

# 4 BASIC OPERATIONS

## Turning ON/OFF the Power

Check to ensure that the connections are correct before turning on the power of the regulated DC power supply.

### 1 Press [POWER].

When the power turns on, the [POWER] LED lights up in green. The message screen (“KENWOOD”, “HELLO”) is displayed, followed by the frequency display.



### 2 Press and hold [POWER].

The power is turned off.



- The message screen “HELLO” can be changed. (Menu [0-06] “Power-on Message”)
- When a voltage that exceeds approximately DC 18 V is applied, the overvoltage protection circuit is activated and the power is turned off automatically.
- When the temperature of this transceiver or the surroundings is extremely low, it may take a while before the screen reaches the normal level of brightness.



- To prevent damage of the internal data, do not turn off the regulated DC power supply while leaving the power of the TS-890S on.

### Current Flow when Power is OFF

When the power of the external power supply is ON, a small amount of electric current is flowing even when the power of this transceiver is OFF. The amount of current that flows through when power is OFF varies depending on whether this transceiver is connected to a PC or connected for KNS operation.

PC Connection via USB	KNS Operation Setting		
	Off	On (LAN) LAN MODE	On (Internet) WAN MODE
No	Approx. 4 mA	Approx. 20 mA	Approx. 150 mA
Yes	Approx. 95 mA	Approx. 110 mA	Approx. 210 mA

- Refer to (1-4) for details on PC connection and (15-2) for details on KNS operation.

## Screen Display Settings

The background color of the screen, function key guide display and font type for the frequency display can be changed.

### Changing the Background Color

A background color for the screen can be chosen from the three choices available.

#### ● Configure in Menu [0-00] “Color Display Pattern”

Setting Value	Type 1 (default)/ Type 2/ Type 3
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- Type 1:** Black
- Type 2:** Blue
- Type 3:** Dark green

### Changing the Type of Function Key Display

A function key display can be chosen from the three choices available.

#### ● Configure in Menu [0-01] “Function Key Style”

Setting Value	Type 1 (default)/ Type 2/ Type 3
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- Type 1:** Standard
- Type 2:** Gradation
- Type 3:** Illuminated

### Changing the Frequency Display Font Type

A font type for the frequency display can be chosen from the five choices available.

#### ● Configure in Menu [0-02] “Font Style (Frequency Display)”

Setting Value	Font 1 (default)/ Font 2/ Font 3/ Font 4/ Font 5
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- Font 1:** Type 1 fonts
- Font 2:** Type 2 fonts
- Font 3:** Type 1 italic fonts
- Font 4:** Type 2 italic fonts
- Font 5:** 7-segment fonts

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### Dimmer

Below are steps to adjust the brightness of the screen and LED.

#### Switching the Brightness Level

The preset brightness of the screen and LED can be adjusted according to the surrounding conditions.

- 1 Press **[MENU]**.
- 2 Press **F [DIMMER]**.  
Pressing **F [DIMMER]** each time switches the dimmer setting in the following sequence: "DIMMER 1" → "DIMMER 2" → "DIMMER 3" → "DIMMER 4".

#### Adjusting the Dimmer Level

The preset values for "Dimmer 1", "Dimmer 2", "Dimmer 3" and "Dimmer 4" can be configured to a different value for Display (screen) and LED respectively.

- 1 Press and hold **F [DIMMER]**.  
The Dimmer configuration screen appears.



- 2 Press **F2 [DIMMER]** to select a dimmer preset.
- 3 Press **F3 [◀|/ F4 [||▶]** to select "Display" or "LED".
- 4 Press **F5 [-]/ F6 [+]** or turn **[MULTI/CH]** to change the setting value.

The setting values and default values are shown below.

Dimmer	Display	Setting Value	Default
1	Display	5 to 100 (5-step)	100
	LED	5 to 100 (5-step)	100
2	Display	5 to 100 (5-step)	75
	LED	5 to 100 (5-step)	75
3	Display	5 to 100 (5-step)	50
	LED	5 to 100 (5-step)	50
4	Display	0 to 100 (5-step)	25
	LED	5 to 100 (5-step)	25

- Configuring the screen brightness to "0" and exiting the menu turns all the lights off. Pressing **[MENU]** at this time displays the screen with the dimmest level of brightness.

### Adjusting AF Gain

Below are the steps to adjust the volume so that sound can be heard from the speaker.

- Turn the **[AF]** control.  
Turning the control to the right raises the volume, while turning to the left lowers it.
  - If no sound is heard or if only a light noise-like sound is heard even when the **[AF]** control is turned all the way to the right, the squelch may be closed. Adjust the squelch level in this case.

- ! • The volume of the beep sound, sidetone and announcement cannot be adjusted using the **[AF]** control.

### Adjusting RF Gain

Below are the steps to adjust the gain of the RF amplifier. Under normal circumstances, turn the **[RF]** control all the way to the right. To enhance clarity when there is external noise or interference by other stations, turn the control slightly to the left to lower the gain level.

- Turn the **[RF]** control.
  - Start by checking the peak scale of the S meter, followed by turning the **[RF]** control in the anti-clockwise direction without lowering the peak value of the S meter. Doing so attenuates signals weaker than this level and eases reception from the desired station.
  - Depending on the type of antenna, gain level and band condition, better effect may sometimes be achieved by turning the **[RF]** control slightly to the left rather than all the way to the right.

- ✎ • In the FM mode, turning the **[RF]** control does not change the gain level. Under normal circumstances, turn the **[RF]** control all the way to the right.

### Adjusting the Squelch Level

Below are steps to adjust the threshold level for squelch, a function for eliminating noise that is heard when receiving a frequency with no signal.

- Turn the **[SQL]** control.  
Configure the squelch level to the position where noise disappears. When squelch opens upon receiving a signal, the **[BUSY/TX]** LED lights up in green.

- ! • The position of the **[SQL]** control at which noise disappears varies according to the strength of the noise and surrounding conditions such as temperature.
- The position of the control knob at which noise disappears also varies depending on whether this transceiver is in the FM mode or in other modes.

### Selecting VFO A/ B

This transceiver is equipped with two VFOs, A and B. The two VFOs operate independently of each other, and thus can be configured to different frequencies and modes. Additionally, one VFO can be configured to the TX frequency and the other to the RX frequency.

- Press **[A/B]**.  
Pressing **[A/B]** each time switches between "VFO A" and "VFO B". The currently selected VFO is indicated as << ◀ **A** >> or << ◀ **B** >>.
  - Pressing and holding down **[A/B]** configures both "VFO A" and "VFO B" to the same frequency and mode.

**Selecting an Operating Band**

Below are steps to select the frequency bandwidth to use. A different frequency bandwidth can be selected for VFO A and VFO B. By using the numeric keypad or [GENE] key, it is possible to call up an amateur frequency between 1.8 MHz and 50/70 (E type) MHz or a general band frequency at one touch.

- This transceiver comes with a band memory feature that is able to store up to 5 pairs of frequencies and modes (3 pairs in the default setting) that were used most recently for each band.

● **Press [1 (1.8)] to [0 (50)] or [GENE].**

- Pressing one of the above keys saves the current VFO frequency and mode and calls up the next memory band at the same time. Pressing the key each time switches to the next band memory in sequence from band memory 1 to band memory 5.
- Frequencies that are out of the range of the band memory will not be stored.
- The default values for each of the band memories are as follows.

**K Type**

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

**E Type**

Band/ Frequency (MHz)	Default Setting (MHz)/Mode				
	Band Memory 1	Band Memory 2	Band Memory 3	Band Memory 4	Band Memory 5
1.8 MHz/ 1.62 to 2	1.83/ CW	1.84/ CW	1.85/ CW	1.81/ CW	1.82/ CW
3.5 MHz/ 3 to 4	3.5/ LSB	3.55/ LSB	3.6/ LSB	3.65/ LSB	3.7/ LSB
7 MHz/ 6.5 to 7.5	7.0/ LSB	7.05/ LSB	7.1/ LSB	7.15/ LSB	7.2/ LSB
10 MHz/ 10 to 10.5	10.1/ CW	10.11/ CW	10.12/ CW	10.13/ CW	10.14/ CW
14 MHz/ 13.5 to 14.5	14.0/ USB	14.1/ USB	14.15/ USB	14.20/ USB	14.25/ USB
18 MHz/ 18 to 19	18.068/ USB	18.1/ USB	18.11/ USB	18.15/ USB	18.16/ USB
21 MHz/ 20.5 to 21.5	21.0/ USB	21.1/ USB	21.15/ USB	21.2/ USB	21.3/ USB
24 MHz/ 24 to 25	24.89/ USB	24.92/ USB	24.94/ USB	24.96/ USB	24.98/ USB
28 MHz/ 27.5 to 30	28/ USB	28.3/ USB	28.5/ USB	29/ FM	29.3/ FM
50 MHz/ 50 to 54	50/ USB	50.15/ USB	50.2/ USB	51/ FM	52/ FM
General/ 0.030 to 74.8	70.1/ USB	0.1357/ CW	0.472/ CW	0.999/ AM	5.2585/ USB



- When the number of band memories is reduced, the change will be applied when the band memory is switched.

**Changing the Number of Band Memories**

The number of band memories can be changed.

● **Configure in Menu [3-11] “Number of Band Memories”**

<b>Setting Value</b>	1/ 3 (default)/ 5
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### Selecting an Operating Mode

Below are steps to select an operating mode. It is also possible to configure the operating mode to DATA mode for data communication.

#### SSB (LSB-USB) Mode

##### ● Press [LSB/USB].

Pressing [LSB/USB] each time switches between "LSB" and "USB".



#### CW/ CW-R Mode

##### ● Press [CW/ CW-R].

Pressing [CW/ CW-R] each time switches between "CW" and "CW-R".

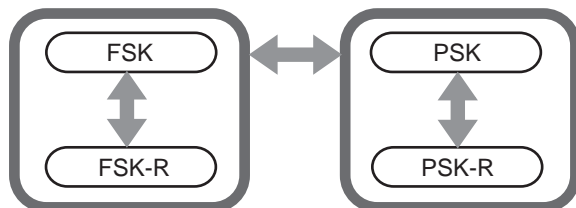


#### FSK/ FSK-R/ PSK/ PSK-R Mode

##### ● Press [FSK/PSK].

Pressing [FSK/PSK] each time switches between "FSK" and "PSK".

- Pressing and holding down [FSK/PSK] each time in the respective modes switches the mode to FSK-R and PSK-R.

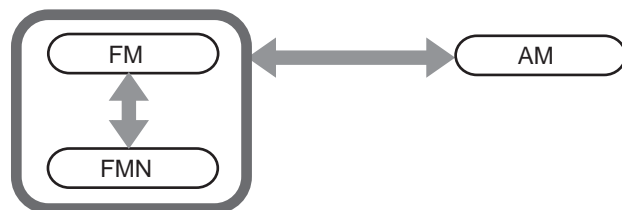


#### FM/ AM Mode

##### ● Press [FM/AM].

Pressing [FM/AM] each time switches between "FM" and "AM".

- While in the FM mode, pressing and holding down [FM/AM] each time switches between "FM" and "FMN" (FM Narrow).



- The mode and DATA mode settings are stored in the band memory.
- FM narrow and normal settings are stored in each of the following bandwidths: HF, 50 MHz and 70 MHz.

### DATA Mode

This is a mode for data communication by connecting an external device.

#### 1 Press the mode key to configure to FM, AM or SSB (LSB/USB) mode.

#### 2 Press [DATA].

Pressing [DATA] each time switches between "DATA OFF" and "DATA ON".

	DATA OFF	DATA ON
During LSB Mode	LSB	LSB-D
During USB Mode	USB	USB-D
During FM Mode	FM	FM-D
During FMN Mode	FMN	FMN-D
During AM Mode	AM	AM-D



- Turn OFF the speech processor before performing data communication.
- Settings such as the method of standby and muting audio input path that is not used during transmission can be configured for each of the DATA OFF and DATA ON statuses.

### Auto Mode

By configuring the auto mode frequency point and the corresponding operating mode in advance, the operating mode will switch automatically when the frequency exceeds the auto mode frequency point after it has been changed.

- Auto mode is a convenient function that allows automatic switching of the operating mode according to the band plan.
- Up to 32 points can be configured for the auto mode frequency.

### Turning ON/OFF Auto Mode

#### 1 Press [MENU].

#### 2 Press F [AUTO MODE] to display the Auto Mode screen.



#### 3 Pressing F1 [A.MODE] each time switches the Auto Mode to ON or OFF.

When the Auto Mode is turned ON, <<AUTO>> is displayed. This display disappears when Auto Mode is turned OFF.

### Configuring Auto Mode Frequency Points

#### 1 Display the Auto Mode screen.

#### 2 Turn the Tuning control to select a frequency point.

Align the frequency of the selected band with the frequency to register.

#### 3 Press the Mode key or press and hold down the key to switch to the mode to which the band is to be registered.

**4 Press F4 [COPY] to copy the frequency and mode.**

- The frequency and mode of the selected band is imported into the list as a new classification.
- To delete a registered classification, press F2 [▲] / F3 [▼] or turn the [MULTI/CH] control to select the row to delete, followed by pressing F5 [DELETE] to delete the row. Doing so shifts up the classifications after the deleted row in the list.

**5 Repeat the steps from 2 to 5 to configure the frequency and mode for all the points.**

**6 Press F6 [OK].**

- When the Auto Mode is turned ON, the mode that is assigned to the respective channels will be automatically selected. In the SSB mode, LSB mode will be selected for frequencies below 10.1 MHz, and USB mode will be selected for frequencies that are 10.1 MHz or higher.
- The table below shows an example when auto mode frequency is configured to the HF/50/70 MHz band.

Frequency	Mode	Preset Frequency Range
1.620 MHz	AM	30 kHz ≤ f < 1.62 MHz
2.000 MHz	CW	1.62 MHz ≤ f < 2.0 MHz
3.500 MHz	LSB	2.0 MHz ≤ f < 3.5 MHz
3.525 MHz	CW	3.5 MHz ≤ f < 3.535 MHz
10.100 MHz	LSB	3.535 MHz ≤ f < 10.1 MHz
10.150 MHz	CW	10.1 MHz ≤ f < 10.15 MHz
14.000 MHz	USB	10.15 MHz ≤ f < 14.0 MHz
14.070 MHz	CW-R	14.0 MHz ≤ f < 14.07 MHz
14.112 MHz	FSK	14.07 MHz ≤ f < 14.112 MHz
18.068 MHz	USB	14.112 MHz ≤ f < 18.068 MHz
18.110 MHz	CW	18.068 MHz ≤ f < 18.11 MHz
21.000 MHz	USB	18.11 MHz ≤ f < 21.0 MHz
21.070 MHz	CW	21.0 MHz ≤ f < 21.07 MHz
21.125 MHz	FSK-R	21.07 MHz ≤ f < 21.125 MHz
21.150 MHz	CW	21.125 MHz ≤ f < 21.15 MHz
24.890 MHz	USB	21.15 MHz ≤ f < 24.89 MHz
24.930 MHz	CW	24.89 MHz ≤ f < 24.93 MHz
28.000 MHz	USB	24.93 MHz ≤ f < 28.0 MHz
28.070 MHz	CW	28.0 MHz ≤ f < 28.07 MHz
28.150 MHz	FSK	28.07 MHz ≤ f < 28.15 MHz
28.200 MHz	CW	28.15 MHz ≤ f < 28.2 MHz
29.000 MHz	USB	28.2 MHz ≤ f < 29.0 MHz
30.000 MHz	FM-DATA	29.0 MHz ≤ f < 30.0 MHz
50.000 MHz	USB	30.0 MHz ≤ f < 50.0 MHz
50.100 MHz	CW	50.0 MHz ≤ f < 50.1 MHz
51.000 MHz	USB	50.1 MHz ≤ f < 51.0 MHz
52.000 MHz	FM	51.0 MHz ≤ f < 52.0 MHz
-	USB	52.0 MHz ≤ f < 60.0 MHz (K type) 52.0 MHz ≤ f < 74.8 MHz (E type)

**Adjustment of Frequencies**

The steps to adjust the TX and RX frequencies are described below.

**Adjustment Using the Tuning Control**

- Turn the Tuning control to increase or decrease the frequency.

**Adjustment Using the Microphone Key**

- Press the [UP] or [DWN] key on the microphone to increase or decrease the frequency.

**FINE Tuning**

The step frequency of the Tuning control can be configured to one-tenth of the step size. Doing so allows fine-tuning of the frequency.

- Press [FINE].  
Pressing [FINE] each time toggles FINE tuning between ON and OFF.



- When fine tuning is set to OFF, the 1 Hz digit frequency display will be grayed out. When in the FM or AM mode, both the 10 Hz and 1 Hz digits are grayed out. Setting fine tuning to ON turns off the gray-out display and shows the frequency in full up to the 1 Hz digit.
- Depending on the operating frequency, the 1 Hz digit display may not gray out on the operating frequency display of the transverter even when fine tuning is set to OFF.

**Configuring the Number of Steps per Revolution of the Tuning Control**

The number of steps per revolution of the Tuning control can be changed.

- Configure in Menu [3-07] “Tuning Control: Number of Steps per Revolution”

Setting Value	250/ 500/ 1000 (default) [Step]
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**Configuring the Fast Forward Rate of the Tuning Control**

This function enables the speed of frequency change to increase by 2 to 10 times with respect to the speed of turning when the Tuning control is turned at a fast speed.

- Configure in Menu [3-08] “Tuning Speed Control”

Setting Value	Off (default)/ 2 to 10 (1 step)
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**Configuring the Sensitivity for Starting the Fast Forward Operation**

Configuring this to a larger value increases the sensitivity for starting the fast forward operation.

- Configure in Menu [3-09] “Tuning Speed Control Sensitivity”

Setting Value	1 to 5 (default) to 10 (1 step)
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### Frequency Adjustment Using the [MULTI/CH] Control

Turning the [MULTI/CH] control enables the frequency to be changed quickly. The frequency increases or decreases in increments based on the configured step size.

- Turn the [MULTI/CH] control to increase or decrease the frequency.

The default frequency per step is 1 kHz in the SSB mode, 0.5 kHz in the CW/ FSK/ PSK mode, 5 kHz in the AM mode and 10 kHz in the FM mode.

### Rounding the Frequency

When the frequency is adjusted by turning the [MULTI/CH] control, the new frequency is automatically rounded to the integer multiple of the step size. Rounding of the frequency can also be disabled.

- Configure in Menu [3-00] “Frequency Rounding Off (Multi/Channel Control)”

Setting Value	Off/ On (default)
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### Configuring the Frequency Step Size of the [MULTI/CH] Control

The frequency per step when the [MULTI/CH] control is turned can be configured or changed to a different value for each mode.

#### SSB Mode

- Configure in Menu [3-01] “SSB Mode Frequency Step Size (Multi/Channel Control)”

Setting Value	0.5/ 1 (default)/ 2.5/ 5/ 10 [kHz]
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#### CW/ FSK/ PSK Mode

- Configure in Menu [3-02] “CW/FSK/PSK Mode Frequency Step Size (Multi/Channel Control)”

Setting Value	0.5 (default)/ 1/ 2.5/ 5/ 10 [kHz]
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#### FM Mode

- Configure in Menu [3-03] “FM Mode Frequency Step Size (Multi/Channel Control)”

Setting Value	5/ 6.25/ 10 (default)/ 12.5/ 15/ 20/ 25/ 30/ 50/ 100 [kHz]
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#### AM Mode

- Configure in Menu [3-04] “AM Mode Frequency Step Size (Multi/Channel Control)”

Setting Value	5 (default)/ 6.25/ 10/ 12.5/ 15/ 20/ 25/ 30/ 50/ 100 [kHz]
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### Switching the AM Broadcast Frequency in 9 kHz Steps

In the BC band (medium frequency band) from 522 kHz to 1710 kHz and LF band (long frequency band) from 153 kHz to 279 kHz, the RX frequency can be adjusted in steps of 9 kHz by turning the [MULTI/CH] control.

- Configure in Menu [3-05] “9 kHz Step in AM Broadcast Band (Multi/Channel Control)”

Setting Value	Off (K type: default)/ On (E type: default)
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### Adjusting Frequency in MHz Steps

The frequency can be adjusted in units of MHz.

- 1 Press [MHz].

Pressing [MHz] each time toggles the MHz step function between ON and OFF.

When the function is turned ON, <<[MHz]>> lights up.

- 2 Turn the [MULTI/CH] control while the function is turned ON.

The frequency increases or decreases according to the MHz frequency step configured in Menu [3-06].

### Configuring the Frequency Step Size in MHz

- Configure in Menu [3-06] “MHz Step”

Setting Value	100/ 500/ 1000 (default) [kHz]
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### Direct Input of Frequency Value

If the desired frequency is far apart from the current frequency value, the fastest way is to input the frequency value directly using the numeric keypad.

- 1 Press [ENT].

A screen to input the frequency for the operable band appears with all the frequency digits displayed as “-”.



- 2 Key in a frequency value using the numeric keypad.

- “-” changes into a numeric value when a numeric key is pressed and a value can be input starting from the highest-order digit.
- To enter 1.82 MHz, press [0/50], [1/1.8], [8/24] followed by [2/3.5], and press [ENT] when input is complete.
- To enter a frequency lower than 6 MHz for K type transceivers, start by keying in a “0”.
- To enter a frequency lower than 8 MHz for E type transceivers, start by keying in a “0”.
- Pressing [CLR] halfway through the input process clears the input and restores the VFO frequency display before the input.



- During fine tuning, a frequency up to 59.99999 MHz can be input (input of 60 MHz is not allowed).
- Pressing [ENT] halfway through the input process fills the remaining digits with “0” and completes the input.
- When a frequency value out of the TX and RX range is input, an alarm tone is output and the input value is automatically cleared.
- If the first input value is between 0 and 5, input starts from the 10 MHz digit. If the first input value is between 6 and 9, input starts from the 1 MHz digit.
- “0” that is entered up to the 10 Hz digit will not appear as “0” in the display.
- Inputting a frequency value automatically switches RIT and XIT to OFF but does not clear the offset frequency.
- When fine tuning is OFF, the smallest digit for input is the 10 Hz digit in modes other than AM and FM, and 100 Hz in the AM and FM mode.
- When in the auto mode, the mode switches automatically after input of frequency is complete.

### Frequency Input History

The latest 10 frequency values that were input using the numeric keypad are stored in the transceiver. To use the same frequency value, it is possible to retrieve it from the history.

- 1 Press [ENT] to enable input of a frequency value. “.” is displayed for all digits of the frequency value.
- 2 Turn the [MULTI/CH] control to display the history.
  - Frequency values that were previously entered and the record number (E0 to E9) are displayed. The first frequency value shown is the most recent input.
  - Turning the control to the right jumps to the subsequent record numbers in ascending order. The larger the record number, the older the record.



- 3 Press [ENT] to configure the selected frequency to VFO.



- When 10 frequency values have been registered, the oldest input in the history will be deleted when another frequency value is registered.

