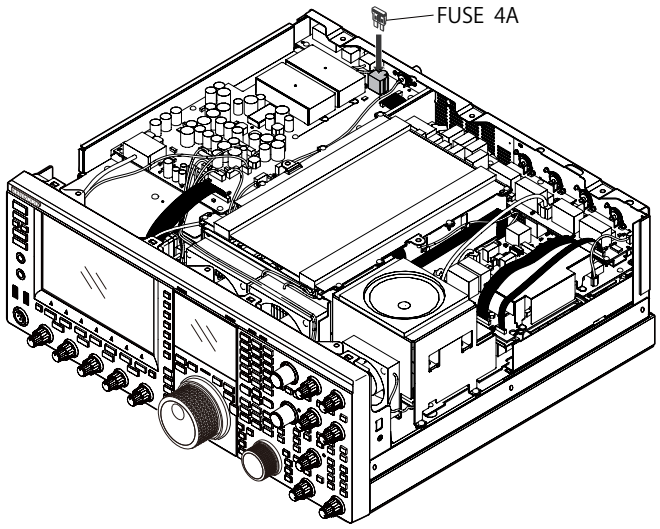
HOW TO REPLACE THE FUSE

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 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 SIGNAL 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 signal 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 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 instructions given in the 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 a 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 the 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 any 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. • As a result of storing multiple files at a time, the same name might be given to 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 PLL unlock was detected. Full Reset is required. If PLL unlock is still detected, note the error message number (ERR: 0048), and contact a 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 a 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; 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 the error message does not disappear even after the transceiver cools down, note the error message number (ERR: 0051), and contact a 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 a few 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 a KENWOOD service center.

ID	Message	Outline and What to do
0059	Failure in Deleting a File. (ERR: 0059)	Appears when deletion of a file fails. Be sure the USB flash drive is write protected.
005A	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 an external source cannot be detected. Be sure the signal is present at the **REF I/O** connector and that the signal level is sufficient.
005B	Safe Removal of USB Flash Drive 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 the USB flash drive fails. Follow the instruction given on the 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 a Full Reset. If this error message frequently appears, note the error message number (ERR: 005C), and contact a 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 firmware.	Appears if the transceiver attempts 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 the latest version.
005E	Corruption of the data was detected. (ERR: 005E) Executing a Full Reset will initialize the transceiver to the defaults. Press **[OK]** (F) to start the Full Reset.	Appears when 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 a Full Reset. If this error message frequently appears, note the error message number (ERR: 0060 to 0063), and contact a 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 a Full Reset. If this error message frequently appears, note the error message number (ERR: 0064 to 0067), and contact a 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 a Full Reset. If this error message frequently appears, note the error message number (ERR: 0068, 0069, 006A, 006B), and contact a KENWOOD service center.
	An unsolvable 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 firmware. If this error message repeatedly appears, contact a 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 an 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 in the 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 is 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 a 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 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: • A write protected USB flash drive is connected to a USB connector. • The USB flash drive is not correctly connected to a USB connector. A security-protected USB flash drive is connected to a USB connector.	Appears when formatting of the USB flash drive fails. • You attempt to format the USB flash drive while the transceiver is distinguishing the USB flash drive (the icon blinks). If formatting fails, remove the USB flash drive following the procedure of "Safe Removal of USB Flash Drive", then format the USB flash drive following the procedure of "USB Flash Drive Formatting".

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TROUBLESHOOTING

Prior to requesting 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 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 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 default.	{page 6-1}
	Configuration for the 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 is working properly.	{page 16-33}
	An additional filter has been enabled even though an 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 another 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 headphones.	{page 1-2}
	CTCSS tone is enabled in FM mode.	Deactivate 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 stereo headphones, 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 the S meter is dull.	Sensitivity of the S meter is low.	Select "High" for the 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 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 the Drive Output.	{page 4-21}
	The microphone is not correctly connected.	Review the connection.	{page 1-3}
	Keyer or paddle is not correctly connected.	Review the connection.	{page 1-3}
	A 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 2-11}
	The frequency is off band.	Select the frequency from the amateur band.	{page 4-8}
	TX Inhibit is active.	Disable 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 while 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 until the COMP meter readout indicates the appropriate range.	{page 9-6}
The VOX function does not behave.	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}
Transmission begins without any operation.	The VOX function is enabled, the VOX Gain Level is not appropriate.	Disable 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 the audio source then adjust the VOX Gain level.	{page 9-2}
You received a report from another station that your audio was distorted or clipped.	The microphone gain is too high.	With the transmit monitor function, or with having the 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 the 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 the 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 the 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 behave.	AT-300 was connected to something other than the **ANT 1** connector.	Connect the 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 retains the transmission even after 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 frequency tracking.	{page 5-3}
The frequency cannot be changed even with a rotation of the **Tuning** control.	Fine Tuning is enabled.	Disable 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 11-4}
	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 11-4}
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 **[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 sufficient remaining memory.	{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 pressing **[TIMER/SET]** after the time task by a timer has been set.	{page 15-5}
The frequency cannot be configured for the Program Timer.	The transceiver is in Memory Channel mode for the main band or sub band.	Select VFO mode for both the main band and the 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 the PC.	Refer to 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 the 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.	
The received audio sounds from one channel in a PC (the PC is connected to the **ACC 2** connector).	Monaural is configured in the 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.	

