YAESU

FTDX9000

Operating Manual

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General

PLUG/CONNECTOR PINOUT DIAGRAMS

SUPPLIED ACCESSORIES

AC Power Cord 1
USA: T9017882
T9013285 for EU plug, T9013283A for EU plug, or P0091086)
CF Card (64 MB: Q9000838) 1
RCA Plug (P0091365) 6
1/4-inch 3-contact Plug (P0090008) 2
3.5 mm 3-contact Plug (P0091046) 1
3.5 mm 2-contact Plug (P0090034) 2
4-pin DIN Plug (P0091004) 1
5-pin DIN Plug (P0091006) 1
8-pin DIN Plug (P0090816) 1

AVAILAVLE OPTIONS

SAFETY PRECAUTIONS

Before initiating the installation of your **FTDX9000** transceiver, please take the time to review the following safety guidelines.

POWER CONNECTIONS

The advanced switching-regulator power supply of the **FTDX9000** does not require any transformer rewiring, nor any changing of a switch position: the **FTDX9000** will operate from either 220 V or 117 Volt line voltages without configuration changes.

GROUND CONNECTIONS

The **FTDX9000** HF transceiver, like any other HF communications apparatus, requires an effective ground system for maximum electrical safety and best communications effectiveness. A good ground system can contribute to station efficiency in a number of ways:

- ❒ It can minimize the possibility of electrical shock to the operator.
- ❒ It can minimize RF currents flowing on the shield of the coaxial cable and the chassis of the transceiver; such currents may lead to radiation which can cause interference to home entertainment devices or laboratory test equipment.
- ❒ It can minimize the possibility of erratic transceiver/accessory operation caused by RF feedback and/or improper current flow through logic devices.

An effective earth ground system make take several forms; for a more complete discussion, see an appropriate RF engineering text. The information below is intended only as a guideline.

Typically, the ground connection consists of one or more copper-clad steel rods, driven into the ground. If multiple ground rods are used, they should be positioned in a "V" configuration, and bonded together at the apex of the "V" which is nearest the station location. Use a heavy, braided cable (such as the discarded shield from type RG-213 coaxial cable) and strong cable clamps to secure the braided cable(s) to the ground rods. Be sure to weatherproof the connections to ensure many years of reliable service. Use the same type of heavy, braided cable for the connections to the station ground bus (described below).

Inside the station, a common ground bus consisting of a copper pipe of at least 25 mm (1"") diameter should be used. An alternative station ground bus may consist of a wide copper plate (single-sided circuit board material is ideal) secured to the bottom of the operating desk. Grounding connections from individual devices such as transceivers, power supplies, and data communications devices (TNCs, etc.) should be made directly to the ground bus using a heavy, braided cable.

Do not make ground connections from one electrical

GROUND CONNECTIONS

device to another, and thence to the ground bus. This so-called "Daisy-Chain" grounding technique may nullify any attempt at effective radio frequency grounding. See the drawing below for examples of proper grounding techniques.

Inspect the ground system - inside the station as well as outside - on a regular basis so as to ensure maximum performance and safety.

Besides following the above guidelines carefully, note that household or industrial gas lines must never be used in an attempt to establish an electrical ground. Cold water pipes may, in some instances, help in the grounding effort, but gas lines represent a significant explosion hazard, and must never be used.

ELECTRICAL SHOCK PREVENTION

Be certain that all station wiring is properly insulated so as to prevent short-circuits which could damage this transceiver and/or accessories connected to it. Be sure to protect power cables from damage due to abrasion by ensuring that they cannot be walked upon nor crushed under rolling chairs, etc. Never route power cables near sharp metallic edges which might cut through protective insulation.

Never spill liquids into this transceiver, and do not drop sharp metallic objects into the transceiver enclosure. Electrical shock may result when you attempt to remove the object.

Unsupervised children should be kept away from any electrical apparatus such as the **FTDX9000** transceiver and its accessories.

ANTENNA PRECAUTIONS

Always install antennas such that they can never come in contact with outdoor power lines in the event of a catastrophic antenna support or power line support structure failure. An adequate safety margin is usually provided by separating power lines from the antenna and its support structure [1.5 times the height of the support] plus [the length of any antenna or guy wires attached to the support] plus [the height of the power line support pole].

Ground the antenna support structure adequately, so as to dissipate energy absorbed during a lightning strike. Install appropriate lightning arrestors in the antenna lead-in and rotator cable (if used) according to the arrestor's instructions.

In the event of an approaching electrical storm, disconnect all antenna lead-in, rotator control, and power cables completely from the station, but only if the storm is not immediately in your area. Do not allow disconnected cables to touch the case of your **FTDX9000** transceiver or accessories, as lightning can easily jump from the cable to the circuitry of your transceiver via the case, causing irreparable damage. If a lightning storm is in progress in your immediate area, do not attempt to disconnect the cables, as you could be killed instantly should lightning strike your antenna, tower, or a nearby power line.

If a vertical antenna is used, be certain that humans and/or pets or farm animals are kept away both from the radiating element (to prevent electrical shock and RF exposure danger) and the ground system (in the event of an electrical storm). The buried radials of a ground-mounted vertical antenna can carry lethal voltages outward from the center of the antenna in the event of a direct lightning strike.

RF FIELD EXPOSURE ADVISORY & ELECTROMAGNETIC COMPATIBILITY

This transceiver is capable of power output in excess of 50 Watts, so customers in the United States may be required to demonstrate compliance with Federal Communications Commission (FCC) regulations concerning maximum permissible exposure to radio frequency energy. Compliance is based on the actual power output used, feedline loss, antenna type and height, and other factors which can only be evaluated as a system. Information regarding these regulations may be available from your Dealer, your local radio club, from the FCC directly (press releases and other information can be found on the FCC's site on the World Wide Web at <http://www.fcc.gov>), or from the American Radio Relay League, Inc. (225 Main St., Newington CT 06111 or <http://www.arrl.org>).

Remember to re-evaluate your station's compliance with these regulations during portable operations such as Field Day or special-event stations.

Regarding electromagnetic compatibility: if this transceiver is used with, or in the vicinity of, a computer or computer-driven accessories, you may need to experiment with grounding and/or Radio Frequency Interference (RFI) suppression devices (such as ferrite cores) to minimize interference to your communications caused by energy from the computer. Computer-generated RFI is usually a result of inadequate shielding of the computer's cabinet or I/O and peripheral connections. While computer equipment may "comply" with RF emission standards, this does not ensure that sensitive amateur radio receivers will not experience interference from the device!

Be certain to use only shielded cables for TNC-to-Transceiver connections. You may need to install AC line filters on the power cord(s) of the suspected equipment, and decoupling ferrite toroidal chokes may be required on interconnecting patch/data cables. As a last resort, you can try installing additional shielding within the computer's case, using appropriate conductive mesh or conductive shielding tape. Especially check "RF holes" where plastic is used for cabinet front panels.

For further information, consult amateur radio reference guides and publications relating to RFI suppression techniques.

PRELIMINARY INSPECTION

Inspect the transceiver upon opening the packing carton. Check that all controls and switches work freely, and inspect the cabinet for any damage. Ensure the accessory fuses and plugs pictured on page ?? are included. If any damage is found, document it completely, and contact the shipping company (or dealer, if you purchased it over-the-counter) right away. Save the packing materials in case you need to return the set for service. If you have purchased optional internal accessories separately, install them as described on page ??.

POWER CONNECTIONS

The advanced switching-regulator power supply of the **FTDX9000** does not require any transformer rewiring, nor any changing of a switch position: the **FTDX9000** will operate from either 220 V or 117 Volt line voltages without configuration changes.

Connect the supplied AC power cord between the 3-pin **~AC IN** jack on the rear panel and the AC wall outlet.

TRANSCEIVER LOCATION

To assure long life of the components, a primary consideration in setting up the **FTDX9000** is providing for adequate ventilation around the cabinet. The cooling system of the **FTDX9000** must be free to draw cool air in around the transceiver body, and to expel warm air out of the rear panel. Do not place the transceiver on top of another heat-generating device such as a linear amplifier, and do not place equipment, books or papers on top of the transceiver. Also, provide a few centimeters of space on either side of the transceiver, if possible. Avoid heating vents and window locations that could expose the transceiver to excessive direct sunlight, especially in hot climates.

GROUNDING

For protection from electrical shock, and to ensure proper performance, connect the **GND** terminal on the rear panel to a good earth ground, using a heavy braided cable of the shortest length possible. All other station equipment should be connected to the same grounding cable, as close together as practical. If you use a computer with or near the **FTDX9000**, you may need to experiment with ground wiring to suppress computer noise in the receiver, and ground loops during transmission.

ANTENNA CONSIDERATIONS

The **FTDX9000** is designed for use with any antenna system providing a 50 ohm resistive impedance at the desired operating frequency. While minor excursions from the 50 ohm specification are of no consequence, the transceiver's Automatic Antenna Tuner may not be able to reduce the impedance mismatch to an acceptable value if the Standing Wave Ratio (SWR) present at the Antenna jack is greater than 3:1. Among the undesirable consequences that high SWR may produce are:

- The transceiver's power amplifier protection circuitry will reduce power if the Automatic Antenna Tuner is unsuccessful in reducing the SWR.
- Even if the Automatic Antenna Tuner successfully normalizes the impedance presented to the radio, feedline losses will escalate rapidly with increasing SWR at the higher operating frequencies, especially 28 MHz.
- Although high SWR itself does not cause feedline radiation, the sudden onset of high SWR may well indicate a mechanical failure in a matching device, leading to an electrical condition which may cause excessive feedline radiation, which can cause interference to nearby home-entertainment devices.

Every effort should, therefore, be made to ensure that the impedance of the antenna system utilized with the **FTDX9000** be as close as possible to the specified 50 ohm value.

Any antenna to be used with the **FTDX9000** must, ultimately, be fed with 50 ohm coaxial cable. Therefore, when using a "balanced" antenna such as a dipole, remember that a balun or other matching/balancing device must be used so as to ensure proper antenna performance.

The same precautions apply to any additional (receive-only) antennas connected to the **RX ANT** jack; if your receive-only antennas do not have an impedance near 50 ohm at the operating frequency, you may need to install an external antenna tuner to obtain optimum performance.

Use high-quality 50 ohm coaxial cable for the lead-in to your **FTDX9000** transceiver. All efforts at providing an efficient antenna system will be wasted if poor quality, lossy coaxial cable is used. Losses in coaxial lines increase as the frequency increases, so a coaxial line with only 0.5 dB of loss at 7 MHz may have 2 dB of loss at 28 MHz. For reference, the chart in the next column shows approximate loss figures for typically-available coaxial cables frequently used in amateur radio installations.

CABLE TYPE	Loss		
	2 MHz	15 MHz	28 MHz
RG-58A	0.55	1.75	2.60
RG-58 Form	0.54	1.50	2.00
RG-8X	0.39	1.07	1.85
RG-8A, RG-213	0.27	0.85	1.25
RG-8 Form	0.22	0.65	0.88
Belden® 9923	0.18	0.50	0.69
RG-17A	0.88	0.30	0.46

LINEAR AMPLIFIER INTERFACING

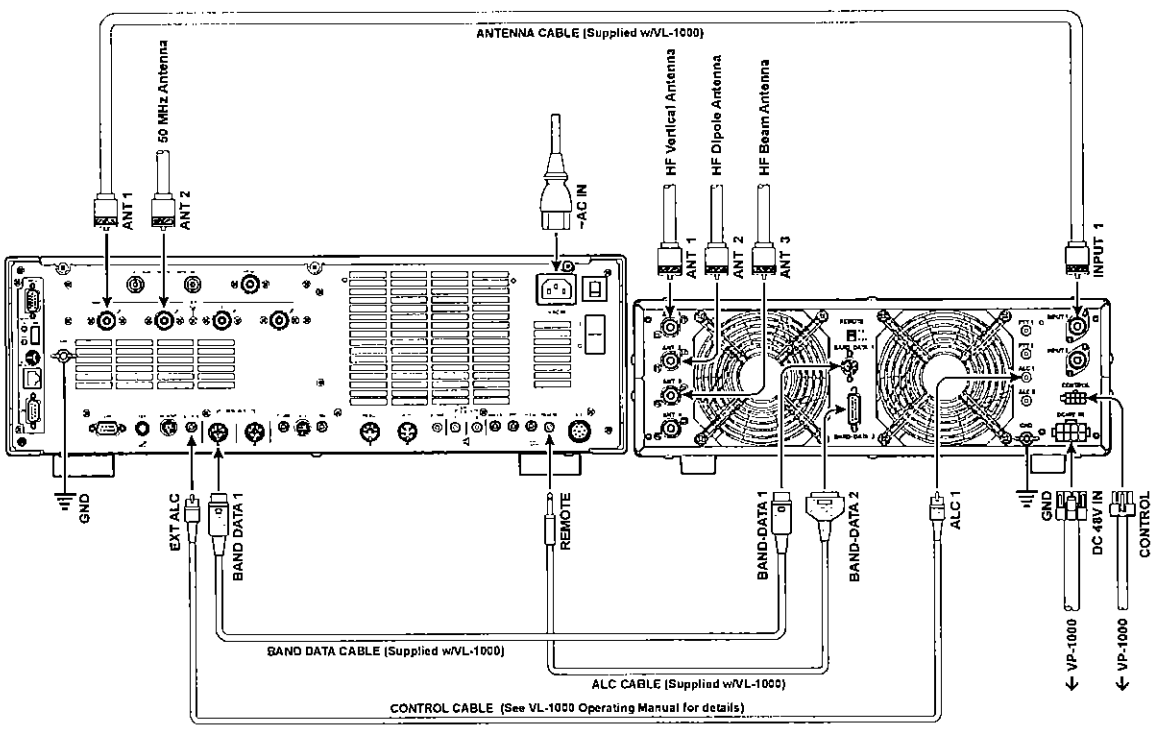
The **FTDX9000** can be used with the optional Yaesu **VL-1000** Linear Amplifier, providing automatic band switching via digital band data output from the **BAND DATA 1** jack on the rear panel of the transceiver. Most other amplifiers can be adapted to operate with the **FTDX9000**; however, the main points to be concerned with are the switching requirements of the amplifier, and if QSK (full break-in) operation is desired. The linear amplifier Tx/Rx switching capability of the **FTDX9000** is described in the table below.

PARAMETER	OPERATION	
	QSK (Relay Disabled)	Non-QSK (Relay Enabled)
DC Switching Voltage	< 40 VDC	< 60 VDC
DC Switching Current	< 150 mA	< 200 mA
AC Switching Voltage	---	< 100 VAC
AC Switching Current	---	< 500 mA

Operation with QSK Amplifiers

Connect the RF output from the one of four transceiver **ANT** jacks to the RF input jack of the linear. Connect the ALC output from the linear to the **EXT ALC** jack on the rear of the transceiver (see the "About ALC" chapter). After making the RF and Tx/Rx switching connections described below, you may need to adjust the ALC output level of the linear so that it is not overdriven by the **FTDX9000**. Your linear's manual should describe how to do this.

If using a **VL-1000**, connect the **BAND DATA** Cable (supplied with the **VL-1000**) from the transceiver **BAND DATA 1** jack to the amplifier **BAND-DATA 1** jack; this will provide automatic band selection for the linear, as well as QSK Tx/Rx switching control. You may also connect a user-constructed control cable (refer to **VL-1000** manual for details) from the transceiver **REMOTE** jack to the amplifier **BAND-DATA 2** jack to provide automatic amplifier tune-up for the linear using the **FTDX9000**. Press the **VL-1000**'s front panel **ATT** switch to disable the 3 dB input RF power attenuator.



LINEAR AMPLIFIER INTERFACING

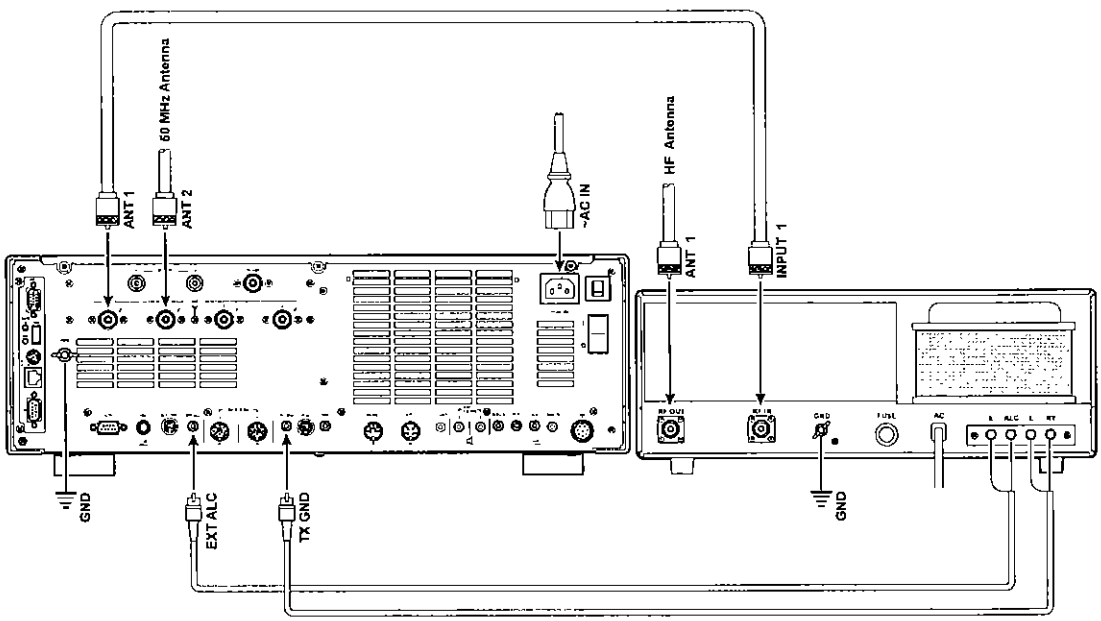
If using another manufacturer's QSK linear, and if its switching circuitry consumes less than 150 mA of DC voltage below 40 V, you can connect the Tx/Rx switching line for the linear to pin 2 ("TX GND" of the **BAND DATA 1** jack (use pin 3 for ground), and the linear's exciter-enable output to pin 8 ("TX INHIBIT" of the **BAND DATA 1** jack. This line must be switched to ground to enable transmission once the linear is ready for excitation from the **FTDX9000**. If your QSK linear sinks more than 100 mA or uses more than 15 V for T/R relay switching, you will have to provide a suitable external interface transistor, controlled by pin 2. Be certain to make provision for suitable reduction of the drive power from the **FTDX9000**, so as not to damage your amplifier.

Operation with non-QSK Amplifiers

The **TX GND** jack on the transceiver rear panel is connected to an internal relay, for non-QSK T/R switching of linear amplifiers that use AC switching voltage, or DC voltage greater than +15 V, negative DC voltage of any kind (such as the HeathR SB-220/SB-221 models), or if they are required to sink more than 100 mA for T/R switching. A schematic diagram of the relay circuit is provided below. If not using your linear amplifier in a full break-in environment, the use of this relay for amplifier switching is highly recommended.

In the factory default, this relay comes disabled to avoid the clicking sound when the transceiver is used alone or with a QSK linear. To enable the relay for non-QSK linears that exceed the above T/R switching requirements, you will need to change Menu Selection 118: EXT TX-GND to ENABLE. Then connect the center contact of the **TX GND** jack to the positive relay-control line to your linear, and the outer contact to the "common" line or the linear's chassis ground. Refer to the diagram at the below; in this example, a older non-QSK amplifier (**FL-2100B**) is shown.

With the relay now enabled, the **FTDX9000** can support non-QSK linear T/R switching voltages up to 100 VAC @ 500 mA, or DC voltage up to 60 V @ 200 mA, or closed-circuit current up to 1 A with DC voltage up to 30 V.



LINEAR AMPLIFIER INTERFACING

Caution - Please Read!!

The **FTDX9000** is designed for use with the **VL-1000** when QSK operation with a linear amplifier is desired. If you are using a different amplifier, do not attempt QSK operation with the linear if its switching circuitry requires that the **FTDX9000**'s relay be enabled. Using pins 2 and 8 of the **BAND DATA 1** jack for other amplifiers will not work unless the control line signals are carefully matched, and damage may result otherwise.

Your transceiver's warranty does not cover damage resulting from improper connections to this jack, so if you are not sure of the linear amplifier's break-in capabilities or switching requirements, the safest approach is to enable the relay, use the **TX GND** jack (after setting Menu Selection 118: EXT TX-GND to ENABLE) and resort to non-QSK operation. This will help prevent possible damage to the amplifier or transceiver.

About ALC

The **FTDX9000** provides an external ALC jack on the rear panel (RCA-type jack) for input of Automatic Level Control voltage from a linear amplifier.

ALC voltage is used to provide dynamic control of the output of the transceiver, so as not to provide more drive than is needed for full amplifier output. The ALC control voltage range is 0 to -4 V DC, with the voltage going more negative as the amplifier's drive requirements are approaching fulfillment.

The **FTDX9000**s ALC system is very typical of designs in the amateur radio industry, and consequently is compatible with many manufactured and home-built amplifiers. However, ALC voltage may be generated by an amplifier in a manner incompatible with efficient ALC operation in the **FTDX9000**, and it is important that you recognize the differences in amplifier ALC circuits before proceeding with ALC line connection.

- ALC circuits which detect Power Output from the amplifier, and generate negative-going ALC control voltage when maximum output power has been realized, will generally work properly with the **FTDX9000**.
- The exact amount of ALC voltage fed to the **FTDX9000** can usually be adjusted via a potentiometer on the rear panel of the amplifier.
- ALC circuits which detect Amplifier Tube Grid Current, and generate ALC voltage when excessive grid current is present, may not work well with the **FTDX9000** and other similar transceivers, as the ALC voltage may be generated because of amplifier miss-tuning not related to an excessive-drive condition. With amplifiers deriving their ALC voltage in this manner, we recommend that you not connect the ALC line, and rather let the amplifier's protection circuitry manage its ALC requirements internally.

DIGITAL MODEM (TNC, WEATHERFAX, ETC.) INTERFACING

The **FTDX9000** offers special features for digital modes, such as a built-in digitally-synthesized AFSK generator for RTTY and AMTOR terminal units, IF bandwidth optimization and automatic display offsets, and an 18-ms transmit-to-receive turn-around time.

Low-level main (VFO-A) band audio output is provided from the rear-panel RTTY and PKT jacks, and is unaffected by front panel AF GAIN control settings. If you prefer to use sub (VFO-B) audio for TNC input, set Menu Selection 90: DATA OUT (AFDT) setting to Sub.

Audio level is 100 mV from both jacks. The RTTY level is fixed; however, PKT audio level can be adjusted by potentiometer VR3010. In many cases, it is easier to perform level adjustments at the TNC.

Digital Modes with a TNC or Computer Sound Card (PSK-31)

The explosion of new digital modes of amateur communication means that you will want to make connections to your TNC and/or computer as "standardized" as possible. Generally, this will mean that you will want to connect your transceiver in an "AFSK" environment. On the **FTDX9000**, the **PACKET** jack is the "AFSK" connection port, while the **RTTY** jack is an "FSK" connection port. In the AFSK mode, the TNC or computer generates the data signal as a set of audio tones, while the FSK mode uses a closure to ground (in the TNC or terminal unit) to cause the transceiver to generate the "mark" and "space" tones.

Construct a patch cable or cables to make the necessary connections between your TNC and the appropriate rear panel jack(s) (RTTY for FSK, PACKET for AFSK). Refer to the pin-out diagram below, and the wiring instructions included with your TNC.

A description of the **PACKET** jack's individual pins follows:

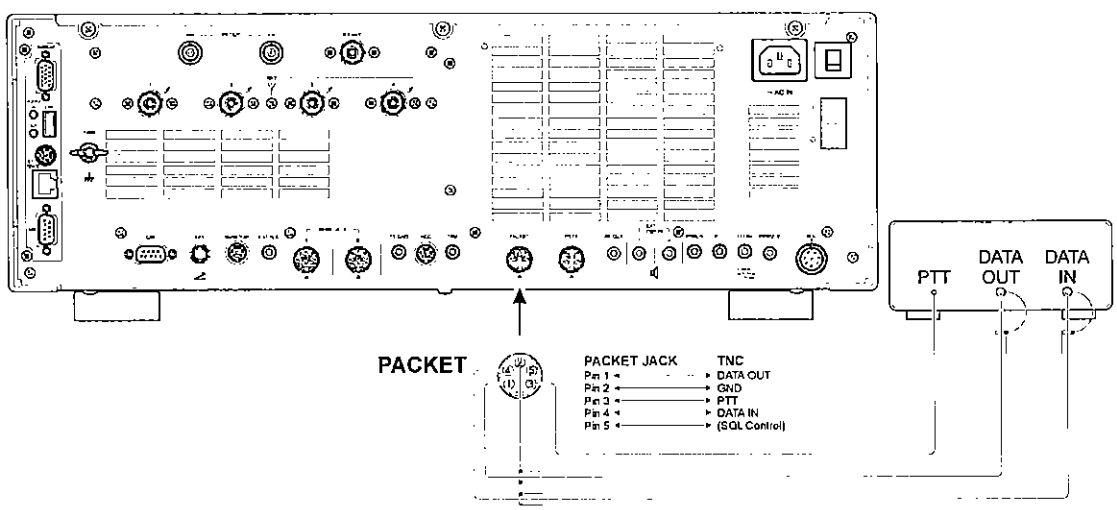
Pin 1 (DATA IN) - Connect this pin to your TNC's "AFSK Out" or "Mic Audio" output line. The optimum input level is 30 mV rms, and the input impedance is 3 k-ohm. Your TNC's audio output level potentiometer will allow you to set the level to the optimum value. This pin may be used either for 300 baud SSB-mode digital operation or for 1200-baud FM packet. The bandwidth and frequency response are not, however, suitable for 9600 baud operation.

Pin 2 (GND) - Connect this to the shield(s) of the cable(s) used for connections between the TNC and the **FTDX9000**.