### Frequency Lock

The frequency lock function disables operation of specific keys or control knobs to prevent the frequency from being altered accidentally due to erroneous operation of the key or control knobs.

- Press [LOCK] to lock the frequency value. The [LOCK] LED lights up in orange. The following operations are disabled when frequency lock is turned on.
  - Frequency tuning
  - Change of memory channel
  - Change of quick memory channel
  - Direct input of frequency value
  - Registration of memory channel
  - Starting program scan or VFO scan
  - Starting memory scan or quick memory scan
  - Switching between the VFO and memory channel modes
  - Frequency band selection
  - Memory shift
  - Configuring the frequencies for VFO A and VFO B to the same value
  - Switching between VFO A and VFO B
  - Mode selection
  - Switching to FINE tuning
  - CW auto tune
  - Quick memory channel mode switch
  - Registration of quick memory channel
  - Touchscreen tuning



- When “Tuning Control Lock” is selected in Menu [3-10], only the Tuning control will be locked.

### Lock Target

This function allows the selection of a control knob to be locked.

- Configure in Menu [3-10] “Lock Function”

Setting Value	Frequency Lock (default)/ Tuning Control Lock
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**Frequency Lock:** Locks both Tuning and [MULTI/CH] controls.

**Tuning Control Lock:** Locks only the Tuning control.

### Transmission

#### Audio Transmission

- 1 Press and hold the [PTT] key on the microphone or press the [SEND] key. The transmitting status is activated and the [BUSY/TX] LED lights up in red.
- 2 Speak into the microphone in the normal tone and loudness.
- 3 Release the [PTT] key on the microphone or press the [SEND] key. Doing so restores the receiving status.

#### CW Transmission

Performing the following steps when a key or paddle is connected enables transmission in the CW mode.

- 1 Press [CW/ CW-R] to select CW mode.
- 2 Press [VOX] to enable break-in.
- 3 Operate the keyer or paddle.

#### Adjusting Microphone Gain

Microphone gain can be adjusted in the SSB or AM mode as follows while referring to the ALC meter display.

- 1 Press and hold the [PTT] key on the microphone or press the [SEND] key.
  - The transmitting status is activated and the [BUSY/TX] LED lights up in red.
- 2 Speak into the microphone in the normal tone and loudness.
- 3 Turn the [MIC/PITCH] control to adjust the microphone gain level. Microphone gain is displayed as “MIC:nnn” at the top of the screen. [nnn: 0 to 100]



#### When in the SSB mode

Turn the [MIC/PITCH] control while speaking into the microphone. The ALC meter fluctuates according to the volume level. Ensure that the maximum level does not exceed the ALC zone during the adjustment.

#### When in the AM mode

Turn the [MIC/PITCH] control while speaking into the microphone. Adjust in such a way that the PWR meter fluctuates slightly according to the volume level.

- 4 Release the [PTT] key on the microphone or press the [SEND] key. Depending on the squelch level setting, the [BUSY/TX] LED may light up in green or go off.

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- Speak into the microphone in the normal tone and loudness. Make sure that your mouth is not too close to the microphone and do not speak too loudly. Doing so may increase the extent of distortion, thus causing audibility to deteriorate at the receiving end.
- To use a speech processor, refer to “[Speech Processor](#)”.
- Note that the output level tend to be larger when a microphone with a built-in AF amplifier is used.
- Microphone gain in the FM mode can be configured in Advanced Menu [10] “Microphone Gain (FM Mode)”.

### Adjusting TX Output Power

Maintain a TX output power level that is as low as possible while ensuring that communication can be carried out smoothly. Doing so reduces the likelihood of interference with other stations. The TX output power level can also be adjusted while transmission is in progress.

#### ● Turn the [POWER] control to adjust the TX output power.

Turning the [POWER] control to the right increases the output level, while turning it to the left reduces the output level. The selectable range varies with the band and mode in use as follows.

	Other than AM	AM
HF Band	5 to 100 [W]	5 to 25 [W]
50 MHz Band	5 to 100 [W]	5 to 25 [W]
70 MHz Band (E type)	5 to 50 [W]	5 to 12.5 [W]



- Output is displayed in a step size of 1 W. An output of 12.5 W will be shown as “12 W”.

### Fine Adjustment of TX Output Power

It is possible to alter the step size when the [POWER] control is turned.

#### ● Configure in Menu [6-04] “Transmit Power Step Size”

Setting Value	1 [W]/ 5 (default) [W]

- 1[W]:** Adjusts the TX output level in a step size of 1 W.
- 5[W]:** Adjusts the TX output level in a step size of 5 W (e.g., 5, 10, 15...).

## TX Output Power Limiter

The TX output power limiter can be used to limit the TX output power. This is a function to prevent the TX output power level from exceeding the preconfigured level for each band when the [POWER] control is turned. It can also be used to limit TX output power only in the DATA mode with a specific band.

### Turning ON/OFF TX Output Power Limiter

#### ● Press F [MAX-Po].

Pressing F [MAX-Po] each time toggles the TX output power limiter function between ON and OFF.

- When the TX output power limiter is turned ON, pressing F [MAX-Po] displays the confirmation screen for turning off the TX output power limiter.



### Configuring the TX Output Power Limiter

#### 1 Press and hold F [MAX-Po] to display the TX output power limiter screen.



#### 2 Press F4 [◀|||] / F5 [|||▶] to select a frequency band.

#### 3 Press F2 [▲] / F3 [▼] to select the TX output power to limit.

Select the TX output power item to limit as follows.

**Max Power Limit:** For configuring the TX output power limit during transmission.

- The TX output power limit can be configured separately for the SSB, CW, FSK/PSK, FM/AM and DATA modes.

**TX Tune Power:** For configuring the TX output power limit during TX tuning.

#### 4 Press F6 [-] / F7 [+] or turn the [MULTI/CH] control to select a limit value for TX output power.

- To restore the default setting, press and hold F1 [(RESET)].



- A different TX output power limit cannot be configured for the antenna connectors (antenna 1/2).
- If Advanced Menu [06] “TX Power Down with Transverter Enabled” is configured to “On”, the F [MAX-Po] and watt display at the right edge of the screen will disappear when the transverter or drive output is turned ON.



## Meter

The meter displays the measured reading of the S meter during reception and that of the selected meter during transmission.

### Changing the Meter Type

A digital meter and two types of analog meters are available for selection.

### Changing the Meter Type from the Menu

#### ● Configure in Menu [0-09] “Meter Display Pattern”

Setting Value	Digital/ Analog (White) (default)/ Analog (Black)
---------------	---

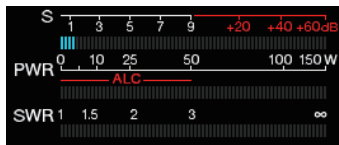
### Changing the Meter Type via Touchscreen Operation

#### ● Touch the meter display area while an analog or digital meter is displayed

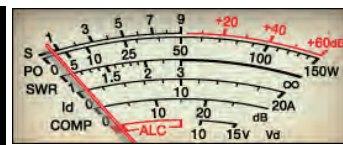
Touching the screen each time switches the meter in the following sequence: “Digital” → “Analog (White)” → “Analog (Black)”.

- When in the compressed mode, touching the meter will not change the display.

Digital Meter



Analog Meter



### Switching between TX Meters

#### ● Press F [METER].

Press F [METER] each time switches the display as follows according to the meter type.

**Analog meter display when the TX meter (digital) is OFF:**  
 “Po” → “SWR” → “Id” → “COMP” → “ALC” → “Vd” → ...

**Display at the bottom of the TX meter (digital) when the TX meter (digital) is ON:**

“SWR” → “Id” → “COMP” → “Vd” → “TEMP” → ...

**The last line of the display in the digital meter display mode:**

“SWR” → “Id” → “COMP” → “Vd” → “TEMP” → ...

**When a mini digital meter is displayed:**

“Po” → “SWR” → “Id” → “COMP” → “ALC” → “Vd” → “TEMP” → ...

Po	Indicates the TX output power. (Output power at the peak)
SWR	Indicates the standing wave ratio which reflects the matching status of the antenna.
COMP	Indicates the amount of TX audio amplitude that is compressed by the speech processor.
ALC	Indicates the ALC level.
Id	Indicates the drain current of the final FET.
Vd	Indicates the voltage of the final FET.
TEMP	Indicates the temperature of the internal circuit.



- An external meter can also be used to display the signal level by connecting an analog meter to the METER terminal on the rear panel.
- \*: COMP meter can only be selected when the speech processor is ON.

## FM Mode S-meter Sensitivity

The default deflection type in the FM mode is the same as that in the other modes. Selecting “High” switches the transceiver to the same deflection type (high sensitivity) as our conventional models.

#### ● Configure in Menu [0-07] “FM Mode S-Meter Sensitivity”

Setting Value	Normal (default)/ High
---------------	------------------------



- This function is available when Menu [0-11] “S-Meter Scale” is configured to “Type 1”.

## Analog Meter Response

Configure the response speed of the analog meter indicator.

#### ● Configure in Menu [0-08] “Meter Response Speed (Analog)”

Setting Value	1 to 3 (default) to 4 (1 step)
---------------	--------------------------------

## Meter with Peak Hold

Display the peak hold of the digital meter.

#### ● Configure in Menu [0-10] “Meter Display Peak Hold”

Setting Value	Off/ On (default)
---------------	-------------------

## S Meter Scale

Switch the type of deflection for the S meter.

#### ● Configure in Menu [0-11] “S-Meter Scale”

Setting Value	Type 1 (default)/ Type 2
---------------	--------------------------

**Type 1:** Same scale as our HF products.

**Type 2:** Initial deflection is more sensitive compared to Type 1.

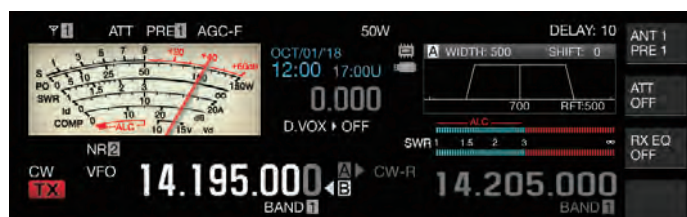


- Additional notes for “Type 2”
  - The S meter indicator will appear deflected at all times when there is external noise.
  - The movement may not be smooth as it is a pseudo representation of the S meter deflection.
  - Narrowing the RF gain may disrupt the continuity from S0 to S4.

## 4 BASIC OPERATIONS

### TX Meter (Digital)

In addition to the analog meter display, a two-tiered digital meter can also be displayed at the same time.



#### ● Configure in Menu [0-12] “TX Digital Meter”

Setting Value	Off (default)/ On
---------------	-------------------

- The TX meter (digital) only appears in the analog meter display mode.
- The TX meter (digital) is displayed in a two-tiered bar format. ALC is shown at the upper level, while the display at the lower level varies according to the setting of the F [METER] digital meter.
- During transmission, the analog meter always displays the TX output power.

### Switching the Antenna

Switch the antenna that is connected to the antenna connector. The ANT 1/2, RX ANT and DRV settings are automatically stored in the antenna band memory. When the same band is selected subsequently, the same antenna will be selected automatically.

#### ● Press and hold F [ANT/PRE].

Pressing and holding F [ANT/PRE] switches the option between “ANT 1” and “ANT 2”.

- When “ANT 1” is selected, << [1] >> is displayed. When “ANT 2” is selected, << [2] >> is displayed.

Selectable Antenna Frequency Range (MHz)	
0.03 to 0.522	10.5 to 14.5
0.522 to 2.5	14.5 to 18.5
2.5 to 4.1	18.5 to 21.5
4.1 to 6.9	21.5 to 25.5
6.9 to 7.5	25.5 to 30.0
7.5 to 10.5	30.0 to 60.0
60.0 to 74.8 (E type)	

### RX Antenna

Select an RX antenna.

To use an RX antenna such as an HF low-band Beverage antenna or a directional loop antenna, connect it to the RX IN terminal on the rear panel. The input impedance is 50 Ω. A self-made or commercially available BPF or trap filter can also be inserted between the RX IN and RX OUT terminals.

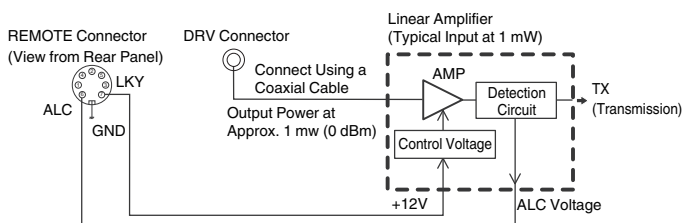
#### ● Press [RX ANT].

Pressing [RX ANT] each time enables or disables the RX antenna of the selected band.

When the RX antenna is enabled, << [RX] >> is displayed on the screen.

### Drive Output (DRV)

The allowable output frequency ranges from the drive output (DRV) are the 135 kHz band (135.700 kHz to 137.799 kHz), 475 kHz band (472.000 kHz to 478.999 kHz) and the amateur bands between 1.9 and 50/70 MHz. The output impedance is 50 Ω and output level is approximately 1 mW (0 dBm).



### Turning ON/OFF Drive Output

#### ● Press [DRV].

Pressing [DRV] each time toggles drive output between ON and OFF.

- When drive output is ON, the [DRV] LED lights up in green.
- During output from the DRV terminal, TX signals will not be output from the ANT 1 and ANT 2 connectors.
- Transmission from the DRV terminal will not be displayed on the PWR meter. ALC (automatic level control) can be operated by inputting ALC voltage from an external device to the ALC terminal of the REMOTE connector. The operating status will be displayed on the meter in this case. The DRV output level is not controlled when there is no ALC voltage input. As such, the output level is determined according to the MIC input or [CAR] control settings.



- Pay careful attention to the connection when making use of drive output as described above.

### Adjusting the Drive Output Level

#### ● Turn the [POWER] control.

“nnn%” is displayed according to the selected drive output level. [nnn: 5 to 100]

- A different drive output level can be configured for the AM and modes other than the AM mode.
- The resolution [1% / 5%] for changing the drive output level can be switched using the Menu 6-04 “Transmit Power Step Size” setting.

Band/Mode		Setting Value	Default
HF	CW/FSK/PSK/SSB/FM/SSB-DATA/FM-DATA	5 to 100 [%] (1 step or multiples of 5)	100
	AM/AM-DATA	5 to 25 [%] (1 step or multiples of 5)	25
50M	CW/FSK/PSK/SSB/FM/SSB-DATA/FM-DATA	5 to 100 [%] (1 step or multiples of 5)	100
	AM/AM-DATA	5 to 25 [%] (1 step or multiples of 5)	25
70M (E Type)	CW/FSK/PSK/SSB/FM/SSB-DATA/FM-DATA	5 to 100 [%] (1 step or multiples of 5)	100
	AM/AM-DATA	5 to 25 [%] (1 step or multiples of 5)	25

## Built-in Antenna Tuner

It is important to ensure that the impedance of the coaxial cable and that of the antenna coincide with each other. An external antenna tuner or the built-in antenna tuner is used to adjust the impedance between the antenna and this transceiver.

### Impedance Matching with the Antenna

- 1 **Select a TX frequency.**
- 2 **Press F [ANT] to select an antenna.**
  - When an external antenna tuner is connected to the ANT 1 connector, select ANT 2 if the built-in antenna tuner is to be used.
  - The built-in antenna tuner cannot be used with ANT 1 when it is connected to an external antenna tuner.
- 3 **Press and hold [AT] to perform tuning.**
  - The transceiver switches to the CW mode and starts tuning. TX output power is automatically configured to 10 W and the SWR meter will be selected as the TX meter.
  - <<R[AT]T>> and [AT] LED will start to blink. "R<" blinks when the antenna tuner is ON during reception.
  - To undo the tuning, press [AT] again.
  - If the SWR (standing wave ratio) of the antenna is extremely high (10:1 and above), an alarm tone ("SWR" in the Morse code) will be output, and the built-in antenna tuner will be disabled.
  - Adjust the antenna to lower the SWR before restarting the tuning operation.
- 4 **Check to ensure that tuning is complete.**
  - When tuning is completed successfully, a Morse code tone "T" is output.
  - When tuning is complete, the blinking <<R[AT]T>> and [AT] LED become lit in solid light. "R<" blinks when the antenna tuner is ON during reception.
  - If matching is not achieved for a duration of 20 seconds, an alarm tone will be output (continuous output of "5" in the Morse code). When this occurs, check the SWR meter and press [AT] to stop tuning when the SWR value is low.



- Tuning of the built-in antenna tuner will not be performed outside the permitted TX frequency range.
- During transmission, pressing and holding [AT] starts the tuning.
- If matching is not achieved for a duration of 60 seconds, tuning will end automatically. When this occurs, the antenna tuner circuit turns OFF, <<R[AT]T>> will disappear, and the [AT] LED will go off.
- If tuning does not end automatically even though the SWR of the antenna 3:1 or lower, adjust the antenna system to lower the SWR and try to perform tuning again.
- The SWR may not reach 1:1 even though tuning has ended.

### Preset

The tuning results can be stored as preset information in the built-in antenna tuner according to the preset frequency categories. When the built-in antenna tuner is ON, the preset information that corresponds to the current TX frequency is automatically configured for the built-in antenna tuner.

#### ● Press [AT].

- <<AT T>> appears on the screen. When the antenna tuner is ON while receiving, <<R>> is displayed. The preset information that corresponds to the current TX frequency is configured for the built-in antenna tuner.
- When the TX frequency is altered, the preset information that corresponds to the preset frequency category is automatically configured for the built-in antenna tuner.
- To turn off the built-in antenna tuner, press [AT] again.

**Preset Frequency Categories for Built-in Antenna Tuner (MHz)**

$0.030 \leq f < 1.850$	$14.100 \leq f < 14.500$
$1.850 \leq f < 2.500$	$14.500 \leq f < 18.500$
$2.500 \leq f < 3.525$	$18.500 \leq f < 21.150$
$3.525 \leq f < 3.575$	$21.150 \leq f < 21.500$
$3.575 \leq f < 3.725$	$21.500 \leq f < 25.500$
$3.725 \leq f < 4.100$	$25.500 \leq f < 28.300$
$4.100 \leq f < 6.900$	$28.300 \leq f < 29.000$
$6.900 \leq f < 7.050$	$29.000 \leq f < 30.000$
$7.050 \leq f < 7.100$	$30.000 \leq f < 51.000$
$7.100 \leq f < 7.500$	$51.000 \leq f < 52.000$
$7.500 \leq f < 10.500$	$52.000 \leq f < 53.000$
$10.500 \leq f < 14.100$	$53.000 \leq f < 60.000$
$60.000 \leq f < 74.800$ (E type)	

### Holding Transmission at the End of Antenna Tuning

Transmission can be held after antenna tuning has ended.

#### ● Configure in Advanced Menu [7] "TX Hold After AntennaTuning"

Setting Value	Off (default)/ On

- Off:** Returns to receiving state after antenna tuning has ended.
- On:** Continues 10 [W] transmission in the CW mode after antenna tuning has ended.



- When transmission is held after antenna tuning has ended, the held status will be canceled when transmission operations such as [SEND] or PF [DATA SEND] is performed or when [AT] is pressed.

## 4 BASIC OPERATIONS

### Switching Antenna Tuner Behavior during Reception

Signals received may be made to pass through the built-in antenna tuner. Turning ON this function may help to reduce reception interference from other distant frequencies.

#### ● Configure in Advanced Menu [8] “Antenna Tuner during RX”

Setting Value	Off (default)/ On
---------------	-------------------

**Off:** Signals received do not pass through the built-in antenna tuner.

**On:** Signals received pass through the built-in antenna tuner.

- When full break-in is ON in the CW mode, the antenna tuner will function during reception regardless of the above setting.
- If the TX and RX frequencies are different during split operation, the antenna tuner will not function during reception regardless of the above setting.

### Configuring the Built-in Antenna Tuner Behavior for Each Band

Two options to either store the ON/OFF status of the built-in antenna tuner separately for each band category or to store the same status for all bands are available.

#### ● Configure in Advanced Menu [9] “Antenna Tuner Operation per Band”

Setting Value	Off (default)/ On
---------------	-------------------

**Off:** Stores the same ON/OFF status of the built-in antenna tuner for all bands.

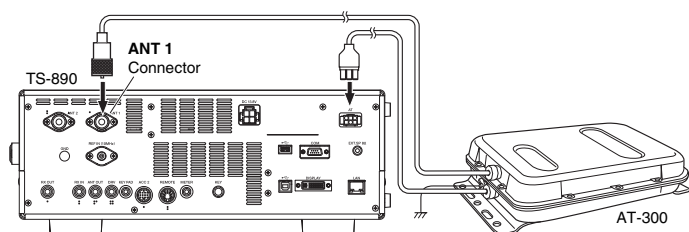
**On:** Stores the ON/OFF status of the built-in antenna tuner for each band category.

### Connecting the External Antenna Tuner AT-300

To use the external antenna tuner AT-300, connect it to the ANT 1 connector and AT connector.

- AT-300 will not function if it is connected to the ANT 2 connector. AT connector is a control terminal that is used exclusively for AT-300. It cannot be used to control other external antenna tuners. When an external antenna tuner other than AT-300 is connected, make use of TX tuning.

- AT-300 cannot be used with the 50/70 MHz band. When using a 50/70 MHz band antenna, connect it to the ANT 2 connector.
- When AT-300 is connected to the AT connector and ANT 1 is used, the signal bypasses the built-in antenna tuner circuit.
- Production of the AT-300 has been discontinued.



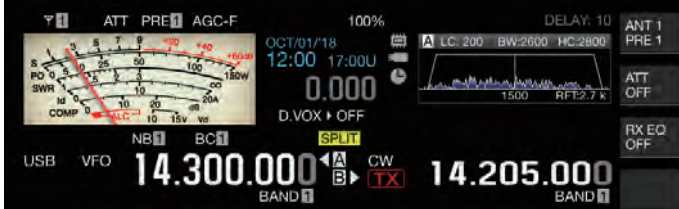
# 5 COMMUNICATING AIDS

## Split Operation

The same frequency is used for both reception and transmission during normal communication. Select either VFO A or VFO B in this case. However, depending on the circumstances, a different frequency may be chosen for reception and transmission. In this case, it is necessary to use two VFOs. This is known as “split operation”. “Split operation” is used in cases such as when using an FM repeater or when calling a DX station.

### 1 Press [SPLIT].

<< **SPLIT** >> lights up when the transceiver enters the split mode.



### 2 Press [A/B] to select “VFO A” or “VFO B”.

The value on the left is the RX frequency. (Indicated by ◀ **A** in the example)

The value on the right is the TX frequency. (Indicated by ▶ **B** in the example)

### 3 Select a frequency.

- To copy a selected VFO frequency to the other VFO, press and hold [A/B].

### 4 Press [A/B] to select the other VFO.

### 5 Select a frequency.

#### Exiting Split Operation

### 6 Press [SPLIT].

The transceiver switches to the simplex mode and the light for << **SPLIT** >> goes off.

