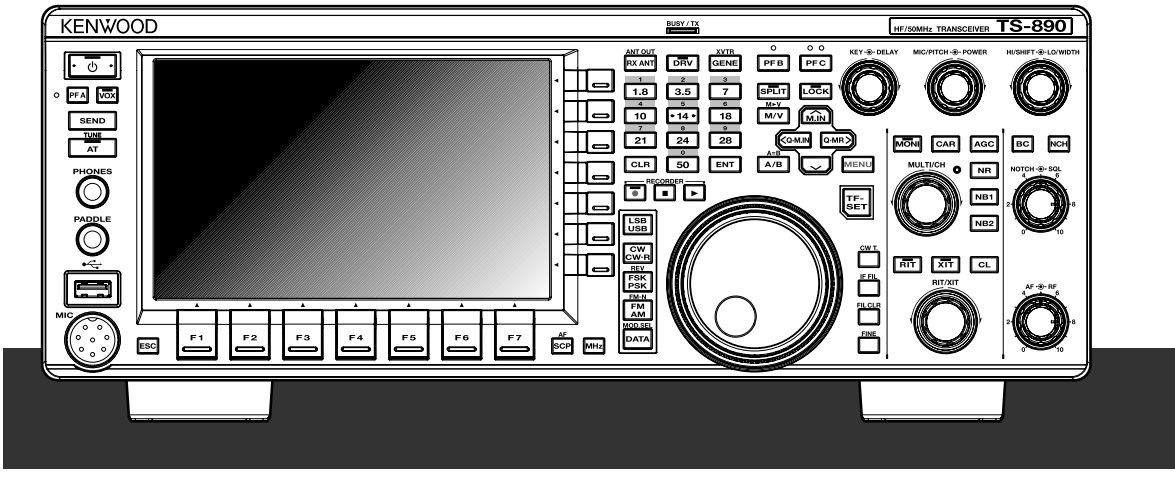
KENWOOD

TS-890S

INSTRUCTION MANUAL



JVCKENWOOD Corporation

B5A-2215-10 (K, E)

BEFORE USING

Thank You

Thank you for choosing this **KENWOOD** TS-890S transceiver.

FEATURES

- A high-end and practical transceiver with superior reception performance that exceeds its class, with multiple functions and with a feel of TS-990S
- Incorporates a 7" TFT color display for comfortable centralized control of operations using various information: auto scroll mode, filter scope, TX digital meter, etc.
- Top-class reception performance
  Covers all frequency bands by means of down conversion method. Equipped with standard 15 kHz, 6 kHz, 2.7 kHz and 500 Hz roofing filters (and a 270 Hz option)
- HF + 50 MHz + 70 MHz (E type)
- 100 W heavy duty output power
- Built-in automatic antenna tuner (relay system, high speed matching)
- SSB, CW, FSK (RTTY), PSK31 (BPSK/QPSK), PSK63 (BPSK), AM, FM
- Capable of FSK, PSK31/63 as well as CW decoding/encoding
- Equipped with two 32-bit floating-point arithmetic DSPs for transmission and reception and scope display
- Equipped with LAN, USB and COM ports
- External display connection (via DVI-I connector)
- Capable of remote control operation (direct IP connection) without using a host PC. Radio Control Program (ARCP-890) and Radio Host Program (ARHP-890) are also provided free as before
- Supports USB audio. The speaker and the microphone of a PC can be used during the USB audio operation by using the USB Audio Controller (ARUA-10) freeware.

Supplied Accessories

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

Item		Quantity	
		K Type	E Type
DC power cable		1	1
7-pin DIN plug (For REMOTE connector)		1	1
13-pin DIN plug (For ACC2 connector)		1	1
Fuse 4 A		1	1
Fuse 25 A		1	1
Instruction Manual	English	1	1
	French	1	1
	Spanish	–	1
	Italian	–	1
	German	–	1
	Dutch	–	1
Schematic diagram		3	3
Warranty Card		1	1

- We recommend you keep the box and packing materials in case you need to repack the transceiver in the future.
- Do not put the plastic bag used for packing of this equipment on the place which reaches a small child's hand. It will become a cause of suffocation if it wears flatly.

Market Codes

K Type : The Americas
E Type : Europe
The market code is shown on the carton box.
Refer to the specifications for information on the available operating frequencies.

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Software License Agreement

Software License Agreement contains the terms and conditions of use of the software embedded in or used with the transceiver. A user is entitled to use the software subject to the acceptance and agreement of this Software License Agreement by the user. Also, this Software License Agreement stipulates the terms and conditions of use of this software embedded in or used with the transceiver, and a user has the right to use the transceiver with the software embedded subject to the applicable laws and regulations, the description and defined in this manual and the warranty card.
The Software License Agreement can be displayed in the menu below. (Refer to Chapter 3 for operation of menu.)
Advanced menu [24] "Software License Agreement"

Important Notices Concerning the Software License Agreement

The software embedded in this transceiver consists of a multiple number of and individual software components. Title to and ownership of copyrights for each software component is reserved for JVC KENWOOD Corporation and the respective bona fide holder.
This product employs the software component in accordance with the End User License Agreement (hereinafter referred to as the "EULA") stipulated by JVC KENWOOD Corporation and/or the respective bona fide holder.
There is free software stipulated and governed by the "EULA", and this, a distribution condition of the software component in the executable format under the terms and conditions contained in the GNU General Public License or Lesser General Public License (hereinafter referred to as the "GPL/LGPL"), requires to make the source code for the relevant software components available. Access the URL below for details of the software component stipulated in the "GPL/LPGL".
http://www2.jvckenwood.com/gpl/index.html
Important notice about software can be displayed in the menu below. (Refer to Chapter 3 for operation of menu.)
Advanced menu [25] "Important Notices concerning Free Open Source"

About the GPL/ LPGL License

The GPL / LGPL license agreement can be displayed in the menu below. (Refer to Chapter 3 for operation of menu.)
Advanced menu [26] "About Various Software License Agreements"

This product includes "Ubiquitous QuickBoot™" technology developed by Ubiquitous Corp.
Ubiquitous QuickBoot™ is a trademark of Ubiquitous Corp.

Ubiquitous

Copyrights for Recorded Audio

The broadcast content recorded in this transceiver may not be reused, except for the personal use, without prior consent of the right holder under the copyright laws.

Trademarks

KENWOOD is a registered trade mark of JVC KENWOOD Corporation.
All other product names referenced herein are trademarks or registered trademarks of their respective manufacturers. Marks such as ™ and ® are omitted in the text of body.

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- JVC KENWOOD Corporation takes all appropriate measures to ensure all descriptions in this manual are accurate; however, this manual may still contain typographical errors ("typos") and expressions that are misleading. JVC KENWOOD Corporation is entirely free from any responsibilities arising from any losses or damages caused by such typos or expressions.
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- JVC KENWOOD Corporation shall be free from any responsibilities for any incidental losses or damages, such as missing communications or call opportunities caused by a failure or performance error of the transceiver.

Your Queries about External Devices or PC Connected to the Transceiver

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

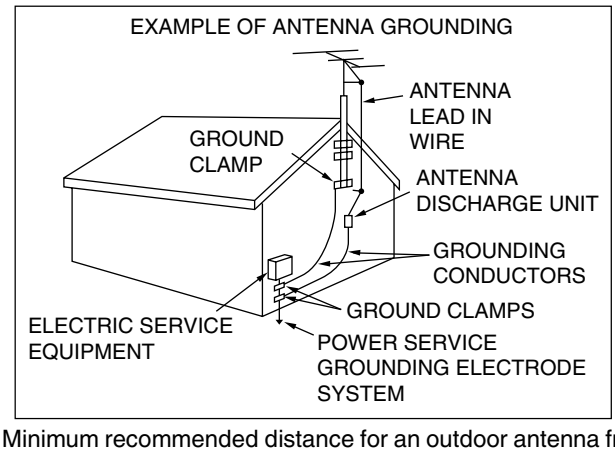
Handling Your Important Data

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

Precautions

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

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



- Minimum recommended distance for an outdoor antenna from power lines is one and one-half times the vertical height of the associated antenna support structure. This distance allows adequate clearance from the power lines if the support structure fails for any reason.
- Locate the transceiver so as not to interfere with its ventilation. Do not place books or other equipment on the transceiver that may impede the free movement of air. Allow a minimum of 10 cm (4 inches) between the rear of the transceiver and the wall or operating desk shelf.
- Do not use the transceiver near water or sources of moisture. For example, avoid use near a bathtub, sink, swimming pool, or in a damp basement or attic.
- The presence of an unusual odor or smoke is often a sign of trouble. Immediately turn the power OFF and remove the power cable. Contact a **KENWOOD** service station or your dealer for advice.
- Locate the transceiver away from heat sources such as a radiator, stove, amplifier or other devices that produce substantial amounts of heat.
- Do not use volatile solvents such as alcohol, paint thinner, gasoline, or benzene to clean the cabinet of the transceiver. Use only a clean cloth with warm water or a mild detergent.
- Disconnect the input power cable from the power source when the transceiver is not used for long periods of time.
- Remove the transceiver's enclosure only to do accessory installations described in this manual or accessory manuals. Follow provided instructions carefully, to avoid electrical shocks. If unfamiliar with this type of work, seek assistance from an experienced individual, or have a professional technician do the task.
- Enlist the services of qualified personnel in the following cases:
  a) The power supply or plug is damaged.
  b) Objects have fallen into or liquid has spilled into the transceiver.
  c) The transceiver has been exposed to rain.
  d) The transceiver is operating abnormally or performance has seriously degraded.
  e) The transceiver has been dropped or the enclosure damaged.
- Do not place the unit in excessively dusty and/or humid areas, nor on unstable surfaces.
- HF/ 50/ 70 MHz mobile antennas are larger and heavier than VHF/ UHF antennas. Therefore, use a strong and rigid mount to safely and securely install the HF/ 50/ 70 MHz mobile antenna.
- Do not put the plastic bag used for packing of this equipment on the place which reaches a small child's hand. It will become a cause of suffocation if it wears flatly.
- Turn the transceiver power off in the following locations:
  In explosive atmospheres (inflammable gas, dust particles, metallic powders, grain powders, etc.)

About Liquid Crystal Display

- Brightness of the LCD screen may appear uneven and flickering may occur depending on the content displayed. This is not a malfunction.
- The LCD is manufactured using high-density technology to achieve more than 99.99 % of effective pixels. Less than 0.01 % of the pixels may not be lit or may remain lit all the time. This is not a malfunction.
- When using this product in a cold region or when the temperature of this unit or its surroundings is extremely low, it may take a few minutes for the LCD to reach the normal level of brightness after turning on the power. This is not a malfunction. When this occurs, turn off the power and allow the surrounding environment to reach the ambient temperature (10 ℃ to 30 ℃ or 32°F to 86°F) before using the unit.
- If you accidentally damaged the LCD display and the liquid in the LCD display splashes and gets into your eyes or mouth, rinse thoroughly with water immediately and seek medical attention. And if the liquid splashes on your clothes or skin, wipe off immediately with alcohol etc. Leaving it as is will harm your skin or damage your clothes.

Notice to the User

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

FCC WARNING
This equipment generates or uses radio frequency energy. Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved by the party responsible/ JVC KENWOOD. The user could lose the authority to operate this equipment if an unauthorized change or modification is made.

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

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

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

Notification

This equipment complies with the essential requirements of Directive 2014/53/EU.

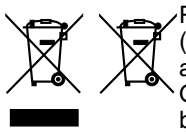
Restrictions

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

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

ISO3166

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

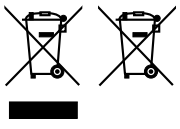


Products and batteries with the symbol (crossed-out wheeled bin) cannot be disposed as household waste.
Old electrical and electronic equipment and batteries should be recycled at a facility capable of handling these items and their waste byproducts.
Contact your local authority for details in locating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

Firmware Copyrights
The title to and ownership of copyrights for firmware embedded in KENWOOD product memories are reserved for JVC KENWOOD Corporation.

Bu ürün 28300 sayılı Resmi Gazete'de yayımlanan Atik Elektrikli ve Elektronik Eşyalarin Kontrolü Yönetmeliğe uygun olarak üretilmiştir.

Eski Elektrikli ve Elektronik Cihazların ve Pillerin İmhası Hakkında Bilgi (ayrı atık toplama sistemlerine sahip olan ülkelerde geçerlidir)



Bu sembolü (üzeri çizili çöp bidonu) içeren ürün ve piller evsel atı k çöpleri ile birlikte atılamaz.
Kullanılmış elektrikli ve elektronik cihaz ve piller, bu tür maddeleri ve bunların yan ürünlerini iş lemeye elverişli bir geri kazanım tesisine gönderilmelidir.
Size en yakın geri kazanım tesisinin konumunu öğrenmek üzere yerel yetkililerinize danışın.
Doğru geri kazanım ve atık uzaklaştırma y öntemleri, sadece öz kaynakların korunmasına yardımcı olmakla kalmayıp ayrıca sağlığımıza ve çevreye olacak zararlı etkilerini engellemeye yardımcı olur.

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

CONTENTS

CONTENTS

1 INSTALLATION AND CONNECTION

Installation

- Do not lift this transceiver by holding the **Tuning** control or other control knobs on the front panel or the connectors on the rear panel. Doing so may result in injury or damage of the control knobs.

Antenna Installation and Connection

The antenna system is made up of the antenna, coaxial cables and a ground terminal. Installing the antenna system carefully and properly helps to optimize the performance of the transceiver.

- Make use of a correctly-adjusted 50 Ω antenna, 50 Ω coaxial cables and appropriate connectors. Make sure that all connections are cleaned and free of dirt before fastening them.
- Match the impedance of the coaxial cable and antenna such that SWR is 1:1.5 or lower.
- A high SWR may lower the TX output power, thereby causing radio interference with electrical appliances such as radio and TV as well as failure of this transceiver.
- If reports on signal distortion are received, this means the transceiver may not be transmitting efficiently.

- Transmitting without connecting the antenna may damage this transceiver. Before transmission, connect an antenna or a 50 Ω dummy load to this transceiver.
- The protection circuit of this transceiver will be activated if the SWR of the antenna exceeds 1.5. Use an antenna with a low SWR.
- When an RX antenna that makes use of semiconductors (such as an active antenna) is connected, transmission or antenna tuning must not be performed. Doing so supplies power to the antenna and may damage the semiconductor circuit of the antenna.

Ground Connection

Connect to the ground terminal correctly to avoid risks such as electric shock.
First of all, bury one or multiple ground bars or a large copper sheet in the ground and connect them to the GND terminal of this transceiver. Use a thick conducting wire or a cut copper band that is as short as possible for this connection.

- Gas pipes, conduit pipes for power distribution, plastic water pipes and the like must not be used for grounding. Not only are they ineffective for grounding, they may also result in accidents or fire.

Installation of Lightning Arrestors

- To prevent fire, electric shock, malfunctioning and injury due to lightning, install a coaxial lightning arrestor.
- Besides installing a coaxial lightning arrestor, disconnect the cable of the antenna from this transceiver if lightning is anticipated.

Connection of Regulated DC Power Supply

- Make sure to turn off the power of the regulated DC power supply before connecting the DC power cord.
- Do not insert the power plug of the regulated DC power supply into the AC outlet until all the connections are complete.

A DC 13.8 V regulated DC power supply is needed for using this transceiver. It cannot be connected directly to an AC outlet. Use the supplied DC power cord to connect this transceiver to the regulated DC power supply.

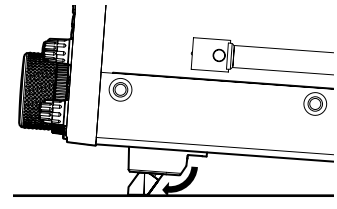
- The current capacity needed for the regulated DC power supply is 22.5 A and above. Use one with sufficient current capacity.