Pin 3 (PTT) - Connect this pin to the PTT line from the TNC. This pin, when grounded by the TNC, places the **FTDX9000** into the Transmit condition.

Pin 4 (DATA OUT) - Connect this pin to your TNC's "TX Audio" input line. This is a constant-level (100 mV rms @ 600 ohm) audio output line which is not affected by the position of the front panel AF GAIN control.

Pin 5 (BUSY) - This is a "Squelch Status" pin not generally required for digital mode operation. This pin is held at +5V when the squelch is open, and is grounded when the receiver is muted by the squelch ("no-signal" condition).



DIGITAL MODEM (TNC, WEATHERFAX, ETC.) INTERFACING

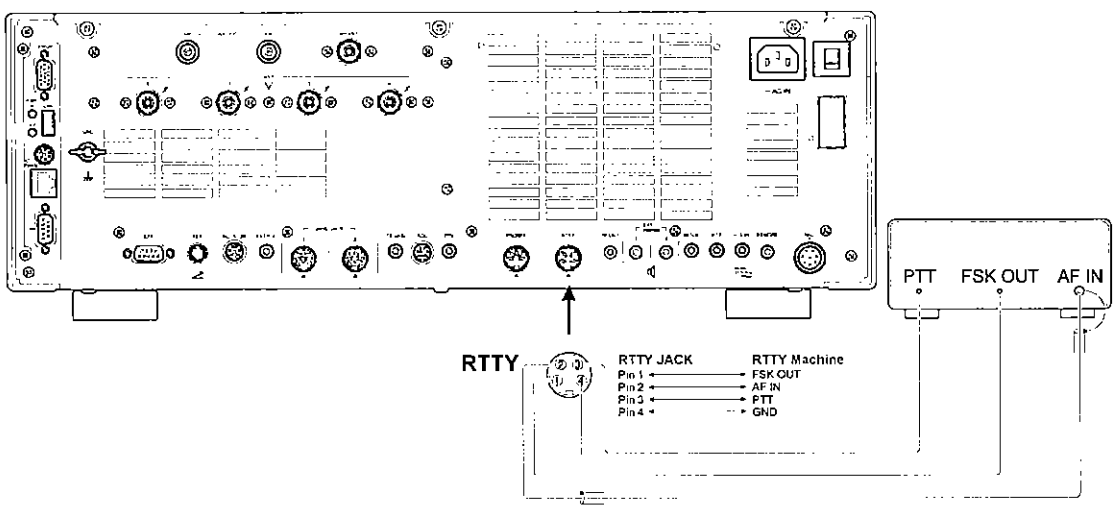
For FSK operation using the RTTY jack, the following are the pin connections required:

Pin 1 (SHIFT) - Connect this pin to your TNC or terminal unit's "ASK Key" port. Closing and opening of this line to ground causes mark/space keying.

Pin 2 (RX AF OUT) - Connect this pin to your TNC's "TX Audio" input line. This is a constant-level (100 mV rms @ 600 ohm) audio output line which is not affected by the position of the front panel **AF GAIN** control.

Pin 3 (PTT) - Connect this pin to the PTT line from the TNC. This pin, when grounded by the TNC, places the **FTDX9000** into the Transmit condition.

Pin 4 (GND) - Connect this to the shield(s) of the cable(s) used for connections between the TNC and the **FTDX9000**.



DIGITAL MODEM (TNC, WEATHERFAX, ETC.) INTERFACING

For operation on PSK31, connect your computer's sound card to the **PACKET** jack (for "PKT" mode operation) or the **MIC** and **EXT SP** jacks (for "SSB" mode operation).

CAUTION!!

The **FTDX9000** cooling system is designed to handle continuous duty transmission at 200 watts output. However, for continuous-duty digital modes like RTTY, we recommend limiting your transmissions to 3 minutes or less, with at least 3 minutes receive in between transmissions. Place your hand on the transceiver occasionally to ensure that it's not getting too hot, and try to keep power output at 100 watts or less.

Note: Computer-Generated RFI

When using a TNC connected to your transceiver, or even having a PC located in the shack, the possibility exists that you may experience computer-generated RFI (Radio Frequency Interference).

The CPU in a personal computer operates with a crystal-controlled oscillator (clock), which may generate harmonics or other spurious signals. In addition, high-speed digital data switching uses square waves, which produce odd-order harmonic frequencies.

Computer-generated RFI may appear at seemingly random frequencies (usually right where a rare DX station is calling CQ!) throughout the range of your transceiver, and may sound like constant ticking or buzzing that may change as you type or work within a program. Severe RFI may have S-meter indications as much greater than S-9, making copy of voice signals difficult and data signals virtually impossible.

Computer-generated RFI is usually a result of inadequate shielding of the PC's cabinet or I/O and peripheral connections. While computer equipment may comply with RF emission approval standards, this does not ensure that sensitive amateur radio receivers will not experience RFI from the device.

There are a few steps you can take to reduce or eliminate computer-generated RFI. The first step is to ensure that only shielded cables are used for TNC-to-transceiver connections, carefully check RF ground connections and re-orient your station equipment in relation to the computer. Try moving your PC and peripherals slightly and see if it has any affect on the RFI, in some cases, this alone may be enough to correct the problem.

If not, several additional steps to try include installing AC line filters on the power cord(s) of the suspected equipment and inserting decoupling ferrite toroidal chokes on interconnecting patch/data cables and smaller ferrite beads on single wires.

As a last resort, you can try installing additional shielding within the PC case, using appropriate conductive mesh/screening or conductive tape. Especially check RF "holes" where plastic is used for cabinet front panels. For further information, consult amateur radio reference guides and publications relating to RFI suppression techniques.

OTHER DIGITAL/RECORDING DEVICE INTERFACING

AF OUT Jack

This is a 3.5 mm miniature stereo phone jack which provides constant-level (100 mV @ 600 ohm) for connection to a WeatherFax decoder, tape recorder, or other accessory. The audio output level is not affected by the setting of the front panel **AF GAIN** controls, so you can turn the volume down, if you like, without affecting the audio level being presented to your decoding device. The tip connection of this jack is main (VFO-A) receiver audio, while the ring connection is sub (VFO-B) receiver audio.

The connections to the **AF OUT** jack are at the same level as the connection to Pin 4 of the **PACKET** jack. However, the two output ports use independent output buffer amplifiers, so you can freely connect and disconnect devices to/from these ports without concern over the impedances and levels.

PTT (Push To Talk) Jack

This **RCA** jack is wired in parallel with the rear panel's **MIC** jack, providing a handy connection point for a footswitch for voice operation, allowing hands-free PTT operation or enabling the T/R switching when operate the **FTDX9000** from the front panels **MIC** jack.

PATCH Jack

For transmit audio input for SSTV (Slow-Scan Television) operation, you may connect the SSTV terminal's Tx Audio line to the **PATCH** jack. You will need to disconnect the microphone, however, during transmission, as the **PATCH** jack is connected in a "Y" configuration along with the microphone input (from pin 8 of the rear panel's **MIC** jack).

CW KEY/PADDLE AND COMPUTER KEYING INTERFACE SUGGESTIONS

Features

The **FTDX9000** includes a host of features for the CW operator, the functions of which will be detailed in the "**Operation**" section later. Besides the built-in Electronic Keyer, two key jacks are provided, one each on the front and rear panels, for convenient connection to keying devices.

Both **KEY** jacks on the **FTDX9000** utilize "Positive" keying voltage. Key-up voltage is approximately +5V DC, and key-down current is approximately 0.5 mA. When connecting a key or other device to the **KEY** jacks, use only a 3-pin ("stereo") 1/4" phone plug; a 2-pin plug will place a short between the ring and (grounded) shaft of the plug, resulting in a constant "key-down" condition in some circumstances.

Configuration Suggestions

- ❒ For everyday operation using the internal electronic memory keyer, connect your paddle to the front panel **KEY** jack.
- ❒ If two operators are using the **FTDX9000** simultaneously (for a contest, Field Day, etc.), a second keyer paddle may be connected to the rear panel **KEY** jack, and activate internal keyer for the keyer paddle which is connected to the rear panel's **KEY** jack by Menu Selection 85: KEYER REAR. Both operators paddles will have access to the internal keyer.
- ❒ If two operators are using the **FTDX9000** simultaneously, but both wish to use a straight key, outboard electronic keyer, or computer-driven keying cables, the key plugs may be inserted into the front and rear panel **KEY** jacks, and disable the internal keyer by Menu Selection 84: KEYER FRONT and 85: KEYER REAR.

ANTENNA CONNECTIONS

The **FTDX9000**'s five antenna connectors, plus innovative microprocessor-based memory and switching circuits, provide excellent flexibility in setting up your antenna connections.

Typical antenna configurations are shown below. Remember that "**ANT 1**" through "**ANT 4**" jacks may be used for transmission and reception, while the **RX ANT** jack may only be used for reception.

NOTE REGARDING LARGE RECEIVE ANTENNAS

Although surge suppression is provided on all antenna ports, you may wish to consider building a simple external circuit which will disconnect, on TX, any antenna connected to the RX ANT IN jack, particularly if you are using a very long wire antenna such as a Beverage. Very long antennas can build up very high RF and static voltages on them, and the circuit below may provide better protection for your receiver's input circuitry.

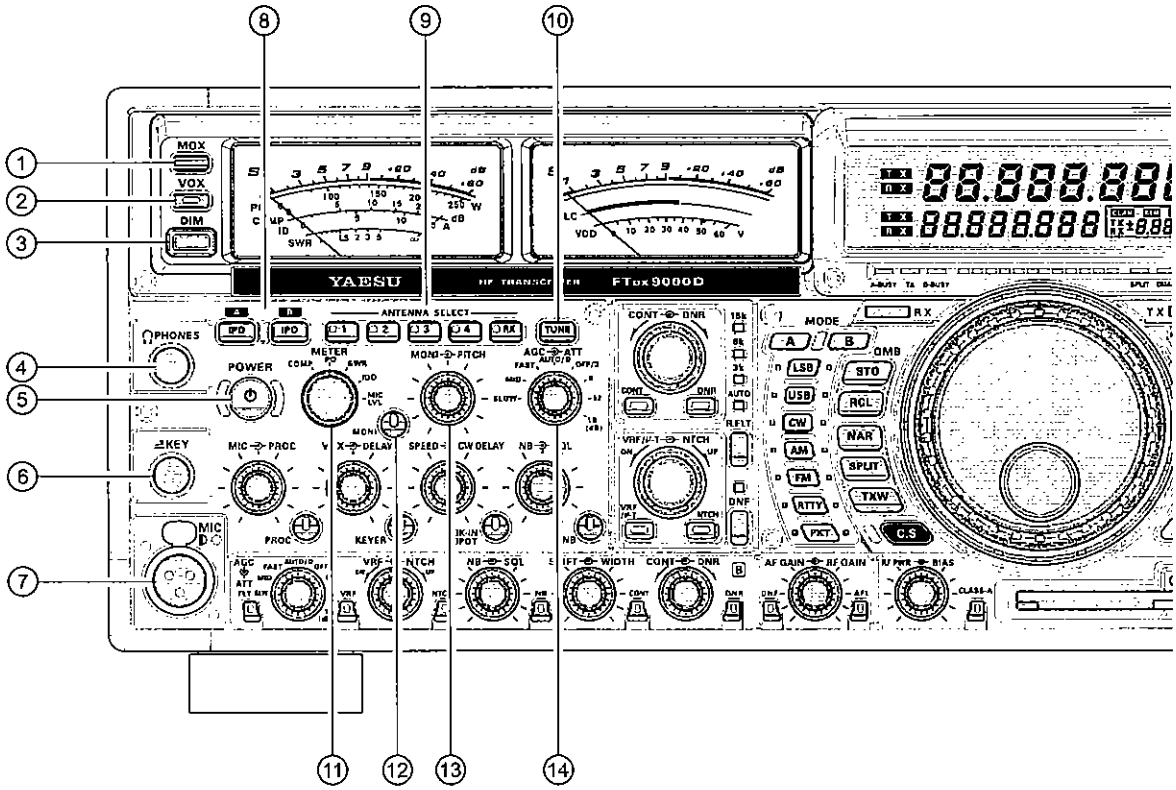
PERSONAL COMPUTER INTERFACING FOR CONTEST SOFTWARE, ETC.

The FTDX9000 features a built-in level converter, allowing direct connection from the rear-panel **CAT** jack to the serial port of your computer, without the need for any external converter box.

When your software requests serial port configuration information, set it for "***4800,N,8,2***" (4800 baud, No Parity, 8 Data Bits, and 2 Stop Bits). Be certain to configure and activate any required "TSR" (Terminate-and-Stay-Resident) utilities before beginning computer-controlled transceiver operation (your software's instruction manual will describe any such requirement).

Details regarding the programming protocols for the CAT system may be found beginning on page ??.

FRONT PANEL CONTROLS



① MOX Button

Pressing this button engages the PTT (Push to Talk) circuit, to activate the transmitter. It must be in the undepressed position for reception.

② VOX Button

This button enables automatic voice-actuated transmitter switching in the SSB, AM, and FM modes. While activated, the LED inside this button glows red. The controls affecting VOX operation are the front panel's **VOX** and **DELAY** knobs. The front panel's **CW DELAY** knob independently sets the receiver recovery time during semi-break-in CW operation.

③ DIM Button

This button selects the display intensity between "High" and "Low."

④ KEY Jack

This 1/4-inch, 3-contact jack accepts a CW key or keyer paddles (for the built-in electronic keyer), or output from an external electronic keyer. You cannot use a 2-contact plug in this jack (to do so produces a constant "key down" condition). Pinout is shown on page ??. Key up voltage is 5 V, and key down current is 0.5 mA. There is another jack with the same name, connected in parallel with this jack, on the rear panel. This jack may be configured for keyer, "Bug," "straight key," or computer keying interface operation via Menu Selection 75: *KEYEY FRONT* (see page ??).

⑤ POWER Button

This button turns the transceiver on and off. Always turn this switch on *after* turning on the rear panel's **POWER** switch.

⑥ PHONES Jack

A 1/4-inch, 3-contact jack accepts either monaural or stereo headphones with 2- or 3-contact plugs. When a plug is inserted, the loudspeaker is disabled. With stereo headphones such as the optional **YH-77STA**, you can monitor both Main (VFO-A) and Sub (VFO-B) receiver channels at the same time during Dual Receive operation.

⑦ MIC Connector and Indicator

This Cannon-type (XLR) connector accepts input from the MH-???? Microphone. MIC connector pinout is shown on page ??. Proper microphone input impedance is 500 ~ 600 Ohms.

When the available 48-V DC power (Phantom Power Supply) has been enabled so as to appear on the microphone line, the LED glows red.

To disconnect the microphone plug, draw out the microphone plug while pressing and holding in the silver PUSH button.

⑧ IPO (INTERCEPT POINT OPTIMIZATION) Lamp-buttons

The [**IPO(A)**] Lamp-button may be used to set the optimum receiver front end characteristics of the main receiver circuit for a very strong-signal environment. Selecting IPO bypasses the front end RF amplifier and feeds the received signals directly to the first mixer of the main band (VFO-A) receiver circuit. While the IPO feature is activated, this button will remain illuminated.

The [**IPO(B)**] Lamp-button, similarly, allows direct feed of the received signals to the first mixer of the sub band (VFO-B) receiver circuit. While the IPO feature is activated on the sub receiver, this button will be lit.

⑨ ANTENNA SELECT Buttons

These momentary buttons select the antenna jack on the rear panel, with the selection indicated by the LED in each button. When an antenna has been selected for operation on main band (VFO-A), the LED in the button glows red. When an antenna has been selected for operation on sub band (VFO-B), the LED in the button glows umber.

⑩ TUNER Button

This is the on/off switch for the **FTDX9000**'s Automatic Antenna Tuner.

Pressing this button momentarily places the antenna tuner in line between the transmitter final amplifier and the antenna jack. Reception is not affected.

Pressing and holding in this button for 1/2 second, while receiving in an amateur band, activates the transmitter for a few seconds while the automatic antenna tuner rematches the antenna system impedance for minimum SWR. The resulting setting is automatically stored in one of the antenna tuner's 99 memories, for instant automatic recall later when the receiver is tuned near the same frequency.

⑪ METER Knob

This control switch determines the function of the Main Meter during transmission.

- COMP: Indicates the RF speech compressor level (SSB modes only).
- PO: Indicates the power output level.
- SWR: Indicates the Standing Wave Ratio (Forward: Reflected).
- IDD: Indicates the final amplifier drain current.
- MIC LVL: Indicates the relative microphone level.

⑫ MONI Button

This button enables the transmit (RF) monitor in all modes (except CW, in which the monitor function is always on, to produce the sidetone). While activated, the LED in this button glows red.

⑬ MONI ⊷ PITCH Knob

MONI Knob

The inner **MONI** knob adjust the audio level of the transmit RF monitor during transmission (relative to the **AF GAIN** control), when activated by the **MONI** button (above).

PITCH Knob

The outer **PITCH** knob selects your preferred CW tone pitch (from 300 ~ 1000 Hz, in 50 Hz increments). The Tx sidetone, receiver IF passband, and display offset from the BFO (carrier) frequency are all affected simultaneously.

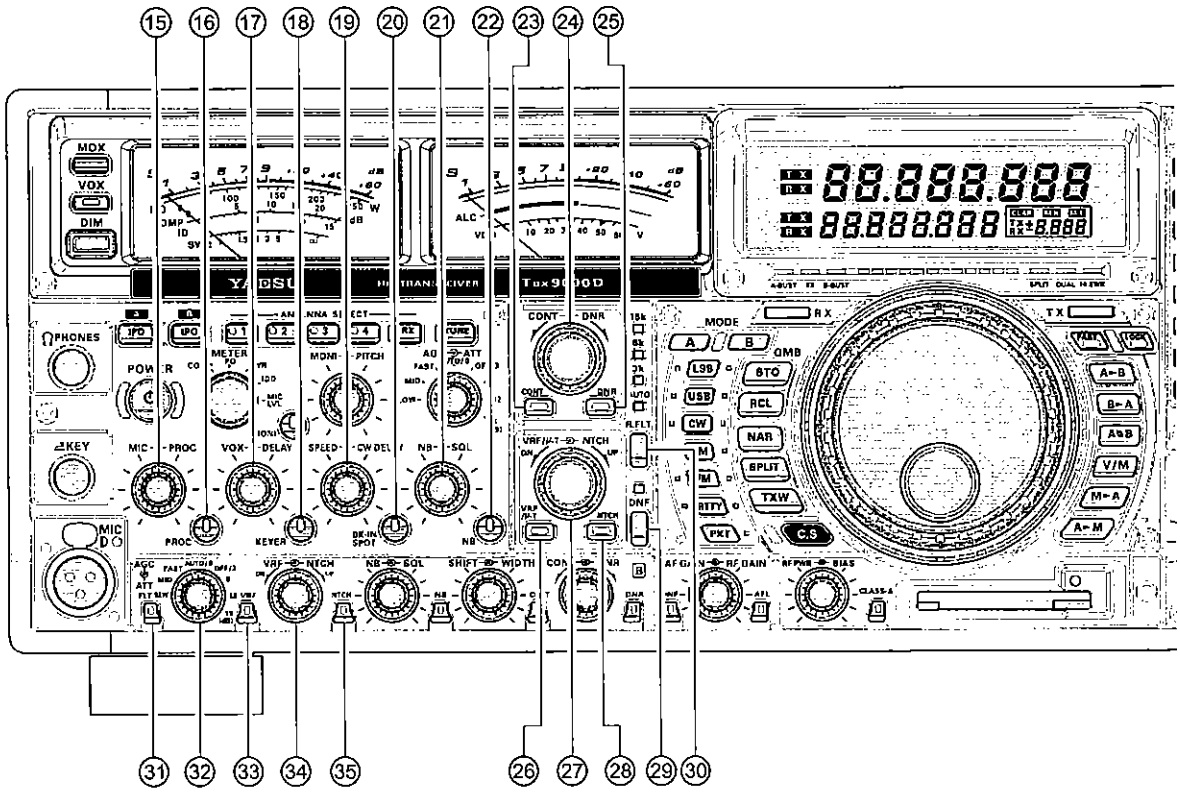
⑭ AGC ⊷ ATT Knob

AGC Knob

The inner **AGC** knob selects the main band (VFO-A) receiver's Automatic Gain Control decay time for the most comfortable reception, or disables receiver AGC (off). Normally this switch is set to the "AUTO" position. Strong signals will cause distortion if this selector is set to "OFF," unless you rotate the RF Gain control counterclockwise to apply AGC to the receiver manually.

ATT Knob

The outer **ATT** knob inserts 3, 6, 12, or 18 dB (1/2, 1, 2, or 3 S-units) of attenuation before the main band (VFO-A) mixer to suppress band noise and reduce the possibility of overload from very strong signals.



⑮ MIC ◈ PROC Knob

MIC Knob

The inner **MIC** knob adjusts the microphone input level for (non-processed) SSB transmission.

PROC Knob

The outer **PROC** knob sets the compression (input) level of the transmitter RF speech processor in the SSB mode, when activated by the button with the same name.

⑯ PROC Button

This button enables the RF speech processor for SSB transmission. Processing level is set by the outer control with the same name. While activated, the LED in this button glows red.

⑰ VOX ◈ DELAY Knob

VOX Knob

The inner **VOX** knob sets the gain of the VOX circuit, to set the level of microphone audio needed to activate the transmitter during voice operation while the **VOX** button is engaged.

DELAY Knob

The outer **DELAY** knob sets the hang time of the VOX circuit, between the moment you stop speaking, and the automatic switch from transmit back to receive. Adjust this for smooth VOX operation, so the receiver is only activated when your transmission is ended and you wish to receive.

⑱ KEYER Button

This button toggles the internal CW keyer on and off. While activated, the LED in this button glows red.

⑲ SPEED ◈ CW DELAY Knob

SPEED Knob

The inner **SPEED** knob adjusts the keying speed of the internal CW keyer.

CW DELAY Knob

This outer **CW DELAY** knob sets the hang time of the CW "VOX" circuit, between the moment you stop sending, and the automatic switch from transmit back to receive during "semi-break-in" operation. Adjust this just long enough to prevent the receiver from being restored during word spaces at your preferred sending speed.

⑳ BK-IN/SPOT Button

This button turns the full break-in (QSK) CW capability on and off. While QSK is activated, the LED in this button glows red.

The SPOT button turns on the CW receiver spotting tone; by matching the SPOT tone to that of the incoming CW signal (precisely the same pitch), you will be "zero beating" your transmitted signal on to the frequency of the other station.

㉑ NB ⊕ SQL Knob

NB Knob

The inner **NB** knob adjusts the noise blanking level when the (analog) IF noise blanker is activated by pressing the **NB** button.

SQL Knob

The outer **SQL** knob sets the signal level threshold at which main (VFO-A) receiver audio is muted, in all modes. This control is normally kept fully counter-clockwise, except when scanning and during FM operation.

㉒ NB Button

Pressing this button activates the (analog) IF Noise Blanker, which may help reduce many different types of man-made impulse noise (but not atmospherics). When the Noise Blanker is activated, the LED inside the button will glow red.

㉓ CONT Button

This button turns the main band (VFO-A) CONTOUR filter on and off. When the CONTOUR filter is activated, the LED inside the button will glow red.

㉔ CONT ⊕ DNR Knob

CONT Knob

The inner **CONT** knob selects the desired main band (VFO-A) CONTOUR filter response.

DNR Knob

The outer **DNR** knob selects the optimum main band (VFO-A) Digital Noise Reducer response.

㉕ DNR Button

This button turns the main band (VFO-A) Digital Noise Reduction circuit on and off. When the Digital Noise Reducer is activated, the LED inside the button will glow red.

㉖ VRF/μ-T Button

This button turns the main band (VFO-A) receiver's VRF filter or μ-TUNE filter on and off. While activated, the LED inside the button will glow red.

㉗ VRF/μ-T ⊕ NTCH Knob

VRF/μ-T Knob

The inner **VRF/μ-T** knob tunes the passband of the main band (VFO-A) receiver's VRF filter (above the 18 MHz amateur bands) or μ-TUNE filter (Narrow-bandwidth High-Q RF Filter) (below the 14 MHz amateur bands) for maximum receiver sensitivity (and out-of-band interference rejection).

NTCH Knob

The outer **NTCH** knob adjusts the center frequency of the main band (VFO-A) IF notch filter.

㉘ NTCH Button

This button turns the main band (VFO-A) IF notch filter on and off. When the IF notch filter is activated, the LED inside the button will glow red.

㉙ DNF Button

This button turns the main band (VFO-A) Digital Notch Filter on and off. When the Digital Notch Filter is activated, the LED indicator will glow red.

㉚ R.FLT Button and Indicator

This button selects the bandwidth for the main band (VFO-A) receiver's first IF Roofing Filter. Available selections are 3 kHz, 6 kHz, 15 kHz, or Auto, and the LED indicator will change according to the bandwidth selected.

㉛ FLT Button (VFO-B)

This button selects the bandwidth for the sub band (VFO-B) receiver's first IF Roofing Filter. Available selections are 3 kHz, 6 kHz, 15 kHz, or Auto.

㉜ AGC ⊕ ATT Knob (VFO-B)

AGC Knob

The inner **AGC** knob selects the sub band (VFO-B) receiver's Automatic Gain Control decay time for the most comfortable reception, or disables the receiver AGC (off). Normally this switch is set to the "AUTO" position. Strong signals will cause distortion if this selector is set to "OFF," unless you rotate the RF Gain control counterclockwise to apply AGC to the receiver manually.

ATT Knob

The outer **ATT** knob inserts 3, 6, 12, or 18 dB (1/2, 1, 2, or 3 S-units) of attenuation before the sub band (VFO-B) mixer to suppress band noise and reduce the possibility of overload from very strong signals.

㉝ VRF Button (VFO-B)

This button turns the sub band (VFO-B) receiver's VRF (preselector) filter on and off. While activated, the LED inside the button will glow umber.