## Direct Input of Frequency Difference Specified by DX Station

To directly configure the frequency difference between the frequency specified by the DX station and the RX frequency, perform the steps below while receiving signals from the DX station.

### 1 Press and hold [SPLIT].

- << **SPLIT** >> starts to blink.

### 2 Enter the frequency specified by the DX station in units of kHz.

To exit the configuration process, press [CLR].

If the frequency specified by the DX station is a positive value, enter the specified frequency in units of kHz using the numeric keypad.

If the frequency specified by the DX station is a negative value, enter a “0” at the beginning of the frequency value.

For example, if “+5 kHz” is specified, enter “5”. If “-5 kHz” is specified, enter “0” followed by “5”.

After input is complete, the TX frequency is configured and split operation is now enabled.

- << **SPLIT** >> changes from a blinking to a solid display.

## Turning the Tuning Control to Search for a TX Frequency

To search for a TX frequency, perform the steps below while receiving signals from the DX station.

### 1 Press and hold [SPLIT].

- << **SPLIT** >> starts to blink.

### 2 Turn the Tuning control to search for a TX frequency.

To exit the configuration process, press [CLR].

### 3 Press [SPLIT].

The frequency that is found in step 2 is configured as the TX frequency and split operation is now enabled.

- << **SPLIT** >> changes from a blinking to a solid display.

## ΔF Display

This item displays the difference between the RX frequency and TX frequency during split operation.



### ● Configure in Menu [6-15] “Delta Frequency Display”

Setting Value	Off/ On (default)
---------------	-------------------

- When the ΔF display is ON, << **ΔF** >> is displayed below the TX frequency display during split operation.
- When << **ΔF** >> is displayed below the TX frequency, the band memory number on the right will not be displayed.
- When RIT or XIT is ON, the ΔF value is the difference between the TX frequency and the RX frequency with the RIT or XIT frequency added.

## Changing the split frequency using the [RIT/XIT] control

While in the split mode with the RIT/XIT function set to OFF, the split frequency can be adjusted by turning the [RIT/XIT] control.

### ● Configure in Menu [3-12] “Split Frequency Offset by RIT/XIT Control”

Setting Value	Off (default)/ TX Frequency Offset while RX/ RX Frequency Offset while TX/ Both
---------------	---

**TX Frequency Offset while RX:** Split transmission frequency can be adjusted while receiving. While receiving signals from a DX-pedition station, turning the [RIT/XIT] control changes the TX frequency in advance to the frequency specified by the target station.

**RX Frequency Offset while TX:** Split reception frequency can be adjusted while transmitting. While one’s own station is transmitting as a DX-pedition station, turning the [RIT/XIT] control changes the RX frequency in advance to the frequency specified for the target station.

**Both:** Enables both the above.



- Adjustment of the split frequency using this function is disabled during TF-SET.

## Configuring the Band Direct Key during Split Operation

Three options are available for selection with regard to the behavior when the band direct key is pressed during split operation.

### ● Configure in Menu [3-13] “Band Direct Keys in Split Mode”

Setting Value	RX Band (default)/ RX Band and Cancel Split Mode/ RX/ TX Band
---------------	---

**RX Band:** Changes the receiving band.

**RX Band and Cancel Split Mode:** Changes the receiving band and cancels the split mode.

**RX/TX Band:**

- Changes both the receiving and transmitting bands at the same time.
- The transmitting band and receiving band is assigned with the same memory number.
- Each band can be adjusted while maintaining the split status.

# 5 COMMUNICATING AIDS

## TF-SET (Setting the TX Frequency)

TF-SET is a function for temporarily switching the TX frequency and RX frequency. Signals can be received at one's own frequency while the TF-SET switch is pressed and held down, and the TX frequency can also be changed in this state. Doing so allows checking of whether there is interference in the newly-selected TX frequency.

- A call is made to the target station when there is no interference and at the right timing to ensure smooth communication with DX stations that are receiving calls from a large number of stations. In other words, the communication status of the DX station in the presence of interfering signals are taken into consideration and transmission is carried out using the TF-SET function at the instant when the DX station is in the receiving state and there is no transmission from other stations. Putting this function to good use enables communication with a larger number of DX stations.

- 1 Configure the split operation frequency.**
- 2 Press and hold [TF-SET].**  
The TX frequency and RX frequency are switched.
- 3 Turn the Tuning control while pressing and holding [TF-SET], or press [UP]/[DWN] on the microphone.**  
Signals are received at the new TX frequency.
- 4 Release [TF-SET].**  
Reception starts at the original RX frequency.



- Adjustment of the split frequency using the [RIT/XIT] control is disabled during TF-SET.
- Turning on the frequency lock before using the TF-SET function helps to prevent the transceiver from losing communication with the DX station due to erroneous operation.

## AGC

AGC (Automatic Gain Control) is a function for controlling the IF gain automatically so as to minimize fluctuations in the strength of the signal that is being received.

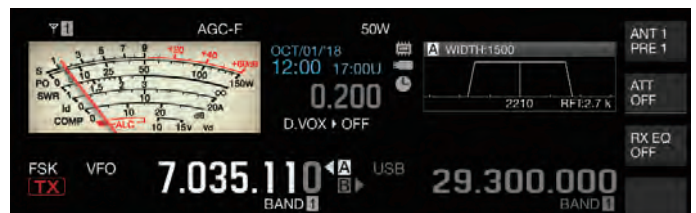
- The AGC time constant is configured to FAST, MID or SLOW according to the receiving status and operation mode (other than FM mode).
- The digital AGC circuit of this transceiver divides the time constant into 20 levels from SLOW to FAST, with "1" being the fastest and "20" the slowest.
- Generally, the time constant is configured to a fast time constant in the CW and FSK modes where fluctuations in the signal strength are well defined, and a slow time constant is used in the SSB and AM modes where changes are gradual.
- However, a fast time constant is also useful in the SSB and AM modes to perform tuning quickly or when receiving weak signals.
- AGC can also be turned off.
- A different default time constant for AGC is configured for each mode as shown below.

### Default AGC Time Constant Setting

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

### Switching the AGC Time Constant

- 1 Select a mode other than FM.**
- 2 Press [AGC] to select an AGC time constant.**  
Pressing [AGC] each time switches the selection in the following sequence: "AGC-F" → "AGC-M" → "AGC-S".



### Adjusting the AGC Time Constant Preset Value

- 1 Press and hold [AGC] to display the AGC configuration screen.**



- 2 Press F3 [AGC] or [AGC] to select "FAST", "MID" or "SLOW".**
- 3 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to change the AGC time constant.**

Setting Value	1 to 20
---------------	---------

The AGC time constant is fastest when it is configured to “1”, and slowest when configured to “20”.

- The default AGC time constant values in the respective operation modes are as follows.

Mode	FAST	MID	SLOW
SSB	9	12	14
SSB-DATA	9	12	14
CW	9	12	14
FSK	7	11	14
PSK	7	11	14
AM	9	13	16
AM-DATA	9	13	16

### AGC OFF

Turns off AGC according to the status of the signals received. RF gain is fixed when AGC is set to OFF, which makes it easier to hear weak signals in some cases.



- If AGC is turned OFF while the S meter is deflecting due to the signal, sound may be output to the speaker or headphones at an unexpectedly loud volume.

Turn the [RF] control to turn down the RF gain level in advance. After turning off AGC, adjust RF gain by turning the [RF] control until the signal can be heard clearly.

To turn off AGC, perform the steps below.

- 1 Press and hold [AGC] to display the AGC configuration screen.
- 2 Press and hold F6 [(OFF)] to configure AGC to OFF. <<AGC OFF>> lights up and the preset value display area is grayed out.

### AGC Quick Recovery

This function performs recovery from the suppression that occurs when the RX signal contains pulse noise. The strength of pulse noise at which this function is activated is determined by adjusting the threshold level.

- 1 Press and hold [AGC] to display the AGC configuration screen.
- 2 Press F2 [PULSE] to display the AGC Quick Recovery configuration screen.



- 3 Press F3 [ON/OFF] to set the function to “On”.
- 4 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to change the threshold level.

Setting Value	1 to 5 (default) to 10
---------------	------------------------



- This function may not be effective for pulse noise occurring in short time interval.

## RX Equalizer

This function allows the sound quality to be altered by adjusting the characteristics of the RX frequency. 6 types of RX equalizer are available, which can be configured separately for each mode. A set of equalizer characteristics can be configured freely for each of the options between “User 1” and “User 3”.

### Turning ON/OFF RX Equalizer

- **Press F [RX EQ].**  
Pressing **F [RX EQ]** each time toggles the RX equalizer between ON and OFF.

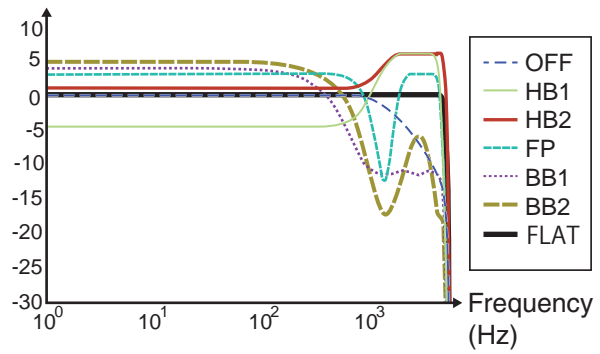
### Selecting an RX Equalizer Characteristic

- 1 **Press and hold F [RX EQ] to display the RX Equalizer configuration screen.**



- 2 **Press F2[▲] / F3[▼] or turn the [MULTI/CH] control to select an equalizer characteristic.**  
The selected equalizer characteristic turns on.

Characteristic	Purpose
High Boost 1 (HB1)	Boosts the high frequency component. This is effective for audio sound that contains a low frequency component.
High Boost 2 (HB2)	Boosts the high frequency component. The low frequency attenuation level for this option is half of that of the High Boost 1 option.
Formant Pass (FP)	This option attenuates frequency components that is outside the audio bandwidth so that the audio can be heard more clearly.
Bass Boost 1 (BB1)	Boosts the low frequency component. This is effective for audio sound that contains a high frequency component.
Bass Boost 2 (BB2)	Boosts the low frequency component. The low frequency is further boosted compared to Bus Boost 1.
Flat (FLAT)	This option has a flat frequency response.
User 1 (U1)	Frequency characteristics can be adjusted according to the user's preferences and stored in the options between User 1 and User 3. The flat frequency characteristic is selected in the default setting.
User 2 (U2)	
User 3 (U3)	



RX Characteristic Curve

- When the RX DSP equalizer is set to ON, the effect (“HB1”/“HB2”/“FP”/“BB1”/“BB2”/“FLAT”/“U1”/“U2”/“U3”) is displayed at the lower end of the key guide.
- When the RX DSP equalizer is OFF, “OFF” is displayed at the lower end of the key guide.

### Adjusting the Equalizer Characteristics

The equalizer characteristics can be customized according to the user's preferences. Also, the customized characteristics can be stored as user-defined settings.

- 1 **Select a equalizer characteristic.**
- 2 **Press F4 [ADJ] to display the RX Equalizer Adjustment screen.**



- 3 **Press F3[◀|||] / F4[|||▶] to select the frequency to adjust.**
- 4 **Press F5 [-] / F6 [+] or turn the [MULTI/CH] control to adjust the frequency level.**
  - Touching a point on the RX Equalizer Adjustment screen selects the corresponding band and changes the frequency to the selected level. An alternative way is to touch a rough point followed by fine-tuning in steps 3 and 4.
  - Pressing and holding **F2 [(RESET)]** resets all the frequency levels to the default setting.

- Besides the User 1 to User 3 options, the equalizer characteristics of the other options can also be altered on the RX Equalizer Adjustment screen.
- If the configured level of the RX DSP equalizer deviates from the configured level of the adjacent frequency, the desired amount of attenuation may not be obtained.

### Copying Equalizer Data

The customized equalizer characteristics can be copied to one of the options from “User 1” to “User 3”.

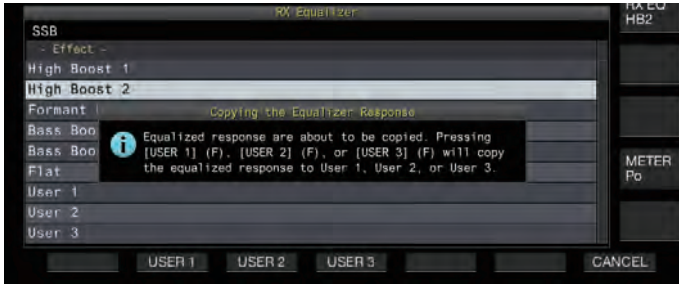
- 1 **Press and hold F [RX EQ] to display the RX Equalizer configuration screen.**
- 2 **Press F2[▲] / F3[▼] to select the equalizer to save.**
  - Pressing **F4 [ADJ]** on the RX Equalizer screen displays the RX Equalizer Adjustment screen. Equalizer data can be copied from either the RX Equalizer screen or RX Equalizer Adjustment screen.



**3 Press F5 [COPY].**

A message appears prompting you to confirm the destination to copy the equalizer characteristics.

- Pressing **F7 [CANCEL]** ends the equalizer data copy operation without copying and restores the display to the RX Equalizer screen or RX Equalizer Adjustment screen.



**4 Press F2 [USER 1], F3 [USER 2] or F4 [USER 3] to specify the destination to copy the data to.**

The equalizer selected in step 2 is copied to “USER 1”, “USER 2” or “USER 3”.

- After copy is complete, the message to confirm the destination for copying the equalizer characteristics disappears and the display is restored to the RX equalizer screen or RX equalizer adjustment screen.

**Saving Equalizer Data**

Multiple sets of customized DSP equalizer settings data can be created and saved.

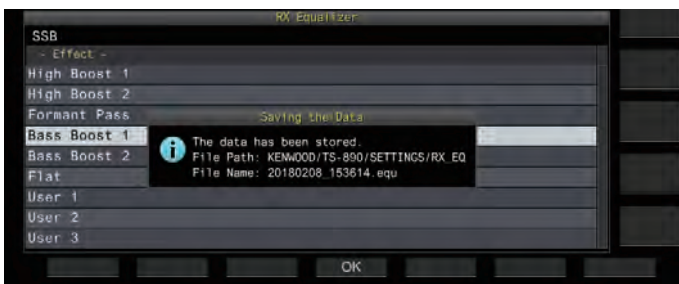
- Before doing so, configure the destination for saving the data in “File Storage Location” of the “USB/File Management Menu” to “Internal Memory” or “USB Flash Drive”. (See 11-2)
- To save the data to a USB flash drive, insert a USB flash drive formatted using this transceiver into (USB-A).

**1 Press and hold F [RX EQ] to display the RX Equalizer configuration screen.**

**2 Press F2[ ▲ ] / F3[ ▼ ] to select the equalizer to save.**

**3 Press F7 [SAVE].**

A message indicating that saving is complete is displayed.



**4 Press F4 [OK].**



- The saved file is named in the “yyyymmdd\_hhmmss” format. The extension of the saved file is “.equ”. (Example) If the date is 10:20:30 a.m., February 15, 2018: 20180215\_102030.equ
- The name of the destination folder is as follows. (The name varies depending on the destination for saving files.)
  - USB flash drive: “KENWOOD\TS-890\SETTINGS \RX\_EQ”
  - Built-in memory: “SETTINGS\RX\_EQ”
- When removing the USB flash drive, make sure to execute “Safe Removal of USB Flash Drive”. (See 11-6)

**Reading Equalizer Data**

RX DSP equalizer data that is saved in the internal memory or USB flash drive can be read.

- To read the data from a USB flash drive, insert the USB flash drive containing the RX equalizer data into (USB-A).

**1 Press and hold F [RX EQ] to display the RX Equalizer configuration screen.**

**2 Press F2[ ▲ ] / F3[ ▼ ] to select the equalizer to read.**

**3 Press F6 [READ] to display the screen for selecting the file to read.**



**4 Select the file to read.**

- To read data from the internal memory, press **F7 [INT.MEM]**.
- To read data from the USB flash drive, press **F7 [USB.MEM]**. (If a USB flash drive is not connected, a message screen will appear prompting you to get ready the USB flash drive.)
- Pressing **F5 [NAME]** allows the file name to be changed.
- Pressing **F6 [DELETE]** displays a message to confirm deletion of the file. Pressing **F4 [OK]** deletes the file.

**5 Press F2[ ▲ ] / F3[ ▼ ] to select the RX equalizer data file to read.**

Alternatively, the RX equalizer data file can also be selected by turning the [MULTI/CH] control.

**6 Press F4 [OK].**

- After the RX equalizer data has been read successfully, a message indicating that reading is complete is displayed.

**7 Press F4 [OK] to end the process.**

## Preamplifier

The preamplifier can be configured to one of the two options: low gain type that places priority on IMD (PRE 1) and high gain type that places priority on sensitivity (PRE 2).

### ● Press F [ANT/PRE].

Pressing F [ANT/PRE] each time switches the selection in the following sequence: “PRE 1” → “PRE 2” → “OFF”.

- The preamplifier selection is stored for each antenna selection band.
- The default values are as follows.  
Less than 7.5 MHz: OFF  
7.5 MHz to less than 21.5 MHz: PRE 1  
More than 21.5 MHz: PRE 2

## RX Monitor

If weak signals are received while the squelch is closed, the signals tend to be interrupted. Also, you may sometimes want to monitor the condition of the RX frequency while in the CTCSS standby state. In this case, the RX monitor is used to open the squelch temporarily.

“RX Monitor” (Menu [0-15] to [0-31]) can be assigned to a PF key. While the PF key that is assigned with “RX Monitor” is pressed and held down, the squelch opens and the RX frequency can be monitored. The RX monitor turns OFF once the key is released. Scanning is paused while PF [RX Monitor] is pressed.

## SWL (BCL) Mode

The SWL (BCL) mode is intended for SWL (Short Wave Listening) and BCL (Broadcast Listening) by displaying the horizontal dial of the “9R-59” communications receiver on the screen.

### 1 Press F [SWL] on the menu screen to display the SWL screen.



### 2 Press [MENU] followed by F [SWL].

Returns to the normal screen.



- Switching to the SWL mode is not possible while the transverter is ON.
- An indicator is not displayed if a memory channel that is not registered is being called up.

- Restrictions are applied to the following functions in the SWL mode.

Function	Status
Transmission	Disabled
Sending of voice message	Disabled
Decoding/Encoding	Disabled
Sending of CW message	Disabled
TX output power limiter	Disabled
Meter switching	Disabled
TX filter switching	Disabled
Turning ON transverter	Disabled
FM tone	Disabled
Antenna tuning	Disabled
Configuration of the TX equalizer and related settings	Disabled

## Band Switching in the SWL Mode (VFO Mode)

### ● Press F [BAND ▲] / F [BAND ▼].

- The “broadcast/meter band” is displayed when the frequency falls within the band range. The preset broadcast bands are shown in the table below.

Broadcast/Meter Band	Lower Limit [kHz]	Upper Limit [kHz]	Default [kHz]/ Mode
LW	145	285	145
MW	525	1705	525
120 m	2300	2495	2300
90 m	3200	3400	3200
60 m	4750	5060	4750
49 m	5900	6200	5900
41 m	7200	7450	7200
31 m	9400	9900	9400
25 m	11600	12100	11600
21 m	13570	13870	13570
19 m	15100	15800	15100
16 m	17480	17900	17480
15 m	18900	19020	18900
13 m	21450	21850	21450
11 m	25670	26100	25670

AM

- The band segments of the SWL mode that is preconfigured on this transceiver are represented in a slightly different way compared to conventional meter bands. Different band segments are used so as to achieve wider coverage to include the broadcast bands of the different regions and other bands.

## Transmission in Data Mode

### Transmission via PTT Switch, SS Terminal and SEND

Switch transmission by making use of the [PTT] switch on the microphone, SS terminal of the REMOTE connector and [SEND] on the front panel. Under normal circumstances, the microphone audio is transmitted via this operation.

- This transceiver continues to transmit signals while the [PTT] switch is pressed and held down.
- This transceiver transmits signals when the SS terminal of the REMOTE connector is short-circuited to GND.
- Pressing [SEND] each time toggles between transmission and reception.

### Transmission via DATA PTT or DATA SEND

DATA PTT (PKS terminal of ACC 2 connector) or the PF key that is assigned with "DATA SEND" is used to switch between transmission and reception. For more details, please refer to "PF Keys (Programmable Function Keys)".

This function comes in handy when transmitting audio or data from an external device.

This operation transmits normal audio signals or audio signals that are input to the ANI terminal of the ACC 2 connector. A different audio path can be specified. For more details, please refer to "Configuration of the Input Path of TX Audio" (8-1).

- This transceiver continues to transmit signals while DATA PTT (PKS terminal of the ACC 2 connector) is short-circuited to GND.
- Pressing the PF key that is assigned with "DATA SEND" toggles between transmission and reception.

## RIT/XIT

### RIT (Receiver Incremental Tuning)

RIT is a function for fine-tuning only the RX frequency in 10 Hz steps within the  $\pm 9.99$  kHz range without altering the TX frequency. This is used when the TX frequency of the station that this transceiver is communicating with has become slightly deviated.

- When the FINE mode is ON, the offset frequency of RIT switches to a step size of 1 Hz. RIT functions in the same way in all modes as well as when VFO or the memory channel mode is in use.

#### 1 Press [RIT].

The [RIT] LED lights up and the RIT offset frequency is displayed.

#### 2 Turn the [RIT/XIT] control.

Fine-tune the RX frequency for RIT.

- To clear the offset frequency for RIT, press [CL]. The RIT offset frequency value is reset to 0.

#### 3 Press [RIT] to end the process.

RIT is turned off. The RX frequency is restored to the value prior to performing step 1.

### RIT Shift

This is a function for setting the frequency adjusted with RIT to a RX band.

#### ● Press and hold [RIT].

The RX frequency that is adjusted using RIT is set to a RX band and the RIT function is turned off.

### XIT (Transmitter Incremental Tuning)

XIT is a function that can be used to fine-tune the TX frequency in 10 Hz steps within the  $\pm 9.99$  kHz range without altering the RX frequency.

- When the FINE mode is ON, the offset frequency of XIT switches to a step size of 1 Hz.

#### 1 Press [XIT].

The [XIT] LED lights up and the XIT offset frequency is displayed.

#### 2 Turn the [RIT/XIT] control.

Fine-tune the TX frequency for XIT.

- To clear the offset frequency for XIT, press [CL]. The XIT offset frequency value is reset to 0.

#### 3 Press [XIT] to end the process.

XIT is turned off. The TX frequency is restored to the value prior to performing step 1.

### XIT Shift

This is a function for shifting from operation using XIT to the split mode at one touch.

#### ● Press and hold [XIT].

When the TX frequency that is adjusted using XIT is set to a TX band, operation switches to the split mode at the same time and the XIT function is turned off.



- If the frequency is changed in the entry mode, the RIT/XIT function is automatically turned off.

### Adjusting the Carrier Level

The steps to adjust the carrier level in the CW, FSK, PSK and AM modes are as follows.