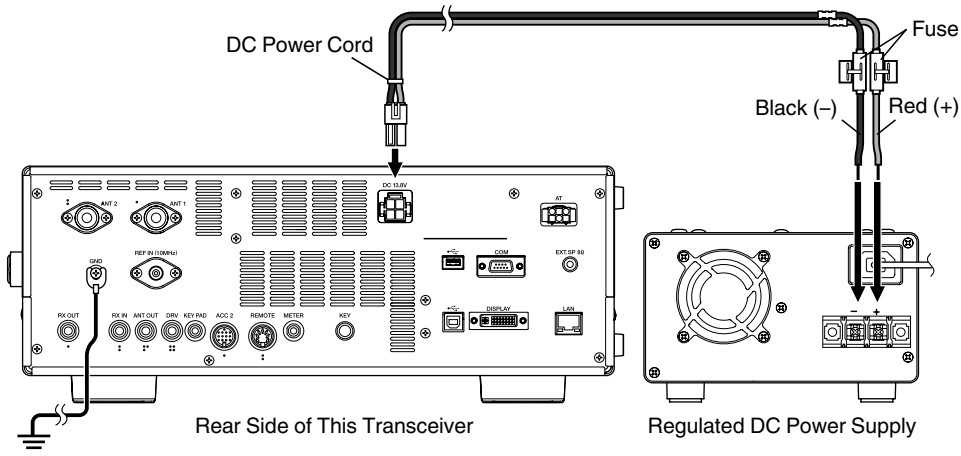
1 **Connect the DC power cord to the regulated DC power supply.**
Connect the red wire to the "+" terminal and the black wire to the "-" terminal.

2 **Next, connect the DC power cord to the DC 13.8 V power connector of this transceiver.**
Insert the cord fully into the power connector.

Using the Auxiliary Support

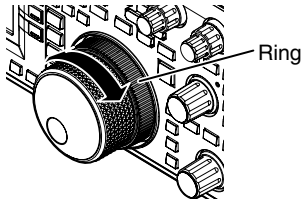
An auxiliary support is stored inside the front leg of this transceiver. Pull it toward you if you want the panel to face slightly upwards.





Torque Adjustment with Tuning Control

The **Tuning** control allows the rotational torque (weight) to be adjusted according to the user's preference. With the ring at the base of the **Tuning** control fixed, turning the **Tuning** control to the right increases the rotational torque, while turning to the left decreases it.



Connection of Accessories (Front Panel)

■ Headphones (PHONES)

Monaural and stereo headphones (4 to 32 Ω, standard: 8 Ω/plug: Φ6.3 mm) can be used with this transceiver.
When headphones are connected, sound will not be output from the built-in speakers (or optional external speakers). The following optional headphones are compatible with this transceiver.
●HS-5 ●HS-6

- The volume may be louder for headphones with a higher impedance.
- The audio output is monaural even when stereo headphones are connected.

■ Paddle (PADDLE)

For CW operation using the built-in electronic keyer, connect a keyer paddle to the PADDLE jack. A Φ6.3 mm three-pronged plug is used for the paddle. Also, a straight key can be connected to the PADDLE jack. In this case, change the setting of Menu [5-00] to "Straight Key". (Refer to Chapter 3 for details on menu operation.)

■ USB Flash Drive/ USB Keyboard (•⟷)

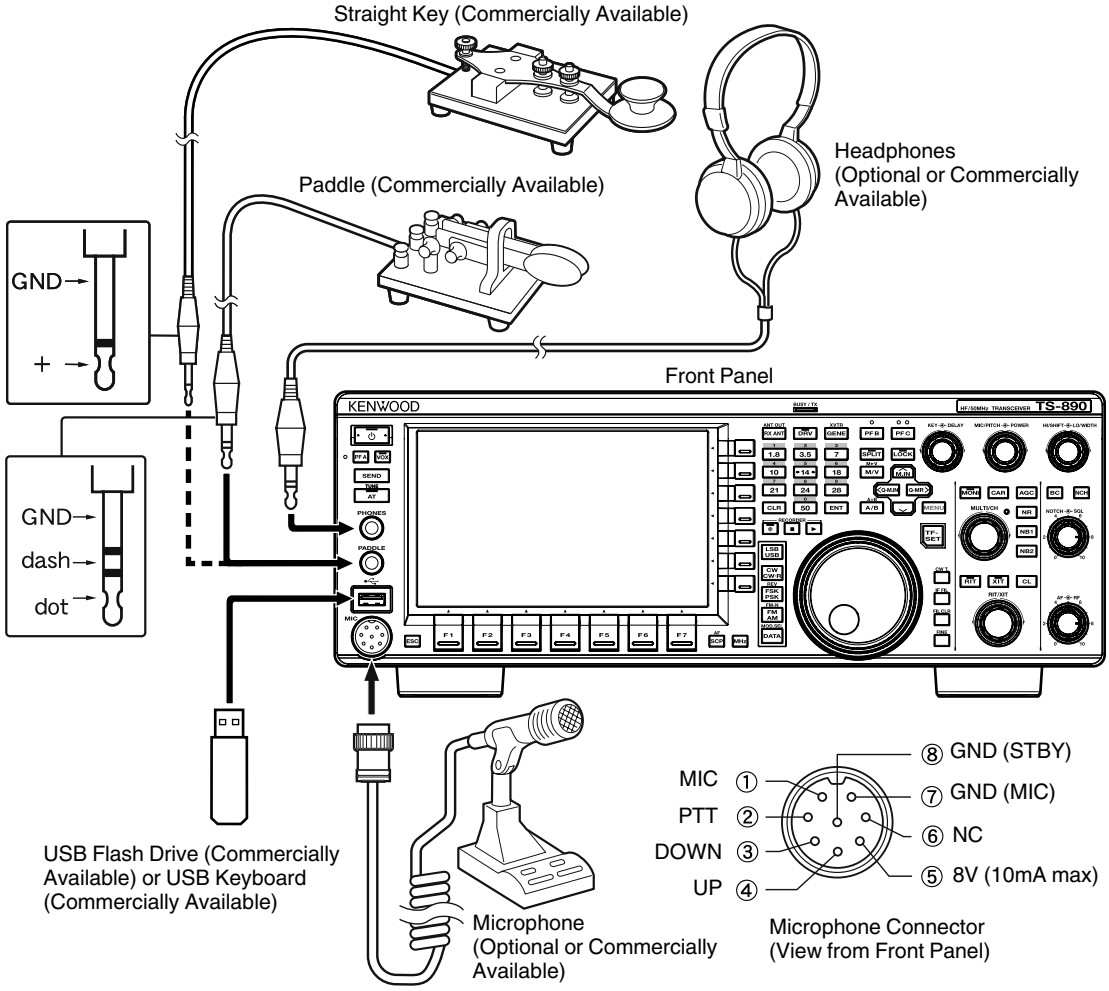
For connecting a commercially available USB flash drive or USB keyboard.
Plug the USB flash drive or USB keyboard firmly into the (USB-A) connector.

- Do not remove the USB flash drive while reading or writing files or while the USB flash drive is being accessed by this transceiver. Also, do not turn off the power of this transceiver.
- Always remove the USB flash drive after executing "Safely Removing the USB Flash Drive" (11-6) to prevent data in the USB flash drive from being damaged. (USB/File Management Menu "Safe Removal of USB Flash Drive")
- A USB flash drive or USB keyboard can be connected to the connector on the front panel and rear panel respectively.

■ Microphone (MIC)

Microphones with an impedance of 250 Ω to 600 Ω can be used. Insert the microphone plug fully into the MIC connector of this transceiver and tighten it firmly using the fastening ring.
The following microphones (sold separately) are compatible with this transceiver.
●MC-43S ● MC-60A ● MC-90 ●MC-47
The following microphones are not compatible with this transceiver.
●MC-44 ●MC-44DM ●MC-45 ●MC-45DM

- Production of the MC-47 microphone has been discontinued.



Connection of Accessories (Rear Panel)

- Do not connect a cable exceeding 3 m (9.8 feet) to the following connectors. Doing so may affect proper operation due to signal attenuation.
  - KEY jack
  - ACC 2 connector
  - REMOTE connector
  - METER jack
  - DRV connector
  - KEYPAD jack
  - COM connector
  - EXT.SP jack
  - DISPLAY connector
  - LAN connector
  - PHONES jack
  - PADDLE jack
  - MIC connector
  - USB connector

■ Key for CW (KEY)

For CW operation without using the built-in electronic keyer, connect the plug of an electronic key, bug key, external electronic keyer or PC keyer to the KEY jack. Use a Φ3.5 mm two-pronged plug. Positive keying needs to be used for external electronic keyers and PC keyers. Use a shielded cable to connect the key and this transceiver.

- For more detailed explanation on the built-in keyer, refer to “Electronic Keyer”. (5-13)

■ USB Flash Drive/USB Keyboard (•<)

For connecting a commercially available USB flash drive or USB keyboard.
Plug the USB flash drive or USB keyboard firmly into the •< (USB-A) connector.

- A USB flash drive or USB keyboard can be connected to the connector on the front panel and rear panel respectively.

■ Keypad (KEYPAD)

For connecting a self-made PF keypad.

■ External Speaker (EXT. SP 8Ω)

For connecting an external speaker.

- The EXT. SP 8 Ω is used exclusively for connecting an external speaker. Due to the loud audio output, hearing may be impaired when headphones are used. Do not connect headphones.

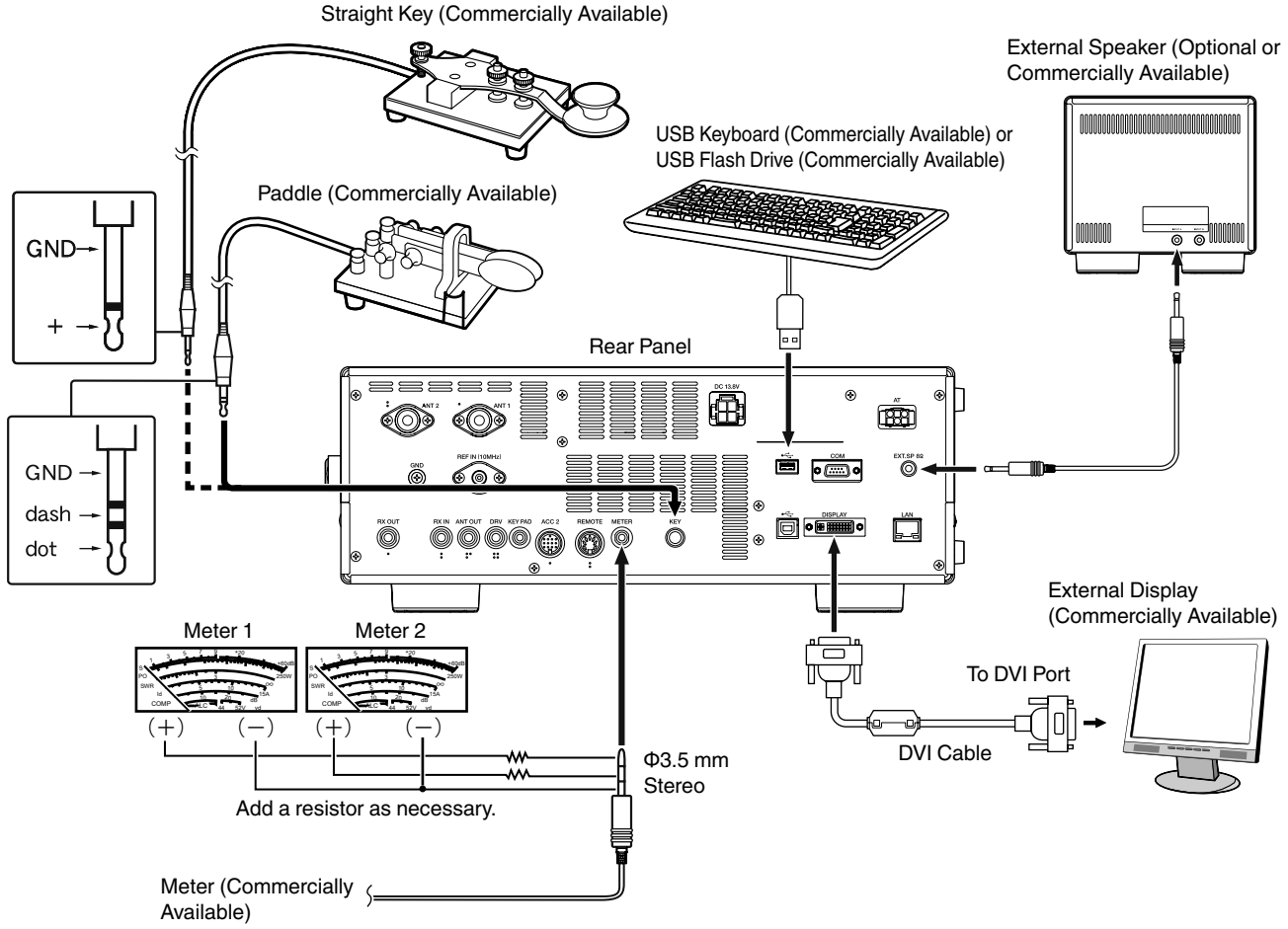
■ External Display (DISPLAY)

Connect this transceiver with an external display using a commercially available DVI cable.
Doing so enables information displayed on the screen of this transceiver to be shown on the external display.

- Use an external display with a resolution of 800 x 600 or 848 x 480.
- This transceiver supports digital and analog outputs.
- If the display to connect uses a D-sub terminal, make use of a commercially available DVI/D-Sub conversion adapter.

■ External Meter (METER)

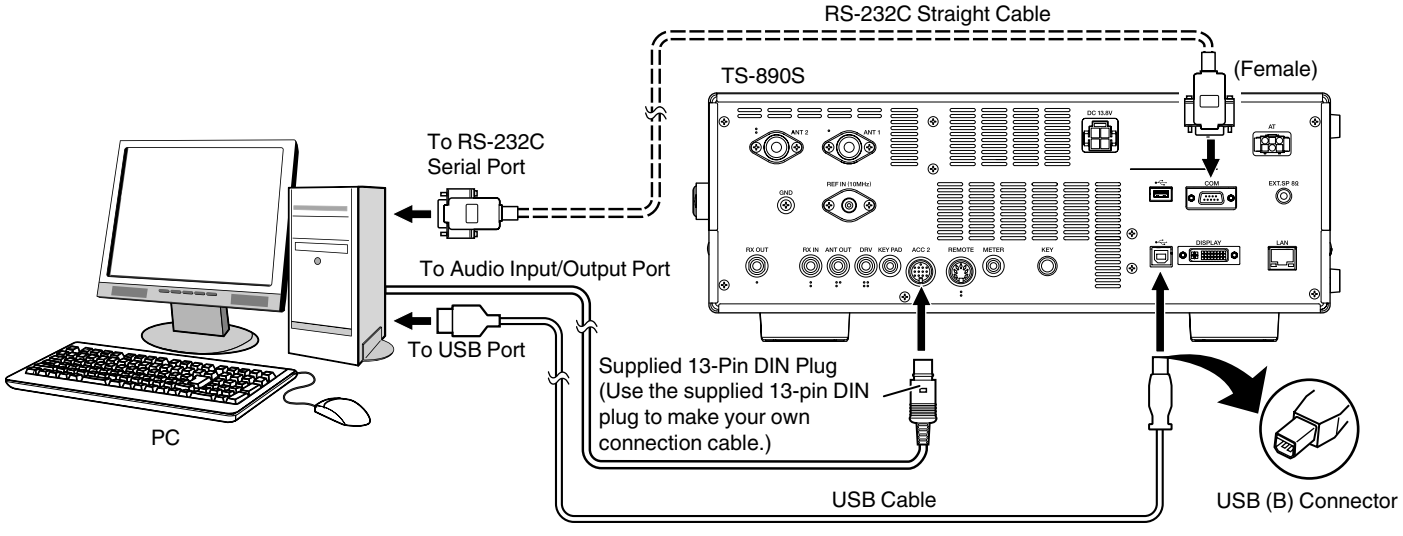
For connecting a commercially available meter.