㉞ VRF ⊕ NTCH Knob (VFO-B)

VRF Knob

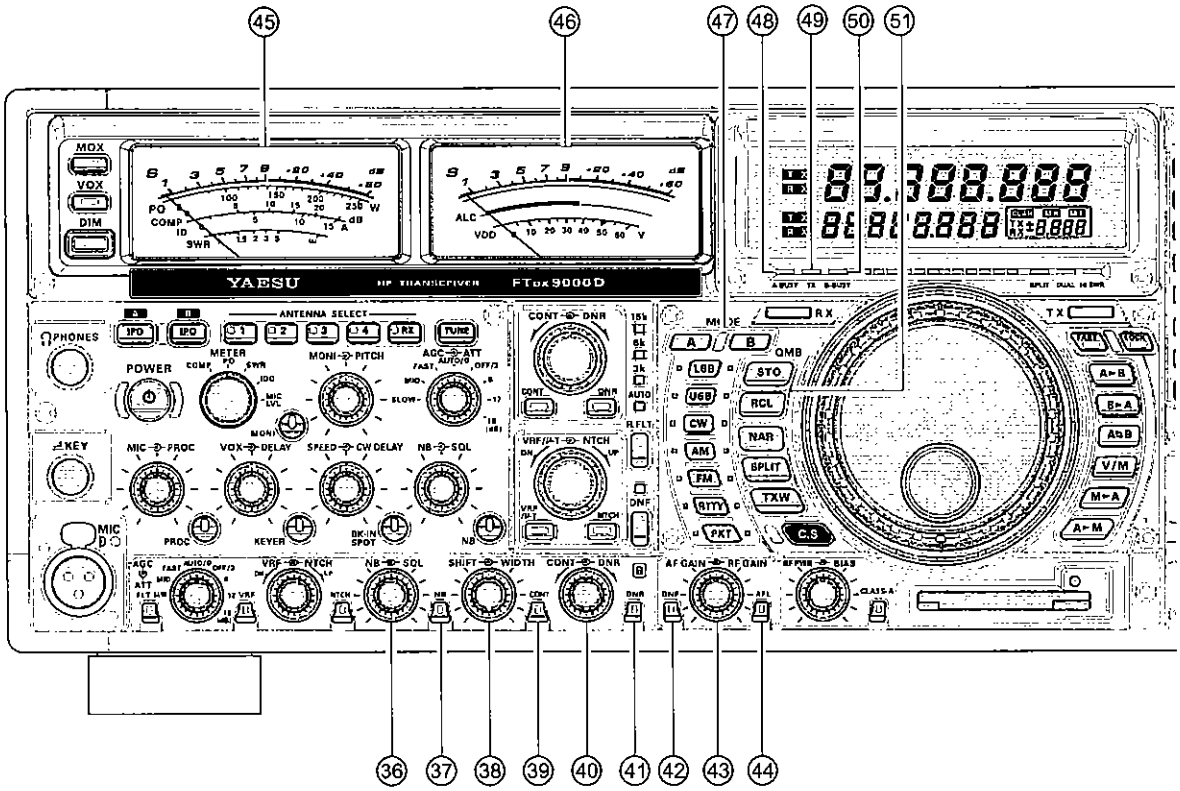
The inner **VRF** knob tunes the passband of the sub band (VFO-B) receiver's VRF filter for maximum receiver sensitivity (and out-of-band interference rejection).

NTCH knob

The outer **NTCH** knob adjusts the IF notch frequency of the sub band (VFO-B) IF notch filter.

㉟ NTCH Button (VFO-B)

This button turns the sub band (VFO-B) IF notch filter on and off. When the sub band (VFO-B) IF notch filter is activated, the LED inside the button will glow umber.



㊱ NB ⊰ SQL Knob (VFO-B)

NB Knob

The inner **NB** knob adjusts the noise blanking level when the sub band (VFO-B) (analog) IF noise blanker is activated by pressing the NB button.

SQL Knob

The outer **SQL** knob sets the signal level threshold at which sub band (VFO-B) receiver audio is muted, in all modes. This control is normally kept fully counter-clockwise, except when scanning and during FM operation.

㊲ NB Button (VFO-B)

Pressing this button activates the sub band (VFO-B) IF Noise Blanker, which may help reduce many different types of man-made impulse noise (but not atmospherics). When the Noise Blanker is activated, the LED inside the button will glow umber.

㊳ SHIFT ⊰ WIDTH Knob (VFO-B)

SHIFT Knob

The inner **SHIFT** knob offsets the center frequency of the sub band (VFO-B) IF passband to ±1.28 kHz when rotated from its "normal" (center) position. This control functions in all modes except FM.

WIDTH Knob

The outer **WIDTH** knob, when turned to the fully clockwise position, the overall IF bandwidth of the sub band (VFO-B) receiver is maximum bandwidth. Turn the **WIDTH** knob to the counter clockwise, reduces the overall IF bandwidth of the sub band (VFO-B) receiver.

㊴ CONT Button (VFO-B)

This button turns the sub band (VFO-B) CONTOUR filter on and off. When the CONTOUR filter is activated, the LED inside the button will glow umber.

㊵ CONT ⊰ DNR Knob (VFO-B)

CONT Knob

The inner **CONT** knob selects the desired sub band (VFO-B) CONTOUR filter response.

DNR Knob

The outer **DNR** knob selects the optimum sub band (VFO-B) Digital Noise Reducer response.

㊶ DNR Button (VFO-B)

This button turns the sub band (VFO-B) Digital Noise Reducer circuit on and off. When the Digital Noise Reduction is activated, the LED inside the button will glow umber.

㊷ DNF Button (VFO B)

This button turns the sub band (VFO-B) Digital Notch Filter on and off. When the sub band (VFO-B) Digital Notch Filter is activated, the LED indicator will glow umber.

㊸ AF GAIN ⊛ RF GAIN Knob (VFO-B)

AF GAIN Knob

The inner **AF GAIN** knob adjusts the audio volume level of the sub band (VFO-B) receiver in the speaker or headphones.

RF GAIN Knob

The outer **RF GAIN** knob adjusts the receiver signal input level in the front end of the sub band (VFO-B) receiver, ahead of the 1st mixer (via PIN diodes), and also the gain of the sub receiver's IF amplifiers.

This control is normally set fully clockwise for maximum sensitivity. When rotated counter-clockwise, the sub band (VFO-B) S-meter minimum deflection point will move up the scale. The peak deflection for a particular signal will remain the same if it is greater than the level set by this control, but the sub band (VFO-B) receiver will be less sensitive to weaker signals.

㊹ AFL Button (VFO-B)

Pressing this button activates the Audio (AF) Limiter circuit of the sub band (VFO-B) receiver. This will protect the audio amplifier from distortion, and protect your ears from high audio levels, caused by sudden peaks in audio input.

When the Audio Limiter circuit is activated, the LED inside the button will glow umber.

㊺ Main Meter

There are five functions on the main multi-meter.

S: Indicates the received signal strength on the main band (VFO-A), from S-0 to S9 +60 dB.

PO: Indicates the RF Power Output, from 0 to 250 Watts on transmit.

COMP: Indicates the compression level of the speech processor, from 0 to 20 dB.

IC: Indicates the final amplifier drain current (ID) from 0 to 15 A.

SWR: Indicates the antenna system observed standing wave ratio (SWR), from 1.0 to 5.0.

㊻ Sub Meter

S: Indicates the received signal strength on the sub band (VFO-B), from S-0 to S9 +60 dB.

ALC: Indicates the ALC (Automatic Level Control) relative voltage on transmit.

VDD: Indicates the final amplifier drain voltage.

When the ACM (Adjacent Channel Monitor) function is activated, the meter indicates the relative signal strength of any signals just outside the RX passband on the main band (VFO-A).

㊼ MODE Selection Buttons

These momentary buttons allow selection of the operating mode of the main band (VFO-A) and sub band (VFO-B) independently.

Pressing the **[A]** or **[B]** button will select either the main band (VFO-A) or sub band (VFO-B) for individual mode selection within that band.

Pressing the **[LSB]**, **[USB]**, **[CW]**, **[AM]**, **[FM]**, **[RTTY]**, or **[PKT]** button will select the main band (VFO-A) and sub band (VFO-B) operating mode.

Pressing the **[CW]**, **[AM]**, **[RTTY]**, or **[PKT]** button multiple times will switch between the alternate operating features that can be used on these modes (covered later). Also, when you press and hold in the **[PKT]** button for one second, the user-programmed custom function setting mode will be activated.

㊽ A-BUSY Indicator

This LED glows green whenever the main band (VFO-A) receiver squelch is open.

㊾ TX Indicator

This LED glows red when transmission is occurring. If transmission is inhibited for some reason (for example, attempting to transmit outside an amateur band), this LED will blink red.

㊿ B-BUSY Indicator

This LED glows green whenever the sub band (VFO-B) receiver squelch is open.

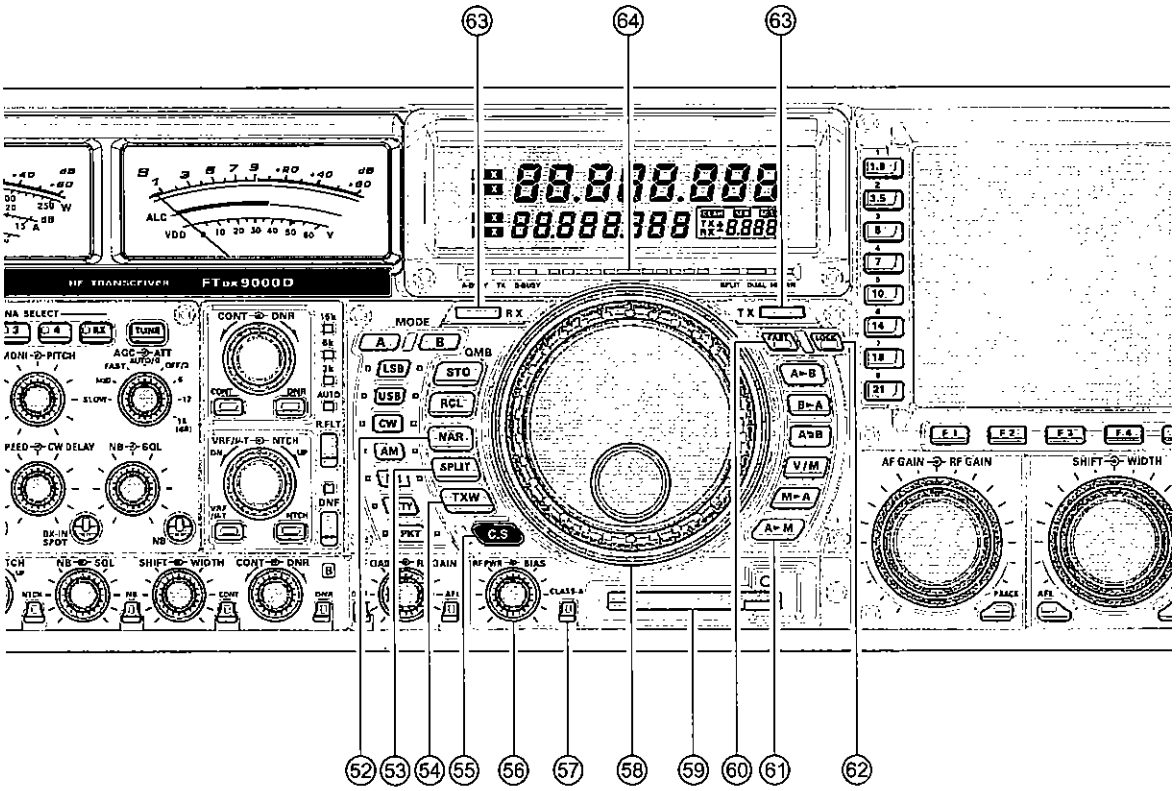
(51) QMB Buttons

STO (Store) Button

Pressing this button copies operating information (frequency, mode, bandwidth, and also repeater direction/shift frequency and CTCSS functions on the FM mode) into consecutive QMB Memories.

RCL (Recall) Button

Pressing this button recalls one of up to five Quick Memory Bank memories for operation.



㊷ NAR Button

In the SSB/CW mode, this button is used to set the bandwidth of the EDSP (digital) IF filters to the programmed bandwidth regardless the **WIDTH** knob setting (SSB: 1.8 kHz, CW/RTTY/PSK: 300 Hz).

In the FM mode on the 28 MHz and 50 MHz band, this button is used to toggle the FM deviation/bandwidth between wide (±5.0 kHz Dev./25.0 kHz BW) and narrow (±2.5 kHz Dev./12.5 kHz BW).

Pressing the [**A**] or [**B**] button (located above the MODE selection buttons) will select either the main band (VFO-A) or sub band (VFO-B) for individual bandwidth.

㊸ SPLIT Button

Pressing this button to activates split frequency operation between the main band (VFO-A), used for transmission and sub band (VFO-B), used for reception. The same name LED located at the right of the main tuning knob glows orange while this function is active.

㊹ TXW Button

Pressing this key monitor the transmit frequency while working on the split frequency operation. When receiving the transmit frequency, the LED indicator will glow green. Press this key again to return to normal operation.

㊺ CS Button

Pressing this button to recall the favorite Menu Selection directly.

Press and hold this button for 1/2 second to assign the current Menu Selection into this button while operating on the Menu Mode.

㊻ RF PWR ⊕ BIAS Knob

RF PWR Knob

This inner **RF PWR** knob adjusts the transmitter's output power in all modes. The adjustment range is from approximately 5 to 200 watts, except in the AM mode, where the permitted carrier level is about 5 to 50 watts. This knob also controls the carrier level for CW transmission. In setting the output power, the ALC function of the meter should always be monitored, to avoid overdriving the transmitter final amplifier.

In the "*Class A*" SSB operating mode, the adjustment range for power output will be between approximately 5 and 75 watts.

BIAS Knob

The outer **BIAS** knob, adjust the transmitter final amplifier between "*Class A*" (fully clockwise) and "*Class AB*" (fully counter clockwise).

when turned to the fully clockwise position, the transmitter final amplifier operates the "*Class A*" mode while operating in the "*Class A*" mode.

⑰ CLASS-A Button

This orange button changes the final amplifier operating mode to *Class-A*. When operating the final amplifier in the *Class-A* mode, the maximum output power will be reduced to approximately 75 watts, and the LED inside this button will glow red. Operating SSB in *Class-A* yields an ultra-clean signal waveform.

⑱ Main Tuning Knob

This large knob adjusts the operating frequency of main band (VFO-A) or a recalled memory. Default tuning increments are 10 Hz (100 Hz in AM and FM modes). When the **FAST** button (located at the right of the this knob) has been pressed, the increments are 10x these step sizes. See the table on page ?? for a listing of all available steps.

⑲ SMC Card Slot

This slot accepts the Smart Memory Card, which allows storage, transfer, and recall of transceiver configuration data and operator preferences.

To remove the card out from slot, press the small push-button at the right hand of the slot.

⑳ FAST Button

Pressing this button will increase or decrease the tuning rate of the Main Tuning Knob by a factor of ten.

When this function is activated, the LED inside the button will glow red.

㉑ VFO & Memory Control Buttons

[A▶B] Button

Pressing and holding in this button for 1/2 second (until the double beep) transfers data from the main band (VFO-A) frequency (or a recalled memory channel) to sub band (VFO-B), overwriting any previous contents in the sub band (VFO-B). Use this key to set both main band (VFO-A) and sub band (VFO-B) receivers to the same frequency and mode.

[B▶A] Button

Pressing and holding in this button for 1/2 second (until the double beep) transfers data from the sub band (VFO-B) frequency to main band (VFO-A), overwriting any previous contents in the main band (VFO-A). Use this key to set both main band (VFO-A) and sub band (VFO-B) receivers to the same frequency and mode.

[A◥B] Button

Pressing this button momentarily exchanges the contents of main band (VFO-A) (or a recalled memory channel) and sub band (VFO-B).

[V/M] Button

This button toggles main band (VFO-A) receiver operation between the memory system and the VFO. Either "VFO," "MEM," or "M TUNE" will be displayed to the left of the main frequency display field to indicate the current selection. If you have tuned off of a Memory channel frequency, pressing this button returns the display to the original memory contents, and pressing it once more returns operation to the Main VFO.

[M▶A] Button

Pressing this button momentarily displays the contents of the currently-selected memory channel for three seconds.

Holding this button in for 1/2 second copies the data from the currently-selected memory to the Main VFO (VFO-A), as two beeps sound. Previous data in the Main VFO will be overwritten.

[A▶M] Button

Pressing and holding in this key for 1/2 second (until the double beep) copies the current operating data from main band (VFO-A) to the currently selected memory channel, overwriting any previous data stored there. Also, pressing and holding in this button after recalling a memory, without first retuning, causes the memory channel to be "masked," and repeating the process restores the masked memory.

㉒ LOCK Button

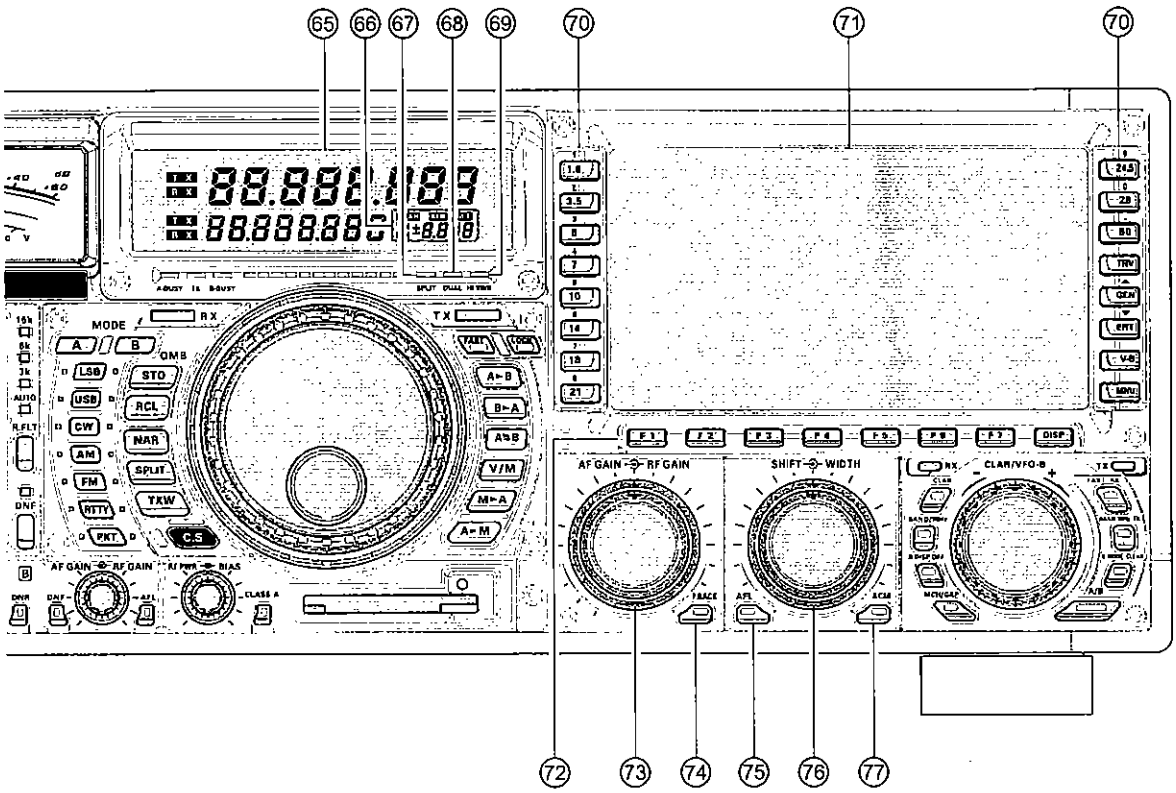
This button toggles locking of the main tuning knob to prevent accidental frequency changes. When the button is active, the main tuning knob can still be turned, but the frequency will not change, and the LED inside the button will glow green.

㉓ RX & TX Button-LED (VFO-A)

These combination lamp-buttons select and indicate the transmit/receive status of the main tuning knob and display. When the green "RX" lamp is lit, the receiving frequency is under control of the main knob and display (either VFO-A or a recalled memory channel). When the red "TX" lamp is lit, the transmitting frequency is under control of the main knob and display. Thus, for "normal" (non-split) operation, both the red and green lamps associated with the main tuning knob will be illuminated.

㉔ Tuning Offset Indicator

Displays sub-resolution tuning steps or clarifier offset in LED increments.



⑥⑤ Frequency Display

The upper large display field indicates the current operating frequency on the main band (VFO-A) and its TX/RX status.

The lower small display field indicates the current operating frequency on the sub band (VFO-B) and its TX/RX status.

⑥⑥ Multi Display Window

This window indicates either the Clarifier offset, Memory Channel number, split frequency offset, or CW pitch.

⑥⑦ SPLIT Indicator

This LED glows orange whenever "Quick Split" frequency operation is activated.

⑥⑧ DUAL Indicator

This LED glows green when Dual Receive operation is activated.

⑥⑨ HI-SWR Indicator

This LED glows red when an abnormally high SWR condition exists that can not be matched below 3.0:1.

⑦⓪ BAND Buttons

These buttons provides one-touch band selection, or digital frequency entry. Normally, pressing one of the eleven white numbered keys selects the corresponding (MHz) amateur band for operation (pressing the **V-B** button first, followed by a **BAND** key, selects that band for the sub band (VFO-B)). If you press the white numbered key for the band you are already on, you will select the alternate subband VFO on that band. See the "Operation" chapter for details.

If the **ENT** key is pressed first, the orange labels on the buttons become effective, for manually entering any frequency one digit at a time; press **V-B** then **ENT** to enter sub band (VFOB) frequencies directly.

⑦① TFT Status/Information Display

This 6.5" 800 x 400 dot TFT display indicates the main (VFO-A) and sub (VFO-B) status and displays a multi-function World Clock. In the Spectrum Scope mode, this display becomes a panoramic spectrum display, with enhanced viewing ease and resolution, important for discerning weak signals in the noise and interference on the band.

⑫ FUNCTION Buttons

These buttons select the operating and/or display functions for the TFT Status/Information Display. See the "TFT Monitor Operation" chapter for details.

⑬ AF GAIN ⊙ RF GAIN Knob

AF GAIN Knob

The inner **AF GAIN** knob adjusts the audio volume level of the main band (VFO-A) receiver in the speaker or headphones.

RF GAIN Knob

The outer **RF GAIN** knob adjusts the receiver signal input level in the front end of the main band (VFO-A) receiver, ahead of the 1st mixer (via PIN diodes), and also the gain of the main receiver's IF amplifiers.

This control is normally set fully clockwise for maximum sensitivity. When rotated counter-clockwise, the main band (VFO-A) S-meter minimum deflection point will move up the scale. The peak deflection for a particular signal will remain the same if it is greater than the level set by this control, but the main band (VFO-A) receiver will be less sensitive to weaker signals.

⑭ P.BACK Button

Press and hold this button for 1/2 second to activates the recording feature of the internal Voice Recorder. The Voice Recorder allows to record the main band (VFO-A) receiver audio for the most-recent 30 seconds. While recording the receiver audio, the LED in this button glows red.

Press this button momentarily to stop the recording, then press this button momentarily again plays back the receiver audio for the most-recent 30 seconds before stopping the recording.

While playing back the receiver audio, the LED inside button will glow umber.

Press and hold this button for 1/2 second again, resume the recording feature.

⑮ AFL Button

Pressing this button activates the Audio (AF) Limiter circuit of the main band (VFO-A) receiver. This will protect the audio amplifier from distortion, and protect your ears from high audio levels, caused by sudden peaks in audio input when the AGC is set to "OFF."

When the Audio Limiter circuit is activated, the LED inside the button will glow red.

⑯ SHIFT ⊙ WIDTH Knob

SHIFT Knob

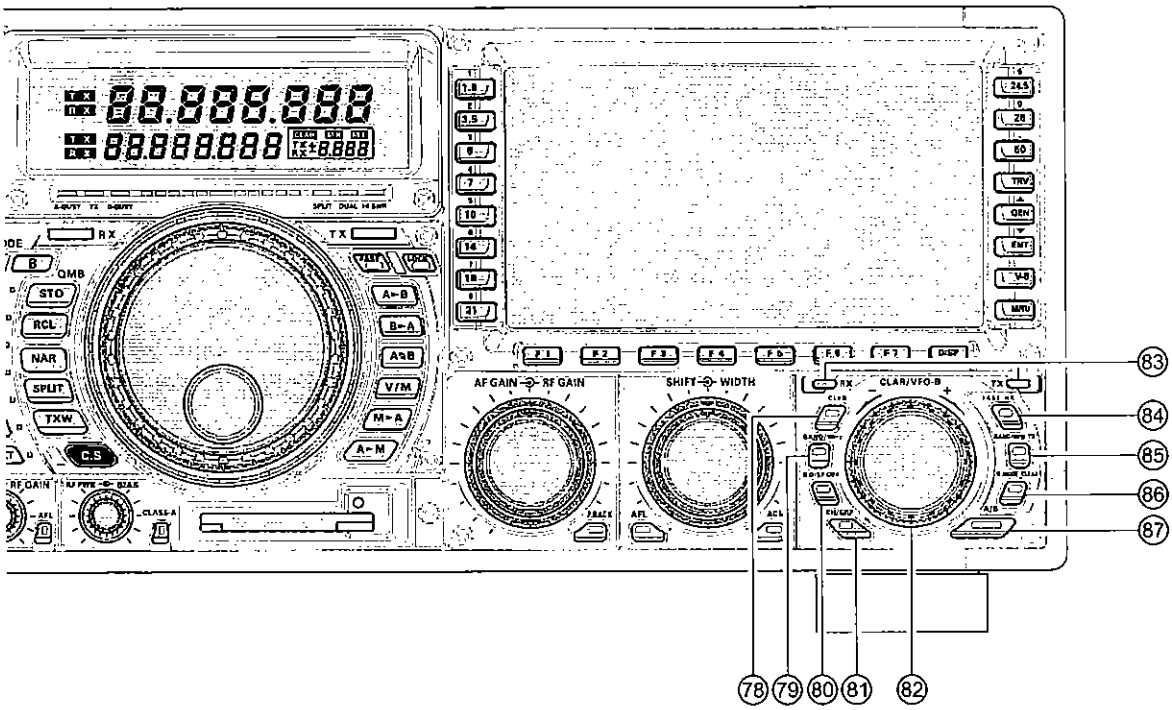
The inner **SHIFT** knob offsets the center frequency of the main band (VFO-A) IF passband when rotated from its "normal" (center) position. This control functions in all modes except FM.