**1 Press [CAR] to display the Carrier Level configuration screen.**




**2 Transmit in the CW, FSK, PSK or AM mode.**

**3 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to adjust the carrier level while referring to the ALC meter.**

<b>Setting Value</b>	0 to 50 (default) to 100 (1 step)
----------------------	-----------------------------------

- CW/ FSK mode: Adjust the carrier level while ensuring that the ALC meter reading does not exceed the ALC zone.
- AM/ PSK mode: Adjust the carrier level until the ALC meter needle starts to deflect.
- SSB/ FM mode: The carrier level value is fixed. (Cannot be adjusted)

 • Note that the TX output will be disabled if the setting value of carrier level is "0".

### Operation in CW Mode

In the world of amateur radio, there is active communication in the CW mode. This is because this mode of communication consumes less power than SSB, and can be regarded as the simplest type of digital communication that combines the use of "dots" and "dashes".

- The built-in electronic keyer of this transceiver offers a wide variety of functions to support the operation of the users. For more details, please refer to "Electronic Keyer".

**1 Select band and frequency.**

Select a frequency band and configure the frequency.

**2 Press [CW/ CW-R] to select CW mode.**

**3 Press [SEND] to transmit.**

**4 Operate the electronic keyer or paddle to transmit a Morse code signal.**

While transmission is in progress, a sidetone for monitoring the Morse code of one's own station can be heard. The frequency of the sidetone changes in tandem with the pitch frequency.

**5 After the Morse code is transmitted, press [SEND] to end the transmission.**

This transceiver is restored to the receiving state.



- The sidetone volume can be adjusted in Menu [1-02] "Sidetone Volume".

### CW Break-in

Break-in is a convenient function that places this transceiver in the TX mode simply by switching to the key-down state when in the CW mode, and restores this transceiver to the RX mode upon switching to the key-up state. Break-in is divided into 2 types, full break-in and semi break-in.

#### Full Break-in

Switches this transceiver from the TX mode to the RX mode at almost the same time as the key-up operation.

#### Semi Break-in

This transceiver does not return to the RX mode immediately after the key-up operation, but remains in the TX mode and switches to the RX mode only after the preconfigured delay time has elapsed.

### Turning ON/OFF Break-in

**● Press [VOX].**

Pressing [VOX] each time toggles break-in between the ON and OFF states.

- When break-in is ON, the [VOX] LED lights up.


### Adjusting the Break-in Mode and Break-in Delay Time

- 1 Press [VOX] to set break-in to ON.
- 2 Turn the [DELAY] control to adjust the delay time after key-up.

Setting Value	FULL-BK/ 50 to 500 (default) to 1000 [ms] (50 step)
---------------	---

- Turn the [DELAY] control all the way to the left, and the full break-in mode is activated when “FULL-BK” is displayed.
- Turning the control to the right lengthens the delay time while turning the control to the left shortens it.
- “FULL-BK” or “DELAY:nn” ([nn: 1 to 20 (equivalent to 50ms to 1000ms)]) is displayed at the top right corner of the filter information area.

- 3 Operate the electronic keyer or paddle.  
Transmission/reception is repeated automatically according to the dot and dash Morse code.

 Before using this transceiver in combination with a linear amplifier, check whether the linear amplifier supports full break-in. If its compatibility with full break-in is unknown or if it is not compatible, operate using the semi break-in mode.

- Full break-in and semi break-in cannot be used at the same time.

### Adjusting the Sidetone and Pitch Frequency

- During key-down in the CW mode, a tone can be heard from the speaker of this transceiver. This tone is known as a sidetone. When this tone is heard, it means it is possible to monitor the Morse code transmitted by one's own station.
- In the CW mode for direct keying of the carrier, a BFO (beat frequency oscillator) is needed to convert the carrier wave into audible sound. The difference in frequency between the BFO and carrier wave can be heard in the form of a beat. This difference in frequency is called RX pitch.
- Both the sidetone and the RX pitch have the same frequency.


- Turn the [MIC/PITCH] control.  
Configure to a sidetone frequency that can be heard most clearly. Turning the [MIC/PITCH] control to the right increases the frequency, while turning the control to the left decreases it.

Setting Value	300 to 700 (default) to 1100 [Hz] (5-step)
---------------	--

### Adjusting the Sidetone Volume

- Configure in Menu [1-02] “Sidetone Volume”

Setting Value	Off/ 1 to 10 (default) to 20 (1 step)
---------------	---------------------------------------

 Sidetone volume like the playback volume of the CW message cannot be altered using the [AF] control.

### CW Rise Time

The rise time of CW refers to the time interval from key-down to the point where the output waveform reaches the highest peak.

- Configure in Menu [5-15] “CW Rise Time”

Setting Value	1/ 2/ 4/ 6 (default) [ms]
---------------	---------------------------

- The default setting (6 [ms]) is suited for low-speed to medium-speed keying. For high-speed keying, configure to “4 [ms]”, “2 [ms]” or “1 [ms]”.


### Auto Zero-in (CW Auto Tune)

This function automatically tunes the TX frequency to coincide with the RX frequency of the target station in order to communicate with a station receiving in the CW mode.

- 1 Turn the Tuning control and adjust roughly until the RX audio of CW can be heard.
- 2 Press [CW T.] to set auto zero-in (CW auto tune) to ON.



- <<CW TUNE>> starts to blink.
- The TX frequency is automatically adjusted to match the RX frequency of the target station, and the pitch of the RX signal coincides with the sidetone and RX pitch frequency.
- After auto zero-in (CW auto tune) has ended, <<CW TUNE>> disappears. If auto zero-in (CW auto tune) cannot be started up, the frequency is restored to the original value.

 Using auto zero-in (CW auto tune) allows tuning up to ±50 Hz from the RX frequency of the target station.

- Auto zero-in (CW auto tune) may not be successful when the keying speed at the receiving station is slow, when there is interference or when the signals are weak.
- When RIT is ON, auto zero-in (CW auto tune) functions with respect to the frequency shifted using RIT.
- The operable range of auto zero-in (CW auto tune) varies depending on the status of reception. For example, if the DSP filter width is 500 Hz, auto zero-in (CW auto tune) will function with respect to RX signals within an approximate RX pitch frequency range of ±300 Hz.

### CW BFO Sideband

This is a function for switching CW (USB) and CW-R (LSB) with CW (LSB) and CW-R (USB).  
Example: Set the CW carrier point to LSB so that the CW RX tone rises at the same time when the frequency is raised.

- Configure in Menu [5-05] “CW BFO Side Band”

Setting Value	USB (default)/ LSB
---------------	--------------------

### CW Automatic Transmission from SSB Mode

When the menu below is configured to ON and paddle or key-down of the electronic keyer is performed during operation in the SSB mode, the SSB mode switches automatically to the CW mode and transmission is enabled in the CW mode. The mode switches automatically from USB to CW or LSB to CW-R.

- Upon shifting from the SSB mode to the CW mode, carrier frequency offset will function even when “Carrier Frequency Offset (SSB Mode to CW Mode)” is set to OFF. For this reason, to call a station that transmitted a CW after the CW is received during operation in the SSB mode, this can be done easily using the paddle or electronic keyer operation.
- Configure in Menu [5-06] “Automatic CW TX with Keying in SSB Mode”

Setting Value	Off (default)/ On
---------------	-------------------

- Menu [5-06] “Automatic CW TX with Keying in SSB Mode” does not function during transmission and when in the split mode.

# 5 COMMUNICATING AIDS

## Frequency Offset when Shifting from SSB to CW Mode

Upon switching to the CW mode to communicate with a station that transmitted a CW after the CW signal is received during operation in the SSB mode, it is usually necessary to correct the frequency by turning the Tuning control slightly. However, turning on this function enables the frequency to be corrected automatically.

### ● Configure in Menu [5-07] “Carrier Frequency Offset (SSB Mode to CW Mode)”

Setting Value	Off (default)/ On
---------------	-------------------

## Encoding/Decoding Morse Code

Below are the steps to decode the RX signals of CW and display them as character strings on the screen. Details of the transmitted CW signals are also displayed as character strings.

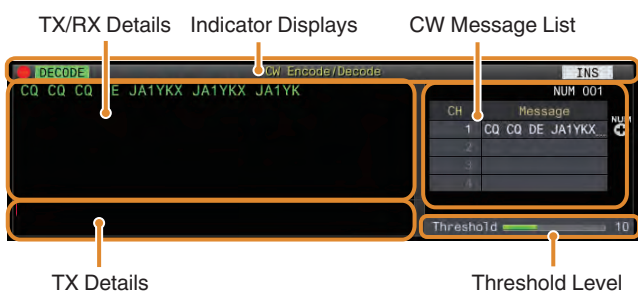
### Displaying the CW Communication Screen

- 1 Set to the CW mode.
- 2 Press F3 [DECODE] to display the CW communication screen.

### Decoding in Progress (Decodes and Displays the Received Signal)



### Encoding in Progress (Analyzes and Displays the Transmission Code)



### Indicator Displays

Indicates the status of the function.

### TX/RX Details

Displays the character strings that are transmitted or received.

### TX Character String Buffer

Character strings to be transmitted.

### CW Message List

Displays the fixed phrases that are registered in the CW message memory. The number of channels displayed varies according to the display screen size. (Standard: 4CH; Expanded: 8CH)

### Threshold Level

Displays the threshold value of the RX signal strength for decoding.

## Operating the CW Communication Screen

Key	Behavior
F1 [MORE]	Switches the key guide.
F2 [LOG]	Turns ON/OFF the communication log function. Pressing and holding this key displays the screen for selecting a log file that is saved.
F2 [← X ]	Clears the characters inside the character string buffer area one at a time. Pressing and holding down the key clears the characters continuously.
F3 [PAUSE]	Pauses update (drawing) of the TX/RX details display area. Pressing the key again resumes the update (drawing).
F3 [CLEAR]	Clears the character strings inside the character string buffer area. Pressing and holding down the key clears the information inside the TX/RX details display area all at once.
F4 [START] F4 [STOP]	Starts encoding of the character strings in the TX/RX details display area. Stops encoding and returns to the decoding state.
F4 [QUICK]	Turns ON/OFF the quick mode.
F5 [DEC.OFF] F5 [DEC.ON]	Stops decoding. Resumes the decode function.
F5 [DEC.FIL]	Switches the decoding filter.
F6 [CW.MSG]	Switches to the CW message screen.
F6 [CW.DEC]	Switches to the CW communication screen.
F6 [THLD]	Switches to the threshold level configuration mode.
F7 [EXTEND]	Enlarges the size of the CW communication screen. Pressing it again restores the screen to the standard size.

## Indicator Displays

Display	Behavior
●	Appears when the log function is ON.
○	Appears when the log function is ON and in the standby mode.
DECODE	Appears when signal decoding is in progress.
ENCODE	Appears when encoding the character strings in the TX character string buffer.
DECODE	Appears when the decode function is stopped or disabled.
↺	Appears when CW message is configured to the repeat setting.
WAIT	Appears during the repeat interval of the CW message.
QUICK	Appears when the quick mode is ON.
INS	Appears when in the insert mode.
NUM	Appears when it is a count-up trigger message of the contest number.

- Characters/character strings that are received or transmitted are displayed in the “TX/RX details display area”.
- Eight code abbreviations are supported, namely BT, AR, AS, HH, SK, KN, BK and SN.
- The code abbreviations are displayed in the “TX/RX details display area” in the same way as normal character strings. For example, when “AR” (code with no space between “A” and “R”) is received, “AR” is displayed.
- The code abbreviations “KN”, “BT” and “AR” have the same Morse code as the symbols “(”, “=” and “+” respectively. When these Morse codes are received, they will be displayed as the code abbreviations received. (Symbols are not displayed.)
- The “\*” symbol has the same Morse code as the alphabet “X”. When this Morse code is received, it will be displayed as the alphabet “X” received.
- The codes might not be decoded correctly depending on the signal quality.
- If the keying speed of the target signal changes halfway, the characters immediately before or after the change cannot be decoded correctly.
- Characters that cannot be decoded are indicated using an underscore (\_).
- Time stamp and frequency information can be added to the TX or RX data that is displayed in the TX/RX details display area.
- This transceiver does not support Japanese characters.
- Press **[Page Up]** / **[Page Down]** on the USB keyboard to scroll through the information displayed in the TX/RX details display area.
- When encoding is started with the details of the past transmission or reception displayed using **[Page Up]** on the USB keyboard, the display moves automatically to the bottom of the screen.
- Noise Reduction 1, Noise Reduction 2, audio peak filter and RX DSP equalizer do not function during CW decoding.

### Adjusting the Decode Threshold Level

The threshold value for the signal strength to activate decoding can be adjusted as follows. Raising the threshold level may reduce erroneous detection due to noise.

#### 1 Press F6 [THLD] to switch to the threshold level configuration mode.



#### 2 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to select a threshold level.

Setting Value	1 to 10 (default) to 30 (1-step)
---------------	----------------------------------

- Adjust the threshold value in the ascending order according to the receiving status of noise, for example. Start from a small value between the range of 1 to 30 and configure the threshold value to a point where reception is good.
- Pressing and holding **F2 [(RESET)]** resets the threshold level to the default setting.

#### 3 Press F1 [**↑**] to end the process.

### Decode Filter

A decode filter (narrow-band filter used exclusively for decoding) can be used when there is significant interference or noise while decoding the Morse code.

#### ● Press F5 [DEC.FIL].

Pressing **F5 [DEC.FIL]** each time switches the decode filter mode (Off/Normal/ Narrow).

- The selected mode is displayed for about 2 seconds.

### Transmitting Character Strings via USB Keyboard Operation

Text input by the USB keyboard can be transmitted in Morse code.

#### 1 Connect the USB keyboard (commercially available) to this transceiver.

#### 2 Press F3 [DECODE] to display the CW communication screen.

#### 3 Press F4 [QUICK].

Press **F4 [QUICK]** each time toggles the quick mode between ON and OFF.

- << **QUICK** >> appears when the quick mode is ON.

#### 4 Select a frequency for communication.

#### 5 Enter a character string using the USB keyboard.

##### When Quick Mode is ON:

After characters are input using the USB keyboard, a “TX details display area” is displayed and encoding starts immediately.

##### When Quick Mode is OFF:

After characters are input using the USB keyboard, they are displayed in the “TX details display area”. To start encoding, press **[Enter]** on the USB keyboard or the **F4 [START]** key.

- Sending a character string using the USB keyboard while the update (drawing) of TX/RX display area is paused cancels the paused state.
- The maximum number of characters that can be entered in the TX details display area is 4300 characters.
- The consecutive code (code abbreviation) applies to the characters after inputting “~” (tilde) and continues until there is a space between the characters.
- For example, when “~ HH” and “~ OSO” are input, they denote a correction code and emergency communication respectively.
- To start encoding from a consecutive code while quick mode is ON, input the first character of the consecutive code within the time interval equivalent to 7 dots (space between words) after inputting “~” (tilde).

### Encoding Character Strings Using the CW Message Memory

Fixed phrases can be registered in the CW message memory for use during transmission.

- Use the CW message memory when transmitting a fixed phrase. Otherwise, the USB keyboard can also be used to input the character string.

#### ● Press F2 [CH 1] to F5 [CH 4].





The phrase registered in the corresponding message channel is displayed in the “TX details display area” and encoding starts immediately.

- The registration number is “x”.



- If a character string already exists in the “TX details display area”, encoding starts after the fixed phrase is added to the end of the character string.
- If encoding of a character string is already in progress, the fixed phrase is added to the end of the character string and encoding will continue.
- A space is inserted before the fixed phrase when it is added to the end of an existing character string.
- Message CH supports only messages registered via text input. (Even when “Paddle” is selected for registering messages in the menu, the message CH information registered via text input using the USB keyboard is displayed on the CW communication screen.)
- If the message displayed in the message list is too long to fit into the display range, this will be indicated by a “...” display to the right of the truncated message.

### Encoding Operation of Message Channel with Repeat Function Enabled

- Upon pressing the key that corresponds to a message channel for which the repeat function is enabled, <<  >> lights up.
- After encoding of the character strings in the “TX details display area” is complete, the transceiver switches to the “repeat wait” mode. After the specified time interval has elapsed, the same character strings of the channel for which the repeat function is enabled is encoded again, and this process goes on.
- After encoding of the information in the “TX details display area” is fully complete, all the information in the area is cleared. Only the character string of the repeat channel is displayed in white fonts, and the transceiver switches to the “repeat wait” mode.
- Upon switching to the “repeat wait” mode, << **WAIT** >> lights up, after which << **ENCODE** >> is illuminated. (These will light up in the grayed-out state when the decoding function is stopped.)
- When the specified time interval after entering the “repeat wait” state has elapsed, << **WAIT** >> disappears and encode operation resumes.
- Pressing **F4 [STOP]** or **[ESC]** on the USB keyboard stops the encoding operation or “repeat wait” state and returns the transceiver to the decoding state. (The light for the <<  >> and << **WAIT** >> displays go off.)
- While <<  >> is illuminated, character strings cannot be added using the USB keyboard or the **F2 [CH 1]** to **F5 [CH 4]** keys.
- While <<  >> is illuminated, characters cannot be deleted using the backspace key of the USB keyboard or the **F2 [X]** key.

### Contest Number Behavior

- To use a contest number, “%N” needs to be embedded in the message of the message channel.
- The “%N” portion will be substituted with the current contest number during encoding.
- The contest number is counted up after all the contents in the “character string buffer area” are encoded.

### Paddle Operation on CW Communication Screen

Morse code that is input via paddle operation (straight key, bug key, etc.) can be converted into text and displayed on the screen. This function can also be used to practice the input of Morse code.

### Paddle Operation when the TX Details Display Area is Empty

- When break-in is ON, the Morse code input is transmitted and information that is keyed is displayed in the TX details display area character by character.
- When break-in is OFF, the Morse code input is not transmitted and information that is keyed is displayed in the character string buffer area character by character.



- Encoding does not start even when the quick mode is set to ON.
- Encoding does not start even when characters are added using the USB keyboard after the character strings that are added via paddle operation.
- To enable encoding of the character strings displayed in the character string buffer area, press **F4 [START]** or **[Enter]** on the USB keyboard.

### Paddle Operation during Encoding of Character Strings in the TX Details Display Area

- When Interrupt Keying is ON, encoding of character strings is temporarily stopped and resumes only after keying is complete.
- When Interrupt Keying is OFF, encoding of character strings is stopped.
- If the signals input via paddle operation are codes that cannot be converted into text, the characters are not added to both the “TX details display area” and “TX/RX details display area”.

### Saving CW Communication Logs

The CW, RTTY and PSK communication screens can be saved using the communication log function. Please refer to “Communication Log” on page 5-27.



## Electronic Keyer

This transceiver comes with a built-in electronic keyer that can be used simply by connecting a paddle to the PADDLE jack on the front panel. Depending on the settings, it can also be used as a bug key (semi-auto electronic keyer).

- A straight key can also be connected to the PADDLE jack.

### Selecting the PADDLE Jack Behavior

Select the device to be connected to the PADDLE jack.

#### ● Configure the behavior in Menu [5-00] “Paddle Jack Configuration (Front)”

<b>Setting Value</b>	Straight Key/ Paddle (default)/ Paddle (Bug Key Mode)
----------------------	---

### Selecting the KEY Jack Behavior

For operation in the CW mode without using the built-in electronic keyer, connect the plug of a straight key, bug key, external electronic keyer or PC keyer to the “KEY” jack. The built-in electronic keyer can also be used by connecting a paddle to the “KEY” jack.

Select the device to be connected to the “KEY” jack on the rear panel.

#### ● Configure in Menu [5-01] “Key Jack Configuration (Rear)”

<b>Setting Value</b>	Straight Key (default)/ Paddle/ Paddle (Bug Key Mode)
----------------------	---



- Connect a PC keyer or an external electronic keyer with a positive-polarity wire using a shield wire.
- Behavior when Paddle (Bug Key Mode) is selected
  - While dots are combined according to the usual keyer, dashes are keyed while the paddle is pressed.
  - The keying speed is variable, but the message memory function does not work.
- When both dot and dash are configured to ON at the same time, priority is given to dash.

### Operation Mode of the Electronic Keyer

2 operation modes of the built-in electronic keyer are available for selection (A or B).

#### ● Configure in Menu [5-02] “Electronic Keyer Squeeze Mode”

<b>Setting Value</b>	Mode A/ Mode B (default)
----------------------	--------------------------

**Mode A:** When both paddles are open, code transmission ends after the code elements (dot or dash) are transmitted. Both dot and dash memory are not active.

**Mode B:** When both paddles are open, code transmission ends after a dash (or dot) is transmitted following the dot (or dash) that is currently being transmitted. Both dot and dash memory are active.

## Reversing Dot and Dash

It is possible to reverse dot and dash of the paddle without having to rewire the electronic keyer. Reversing the position for operating the paddle according to the operator’s preferences or dominant hand helps to ease keying.

#### ● Configure in Menu [5-03] “Dot and Dash Reversed Keying”

<b>Setting Value</b>	Off (default)/ On
----------------------	-------------------

- Dot and dash is reversed when this function is set to “On”.



- This setting applies to both the mic paddle mode and paddle that is connected to the PADDLE or KEY jack.

## Mic Paddle Mode

The [UP] and [DOWN] keys of the microphone is used in place of the paddle for keying.

#### ● Configure in Menu [5-04] “Paddle (Microphone Up/Down Keys)”

<b>Setting Value</b>	Off (default)/ On
----------------------	-------------------

- When this is “On”, keying can be performed using the [UP] and [DOWN] keys of the microphone.



- Response will be slower in the mic paddle mode compared to the normal paddle operation.
- In the default setting, the [DOWN] key is assigned with dot and the [UP] key with dash.

## Adjusting the Keying Speed

The keying speed of the electronic keyer can be adjusted freely. To ensure that CW is transmitted precisely, it is necessary to adjust the keying speed according to the skill level of the user. Also, it is recommended that the keying speed be as closely aligned as possible with the CW speed of the target station.

#### ● Turn the [KEY] control to adjust the keying speed.

The keying speed can be adjusted within the range of 4 to 60 [wpm] (20 to 300 characters/minute).

- Turning the [KEY] control to the right increases the keying speed, while turning the control to the left slows it down.
- The keying speed is displayed while the [KEY] control is being operated.
- After operating the [KEY] control, the TX output power display shows the keying speed for a duration of 2 seconds.



- Only dots are supported in the bug key mode.

## Changing the Weighting

The electronic keyer allows the dot-dash weighting to be adjusted automatically. Weighting is the ratio of the dash length to the dot length.

- 2 weighting modes are available for selection: the “auto weighting” mode changes the ratio automatically in tandem with the keying speed, while the ratio is fixed in the “manual weighting” mode and not affected by the keying speed.
- When [2.5] (1:2.5) to [4.0] (1:4) is selected, the dot-dash weight ratio is fixed regardless of the keying speed.