Symptom	Common Problem	What to do	Ref. Page
The **Firmware Updating** screen remains on 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 a 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 with the ARCP-990 using the COM port.	The baud rate is inappropriate.	Be sure that the baud rate configured for the 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 with the ARCP-990 using the USB port.	No driver is installed onto the 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 the 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 a KENWOOD transceiver, such as the TH-D72A/E, TS-590S, or TS-990S, is connected to the port which is different from the last used USB port, the OS assigns a new COM port number.	Keep connecting the KENWOOD transceiver to a PC using a USB cable, and delete the unnecessary COM port number from the "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 an NTP Server address.	{page 15-3}
	The NTP information cannot be transferred 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 a security capacity.	This transceiver does not accept USB flash drives having security capability.	{page 12-1}
	The USB flash drive deems to have been damaged.	Use a PC to check whether the USB flash drive connected to the transceiver properly works.	
	The USB flash drive does not conform to the standard.	Use a 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 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 security capacity.	This transceiver does not accept USB flash drives having security capability.	{page 12-1}
	The USB flash drive deems to have been damaged.	Use a PC to check whether the USB flash drive connected to the transceiver properly works.	
	The USB flash drive does not conform to the standard.	Use a 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}
	Insufficient remaining memory size	Use a 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 an already used file name.	{page 12-4}
Formatting of a USB flash drive failed.	You attempt to format the USB flash drive while "[redacted]" is blinking, and the formatting failed.	Remove the USB flash drive following the procedure of "Safe Removal of USB Flash Drive", then connect and format the USB flash drive again.	{page 12-1}
Safe Removal of USB Flash Drive failed.	Failure has occurred by any reason.	Press the main power switch (I/O) to the "O" position to shut down, then remove the USB flash drive. Depending on the status of data processing by this transceiver, some data may not be stored to the 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 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 mute is inactive during the timer recording. While 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 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 transmission. This does not function only for playing.	{page 13-3}
	Repeating is disabled.	Enable 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 a USB flash drive to store the received audio.	{page 12-1}
	Full time recording is selected.	A maximum recording time for Full time recording is 30 seconds despite the destination.	{page 13-5}
WAV file cannot be played.	The audio file has a different file format than what the transceiver can play.	The transceiver can play an 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 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 match the sampling rate of the sourcing device.	The sampling frequency for the entered signal is 44.1 kHz and 48 kHz, the number of bits is 24 or 16.	{page 2-9}
No signal is entered from the **OPTICAL OUT** connector.	The sampling rate of the transceiver does not match the sampling rate of the target device.	The sampling frequency for the signal to be transferred is 48 kHz, the number of bits 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

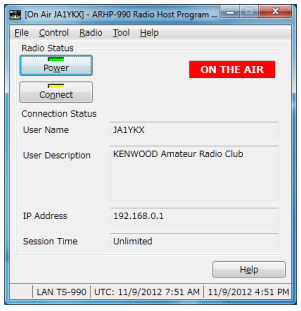
Note:

- Optional accessories that can be used along with this transceiver may from time to time be added or discontinued. Refer to the KENWOOD web site and catalog for details of the optional accessories.

DEDICATED APPLICATIONS

ARCP-990
Radio Control Program

ARHP-990
Radio Host Program



Note:

- The 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
Power supply voltage		AC 120 V ±10 % (60 Hz) (K-type) AC 220-240 V ±10 % (50/60 Hz) (E-type) *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 Double superheterodyne	Sub1 *3 Double superheterodyne	Sub2 *4 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 more		
IF Rejection Ratio		70 dB or more		
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).
*3 In 160m/80m/40m/20m/15m Amateur bands, IF bandwidth 2.7 kHz or less (SSB, CW, FSK, PSK)
*4 Except in above *3
*5 60m band: Refer to applicable Amateur Radio regulations for your country.

Internal beat may occur during amateur radio band reception depending on combination of main band and sub band Spurious signals other than the 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 developments.

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