WIDTH Knob

The outer **WIDTH** knob, when turned to the fully clockwise position, the overall IF bandwidth of the main band (VFO-A) receiver is maximum bandwidth. Turn the **WIDTH** knob to the counter clockwise, reduces the overall IF bandwidth of the main band (VFO-A) receiver.

⑰ ACM Button

Pressing this button activates the ACM (Adjacent Channel Monitor) function while operating on the CW mode. When the ACM (Adjacent Channel Monitor) function is activated, Sub Meter indicates the relative signal strength of any incoming signals which are just outside of the receiver (CW filter) passband on the main VFO. When ACM is activated, the LED inside the button will glow red.



⑱ CLAR Button

Pressing this button activates the TX/RX Clarifier (offset tuning) function.

When the clarifier function is activated, the LED inside the button will glow green.

⑲ BAND/MHz Button

Pressing this button momentarily, allows you to select the main (VFO-A) operating band using the **CLAR/VFO-B** knob.

Pressing and holding in this button for one second allows you to tune the main band (VFO-A) frequency down or up in 100 kHz increments, using the **CLAR/VFO-B** knob.

⑳ B.DISP OFF Button

Pressing this button causes the sub band (VFO-B) frequency to be blanked out.

When this function is activated, the LED inside the button will glow green.

㉑ MCH/GRP Button

Pressing this button momentarily allows you to select the memory channel using the **CLAR/VFO-B** knob.

Pressing and holding in this button for one second allows you to select the memory group using the **CLAR/VFO-B** knob.

㉒ CLAR/VFO-B Knob

Usually, this knob adjusts (offsets) the operating frequency of the main band (VFO-A) during Clarifier operation, or adjusts the frequency of the sub band (VFO-B). Alternate uses for this knob are described above.

㉓ RX & TX Button-LED (VFO-B)

These combination lamp-buttons select and indicate the transmit/receive status of the **CLAR/VFO-B** knob and display. When the green "RX" lamp is lit, the receiving frequency is under control of the **CLAR/VFO-B** knob and display (VFO-B). When the red "TX" lamp is lit, the transmitting frequency is under control of the **CLAR/VFO-B** knob and display (VFO-B). Thus, for "normal" (non-split) operation, both the red and green lamps associated with the **CLAR/VFO-B** tuning knob will be turned off.

㉔ FAST/RX Button

Pressing this button increases/decreases the tuning rate of the **CLAR/VFO-B** knob by a factor of ten.

When the Clarifier function is engaged, pressing this button allows offsetting of the main band (VFO-A) *receive* frequency temporarily using the **CLAR/VFO-B** knob.

⑮ BAND/MHz TX Button

Pressing this button momentarily allows you to select the sub (VFO-B) operating band, using the **CLAR/VFO-B** knob.

When the Clarifier function is engaged, pressing this button allows offsetting of the main band (VFO-A) *transmit* frequency temporarily using the **CLAR/VFO-B** Knob.

⑯ B. MODE CLEAR Button

Pressing this button momentarily allows you to select the operating mode of the sub band (VFO-B) using the **CLAR/VFO-B** knob.

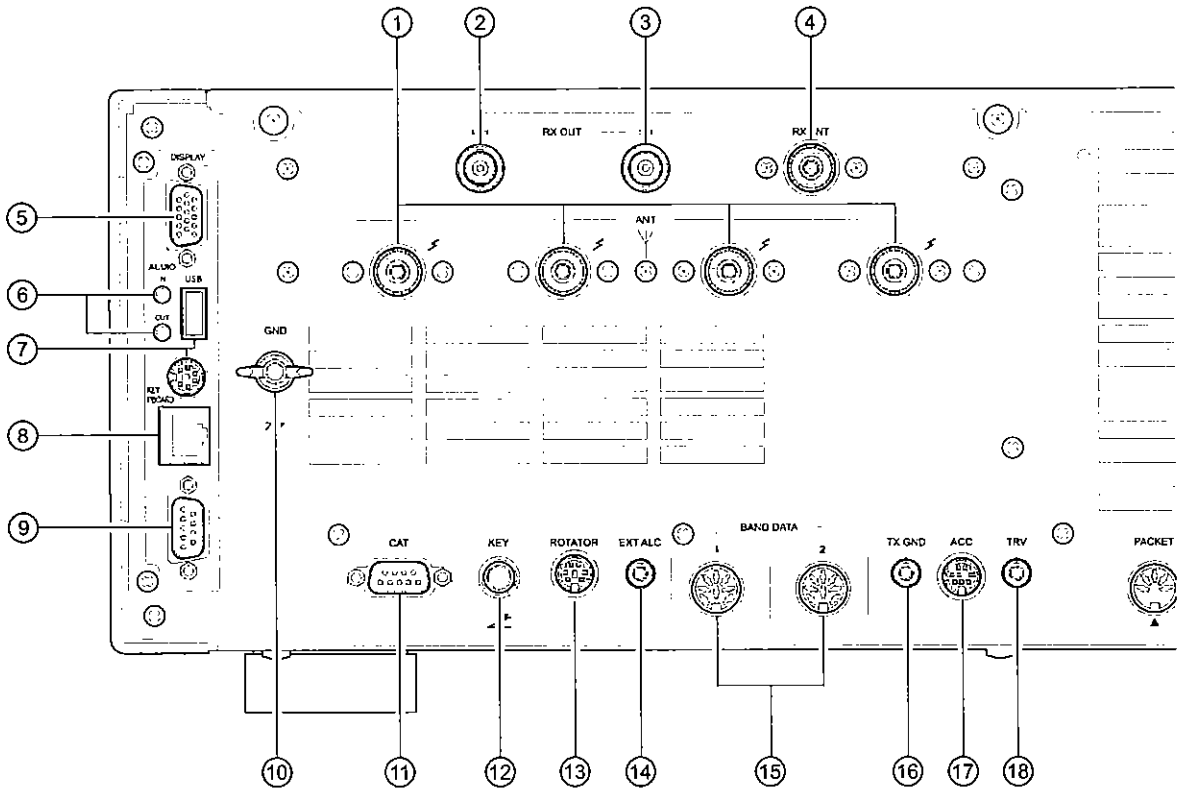
When the clarifier function is engaged, pressing this button zeroes any (Clarifier) offset tuned via the **CLAR/VFO-B** knob.

⑰ A/B Button

Pressing this button toggle the **CLAR/VFO-B** knob function to be work between main band (VFO-A) frequency and sub band (VFO-B) frequency.

When the LED inside this button glows red, the **CLAR/VFO-B** knob works to the main band (VFO-A). When the LED inside this button glows umber, the **CLAR/VFO-B** knob works to the sub band (VFO-B).

REAR PANEL CONNECTIONS



① ANT Jacks

Connect your main antenna(s) here, using a type-M (PL-259) plug and coaxial feedline for each. These antenna ports are always used for transmission, and also are used for reception unless a separate receive antenna is also used for the main receiver. The internal antenna tuner affects only the antenna(s) connected here, and only during transmission.

② RX OUT (MAIN) Jack

This BNC jack provides output of the receiver signal line from the Antenna jack which is connected to the main band (VFO-A) front end.

③ RX OUT (SUB) Jack

This BNC jack provides output of the receiver signal line from the Antenna jack which is connected to the sub band (VFO-B) front end.

④ RX ANT Jack

This type-M jack is for a separate receive-only antenna. An antenna connected here can be used by both the main (VFO-A) and sub (VFO-B) receiver when the **RX ANT** button the front panel is pressed.

⑤ DISPLAY Jack

Connect an external monitor (not supplied) to this jack.

⑥ AUDIO Phone Jacks (IN/OUT)

⑦ KEY BOARD Jacks

Connect your keyboard (not supplied) to these jacks in accordance with your keyboard type ("USB" or "PS/2") to use the Smart Memory Card for storage of logbook data.

⑧ This jack is no connection.

⑨ COM Jack

Connect the GPS receiver Unit (not supplied) to this jack. When connect the GPS receiver Unit to this jack, the **FTDX9000** sets your current location automatically into the "World Map" page in the TFT monitor.

⑩ GND Terminal Post

Use this terminal to connect the transceiver to a good earth ground, for safety and optimum performance. Use a large diameter, short braided cable.

⑪ CAT Serial DP-9 Jack

This 9-pin serial DB-9 jack allows external computer control of the **FTDX9000**. Connect a serial cable here and to the RS-232C COM port on your personal computer (no external interface is required). CAT command protocol and data formats are described in the CAT chapter, starting on page ??.

⑫ KEY Jack

This 1/4-inch phone jack accepts a CW key or keyer paddle. It is connected in parallel with the jack with the same name on the front panel (either or both may be used). A 2-contact plug cannot be used in this jack. Key-up voltage is +5 V, and key-down current is 0.5 mA. Plug wiring is shown on page 4, and this jack may be configured for keyer, "Bug," "straight key," or computer keying interface operation via Menu Selection 76: KEYEY REAR (see page ??).

⑬ ROTATOR 5-pin MINI-DIN Jack

This 5-pin MINI-DIN Jack accepts a cable connected to a YAESU **G-800DXA/-1000DXA/-2300DXA/-2800DXA** Antenna Rotator. You may control the antenna azimuth rotation from the Function buttons on the front panel.

⑭ EXT ALC RCA Jack

This input jack accepts negative-going external ALC (Automatic Level Control) voltage from a linear amplifier, to prevent over-excitation by the transceiver. Acceptable input voltage range is 0 to –4 VDC.

⑮ BAND DATA DIN Jacks (1/2)

BAND DATA 1

This 8-pin output jack provides band selection data which may be used for control of optional accessories such as the **VL-1000** Solid-state Linear Amplifier.

BAND DATA 2

This 6-pin output jack provides band selection data for future products.

⑯ TX GND

This output jack connects, inside the **FTDX9000**, to a set of relay contacts which short together (to chassis ground) whenever the transmitter is active. This allows transmit/receive switching of an external device such as a linear amplifier. Maximum ratings for these relay contacts are 500 mA @ 100 VAC, 200 mA @ 60 VDC or 1 A @ 30 VDC. Before connecting an external device, make sure its switching requirements will not exceed these limits. If your amplifier requires higher current, or has higher voltage switching requirements, an external switching device must be used.

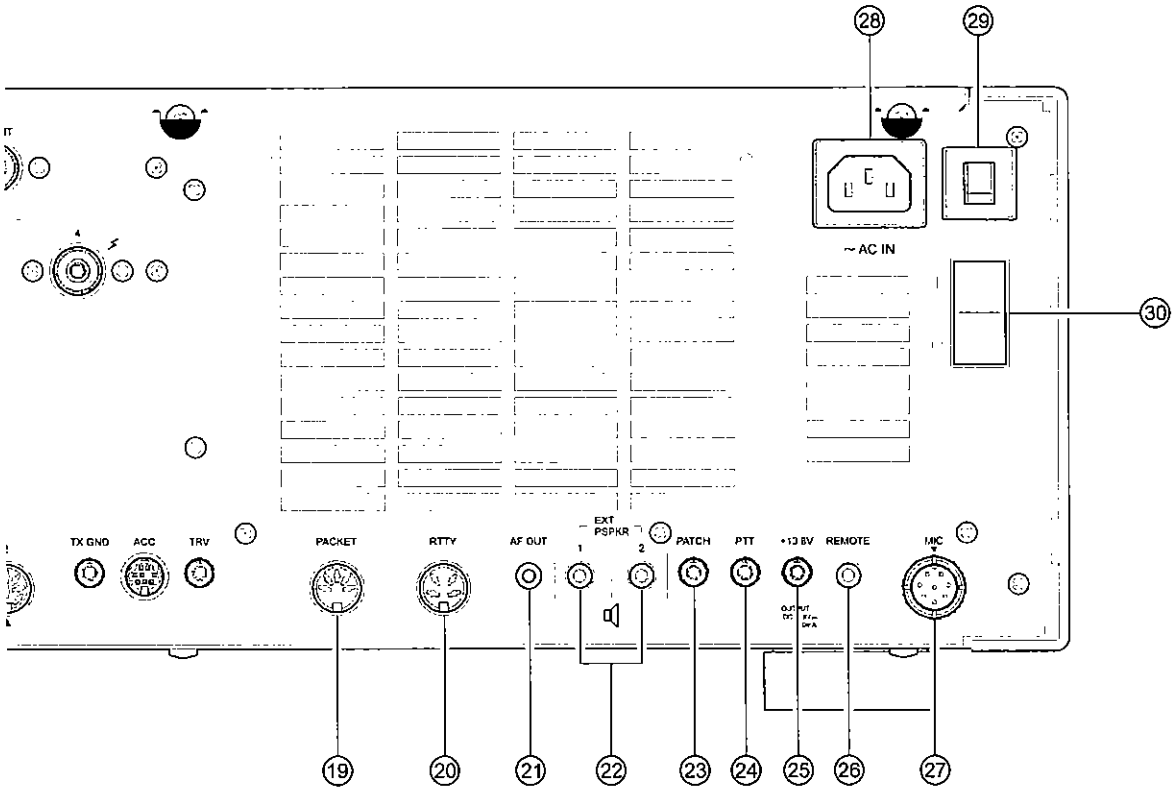
⑰ ACC

This is an accessory jack which is used at the factory for adjustment of the radio.

⑱ TRV

This jack provides a low level RF output for use with a transverter. Maximum output is approximately 100 mVrms at 50 Ohms (–6 dBm).

REAR PANEL CONNECTIONS



⑲ PACKET DIN Jack

This 5-pin input/output jack provides receiver audio and squelch signals, and accepts transmit (AFSK) audio and PTT control, from an external Packet TNC. Pinout is shown on page ??. The receiver audio level at this jack is approximately 100 mV (@600 Ohms).

⑳ RTTY

This 4-pin input/output jack provides connections for an RTTY terminal unit. Pinout is shown on page ??. The receiver audio level at this jack is at a constant 100-mV (@600 Ohms) level. FSK keying at this jack is accomplished by a closure of the SHIFT line to ground by the terminal unit.

㉑ AF OUT

This 3-contact jack provides dual-channel low-level receiver output, for recording or external amplification. Peak signal level is 100 mVrms at 600 Ohms. Main band (VFO-A) receiver audio is on the left channel (tip), and sub band (VFO-B) receiver audio is on the right channel (ring). A stereo amplifier or recorder is recommended, to record each receiver's audio separately when dual reception is enabled. The front panel **AF GAIN** knobs do not affect the signals at this jack.

㉒ EXT SPKR (1/2)

The **EXT SPKR 1** two-contact output jack provides main band (VFO-A) receiver audio for an external loudspeaker, such as the **SP-8**. Inserting a plug into this jack disables the internal main band (VFO-A) loudspeaker. Impedance is 4 ~ 8 Ohms. The **EXT SPKR 2** two-contact output jack provides sub band (VFO-B) receiver audio for an external loudspeaker. Inserting a plug into this jack disables the internal sub band (VFO-B) loudspeaker. Impedance is 4 ~ 8 Ohms.

㉓ PATCH Jack

This input jack accepts transmitter audio - either AFSK or voice - for transmission. This line is mixed with the microphone audio input line, so the microphone should be disconnected if using this jack and mixing is not desired. Impedance is 500 ~ 600 Ohms.

㉔ PTT RCA Jack

This input jack may be used to provide manual transmitter activation using a footswitch or other switching device. Its function is identical to the **MOX** button on the front panel. The same line is available at the **PACKET** and **RTTY** jacks for TNC control. Open-circuit voltage is +13.5 VDC, and closed-circuit current is 1.5 mA.

㉕ +13.8 V RCA Jack

This output jack provides regulated, separately fused 13.8 VDC at up to 200 mA, to power an external device such as a packet TNC. Make sure your device does not require more current (if it does, use a separate power source).

㉖ REMOTE Phone Jack

By plugging in a supplied **FH-2** Remote Control Keypad here, direct access to the **FTDX9000** CPU is provided for control functions such as contest memory keying, frequency, and function control. This jack may also be also used for remote control of the **VL-1000** Linear Amplifier, if used.

㉗ MIC Jack

This 8-pin jack accepts input from a microphone utilizing a traditional YAESU HF-transceiver pinout.

㉘ AC IN Socket

Connect the supplied AC line cord to this socket after ensuring that your AC mains voltage matches that on the label.

㉙ Circuit Breaker

This circuit breaker shut off when over current occure.

㉚ MAIN POWER Switch

This is main power switch of the **FTDX9000**. Always turn this switch on *before* turning on the front panel's **POWER** button.

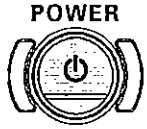
Before plugging in the transceiver, check your installation to make sure your AC voltage is correct, and that your ground and antenna are connected as described in the Installation chapter. Then preset the following controls as indicated:

- ❒ **MOX** button to Off.
- ❒ **METER** knob to PO.
- ❒ **ATT** knob to 0.
- ❒ **AGC** knob to AUTO.
- ❒ **AF GAIN** knobs matched at approximately 9 o'clock.
- ❒ **RF GAIN** knobs fully clockwise.
- ❒ **MIC**, **PROC**, **RF PWR**, **MONI**, **SQL**, and **NB** knobs all counterclockwise.
- ❒ **SHIFT**, **WIDTH**, and **NOTCH** knobs at 12 o'clock.
- ❒ **[LOCK]**, **[FAST]**, **[SPOT]**, [BK-IN], and [KEYER] switches all Off.

Connect your microphone and CW key/paddle, then plug the AC cord into the wall outlet.

Turn on the rear panel's main **POWER** switch.

TURNING THE FTDX9000 ON AND OFF



- ❒ To turn the **FTDX9000** on, press the front panel's **POWER** button.
- ❒ Take a moment to study the display. You should see upper large frequency field, which displays the main band (VFO-A) frequency, and the (lower) small frequency field, which displays the sub band (VFO-B) frequency. The Clarifier offset ("0.000") appears in the small box on the display.
- ❒ To turn the **FTDX9000** off, just press the **POWER** button again. Usually, you do not turn off the rear panel's main **POWER** switch.

KEY BEEPER

Pressing a front-panel button normally produces a beep. Its volume is independent of receiver volume, and can be set via menu selection 108: BEEP LEVEL.

FTDX9000 MENU PROGRAMMING

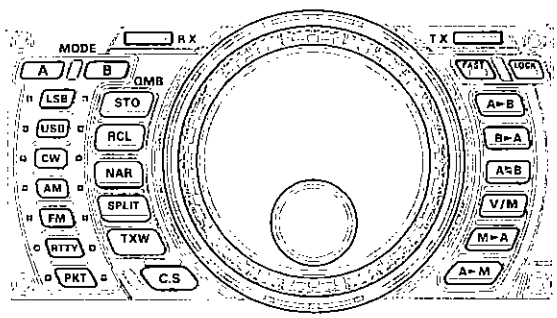
The **FTDX9000** incorporates a wealth of operating functions and features. For flexibility in configuring these capabilities, and to keep the front panel controls to a minimum, an internal Menu Programming routine is used. This allows customizing the functions via menu selections that allow you to "set and forget" a number of features and configurations, without the clutter of additional front and rear panel controls/switches. This permits each rig to have a custom "personality" that specifically matches your operating requirements, with the capability for easy modification as your requirements change.

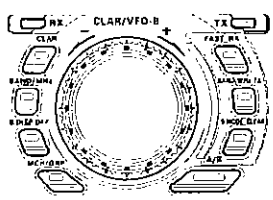
Menu programming is enabled by pressing the **MNU** button. You may then rotate the Main Tuning knob to display the desired setting. Each of the settings can be changed or customized by the **CLAR/VFO-B** knob, as you like, in this mode. For clarity's sake, transceiver functions that have several settings or options are referenced to the Menu Programming chapter separately, where details of programming are covered. Descriptions for most transceiver functions in this chapter assume default (factory-configured) transceiver settings.

VFO SELECTION & RECEIVER MUTING

Above the Main Tuning knob and **CLAR/VFO-B** knob are a pair of button/LEDs labeled **RX** and **TX**. An illuminated green "RX" LED indicates the VFO(s) controlling the receiver, while the red "TX" LED shows the VFO controlling the transmit frequency. As we will see later on in dual and split operation, these buttons can configure split and/or dual receive operation as you choose.

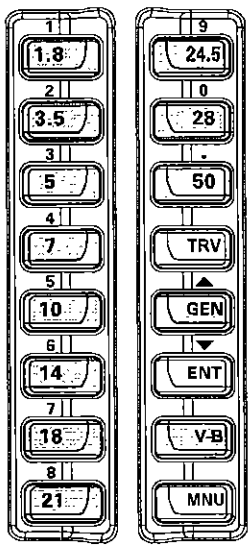
You can mute the main band (VFO-A) at any time by pressing the RX button/LED above the Main Tuning knob. The LED blinks while the receiver remains muted; simply press the button again to unmute.





AMATEUR BAND SELECTION

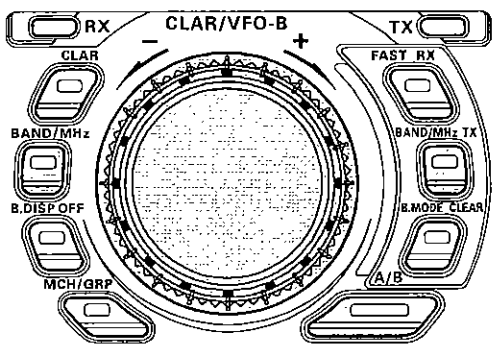
Press a **BAND** button (lining both sides of the TFT display) to select the amateur band of the main band (VFO-A) on which you wish to operate. Press the one of the eleven **BAND** buttons after pressing the **V-B** button, select the amateur band of the sub band (VFO-B) on which you wish to operate. Refer to the white "MHz" labels, and press the appropriate one.



You may also select the amateur band by rotating the **CLAR/VFO-B** knob.

To select the amateur band of the main band (VFO-A), rotate the **CLAR/VFO-B** knob after pressing the **BAND/MHz** button which located at the *left* side of the **CLAR/VFO-B** knob.

To select the amateur band of the sub band (VFO-B), press the **A/B** button first (illuminate the orange at the right side of the **CLAR/VFO-B** knob), then rotate the **CLAR/VFO-B** knob after pressing the **BAND/MHz** button which located at the *right* side of the **CLAR/VFO-B** knob.



Customization: You may programs a amateure band to be skipped while selecting bands using the **CLAR/VFO-B** knob via menu selection 127: SKIP BAND.

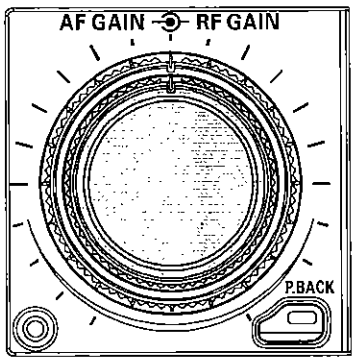
ANTENNA SELECTION

Press the one of the four **ANTENNA SELECT** buttons (under the Main Meter), set a rear-panel antenna port which is same number to the main band (VFO-A). Press the one of the four **ANTENNA SELECT** buttons after pressing the **V-B** button which is located on the right side of the TFT display, set a rear-panel antenna port which is same number to the sub band (VFO-B).

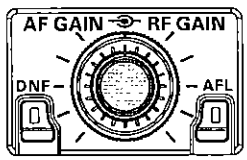
When an antenna has been selected for operation on main band (VFO-A), the LED in the button glows red. When an antenna has been selected for operation on sub band (VFO-B), the LED in the button glows umber.

Customization: The **FTDX9000**, in the factory-default configuration, selects the antenna in accordance with the current operating band. That is, if you choose Antenna "2" when operating on 14 MHz on the main band (VFO-A), Antenna "2" will be selected any time you choose 14 MHz on the main band (VFO-A). However, you may change the antenna selection method to assign antennas in accordance with the band stack (different antennas may be utilized on the same band, if so selected in the band stack) via menu selection 106: ANT Select.

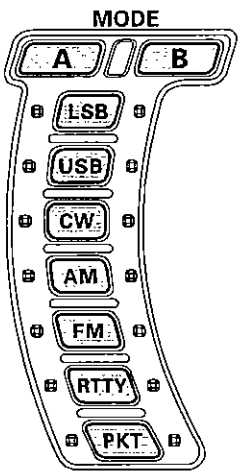
AUDIO VOLUME SETTING



Adjust the "large" **AF GAIN** knob for comfortable volume on main band (VFO-A) signals or noise in the loudspeaker or headphones. The "small" **AF GAIN** knob (to the left of and below the Main Tuning knob) adjusts the volume on sub band (VFO-B) signals or noise in the loudspeaker or headphones.



MODE SELECTION



Press the **MODE** button (to the left of the Main Tuning knob) corresponding to the mode on which you wish to operate - for now, we suggest an SSB mode: USB if you have selected a band above 10 MHz, or LSB otherwise. The red LED at the left of the button indicates the selected mode on the main band (VFO-A), and the umber LED at the right of the button indicates the selected mode on the sub band (VFO-B).

CW and RTTY have "reverse" modes that are selected by pressing their button twice (see the box at the right). Also, Packet operation can be toggled between LSB and FM (for 29 MHz operation) by pressing the **PKT** button in the same way. These special features are covered later.