### ● Configure in Menu [5-08] “CW Keying Weight Ratio”

<b>Setting Value</b>	Automatic (default)/ 2.5 to 4.0 (0.1 step)
----------------------	--

- When this is configured to “Automatic”, the keying speed and weight ratio settings are as follows.

Adjusting the Keying Speed	Weight
4 to 24	1:2.8
25 to 44	1:3.0
45 to 60	1:3.2

## Weight Ratio Reverse

When the weighting mode is configured to “Automatic”, increasing the keying speed increases the weight ratio. Configuring the menu below to ON decreases the weight ratio when the keying speed increases.

### ● Configure in Menu [5-09] “CW Keying Reversed Weight Ratio”

<b>Setting Value</b>	Off (default)/ On
----------------------	-------------------

- When weight reverse is enabled in the “Automatic” weighting mode, the keying speed and weight ratio settings are as follows.

Adjusting the Keying Speed	Weight
4 to 24	1:3.2
25 to 44	1:3.0
45 to 60	1:2.8

## CW Message Memory

This transceiver comes with memory channels that can store up to 8 CW messages. In addition to paddle operation, a message can be registered by entering a text using the USB keyboard or via operating this transceiver.

- CW message memory channels come in handy for messages that are repeatedly transmitted as registering the messages in advance allows them to be used repeatedly such as during contest.

## Switching the Method of Registering CW Messages

A method for registering messages can be selected from the options below.

### ● Configure in Menu [5-11] “CW Message Entry”

<b>Setting Value</b>	Text String/ Paddle (default)
----------------------	-------------------------------

**Text String:** Registers messages using text strings.

**Paddle:** Registers messages via paddle operation.

## Registering CW Messages via Text Input

Check to ensure that the CW message registration method in Menu [5-11] is configured to “Text String”, followed by performing the steps below to register a CW message. CW messages can be stored in any of the channels from 1 to 8.

### 1 Press F2 [KEYER] to display the CW Message screen (for text input).

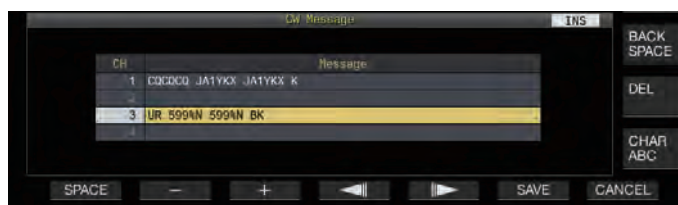


- When this transceiver is in a mode other than CW, F2 [KEYER] is not displayed in the key guide. Press [CW/CW-R].
- If the channel to register the CW message is not displayed in the key guide, press F1 [MORE]. Doing so switches the key guide.

### 2 Press and hold F2 [CH 1] to F5 [CH 4] or F2 [CH 5] to F5 [CH 8] to select the channel to register the CW message.

The CW message edit screen is displayed.

- Pressing F7 [NEXT] each time switches between F2 [CH 1] to F5 [CH 4] and F2 [CH 5] to F5 [CH 8].



### 3 Use the function keys, [MULTI/CH] control or USB keyboard to enter a CW message.

- Enter a message that contains not more than 50 characters. The default setting is blank.

Key	Behavior
F1 [SPACE]	Inserts a space.
F2 [-]/ F3 [+]	Selects a character.
F4 [◀   ]/ F5 [  ▶]	Moves the cursor.
F [BACK SPACE]	Deletes the character to the left of the cursor.

Key	Behavior
F [DEL]	Deletes the character to the right of the cursor.
F [CHAR]	Switches the type of character to edit. Pressing the key each time switches the selection in the following sequence: ABC (upper case) → !"# (symbols) → ABC (upper case)

- Pressing **F7 [CANCEL]** returns the display to the CW message screen without registering the input message.
- When "%N" is saved as part of a CW message, this will be substituted with a contest number during transmission.
- A continuous text string that is input after "~" and up to that before an inserted space becomes a consecutive code such as AR or BT.
- Characters that can be input are as follows.

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	1	2	3	4	5	6	7	8	9			
/	?	.	,	'	(	)	:	=	+	-	_	"
@	~	%	<	>								Space

**4 Press F6 [SAVE] to save the CW message.**

**Registering CW Messages via Paddle Operation**

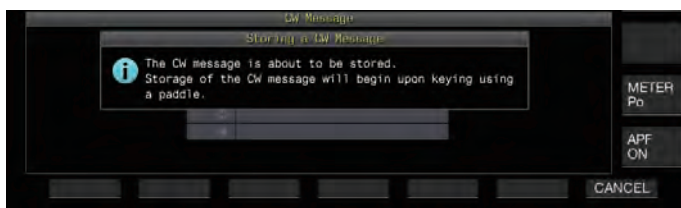
Check to ensure that the CW message registration method in Menu [5-11] is configured to "Paddle", followed by performing the steps below to register a CW message. CW messages can be stored in any of the channels from 1 to 8.

**1 Press F2 [KEYER] to display the CW Message screen.**



**2 Press and hold F2 [CH 1] to F5 [CH 4] or F2 [CH 5] to F5 [CH 8] to select the channel to register the CW message.**

A message prompting registration of a CW message is displayed.



- While in the input standby mode, pressing **F7 [CANCEL]** returns the display to the CW message screen without registering the message.

**3 Register a CW message via keying with a paddle.**

When keying using a paddle starts, the display switches to a CW message (paddle) registration screen. Continuing keying in this state registers the CW message. During registration of a CW message, memory usage (%) is displayed on the screen.

- If paddle operation is not performed during the registration process, a space will be inserted at every interval equivalent to 7 dots.



**4 Press F6 [STOP] to end registration of the CW message.**

- The display returns to the CW Message screen.
- If the memory is used up (indicated as 100%), the CW message registration process ends automatically even when it is still in progress.
- Morse code that is input is converted into text strings and displayed in the channel list of the CW Message screen.



- For channels that do not contain any CW message, the corresponding channel numbers are displayed in gray.
- CW messages cannot be registered if the PADDLE or KEY jack is not configured to the PADDLE mode. Operate the paddle to register a CW message.
- The Morse code displayed in the channel list uses the same functions as "Morse code decoding". For this reason, the spacing may be wider or different characters may be displayed depending on the habit and the speed of the operator performing the keying.
- The "\*" symbol and code abbreviations are also displayed in the same way as "Morse code decoding".
- Japanese texts can be registered but will not be displayed correctly.

**Contest Number**

**Configuring the Starting Contest Number (Text Input Only)**

The starting contest number can be configured when the contest numbers are 3-digit serial numbers that run from 001 (001 method).

**Configure in Menu [5-12] "Contest Number"**

Setting Value	Value
Setting Value	001 (default) to 9999 (1 step)

**Selecting a Method for Sending out Contest Number (Text Input Only)**

When a CW message that contains a "%N" input is transmitted, numeric values "1", "9" and "0" are converted into alphabets "A", "N" and "O" (or "T") respectively in the Morse code format and sent out as a contest number.

**Configure in Menu [5-13] "Contest Number Format"**

Setting Value	Value
Setting Value	Off (default)/ 190 to ANO/ 190 to ANT/ 90 to NO/ 90 to NT

**Coding Example**

Option	Text String Sent out as Contest Number	Output Code
190 to ANO	190	ANO (·- - ·- - -)
190 to ANT		ANT (·- - - -)
90 to NO	90	NO (- · - - -)
90 to NT		NT (- · -)

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### Selecting a Channel for Counting up the Contest Numbers (Text Input Only)

The CW message channel for which contest numbers are counted up can be registered using this setting.

#### ● Configure in Menu [5-14] “Channel Number (Count-up Message)”

Setting Value	Off (default)/ Channel 1 to Channel 8
---------------	---------------------------------------

### Decrementing the Contest Number (Text Input Only)

If communication is not established after a contest number is sent to the receiving station, the contest number that is sent next will be decremented (reduced) by 1.

#### 1 Press F2 [KEYER] to display the CW Message screen.



#### 2 Press F7 [NEXT] to select a channel group for which the contest numbers are to be displayed.

- <<NEW>> is displayed beside the channel for counting up the contest number, and F6 [-1] is displayed in the key guide.
- Pressing F7 [NEXT] each time switches between F2 [CH 1] to F5 [CH 4] and F2 [CH 5] to F5 [CH 8].
- For more details on the method for selecting a channel group, please refer to “Registering CW Messages via Text Input”.

#### 3 Press F6 [-1] to reduce the contest number by 1.

- When the setting of the channel for counting up the contest number in Menu [5-14] is configured to “Off”, <<NEW>> is not displayed and F6 [-1] is also not shown in the key guide.

### Playing/Transmitting CW Messages

This transceiver can be configured as follows to play back or transmit a registered CW message. The CW message screen and function key displays are different when Menu [5-11] “CW Message Entry” is configured to “Paddle” and when it is configured to “Text String”. Descriptions in this manual are based on the “Paddle” setting, but the steps are the same when it is configured to “Text String”. Also, a CW message needs to be registered in advance before it can be played back or transmitted.

#### 1 Press F2 [KEYER] to display the CW Message screen.

#### 2 To play back a CW message, press [VOX] to set break-in to OFF.

- When break-in is set to OFF, the [VOX] LED light goes off.
- To transmit a CW message, set break-in to ON. When break-in is set to ON, the [VOX] LED lights up.

#### 3 Press F2 [CH 1] to F5 [CH 4] or F2 [CH 5] to F5 [CH 8] to select a CW message.

- Playback or transmission starts. To cancel the operation, press F5 [STOP].



- When Menu [5-14] “Channel Number (Count-up Message)” is configured to a setting other than “Off”, the contest number is added immediately after playback or transmission of the CW message for the selected channel has ended.
- Operating the paddle while Menu [5-10] “Interrupt Keying” is “On” pauses playback or transmission of the message memory. After paddle operation has ended, playback or transmission resumes from the paused state. Operating the paddle while “Off” is configured stops playback or transmission of the message memory.
- To transmit a CW message without using break-in, press [SEND] instead of performing step 2.

### Repeat Playback of CW Messages

#### ● Press F4 [REPEAT].

Pressing F4 [REPEAT] each time toggles the repeat function between ON and OFF.

- When the repeat mode is ON, <<REPEAT>> lights up for the selected CW message memory.

### Configuring the Repeat Playback Interval

The time interval for repeating playback of a CW message can be configured.

● **Configure in Menu [5-16] “CW/Voice Message Retransmit Interval Time”**

Setting Value	0 to 10 (default) to 60 [s] (1 step)
---------------	--------------------------------------

Configuring to a larger value lengthens the playback interval.

### Interrupt Keying

Operating the paddle while playback or transmission of a CW message is in progress allows the CW message playback or transmission process to be interrupted for the Morse code input using the paddle to be inserted.

● **Configure in Menu [5-10] “Interrupt Keying”**

Setting Value	Off (default)/ On
---------------	-------------------

### Deleting a CW Message

The steps to delete a CW message that is registered in Channel 1 to Channel 8 are as follows.

- 1 Press F2 [KEYER] to display the CW Message screen.
- 2 Select a channel number that contains the CW message to delete.
- 3 Press and hold F5 [(DELETE)] to delete the CW message.

### RTTY Operation

This transceiver comes with a built-in demodulator for RTTY operation, a RX decoder and a TX encoder. It is possible to operate in RTTY (FSK) independently by combining the use of a commercially available USB keyboard. Also, it is possible to operate in the RTTY mode by connecting an external device.

- ! Before operating in the RTTY mode, adjust the carrier level while checking the ALC meter.

### Displaying the RTTY Communication Screen

- 1 Press [FSK/PSK] to select RTTY (FSK) mode.
  - 2 Press F3 [DECODE].
- The RTTY communication screen appears.

### Text Display Area + FFT Scope



### Text Display Area + X-Y Scope

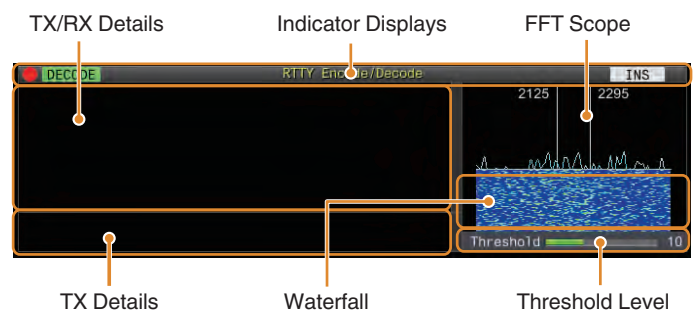


### Switching between the FFT Scope and X-Y Scope Display

The display toggles between the audio FFT scope and X-Y scope each time the scope display is touched.

- ! The RTTY communication screen will not be displayed if Menu [2-06] “FSK Spacing” is not configured to “170 [Hz]”.
- Noise Reduction 1, Noise Reduction 2, Beat Canceler 1, Beat Canceler 2, audio peak filter and RX DSP equalizer do not function during decoding of RTTY messages.

The layout of the RTTY communication screen is as follows.



### Indicator Displays

Indicates the status of the function.

### TX/RX Details

Displays the character strings that are transmitted or received.

### TX Details

Character strings to be transmitted.

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### FFT Scope

The audio FFT scope is used for viewing the tuning status. The two vertical lines on the left and right represent the mark and space frequencies respectively. Adjust the tuning frequency while receiving a signal such that the two peaks overlap evenly with the two lines.

### Waterfall

The waterfall is a time-series display of the RX signal spectrum which functions in tandem with the FFT scope. The entire waterfall display can also be shifted in tandem with changes in the RX frequency.

### X-Y Scope

The X-Y scope displays the tuning status in the RTTY (FSK) mode as a cross pattern. The cross patterns bisect at right angles (90 degrees) when this transceiver is correctly tuned to the signal.

### Threshold Level

Displays the threshold value of the RX signal level for decoding.









### Operating the RTTY Encode/Decode Screen

The following operations are enabled when the RTTY communication screen opens.

- Pressing the **[Page Up]** or **[Page Down]** key scrolls the display of the TX or RX details.

Key	Behavior
<b>F1 [MORE]</b>	Switches the key guide.
<b>F3 [PAUSE]</b>	Pauses update (drawing) of the TX/RX details display area. Pressing the key again resumes the update (drawing).
<b>F4 [LOG]</b>	Turns ON/OFF the communication log function. Pressing and holding this key displays the screen for selecting a log file that is saved.
<b>F4 [(CLEAR)]</b>	Pressing and holding the key clears the text displayed on the TX/RX details screen.
<b>F5 [THLD]</b>	Switches to the threshold level configuration mode.
<b>F5 [MEMORY]</b>	Switches to the RTTY Message screen.
<b>F6 [X-Y LEV]</b>	Switches between the speed and density of the X-Y scope.
<b>F7 [EXTEND]</b>	Enlarges the size of the RTTY communication screen. Pressing it again restores the screen to the standard size.

### Indicator Displays

Display	Behavior
	Appears when the communication log function is ON.
	Appears when the communication log function is ON and in the standby mode.
	Appears when signal decoding is in progress.
	Appears when encoding the characters in the TX buffer.
	Appears when the decode function is stopped or disabled.
	Appears when transmitting the message memory.
	Appears when in the insert mode.
	Appears when in the overwrite mode.

### Saving RTTY Communication Logs

The CW, RTTY and PSK communication screens can be saved using the communication log function. Please refer to “Communication Log” on page 5-27.

### Adjusting the RTTY Decode Threshold Level

Noise that occurs when there is no signal may sometimes be erroneously detected as text, which results in the display of unwanted text. To reduce the occurrence of such issues, adjust the threshold level.

- Raise the threshold level when there is frequent erroneous detection due to noise.

#### 1 Press F5 [THLD].

The threshold level setting can now be adjusted.



#### 2 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to adjust the level.

<b>Setting Value</b>	1 to 10 (default) to 30 (1 step)
----------------------	----------------------------------

- Adjust the threshold value in the ascending order according to the receiving status of noise, for example. Start from a small value between the range of 1 to 30 and configure the threshold value to a point where reception is good.
- To restore the default setting, press and hold **F2 [(RESET)]**.

#### 3 Press F1 [] to end the process.

### FFT Scope/X-Y Scope Display Setting

The tuning scope displayed on the RTTY communication screen can be switched to an “FFT scope” or “X-Y scope” display.

#### ● Configure in Menu [2-09] “RTTY Tuning Scope”

<b>Setting Value</b>	FFT Scope (default)/ X-Y Scope
----------------------	--------------------------------

- The display toggles between the “FFT Scope” and “X-Y Scope” each time the scope display on the screen is touched.

### FFT Scope Waveform Averaging

The waveform displayed on the FFT scope can be averaged. Averaging of the waveform reduces random noise and makes observation of the target signal easier.

#### ● Configure in Menu [2-00] “FFT Scope Averaging (RTTY Decode)”

<b>Setting Value</b>	0 (default) to 9 (1 step) (minimum to maximum averaging)
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### Selecting a Waterfall Display Type

- **Configure in Menu [2-17] “Waterfall when Tuning (RTTY/PSK Audio Scope)”**

Setting Value	Straight (default)/ Follow
---------------	----------------------------

**Straight:** Uses a straight line to show transition in the level of the target signal displayed on the waterfall when the RX frequency is altered.

**Follow:** Tracks and displays the latest audio FFT level at the portion where the waterfall starts flowing when the RX frequency is altered.

### Tracking Speed/Density Level of X-Y Scope

Switch between the speed and density of the X-Y scope.

- **Press F6 [XY LEV.].**  
Pressing **F6 [XY LEV.]** each time switches the level. The tracking speed is displayed on the X-Y scope display.

Setting Value	Lv1/ Lv2 (default)/ Lv3
---------------	-------------------------



### Transmitting Character Strings Using USB Keyboard

A commercially available USB keyboard can be used to input and transmit character strings.

#### Transmitting the Input Character String Immediately

- 1 Connect the USB keyboard to (USB-A).**
- 2 Press F3 [DECODE] to display the RTTY communication screen.**
- 3 Press [F12] on the USB keyboard to enter the TX mode.**  
The [BUSY/TX] LED lights up in red, and << **ENCODE** >> is displayed in the status bar.
- 4 Enter a character string using the USB keyboard.**
  - The input character string is displayed in the TX details display area and transmitted immediately.
  - In the TX details display area, the color of the individual characters change successively once they are transmitted.
  - Characters that have been transmitted appear successively in the TX/RX details display area.
- 5 Press [F12] on the USB keyboard to end transmission.**

- If there remain characters in the TX details display area that are not transmitted when **[F12]** is pressed in step 5, << **WAIT** >> is displayed in the status bar. After transmission of all the character strings is complete, the transceiver switches to the RX mode and the light of the [BUSY/TX] LED and << **WAIT** >> display go off.

### Temporarily Placing Character Strings in the TX Details Display Area before Transmission

- 1 Connect the USB keyboard to (USB-A).**
- 2 Press F3 [DECODE] to display the RTTY communication screen.**
- 3 Enter a character string using the USB keyboard.**  
The input character string is displayed and temporarily placed in the TX details display area.
- 4 Press [F12] on the USB keyboard to send out the character string.**
  - Character strings that are stored in the TX details display area are sent out by this transceiver.
  - Upon entering the TX mode, the [BUSY/TX] LED lights up in red, and << **ENCODE** >> is displayed in the status bar.
  - In the TX details display area, the color of the individual characters change successively once they are transmitted. Character strings that have been transmitted appear successively in the TX/RX details display area.
- 5 Press [F12] on the USB keyboard to end transmission.**

- If there remain characters in the TX details display area that are not transmitted when **[F12]** is pressed in step 5, << **WAIT** >> is displayed in the status bar. After transmission of all the character strings is complete, the transceiver switches to the RX mode and the light of the [BUSY/TX] LED and << **WAIT** >> display go off.
- Pressing **[ESC]** while transmission of the character strings is in progress switches this transceiver to the RX mode. Transmission of the character strings stops, and character strings in the character string buffer that are not yet transmitted are cleared.
- Time stamp and frequency information can be added to the TX or RX data that is displayed in the TX details display area. Refer to “Displaying a Time Stamp” (5-28).
- Sending a character string using the USB keyboard while the TX/RX display is paused by pressing **F3 [PAUSE]** cancels the paused state.
- The character strings that can be placed temporarily in the TX details display area can contain a maximum of 4300 characters.
- Alphanumeric characters and symbols that can be input using a USB keyboard are as follows.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
O	P	Q	R	S	T	U	V	W	X	Y	Z	0	1
2	3	4	5	6	7	8	9	!	“	#	\$	&	'
(	)	.	,	-	?	:	;	/	Space	Line Break			

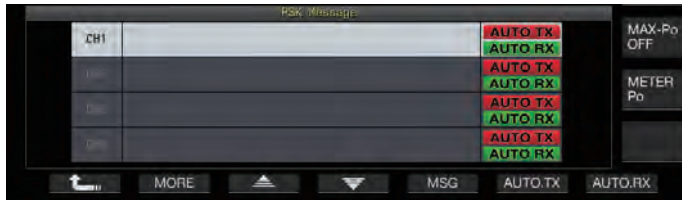
# 5 COMMUNICATING AIDS

## RTTY Message Memory

Fixed phrases that are often used in the RTTY mode can be registered in advance as an RTTY message in the RTTY message memory. Configuring a message to be saved to auto transmission (Auto TX) or auto reception (Auto RX) enables the RTTY message to be transmitted via simple operation. Up to 8 types of RTTY messages can be registered to Channels 1 to 8 in the memory.

### Registering RTTY Messages

1 Press F5 [MEMORY] on the RTTY communication screen to display the RTTY Message screen.



- 2 Press F3[▲] / F4[▼] or turn the [MULTI/CH] control to select the channel for saving the RTTY message.
- 3 Press F5 [MSG] to enter the RTTY message memory edit mode.



4 Use the function keys, [MULTI/CH] control or USB keyboard to enter a character string.

Key	Behavior
F1 [SPACE]	Inserts a space.
F2 [-] / F3 [+]	Selects a character.
F4 [◀] / F5 [▶]	Moves the cursor.
F [BACK SPACE]	Deletes the character to the left of the cursor.
F [DEL]	Deletes the character to the right of the cursor.
F [CHAR]	Switches the type of character to edit. Pressing the key each time switches the selection in the following sequence: ABC (upper case) → !"# (symbols) → ABC (upper case)

5 Press F6 [SAVE] to save the RTTY message.

- Pressing F7 [CANCEL] discards the content that is currently being edited and exits the character string input mode.
- Alphanumeric characters and symbols that can be input (up to 70 characters)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
O	P	Q	R	S	T	U	V	W	X	Y	Z	0	1
2	3	4	5	6	7	8	9	!	"	#	\$	&	'
(	)	.	,	-	?	:	;	/	Space	Line Break			

## Configuring Auto TX/RX for the RTTY Message Memory

The transmission and reception behavior can be configured when an RTTY message memory channel is selected.