PC Connection for Data Communication

This transceiver is equipped with data communication connectors (USB and ACC2) for exchanging audio signals with the auxiliary equipment and connectors (USB and COM) for controlling using PC commands when performing data communication with an external device such as a PC as the auxiliary equipment.
To make use of data communication such as RTTY (AFSK), PSK31, SSTV, JT65 and FT8 using data communication software that employs the sound function of a PC and with this transceiver configured to the DATA mode (SSB-DATA, FM-DATA, AM-DATA), set up the connection as follows.

- When using the USB audio function: connect to the PC using a USB cable. Data communication with only the USB cable connection is possible by making use of data VOX or PC commands ("TX1;" to start transmission and "RX;" to end transmission) to switch between transmission and reception. (For details on the configuration of the input sound source in the DATA mode and the VOX function, refer to page 8-1.)
- When using an ACC 2 connector: connect the audio output line of the PC to pin 11 (ANI) of the ACC 2 connector and the audio input line of the PC to pin 3 (ANO). Pin 9 (PKS) of the ACC 2 connector, data VOX or PC commands ("TX1;" to start transmission and "RX;" to end transmission) are used to switch between transmission and reception.
- When controlling using PC command, connect to the PC with a RS-232C straight cable or a USB cable. To connect with a USB cable, use the virtual COM (Standard) port. For more details, please refer to "Virtual COM Port" (1-5).
- For performing RTTY keying by connecting to a PC (or other external devices) while this transceiver is configured to the FSK mode, please refer to "Operating RTTY (FSK) Using an External Device" (5-22).



Configure the transceiver as follows according to the method of connection with the PC, the specification of the software used for data communication and the settings, etc.

■ Baud Rate Configuration for PC Control

Configure the baud rate of the COM/USB port used for PC control as follows.
* Refer to "Configuring the COM/USB (Rear Panel) Baud Rate" (16-5).
When using the USB port: Configure in Menu [7-01] "Baud Rate (Virtual Standard COM)".
When using the COM port: Configure in Menu [7-00] "Baud Rate (COM Port)".

■ Audio Source Input Configuration

Configure the audio source input for data transmission via PC commands in the SSB-DATA mode as follows.
* Refer to "Configuration of the Input Path of TX Audio" (8-1).
1) Press and hold **[DATA]** to display the audio source input screen.
2) Press **[DATA]** to switch from "Data Mode Off" to "Data Mode On".
Check the "Rear" setting under "Audio Input" for "DATA SEND (PF)" under "TX Method".
When using the USB audio function: Configure to "USB Audio" (default).
When using the ACC 2 connector: Configure to "ACC 2".

■ RX Level Adjustment

Adjust the audio output level for receiving via data communication as necessary by using the sound setting (recording device) on the PC or using the following menus on the transceiver.
* Refer to "Configuring Audio Input/Output" (16-7).
When using the USB audio function: Configure in Menu [7-08] "USB: Audio Output Level".
When using the ACC 2 connector: Configure in Menu [7-09] "ACC 2: Audio Output Level".

■ TX Level Adjustment

Adjust the audio input level for transmitting via data communication as necessary by using the sound setting (playback device) on the PC or using the following menus on the transceiver.
* Refer to "Configuring Audio Input/Output" (16-7).
When using the USB audio function: Configure in Menu [7-06] "USB: Audio Input Level".
When using the ACC 2 connector: Configure in Menu [7-07] "ACC 2: Audio Input Level".

■ Configuration for Switching the RX Bandwidth

Configure the setting as follows to switch the RX bandwidth by cutting off the high or low frequencies within the frequency range of 0 Hz to 5000 Hz even in the SSB-DATA mode, in the same way as in SSB mode, during operations such as FT8.
* Refer to “Configuring the Behavior of the HI/SHIFT and LO/WIDTH Controls (SSB/SSB-DATA Only)” (6-3).
Configure in Menu [6-12] “Filter Control in SSB-DATA Mode (High/Low and Shift/Width)”. Select “High & Low Cut”.

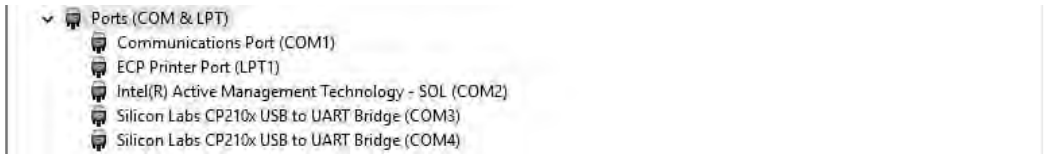
- USB cable and RS-232C straight cable are not supplied with this transceiver. Please purchase commercially available cables.
- Delays may occur when using USB audio, and there may also be audio interruptions depending on the performance and load of the PC.
- Place this transceiver far enough from the PC so that noise will not be picked up.
- For data communication software settings, refer to the instruction manual or Help file of the software in use.

Virtual COM Port

PC command control using the virtual COM port and USB keying control using the RTS/DTR signal of the virtual COM port can be performed by connecting this transceiver and the PC using a USB cable.

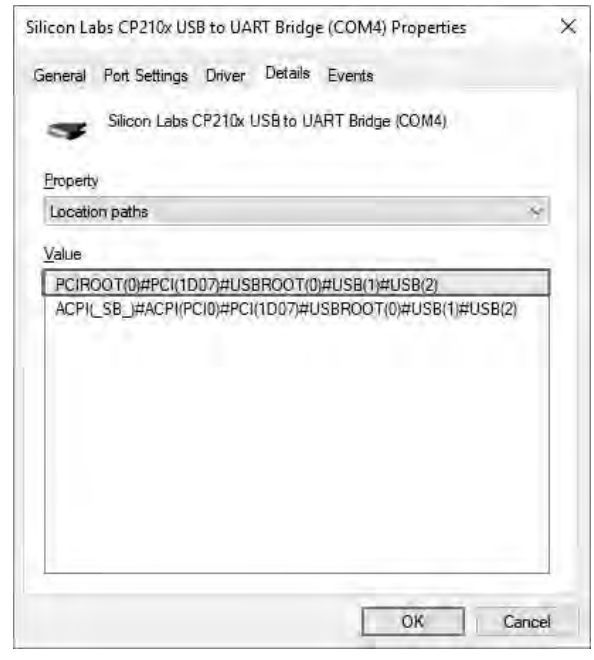
- To use the virtual COM port, Windows 10, Windows 8.1 or Windows 7 is required. (as of January, 2019)
- Install the virtual COM port driver on the PC before connecting the USB cable. Download the driver from the following URL.
  http://www.kenwood.com/i/products/info/amateur/software_download.html
- There are 2 types of virtual COM port on this transceiver, namely virtual COM (Standard) port and virtual COM (Enhanced) port.
- The COM port numbers of the virtual COM (Standard) port and virtual COM (Enhanced) port on the PC can be checked using the following way.
  - Open the Device Manager in Windows.
  - Connect this transceiver and the PC using a USB cable. The following 2 COM ports are displayed in “Ports (COM & LPT)” in the Device Manager.
    “Silicon Labs CP210x USB to UART Bridge (COM x)”
    “Silicon Labs CP210x USB to UART Bridge (COM y)”

  x and y are numbers. The numbers vary depending on the PC environment used. The following is the display example of the virtual COM ports on this transceiver assigned to COM3 and COM4.

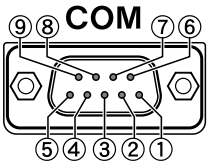


- Double-click on these in the Device Manager to display the respective Properties windows.
- Select the “Details” tab and then select “Location paths” from the Property drop-down menu.
- Move the mouse cursor to the top line displayed in the “Value” column and check the number in the parenthesis on the right end of the character string.

The port displayed with the number (1) is the virtual COM (Standard) port of this transceiver.
The port displayed with the number (2) is the virtual COM (Enhanced) port of this transceiver.
The following is the display example of the Properties window of each COM port when the virtual COM (Standard) port and the virtual COM (Enhanced) port are assigned to COM3 and COM4 respectively.

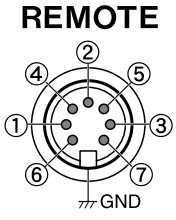


Terminal Descriptions



COM Connector

Pin No.	Pin Name	Function	Input/Output
1	NC	No connection	—
2	RXD	Sends serial data from this transceiver to RXD on the PC.	O
3	TXD	Receives serial data from TXD on the PC to this transceiver.	I
4	NC	No connection	—
5	GND	Signal ground	—
6	NC	No connection	—
7	RTS	Sends signal from RTS on the PC to this transceiver. If the PC is unable to accept incoming data, an "L" level signal is output from the PC to this transceiver and data will not be sent in this case.	I
8	CTS	Sends signal from this transceiver to CTS on the PC. If this transceiver is unable to accept incoming data, an "L" level signal is output from this transceiver to the PC and input of incoming data will be forbidden.	O
9	NC	No connection	—

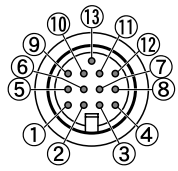


GND :
Connect to metal shield.

REMOTE Connector

Pin No.	Pin Name	Function	Input/Output
1	SPO	Speaker out	O
2	COM	Common terminal of the built-in relay for linear amplifier control	I/O
3	SS	PTT input • Sends signal by grounding the SS terminal.	I
4	MKE	Make terminal of the built-in relay for linear amplifier control • The make terminal can be connected to the common terminal during transmission by configuring " Internal Relay Control " (16-14) of the linear amplifier menu. Rated control capacity of relay contact: 2 A/ 30 V DC (resistance load) Maximum allowable voltage of relay contact: 220 V DC, 250 V AC	I/O
5	BRK	Break terminal of the built-in relay for linear amplifier control • The break terminal can be connected with the common terminal when the latter is not connected to a make terminal. Rated control capacity of relay contact: 2 A/ 30 V DC (resistance load) Maximum allowable voltage of relay contact: 220 V DC, 250 V AC	I/O
6	ALC	ALC input from the linear amplifier • This is a negative input. The ALC circuit starts to operate from an input of approximately -4 V (which can be changed from the Linear Amplifier menu).	I
7	LKY	Linear amplifier control output • The output logic during transmission can be configured using " Keying Logic " (16-14) of the linear amplifier menu. "Active High": Outputs DC 12 V during transmission. The maximum output current is 100 mA. "Active Low": Switches to the "L" level (GND and short) during transmission. When an external bias is applied while receiving is in progress, the signal switches to the "H" level. Voltage and current not higher than DC 50 V and 100 mA respectively can be controlled.	O

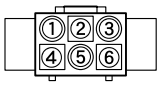
ACC 2



ACC 2 Connector

Pin No.	Pin Name	Function	Input/Output
—	NC	No connection	—
2	RTTY	RTTY control terminal (FSK key input)	I
3	ANO	Audio output • Connect to the audio input of a PC or an external device such as a PC connection interface. • The audio output level is independent of the AF volume control knob on the front panel. • The audio output level can be adjusted in Menu [7-09]. Adjust it to an appropriate level. • When the audio output level is configured to the default value of “50” in Menu [7-09], the peak-to-peak voltage is approximately 0.5 V p-p in the case of standard modulation signals. Altering the audio output level between “0” and “100” changes the peak-to-peak voltage level between approximately 0 Vp-p and 1.2 Vp-p. (Impedance 10 kΩ)	O
4	GND	Signal ground	—
5	PSQ	Squelch control output • Connect to the squelch input of an external device such as a PC connection interface. • When squelch is open: Low impedance • When squelch is closed: High impedance	O
6	MET 1	Meter level output 1	O
7	NC	No connection	—
8	GND	Signal ground	—
9	PKS	PTT input for data communication (DATA SEND) • Connect to the PTT output of an external device such as a PC connection interface. • Signal can be transmitted by connecting the PKS terminal to GND. • The PKS terminal mutes unnecessary modulation input signals during transmission. Refer to Configuration of the Input Path of TX Audio (8-1).	I
10	MET2	Meter level output 2	O
11	ANI	Audio input for data communication • Connect to the audio output of a PC or an external device such as a PC connection interface. • The audio input level is independent of MIC GAIN on the front panel. • The audio input level can be adjusted in Menu [7-07]. • Standard modulation can be obtained with an input of approximately 10 mVrms in the default setting of “50” in Menu [7-09]. Altering the audio input level between “0” and “100” changes the standard modulation input level between approximately “almost no modulation” and approx. 1 mVrms. (Impedance 10 kΩ)	I
12	GND	Signal ground	—
13	SS	PTT input • This is the same terminal as pin 2 (SS terminal) of the MIC connector on the front panel and pin 3 (SS terminal) of the REMOTE connector. • It has the same behavior as pressing **[SEND]** on the front panel. • Signal can be transmitted by connecting the SS terminal to GND. • The SS terminal mutes unnecessary modulation input signals during transmission. Refer to Configuration of the Input Path of TX Audio (8-1).	I

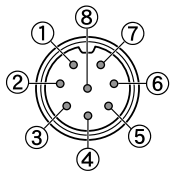
AT



EXT. AT Connector

Pin No.	Pin Name	Function	Input/Output
1	GND	Signal ground	—
2	TT	EXT.AT connector (TTI/TTO)	I/O
3	GND	Signal ground	—
4	NC	No connection	—
5	TS	EXT.AT connector (TSI/TSO)	I/O
6	14S	DC 13.8 V power supply for EXT.AT (4 A max.)	O

MIC

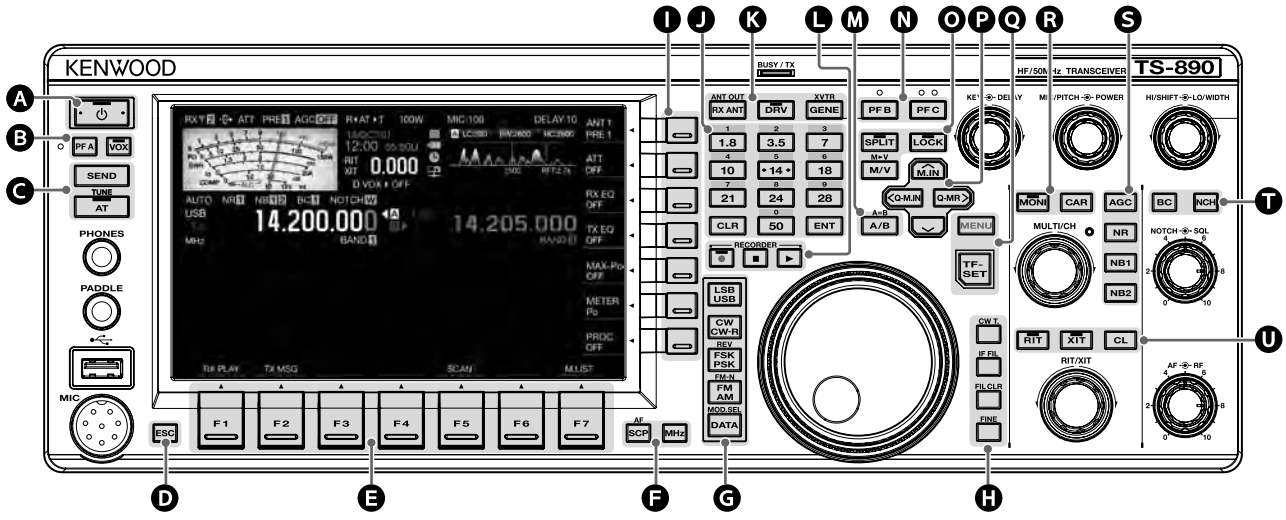


MIC Connector

Pin No.	Pin Name	Function	Input/Output
1	MIC	MIC signal input	I
2	SS	MIC standby (PTT) control	I
3	MD	MIC DOWN control	I
4	MU	MIC UP control	I
5	8 A	DC 8 V power supply for MIC (10 mA max.)	O
6	NC	No connection	—
7	MSG	MIC ground	—
8	MCG	Signal ground	—