MODE SELECTION

- Special Note for CW Mode - (Reverse CW Sideband)

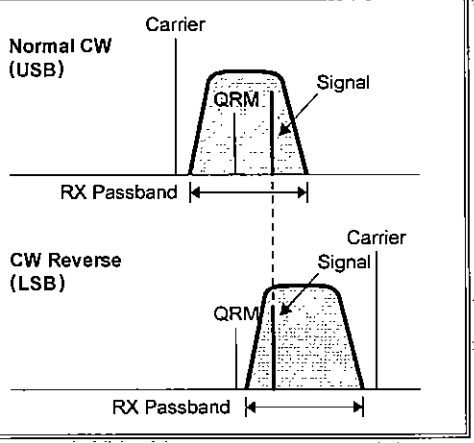
When you switch modes between CW and USB, you may notice that the frequency of the received signal stays the same (even though the panel frequency may change slightly). Also notice that the pitch of a received signal decreases as you increase the dial frequency.

However, switching to *LSB* from CW normally requires retuning the desired station. This can be especially inconvenient if you enjoy working the lower HF bands (40 meters and below) where LSB mode is used.

To eliminate the need for retuning in this situation, you may switch the receiver CW carrier oscillator injection to the reverse side (LSB). When you press the **CW** button, you should notice that the green LED in the USB button blinks for a second or two. This informs you of the default carrier offset (upper) for CW. To switch to the LSB injection side, simply press the **CW** button again; you will see the displayed frequency shift, and the LSB LED will blink.

When using the reverse sideband (LSB) for CW reception, you can freely switch between LSB and CW without having to retune a station. Note that, in the LSB and CW modes, the received signal pitch now increases as you increase the dial frequency.

To return the receiver to the default (upper) sideband, simply press the **CW** button again.



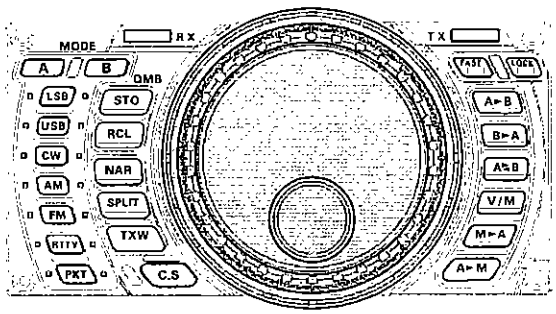
Operating Hint - An added benefit from this feature is QRM rejection. If you have interference on a CW station that the IF SHIFT does not easily eliminate, you can try switching to the reverse sideband, retuning the signal, and trying the IF SHIFT again.

TUNING THE FTDX9000

Tuning is accomplished in several ways, with each method having its own advantages.

Main Tuning Knob

Rotating the Main Tuning knob tunes the main band (VFO-A) frequency according to the selected tuning step size. The table below shows the available tuning step sizes, and their default settings.

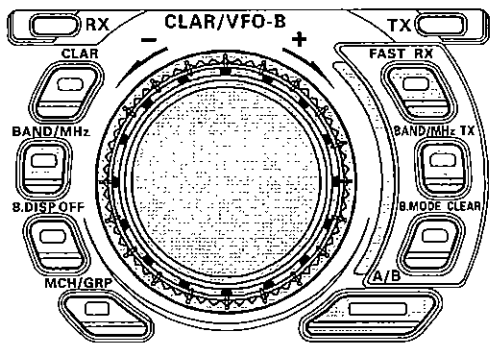


MODE	STEP※1
SSB/CW/AM	1.0 / 10 Hz※2
FM	10 / 100 / 1000 Hz※3

※1: Increase the tuning rate ten times by pressing the **FAST** button.
※2: Determined via menu selection 124: DIAL STEP. Factory default is 1.0 Hz.
※3: Determined via menu selection 126: FM DIAL STEP. Factory default is 100 Hz.

CLAR/VFO-B Knob

Rotating the **CLAR/VFO-B** knob tunes the main band (VFO-A) and sub band (VFO-B) frequencies according to the settings of the button which is located around the **CLAR/VFO-B** knob and selected tuning step size. The table below shows the available tuning step sizes and their default settings.



Microphone Up/Dwn Buttons

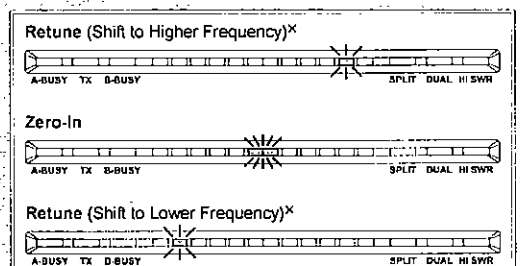
If your microphone has **UP** and **DWN** buttons (such as the **MD-200A8X**), you can press them momentarily to tune the main band (VFO-A) frequency according to the selected tuning step size, or hold them down to start VFO scanning. The table below shows the available tuning step sizes, and their default settings.

MODE	FST "OFF"	FST "ON"
SSB/CW	—	—
AM	2.5 / 5 / 9 / 10 / 12.5 kHz※1	X 10
FM	5 / 6.25 / 10 / 12.5 / 25 Hz※2	X 10

※1: Determined via menu selection 121: AM CH STEP. Factory default is 5 kHz.
※2: Determined via menu selection 125: FM CH STEP. Factory default is 5 kHz.

Note
Regarding CW Reception

In the CW mode on the main band (VFO-A), when you tune a signal near the center of the receiver passband, illuminates the Tuning Offset Indicator (located above the Main Tuning Knob), and the S-meter increase as you slowly tune the Main Tuning Knob. The idea is to tune for maximum indication, and so that a lone center marker illuminates in the Tuning Offset Indicator. If you detune, the center marker shift to left or right, indicating that you need to re-center the marker.



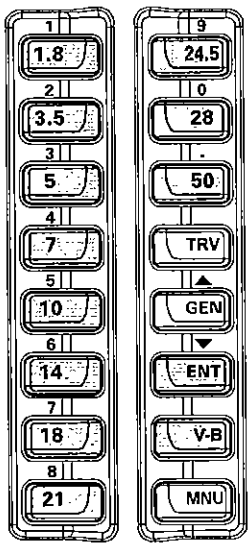
※: When the CW reverse feature is activated, the indication of the Tuning Offset Indicator is oppositely

		A/B button "OFF"	A/B button "ON"	
		White Labeld BAND/MHz button "ON"	Yellow Labeld BAND/MHz button "OFF"	Yellow Labeld BAND/MHz button "ON"
Main Band (VFO-A)	SSB/CW/AM	100 kHz /1 MHz※1	—	—
	FM	100 kHz /1 MHz※1	—	—
Sub Band (VFO-B)	SSB/CW/AM	—	1.0 /10 Hz※2, 3	100 kHz /1 MHz※1
	FM	—	10 /100 / 1000 Hz※2, 4	100 kHz /1 MHz※1

※1: Determined via menu selection 120: 1 MHz/100 kHz. Factory default is 1 MHz.
※2: Increase the tuning rate ten times by pressing the **FAST RX** button just above the Yellow Labeld **BAND/MHz** button.
※3: Determined via menu selection 124: DIAL STEP. Factory default is 1.0 Hz.
※4: Determined via menu selection 126: FM DIAL STEP. Factory default is 100 Hz.

KEYPAD FREQUENCY ENTRY

Frequencies can be entered directly using the BAND buttons (lined up both side of the TFT display), if desired, as follows:



Press the **ENT** button at the lower right of the TFT display (the leftmost operating frequency digit will blink). Then, referring to the orange numbers on the **BAND** buttons, enter the digits of the new frequency, from left to right ([1] - [4] - [.] - [2] - [5] - [0] - [0] - [0] - [0]), followed by **ENT** button again. As you enter the numbers, the next digit to be entered will blink on the display.

To enter the Frequencies into the sub band (VFO-B), press the **V-B** button followed by **ENT** button, then referring to the orange numbers on the **BAND** button, enter the digits of the new frequency, from left to right ([2] - [1] - [.] - [3] - [5] - [0] - [0] - [0] - [0]), followed by **V-B** button again.

Note

Regarding AM Broadcast Reception

In many countries, broadcast stations in the Standard AM Broadcast Band are separated by a spacing of 9 kHz. The microphone's **UP/DWN** buttons can be highly useful in this case, as you can set the **UP/DWN** button's step size to 9 kHz via menu selection 121: AM CH STEP. If "9 kHz" has been set via menu selection 121, you can now use microphone's **UP/DWN** buttons to tune through the broadcast band in the desired 9 kHz steps.

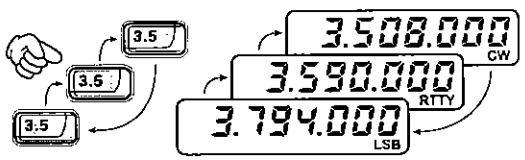
STACKED VFO SYSTEM ("FRONT, MIDDLE, & REAR" VFOS)

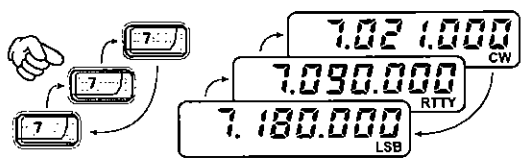
If you press the **BAND** button for the same band that you are already operating on, the display will shift to a different frequency in the same band. Pressing the same **BAND** button again display will shift to another different frequency in the same band. Pressing the same **BAND** button once again switches you back to the frequency you were on before. What you have here are three completely independent VFO selections for each (main and sub) band, selectable by each band's keypad key. You can think of the VFO for every band having a "front," "middle," and "rear" division that can be swapped for operation by toggling the **BAND** button. You can tune, and select a mode for each of these three VFO division in each band, and they will be remembered until you return to this particular VFO selection.

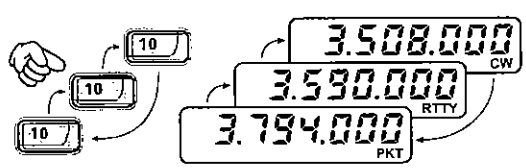
A practical use of this feature is to configure the top VFO for phone operation, the middle division for CW operation, and the bottom division for RTTY operation on the same band (see the illustration above).

For example, if one of your VFOs is set to the SSB portion of the band (and in an SSB mode), press the keypad key for that same band, tune to the low end of the band, and press the **CW** (mode) button. You can consider this your CW VFO. Press the keypad key for that same band again, tune to the low end of the band, and press the **RTTY** (mode) button. You can consider this your RTTY VFO. Now press the band key again several times, and notice that operation toggles the SSB, CW, and RTTY VFO division.

The Front, Middle, and Rear VFOs are preset to bottom of the band when you turn on the FTDX9000 for the first time.

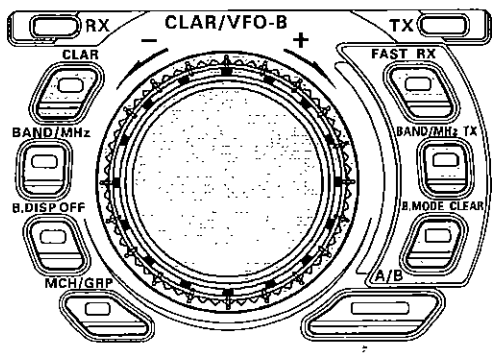






CLARIFIER (RX/TX OFFSET TUNING)

The **CLAR** button and **CLAR/VFO-B** knob are used to offset either the receive, transmit, or both frequencies from their settings on the main band (VFO-A) frequency (the Clarifier does not affect the sub band (VFO-B), however). The four small numbers on the Multi Display Window show the current Clarifier offset. The Clarifier controls on the **FTDX9000** are designed to allow you to preset an offset (up to ±9.999 kHz) without actually retuning, and then to activate it via the Clarifier's RX (**FAST RX**) and TX (**BAND/MHz TX**) buttons.



Perform the following steps, if you like, to familiarize yourself with the Clarifier controls:

- ❒ Press the **CLAR** button, then rotate the **CLAR/VFO-B** knob back and forth while watching on the Multi Display Window. Notice that the small digits change, indicating the preset Clarifier offset (which hasn't been applied to the Tx or Rx frequency yet) while the main display remains unchanged.
- ❒ If you press the **BAND/MHz TX** button, the LED inside the button will glow green, and if you press the **PTT** you will see the Tx frequency shift by the amount of Clarifier offset.
- ❒ If you press the **FAST RX** button instead, the LED inside the button will glow green, the frequency offset will be applied, and the display will shift to the offset receive frequency. Press the **PTT** switch, and notice that the transmit frequency remains the same as the original frequency display when the receive Clarifier is on. You can reset the offset to 0.000 kHz at any time by simply pressing **B.MODE CLEAR** button.
- ❒ With the RX Clarifier active, the Tuning Offset Indicator (just above the Main Tuning Knob) moves to the right or left as you change the offset by rotating the **CLAR/VFO-B** knob. Also notice that the main frequency and the Clarifier offset displays change together.
- ❒ To exit from Clarifier operation, press the **CLEAR** button. The main band (VFO-A) frequency will return to what it was originally, but the microprocessor will remember the clarifier offset, in case you want to return to it.

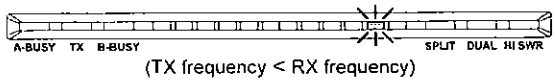
The Clarifier is commonly used when you are in contact with a station whose transmitter drifts (or perhaps you didn't have him quite tuned in when you called him). You don't want to change your transmitting frequency, as that would force him to retune - you just want to adjust your receiver.

Another application for the Clarifier is in a casual DX pile-up situation, where the DX station is listening in a "Split" mode (but listening "UP 5" or a similar split of less than 10 kHz). In this case, you leave the main receiver on the DX station's frequency, then use the RX Clarifier to tune the pile-up area, listening for the station currently in QSO with the DX station. When you find that station, you can switch the TX Clarifier On and the RX Clarifier Off; you will now be receiving back on the DX station's frequency, but you will be transmitting on the frequency where the DX station probably is still listening. See the discussion on page ?? regarding the use of the SPOT control for CW spotting; it speeds up the above process significantly.

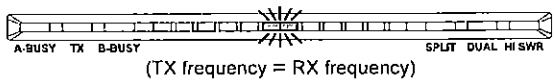
When you finish your QSO, remember to press the Clarifier RX button again to turn off the Clarifier. You might also want to clear the offset when done.

The **FTDX9000** has an independent Clarifier for "Stacked" VFO-A, on every band, plus one on each of the 99 memories. This means that Clarifier TX/RX and offset settings are not (improperly) carried over when you change bands or memory channels, but rather are stored in the same condition you last set them until you return to that VFO, band, sub receiver, or memory again.

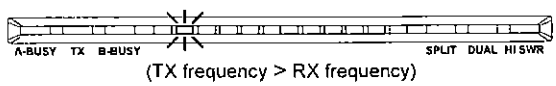
Customization: 1) You may change the Tuning Offset Indicator (located above the Main Tuning knob) indication to the Clarifier offset via the menu selection 111: BAR GRAPH.
2) You may select the resolution of the Tuning Offset Indicator via the menu selection 133: CLAR-DISP.



(TX frequency < RX frequency)



(TX frequency = RX frequency)



(TX frequency > RX frequency)

VOICE RECORDING

The internal Voice Recorder allows to record the main band (VFO-A) receiver audio for the most-recent 30 seconds.

Press and hold this button for 1/2 second to activates the recording feature of the internal Voice Recorder. While recording the receiver audio, the LED in this button glows red.

Press this button momentarily to stop the recording, then press this button momentarily again plays back the receiver audio for the most-recent 30 seconds before stopping the recording. While playing back the receiver audio, the LED inside button will glow umber.

Press and hold this button for 1/2 second again, resume the recording feature.

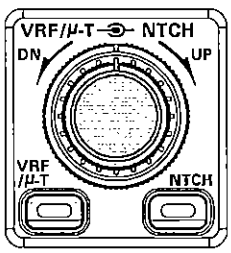
The **FTDX9000** includes a wide range of special features to suppress the many types of interference that may be encountered on the HF bands. However, real world interference conditions are constantly changing, so optimum setting of the controls is somewhat of an art, requiring familiarity with the types of interference and the subtle effects of some of the controls. Therefore, the following information is provided as a general guideline for typical situations, and a starting point for your own experimentation.

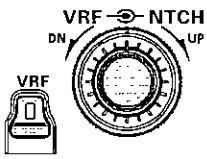
The **FTDX9000**'s interference-fighting circuitry begins in its "RF" stages, and continues throughout the entire receiver section. The **FTDX9000** allows configuration of the features described below independently on the main band (VFO-A) and sub band (VFO-B), except for the μ-TUNE (Narrow-bandwidth High-Q RF Filter) feature; the sub band (VFO-B) receiver does not have provision for a μ-TUNE module or modules.

VRF/μ-TUNE

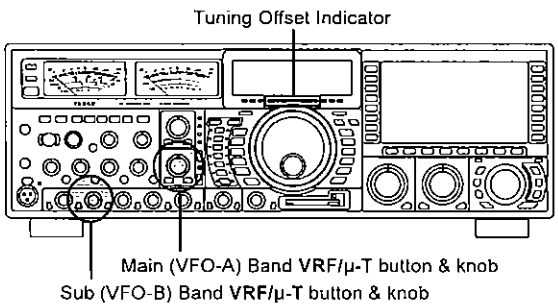
The VRF (Variable RF Front-end Filter) feature allows you to engage a narrow band-pass "preselector" filter into the receiver's RF circuit path. The μ-TUNE (Narrow-bandwidth High-Q RF Filter) feature (main band (VFO-A) receiver only) alternative is a very-narrow-bandwidth, high-Q RF filter in the receiver's RF circuit path. Either the VRF and μ-TUNE feature will add selectivity that can be a tremendous help in minimizing potential interference from strong close-in (μ-TUNE) or out-of-band (VRF) signals, especially in a multi-transmitter operating environment.

To activate the VRF/μ-TUNE feature, press the **VRF/μ-T** button, then turn the **VRF/μ-T** knob to peak the signal or background noise level. When the VRF/μ-TUNE feature is engaged, the LED in the **VRF/μ-T** button will be illuminated.

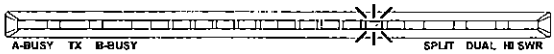




Note: The μ-TUNE feature only activates below the 14 MHz amateur band on the main band (VFO-A). The VRF feature will activate on and above 18 MHz on the main band (VFO-A), and all amateur bands on the sub band (VFO-B).



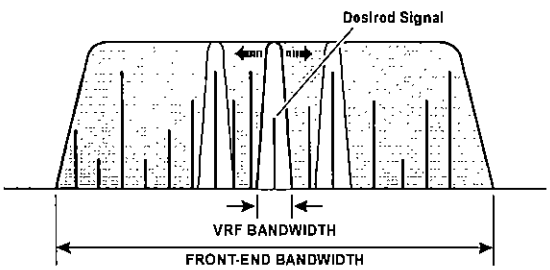
Customization: You may display the peak position of the VRF or μTUNE filter (main band (VFO-A) only) on the Tuning Offset Indicator via menu selection 111: BAR GRAPH.

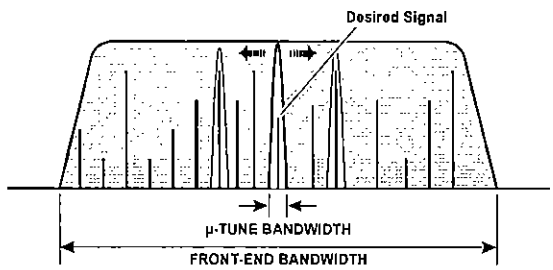


(Peak Tune: Shift to Band Higher)

(Peak Tune: Band Center)

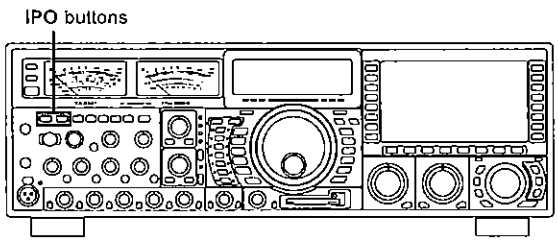
(Peak Tune: Shift to Band Lower)



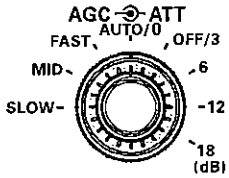


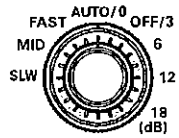
IPO (INTERCEPT POINT OPTIMIZATION)

Normally, the front-end FET RF amplifiers provide maximum sensitivity for weak signals. During typical conditions on lower frequencies (where strong signals on adjacent frequencies are common), the RF amplifiers can be bypassed by pressing the **IPO** button so that the button illumination is lit. This improves the IMD (intermodulation distortion) rejection characteristics of the receiver, with only a slight reduction of sensitivity. On frequencies below about 10 MHz, you generally will want to keep the IPO button engaged at all times, as the preamplifiers are usually not needed at these frequencies unless you are using a Beverage or other lossy receive antenna.



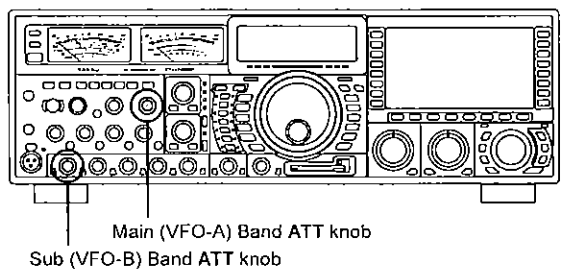
ATT (RF ATTENUATOR)



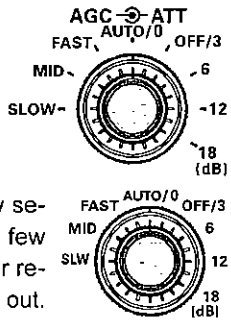


Even with the IPO function on, extremely strong local signals can still degrade reception. So if you still notice the effects of overloading, or if the signals you want to listen to are very strong, you can use the **ATT** knob to insert 3, 6, 12, or 18-dB of RF attenuation in front of the RF amplifier. If background noise causes the S-meter to deflect on clear frequencies, turn the **ATT** knob clockwise until the S-meter drops to about "S-1." This setting optimizes the trade-offs between sensitivity, noise, and interference immunity. Also, once you have tuned in a station you want to work, you may want to reduce sensitivity further (or add more attenuation) by turning the **ATT** knob to a more clockwise setting. This reduces the strength of all signals (and noise) and can make reception more comfortable, important especially during long QSOs.

When looking for weak signals on a quiet band, you will want maximum sensitivity, so the IPO should be disabled and the **ATT** knob should be set to "0." This situation is typical during quiet times on frequencies above 21 MHz, and when using a small or negative-gain receiving antenna on other bands.



AGC (AUTOMATIC GAIN CONTROL)

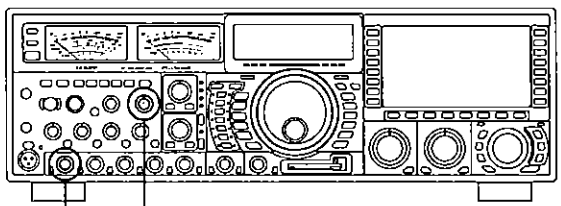


When tuning around the band looking for signals, the **AGC** knob is usually best kept in the "AUTO" position, where AGC decay is automatically selected according to the operating mode. You can manually select receiver AGC; however, a few points about AGC and receiver recovery time need to be pointed out.

For SSB reception, the "**FAST**" position allows the receiver gain to recover quickly after tuning past strong signals or when fast fading occurs. However, once you have a station tuned in, reception will usually be more comfortable if you switch to the "**MID**" position (keeping the receiver from picking up low-level noise during pauses in speech).

For CW reception, when several signals are present in the passband, the "**FAST**" position can avoid AGC "pumping" (gain fluctuations) caused by strong undesired signals.

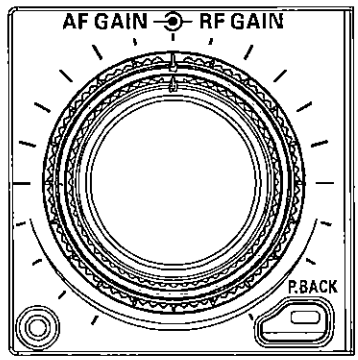
For AM reception, the "**SLOW**" position is usually better, and for 300-baud packet and RTTY/AMTOR, the "FAST" or "OFF" positions will usually give the fewest errors/retries.

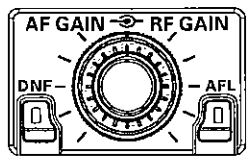


Customization: You may change the gain curve of the AGC amplifier via menu selection 1: AGC-MAG, and set the delay and hang times independently for the AGC FAST, MID, and SLOW on the main band (VFO-A) and sub band (VFO-B) via the menu selection 2: MAIN-AGC-FAST DELAY through 13: SUB-AGC-SLOW HOLD.

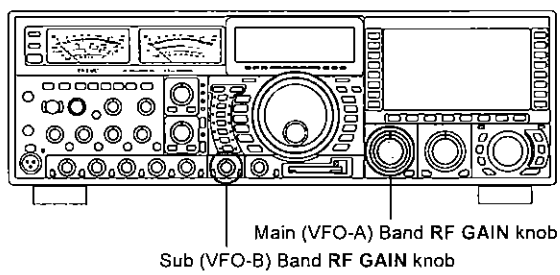
RF GAIN

When tuned to a moderate strength signal, if low level background noise is still present after setting the **ATT** knob, try reducing the **RF GAIN** knob from the fully clockwise position. This reduces the signal input to the first mixer via a PIN diode attenuator, and causes the minimum S-meter reading to move up the scale, often clearing up the background noise and putting the desired signal more "in the clear." Remember, however, to return this control fully clockwise when you want to receive weak signals, or read low levels on the S-meter. Also read the box on this page.





Note: The AGC "OFF" position disables the overload-protection normally provided by the AGC circuitry. If the **RF GAIN** knob is left fully clockwise in this condition, the RF and IF amplifiers can be easily overloaded (causing distortion) when a strong signal is received. Correct the overload either by setting the AGC selector to another position, or by turning the **RF GAIN** knob counterclockwise to set receiver gain to a comfortable level.