- Auto TX places this transceiver in the TX mode before transmitting a message when a message memory channel is selected, and maintain the TX mode after all messages have been sent out.
- For auto RX, pressing [F12] after selecting a message memory channel for transmission places this transceiver in the TX mode. When the message is sent out, this transceiver is automatically restored to the RX mode.
- Combining auto TX and auto RX enables both transmission and reception to be performed automatically.

1 Press F3[▲] / F4[▼] or turn the [MULTI/CH] control to select the message for auto TX/RX.

2 Press F6 [AUTO.TX] to set auto TX to ON.

<< **AUTO TX** >> is displayed to the right of the RTTY message.



- When auto TX is set to OFF, the << **AUTO TX** >> display goes off, and the RTTY message of the channel is temporarily placed in the character string buffer but not transmitted automatically.

3 Press F7 [AUTO.RX] to set auto RX to ON.

<< **AUTO RX** >> is displayed to the right of the RTTY message.

- When auto RX is set to OFF, the << **AUTO RX** >> display goes off, and this transceiver is not restored to the RX mode after the RTTY message for the channel has been sent out.



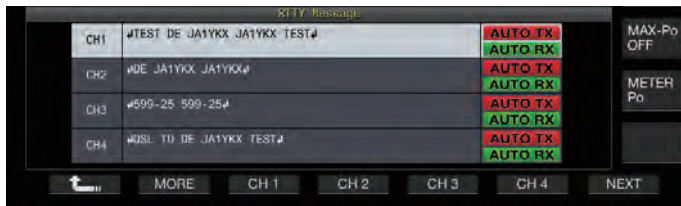
- To send an RTTY message for which "AUTO TX" is configured to "OFF", select the channel in which the RTTY message is stored. Check to ensure that the character string (RTTY message) is forwarded to the character string buffer, followed by pressing [F12] on the USB keyboard.
- To switch this transceiver to the RX mode after transmitting an RTTY message for which "AUTO RX" is set to OFF, press [F12] on the USB keyboard after the RTTY message has been sent out.



### Transmitting Character Strings from the RTTY Message Memory

A message that is registered in the RTTY message memory can be transmitted as follows.

1 Press F5 [MEMORY] to display the RTTY Message screen.



2 Press F3 [CH 1] to F6 [CH 4] or F3 [CH 5] to F6 [CH 8] to select the channel that contains the message to be transmitted.

The RTTY message of the channel corresponding to the function key is being transmitted automatically.

- If the channel guide is not displayed, press F2 [MORE].
- Pressing F7 [NEXT] each time switches between F3 [CH 1] to F6 [CH 4] and F3 [CH 5] to F6 [CH 8].
- After transmitting the RTTY message that is indicated by an << **AUTO RX** >> display beside it, this transceiver returns to the RX mode.

### Settings Related to RTTY Encode/Decode

#### Enabling Decode UOS (Unshift on Space)

If a space character is included in the RTTY signal that is received, the character following the space can be forcibly interpreted as a character code (alphabet).

In RTTY, garbled characters may appear due to the signal strength or noise. To avoid this from happening as much as possible, the character after a space character is interpreted as a more frequently used character code (alphabet).

● Configure in Menu [2-01] “RX UOS”

Setting Value	Off/ On (default)
---------------	-------------------

**On:** Encodes space characters.

**Off:** Does not encode space characters.

- To receive a numeric value or symbol that immediately follows a space character, turn off the UOS function.

#### Newline Code Setting

Configure the newline code when receiving an RTTY signal.

● Configure in Menu [2-02] “Newline Code”

Setting Value	CR+LF/ All (default)
---------------	----------------------

**All:** Inserts a line break for every newline code.

**CR+LF:** Inserts a line break only when a CR+LF code is received.

### Diddle Operation

Diddle allows the user to select the type of code to transmit when the characters to be sent run out during transmission in the RTTY (FSK) mode.

● Configure in Menu [2-03] “Diddle”

Setting Value	Off/ Blank Code (default)/ Letters Code
---------------	---

**Off:** Does not send out a character code.

**Blank Code:** Sends out a space character.

**Letters Code:** Sends out a character code.

### Encode UOS

This is used for sending out a numeric value or symbol that immediately follows a space during transmission in the RTTY (FSK) mode. Enabling this function allows the receiving station to recognize the code that comes after a space as a numeric value or symbol, thus reducing the occurrence of garbled characters.

● Configure in Menu [2-04] “TX UOS”

Setting Value	Off/ On (default)
---------------	-------------------

**On:** Uses encode UOS.

**Off:** Does not use encode UOS.

### Sending a Newline Code at the Start or End of a Transmission

A newline code (CR+LF) can be sent out when RTTY encode/decode starts or ends. A line break is inserted before and after the RTTY message on the decode screen of the receiving station, which makes it easier to identify the transmitted RTTY message.

● Configure in Menu [2-05] “Automatic Newline Insertion”

Setting Value	Off/ On (default)
---------------	-------------------

**On:** Sends out a newline code.

**Off:** Does not send out a newline code.

### RTTY Parameters

#### Configuring the Mark Frequency

Configure the frequency of the mark signal that is used for communication in the RTTY (FSK) mode. The 1275 Hz frequency is referred to as a low tone, and the 2125 Hz frequency as a high tone. The high tone is used under normal circumstances.

● Configure in Menu [2-08] “FSK Tone Frequency”

Setting Value	1275/ 2125 (default) [Hz]
---------------	---------------------------

#### Configuring the RTTY Shift Width

The difference between the mark signal frequency and space signal frequency is called shift width. Configure the shift width during communication in the RTTY mode.

● Configure in Menu [2-06] “FSK Spacing”

Setting Value	170 (default)/ 200/ 425/ 850 [Hz]
---------------	-----------------------------------

- RTTY shift width cannot be altered when the RTTY communication screen is open.
- When the shift width in RTTY exceeds 170 Hz, the audio peak filter for the selected band cannot be set to ON.

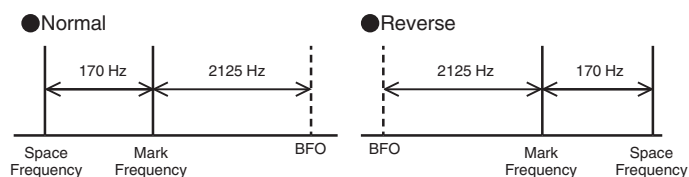


- To operate in the RTTY mode using the built-in demodulator, encoder and decoder of this transceiver, configure the setting to “170 [Hz]”.

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### Frequency Reverse in RTTY Mode

Decoding cannot be performed correctly when the RTTY signal received is in the reverse state (frequencies of the mark signal and space signal are reversed). When this occurs, press and hold **[FSK/PSK]** to reverse the RTTY signal received so that the reverse signal can be decoded.



### Operating RTTY Using an External Device

To operate in the RTTY mode using an external device instead of the built-in encoder and decoder functions of this transceiver by configuring this transceiver to the RTTY (FSK) mode, make use of the ACC 2 connector. Connect the keying output line of the external device to pin 2 (RTTY) of the ACC 2 connector and the demodulation input line of the external device to pin 3 (ANO) of the ACC 2 connector. Also, connect the TX control (PTT) line to pin 13 (SS) of the ACC 2 connector.

- For RTTY transmission using PKS/SS signals of the ACC 2 connector, encoding is performed using the RTK signals input to the ACC 2 connector. However, if the built-in encoder is activated during transmission via the PKS/SS signals, encoding will be performed using the built-in encoder and the RTK signals from the ACC 2 connector will be ignored. (Transmission of the built-in message memory is also possible during RTTY operation using an external device.)

See below for examples of the connection setup (1-4).

- Connection with a PC
- Connection with devices with a built-in TNC

### ACC 2 Keying Polarity Setting

When communicating using an external device in the RTTY (FSK) mode, input keying signals to pin 2 (RTTY) of the ACC 2 connector.

#### ● Configure in Menu [2-07] “FSK Keying Polarity”

Setting Value	Off (default)/ On

- Configure the keying polarity of this pin 2 (RTTY) according to the specifications of the external device. When Menu [2-07] “FSK Keying Polarity” is configured to “Off” and pin 2 (RTTY) is short-circuited to GND, signals are transmitted at the mark frequency configured in Menu [2-08] “FSK Tone Frequency”.
- When Menu [2-07] “FSK Keying Polarity” is configured to “On”, signals are transmitted as space signals with the mark frequency shifted by the amount configured in Menu [2-06] “FSK Spacing”.

### Audio Peak Filter

Using the audio peak filter may help to improve the decodability of RTTY messages when operating in the RTTY (FSK) mode with this transceiver connected to an external device.

#### ● Press F [APF] to set the audio peak filter to ON.

- When audio peak filter is turned on, “ON” is displayed in the lower row of F [APF].
- When audio peak filter is turned off, “OFF” is displayed in the lower row of F [APF].

## PSK Operation

This transceiver is equipped with a built-in demodulator, encoder and decoder for operating in the PSK31 and PSK63 modes. Operation in the PSK31 or PSK63 mode can be performed easily by connecting a commercially available USB keyboard. PSK can also be operated using a data communication software program that makes use of the sound function of a PC.



- When transmitting in the PSK mode, adjust the carrier until the ALC meter starts to deflect.
- When an external device is used, adjust the audio signal level from the external device, followed by adjusting the ALC meter until it starts to deflect.

### Displaying the PSK Communication Screen

- Press **[FSK/PSK]** to select PSK mode.
- Press **F3 [DECODE]**.  
The PSK communication screen appears.

#### Text Display Area + FFT Scope



#### Text Display Area + Vectorscope



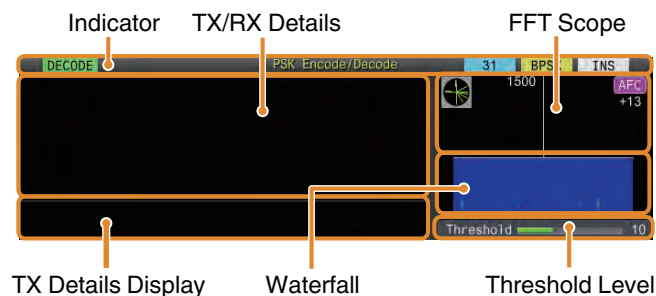
### Switching between the FFT Scope and Vectorscope Display

The display toggles between the “audio FFT scope and waterfall” and “vectorscope” each time the scope display on the screen is touched.



- Noise Reduction 1, Noise Reduction 2, Beat Canceler 1, Beat Canceler 2 and RX DSP equalizer do not function during decoding of PSK messages.

The layout of the PSK communication screen is as follows.



#### Indicator

Indicates the status of the function.

#### TX/RX Details

Displays the character strings that are transmitted or received.

#### TX Details Display

Character strings to be transmitted.

### FFT Scope

The audio FFT scope is used for viewing the tuning status. If there are multiple signals in the band, the target signal is tuned such that it becomes a 1500 Hz tone. Zero-in needs to be performed accurately in the PSK mode. Zero-in the target signal while monitoring the FFT scope and vectorscope.

### Waterfall

Displays the transition in the spectrum of the TX audio signal in tandem with the FFT scope.

### Vectorscope

The vectorscope indicates the way in which the PSK signals received are tuned. It comes in handy when tuning to the signal of the target station while monitoring the waveform on the vectorscope.

### Threshold Level

Displays the threshold value of the RX signal input level for decoding.

### Operating the PSK Communication Screen

The following operations are enabled when the PSK communication screen opens.

- Pressing the **[Page Up]** or **[Page Down]** key scrolls the display of the TX or RX details.

Key	Behavior
<b>F1 [MORE]</b>	Switches the key guide.
<b>F2 [B/QPSK]</b>	Switches between the BPSK and QPSK modes.
<b>F3 [31/63]</b>	Switches between the PSK31 and PSK63 modes.
<b>F3 [PAUSE]</b>	Pauses update (drawing) of the TX/RX details display area. Pressing the key again resumes the update (drawing).
<b>F4 [LOG]</b>	Turns ON/OFF the communication log function. Pressing and holding this key displays the screen for selecting a log file that is saved.
<b>F4 [(CLEAR)]</b>	Pressing and holding the key clears the text displayed on the TX/RX details screen.
<b>F5 [THLD]</b>	Switches to the threshold level configuration mode.
<b>F5 [MEMORY]</b>	Switches to the PSK Message screen.
<b>F6 [AFC]</b>	Switches the AFC function.
<b>F7 [EXTEND]</b>	Enlarges the size of the PSK communication screen. Pressing it again restores the screen to the standard size.

### Indicator Displays

Display	Behavior
	Appears when the communication log function is ON.
	Appears when the communication log function is ON and in the standby mode.
	Appears when signal decoding is in progress.
	Appears when encoding the character strings in the TX character string buffer.
	Appears when the decode function is stopped or disabled.
	Appears when transmitting the auto standby channel during transmission of the message memory.
 	Displays the baud rate.
 	Displays the communication mode.
	Appears when in the insert mode.
	Appears when in the overwrite mode.
	Appears when AFC is ON. Displays the difference in frequency at the bottom.
	Appears when NET is ON.

### Saving PSK Communication Logs

The CW, RTTY and PSK communication screens can be saved using the communication log function. Please refer to “Communication Log” on page 5-27.

### Adjusting the PSK Decode Threshold Level

Noise that occurs when there is no signal may sometimes be erroneously detected as text, which results in the display of unwanted text. To reduce the occurrence of such issues, adjust the threshold level. Raise the threshold level when there is frequent erroneous detection due to noise.

#### 1 Press F5 [THLD].

The threshold level setting can now be adjusted.



#### 2 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to adjust the level.

<b>Setting Value</b>	1 to 10 (default) to 30 (1 step)
----------------------	----------------------------------

- Adjust the threshold value in the ascending order according to the receiving status of noise, for example. Start from a small value between the range of 1 to 30 and configure the threshold value to a point where reception is good.

#### 3 Press F1 [] to end the process.

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## FFT Scope/Vectorscope Display Setting

The tuning scope displayed on the PSK communication screen can be switched to an “FFT scope” or “vectorscope” display.

### ● Configure in Menu [2-13] “PSK Tuning Scope”

Setting Value	FFT Scope (default)/ Vector Scope
---------------	-----------------------------------

- The display toggles between the “FFT scope” and “vectorscope” each time the scope display on the screen is touched.

## FFT Scope Waveform Averaging

The waveform displayed on the FFT scope can be averaged. Averaging of the waveform reduces random noise and makes observation of the target signal easier.

### ● Configure in Menu [2-10] “FFT Scope Averaging (PSK Decode)”

Setting Value	0 (default) to 9 (1 step) (minimum to maximum averaging)
---------------	--

## Selecting a Waterfall Display Type

### ● Configure in Menu [2-17] “Waterfall when Tuning (RTTY/PSK Audio Scope)”

Setting Value	Straight (default)/ Follow
---------------	----------------------------

**Straight:** Uses a straight line to show transition in the level of the target signal displayed on the waterfall when the RX frequency is altered.

**Follow:** Tracks and displays the latest audio FFT level at the portion where the waterfall starts flowing when the RX frequency is altered.

## Vectorscope

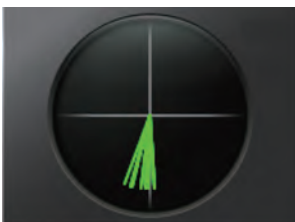
Turn the Tuning control to perform tuning such that the emission lines displayed on the vectorscope radiate from the center into the same direction.



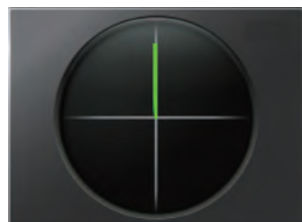
In Tune (BPSK)



In Tune (QPSK)



Idle Signal of BPSK or QPSK



Unmodulated Carrier Signal

- Make use of the fine-tuning function if there is difficulty in performing tuning.
- While transmission is in progress, the vectorscope does not function and points to the 12 o'clock direction.

## AFC (Automatic Frequency Control)

The AFC (Automatic Frequency Control) function can be used to tune the PSK signal that is being received.

### ● Press F6 [AFC] to set the AFC function to “On”.

- Pressing **F6 [AFC]** each time toggles the option in the following sequence: “OFF” → “AFC ON” → “AFC&NET ON” → “OFF”.
- When the AFC function is ON, the << **AFC** >> display lights up. The amount of frequency correction made by the AFC function is displayed below “AFC”.
- Pressing and holding **F6[AFC]** while the AFC function is ON increases or decreases the displayed frequency which indicates the amount of correction made by the AFC function.



## Configuring the AFC Tuning Range

Configure the frequency range for tuning the PSK signals that are received using the AFC function.

### ● Configure in Menu [2-11] “PSK AFC Tuning Range”

Setting Value	±8/ ±15 (default) [Hz]
---------------	------------------------

## NET

The NET function transmits signals by applying the frequency that is automatically tuned by AFC.

### ● Press F5 [AFC] to select “AFC & NET”.

- Pressing **F5 [AFC]** each time toggles the option in the following sequence: “OFF” → “AFC function ON” → “AFC function & NET function ON” → “OFF”.
- << **AFC** >> and << **NET** >> light up.



## Switching between BPSK and QPSK

The PSK mode is further divided into 2 sub-modes, namely BPSK and QPSK. BPSK is the more commonly used mode. QPSK excels at correcting errors and boasts a higher decoding rate than BPSK.

### ● Press F2 [B/QPSK].

Pressing the key each time toggles the mode between BPSK and QPSK. The display to the right of the status bar toggles between << **BPSK** >> and << **QPSK** >> when the mode is switched.



- This is fixed at BPSK when the PSK63 mode is selected.

**Switching between PSK31 and PSK63**

This transceiver supports PSK31 as well as PSK63. The latter has a transfer rate that is twice that of the BPSK mode. Perform the following step to toggle between PSK31 and PSK63.

**● Press F3 [31/63].**

It is possible to toggle between BPSK31 and BPSK63 or between QPSK31 and QPSK63. The display to the right of the status bar toggles between << 31 >> and << 63 >> when the mode is switched.



● This is fixed at BPSK when the PSK63 mode is selected.

**Transmitting Character Strings from USB Keyboard**

A commercially available USB keyboard can be used to input and transmit character strings.

**Transmitting the Input Character String Immediately**

**1 Connect the USB keyboard to (USB-A).**

**2 Press F3 [DECODE] to display the PSK communication screen.**

**3 Press [F12] on the USB keyboard to switch this transceiver to the TX mode.**

The [BUSY/TX] LED lights up in red, and << ENCODE >> is displayed in the status bar.

**4 Enter a character string using the USB keyboard.**

- The input character string is displayed in the TX details display area and transmitted immediately.
- In the TX details display area, the color of the individual characters change successively once they are transmitted.
- Characters that have been transmitted appear successively in the TX/RX details display area.

**5 Press [F12] on the USB keyboard to switch this transceiver to the RX mode.**



● If there remain characters in the TX details display area that are not transmitted when [F12] is pressed in step 5, << WAIT >> is displayed in the status bar. After transmission of all the character strings is complete, the transceiver switches to the RX mode and the light of the [BUSY/TX] LED and << WAIT >> display go off.

**Temporarily Placing Character Strings in the Character String Buffer before Transmission**

**1 Connect the USB keyboard to (USB-A).**

**2 Press F3 [DECODE] to display the PSK communication screen.**

**3 Enter a character string using the USB keyboard.**

The input character string is stored temporarily in the TX details display area.

**4 Press [F12] on the USB keyboard to send out the character string that is stored in the character string buffer.**

- Upon entering the TX mode, the [BUSY/TX] LED lights up in red, and << ENCODE >> is displayed in the status bar.
- In the TX details display area, the color of the individual characters change successively once they are transmitted.

**5 Press [F12] on the USB keyboard to switch this transceiver to the RX mode.**



- If there remain characters in the TX details display area that are not transmitted when [F12] is pressed in step 5, << WAIT >> is displayed in the status bar. After transmission of all the character strings is complete, the transceiver switches to the RX mode and the light of the [BUSY/TX] LED and << WAIT >> display go off.
- Pressing [ESC] while transmission of the character strings is in progress switches this transceiver to the RX mode. Transmission of the character strings stops, and character strings in the TX details display area that are not yet transmitted are cleared.
- Time stamp and frequency information can be added to the TX or RX data that is displayed in the TX/RX details display area.
- Sending a character string using the USB keyboard while the TX/RX display is paused by pressing F3 [PAUSE] cancels the paused state.
- The character strings that can be placed temporarily in the TX details display area can contain a maximum of 4300 characters.
- Characters and symbols that can be input using a USB keyboard are as follows.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	X	Y	Z				
0	1	2	3	4	5	6	7	8	9					
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z				
À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î
Ī	Ī	Ñ	Ö	Ó	Ô	Õ	Ö	Ø	Ù	Ú	Û	Ü	Ý	Þ
à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î
ï	ð	ñ	ò	ó	ô	õ	ö	ø	ù	ú	û	ü	ý	þ
ÿ	ß													
!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
:	;	<	=	>	?	@	[	\	]	^	_	`	{	
}	~	ı	¢	£	¤	¥	¦	§	¨	©	ª	«	¬	®
-	°	±	²	³	´	µ	¶	•	,	¹	º	»	¼	½
¾	¿	No	÷									Space	Line Break	

- The chart above shows the characters and symbols that can be input when "English" is selected in Menu [9-01]. To input Japanese characters, please download and refer to the Japanese instruction manual from our website.

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## PSK Message Memory

Fixed phrases that are often used in the PSK mode can be registered in advance as a message in the message memory. Adding the auto TX and auto RX functions to the fixed phrases enables messages to be sent out via simple operation.

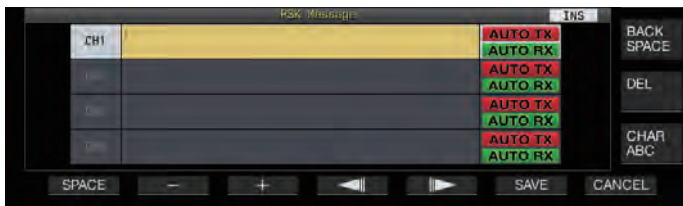
- Up to 8 types of messages can be registered.

### Registering Messages

- 1 Press F3 [DECODE] to display the PSK communication screen.
- 2 Press F5 [MEMORY] to display the PSK Message screen.



- 3 Press F3 [▲] / F4 [▼] or turn the [MULTI/CH] control to select the channel for registering the message.
  - If F3 [▲] and F4 [▼] are not displayed in the key guide, press F1 [MORE] to toggle the key guide display.
- 4 Press F5 [MSG].



- 5 Use the function keys, [MULTI/CH] control or USB keyboard to enter a character string.

Key	Behavior
F1 [SPACE]	Inserts a space.
F2 [-]/ F3 [+]	Selects a character.
F4 [◀]/ F5 [▶]	Moves the cursor.
F [BACK SPACE]	Deletes the character to the left of the cursor.
F [DEL]	Deletes the character to the right of the cursor.
F [CHAR]	Switches the type of character to edit. Pressing the key each time switches the selection in the following sequence: ABC (upper case) → abc (lower case) → !"# (symbols) → ABC (upper case)

- Pressing F7 [CANCEL] discards the content that is currently being edited and exits the character string input mode.