2 NAMES AND FUNCTIONS OF PARTS

Front Panel



Panel Key Behavior

	Key		Behavior	Refer to
Ⓐ	[⏻]	**Press**	Turns on the power.	4-1
		Press and hold	Turns off the power.	
Ⓑ	**[PF A]**	**Press**	Activates the registered function.	16-2
		Press and hold		
	[VOX]	**Press**	Turns ON/OFF the VOX function.	8-1
		Press and hold	Displays the VOX configuration screen.	8-2
Ⓒ	**[SEND]**	**Press**	Starts/ends transmission.	4-8
	[AT]	**Press**	Turns ON/OFF the antenna tuner.	4-11
		Press and hold	Starts antenna tuning.	
Ⓓ	**[ESC]**	**Press**	Exits the configuration screen.	–
Ⓔ	**[F1] to [F7] (Horizontally Arrayed F)**	Activates the function according to the key guide at the bottom of the screen. (Henceforth represented as **F1 [XXX]** to **F7 [XXX]** in this manual.) Refer to “List of Function Key Behaviors (Standard Mode Screen)” for functions of the F key on the normal screen.		2-4
Ⓕ	**[SCP]**	**Press**	Displays the bandscope. Switches the scope screen.	7-1 7-8
		Press and hold	Displays the audio scope. Switches between bandscope and audio scope.	
	[MHz]	**Press**	Turns ON/OFF the MHz step function.	4-6
Ⓖ	**[LSB/USB]**	**Press**	Switches between the LSB and USB modes.	4-4
	[CW/CW-R]	**Press**	Switches between the CW and CW-R modes.	4-4
	[FSK/PSK]	**Press**	Switches between the FSK and PSK modes.	4-4
		Press and hold	Switches between reverse and normal in the FSK/PSK mode.	
	[FM/AM]	**Press**	Switches between the FM and AM modes.	4-4
		Press and hold	Switches between FM narrow and FM normal.	
	[DATA]	**Press**	Switches the DATA mode.	4-4
		Press and hold	Displays the input source configuration screen for the TX audio.	8-1

	Key		Behavior	Refer to
Ⓗ	**[CW T.]**	**Press**	Activates the CW auto tune function.	5-9
	[IF FIL]	**Press**	Switches between receiver (RX) filters A, B and C.	6-1
		Press and hold	Displays the RX Filter screen.	6-2
	[FIL CLR]	**Press**	Restores the passband of the RX filter that has been changed to the preset value.	6-5
	[FINE]	**Press**	Turns ON/OFF the FINE-tuning function.	4-5
Ⓘ	**[ ] to [ ] (Vertically Arrayed F)**	Activates the function according to the key guide on the right side of the screen. (Henceforth represented as **F [XXX]** in this manual.) Refer to "List of Function Key Behaviors (Standard Mode Screen)" for functions of the F key on the normal screen.		2-4
Ⓙ	**[0 (50)] to [9 (28)]**	**Press**	For selecting a frequency band and switching band memory.	4-3
	[CLR]	**Press**	Cancels the direct frequency input mode.	–
	[ENT]	**Press**	Turns on the direct frequency input mode.	4-6
Ⓚ	**[RX ANT]**	**Press**	Turns ON/OFF the RX antenna.	4-10
		Press and hold	Turns ON/OFF the antenna output function for the external receiver.	16-16
	[DRV]	**Press**	Turns ON/OFF the drive output function.	4-11
	[GENE]	**Press**	For selecting a general coverage band such as 70 MHz (E type), 135 kHz, 475 kHz, MW broadcast band, and 5 MHz.	4-3
		Press and hold	Turns ON/OFF the transverter function.	16-15
Ⓛ	**[●]**	**Press**	Starts, pauses or resumes manual recording.	12-3
		Press and hold	Saves the constantly recorded audio file.	12-4
	[■]	**Press**	Stops audio recording or playback.	12-3 12-4
	[▶]	**Press**	Starts, pauses or resumes playback.	12-4
Ⓜ	**[A/B]**	**Press**	Switches between VFO A and VFO B.	4-3
		Press and hold	Aligns the frequency and mode of VFO A and VFO B.	5-1
Ⓝ	**[PF B]**	**Press**	Activates the registered function.	16-2
		Press and hold		
	[PF C]	**Press**	Activates the registered function.	16-2
		Press and hold		
Ⓞ	**[SPLIT]**	**Press**	Turns ON/OFF the split mode.	5-1
		Press and hold	Starts configuration of the frequency for split operation.	5-1
	[LOCK]	**Press**	Turns ON/OFF the frequency lock function.	4-7
	[M/V]	**Press**	Switches between the memory channel and VFO mode.	9-2
		Press and hold	Copies the memory channel data and quick memory channel data to VFO.	9-3

	Key		Behavior	Refer to
ⓟ	[∧ M.IN]	Press	Displays the memory channel list screen.	9-2
			Registers a memory channel.	9-2
			Switches the menu mode item.	3-1
	[<Q-M.IN]	Press	Registers a quick memory channel.	9-5
			Confirms the content selected in menu mode.	3-1
	[Q-MR>]	Press	Calls up a quick memory channel.	9-5
			The parameter setting in the menu mode can now be changed.	3-1
		Press and hold	Deletes all quick memory channels.	9-5
	[∨]	Press	Switches the menu mode item.	3-1
ⓠ	[MENU]	Press	Turns ON/OFF the menu mode.	3-1
	[TF-SET]	Press	Turns ON/OFF TF-SET. (ON while it is being pressed.)	5-2
ⓡ	[MONI]	Press	Turns ON/OFF the TX monitor function.	8-3
		Press and hold	Displays the TX monitor level configuration screen.	8-3
	[CAR]	Press	Displays or closes the carrier level configuration screen.	5-8
ⓢ	[AGC]	Press	Switches the AGC time constant [FAST, MID, SLOW].	5-3
		Press and hold	Displays or closes the AGC configuration screen.	5-3
	[NR]	Press	Switches the mode of the noise reduction function [OFF/NR1/NR2].	6-8
		Press and hold	Displays the NR1 configuration screen. (When Noise Reduction 1 is ON) Displays the NR2 configuration screen. (When Noise Reduction 2 is ON)	6-9
	[NB1]	Press	Turns ON/OFF the Noise Blanker 1.	6-6
		Press and hold	Displays the NB1 configuration screen.	6-6
	[NB2]	Press	Turns ON/OFF the Noise Blanker 2.	6-6
		Press and hold	Displays the NB2 configuration screen.	6-7
ⓣ	[BC]	Press	Switches the mode of the beat canceler function [OFF/BC1/BC2].	6-9
	[NCH]	Press	Turns ON/OFF the notch filter.	6-8
		Press and hold	Switches the bandwidth of the notch filter [Normal, Middle, Wide].	6-8
ⓤ	[RIT]	Press	Turns ON/OFF the RIT function.	5-7
		Press and hold	Shifts the RX frequency via RIT.	5-7
	[XIT]	Press	Turns ON/OFF the XIT function.	5-7
		Press and hold	Shifts the TX frequency via XIT.	5-7
	[CL]	Press	Clears the RIT or RIT/XIT frequency.	5-7

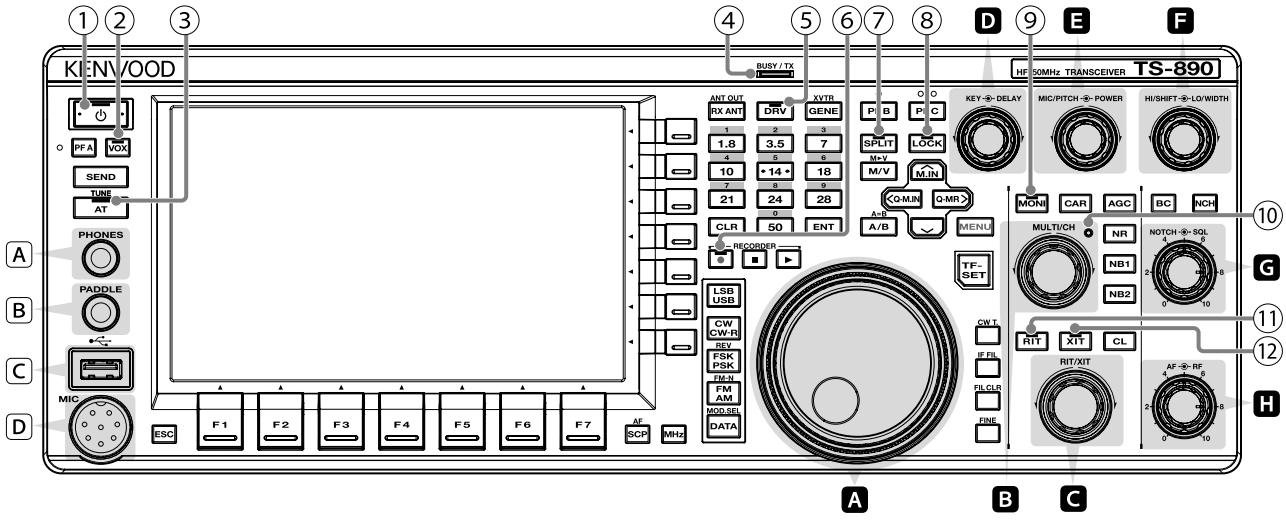
List of Function Key Behaviors (Standard Mode Screen)

Function Keys (Vertically Arrayed)

	Key Guide		Behavior	Refer to
F	**[ANT/PRE]**	**Press**	Switches the preamplifier. (OFF/ PRE 1/ PRE 2)	5-6
		Press and hold	Switches between “ANT 1” and “ANT 2”.	4-10
	[ATT]	**Press**	Switches the attenuation level of the attenuator. (OFF/ 6 dB/ 12 dB/ 18 dB)	6-1
		Press and hold	Switches in the reverse order.	6-1
	[RX EQ]	**Press**	Turns ON/OFF the RX equalizer.	5-4
		Press and hold	Displays the RX equalizer configuration screen.	5-4
	[TX EQ]	**Press**	Turns ON/OFF the TX equalizer.	8-5
		Press and hold	Displays the TX equalizer configuration screen.	8-5
	[MAX-Po]	**Press**	Turns ON/OFF the TX output power limiter.	4-9
		Press and hold	Displays the TX output power limiter configuration screen.	4-9
	[METER]	**Press**	Switches the meter display.	4-9
	[PROC]	**Press**	Turns ON/OFF the speech processor.	8-4
		Press and hold	Displays the Speech Processor configuration screen.	8-4

Function Keys (Horizontally Arrayed)

	Key Guide		Behavior	Refer to
F1	**[RX PLAY]**	**Press**	Displays the audio recording file screen.	12-4
F2	**[TX MSG]**	**Press**	Displays the voice message screen. (Displayed in the SSB, AM and FM modes.)	12-1
	[KEYER]	**Press**	Displays the CW message screen. (Displayed in the CW mode.)	5-14
F3	**[DECODE]**	**Press**	Displays the communication screen. (Displayed in the CW, FSK and PSK modes.)	5-10 5-22 5-22
F4	**[TONE]**	**Press**	Switches in the sequence of: “TONE” → “CTCSS” → “CROSS TONE”. (Displayed in the FM mode.)	5-29
		Press and hold	Displays the TONE frequency, CTCSS frequency or cross tone configuration screen.	5-30
F5	**[SCAN]**	**Press**	Starts/stops scanning.	10-1 10-3
		Press and hold	Displays the VFO/Program Scan segment screen. (Displayed in the VFO mode.)	10-1
			Displays the memory scan group screen. (Displayed in the memory channel mode.)	10-3
F6	**[M ▶ VFO]**	**Press**	Shifts the memory. (Displayed in the memory channel and quick memory channel modes.)	9-3 9-6
F7	**[M.LIST]**	**Press**	Displays the memory channel list.	9-1



List of Control Knob Behaviors

	Control	Behavior	Refer to
A	**Tuning**	Aligns the TX and RX frequencies.	4-5
B	**[MULTI/CH]**	Switches the frequency at a fast speed. (Available in the VFO mode.)	4-5
		Switches the channel number. (Available in the memory channel and quick memory channel modes.)	9-2
		Switches the item to configure or configured value. (Available when a configuration screen is displayed.)	3-1
C	**[RIT/XIT]**	Changes the RIT/XIT frequency.	5-7
D	**[KEY]**	Adjusts the keying speed.	5-13
	[DELAY]	Adjusts the break-in delay time. (When the TX mode is configured to CW.)	5-8
		Adjusts the VOX delay time. (When the TX mode is configured to SSB, FM or AM.)	8-3
E	**[MIC/PITCH]**	Adjusts the microphone gain. (When the TX mode is configured to SSB or AM.)	4-8
		Adjusts the sidetone/pitch frequency. (When the TX mode is configured to CW.)	5-9
		Adjusts the speech processor output level. (When the speech processor is ON.)	8-4
	[POWER]	Changes the TX output power level.	4-8
F	**[HI/SHIFT]**	Changes the RX filter (high cutoff frequency or SHIFT frequency).	6-3
	[LO/WIDTH]	Changes the RX filter (low cutoff frequency or WIDTH frequency).	6-3
G	**[NOTCH]**	Adjusts the notch frequency.	6-8
	[SQL]	Adjusts the squelch level.	4-2
H	**[AF]**	Adjusts the receiving volume.	4-2
	[RF]	Adjusts the RF gain.	4-2

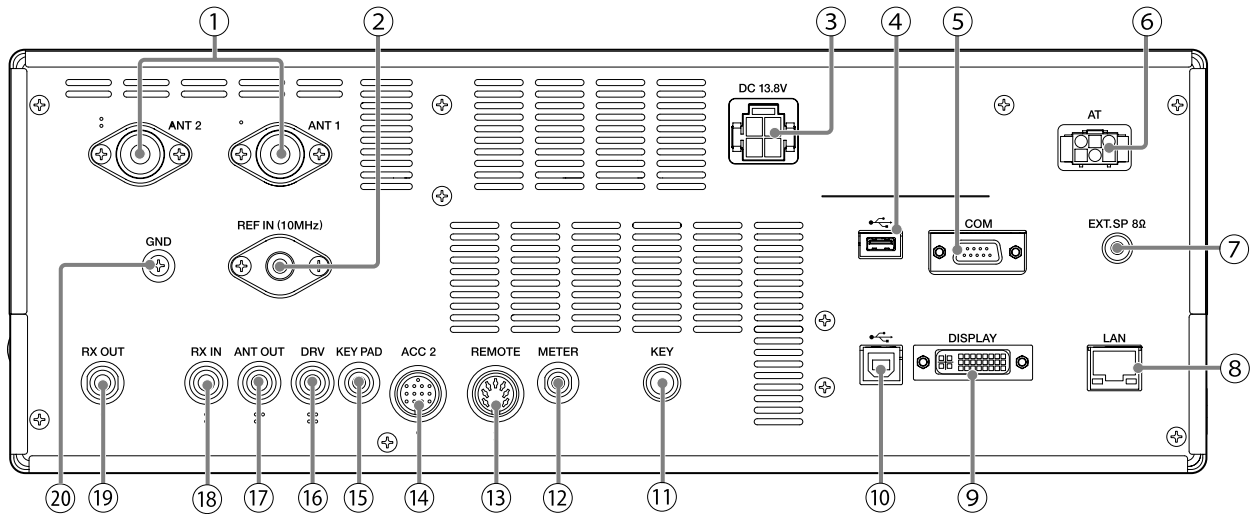
List of LED Behaviors

	LED	Behavior
①	**[POWER]**	When power is OFF: light off
		When power is ON: lights up in green
		When power is OFF with timer activated: lights up in orange
		When timer is starting up: blinks in orange
②	**[VOX]**	Lights up when the VOX function is enabled.
③	**[AT]**	Lights up when the antenna tuner is ON.
		Blinks during antenna tuning.
④	**[BUSY/TX]**	Lights up in green when squelch opens upon receiving a signal.
		Lights up in red when transmission is in progress.
⑤	**[DRV]**	Lights up when drive output is ON.
⑥	**[REC]**	Lights up during manual recording (including when recording is paused). Blinks for 1 second at the start of saving the constantly recorded audio.
⑦	**[SPLIT]**	Lights up in the split mode.
		Blinks during configuration of the split frequency.
⑧	**[LOCK]**	Lights up when the frequency lock function is enabled.
⑨	**[MONI]**	Lights up when the TX monitor function is enabled.
⑩	**[MULTI/CH]**	Lights up when a configuration screen is displayed (when adjustments can be made using the [MULTI/CH] control).
⑪	**[RIT]**	Lights up when the RIT function is enabled.
⑫	**[XIT]**	Lights up when the XIT function is enabled.