ROOFING FILTER SETTING

The **FTDX9000** provides three selectable roofing filters (in the receiver's VHF first IF) in bandwidths of 3 kHz, 6 kHz, and 15 kHz, to protect the following stages from strong signals that could degrade dynamic range in the first IF amplifier and subsequent stages.

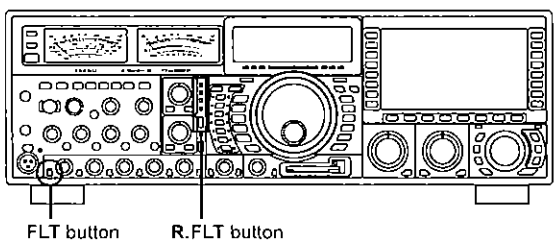
The Roofing Filter is usually best kept in the "AUTO" position; the red "AUTO" LED will be lit for the main band (VFO-A), and the LED inside the **FLT** button will glow umber for the sub band (VFO-B).

You can manually select the bandwidth, in response to current interference conditions, by pressing the **R.FLT** button for main band (VFO-A) or the **FLT** button for the sub band (VFO-B). On the main band (VFO-A), the "3k," "6k," or "15k" LEDs above the **R.FLT** button change according to the bandwidth selected. On the sub band (VFO-B), the LED inside the **FLT** button only indicates the difference between AUTO (where it glows umber) or manual selection (the LED will be off); however, you may confirm the current sub-receiver's roofing filter bandwidth in the TFT monitor.

ROOFING FILTER BANDWIDTH (@AUTO MODE)

MODE	BANDWIDTH
AM/FM/FM-PKT	15 kHz
SSB/PKT	6 kHz
CW/RTTY	3 kHz

Important Note: When the Noise Blanker is engaged (described later), the Roofing Filter's Bandwidth is selected to "15 kHz" automatically and illuminates the "AUTO" LED.



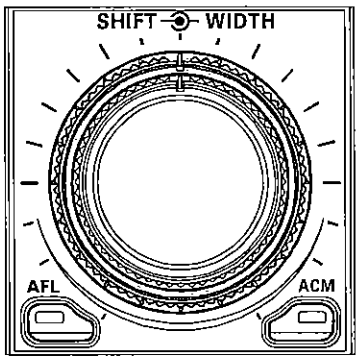
DSP FILTER (BANDWIDTH) SELECTION

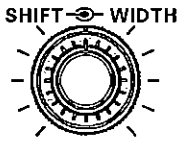
The **FTDX9000** provides digital IF filters which have suitable pre-set bandwidths for each of the operating modes on both the main band (VFO-A) and sub band (VFO-B). You do not need to select a filter, therefore, when changing the operating mode. If you wish to adjust the width or center frequency of the DSP filter, use the **WIDTH** and **SHIFT** controls (see next chapter), which have been crafted so as to emulate the characteristics of earlier analog cascaded-filter systems, only with the superior stopband rejection characteristics of a digital filtering system.

Customization: These mode-optimized DSP filters may be customized independently via Menu Selection 42: MAIN-CW-FIL-PASSBAND through 49: MAIN-SSB-FIL-SHAPE (for main band's (VFO-A) filters) and Menu Selection 51: SUB-CW-FIL-PASSBAND through 58: SUB-SSB-FIL-SHAPE (for main band's (VFO-A) filters).

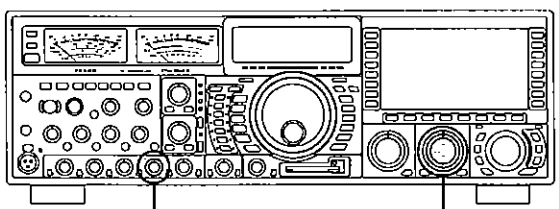
WIDTH CONTROL

In a crowded band, you ideally want to narrow the bandwidth just to the point where unwanted signals are attenuated, while still retaining enough bandpass to recover the desired station. In real-life band conditions, however, this ideal bandwidth is often somewhere "in-between" the several selectable filter bandwidths available on the receiver. In the **FTDX9000**, the DSP filtering provides continuous adjustment capability for the filter bandwidth, shape factor, and passband characteristics of the filter's response.





The **WIDTH** control can be used in all modes except FM continuously to narrow or broaden the bandpass skirt for the optimum cutoff and interference rejection during each QRM situation. Unlike older types of width controls that adjust both sides of the filter slope at the same time, the **FTDX9000**'s **WIDTH** control narrows the passband from either the upper or lower side (see illustration below). Thus, you only narrow the side of the bandpass where the QRM is located.



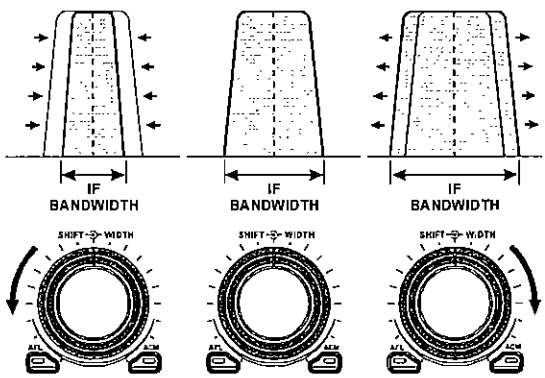
The fully clockwise position on the outer **WIDTH** knob provides maximum bandwidth, then counter-clockwise rotation reduce the bandwidth. If a QRM condition occurs after tuning in a station, slowly rotate the **WIDTH** knob counter clockwise to the position where the interference is reduced while the station is still workable. As you rotate the **WIDTH** knob you will hear the audio response change as the passband is narrowed. If the QRM is very close, the amount of bandwidth reduction necessary to cut the QRM may leave the desired station's audio unrecoverable, or it may not be possible to entirely eliminate the QRM.

When the QRM is only above or below the desired signal the **SHIFT** knob (covered next) will also work for reducing the interference.

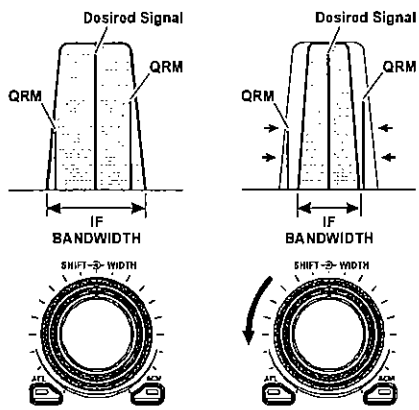
You will be able to see the effects of your changes in the TFT monitor.

Note: The **WIDTH** control is ignored when the **[NAR]** button is activated.

MODE	BANDWIDTH		
	FULLY CCW	CENTER	FULLY CW
SSB	200 Hz	2.4 kHz	2.95 kHz
CW/RTTY/PKT	25 Hz	1000 Hz	2.4 kHz



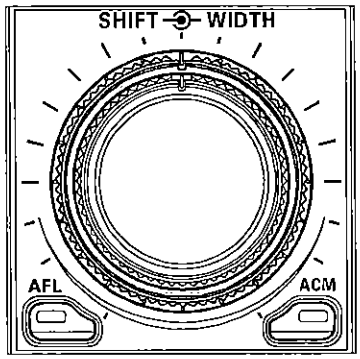
WIDTH ACTION

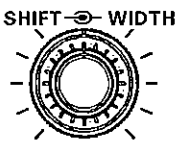


USING WIDTH CONTROL TO REDUCE QRM

SHIFT CONTROL

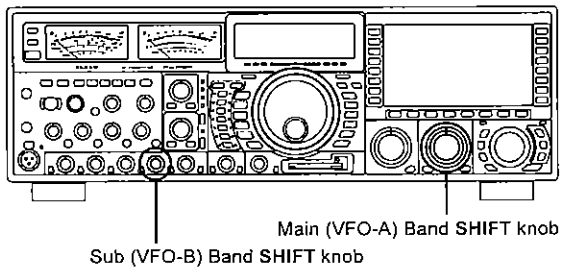
The **SHIFT** knob tunes the relative position of the receiver IF passband with respect to the displayed frequency in all modes except FM. The control is detented in the center position, which represents the passband center frequency, which is also the displayed frequency. Turning the **SHIFT** knob clockwise raises the passband center frequency, while turning the **SHIFT** knob counter-clockwise lowers it.

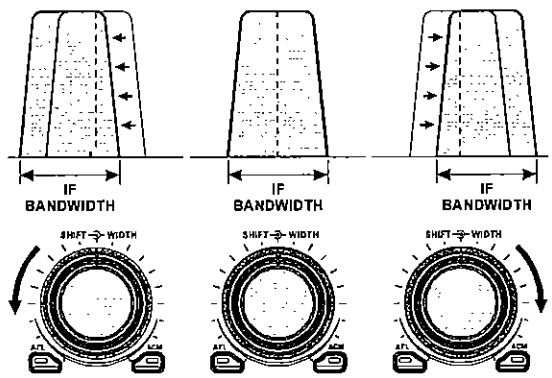




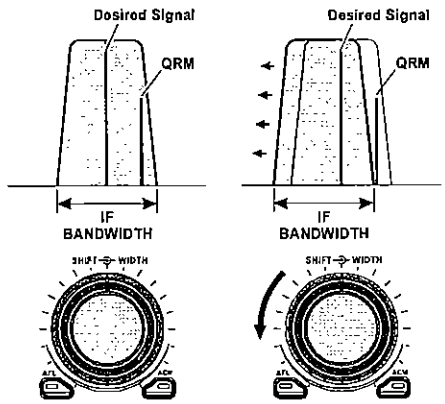
When QRM is present on both sides of the tuned station, first adjust the **SHIFT** knob just to the point where the interference from one side is eliminated, and then rotate the **WIDTH** knob in the opposite direction to eliminate interference from the other side. The optimum settings of these controls depend on the relative signal strengths of the desired station and the QRM, and practice will develop your intuition about how these controls may be most optimally utilized.

You will be able to see the effects of your changes in the TFT monitor.





SHIFT ACTION

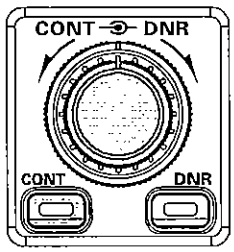


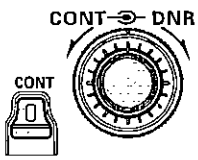
USING SHIFT CONTROL TO REDUCE QRM

DSP CONTOUR

QRM reduction may be enhanced by utilization of the variable DSP Contour control.

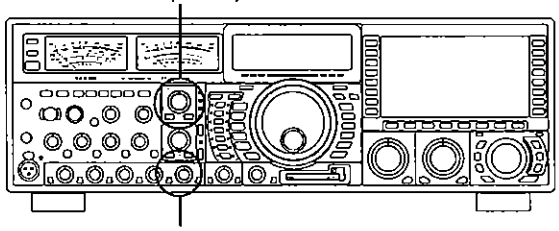
The Contour system is a pseudo-Parametric Equalization filter technique that allows emphasis or de-emphasis of the audio frequency ranges within the main passband (although it is the digital IF that is actually being adjusted). And the main and sub receivers have independent Contour filters, so each may be optimized separately.





Press the main band (VFO-A) receiver **CONT** button (located just below the S-meter) to activate the DSP Contour filter system; for the sub band (VFO-B) receiver, press the **CONT** button along the bottom edge of the front panel, directly below the main receiver **CONT** control. The LED inside the corresponding **CONT** button will become illuminated when the Contour filter system is engaged. Slowly adjusting the **CONT** knob to peak the passband response of the filter passband.

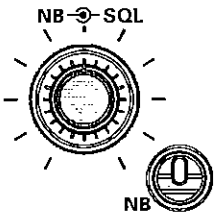
Main (VFO-A) Band **CONT** button & knob



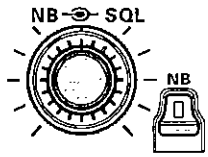
Sub (VFO-B) Band **CONT** button & knob

Customization: The Q and gain of the response may be adjusted via Menu Selections 17: MAIN-CONT-GAIN and 18: MAIN CONT-Q for the main band (VFO-A) receiver, and Menu Selections 19: SUB-CONT-GAIN and 20: SUB CONT-Q for the sub band (VFO-B) receiver.

NOISE BLANKER (ANALOG IF)



Press the **NB** button to activate the IF Noise Blanker; the LED inside the **NB** button will appear. Rotate the **NB** knob to the point where the interfering noise is eliminated.

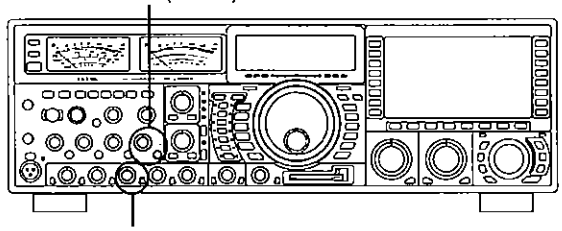


If the blanker seems to distort a signal you're listening to, reduce the setting for optimum readability, or turn it off. During periods of extreme signal density (such as a contest), the noise blanker is best left off.

The analog IF Noise Blanker may be used in tandem with the Digital IF Noise Reduction (see the next section), providing two methods of reducing or eliminating noise that is interfering with effective communication.

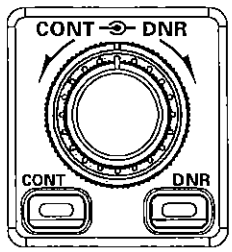
Important Note: When the Noise Blanker is activated, the Roofing Filter's Bandwidth is selected to "15 kHz" automatically and illuminates the "AUTO" LED, if engaged.

Main (VFO-A) Band **NB** button & knob

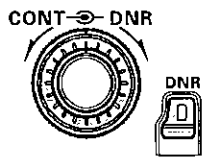


Sub (VFO-B) Band **NB** button & knob

EDSP NOISE REDUCER

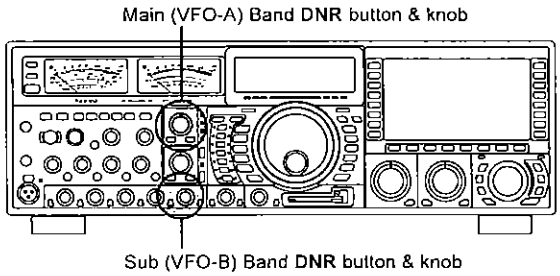


Noise reduction is accomplished by utilization of the DSP Noise Reduction filter. Utilizing sixteen different mathematical algorithms for reduction of the noise profiles observed on the HF and 50 MHz bands.

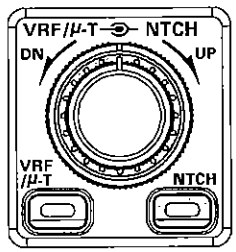


Press the **DNR** button to activate the EDSP Noise Reducer; the LED inside the **DNR** button will become illuminated. Slowly adjusting the **DNR** knob will cause the incoming noise to be reduced, and you should try different settings for different noise types, as changing noise conditions may call for a different noise reduction algorithm for maximum effect.

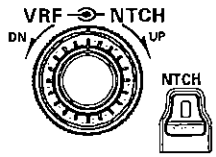
The EDSP Noise Reducer system may be used in tandem with the Analog IF Noise Blanker (see the previous section), providing two methods of reducing or eliminating noise that is interfering with effective communication.

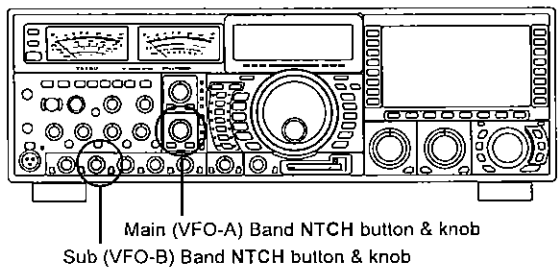


IF DSP NOTCH FILTER (MANUAL)

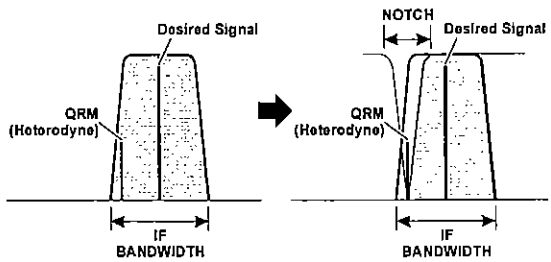


If "heterodyne" interference such as from a carrier or CW signal occurs, activate the DSP Notch filter by pressing the **NTCH** button and slowly adjusting the **NTCH** knob to null the offending carrier. Note that if the interfering carrier is more than about ±1.2 kHz away from the center of the passband, the notch filter may be unable to null it. In this case, switch the notch filter off, and readjust the **WIDTH** and **SHIFT** controls so that the undesired carrier is outside of the passband.





Customization: You may change the bandwidth of the IF DSP Notch via menu selection 41: IF-NOTCH.

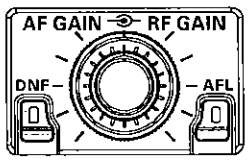


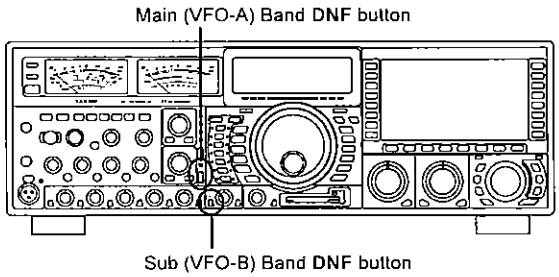
USING DSP MANUAL NOTCH FILTER TO REDUCE QRM

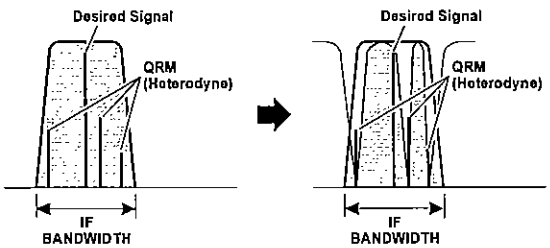
DSP AUTO-NOTCH FILTER

The **DNF** button serves as an On/Off switch for the DSP auto-notch filter, which automatically locates incoming heterodynes and notches them out. Any additional heterodynes are also notched as they appear.

The DNF system is most typically used in a voice operating environment, where incoming carriers are, most likely, interfering with communication. The DSP manual Notch Filter, by comparison, may be used on a mode like CW, where one carrier is interfering with another (desired) carrier (a CW station). If the auto-notch filter were used on CW, all the (desired) CW signals would be notched out!



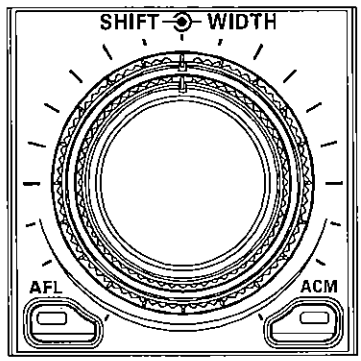


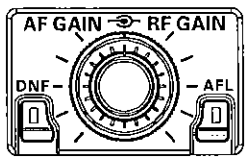


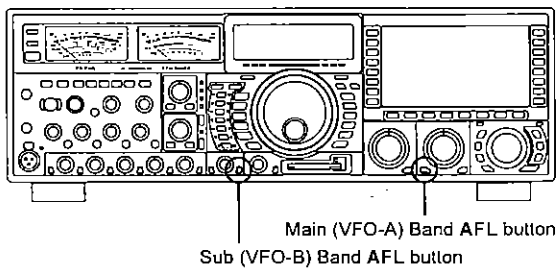
USING DSP AUTO-NOTCH FILTER TO REDUCE QRM

AUDIO (AF) LIMITER

The **AFL** button serves as an On/Off switch for the Audio (AF) Limiter circuit, which protect the audio amplifier from distortion, and protect your ears from high audio levels, caused by sudden peaks in audio input. When the Audio Limiter circuit is activated, the LED inside the button will become illuminated.







The transmitter can be activated within the 500-kHz segment of any of the HF, 28 MHz, and 50 MHz amateur bands. When tuned to any other frequency, the transmitter is disabled. However, you are responsible to restrict your transmissions to those frequencies on which you are authorized to operate, per the terms of your amateur license. You should also restrict transmissions to the frequencies for which your antenna is designed.

Attempting to transmit outside of an amateur band segment will cause the red "TRANSMIT" indicator to the right of the meter to blink. The transmitter is also temporarily inhibited when stopping memory scanning (described later), as pressing the **PTT** switch while scanning just causes the scanner to stop.

Whenever the transmitter is activated, the **FTDX9000** automatically detects any reflected power that might appear at the main antenna jack (as a result of an impedance mismatch), and disables the transmitter if too much reflected power is found (in which case the red "HI SWR" indicator at the right side of the Main Tuning Knob will be lit). Although this protection system should prevent any damage to the transceiver, we still recommend that you never activate the transmitter without having a proper antenna connected to the **ANT** jack.

PREPARATION

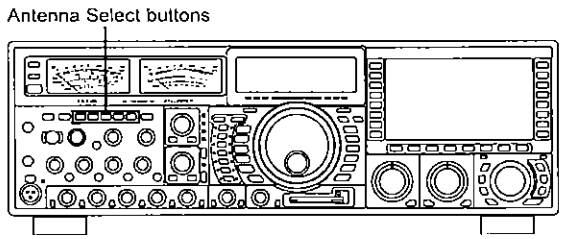
Selecting Antennas

You can select between four rear-panel antenna connectors for transceive operation via the front panel, perhaps eliminating the need to utilize an external coaxial switch.

Press the Antenna Select [**1**] through [**4**] button to select the rear-panel jack you wish to use. The antenna connected to this jack is used for receive (and always for transmit). If a separate receive-only antenna is connected to the **RX ANT** jack, and the front panel's [**RX**] switch is pressed, the antenna connected to the **RX ANT** jack will be used by the receiver. A relay engages during transmit, and the last-selected antenna ("**1**" through "**4**") will be used for transmit.

Antenna selections are automatically copied along with other operating parameters during memory programming (covered later), and will take effect when memories are recalled later.

Customization: The **FTDX9000** select the antenna in accordance with the operating band in the factory default. However, you may change the antenna selection method to accordance with the band stack (different antennas may be utilized on the same band, if so selected in the band stack) via menu selection 101: ANT Select.



PREPARATION

Automatic Antenna Matching

The built-in automatic antenna tuner unit is capable of matching antenna with impedances from 20 ~ 150 Ohms, which corresponds to a maximum SWR of approximately 3.0:1. If the antenna you are using exceeds this SWR as configured, it must be adjusted (mechanically or electrically) until a feedpoint impedance closer to 50 Ohms can be obtained.

The **FTDX9000** provides 39 tuner memories, which store the exact positions of the tuning capacitors and corresponding inductance values, for outstanding operating convenience.

When you use the tuner the first time on an antenna, set the **RF PWR** knob to around the 9 o'clock position, to minimize interference you might cause others, and also to minimize stress on the tuner, feedline, and antenna (in case there is a high SWR). Ensure beforehand that the frequency you will transmit on is clear of other signals. Also, if you want to monitor the tuner's action visually, set the METER knob to "SWR" position.

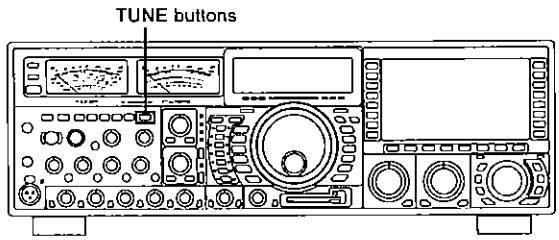
When the channel is clear, press and hold the **TUNE** button for 1/2 second. The LED in the button blink red, while the tuner seeks the proper matching settings (and, if monitoring SWR on the meter, you should see the tuner select the lowest possible reading). When the LED in the button changes to still red, you are ready to transmit (so long as the "HI SWR" indicator didn't light). Furthermore, pressing and holding in the **TUNE** button is the action which causes ATU settings to be stored into memory.

If the SWR presented to the transceiver is above 3:1, the tuner will generally not complete the tuning process (although in certain borderline cases, it may actually be able to lower the SWR below 1.5:1). If the pre-tuning SWR is above 3:1, the auto-tuner will not store the tuning settings, under the presumption that corrective antenna work is required.

After using the antenna tuner (unless you press the **TUNE** button to turn it off), the **TUNE** button will blinks when you change frequency, 

indicating that the main microprocessor is reporting the frequency change to the tuner coprocessor (reception is unaffected). If you have tuned far enough to possibly require rematching, it will reset itself to the new range (if it has any previously stored settings for the new range). However, when you first connect a new antenna, the tuner will not have the correct settings stored in these memories, so you will need to "train" the tuner, by pressing and holding the **TUNE** button for 1/2 second whenever you change to a new band or frequency range (for this antenna).

To disable the automatic antenna tuner unit, just press the **TUNE** button momentarily, so that its red LED turns off.

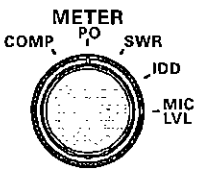


Note: The "G5RV" multiband antenna does not present an SWR below 3:1 on all HF amateur bands, despite its reputation as an "all-band" antenna. You will need to perform additional impedance matching with respect to the basic G5RV design, especially on 30, 17, and 12 meters.

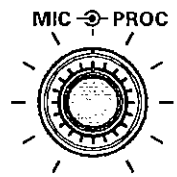
GENERAL

To transmit in LSB or USB mode:

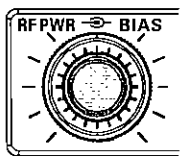
- ❒ In the factory default, the microphone to be used on the SSB mode set to the microphone which is connected to the front panel's microphone jack. If you use the traditional YAESU microphone, switch the microphone input to the rear panel's microphone jack via the Menu Mode (see box at the bottom).
- ❒ Make sure the appropriate mode indicator is lit, and set the **METER** knob to "**PO**" position.