- 6 Press F6 [SAVE] to save the edited message.

## Configuring Auto TX/RX for the PSK Message Memory

The transmission and reception behavior can be configured when a PSK message memory channel is selected.

- Auto TX places this transceiver in the TX mode before transmitting a message when a message memory channel is selected, and maintain the TX mode after all messages have been sent out.
- For auto RX, pressing [F12] after selecting a message memory channel for transmission places this transceiver in the TX mode. When the message is sent out, this transceiver is automatically restored to the RX mode.
- Combining auto TX and auto RX enables both transmission and reception to be performed automatically.

- 1 Press F3 [DECODE] to display the PSK communication screen.
- 2 Press F5 [MEMORY] to display the PSK Message screen.
- 3 Press F3 [▲] / F4 [▼] or turn the [MULTI/CH] control to select the channel containing the message for auto TX/RX.
- 4 Press F6 [AUTO.TX] to set auto TX to ON.
  - << **AUTO TX** >> is displayed to the right of the PSK message.



- When auto TX is set to OFF, the << **AUTO TX** >> display goes off, and the PSK message of the channel is temporarily placed in the character string buffer but not transmitted automatically.

- 5 Press F7 [AUTO.RX] to set auto RX to ON.
  - << **AUTO RX** >> is displayed to the right of the PSK message.
  - When auto RX is set to OFF, the << **AUTO RX** >> display goes off, and this transceiver is not restored to the RX mode after the PSK message for the channel has been sent out.



- To sent a PSK message for which "AUTO TX" is set to ON, select the channel in which the PSK message is stored. Check to ensure that the character string (PSK message) is forwarded to the TX details display area, followed by pressing [F12] on the USB keyboard.
- To switch this transceiver to the RX mode after transmitting a PSK message for which "AUTO RX" is set to OFF, press [F12] on the USB keyboard after the PSK message has been sent out.

### Transmitting Character Strings from the PSK Message Memory

A message that is registered in the PSK message memory can be transmitted as follows.

- 1 Press F3 [DECODE] to display the PSK communication screen.
- 2 Press F5 [MEMORY] to display the PSK Message screen.



- 3 Press F3 [CH 1] to F6 [CH 4] or F3 [CH 5] to F6 [CH 8] to select the channel that contains the message to be transmitted.
  - The PSK message of the channel corresponding to the function key is being transmitted automatically.
  - However, the PSK message will not be transmitted automatically if auto TX is set to OFF.
  - If the channel guide is not displayed, press F2 [MORE].
  - Pressing F7 [NEXT] each time switches between F3 [CH 1] to F6 [CH 4] and F3 [CH 5] to F6 [CH 8].
  - After transmitting the PSK message that is indicated by an << **AUTO RX** >> display beside it, this transceiver returns to the RX mode.

### Settings Related to PSK

#### Configuring the PSK Tone Frequency

Configure the tone frequency when signals are received in the PSK mode.

- Configure in Menu [2-12] "PSK Tone Frequency"

Setting Value	1.0/ 1.5 (default)/ 2.0 [kHz]
---------------	-------------------------------

#### Reversing the Direction of Phase Change in the QPSK Mode

- When the QPSK signal received cannot be decoded correctly, try decoding with the BFO frequency switched from the LSB side to the USB side.
- Decoding cannot be performed correctly when the BFO frequency of the PSK signal received is in the reverse state (frequencies of the lower and upper sidebands are reversed).
- Pressing and holding the [FSK/PSK] mode key enables reverse signals to be decoded.

#### PSK Operation Using a PC

For details on operation in the PSK mode using a data communication software program that makes use of the sound function of a PC instead of the built-in encoder and decoder functions of this transceiver while this transceiver is configured to the SSB-DATA mode, please refer to "PC Connection".

- As audio from an external input cannot be transmitted in the PSK mode, make use of the SSB or SSB-DATA mode.
- Alternatively, audio from an external device can also be transmitted using the DATA VOX function.

### Communication Log

The CW, RTTY and PSK communication screens can be saved using the communication log function.

- Before doing so, configure the destination for saving the data in "File Storage Location" of the "USB/File Management Menu" to "Internal Memory" or "USB Flash Drive". (See 11-12)
- To save the data to a USB flash drive, insert a USB flash drive formatted using this transceiver into (USB-A).

- 1 Set to the CW, RTTY (FSK) or PSK mode.
- 2 Press F3 [DECODE] to display the corresponding communication screen.
- 3 Press F4 [LOG] to set the communication log function to "On".

Pressing F4 [LOG] each time toggles the communication log function between ON and OFF.

- "Log: On" appears on the communication screen for about 1 second when the communication log function is ON, and "Log: Off" is displayed for about 1 second when the function is OFF.
- When the communication log function is functioning in the ON mode, the communication log ON indicator is displayed on the title bar.
- When the communication log function is ON and the transceiver is in the standby mode, "○" is displayed on the title bar. (When there is insufficient space in the USB flash drive or when a USB flash drive is not inserted when the destination for saving the logs is configured to a USB flash drive.)

- The file name is made up of the date and time in numerical format together with an underscore. The extension of the file is based on the selection made in Menu [2-14] "CW/RTTY/PSK Log File Format". The date and time is expressed in the following sequence: `yyyymmdd_hhmmss`.
  - (Example)
  - If the date is 10:20:30 a.m., February 15, 2018: `20180215_102030.txt`
- The file is stored in the following folder.
  - CW: `KENWOOD\TS-890\DECODE\CW`
  - RTTY: `KENWOOD\TS-890\DECODE\RTTY`
  - PSK: `KENWOOD\TS-890\DECODE\PSK`
- When removing the USB flash drive, make sure to execute "Safe Removal of USB Flash Drive". (See 11-6)

#### Selecting a Log File Format

Select a format for the log file to be saved.

- Configure in Menu [2-14] "CW/RTTY/PSK Log File Format"

Setting Value	html/ txt (default)
---------------	---------------------

**html:** Saves the log file in the html format.  
**txt:** Saves the log file in the text format.

## 5 COMMUNICATING AIDS

### Displaying a Time Stamp

A time stamp can be automatically inserted into the “TX/RX details display area” when switching between the RX and TX mode.

### Selecting a Time Stamp Type

It is possible to select whether to display only the time stamp or to display both the time stamp and frequency.

#### ● Configure in Menu [2-15] “CW/RTTY/PSK Time Stamp”

Setting Value	Off/ Time Stamp/ Time Stamp+Frequency (default)
---------------	---

**Off:** Does not display a time stamp.

**Time Stamp:** Displays only the time stamp.

**Time Stamp+Frequency:** Displays both the time stamp and frequency.

### Selecting a Clock Type

Configure the clock for displaying the time stamp to a “Local Clock” or “Secondary Clock”.

#### ● Configure in Menu [2-16] “Clock (CW/RTTY/PSK Time Stamp)”

Setting Value	Local Clock (default)/ Secondary Clock
---------------	--

- When encoding or decoding starts, a line break and time stamp will be inserted before displaying the encoded or decoded character string.
- A time stamp is inserted when there is a change in the encoding or decoding status.

### Editing the Communication Log File

#### 1 In the CW communication screen, press and hold F2 [LOG]. In the RTTY and PSK communication screens, press and hold F4 [LOG].

The screen for selecting log file appears.



#### 2 Press F2[▲]/F3[▼] to select a file.

- Pressing F4 [VIEW] displays the log information of the selected file.



- To read data from the internal memory, press F7 [INT.MEM].
- To read data from the USB flash drive, press F7 [USB.MEM]. (If a USB flash drive is not connected, a message will appear prompting you to get ready the USB flash drive.)
- Pressing F5 [NAME] allows the file name to be changed.
- Pressing F6 [DELETE] displays a message to confirm deletion of the file. Pressing F4 [OK] deletes the file.

### Operation in FM Mode

Operating in the FM mode enables high-quality voice communication as well as communication that is noise-resistant. Communication in the FM mode is also supported on the 29 MHz, 50 MHz and 70 MHz (E type) bands. To communicate with a distant station for which communication cannot be established directly, do so via a repeater.

### Adjusting Microphone Gain during Operation in FM Mode

- 1 Adjust the frequency.
- 2 Press [FM/AM/FM-N] to select FM mode.
- 3 Press F [ADV.] on the menu screen.
- 4 Select Advanced Menu [10] “Microphone Gain (FM Mode)”.
- 5 Press [SEND], or press and hold [PTT] on the microphone.  
This transceiver is placed in the TX mode and a level meter is displayed.
- 6 Speak into the microphone in the normal tone and loudness.
- 7 Press F4 [-]/F5 [+] or turn the [MULTI/CH] control to adjust the microphone gain.

Setting Value	0 to 50 (default) to 100 (1 step)
---------------	-----------------------------------

- Adjust the microphone gain level such that the peak value of the level meter falls within the zone.
- 8 Press [SEND] or release [PTT] on the microphone.  
Doing so places this transceiver in the RX mode.
  - 9 Press F1 [↶].



- When using a microphone with a low sensitivity such as the MC-90, adjust the microphone gain to a higher level.
- When a microphone with a low sensitivity is used, the modulation factor may stabilize by setting the speech processor to ON.



**Operation in Narrow FM Mode**

It is possible to switch to a narrow bandwidth during operation in the FM mode. The occupied bandwidth and maximum modulation factor are shown in the table below. Selecting FM Narrow according to the modulation factor of the target station helps to avoid distortion and deterioration in the clarity of the RX audio.

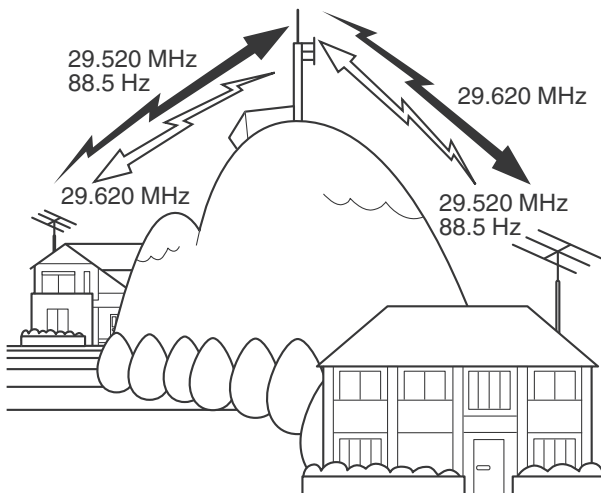
Mode	Occupied Bandwidth	Maximum Modulation Factor
FM (Wide)	16 kHz or lower	±5 kHz or lower
FM Narrow	10 kHz or lower	±2.5 kHz or lower

- **Press and hold [FM/AM].**  
Pressing and holding [FM/AM] each time switches between “FM” and “FMN (Narrow)”.



**Operating the FM Repeater**

Switching this transceiver to split operation and turning on the tone signal while in the FM mode enables this transceiver to be used in the repeater operation mode.

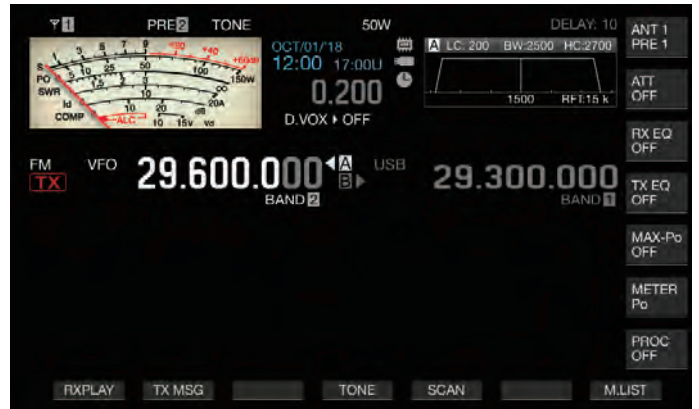


**Configuring the Tone Signal**

- Registering the tone settings to a memory channel and calling up the frequency or operation information from the memory channel eliminates the need to configure the tone frequency each time. For more details on the memory channel settings, please refer to “Memory Channel”.
- The tone frequency may vary depending on the country or region this transceiver is being used.

**Selecting a Tone**

- **Press F4 [TONE] to select “TONE”.**  
Pressing F4 [TONE] each time toggles the tone signal selection in the following sequence: “TONE” → “CTCSS (CT)” → “CROSS” → Blank (deselected).



**Configuring the Tone Frequency**

- 1 Press and hold F4 [TONE] to display the FM Tone Frequency screen.



- 2 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to select the tone frequency.

Tone Frequency (Hz)						
67.0	88.5	114.8	151.4	177.3	203.5	250.3
69.3	91.5	118.8	156.7	179.9	206.5	254.1
71.9	94.8	123.0	159.8	183.5	210.7	1750
74.4	97.4	127.3	162.2	186.2	218.1	
77.0	100.0	131.8	165.5	189.9	225.7	
79.7	103.5	136.5	167.9	192.8	229.1	
82.5	107.2	141.3	171.3	196.6	233.6	
85.4	110.9	146.2	173.8	199.5	241.8	

- The default setting is “88.5 Hz”.
- To restore the default setting, press and hold F1 [(RESET)].

**Tone Frequency Scan**

Tone frequency that is contained in signals received in the FM mode can be searched and displayed with the following steps. This is useful when there is a need to know the tone frequency of the repeater station.

- 1 Press and hold F4 [TONE] to display the FM Tone Frequency screen.
- 2 Press F7 [SCAN] to start tone frequency scan.
  - Scanning stops when a tone frequency is detected, and the frequency is displayed in the “FREQ. [Hz]” field.
  - Pressing F7 [SCAN] while tone frequency scan is in progress stops the scan operation. Pressing F7 [SCAN] again resume scanning.
  - The scan operation stops when the RX signal is interrupted during tone frequency scan. Scanning resumes when a RX signal is detected by this transceiver.

## 5 COMMUNICATING AIDS

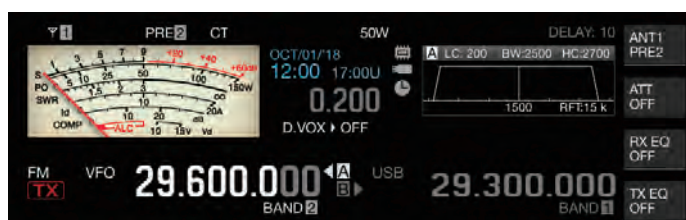
### CTCSS Operation

CTCSS is the abbreviation for Continuous Tone Coded Squelch System. It is used to add a CTCSS tone frequency that is determined in advance with the target station to the audio signal to be transmitted. When the CTCSS tone frequency contained in the RX signal received from the target station coincides with the CTCSS tone frequency of one's own station, the squelch opens and the RX audio can be heard.

- A different value can be selected for CTCSS tone frequency and tone frequency, but CTCSS and tone cannot be used concurrently.
- CTCSS tone frequency: Squelch opens upon receiving a CTCSS tone for which the FM wave is superimposed with the same CTCSS tone frequency as that configured on this transceiver.
- During CTCSS frequency scan, it is possible to detect the CTCSS tone frequency that is contained in the RX signal.
- When a signal is received while CTCSS tone frequency scan is in progress, the RX audio can be heard even when the CTCSS tone frequency does not coincide with that configured on this transceiver.

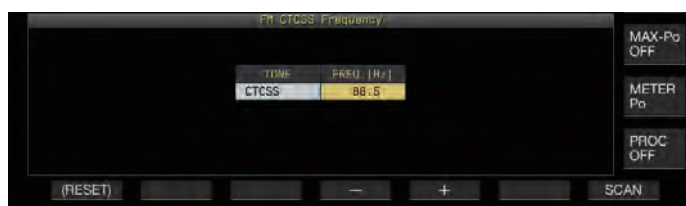
### Selecting CTCSS

- **Press F4 [TONE] to select "CTCSS (CT)".**  
Pressing **F4 [TONE]** each time toggles the tone signal selection in the following sequence: "TONE" → "CTCSS (CT)" → "CROSS" → Blank (deselected).



### Configuring the CTCSS Frequency

- 1 Press and hold **F4 [TONE]** to display the FM Tone Frequency screen.



- 2 Press **F4 [-]** / **F5 [+]** or turn the **[MULTI/CH]** control to select the CTCSS frequency.

CTCSS Frequency (Hz)						
67.0	88.5	114.8	151.4	177.3	203.5	250.3
69.3	91.5	118.8	156.7	179.9	206.5	254.1
71.9	94.8	123.0	159.8	183.5	210.7	
74.4	97.4	127.3	162.2	186.2	218.1	
77.0	100.0	131.8	165.5	189.9	225.7	
79.7	103.5	136.5	167.9	192.8	229.1	
82.5	107.2	141.3	171.3	196.6	233.6	
85.4	110.9	146.2	173.8	199.5	241.8	

- The default setting is "88.5 Hz".
- To restore the default setting, press and hold **F1 [(RESET)]**.

### CTCSS Frequency Scan

CTCSS frequency that is contained in signals received in the FM mode can be searched and displayed with the following steps. This is useful when there is a need to know the CTCSS frequency of the mobile station.

- 1 Press and hold **F4 [TONE]** to display the **CTCSS Frequency** screen.
- 2 Press **F7 [SCAN]** to start tone frequency scan.
  - Scanning stops when a CTCSS frequency is detected, and the frequency is displayed in the "FREQ. [Hz]" field.
  - Pressing **F7 [SCAN]** while CTCSS frequency scan is in progress stops the scan operation. Pressing **F7 [SCAN]** again resume scanning.
  - The scan operation stops when the RX signal is interrupted during CTCSS frequency scan. Scanning resumes when a RX signal is detected by this transceiver.

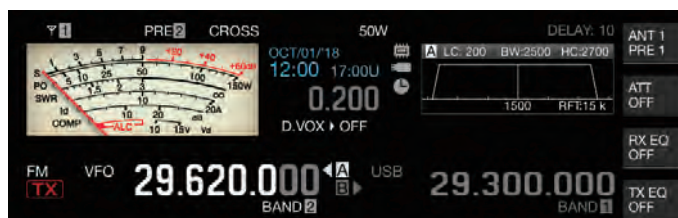
### Cross Tone

Make use of cross tone for communication with a repeater that requires a different tone for transmission to the repeater (uplink) and reception from the repeater (downlink).

- Cross Tone frequency uses the tone frequency during transmission and the CTCSS frequency during reception.
- The tone squelch operates using the CTCSS frequency during reception, while the preconfigured tone frequency is used to transmit a tone during transmission.

### Selecting Cross Tone

- **Press F4 [TONE] to select "CROSS".**  
Pressing **F4 [TONE]** each time toggles the tone signal selection in the following sequence: "TONE" → "CTCSS (CT)" → "CROSS" → Blank (deselected).



### Configuring the TX/RX Tones

- 1 Press and hold **F4 [TONE]** to display the FM Cross Tone Frequency screen.



- 2 Press **F2 [▲]** / **F3 [▼]** to select "TONE (TX)" or "CTCSS (RX)".
- 3 Press **F4 [-]** / **F5 [+]** or turn the **[MULTI/CH]** control to select the tone frequency or CTCSS frequency.
  - To restore the default setting of the selected row, press and hold **F1 [(RESET)]**.

# 6 REJECTING INTERFERENCE

## Attenuator

The attenuator is a function for attenuating the RX signals. If there is interference due to strong signals near the target signal, turning on the attenuator helps to reduce interference caused by nearby frequencies.

It is also effective in situations where the RX audio is distorted when the RX signal is too strong. This transceiver comes with three different types of attenuators.

### ● Press F [ATT].

Pressing F [ATT] each time switches the attenuation level.

Setting Value	Off (default)/ 6 dB/ 12 dB/ 18 dB
---------------	-----------------------------------

- Pressing and holding F [ATT] each time switches the options in the reverse sequence.
- The attenuation level is stored for each antenna selection band.
- The status of the attenuator (attenuation level) is displayed in the key guide.



## Switching the IF Filter Band Characteristics

### Switching the RX Filter (A, B, C)


The setting for the band characteristics of the IF filter on this transceiver can be switched at one touch according to the operating status to one of the three types (A, B or C).

- The band characteristics are configured by combining the roofing filter or IF and AF filter, high-cut/low-cut and WIDTH/SHIFT. A different RX filter setting (A, B or C) can be stored for each of the SSB, CW, FSK, PSK, FM and AM modes.

### ● Press [IF FIL].

Pressing [IF FIL] each time switches the RX filter in the order of "A", "B" and "C".

- The selected filter is displayed at the top left of the filter scope.

 The RX filter does not switch to Type C if Menu [6-10] "RX Filter Numbers" below is configured to "2".

### Configuring the Selectable Types of RX Filters

The selectable types of RX filters can be configured to three (A, B and C) or two (A and B).

Configure in Menu [6-10] "RX Filter Numbers"

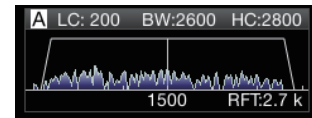
Setting Value	2/ 3 (default)
---------------	----------------

## Filter Scope

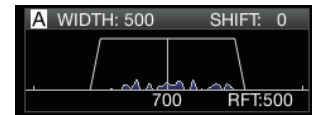
The following information is displayed on the filter scope screen.

- Selected RX filter (A, B or C)
- Image of the IF filter passband characteristics
- Demodulated audio signal
- Parameters including the IF filter passband width
- Pitch frequency in the CW mode
- Notch point of the notch filter
- Passband width of the roofing filter

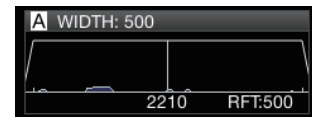
### SSB



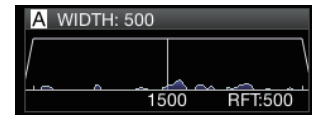
### CW



### FSK



### PSK



### AM/FM



- Audio signals are not shown when the audio scope screen is displayed.
- Audio signals are not shown when the RTTY/PSK communication screen is displayed.
- An out-of-range marker (◀▶) is displayed if an image of the passband characteristics is not displayed in the drawing area.
- Audio FFT is generally displayed within the trapezoidal waveform, but may extend beyond it in some rare cases such as when there is input of a large signal.
- Sideband on the positive side with respect to the carrier wave is drawn on the audio scope. In principle, sideband also exists on the negative side of the carrier wave in the AM mode. As such, changing the notch point may cause it to shift to the sideband on the negative side. When a notch filter is used concurrently, the marker of the notch point may shift to the sideband on the negative side. In this case, the marker is displayed in the folded state. When the marker is in the folded state, it is displayed in a color that is different from the usual color.

## 6 REJECTING INTERFERENCE

### RX Filter Screen

The steps to configure the settings for the different types of RX filters are as follows.

#### Displaying the RX Filter Screen

- Press and hold [IF FIL] to display the RX Filter screen.

#### Selecting a Roofing Filter

A roofing filter helps to reduce strong interference signals that are next to the target signal.