Connectors and Jacks

	Name	Description
Ⓐ	**<PHONES> Jack**	Jack for connecting to headphones.
Ⓑ	**<PADDLE> Jack**	Jack for connecting a paddle while running in the CW mode.
Ⓒ	**<USB-A> Connector**	Connector for connecting a USB flash drive or USB keyboard.
Ⓓ	**<MIC> Connector**	Connector for connecting a microphone.

Rear Panel



Connectors and Jacks on the Rear Panel

No.	Name	Description	Remarks
①	**<ANT 1> Connector** **<ANT 2> Connector**	M-type coaxial connector for connecting the antenna.	
②	**<REF IN (10MHz)> Connector**	For input of 10 MHz signals when using an external reference frequency.	• Input impedance: 50 Ω • Input: 0 dBm ±10 dB
③	**<DC13.8V> Connector**	For connecting a regulated DC power supply.	
④	**<USB-A> Connector**	Connector for connecting a USB flash drive or USB keyboard.	
⑤	**<COM> Connector**	RS-232C connector for connecting a PC or external device.	
⑥	**<AT> Connector**	Connector for controlling an external antenna tuner.	
⑦	**<EXT.SP> Jack**	For connecting an external speaker.	
⑧	**<LAN> Connector**	Connector for connecting a PC or LAN when running with the KNS (KENWOOD NETWORK COMMAND SYSTEM) or for automatic correction of the clock time.	
⑨	**<DISPLAY> Connector**	DVI-I connector for connecting an external monitor. Both analog and digital signals can be output.	
⑩	**<USB-B> Connector**	Connector for connecting a PC. It is used to control this transceiver using the ARCP-890 as well as to input and output signals for transmission and reception via the digital communication application of a PC. It can be switched between transmission and reception by changing the menu setting and keying.	
⑪	**<KEY> Jack**	For connecting an electronic key (straight key, bug key, external electronic key, etc.) when running in the CW mode. This can be configured to a jack for paddle connection in the menu.	
⑫	**<METER> Terminal**	For connecting a commercially available meter.	• Output impedance: 4.7 Ω • Allowable open-end voltage output: 0 to 5 V
⑬	**<REMOTE> Connector**	For connecting a linear amplifier. (Use the supplied 7-pin DIN plug for the connection.)	
⑭	**<ACC 2> Connector**	For connecting an external device such as an auxiliary equipment for data communication. (Use the supplied 13-pin DIN plug for the connection.)	
⑮	**<KEYPAD> Jack**	For connecting a self-made PF keypad.	
⑯	**<DRV> Connector**	For connecting a transverter or linear amplifier.	• Output impedance: 50 Ω • Output: Approx. 1 mW (0 dBm)
⑰	**<ANT OUT> Connector**	For connecting devices such as an external receiver.	
⑱	**<RX IN> Connector**	For connecting an RX antenna, external bandpass filter, transverter and the like.	
⑲	**<RX OUT> Connector**	For connecting an external bandpass filter and the like.	
⑳	**<GND> Terminal**	For connecting a ground wire.	

Microphone (Optional)

① PTT (Push-to-talk) Switch

Switches to the transmitting state while this switch is being pressed. Releasing the switch restores the transceiver to the receiving state.

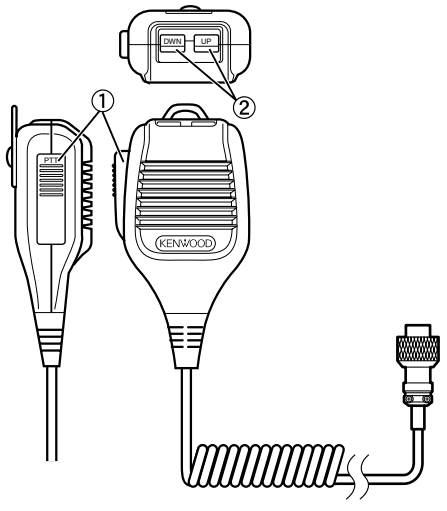
② UP/ DOWN Keys

For scrolling up/down the items in one of the following modes, such as scrolling up/down the VFO frequencies.
Pressing and holding down the key enables continuous scrolling. It can also be configured for use as a PF key.

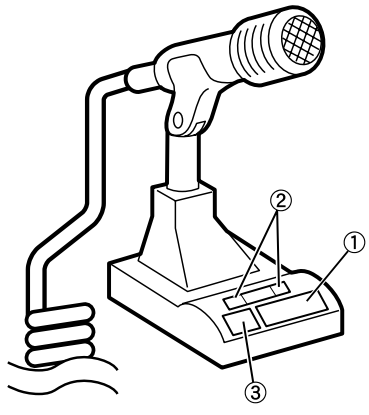
- VFO mode: Scrolls up/down the VFO frequencies
- Memory channel mode: Scrolls up/down the memory channel numbers
- Memory scroll mode: Scrolls up/down the memory scroll numbers
- Mic paddle mode: For paddle (dot/dash) input
- Menu mode: Displays the previous or next option

③ LOCK Key (MC-60A/ MC-90 only)

Pressing this key activates the key lock and switches to the transmitting state. Pressing it again restores the key to the original position and switches to the receiving state.

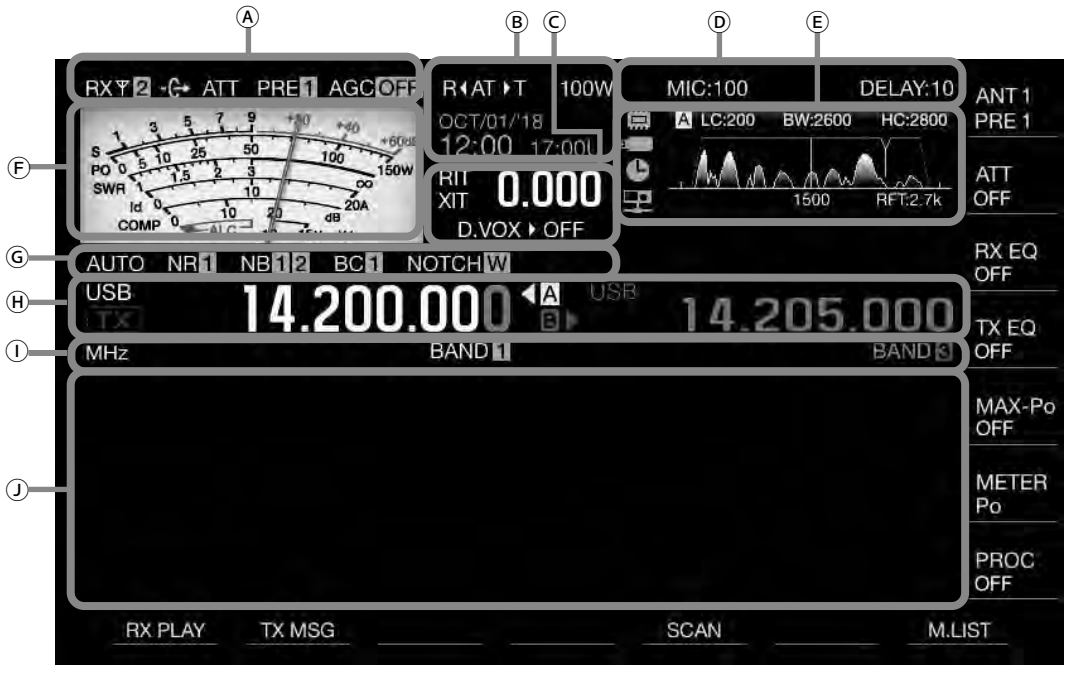


MC-43S



MC-60A/MC-90

Screen



Area	Display	Description	Refer to
Ⓐ	RX	Appears when an RX antenna is functioning.	4-10
	T1	Displays the antenna number. Switches the antenna number accordingly when the antenna is switched.	4-10
	-G-	Appears when antenna output for the external receiver is functioning.	16-16
	ATT	Appears when the receiving attenuator is configured to “6 dB”, “12 dB” or “18 dB”.	6-1
	PRE 1 PRE 2	Appears when the receive preamplifier 1 is ON. Appears when the receive preamplifier 2 is ON.	5-6
	AGC OFF AGC-F AGC-M AGC-S	Appears when AGC is OFF. Appears when AGC is configured to FAST. Appears when AGC is configured to MID. Appears when AGC is configured to SLOW.	5-2
	TONE	Appears when Tone is ON.	5-29
	CT	Appears when CTCSS is ON.	5-30
	CROSS	Appears when Cross Tone is ON.	5-30

Area	Display	Description	Refer to
Ⓑ	R◖AT◗T	Displays the antenna tuner function and operating status. << R◖ >> lights up when the antenna tuner is ON during reception. << R◖AT◗T >> blinks while antenna tuning is in progress.	4-11
	XVTR	Appears when the transverter is ON.	16-15
	TX TUNE	Blinks while TX tuning is ON.	8-8
	100W	Displays the TX output power level. (Not displayed when the TX output power destination is drive output (DRV).) Displayed in yellow when the output power is limited by the TX output power limiter function.	4-8
	100%	Displays the drive output level. (Displayed when drive output is ON.)	4-11
	30WPM	Displays the keying speed. Turning the **[KEY SPEED]** control displays the keying speed (4 to 60 words/minute) in the TX output power area for 2 seconds.	5-13
	01/JAN/'18	Displays the date of the local clock. The date can be displayed in the UK, US or Japanese format.	14-1
	10:00 01:00U	Displays the time (24-hour format). Left: Displays the time of the local clock. Right: Displays the time of the auxiliary clock (indicated by the character "U" at the end).	14-1
Ⓒ	RIT	Appears when the RIT function is enabled.	5-7
	XIT	Appears when the XIT function is enabled.	
	0.000	Displays the RIT or XIT frequency (between -9.999 and 9.999 kHz).	
	D.VOX◗OFF	Appears according to the input path of the TX audio selected by the data VOX function. OFF: Appears when sound is not input from all paths. ACC 2: Appears when ACC 2 is used as the audio source input. USB: Appears when USB AUDIO is used as the audio source input. LAN: Appears when LAN is used as the audio source input.	8-2
Ⓓ	MIC:100 PROC OUT:50	Displays the microphone gain. (Displayed when the speech processor is OFF) Displays the speech processor output level. (Displayed when the speech processor is ON)	4-8 8-4
	DELAY:10 FULL-BK	Displays the VOX delay time when the transmitting end is in the SSB, AM or FM mode. Displays the break-in delay time when the transmitting end is in the CW mode. "FULL-BK" is displayed during full break-in.	8-3 5-8

Area	Display	Description	Refer to
Ⓔ		This is an icon of the internal memory. The icon blinks when writing image data to the built-in memory during screen capture. The icon is displayed in red when the remaining space is running low.	16-6
		The icon starts to blink when a USB flash drive is connected, and lights up when the USB flash drive is recognized by this transceiver. The icon blinks when writing image data to the USB flash drive during screen capture. The icon is displayed in red when the remaining space is running low.	11-2 16-6
		Appears when the timer function is enabled.	14-4
		Appears when a KNS user is connected to this transceiver.	15-2
	A B C	Displays the selected RX filter (A, B or C).	6-1
	LC:200 WIDTH:2600	Displays the low cutoff frequency of the RX filter. Displays the WIDTH frequency of the RX filter.	6-3
	BW:2600	Displays the bandwidth of the RX filter.	
	HC:2800 SHIFT:1500	Displays the high cutoff frequency of the RX filter. Displays the shift frequency of the RX filter.	
		Displays the position of the notch frequency when the notch filter is ON.	6-8
		Displays the IF filter passband. Displays the audio spectrum of the RX or TX audio.	6-1 8-5
	1500	Displays the center indicator. • Indicates the pitch frequency when in the CW mode. • Indicates the center frequency of the passband when in the FSK or PSK mode. • Indicates the center frequency of the horizontal axis that is currently displayed when in the SSB, FM or AM mode.	5-9 5-17 5-22
	RFT:2.7k	Displays the selected bandwidth for the roofing filter.	6-2
Ⓕ		Meter display • This can be switched to an analog or digital display. • Display of the information on the TX meter can be switched when an analog meter is displayed.	4-9
Ⓖ	AUTO	Appears when the auto mode is ON.	4-4
	NR 1 NR 2	Appears when Noise Reduction 1 (NR1) is ON. Appears when Noise Reduction 2 (NR2) is ON.	6-8
	NB 1 NB 2 NB 1 2	Appears when Noise Blanker 1 (NB1) is ON. Appears when Noise Blanker 2 (NB2) is ON. Appears when both Noise Blanker 1 and 2 are ON.	6-6
	BC 1 BC 2	Appears when Beat Canceler 1 (BC1) is ON. Appears when Beat Canceler 2 (BC2) is ON.	6-9
	NOTCH W NOTCH M NOTCH N	Appears when the notch filter is ON and “Wide” is selected for the bandwidth. Appears when the notch filter is ON and “Middle” is selected for the bandwidth. Appears when the notch filter is ON and “Narrow” is selected for the bandwidth.	6-8
	SPLIT	Appears during split operation.	5-1

Area	Display	Description	Refer to
Ⓗ	USB	Displays the mode that is currently running. "-D" is displayed when in the data mode. "-R" is displayed when in the reverse mode.	4-4
	TX TX	Appears while receiving in the TX band. Appears while transmitting in the TX band.	–
	VFO	Appears when configuring the frequency of the VFO mode or auto mode.	–
	E9	Displays the entry history when the frequency entry mode is started up in the VFO mode.	4-7
	M.CH 01	Appears when transmitting or receiving operation information that is called up from the memory channel. The memory channel numbers displayed are from 00 to 99, P0 to P9 and E0 to E9.	9-1
	Q.MR Q1	Displays the quick memory channel mode. Displays one of the quick memory channel numbers from Q0 to Q9.	9-5
	A A A B M M	Displays the VFO A/B and memory channel status that is being used during simplex or split operation.	–
	14.195.000	Displays the frequency used. (The frequency display on the right is grayed out during simplex operation.)	–
Ⓘ	MHz	Appears when the MHz step function is enabled.	4-6
	MEMONAME01	Displays the name of the memory channel.	9-4
	SCAN-SPD1	Displays the scanning speed (when in a mode other than FM).	10-2
	SCANNING	Appears during program scanning, memory scanning or quick memory scanning.	10-1
	SCAN-SLOW	Appears during program slow-scan.	10-2
	CW TUNE	Appears when CW auto tuning is running.	5-9
	BAND 1	Displays the band memory number according to the memory that is being called up.	4-3
	L.OUT	Appears when a channel to be locked out is selected.	10-4
	⊿F 5.000	Displays the difference between the transmission frequency and reception frequency.	5-1
	►PLAY	Appears during playback.	12-4
	❚❚ PAUSE	Appears while playback is paused.	
	● REC	Appears during recording.	12-3
Ⓙ	Configuration Screen Bandscope	Displays the configuration screen or bandscope. This area is usually left blank.	–

3 MENU

Menu Operation

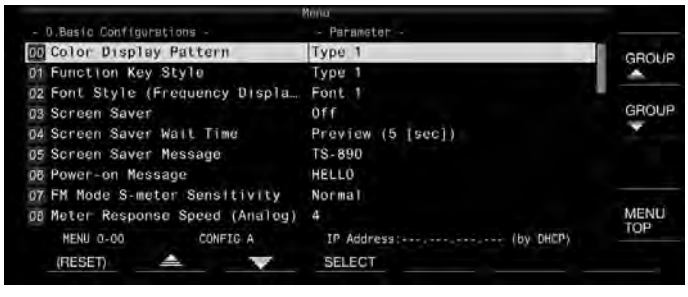
The settings of the different functions of this transceiver can be changed from the menu. It can also be used to switch the operating environment.
There is also a list of frequently used menu items as well as "sub-menus" that are sorted by function.