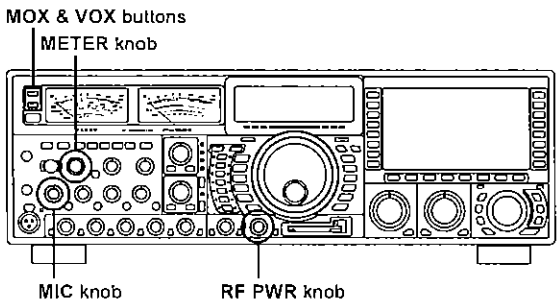
- ❒ If this is the first time you are transmitting SSB with the **FTDX9000**, preset the **MIC** and **RF PWR** knobs to about the 12 o'clock position, and make sure the **VOX** is off (the LED in the button turns off).



- ❒ Check the "RX" and "TX" LEDs above the tuning knobs to determine which frequency you're going to transmit on, and make sure the frequency is set on the amateur band.



- ❒ To transmit, just press the front panel's **MOX** button or **PTT** (push-to-talk) switch which is connected to the rear panel's **PTT** Jack, and speak into the microphone.



- ❒ To determine the optimum setting of the **MIC** knob for your microphone, adjust it while speaking into the microphone (at a normal level) so that the Sub Meter deflects to about midrange on voice peaks (red ALC range). Once found, this setting can be left as-is unless you change microphones. The proper adjustment point for most commonly-available amateur microphones is a setting between about 9 o'clock and 10 o'clock.
- ❒ You can adjust the **RF PWR** knob for more or less output, from about 5 to 200 watts (on the PO meter scale of the Main Meter), as desired. However, you should always use the lowest possible power output to maintain reliable communications - not only as a courtesy to other stations, but to minimize the possibility of causing overload to nearby home-entertainment devices, and to reduce heat generation and maximize the life of the equipment.

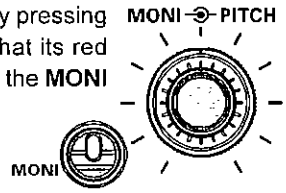
SSB MICROPHONE SELECTION

- ❒ Press the **MNU** key located at the bottom right of the TFT display to enter the Menu Mode.
- ❒ Rotating the Main Tuning Knob to select the Menu Selection 102: SSB MIC SEL.
- ❒ Rotating the **CLAR/VFO-B** knob to select "FRONT."
- ❒ After completing your adjustment, press and hold the **MNU** key for 1/2 second to save the new setting and exit to normal operation.

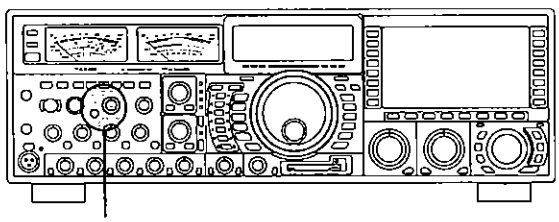
TRANSMITTER MONITOR

The transmitter monitor is actually a separate receiver circuit which picks up a sample of your transmitted RF signal, allowing you to hear accurately how the signal sounds. This feature is very helpful for setting up the speech processor controls, among other things.

- ❒ Activate the monitor by pressing the **MONI** button so that its red LED lights, and adjust the **MONI** knob for a comfortable volume while transmitting.



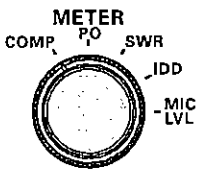
- ❒ Audio feedback of your signal from the loudspeaker to the microphone may occur if the **MONI** knob is not properly set, you may want to use the monitor with headphones; if so you should plug them in now.
- ❒ To disable the monitor function, just press the **MONI** button momentarily, so that its red LED turns off.



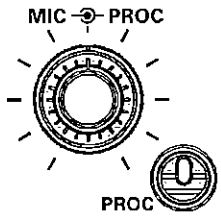
RF SPEECH PROCESSOR

Once the proper **MIC** knob setting has been determined, you can activate the RF speech processor to increase the average power of your transmitted signal.

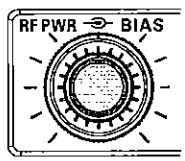
- ❒ Set the **METER** knob to the "COMP" (speech processor compression) position, and press the **PROC** button so that its red LED lights.



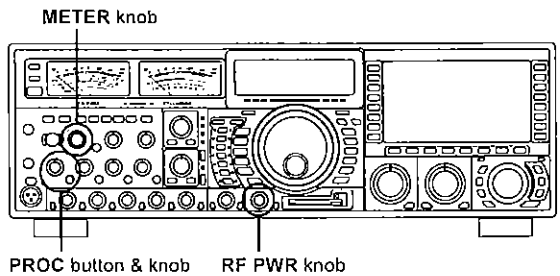
- ❒ Now while speaking into the microphone, adjust the **PROC** knob for a compression level of 5 to 10 dB on the COMP scale of the Main Meter. If you have the monitor activated, you will be able to hear the effect of the compression on your signal. In any case, we do not recommend higher compression settings, as your signal will actually become less readable. For the purposes of making accurate adjustments, the long utterance of the word "Four" usually provides a stable, full voice waveform, ideal for setup of the RF speech processor.



- ❒ Finally, move the **METER** knob to the "PO" position, and (without touching the MIC knob setting) adjust the **RF PWR** knob for the desired power output on voice peaks.



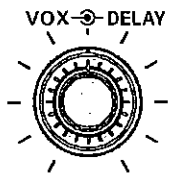
- ❒ To disable the RF speech processor, just press the **PROC** button momentarily, so that its red LED turns off.



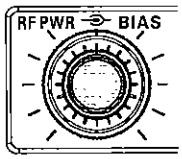
Note: This feature effects to AM mode not only SSB mode.

VOX OPERATION

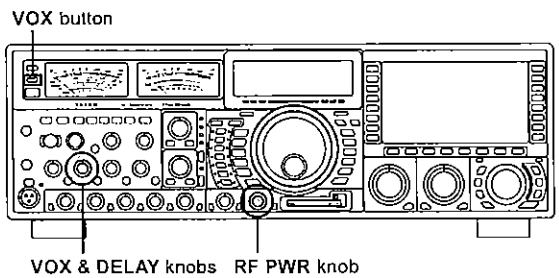
VOX (Voice-Actuated T/R Switching) operation allows you to activate the transmitter in any voice mode merely by speaking into the microphone, without having to press the **MOX** button or **PTT** switch.



- First make sure the receiver is set for normal volume on a clear channel, and preset the **VOX** knob fully counterclockwise. Also preset the **DELAY** (VOX Delay) knob to the 12 o'clock position.
- Set the **RF PWR** knob fully counter clockwise (to avoid creating interference while you set up the VOX controls). Now press the **VOX** button so that its red LED lights.



- Without pressing the **MOX** button or **PTT** switch, speak continuously into the microphone while slowly adjusting the **VOX** knob, looking for the point where your voice just activates the transmitter. Advancing the **VOX** knob beyond this point will make the VOX excessively sensitive to random background noise in your operating room.
- Now speak intermittently into the microphone, and note the "hang time" between the moment you stop speaking and when the receiver is reactivated. This period should be just long enough so that the transmitter remains keyed between words, but drops back to receive during pauses. Adjust the **DELAY** knob, if necessary, for a comfortable hang time.
- To disable the VOX operation, just press the **VOX** button momentarily, so that its red LED turns off.



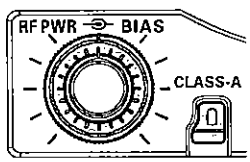
Note: This feature effects to AM and FM modes not only SSB mode.

CLASS-A OPERATION

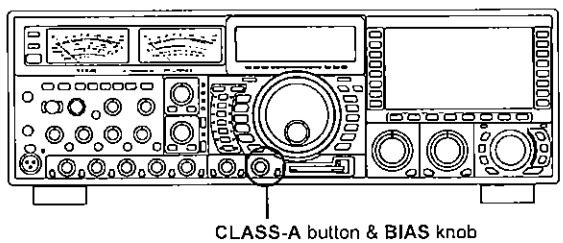
A unique feature of the **FTDX9000** is the capability to operate SSB in Class AB to Class A variably. Switching to Class A yields an ultra-linear transmitted signal, with intermodulation distortion products significantly better than possible with a typical Class AB transmitter design.

Because Class A involves a total current dissipation much greater than utilized for Class AB, to which you're probably accustomed, maximum power output during Class A is limited to 75 Watts as indicated on the PO meter.

- To enable this feature, press the orange **CLASS-A** button (located below and to the left of the Main Tuning Knob) while operating either in USB or LSB, then adjust the bias current by the BIAS knob. When the **BIAS** knob is set to fully counter clockwise, the **FTDX9000** is operated SSB in Class AB. When the **BIAS** knob is set to fully clockwise, the **FTDX9000** is operated SSB in Class A.



- During Class-A operation, the PO meter will indicate up to 75 Watts of power output, while the ID meter will show a no-modulation (constant) current of approximately 10 Amps. Although the full advantage of Class-A operation will be compromised somewhat when a (non-Class-A) linear amplifier is used, the very clean drive power from the **FTDX9000** will, nonetheless, provide a significant improvement in overall signal quality.
- To disable Class A operation, just press the orange **CLASS-A** button momentarily, so that its red LED turns off.



Note: The Class A feature operate to AM mode not only SSB mode. However, the limit transmitter carrier power to 18.5 watts in the AM mode

SSB MODE CUSTOMIZATION

TX EDSP Filter Bandwidth

You may select the audio response tailoring of the Enhanced DSP modulator via the Menu Selection 50: SSB-TX-BPF. Available selections are 10-3000 Hz, 100-2900 Hz, 200-2800 Hz, 300-2700 Hz (factory default), and 400-2600 Hz.

Microphone Equalizer

The **FTDX9000** allows to divide the bandwidth of the parametric microphone into four, and can be adjusting a parametric equalizer gain and it Q-factor individually in each bandwidth.

Two individual microphone settings can be user-adjusted via menu mode.

Menu Selection 21: MICF-EQ-FREQ1 through Menu Selection 29: MICF-EQ-Q3 are adjusted to the front panel's microphone.

Menu Selection 30: MICR-EQ-FREQ1 through Menu Selection 38: MICR-EQ-Q3 are adjusted to the front panel's microphone.

Note: This feature effects to AM and FM modes not only SSB mode.

Carrier Point Offset

This feature allows shifting the carrier point IF passband (and hence the RF passband as well) of your transmitted signal in the SSB mode, to customize your signal for your own voice characteristics.

Four individual carrier settings can be user-adjusted via menu mode.

Menu Selection101: LSB RXCAR (Carrier)
- adjustable from –200 ~ +100 Hz.

Menu Selection102: LSB TXCAR (Carrier)
- adjustable from –200 ~ +100 Hz.

Menu Selection104: USB RXCAR (Carrier)
- adjustable from –200 ~ +100 Hz.

Menu Selection105: USB TXCAR (Carrier)
- adjustable from –200 ~ +100 Hz.

You can adjust the carrier setting throughout the ranges shown above. A minus sign indicates the offset is closer to the carrier (low-frequency speech emphasized). You can transmit during carrier display and adjustment.

Of course, you can adjust the offset by trial-and-error on the air, but it is better to use the built-in monitor circuit or a monitor receiver, in which you can hear the effect yourself. Otherwise, we recommend starting with +0.10 (+100 Hz) offset initially, to add some "crispness" to your processed speech.

GENERAL

There are several types of CW transmission available with the **FTDX9000**. All require that you have a CW key or keyer paddles connected to either of the **KEY** jacks on the front or rear panel (with a 3-contact plug). You simply use the **RF PWR** knob to set your output power.

The built-in electronic keyer offers two iambic modes and a mechanical "bug" keyer emulation. You will need to connect keyer paddles to one of the **KEY** jacks to use the keyer. At the factory default, the front panel's keyer is set for iambic keying, in which one keyer paddle produces dots, and the other dashes. Squeezing both produces alternating dits and dahs. The rear panel's keyer is set for straight keying.

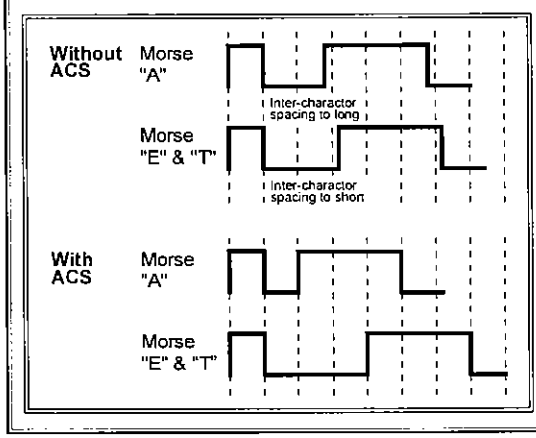
However, you may choose the keyer setting to via the Menu Selection 75: KEYER FRONT for the front panel's keyer and Menu Selection 76: KEYER REAR for the rear panel's keyer. Available selections are OFF, BUG, EL, and ACS.

- OFF: Disables the electronic keyer ("straight key" mode for use with external keyer or computer-driven keying interface).
- BUG: Mechanical "bug" keyer emulation. One paddle produces "dits" automatically, while the other paddle manually produces "dahs."
- EL: Iambic keyer with ACS (Automatic Character Spacing) disabled.
- ACS: Iambic keyer with ACS (Automatic Character Spacing) enabled.

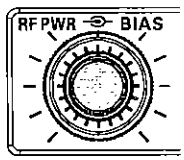
ACS (AUTO CHARACTER SPACING)

This feature improves your CW sending quality by ensuring the inter-character spacing of dots and dashes remains constant. Although dot/dash weighting is automatically maintained at the desired ratio, the inter-character spacing can sometimes vary from operator to operator, and proportional spacing is sometimes not maintained. This does not present much of a problem during slow CW sending, but at higher speeds, the effect is more pronounced and sometimes makes copy difficult.

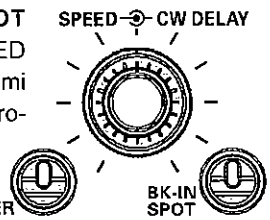
ACS works on the principle that the spacing between characters should be 3x the duration of the "dot." If you utilize the standard 3:1 dash:dot ratio, this also happens to be the same duration of a "dash." Maintaining this inter-character spacing is what prevents the sent characters "E" and "T," for example, from merging into what sounds like the character "A" (see illustration).



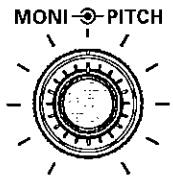
STRAIGHT-KEY OPERATION



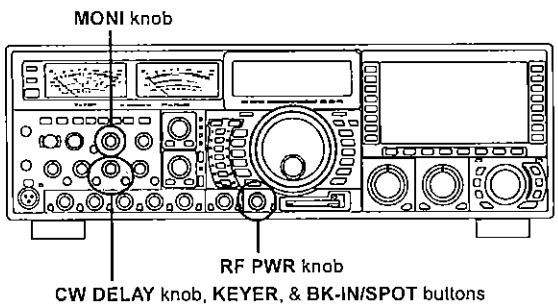
- First preset the **RF PWR** knob to about 12 o'clock. Select the CW mode, if you haven't already, and for now, make sure the **KEYER** and **BK-IN/SPOT** buttons are both off (its red LED is turned off).

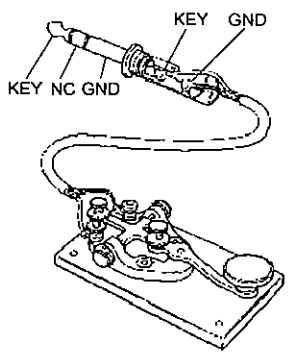


- Press the **BK-IN/SPOT** button so that its red LED lights, to turn on the semi break-in circuit which provides automatic transmitter activation when you close your key. If you want to practice CW with the sidetone, you can leave the semi break-in off.

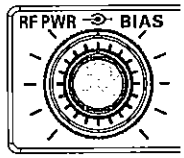


- Adjust the **MONI** knob for confortable volume on sidetone.
- To transmit, simply close your key and advance the **RF PWR** knob for the desired power output level.
- Release the key to return to receive.
- You are now using semi break-in, in which the transmitter remains activated except during pauses in your sending. You can set the delay during which the transmitter remains on after you stop sending, by adjusting the **CW DELAY** knob.
- If you prefer full break-in (QSK) operation, in which the receiver is activated between each dot and dash, switch the CW break-in mode to full break-in via the Menu Selection 69: CW BK-IN.

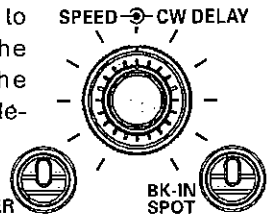




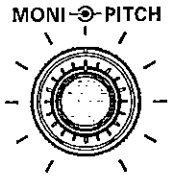
ELECTRONIC KEYER OPERATION



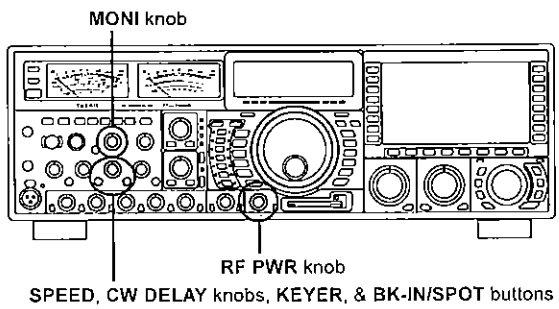
- First preset the **RF PWR** knob to about 12 o'clock. Select the CW mode.
- Press the **KEYER** button so that its red LED lights, to activates the built-in electronic keyer.

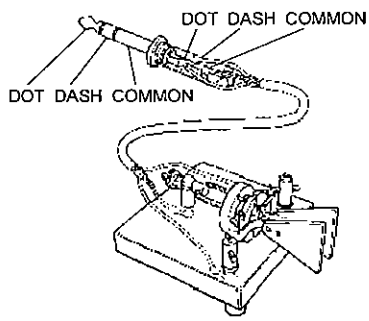


- Squeeze your paddle to practice CW with the sidetone, adjust the **SPEED** knob for the desired sending speed (if you are using the bug simulator mode, don's squeeze both paddles; just press the "dot" paddle).



- Adjust the **MONI** knob for confortable volume on sidetone.
- Press the **BK-IN/SPOT** button so that its red LED lights, to turn on the semi break-in circuit which provides automatic transmitter activation when you squeeze your paddle.
- Squeeze your paddle to transmit and advance the **RF PWR** knob for the desired power output level.
- Stop the keying to return to receive.
- You are now using semi break-in, in which the transmitter remains activated except during pauses in your sending. You can set the delay during which the transmitter remains on after you stop sending, by adjusting the **CW DELAY** knob.
- If you prefer full break-in (QSK) operation, in which the receiver is activated between each dot and dash, switch the CW break-in mode to full break-in via the Menu Selection 69: CW BK-IN.





KEYER CUSTOMIZETION

Keyer Weight

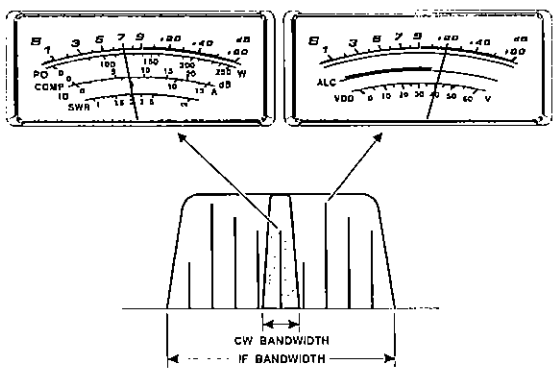
You may selects the Dot:Dash ratio for the built-in electronic keyer via the Menu Selection 74: CW WEIGHT. Available selection are (1:) 2.5 ~ 4.5. The factory default is 1:3.0.

CW Break-In

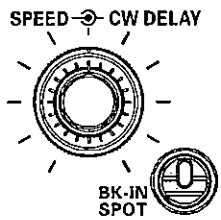
The switching time of the CW carrier waveform can be adjusted from 10 to 40 milliseconds (in 5 milliseconds step) for use with linear amplifiers with T/R switching circuits not designed for full-QSK operation via the Menu Selection 78: QSK. This feature provides a programmable delay in the total CW envelope character string, not a simple truncation of the first character.

Paddle Wiring Configuration

You may select the keyer paddle's wiring configuration of the KEY jack on the front panel via the Menu Selection 71: CW KEY F, and the rear panel via the Menu Selection 72: CW KEY R, independently. The Factory default is NOR (Tip = Dot, Ring = Dash, Shaft = Ground).



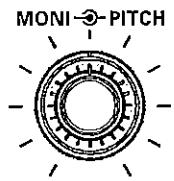
CW Pitch Setting and Spot Tone



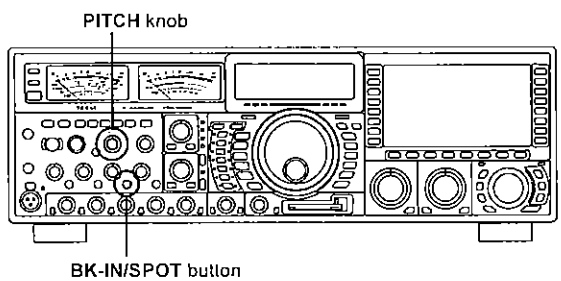
In the CW mode (only), activates the spotting oscillator while press and holding the **BK-IN/SPOT** button. The frequency of this tone is also (exactly) the frequency at which your transmitted signal will appear relative to that of the incoming signal.

Therefore, if you match the pitch of the SPOT oscillator's tone to the pitch of an incoming signal, you will be exactly "zero beat" with that station's CW signal. In a DX pile-up situation, you can match your transceiver's SPOT tone with that of the station being worked by the DX station, so as to be "next in line" on the same frequency. This SPOT signal is centered in the receiver section's IF passband, as well, which ensures that you will not lose track of his signal when switching to a narrower filter. Of course, release the **BK-IN/SPOT** button to turn off the spotting oscillator once frequency alignment has been completed.

The CW Pitch can be set from 300 ~ 1050 Hz (in 50-Hz increments) to match your personal operating preference. The CW Pitch feature adjusts the amount of offset from "zero beat" of your CW carrier, as well as the corresponding pitch of the CW SPOT tone; it also adjusts the center frequency of the receiver's IF passband, so as to be aligned with the other offset parameters just mentioned. The CW Pitch may also be adjusted to match that used by popular TNC (Terminal Node Controller) units and other CW decoders.



To adjust the CW pitch (and SPOT tone along with it), pressing and holding **BK-IN/SPOT** knob then rotate the **PITCH** control to set the tone to the pitch you prefer, or that used by your TNC or CW decoder. The SPOT tone volume can be adjusted using the **MONI** knob.



CW MODE CUSTOMIZATION

CW Carrier Injection

You may select the CW carrier oscillator injection side via the Menu Selection 68: CW BFO. Available selections are USB (factory default), LSB, and AUTO.

- USB: Injects the CW carrier oscillator on the USB side.
- LSB: Injects the CW carrier oscillator on the LSB side.
- AUTO: Injects the CW carrier oscillator on the LSB side while operating on the 7 MHz band and below, and the USB side while operating on the 10 MHz band and up.

CW SHAPE

You may select the CW carrier wave-form shape (rise/fall times) via the Menu Selection 73: CW SHAPE. Available Selections are 1, 2, 4 (factory default), and 6 msec.

CW Frequency Display

You may select the frequency display format between the actual carrier frequency (FREQ) and the reflect the added BFO offset (PITCH) via the Menu Selection 70: CW FREQ. The factory default is PITCH (reflect the added BFO offset).

Enables CW keying while operating on SSB

You may enable the CW keying while operating on SSB via the Menu Selection 67: CW AUTO MODE, which allows you to move someone from SSB to CW without having to change modes on the front panel. Available selections are OFF (factory default), 50M, and ON.

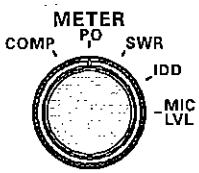
- OFF: Disables CW keying while operating on SSB.
- 50M: Enables CW keying only while operating SSB on 50 MHz.
- ON: Enables CW keying while operating on SSB.

GENERAL

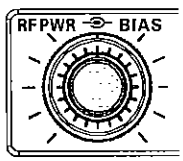
Transmitter setup for the AM mode is essentially the same as for LSB or USB, except that you must avoid overmodulating, and limit carrier power to 50 watts. This carrier level ensures that sufficient power is available for the voice sideband envelopes. Microphone gain for AM is set via the Menu Mode separately, and normally needs no adjustment after leaving the factory. If you receive signals reports of low audio with a strong carrier, you may want to increase the gain. If you notice distortion in the transmit monitor, you may want to decrease the AM MIC gain (see box at the bottom).

- ❒ In the factory default, the microphone to be used on the AM mode set to the microphone which is connected to the front panel's microphone jack. If you use the traditional YAESU microphone, switch the microphone input to the rear panel's microphone jack via the Menu Mode (see box at the bottom).
- ❒ VOX can be used in the AM mode, but for now, make sure the **VOX** button is off (its red LED is turned off), so as not to confuse adjustments.

- ❒ Set the **METER** knob to the "PO" position.

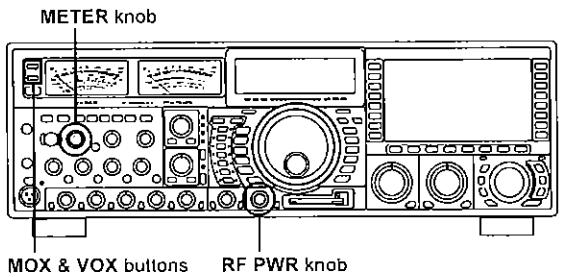


- ❒ Press the **MOX** button or **PTT** switch, and rotate the **RF PWR** knob for the desired power output (remember to limit transmitter carrier power to 50 watts in the AM mode).



- ❒ Press the **MOX** button or **PTT** switch, and speak into the microphone in a normal voice level.