- 1 Press [IF FIL] or F2 [FILTER] to select an RX filter (FIL-A/B/C).
- 2 Press F3 [ROOF]. Pressing F3 [ROOF] each time switches the passband width.

Setting Value	Auto (default)/ 270/ 500/ 2.7 k/ 6 k/ 15 k [Hz]
---------------	---

**Auto:** A roofing filter with a bandwidth wider than the passband width of the DSP filter is automatically selected using high cut/low cut or Width/Shift. (If there are 2 or more bandwidths that satisfy the conditions, the narrower one is selected.)

- In the AM mode, a 6 kHz roofing filter is automatically selected if the high cutoff frequency is 3 kHz or lower, and a 15 kHz roofing filter is selected if the high cutoff frequency is higher than 3 kHz.
- In the FM mode, the option is fixed at 15 kHz and cannot be changed.
- 270 Hz is available for selection when the optional YG-82CN-1 is attached.
- Pressing and holding F3 [ROOF] each time switches the options in the reverse sequence.
- The passband width can also be altered by turning the [MULTI/CH] control.
- "RFT:xxxx" is displayed at the bottom right of the filter scope. [xxxx:270/ 500/ 2.7k/ 6k/ 15k]



- The IF passband width for the AM mode is twice the value of the high cutoff frequency. Example: If the frequency is 3,000 Hz, the IF passband width will be 6 kHz.

### Switching the IF Filter Shape

3 types of IF filter shapes are available for selection according to the condition of interference and operation.



- 1 Press [IF FIL] or F2 [FILTER] to select an RX filter.
- 2 Press F4 [IF]. Pressing F4 [IF] each time switches the shape of the filter.

Setting Value	Medium (default)/ Soft/ Sharp
---------------	-------------------------------

- Pressing and holding F4 [IF] each time switches the options in the reverse sequence.
- The filter shape can also be altered by turning the [MULTI/CH] control.
- The IF filter option is displayed as "-" and cannot be altered in the FM mode.

### Switching the AF Filter Type

3 types of audio frequency passbands are available for selection.



- 1 Press [IF FIL] or F2 [FILTER] to select an RX filter.
- 2 Press F5 [AF]. Pressing F5 [AF] each time switches the shape of the IF filter.

Setting Value	Medium (default)/ Wide/ Narrow
---------------	--------------------------------

- Pressing and holding F5 [AF] each time switches the options in the reverse sequence.

### Configuring the Behavior of the HI/SHIFT and LO/WIDTH Controls (SSB/SSB-DATA Only)

The high cut/low cut selection in the SSB mode and Shift/Width selection in the SSB-DATA mode are preconfigured in the default setting, but they can be changed in the menu.

#### SSB Mode

- Configure in Menu [6-11] "Filter Control in SSB Mode (High/Low and Shift/Width)"

Setting Value	High & Low Cut (default)/ Shift & Width
---------------	---

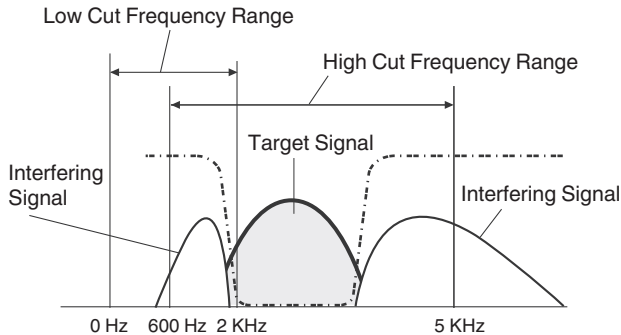
#### SSB-DATA Mode

- Configure in Menu [6-12] "Filter Control in SSB-DATA Mode (High/Low and Shift/Width)"

Setting Value	High & Low Cut/ Shift & Width (default)
---------------	---

**Changing the Cutoff Frequency**

In the SSB, AM and FM modes, the passband width of the filter can be altered by changing the cutoff frequency (low or high). The passband width can be changed so that the interfering signal falls outside the bandwidth of the filter.



● Turn the [HI/SHIFT] or [LO/WIDTH] control.

- Turning the [HI/SHIFT] control to the right increases the cutoff frequency (high) while turning the control to the left decreases the frequency.
- Turning the [LO/WIDTH] control to the right increases the cutoff frequency (low) while turning the control to the left decreases the frequency.
- The amount of change and the filter shape are displayed.



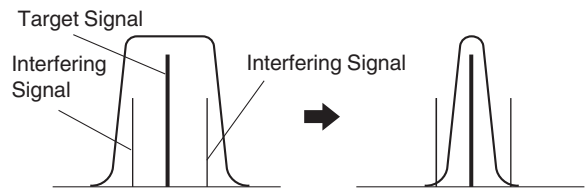
Mode	Low Cutoff Frequency (Hz)	High Cutoff Frequency (Hz)
	Setting Value	Setting Value
SSB/ SSB-DATA	0/ 50/ 100 to 200 (default) to 2000 (100-step)	600 to 2800 (default) to 3000 (100-step)/ 3400/ 4000/ 5000
AM/ AM-DATA	0/ 100 (default) to / 200/ 300	2000 to 3000 (100-step)/ 3500/ 4000/ 5000 (default)
FM/ FM-DATA	0/ 50/ 100 to 200 (default) to 1000 (100-step)	1000 to 2800 (default) to 3000 (100-step)/ 3400/ 4000/ 5000



- When configured to “Auto”, a roofing filter with a bandwidth wider than the passband width of the DSP filter is selected using high cut/low cut or Width/Shift.
- When “Auto” is configured in the AM mode, a 6 kHz roofing filter is automatically selected if the high cutoff frequency is 3 kHz or lower, and a 15 kHz roofing filter is selected if the high cutoff frequency is higher than 3 kHz.
- When the RX Filter screen is displayed, turning the [HI/SHIFT] or [LO/WIDTH] control changes the value of the cutoff frequency (low and high). The cutoff frequency value (low and high) is displayed on the RX Filter screen.
- In the FM mode, the option is fixed at 15 kHz and cannot be changed.
- When the low cutoff frequency is increased until it reaches the high cutoff frequency, the high cutoff frequency will also change at the same time while keeping the passband width at 0 Hz.
- When the high cutoff frequency is decreased until it reaches the low cutoff frequency, the low cutoff frequency will also change at the same time while keeping the passband width at 0 Hz.

**Changing the Passband Width and Shift Amount**

When in the CW or SSB-DATA mode, the passband width and shift amount of the DSP filter can be altered. When in the RTTY (FSK) or PSK mode, the passband width can be changed. The passband width can be changed so that the interfering signal falls outside the bandwidth of the filter.



1 Turn the [LO/WIDTH] control to change the passband width.

Turning the control to the right widens the passband width, while turning to the left narrows it.

2 Turn the [HIGH/SHIFT] control to shift the frequency band.

Turning the control to the right shifts the frequency to the high bandwidth, while turning to the left shifts it to the low bandwidth.

- The shift frequency band cannot be adjusted in the FSK and PSK modes.



Mode	Passband Width (Hz)	Shift Frequency (Hz)	
	Setting Value	Setting Value	Step
SSB/ SSB-DATA	50/ 80/ 100/ 150/ 200/ 250/ 300/ 350/ 400/ 450/ 500/ 600/ 700/ 800/ 900/ 1000/ 1100/ 1200/ 1300/ 1400/ 1500/ 1600/ 1700/ 1800/ 1900/ 2000/ 2100/ 2200/ 2300/ 2400/ 2500/ 2600 (default)/ 2700/ 2800/ 2900/ 3000	50 to 1500 (default) to 2500	50
CW	50/ 80/ 100/ 150/ 200/ 250/ 300/ 350/ 400/ 450/ 500 (default)/ 600/ 700/ 800/ 900/ 1000/ 1500/ 2000/ 2500	-800 to 0 (default) to +800	10
FSK	250/ 300/ 350/ 400/ 450/ 500 (default)/ 1000/ 1500	-	-
PSK	50/ 80/ 100/ 150/ 200/ 250/ 300/ 350/ 400/ 450/ 500 (default)/ 600/ 700/ 800/ 900/ 1000/ 1200/ 1400/ 1500/ 1600/ 1800/ 2000/ 2200/ 2400/ 2600/ 2800/ 3000	-	-

## 6 REJECTING INTERFERENCE

### Preset Passband Characteristics

The frequently-used filter settings (high cut, low cut and WIDTH/SHIFT) can be preset according to the style in which this transceiver is used.



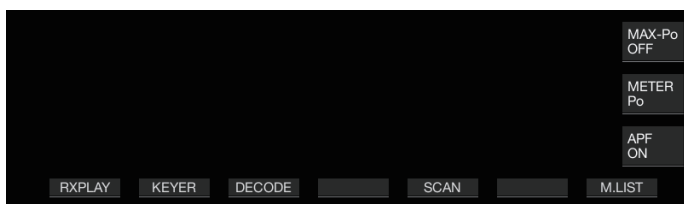
- 1 Press [IF FIL] or F2 [FILTER] to select an RX filter.
- 2 Press F6 [FIL SET].  
The current filter settings (high cut, low cut and WIDTH/SHIFT) are stored as the preset values.
  - When preset values are applied, the values will be highlighted in the display for approximately 0.5 seconds.
  - Pressing F7 [FIL CLR] restores the passband width changed using the [HI/SHIFT] and [LO/WIDTH] controls to the preset value.

### Audio Peak Filter in the CW Mode

During reception in the CW mode, if the signal intelligibility deteriorates due to noise or other reasons, allowing the RX signal to pass through the bandwidth with the pitch frequency as the center frequency helps to improve the intelligibility of the RX signal.

### Turning ON/OFF Audio Peak Filter

- 1 Select CW mode.
- 2 Press F [APF].
  - Pressing F [APF] each time toggles the audio peak filter of the selected band between ON and OFF.
  - When audio peak filter is on, "ON" is displayed on the key guide. "OFF" is displayed when the audio peak filter is turned off.



### Displaying the Audio Peak Filter Screen

- Press and hold F [APF] to display the audio peak filter screen of the selected band.



### Switching the Passband Characteristics

3 types frequency passbands are available for selection for the audio peak filter.



- Press F2 [▲] / F3 [▼] to select a passband width.

Setting Value	Wide (320Hz)/ Medium (160Hz) (default)/ Narrow (80Hz)
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### Shifting the Passband Width

Shifting the passband width of the audio peak filter helps to avoid interference with nearby frequencies.



- Press F4 [◀SHIFT] or F5 [SHIFT▶], or turn the [MULTI/CH] control to shift the passband width.

Setting Value	-200 to 0 (default) to +200 [Hz] (5-step)
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- The shift amount of the passband width is  $\pm 200$  Hz with the pitch frequency as the center frequency.
- The selected passband width for the audio peak filter shifts from the pitch frequency toward a higher or lower bandwidth.

### Configuring the Peak Gain

To further enhance the target CW signal, raise the gain level.

- Press F6 [GAIN +] or F7 [GAIN -] to adjust the gain level.

Setting Value	0dB (default) to +6dB
---------------	-----------------------

**Audio Peak Filter in the FSK Mode**

When receiving signals in the FSK mode, allowing both the mark and space frequencies to have a peak help to reduce the occurrence of garbled characters, thus improving the decodability. This audio peak filter is compatible with the high tone (mark frequency of 2125 Hz) as well as the low tone (mark frequency of 1275 Hz).

**1 Select FSK mode.**

**2 Press F [APF].**

- Pressing **F [APF]** each time toggles the audio peak filter of the selected band between ON and OFF.
- When audio peak filter is on, "ON" is displayed on the key guide. "OFF" is displayed when the audio peak filter is turned off.



- When the shift width in RTTY exceeds 170 Hz, the audio peak filter for the selected band cannot be set to ON.
- Internally demodulated signals are not processed for the audio filter in the FSK mode.
- The passband cannot be shifted for the audio peak filter in the FSK mode.

**Noise Blanker**

The noise blanker is used to reduce pulse noise. This transceiver is equipped with two types of noise blankers: NB 1 that employs analog signal processing and NB2 that performs DSP (digital signal processing) at the IF level. Furthermore, two types of NB2 with different operating principles are available for selection. NB1 and NB2 can be selected for use according to the noise conditions. They can also be employed at the same time.



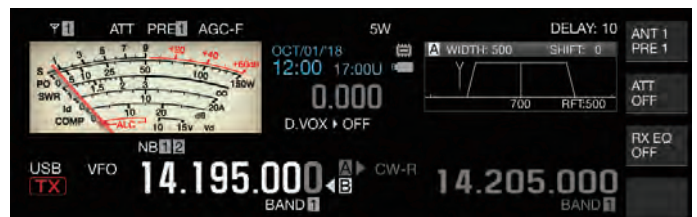
- Noise blanker cannot be used in the FM mode.

**Turning ON/OFF Noise Blanker 1/2**

**● Press [NB1] or [NB2].**

Pressing **[NB1]** or **[NB2]** each time toggles noise blanker 1 and noise blanker 2 respectively between ON and OFF.

- When noise blanker 1 or 2 is ON, <<**NB1**>> or <<**NB2**>> is displayed on the screen.
- When both noise blanker 1 and 2 are ON, <<**NB1|2**>> is displayed on the screen.



**Adjusting the NB1 Level**

**1 Press and hold [NB1] to display the Noise Blanker 1 configuration screen.**



**2 Press F4 [-] or F5 [+], or turn the [MULTI/CH] control to change the level.**

<b>Setting Value</b>	1 to 10 (default) to 20 (1 step)
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- Configuring to a larger value reduces the noise further.



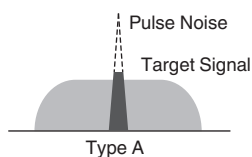
- Configuring to a value with a higher level of noise blanker effect may cause the transceiver to malfunction and distort the RX audio depending on the condition of the RX signal or interfering signal.

## 6 REJECTING INTERFERENCE

### NB2

NB2 is a function for blanking pulse noise with a long pulse width which cannot be blanked by NB1. NB2 is further divided into Type A and Type B, which can be employed according to the circumstances. NB2 can also be used together with NB1.

#### Type A

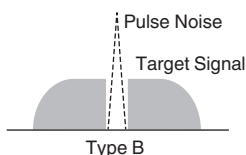


Type A suppresses mainly the pulse noise without blanking the target signal. The level of the effect (Level) can be adjusted.



- As pulse noise remains after blanking when “Type A” is used, pulse noise might be audible when the target signal is strong or when there is strong interference within the passband. Even in such a situation, it has the effect of bringing up the target signal when AGC gain is low due to pulse noise.
- “Type A” is most effective in cases where weak target signals are buried in strong pulse noise.

#### Type B



As with NB1, Type B blanks the pulse noise together with target signal. The pulse sensitivity level (Level), blanking duration (Width) and attenuation level (Depth) can be adjusted.



When pulse noise with a long pulse width is blanked using “Type B”, the time interval for which the target signal is removed becomes longer due to the long blanking time, and this causes the silence period to stand out.

- Press and hold [NB2] to display the Noise Blanker 2 configuration screen.
- Press F6 [TYPE].  
Pressing F6 [TYPE] each time toggles the screen between “Type A” and “Type B”.

#### Type A Screen



#### Type B Screen



- Pressing and holding [NB2] displays the noise blanker 2 screen which shows the current type in use.
- The default setting is “Type A”.
- Type selection is separately available for audio mode (SSB/AM (including DATA mode)) and non-audio mode (CW/FSK/PSK).

### Configuring the NB2 Effect Level (Type A)/ NB2 Pulse Sensitivity Level (Type B)

- While the Type B screen is displayed, press F2 [▲]/ F3 [▼] to select “Level”.
- Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to change the level.

Setting Value	1 to 6 (default) to 10 (1 step)
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- Type A: Configuring to a larger value reduces the noise further.
- Type B: Configuring to a larger value blanks the RX signal and pulse noise with small difference in signal level.



- Configuring to a value with a higher level of noise blanker effect may cause the transceiver to malfunction and distort the RX audio depending on the condition of the RX signal or interfering signal.

### Configuring the Blanking Duration (Type B Only)

- Press F2 [▲]/ F3 [▼] to select “Width”.
- Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to change the blanking duration.

Setting Value	1 to 10 (default) to 20 (1 step)
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- Configuring to a larger value lengthens the blanking time.

### Configuring the NB2 Attenuation Level (Type B Only)

- Press F2 [▲]/ F3 [▼] to select “Depth”.
- Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to change the attenuation level.

Setting Value	1 to 20 (default) (1 step)
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- Configuring to a larger value increases the attenuation level.

### Notch Filter

Notch filter is capable of suppressing beat interference at the IF level. It can be employed to eliminate beat noise and bring up weak signals or during operation while checking the noise condition. The notch filter can be used in the SSB, CW, FSK, PSK and AM modes.

#### Turning ON/OFF Notch Filter

- Press [NCH].  
Pressing [NCH] each time toggles the notch filter between ON and OFF.
  - When the notch filter is ON, “NOTCH” is displayed on the screen.
  - When notch filter is ON, an indicator showing the notch point is displayed in the RX filter passband characteristics inside the filter scope.



- Turn the [NOTCH] control.  
Adjust the notch frequency to the point where beat or interference is to be suppressed.



- The notch point indicator moves as the notch frequency changes.



- Once the notch point has been set in the CW mode, altering the PITCH and SHIFT values will not change the notch point set for beat suppression.

### Switching the Notch Filter Bandwidth

The bandwidth of the stopband for the notch filter can be configured to normal, middle or wide. The middle and wide stopbands are wider than the bandwidth of the normal stopband by two and three times respectively.

#### ● Press and hold [NCH].

Pressing and holding [NCH] each time switches the bandwidth and changes the display as follows.

<<[NOTCH N]>> (Normal) → <<[NOTCH M]>> (Middle) → <<[NOTCH W]>> (Wide)

### Noise Reduction

This transceiver comes with two types of noise reduction functions NR1 and NR2 which are effective for reducing continuous noise. When NR1 is used, the optimal method is activated according to the mode in use.

#### Noise Reduction 1 (NR1)

- In the SSB, FM and AM modes, noise reduction uses a spectrum subtraction system that places focus on the clarity.
- In the CW, FSK and PSK modes, noise reduction employs an LMS filter system that emphasizes the periodic signal.
- The noise reduction effect for NR1 can be adjusted.

#### Noise Reduction 2 (NR2)

- NR2 employs an SPAC system for all modes which extracts the periodic signal. This system detects periodic signals that are contained in the RX signals, connects the detected periodic signals and plays them as part of the RX audio. For this reason, this method is effective for signals with a single frequency such as CW signals.
- NR2 allows configuration to the optimal RX conditions by varying the autocorrelation time for periodic signal detection.
- NR2 is most effective in the CW mode. (Use of NR1 is recommended for modes other than CW.)



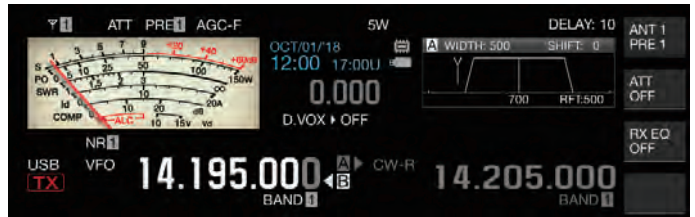
- Beat signals are also suppressed when NR1 is used in the SSB, FM and AM modes as it suppresses stationary signals. This is a theoretical behavior and not a malfunction.
- When NR2 is set to ON in the SSB mode, the signal clarity may deteriorate, or pulse noise or distortion may occur. This is a theoretical behavior and not a malfunction.
- NR2 cannot be used in the FM mode.

### Turning ON/OFF Noise Reduction

#### 1 Press [NR].

Pressing [NR] each time toggles the option in the following sequence: "NR1" → "NR2" → "OFF".

- When NR1 or NR2 is ON, <<[NR1]>> or <<[NR2]>> is displayed on the screen.



- NR1 and NR2 cannot be turned on at the same time.

### Configuring the NR1 Effect Level

#### 1 Press [NR] to select Noise Reduction 1.

#### 2 Press and hold [NR] to display the Noise Reduction 1 effect level configuration screen.



#### 3 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to change the level of effect.

Setting Value	1 to 5 (default) to 10 (1 step)
---------------	---------------------------------

- For NR1, configuring to a larger value reduces the noise further. However, as the impact on the RX audio also gets stronger if the effect level is excessively high, adjust it to an appropriate level.

### Configuring the NR2 Correlation Time

#### 1 Press [NR] to select Noise Reduction 2.

#### 2 Press and hold [NR] to display the NR2 Time Constant configuration screen.



#### 3 Press F4 [-]/ F5 [+] or turn the [MULTI/CH] control to change the correlation time.

Setting Value	2 to 20 (default) [ms] (2-step)
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- As the optimal correlation time varies with the RX signal and noise type when NR2 is used, configure the correlation time while receiving the signals.



- NR2 adjusts the correlation time for periodic signal extraction. It is different from NR1, which adjusts the effect level.

## 6 REJECTING INTERFERENCE

### Beat Canceler

Beat canceler is capable of suppressing multiple periodic interfering signals (beats) within the RX bandwidth through digital processing at the AF level.

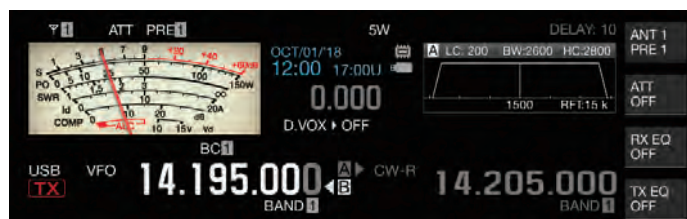
This function can be used in the SSB, AM and FM modes.

#### Turning ON/OFF Beat Canceler

##### ● Press [BC].

Pressing [BC] each time switches the beat canceler mode in the following sequence: "Beat Canceler 1" → "Beat Canceler 2" → "OFF".

- When beat canceler 1 or beat canceler 2 is ON, <<[BC1]>> or <<[BC2]>> is displayed on the screen.
- Beat canceler 1 suppresses weak beats and continuous beats. Beat canceler 2 suppresses intermittent beats such as CW signals.



- Although the beat canceler suppresses the overall auditory beat, the gain of the target signal cannot be recovered using the AGC function. Thus, if the beat signal is larger than the target signal, using a notch filter activates the AGC function to enhance the clarity of the target signal.

### DSP Monitor

DSP monitor is a function for temporarily expanding the passband width of the IF filter and AF filter via DSP in order to monitor the signal condition of nearby frequencies such as when receiving a specific frequency using a filter with a narrow passband width during contesting.

#### Assigning DSP Monitor to PF Key

- Register "DSP MONITOR" in Menu [0-15] "PF A: Key Assignment" to Menu [0-31] "Microphone UP: Key Assignment"

#### Expanding the Passband Width Using DSP Monitor

- Press and hold down the PF key that is assigned with the DSP monitor function.

The passband width of the filter is expanded while the key is held down.

- During DSP monitoring, the audio peak filter is forcibly turned OFF.