Calling Up a Menu

1 **Press [MENU] to display the menu screen.**

2 **Press F2 [▲]/ F3 [▼] or [∧ M.IN]/ [∨] to select a group.**

3 **Press F4 [SELECT] to display the menu items of the selected group.**

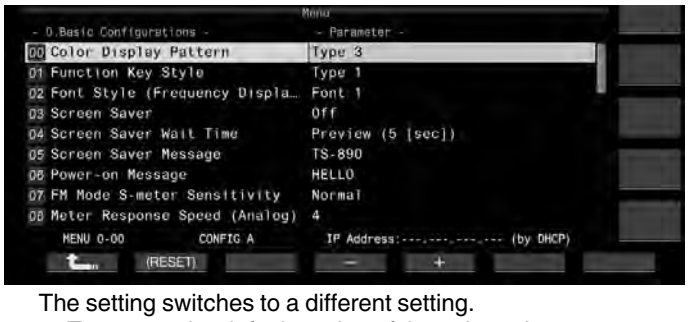


4 **Press F2 [▲]/ F3 [▼] or [∧ M.IN]/ [∨], or turn the [MULTI/CH] control to select the desired menu item.**

- Pressing **F [GROUP ▲]**/ **F [GROUP ▼]** changes the group. (Refer to 3-3 Menu Items.)
- Pressing **F [MENU TOP]** returns the menu screen to the top.

5 **Press F4 [SELECT] or [Q-MR>].**
The parameter setting can now be changed.

6 **Press F4 [–]/ F5 [+] or [∧ M.IN]/ [∨], or turn the [MULTI/CH] control to select the setting value.**



The setting switches to a different setting.

- To restore the default setting of the selected menu, press and hold **F2 [(RESET)]**.

7 **Press F1 [↵] or [<Q-M.IN].**
The selected content is confirmed.

8 **Press [MENU] or [ESC] to exit the menu screen.**

In the subsequent descriptions on the menus, the expression **"Configure in Menu [X-XX] 'Xxxx xxxx xxxxx'"** will be used.
(Example: Configure in Menu [3-06] "MHz Step")

Calling Up a Sub-Menu

1 **Press [MENU] to display the menu screen.**
The function keys of the sub-menu are displayed on the right side of the screen.

2 **Press F [MORE] to switch between sub-menu selection 1 and 2.**

3 **Press the desired function key.**
The following sub-menus are displayed.

Sub-Menu	Key Guide	Behavior
Sub-Menu Selection 1		
Reset	**RESET**	Displays the Reset menu screen.
Advanced	**ADV.**	Displays the Advanced Menu screen.
Linear Amplifier	**LINEAR AMP**	Displays the Linear Amplifier menu screen.
Dimmer	**DIMMER n**	Short press: Switches the dimmer. Long press: Displays the Dimmer menu screen.
SWL	**SWL**	Displays the horizontal dial screen.
USB/File	**USB /FILE**	Displays the USB/File Management menu screen.
MORE	**MORE**	Switches to sub-menu selection 2.
Sub-Menu Selection 2		
Clock	**CLOCK**	Displays the Clock menu screen.
LAN	**LAN**	Displays the LAN menu screen.
Auto Mode	**AUTO MODE**	Displays the Auto Mode menu screen.
KNS	**KNS**	Displays the KNS menu screen.
Timer	**TIMER**	Short press: Switches the paused state of a timer. Long press: Displays the Timer menu screen.
Frequency Marker	**F.MKR xxx**	Short press: Switches the marker display. Long press: Displays the Frequency Marker menu screen.
MORE	**MORE**	Switches to sub-menu selection 1.

Advanced Menu

In the subsequent descriptions on the advanced menus, the expression **"Configure in Advanced Menu [XX] 'Xxxx xxxx xxxxx'"** will be used.
(Example: Configure in Advanced Menu [9] "Antenna Tuner Operation per Band")

Common Menu Screen Operations

- Pressing **F [MENU TOP]** returns the menu screen to the top.
- Pressing **F [GROUP ▲]**/ **F [GROUP ▼]** switches the group.
- The menu item can be selected in the following ways.
  - Turn the **[MULTI/CH]** control.
  - Press **F2 [▲]**/ **F3 [▼]**.
  - Press **[∧M.IN]**/ **[∨]**.
  - Press **[UP]** or **[DOWN]** on the microphone.
- The setting value in the Parameter field can be selected in the following ways.
  - Turn the **[MULTI/CH]** control.
  - Press **[UP]** or **[DOWN]** on the microphone.
  - Press **F4 [–]**/ **F5 [+]**.
  - Press **[∧M.IN]**/ **[∨]**.
  - Press **[◄‖]**/ **[‖►]**.
- Pressing and holding **[(RESET)]** restores the altered setting value to the default setting.
- Pressing **F [MORE]** switches the key guide display.
- Pressing **F [◯◯◯ TOP]** when configuring the sub-menu returns the sub-menu screen to the top.

Exiting the Menu

To exit configuration or editing on the menu screen or to end the configuration of a menu item halfway, follow the steps below. The menu screen closes and the display returns to the normal screen.

● **Press [MENU] or [ESC].**

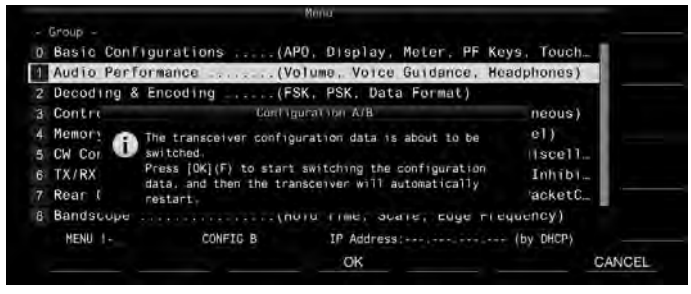
- It is possible to reset only the menu settings.
- The menu items or default values may be altered.
- When editing the screen saver message or power-on message, pressing **[MENU]** will not exit the menu screen.

Switching between the CONFIG A and CONFIG B Operating Environments

"Operating environment" refers collectively to values configured in the menu as well as the different settings data for operation. Two different types of operating environment are available on this transceiver: CONFIG A and CONFIG B. Both CONFIG A and CONFIG B have the same functions and they can be configured independently of each other. For example, it is possible to configure CONFIG A for DX and CONFIG B for rag chew and switch easily between them.

1 **Press [MENU] to display the menu screen.**
The current operating environment (CONFIG A or CONFIG B) is displayed in the status bar of the menu screen. Also, data of the operating environment can be saved to and read from a transceiver or USB flash drive.

2 **Press F7 [CONFIG].**
A message appears.
- Press **F7 [CANCEL]** to return to the Menu screen.



3 **Press F4 [OK].**
- Switches from CONFIG A to CONFIG B or vice versa, and this transceiver automatically restarts after switching is complete.

- The following are common settings between CONFIG A and B.
  - Number of quick memory channels
  - Baud rate of COM port
  - Baud rate of USB connector (virtual COM port) on the rear panel
  - Decoded character output
- Information and data other than those below are common between CONFIG A and B.
  - Advanced menu settings
  - LAN menu settings
  - Clock menu settings
  - Linear amplifier menu settings
  - Timer menu settings
  - Memory channel data (including quick memory and slow scan point data)
  - CW/RTTY/PSK message memory data
  - Band memory (frequency and mode)
  - Broadcast band memory data
  - Antenna selection (including drive output selection and antenna output selection for external receiver)
  - Preset data of antenna tuner
  - Internal audio file data of recording function (wav file)
  - Voice message memory data (wav file)
- If the operating environment is switched while the quick memory is called up by pressing **[Q-MR>]** (quick memory), the quick memory settings will be discarded before the operating environment switches.

Menu Items

Menu

- 0. Basic Configurations -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
		Display			
0-00	Color Display Pattern	Display color type	Type 1/ Type 2/ Type 3	Type 1	4-1
0-01	Function Key Style	Type of function key display	Type 1/ Type 2/ Type 3	Type 1	4-1
0-02	Font Style (Frequency Display)	Font type (frequency display)	Font 1/ Font 2/ Font 3/ Font 4/ Font 5	Font 1	4-1
0-03	Screen Saver	Screen saver	Off/ Type 1/ Type 2/ Type 3/ Display Off	Off	16-1
0-04	Screen Saver Wait Time	Wait time for screen saver	Preview (5 [sec])/ 5/ 15/ 30/ 60 [min]	Preview (5 [sec])	16-1
0-05	Screen Saver Message	Screen saver message	Up to 10 alphanumeric characters	TS-890	16-1
0-06	Power-on Message	Power on message	Up to 15 alphanumeric characters	HELLO	16-1
		Meter			
0-07	FM Mode S-Meter Sensitivity	FM S meter sensitivity	Normal/ High	Normal	4-10
0-08	Meter Response Speed (Analog)	Analog meter response	1 to 4 (1 step)	3	4-10
0-09	Meter Display Pattern	Meter type	Digital/ Analog (White)/ Analog (Black)	Analog (White)	4-9
0-10	Meter Display Peak Hold	Meter with peak hold	Off/ On	On	4-10
0-11	S-Meter Scale	S meter scale	Type 1/ Type 2	Type 1	4-10
0-12	TX Digital Meter	TX meter (digital)	Off/ On	Off	4-10
		Key			
0-13	Long Press Duration of Panel Keys	Duration for pressing and holding a key	200 to 2000 [ms] (100 [ms] step)	500 [ms]	16-2
0-14	Touchscreen Tuning	Touchscreen tuning	Off/ On	On	7-6
0-15	PF A: Key Assignment	Function assignment to **[PF A]** key	Refer to PF (Programmable Function).	VOICE1	16-2
0-16	PF B: Key Assignment	Function assignment to **[PF B]** key	Refer to PF (Programmable Function).	VOICE2	16-2
0-17	PF C: Key Assignment	Function assignment to **[PF C]** key	Refer to PF (Programmable Function).	VOICE3	16-2
0-18	External PF 1: Key Assignment	Function assignment to **[PF 1]** on the keypad	Refer to PF (Programmable Function).	Message Memory CH 1	16-3
0-19	External PF 2: Key Assignment	Function assignment to **[PF 2]** on the keypad	Refer to PF (Programmable Function).	Message Memory CH 2	16-3
0-20	External PF 3: Key Assignment	Function assignment to **[PF 3]** on the keypad	Refer to PF (Programmable Function).	Message Memory CH 3	16-3
0-21	External PF 4: Key Assignment	Function assignment to **[PF 4]** on the keypad	Refer to PF (Programmable Function).	Message Memory CH 4	16-3
0-22	External PF 5: Key Assignment	Function assignment to **[PF 5]** on the keypad	Refer to PF (Programmable Function).	Message Memory CH 5	16-3
0-23	External PF 6: Key Assignment	Function assignment to **[PF 6]** on the keypad	Refer to PF (Programmable Function).	Message Memory CH 6	16-3
0-24	External PF 7: Key Assignment	Function assignment to **[PF7]** on the keypad	Refer to PF (Programmable Function).	Message Memory CH 7	16-3
0-25	External PF 8: Key Assignment	Function assignment to **[PF 8]** on the keypad	Refer to PF (Programmable Function).	Message Memory CH 8	16-3
0-26	Microphone PF 1: Key Assignment	Function assignment to **[PF 1]** on the microphone	Refer to PF (Programmable Function).	A/B, A=B	16-3

- 0. Basic Configurations -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Display					
0-27	Microphone PF 2: Key Assignment	Function assignment to **[PF 2]** on the microphone	Refer to PF (Programmable Function).	SPLIT	16-2
0-28	Microphone PF 3: Key Assignment	Function assignment to **[PF 3]** on the microphone	Refer to PF (Programmable Function).	M/V, M▶V	16-2
0-29	Microphone PF 4: Key Assignment	Function assignment to **[PF 4]** on the microphone	Refer to PF (Programmable Function).	MONI	16-2
0-30	Microphone DOWN: Key Assignment	Function assignment to **[DOWN]** on the microphone	Refer to PF (Programmable Function).	DWN Key (Microphone)	16-2
0-31	Microphone UP: Key Assignment	Function assignment to **[UP]** on the microphone	Refer to PF (Programmable Function).	UP Key (Microphone)	16-2
0-32	Automatic Power Off	APO (Automatic Power Off)	Off/ 60/ 120/ 180 [min]	Off	16-2

- 1. Audio Performance -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Volume					
1-00	Beep Volume	Volume of beep tone	Off/ 1 to 20 (1 step)	10	16-2
1-01	Voice Message Volume (Play)	Playback volume of voice message	Off/ 1 to 20 (1 step)	10	12-2
1-02	Sidetone Volume	Sidetone volume	Off/ 1 to 20 (1 step)	10	5-9
Voice Guide					
1-03	Voice Guidance Volume	Voice guide volume	Off/ 1 to 20 (1 step)	10	13-1
1-04	Voice Guidance Speed	Voice guide speed	1 to 4 (1 step)	1	13-1
1-05	User Interface Language (Voice Guidance & Messages)	Language of voice guide and message display	English/ Japanese	English	13-1
1-06	Automatic Voice Guidance	Automatic voice guide	Off/ On	Off	13-1

- 2. Decoding & Encoding -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
FSK Decoding					
2-00	FFT Scope Averaging (RTTY Decode)	Averaging on the FFT scope (RTTY Decode)	0 to 9 (1 step)	0	5-24
2-01	RX UOS	RX unshift-on-space	Off/ On	On	5-21
2-02	Newline Code	New line code selection (during reception)	CR+LF/ All	All	5-21
2-03	Diddle	Diddle	Off/ Blank Code/ Letters Code	Blank Code	5-21
2-04	TX UOS	TX unshift-on-space	Off/ On	On	5-21
2-05	Automatic Newline Insertion	Automatic new line code insertion	On/ Off	On	5-21
FSK Key					
2-06	FSK Spacing	FSK shift width	170/ 200/ 425/ 850 [Hz]	170 [Hz]	5-21
2-07	FSK Keying Polarity	FSK keying polarity	Off/ On	Off	5-22
2-08	FSK Tone Frequency	FSK tone frequency	1275/ 2125 [Hz]	2125 [Hz]	5-21
2-09	RTTY Tuning Scope	Scope display for checking FSK tuning	FFT Scope/ X-Y Scope	FFT Scope	5-18
PSK Decoding					
2-10	FFT Scope Averaging (PSK Decode)	Averaging on the FFT scope (PSK Decode)	0 to 9 (1 step)	0	5-18
2-11	PSK AFC Tuning Range	Tuning range for PSK AFC	±15/ ±8 [Hz]	±15 [Hz]	5-24
2-12	PSK Tone Frequency	PSK tone frequency	1.0/ 1.5/ 2.0 [kHz]	1.5 [kHz]	5-27
2-13	PSK Tuning Scope	Scope display for checking PSK tuning	FFT Scope/ X-Y Scope	FFT Scope	5-18
Common					
2-14	CW/ RTTY/ PSK Log File Format	File format for saving CW/RTTY/ PSK logs	html/ txt	txt	5-27
2-15	CW/ RTTY/ PSK Time Stamp	CW/ RTTY/ PSK time stamp	Off/ Time Stamp/ Time Stamp + Frequency	Time Stamp + Frequency	5-27
2-16	Clock (CW/ RTTY/ PSK Time Stamp)	Clock selection for CW/ RTTY/ PSK time stamp	Local Clock/ Secondary Clock	Local Clock	5-27
2-17	Waterfall when Tuning (RTTY/ PSK Audio Scope)	Selection of RTTY/ PSK waterfall display type	Straight/ Follow	Straight	5-19 5-24

- 3. Controls Configurations -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Control Rate					
3-00	Frequency Rounding Off (Multi/ Channel Control)	Rounds off the frequency of the **[MULTI/CH]** control	Off/ On	On	4-6
3-01	SSB Mode Frequency Step Size (Multi/ Channel Control)	SSB frequency step size	0.5/ 1/ 2.5/ 5/ 10 [kHz]	1 [kHz]	4-6
3-02	CW/FSK/PSK Mode Frequency Step Size (Multi/Channel Control)	CW/ FSK/ PSK frequency step size	0.5/ 1/ 2.5/ 5/ 10 [kHz]	0.5 [kHz]	4-6
3-03	FM Mode Frequency Step Size (Multi/ Channel Control)	FM frequency step size	5/ 6.25/ 10/ 12.5/ 15/ 20/ 25/ 30/ 50/ 100 [kHz]	10 [kHz]	4-6
3-04	AM Mode Frequency Step Size (Multi/ Channel Control)	AM frequency step size	5/ 6.25/ 10/ 12.5/ 15/ 20/ 25/ 30/ 50/ 100 [kHz]	5 [kHz]	4-6
3-05	9 kHz Step in AM Broadcast Band (Multi/ Channel Control)	Steps of the **[MULTI/CH]** control in the BC band (AM)	Off/ On	K type: Off E type: On	4-6
3-06	MHz Step	MHz step	100/ 500/ 1000 [kHz]	1000 [kHz]	4-6
3-07	Tuning Control: Number of Steps per Revolution	Number of steps per revolution of the **Tuning** control	250/ 500/ 1000 [Step]	1000 [Step]	4-6
3-08	Tuning Speed Control	Fast forward rate of the **Tuning** control	Off/ 2 to 10 (1 step)	Off	4-6
3-09	Tuning Speed Control Sensitivity	Sensitivity of the **Tuning** control for starting the fast forward operation	1 to 10 (1 step)	5	4-6
3-10	Lock Function	Frequency lock function	Frequency Lock/ Tuning Control Lock	Frequency Lock	4-6
3-11	Number of Band Memories	Number of band memories	1/ 3/ 5	3	4-3
3-12	Split Frequency Offset by RIT/XIT Control	Changing the split frequency using the **[RIT/XIT]** control	Off/ TX Frequency Offset while RX/ RX Frequency Offset while TX/ Both	Off	5-1
3-13	Band Direct Keys in Split Mode	Band direct key during split operation	RX Band/ RX Band and Cancel Split Mode/ RX/ TX Band	RX Band	5-1

- 4. Memory Channels & Scan -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Memory					
4-00	Number of Quick Memory Channels	Number of quick memory channels	3/ 5/ 10 [ch]	5 [ch]	9-5
4-01	Temporary Change (Memory Channel Configurations)	Temporary change of memory frequency	Off/ On	Off	9-3
Scan					
4-02	Program Slow Scan	Program slow scan	Off/ On	On	10-2
4-03	Program Slow Scan Range	Range of program slow scan	100/ 200/ 300/ 400/ 500 [Hz]	300 [Hz]	10-3
4-04	Scan Hold	Scan Hold	Off/ On	Off	10-3
4-05	Scan Resume	Scan resume condition	Time-operated/ Carrier-operated	Time-operated	10-4

- 5. CW Configurations -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Jack Terminals					
5-00	Paddle Jack Configuration (Front)	PADDLE jack (front panel) function setting	Straight Key/ Paddle/ Paddle (Bug Key Mode)	Paddle	5-13
5-01	Key Jack Configuration (Rear)	KEY jack (rear panel) function setting	Straight Key/ Paddle/ Paddle (Bug Key Mode)	Straight Key	5-13
Mode					
5-02	Electronic Keyer Squeeze Mode	Operation mode of the electronic keyer	Mode A/ Mode B	Mode B	5-13
5-03	Dot and Dash Reversed Keying	Switches between dot and dash paddle	Off/ On	Off	5-13
5-04	Paddle (Microphone Up/Down Keys)	Paddle (**[UP]** and **[DOWN]** keys on microphone)	Off/ On	Off	5-13
5-05	CW BFO Sideband	CW BFO sideband	USB/ LSB	USB	5-9

- 5. CW Configurations -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Weight and Timing					
5-06	Automatic CW TX with Keying in SSB Mode	CW transmission by keying in the SSB mode	Off/ On	Off	5-9
5-07	Carrier Frequency Offset (SSB Mode to CW Mode)	Carrier frequency correction when shifting from the SSB mode to CW mode	Off/ On	Off	5-9
5-08	CW Keying Weight Ratio	Keyer weight	Automatic/ 2.5 to 4.0 (0.1 step)	Automatic	5-13
5-09	CW Keying Reversed Weight Ratio	Reverse keying auto weight ratio	Off/ On	Off	5-13
5-10	Interrupt Keying	Insert keying	Off/ On	Off	5-17
Memory					
5-11	CW Message Entry	Method for registering CW message	Text String/ Paddle	Paddle	5-14
5-12	Contest Number	Contest number	001 to 9999 (1 step)	001	5-15
5-13	Contest Number Format	Contest number style	Off/ 190 to ANO/ 190 to ANT/ 90 to NO/ 90 to NT	Off	5-15
5-14	Channel Number (Count-up Message)	Specifies the channel used for the count-up message	Off/ Channel 1 to Channel 8	Off	5-15
5-15	CW Rise Time	CW rise time	1/ 2/ 4/ 6 [ms]	6 [ms]	5-9
5-16	CW/ Voice Message Retransmit Interval Time	Repeat interval for retransmitting CW/voice message	0 to 60 [s] (1 [s] step)	10 [s]	5-17 12-3

- 6. TX/RX Filters & Misc. -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Message					
6-00	Playback Time (Full-time Recording)	Playback time for constantly recorded audio	Last 10/ Last 20/ Last 30 [s]	Last 30 [s]	12-4
6-01	Recording with Squelch	Audio recording in tandem with squelch	Off/ On	On	12-4
TX Management					
6-02	Time-out Timer	Maximum continuous transmission time (Timeout timer)	Off/ 3/ 5/ 10/ 20/ 30 [min]	Off	8-8
6-03	TX Inhibit	Inhibits transmission	Off/ On	Off	16-11
6-04	Transmit Power Step Size	Fine adjustment of TX output power	1/ 5 [W]	5 [W]	4-8
6-05	ID Beep	ID beep	Off/ 1 to 30 [min] (1 step)	Off	8-8
Filter					
6-06	TX Filter Low Cut (SSB/AM)	Low cutoff frequency of the TX filter (SSB/AM)	10/ 100/ 200/ 300/ 400/ 500 [Hz]	100 [Hz]	8-5
6-07	TX Filter High Cut (SSB/AM)	High cutoff frequency of the TX filter (SSB/AM)	2500/ 2600/ 2700/ 2800/ 2900/ 3000/ 3500/ 4000 [Hz]	2900 [Hz]	8-5
6-08	TX Filter Low Cut (SSB-DATA/AM-DATA)	Low cutoff frequency of the TX filter (SSB-DATA/AM-DATA)	10/ 100/ 200/ 300/ 400/ 500 [Hz]	100 [Hz]	8-5
6-09	TX Filter High Cut (SSB-DATA/AM-DATA)	High cutoff frequency of the TX filter (SSB-DATA/AM-DATA)	2500/ 2600/ 2700/ 2800/ 2900/ 3000/ 3500/ 4000 [Hz]	2900 [Hz]	8-5
6-10	RX Filter Numbers	Number of RX filters	2/ 3	3	6-1
6-11	Filter Control in SSB Mode (High/Low and Shift/Width)	Switches between high cutoff/low cutoff and WIDTH/ SHIFT (SSB)	High & Low Cut/ Shift & Width	High & Low Cut	6-3
6-12	Filter Control in SSB-DATA Mode (High/Low and Shift/Width)	Switches between high cutoff/low cutoff and WIDTH/ SHIFT (SSB-DATA)	High & Low Cut/ Shift & Width	Shift & Width	6-3
6-13	VOX Voice Delay (Microphone)	Audio delay in the VOX mode (MIC)	Off/ Short/ Middle/ Long	Middle	8-3
6-14	VOX Voice Delay (Except Microphone)	Audio delay in the VOX mode (excluding MIC)	Off/ Short/ Middle/ Long	Middle	8-3
6-15	Delta Frequency Display	⊿F display setting	Off/ On	On	5-1

- 7. Rear Connectors -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Baud Rate					
7-00	Baud Rate (COM Port)	Baud rate of COM connector	4800/ 9600/ 19200/ 38400/ 57600/ 115200 [bps]	9600 [bps]	16-5
7-01	Baud Rate (Virtual Standard COM)	Baud rate of virtual COM (Standard) connector	9600/ 19200/ 38400/ 57600/ 115200 [bps]	115200 [bps]	16-5
7-02	Baud Rate (Virtual Enhanced COM)	Baud rate of virtual COM (Enhanced) connector	9600/ 19200/ 38400/ 57600/ 115200 [bps]	115200 [bps]	16-12
7-03	Decoded Character Output	Decoded character output	Off/ On	Off	16-12
Data transfer					
7-04	Quick Data Transfer	Quick data transfer	Off/ A (TX/RX)/ A (Sub RX)/ B	Off	16-9
7-05	Overwrite Location (Quick Data Transfer)	Destination for data via quick data transfer	VFO/ Quick Memory	Quick Memory	16-9
Audio input					
7-06	USB: Audio Input Level	USB audio input level	0 to 100 (1 step)	50	16-7
7-07	ACC 2: Audio Input Level	Audio input level of ACC 2 connector	0 to 100 (1 step)	50	16-7
Audio output					
7-08	USB: Audio Output Level	USB audio output level	0 to 100 (1 step)	100	16-7
7-09	ACC 2: Audio Output Level	Audio output level from ACC 2 connector	0 to 100 (1 step)	50	16-7
7-10	TX Monitor Level (Rear Connectors)	TX monitor level output to the rear panel connector	Linked/ 0 to 20 (1 step)	Linked	16-7
7-11	Audio Output Type (Rear Connectors)	Format of audio output from the rear panel connector	All/ Received Audio only	All	16-7

- 8. Bandscope -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
Common					
8-00	Bandscope Display during TX	Bandscope display during transmission	Off/ On	Off	7-7
8-01	TX Audio Waveform Display	Waveform display for transmitted audio	On/ Off	On	8-5
8-02	Bandscope Maximum Hold	Maximum hold time	10 [s]/ Continuous	10 [s]	7-7
8-03	Waterfall when Tuning (Center Mode)	Waterfall display during tuning (center mode)	Straight/ Follow	Straight	7-2
8-04	Waterfall Gradation Level	Gradation setting of the waterfall	1 to 10 (1 step)	7	7-5
8-05	Tuning Assist Line (SSB Mode)	Auxiliary tuning line display (SSB only)	Off/ 300/ 400/ 500/ 600/ 700/ 800/ 1000/ 1500/ 2210 [Hz]	Off	7-5
8-06	Frequency Scale (Center Mode)	Frequency scale in the center mode	Relative Frequency/ Absolute Frequency	Relative Frequency	7-5
8-07	Touchscreen Tuning Step Correction (SSB/ CW/ FSK/ PSK)	Correction steps for touchscreen tuning	Off/ On	On	7-6

- 9. USB Keyboard -					
Menu	**Display**	**Description**	**Setting Value**	**Default**	**Refer to**
USB keyboard					
9-00	Send Message by Function Keys	Function key settings of USB keyboard	Off/ On	On	16-5
9-01	Keyboard Language	USB keyboard language	Japanese/ English (US)/ English (UK)/ French/ French (Canadian)/ German/ Portuguese/ Portuguese (Brazilian)/ Spanish/ Spanish (Latin American)/ Italian	English (US)	16-5
9-02	Repeat Delay Time	Key repeat delay time for USB keyboard	1 to 4 (1 step)	2	16-5
9-03	Repeat Speed	Key repeat speed for USB keyboard	1 to 32 (1 step)	1	16-5

Advanced Menu Items

Menu	Display	Description	Setting Value	Default	Refer to
0	Indication Signal Type (External Meter 1)	Target of external meter output 1	Automatic/ TX Power/ ALC/ Drain Voltage (Vd)/ Compression Level (COMP)/ Current (Id)/ SWR	TX Power	16-6
1	Indication Signal Type (External Meter 2)	Target of external meter output 2	Automatic/ TX Power/ ALC/ Drain Voltage (Vd)/ Compression Level (COMP)/ Current (Id)/ SWR	Automatic	16-6
2	Output Level (External Meter 1)	Level of external meter output 1	0 to 100 [%] (1 step)	50 [%]	16-6
3	Output Level (External Meter 2)	Level of external meter output 2	0 to 100 [%] (1 step)	50 [%]	16-6
4	Reference Signal Source	Switches the reference signal	Internal/ External	Internal	16-8
5	Reference Oscillator Calibration	Adjusts the frequency of the reference oscillator	-500 to +500 (1 step)	0	17-2
6	TX Power Down with Transverter Enabled	Powers down the transverter function	Off/ On	On	16-15
7	TX Hold After Antenna Tuning	Holds transmission at the end of antenna tuning	Off/ On	Off	4-12
8	Antenna Tuner during RX	Antenna tuner behavior while receiving	Off/ On	Off	4-12
9	Antenna Tuner Operation per Band	Antenna tuner behavior for each band	Off/ On	Off	4-12
10	Microphone Gain (FM Mode)	FM microphone gain	0 to 100 (1 step)	50	5-28
11	PKS Polarity Reverse	Reversing of PSK polarity	Off/ On	Off	16-12
12	TX Inhibit While Busy	Inhibits transmission while in the BUSY state	Off/ On	Off	16-12
13	CTCSS Unmute for Internal Speaker	Mute behavior of CTCSS	Mute/ Unmute	Mute	16-8
14	PSQ Logic State	SQL control signal logic	Low/ Open	Low	16-8
15	PSQ Reverse Condition	SQL output conditions	Off/ Busy/ Sql/ Send/ Busy-Send/ Sql-Send	Sql	16-8
16	PSQ/ PKS Pin Assignment (COM Connector)	PSQ/PKS mode setting	Off/ On	Off	16-8
17	Virtual Standard COM Port - RTS	RTS settings of virtual COM port (Standard)	Flow Control/ CW Keying/ RTTY Keying/ PTT/ DATA SEND	Flow Control	16-12
18	Virtual Standard COM Port - DTR	DTR settings of virtual COM port (Standard)	Off/ CW Keying/ RTTY Keying/ PTT/ DATA SEND	Off	16-12
19	Virtual Enhanced COM Port - RTS	RTS settings of virtual COM port (Standard)	Off/ CW Keying/ RTTY Keying/ PTT/ DATA SEND	Off	16-12
20	Virtual Enhanced COM Port - DTR	RTS settings of virtual COM port (Standard)	Off/ CW Keying/ RTTY Keying/ PTT/ DATA SEND	Off	16-12
21	External Display	External display output	Off/ On	On	16-7
22	Resolution (External Display)	Resolution settings of external display	800 x 600/ 848 x 480	800 x 600	16-7
23	Touchscreen Calibration	Touchscreen adjustment	–	–	17-3
24	Software License Agreement	Software license of this transceiver	–	–	i
25	Important Notices concerning Free Open Source	Ways to obtain open source resources used by this transceiver	–	–	ii
26	About Various Software License Agreements	Licenses related to software used by this transceiver	–	–	ii
27	Firmware Version	Firmware version used by this transceiver	–	–	17-1

Reset Menu Items

Display	Description	Refer to
Menu Reset	Menu reset	17-1
Memory Channel Reset	Memory channel reset	
VFO Reset	VFO reset	
Standard Reset (The Clock, TX Inhibit, and Transmit Power Upper Limit will not be reset)	Standard reset	
Full Reset	Full reset	

Linear Amplifier Menu Items

Display	Description	Setting Value	Default	Refer to
Band	Target bands of the linear amplifier menu	HF/ 50M/ 70M (E type)	HF	16-14 16-14
Linear Amplifier	Linear amplifier ON/OFF	Off/ On	Off	
Keying Logic	Linear amplifier TX control	Active Low/ Active High	Active Low	
TX Delay	Linear amplifier TX delay ON/OFF	Off/ On	Off	
TX Delay Time (CW/FSK/PSK)	Linear amplifier TX delay time (CW/FSK/PSK)	5/ 10/ 15/ 20/ 25/ 30/ 35/ 40 [ms]	15 [ms]	
TX Delay Time (SSB/FM/AM)	Linear amplifier TX delay time (SSB/FM/AM)	5/ 10/ 15/ 20/ 25/ 30/ 35/ 40/ 45/ 50 [ms]	35 [ms]	
Internal Relay Control	Linear amplifier relay control	Off/ On	Off	
External ALC Voltage	Linear amplifier external ALC voltage	-1/ -2/ -3/ -4/ -5/ -6/ -7/ -8/ -9/ -10/ -11/ -12 [V]	-4 [V]	

Dimmer Menu Items

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

USB/File Management Menu Items

Display	Description	Setting Value	Default	Refer to
Safe Removal of USB Flash Drive	Removes the USB flash drive safely	–	–	11-6
Read Configuration Data	Reads transceiver settings data	–	–	11-3
Save Configuration Data	Saves transceiver settings data	–	–	11-2
Copy Files to PC (via USB cable)	Copies files to PC (via USB cable)	–	–	11-4
Copy Files to USB Flash Drive	Copies files to USB flash drive	–	–	11-5
Read Image Files for Screen Saver (Type 3)	Reads images for screen saver	–	–	16-1
Delete Files (Internal Memory)	Deletes files stored in the internal memory of the transceiver	–	–	11-5
File Storage Location	Configures the destination for saving files	Internal Memory/ USB Flash Drive	Internal Memory	11-2
Format USB Flash Drive	USB flash drive format	–	–	11-5

Clock Menu Items

Menu	Display	Description	Setting Value	Default	Refer to
0.Date and Time					
0-00	Date (Local Clock)	Date of the local clock	Year: '18 (2018) to '99 (2099) Month: JAN/ FEB/ MAR/ APR/ MAY/ JUN/ JUL/ AUG/ SEP/ OCT/ NOV/ DEC Day: 01 to 31	Year: '18 Month: JAN Day: 01	14-1
0-01	Time (Local Clock)	Time of the local clock	00:00 to 23:59 (hour: 00 to 23, minute: 00 to 59)	00:00	
0-02	Timezone (Local Clock)	Time zone of the local clock	UTC -14:00 to UTC ±00:00 to UTC +14:00 (15-minute step)	UTC +00:00	
0-03	Timezone (Secondary Clock)	Time zone of the auxiliary clock	UTC -14:00 to UTC ±00:00 to UTC +14:00 (15-minute step)	UTC +00:00	
0-04	Secondary Clock Identification Letter	Auxiliary clock identifier	Single character (A to Z)	U	
0-05	Date Display Format	Date display format	MMM/DD/'YY, DD/MMM/'YY, 'YY/ MMM/ DD	K type: MMM/ DD/'YY E type: DD/ MMM/'YY	14-2
0-06	Clock Display	Clock display setting	Off/ Local Clock/ Secondary Clock/ Both	Both	
1.Automatic Time Correction					
1-00	Clock Correction using the NTP Server	Automatic clock setting (NTP)	Off/ On	Off	14-3
1-01	NTP Server Address	NTP server address	Up to 50 alphanumeric characters	Blank	

LAN Menu Items

Menu	Display	Description	Setting Value	Default	Refer to
0	DHCP	DHCP	Off/ On	On	15-1
1	IP Address	IP address	1.0.0.0 to 223.255.255.255	192.168.1.100	
2	Subnet Mask	Subnet mask	0.0.0.0 to 255.255.255.252	255.255.255.0	
3	Default Gateway	Default gateway	1.0.0.0 to 223.255.255.255	Blank	
4	Primary DNS Server	Primary DNS server	1.0.0.0 to 223.255.255.255	Blank	
5	Secondary DNS Server	Secondary DNS server	1.0.0.0 to 223.255.255.255	Blank	
6	MAC Address	MAC address	–	Fixed value for each transceiver	

Timer Menu Items

Display	Description	Setting Value	Default	Refer to
Programmable Timer				
Timer Mode	Type of program timer behavior	Off/ Power-on/ Power-off/ Power-on/ off/ Record	Off	14-4
Repeat	Repeat setting for program timer behavior	Off/ On	Off	
Day of the Week - Sun	Day of week setting for activating program timer - Sun	Check/ Uncheck	Check	
Day of the Week - Mon	Day of week setting for activating program timer - Mon	Check/ Uncheck	Check	
Day of the Week - Tue	Day of week setting for activating program timer - Tue	Check/ Uncheck	Check	
Day of the Week - Wed	Day of week setting for activating program timer - Wed	Check/ Uncheck	Check	
Day of the Week - Thu	Day of week setting for activating program timer - Thu	Check/ Uncheck	Check	
Day of the Week - Fri	Day of week setting for activating program timer - Fri	Check/ Uncheck	Check	
Day of the Week - Sat	Day of week setting for activating program timer - Sat	Check/ Uncheck	Check	
Power-on Time	Program timer operation time start	00:00 to 23:59	00:00	
Power-off Time	Program timer operation time end	00:00 to 23:59	00:00	
Frequency/Mode	Frequency during program timer operation	30.000 kHz to 59.999.999 MHz	14.000.000	14-4
	Mode during program timer operation	LSB/ USB/ CW/ CW-R/ PSK/ PSK-R/ FSK/ FSK-R/ FM/ AM/ LSB-DATA/ USB-DATA/ FM-DATA/ AM-DATA	USB	
Sleep Timer				
Sleep Timer	Sleep timer	Off/ 5/ 10/ 15/ 30/ 60/ 90/ 120 [min]	Off	14-6

Auto Mode Menu Items

Display	Description	Setting Value	Default	Refer to
Auto Mode	Auto mode ON/OFF status	Auto Mode Off/ Auto Mode On	Auto Mode Off	4-4
Frequency	Frequency category of auto mode (#0)	30.000 kHz to 59.999990 MHz	9.5 MHz	
Mode	Mode of auto mode (#0)	LSB/ USB/ CW/ CW-R/ PSK/ PSK-R/ FSK/ FSK-R/ FM/ AM/ LSB-DATA/ USB-DATA/ FM-DATA/ AM-DATA	LSB	

KNS Menu Items

Menu	Display	Description	Setting Value	Default	Refer to
0	KNS Operation (LAN Connector)	KNS operation (LAN connection)	Off/ On (LAN)/ On (Internet)	Off	15-3
1	Administrator ID	KNS administrator ID	1 to maximum 32 alphanumeric characters	Blank	
2	Administrator Password	KNS administrator password	1 to maximum 32 alphanumeric characters	Blank	
3	Built-in VoIP	Built-in VoIP function	Off/ On	On	15-4
4	Audio Input Level (VoIP)	VoIP outgoing audio input level	0 to 100 (1 step)	50	
5	Audio Output Level (VoIP)	VoIP incoming audio output level	0 to 100 (1 step)	100	
6	VoIP Jitter Buffer	VoIP jitter absorption buffer	80/ 200/ 500/ 800 [ms]	80 [ms]	
7	Speaker Mute	Speaker mute	Off/ On	Off	
8	Access Log	Log function	Off/ On	Off	
9	Registered Users' Remote Operation	Remote operation by registered user	Off/ On	Off	15-6
10	Session Time	Session time	1 [min]/ 2 [min]/ 3 [min]/ 5 [min]/ 10 [min]/ 15 [min]/ 20 [min]/ 30 [min]/ 40 [min]/ 50 [min]/ 60 [min]/ 90 [min]/ 120 [min]/ Unlimited	Unlimited	
11	KNS Welcome Message	KNS welcome message	Up to 128 single-byte alphanumeric characters	Blank	

Frequency Marker Menu Items

Display	Description	Setting Value	Default	Refer to
Frequency	Marker frequency (#0 to 49)	30.000 kHz to 59.999.999 MHz	–	7-7

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

2 **Press and hold [⏻].**
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. 35 mA	Approx. 165 mA
Yes	Approx. 105 mA	Approx. 135 mA	Approx. 235 mA

- Refer to (1-4) for details on connecting to a PC 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

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

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

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

Dimmer

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

Switching the Brightness Level

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

1 **Press [MENU].**

2 **Press F [DIMMER].**
- If **F [DIMMER]** is not displayed, press **F [MORE]** to display **F [DIMMER]**.

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

3 **Press [MENU] or [ESC] to end the process.**

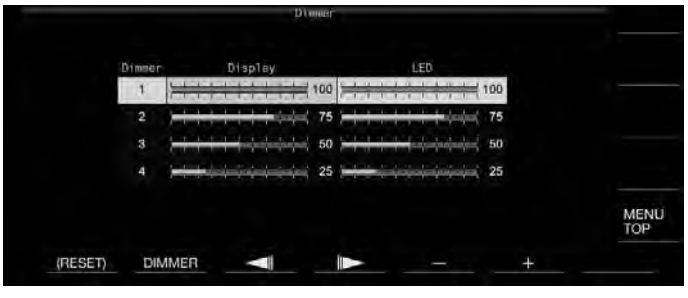
Adjusting the Dimmer Level

Each of 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 [MENU].**

2 **Press F [DIMMER].**
- If **F [DIMMER]** is not displayed, press **F [MORE]** to display **F [DIMMER]**.

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



4 **Press F2 [DIMMER] to select a dimmer preset.**

5 **Press F3 [◄‖]/ F4 [‖►] to select "Display" or "LED".**

6 **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 "Display" for "Dimmer 4" to "0" and exiting the menu turns off the lights on the screen completely. Pressing **[MENU]** at this time temporarily switches the screen brightness to the condition when the setting value of "Display" is "5" and allows the information displayed to be checked.

7 **Press [MENU] or [ESC] to end the process.**

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 MHz or a general band frequency such as 70 MHz (E type), 135 kHz, 475 kHz, MW broadcast band, and 5 MHz 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	21.2/ USB	21.3/ USB	21.4/ 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"

Setting Value	1/ 3 (default)/ 5

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

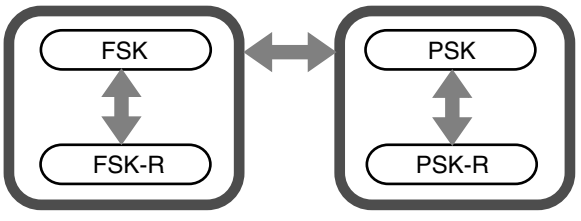
● **Press [LSB/USB].**
Pressing **[LSB/USB]** each time switches between "LSB" and "USB".

CW/ CW-R Mode

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

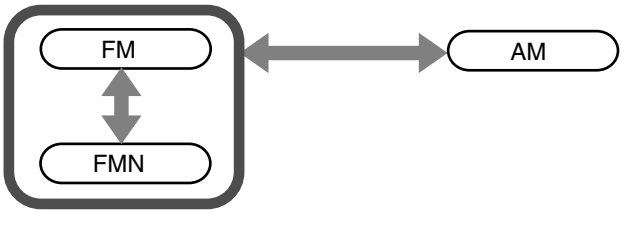
FSK/ FSK-R/ PSK/ PSK-R Mode

● **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 reverse mode (FSK-R or 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 band: HF/ 50 MHz/ 70 MHz (E type).

DATA Mode

This is a mode for performing 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.**
- If **F [AUTO MODE]** is not displayed, press **F [MORE]**.

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].**

7 **Press [MENU] or [ESC] to end the process.**

- 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]

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)

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)

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)

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]

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]

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]

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]

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)

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]

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. Pressing **[LOCK]** again while in the locked state cancels the locked state.
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.

Selecting the Frequency Lock Function Behavior

It is possible to lock only the **Tuning** control in the frequency lock function.

● Configure in Menu [3-10] "Lock Function"

Setting Value	Frequency Lock (default)/ Tuning Control Lock

Frequency Lock: Locks both **Tuning** control and **[MULTI/CH]** control.
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.

- 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” (8-4).
- 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.
- Pressing **[F4](OK)** turns off the TX output power limiter function. Pressing **[F7](CANCEL)** or **[ESC]** cancels the operation.

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)]**.

5 **Press and hold F [MAX-Po] or press [ESC] to end the process.**

- A different TX output power limit cannot be configured for the antenna connectors (antenna 1/2).
- If Advanced Menu [6] "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.

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, << ANT 1 >> is displayed. When “ANT 2” is selected, << ANT 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)

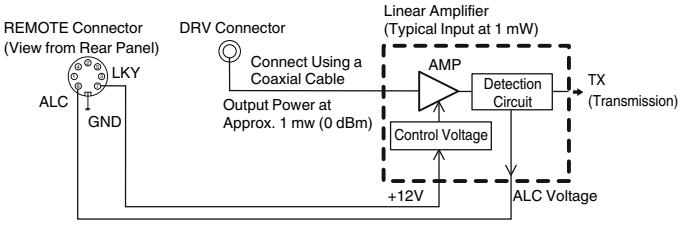
RX Antenna

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 and hold F [ANT/PRE] 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 ATU 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 ATU 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 ATU 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 T>> 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 ≦ f < 1.850	14.100 ≦ f < 14.500
1.850 ≦ f < 2.500	14.500 ≦ f < 18.500
2.500 ≦ f < 3.525	18.500 ≦ f < 21.150
3.525 ≦ f < 3.575	21.150 ≦ f < 21.500
3.575 ≦ f < 3.725	21.500 ≦ f < 25.500
3.725 ≦ f < 4.100	25.500 ≦ f < 28.300
4.100 ≦ f < 6.900	28.300 ≦ f < 29.000
6.900 ≦ f < 7.050	29.000 ≦ f < 30.000
7.050 ≦ f < 7.100	30.000 ≦ f < 51.000
7.100 ≦ f < 7.500	51.000 ≦ f < 52.000
7.500 ≦ f < 10.500	52.000 ≦ f < 53.000
10.500 ≦ f < 14.100	53.000 ≦ f < 60.000
	60.000 ≦ 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 Antenna Tuning"

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.

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.