Note that the speech processor an VOX circuit can be activate in the AM mode, if desired.



AM MIC GAIN SETTING

- ❒ Set the **METER** knob to the "MIC LEL" position which monitor the microphone input level.
- ❒ Press the **MNU** key located at the bottom right of the TFT display to enter the Menu Mode.
- ❒ Rotating the Main Tuning Knob to select the Menu Selection 65: AM MIC GAIN.
- ❒ Rotating the **CLAR/VFO-B** knob while speaking into the microphone (at a normal level) so that the Main Meter ("MIC LEL" meter) deflects to about midrange on voice peaks (S9 on the S-meter scale).
  If this parameter is set to "MCVR" which is found below level "0", you may adjust the AM MIC Gain by the front panel's **MIC** knob.
- ❒ After completing your adjustment, press and hold the **MNU** key for 1/2 second to save the new setting and exit to normal operation.

AM Microphone Selection

- ❒ Press the **MNU** key located at the bottom right of the TFT display to enter the Menu Mode.
- ❒ Rotating the Main Tuning Knob to select the Menu Selection 66: AM MIC SEL.
- ❒ Rotating the **CLAR/VFO-B** knob to select "FRONT."
- ❒ After completing your adjustment, press and hold the **MNU** key for 1/2 second to save the new setting and exit to normal operation.

AM MODE CUSTOMIZATION

TX EDSP Filter Bandwidth

You may select the audio response tailoring of the Enhanced DSP modulator via the Menu Selection 39: AM-TX-BPF. Available selections are 10-3000 Hz, 100-2900 Hz, 200-2800 Hz (factory default), 300-2700 Hz, and 400-2600 Hz.

NOTE

GENERAL

Information regarding connection of your **FTDX9000** to commonly-available digital-mode modem devices is presented beginning on page ??.

Operating practices generally are governed by details provided in the operating manual for the TNC or modem you are using. However, a few guidelines are presented below, to help you get on the air quickly.

RTTY OPERATION

To operate, just press the RTTY mode button once or twice to select the desired sideband for operation. LSB is default,.and is used by normal convention (USB can be selected for MARS or other applications). Should you need reverse tone polarity or non-standard shift (other than 170 Hz), configure Menu Selection 92: POLARITY-R, 93: POLARITY-T, and 94: SHIFT, as desired.

Note that for AMTOR operation, you must have the **VOX** button off, and may need to set the **AGC** knob to "FAST" or "OFF" (and reduce the setting of the RF Gain control) for Mode A (ARQ).

300-BAUD PACKET

Construct a patch cable as required, and connect your TNC to the rear-panel **PACKET** jack. Do not connect the squelch line (pin 5) for 300-baud packet operation.

Tuning is very critical for F1 packet: you should tune the transmitter and receiver within 10 Hz of a signal to minimize repeats. The **FTDX9000** includes a few custom features to make packet operation more convenient.

Packet Tone Pair – This offsets the center of the IF bandpass according to the packet tone pair you are using. If set correctly, the receiver passband will remain centered on a properly-tuned packet station when switching between wide and narrow IF filters, minimizing the need for re-tuning or use of the SHIFT knob for re-centering.

You may chose the Packet Tone Center Frequency from Menu Selection 91: PKT SHIFT [SSB] and the Packet Tone Pair for operation from Menu Selection 95: TONE, as desired. Set the Packet Tone Center Frequency and Tone Pair to match the tones generated by your TNC (these are usually set via terminal software or DIP switches – check in your TNC documentation).

Packet Frequency Display Offset – You can display the center frequency of the two transmitted carriers, (that is, the packet tone pair used), without any offset, instead of the actual carrier frequency. Recall Menu Selection 89: PKT DISP [SSB] and turn the CLAR/VFO-B knob to select the offset (±3.000 kHz).

Note: The default display offset is 0.000 kHz (to match the default tone pair in Menu Selection 95: TONE above, and assuming LSB operation). Ideally, the display offset should match the actual carrier frequency (without offset) displayed. If you would rather have the tone pair, which in turn should match those used by your TNC, set the display offset to –2.125 kHz.

PACKET OPERATION

- ❒ Press the **PKT** button on the front panel once or twice, so that the red LSB LED indicator lights along with the red PKT LED which is indicated to LSB Packet mode.
- ❒ Preset the **RF PWR** knob counterclockwise, and set the **METER** knob to "PO."
- ❒ Now set your TNC to its "calibrate" mode, preferably with both tones alternating, and adjust the DATA input level following procedures;
  1. Press the **MNU** key located at the bottom right of the TFT display to enter the Menu Mode.
  2. Rotating the Main Tuning Knob to select the Menu Selection 90: PACKET GAIN.
  3. Rotating the **CLAR/VFO-B** knob so that the Sub Meter deflects to about midrange (red ALC range).
  4. After completing your adjustment, press and hold the **MNU** key for 1/2 second to save the new setting and exit to normal operation.
     Your TNC's "TX Audio" output may also be capable of adjustment via a potentiometer inside the TNC.
- ❒ Advance the **RF PWR** knob for the desired power output.

When tuning, be aware that some common HF packet channels, such as "14.103" MHz, were originally determined to correspond with an actual IF center frequency 1700 Hz lower (in accordance with an old TAPR convention). Therefore, if you have the Packet Frequency Display Offset (Menu Selection 94: PKT DISP (SSB)) set to match your TNC's actual tones, the display shows 14.101.30 when tuned to the above frequency - which is the actual center of your receiver passband, and the frequency mid-way between the two FSK carriers you will transmit.

Initially, you may need to adjust the receiver IF shift slightly right or left to get the 500-Hz IF filters perfectly centered over incoming signals. Start with the SHIFT knob centered, and try to establish a connection with a moderately strong signal on a clear channel. If the connection is poor (many repeats), move the **SHIFT** knob slightly right, and see if the repeats decline. Continue in this manner until you find the best **SHIFT** knob setting (with minimal repeats), and use this same setting for all future HF packet operation.

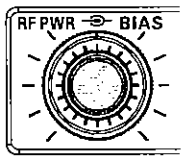
1200-BAUD FM PACKET

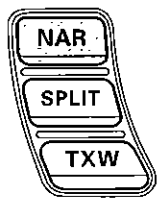
The equipment setup for 1200-baud FM packet (above 29 MHz) is the same as for 300-baud packet, except that you may want to connect the squelch line of the TNC to pin 5 of the PACKET jack if you plan to use the squelch.

- r Press the PKT button on the front panel once or twice, so that the red FM LED indicator lights along with the red PKT LED which is indicated to FM Packet mode.
- r Switch the METER selector to "PO" and set the RF PWR control for the desired power output.
- r Tuning is much less critical in this mode, requiring no special adjustments. Also, the FM MIC GAIN has been preset at the factory for proper deviation with typical signal levels, so you should not need to readjust it (you should adjust the Tx audio output level of your TNC, though, if your signal sounds distorted in the monitor).

GENERAL

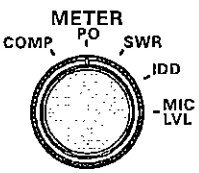
The **FTDX9000** allows you to operate both on 29 MHz FM and 50 MHz FM. For FM transmission, the only control on the front panel you need be concerned about is **RF PWR** knob and **NAR** button which toggle between FM and narrow-FM. Microphone gain for FM is set via the separate FM MIC control via the Menu Mode, and normally needs no adjustment after leaving the factory. If you receive signals reports of low audio with a strong carrier, you may want to increase the gain. If you notice distortion in the transmit monitor, you may want to decrease the FM MIC gain (see box at theright). Otherwise, we suggest leaving it alone. Remember that the apparent modulation level on 29 MHz will be less than you are accustomed to on VHF, due to international regulations restricting the maximum deviation to ±2.5 kHz.



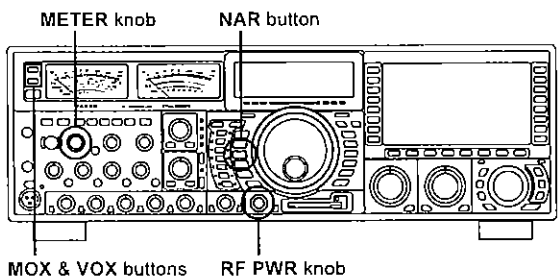


In the factory default, the microphone to be used on the FM mode set to the microphone which is connected to the front panel's microphone jack. If you use the traditional YAESU microphone, switch the microphone input to the rear panel's microphone jack via the Menu Mode (see box at the bottom).

All you need to do for most operation is set the **METER** selector to the "PO" position, and adjust the **RF PWR** knob for the desired output while transmitting. If you need full power, keep your transmissions to three minutes or less, with the same time for reception. Otherwise, set the power output to 100 Watts or less, and you should never encounter any duty cycle limitations.



You can use the VOX circuit for TX/RX switching, if desired, and the transmit monitor to listen to your signal. See also the FM Repeater Operation at the next column.



FM MIC GAIN SETTING

- ❒ Set the **METER** knob to the "MIC LEL" position which monitor the microphone input level.
- ❒ Press the **MNU** key located at the bottom right of the TFT display to enter the Menu Mode.
- ❒ Rotating the Main Tuning Knob to select the Menu Selection 85: FM MIC GAIN.
- ❒ Rotating the **CLAR/VFO-B** knob while speaking into the microphone (at a normal level) so that the Main Meter ("MIC LEL" meter) deflects to about midrange on voice peaks (S9 on the S-meter scale).
  If this parameter is set to "MCVR" which is found below level "0", you may adjust the FM MIC Gain by the front panel's **MIC** knob.
- ❒ After completing your adjustment, press and hold the **MNU** key for 1/2 second to save the new setting and exit to normal operation.

FM Microphone Selection

- ❒ Press the **MNU** key located at the bottom right of the TFT display to enter the Menu Mode.
- ❒ Rotating the Main Tuning Knob to select the Menu Selection 86: FM MIC SEL.
- ❒ Rotating the **CLAR/VFO-B** knob to select "FRONT."
- ❒ After completing your adjustment, press and hold the **MNU** key for 1/2 second to save the new setting and exit to normal operation.

FM REPEATER OPERATION

To access the FM repeater, you must be set the Repeater Shift Direction, Shift Frequency, and CTCSS Encoder and its frequency. To do this:

- ❒ Press and hold the **[FM]** key for 1/2 second to enter the ??? Mode.
- ❒ Press the **[FM]** key to select the Repeater Shift Direction. One press the [FM] key will have set the transceiver for "Minus Shift" operation. In this situation, you will observe the "–" indicator in the Multi Display Window. The transmit frequency will be shifted down by default value so as to access the repeater input frequency. If your repeater uses a positive shift (instead of negative), press the **[FM]** key again; the "+" indicator will replace the "–" indicator on the display. One additional press will set the transceiver for "Simplex" operation; "S" indicator will replace the "+" indicator on the display.
- ❒ If your repeater uses controlled access (using the CTCSS), rotate the Main Tuning knob will activates the CTCSS tone encoder. In this situation, you will observe the "tn" notation on the display. If you rotate the Main Tuning knob still more, you will observe "tS" (CTCSS Encoder/Decoder) and "OFF" (disable the CTCSS Encoder/Decoder). See the next section for a discussion of CTCSS Tone Squelch Operation.
- ❒ Rotate the **CLAR/VFO-B** knob to select the desired CTCSS Encoder frequency.
- ❒ Press and hold the **[FM]** key for 1/2 second to save the new setting and exit to normal operation.
- ❒ If the default repeater shift is not appropriate for the majority of the repeaters your area, it may be set independently for both 28 MHz and 50 MHz band. To change the default repeater shift:
  - ❍ Press the **[MNU]** key located at the bottom right of the TFT display to enter the Menu Mode.
  - ❍ Rotating the Main Tuning Knob to select the Menu Selection 96: RPT SHIFT (28 MHz) or 97: RPT SHIFT (50 MHz) which change the Shift Frequency.
  - ❍ Rotating the **CLAR/VFO-B** knob to set the desired offset frequency.
  - ❍ After completing your change, press and hold the **[MNU]** key for 1/2 second to save the new setting and exit to normal operation.
- ❒ Set the transceiver's receiver to the repeater output (downlink) frequency. Close the **MOX** or **PTT** switch and speak into the microphone. You will observe that the transmit frequency has shift according to the setting of the above. Release the **MOX** or **PTT** switch to return to the receive mode.

We recommend that these settings store into the memory channel for easy operation. Refer to the Memory chapter regarding the memory storage.

Note: Do not forget to set the Repeater Shift Direction to "Simplex" and the CTCSS Encoder/Decoder to "off" when finish the Repeater operation.

CTCSS OPERATION

The CTCSS feature is a selective calling system which uses a continuous, very-low-frequency tone that is filtered out so as not to be heard. If many stations are using the same channel frequency, CTCSS will keep your radio's receiver squelched until a CTCSS tone is received matching the CTCSS tone you have selected for your radio.

To activate the CTCSS feature, you must be set the CTCSS Encoder/Decoder and its frequency via the Menu Mode. To do this:

- ❒ Press and hold the [**FM**] key for 1/2 second to enter the ??? Mode.
- ❒ Rotate the Main Tuning knob will activates the CTCSS CTCSS Encoder/Decoder. You will observe "tS" (CTCSS Encoder/Decoder) on the display.
- ❒ Rotate the **CLAR/VFO-B** knob to select the desired CTCSS frequency.
- ❒ After completing your adjustment, press and hold the [**FM**] key for 1/2 second to save the new setting and exit to normal (with CTCSS) operation.

We recommend that these settings store into the memory channel for easy operation. Refer to the Memory chapter regarding the memory storage.

Note: Do not forget to set the CTCSS Encoder/Decoder to "off" when finish the CTCSS operation.

.FM MODE CUSTOMIZATION

TX EDSP Filter Bandwidth

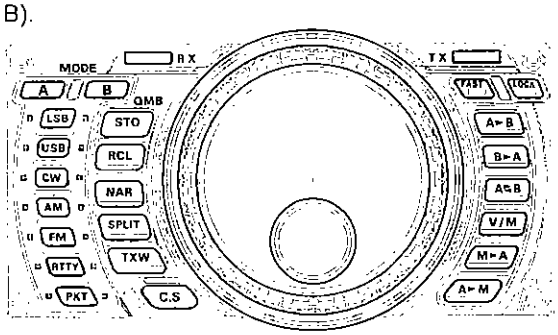
You may select the audio response tailoring of the Enhanced DSP modulator via the Menu Selection 40: FM-TX-BPF. Available selections are 10-3000 Hz, 100-2900 Hz, 200-2800 Hz (factory default), 300-2700 Hz, and 400-2600 Hz.

NOTE

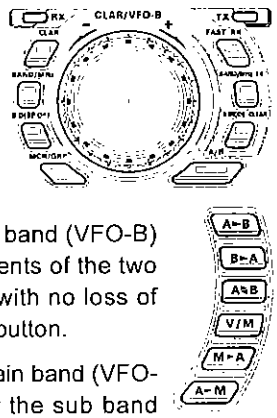
OPERATION (USING SUB BAND "VFO-B")

GENERAL

The sub band (VFO-B) works in a similar manner to the main band (VFO-A), with which you should be familiar by now. The sub band (VFO-B) provides simple split (transmit/receive) frequency operation via the combination of the main band's (VFO-A) RX and TX LED/Buttons and the sub band's (VFO-B) RX and TX LED/Buttons, and, more importantly, dual-channel reception. We'll get into those in a minute, but first let's look at how to control the sub band (VFO-B).



Frequency and operating mode can be transferred from the main band (VFO-A) to the sub band (VFO-B) by pressing [A▶B] button, but don't forget that this will overwrite any settings that were in the sub band (VFO-B) previously. Also, the contents of the two VFOs can be swapped (with no loss of data) by pressing [A⇆B] button.



Most selections for the main band (VFO-A) can also be made for the sub band (VFO-B) independently by the exclusive switches and knobs for the sub band (VFO-B). About the only things you cannot do with the sub band (VFO-B) (that you can with the main band (VFO-A)), are store it directly into a memory, and set the Clarifier. For these functions you need to swap it with the main band (VFO-A) by pressing the [A⇆B] button then hold the [A▶M] button for 1/2-second to store it in a memory, or set the Clarifier, and then press [A⇆B] again to return the data to the respective VFOs.

DUAL RECEPTION

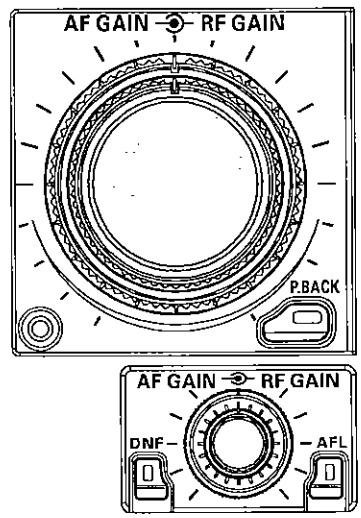
Pressing the sub band's (VFO-B) RX LED/Button so that the green LED is lit, activates the sub band (VFO-B) receiver and the "DUAL" indicator will glow green.

Dual receive operation opens up exciting operating possibilities for split operation, contesting, and chasing elusive DX stations. For split-frequency DX pile-ups the ability to listen to both "sides" of the pile-up allows very precise timing of your calls. For contesting, dual receive allows you to continue a "run" on your "main" frequency while keeping an ear on a DX "multiplier" that might not be listening for your call area, for example.

The **FTDX9000** provides identical circuit from the RF stage through the AF stage and to the speaker on both main band (VFO-A) and sub band (VFO-B), so system performance is unchanged when listing to either receiver.

Main band and Sub band Audio

The hug **AF GAIN** knob controls the main band's (VFO-A) volume level, and the smaller **AF GAIN** knob controls the sub band's (VFO-B) volume.



DUAL RECEPTION

Using Headphones for Dual Receive

To take advantage of dual reception, you will want to connect stereo headphones to the **PHONES** jack. Like the **AF GAIN** control, headphone audio mixing can also be configured as desired from Menu Selection 15: Head Phone Mix [MIX, AMIX]. Three audio mixing schemes are selectable as follows:

OFF: Audio from the main (VFO-A) receiver is heard only in the left ear, and sub (VFO-B) receiver audio solely in the right ear.

MID: Audio from both main (VFO-A) and sub (VFO-B) receivers can be heard in both ears, but sub (VFO-B) audio is attenuated in the left ear and main (VFO-A) audio is attenuated in the right ear.

FULL: Audio from both main (VFO-A) and sub (VFO-B) receivers is combined and heard equally in both ears.

Sideband Diversity Reception

Here you receive a single AM signal through the two receivers, each receiving the opposite sideband. Skywave-propagated signals often show phase distortion in this mode, but it gives you a view of the entire passband, from which you can then select the best sideband for listening (or for SWL Dx'ing, you may want to listen to both sidebands at the same time, to get the best copy). On groundwave signals, where the phase of the sidebands is likely to be the same, there is an interesting sense of depth to the signal.

To tune in a signal using this mode, you should have stereo headphones connected to the front panel **PHONES** jack or an external stereo speaker connected to the rear panel **EXT SP** jacks.

- ❒ Set the main band (VFO-A) to either LSB or USB mode, and tune for zero beat on the desired signal.
- ❒ Press the **[A▶B]** button to copy this mode and frequency into the sub band (VFO-B), then press the mode button to select the opposite sideband for the main band (VFO-A).
- ❒ If using headphones, set the headphone mixing scheme to the "MID" mode via the Menu Selection 15: Head Phone Mix [MIX, AMIX], and activate dual reception.
- ❒ Adjust the **AF GAIN** knob(s) to balance the volume of the two receivers.

If interference is present on one of the channels, you may have to turn its **AF GAIN** control to suppress that channel (or press the green "RX" LED/button to disable the receiver with the sideband experiencing interference). Otherwise, try changing the headphone audio mixing scheme to "FULL" or "OFF" in the Menu Selection 15: Head Phone Mix [MIX, AMIX] for different effects (or try settings with similar effects on your external amplifier). Although you don't get the "stereophonic" effect in the monaural mode, the two signals are still mixed, offering the potential for much better copy than in regular AM or even single-sideband ECSS modes.

Bandwidth Diversity Reception

This mode involves receiving the same signal through two different bandpass filters. The frequency and mode of both main band (VFO-A) and sub band (VFO-B) is the same. The main band (VFO-A) provides a narrow bandpass and the sub band (VFO-B) a wide bandpass by the **WIDTH** knobs, resulting in a spatial perception of the channel. Although any mode (except FM) can be used, CW offers the widest array of choices, and perhaps the most startling effects on crowded channels.

Stereo headphones or an external stereo speaker are recommended for this mode. To set up the transceiver for bandwidth diversity reception:

- ❒ Select the desired mode on the main band (VFO-A).
- ❒ Tune to the signal of interest.
- ❒ Press the **[A▶M]** button to copy this mode and frequency into the sub band (VFO-B).
- ❒ If using headphones, set the headphone mixing scheme to the "MID" mode via the Menu Selection 15: Head Phone Mix [MIX, AMIX], and activate dual reception.
- ❒ Adjust the **AF GAIN** knob(s) to balance the volume of the two receivers.
- ❒ You may find it interesting to try the **SHIFT** and **WIDTH** controls (on both main band (VFO-A) and sub band (VFO-B) receivers) for some interesting effects.

SPLIT FREQUENCY OPERATION

Typical split operation involves receiving on the main band (VFO-A) or a memory channel, and transmitting on the sub band (VFO-B). The special case of FM repeater operation uses some features of its own, and is described on page ??.

Rare DX stations often announce that they will "listen up" or "listen down" a few kHz (from their Tx frequency) when calling CQ or during contests to avoid being covered by the DX pileup from responding stations.

Split operation

Press the TX LED/Button above the Main Tuning Knob so that this TX LED/Button turn to off and the TX LED/Button above the CLAR/VFO-B knob will glows red. Then press the RX LED/Button above the Main Tuning knob so that this RX LED/Button turns off, and "SPLIT" LED at the upper right of the Main Tuning Knob will glow orange.

Quick Split Operation

The "Quick Split" feature is handy when you know the offset a DX station will be listening on beforehand. The offset is applied instantly by just pressing the SPLIT button or the TX LED/Button above the CLAR/VFO-B knob so that this TX LED/Button glows red, saving time and mental arithmetic. It also ensures that you will not be transmitting on the DX station's TX frequency! A Quick Split offset (factory default: ±5 kHz) can be selected in Menu Selection 118: QUICK SPLIT.

NOTE

GENERAL

The supplied Remote Control Keypad "**FH-2**" can be control the voice memory unit for SSB/AM/FM modes and contest memory keyer for CW mode.

FH-2 Controls

① LOCK Switch

Slide this switch to the "ON" position, lock the **FH-2** Keypad.

② [1] - [5] Memory Slot Keys

These keys select which message slot to record or play back over the air. Each slot enables record or play back up to ??-second message (for SSB/AM/FM modes) or up to 20 characters in length (for CW mode).

③ [MEMO] Key

Press this key (followed by a message number key) to record a message via the microphone (for SSB/AM/FM modes) or the keyer paddle or arrow keys of the **FH-2** (for CW mode).

④ [◀] Key

Pressing this key select the CW message digit (move to back digit) while recording the CW message from the **FH-2**.

⑤ [▲] Key

Pressing this key select the character of the CW message while recording the CW message from the **FH-2**.

⑥ [▶] Key

Pressing this key select the CW message digit (move to forward digit) while recording the CW message from the **FH-2**.

⑦ [P/B] Key

After recording the message, press this key to play them back in the transceiver's loudspeaker.

⑧ [▼] Key

Pressing this key select the character of the CW message while recording the CW message from the **FH-2**.

⑨ [DEC] Key

Press this key decrement the contest number manually.

VOICE MEMORY FEATURE

This feature can be record your voice from the microphone and playback it over the air (during transmission) for five ??-seconds messages.

Massage Recording

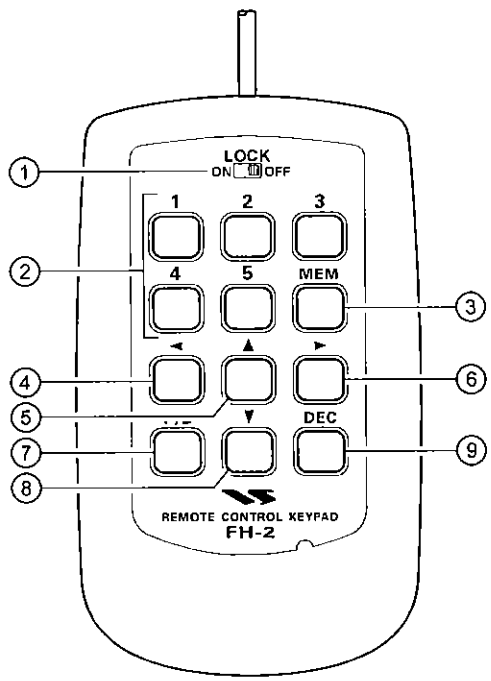
- ❒ Select the operating mode to voice mode (SSB, AM, or FM).
- ❒ Get your microphone ready, then press the [**MEMO**] button.
- ❒ Now, press the numbered button ([**1**] - [**5**]) for the segment to record, and start talking (***do not press*** the PTT switch unless you want to transmit at the same time you are recording).

Message Monitor (PLAYBACK WITHOUT TRANSMITTING)

When the VOX circuit is disabled, you can check the contents of a memory segment without playing it back over the air, just by pressing the [**P/B**] button followed by the appropriate numbered button. We recommend always using this to check the results immediately after making a recording and before playing it back.

Message Transmission ("ON THE AIR" PLAYBACK)

To transmit a message on the air, activates the VOX circuit by pressing the **VOX** button (so that its red LED lights) first, then press the appropriate number button.



CONTEST MEMORY KEYER

Message Recording (FROM THE KEYER PADDLE)

Programming of the five available message storage locations is accomplished by a simple keyed and keyer paddle input sequence. Only lambic (not "Bug") keying can be used for storage of CW messages, and we recommend that Menu Selection 75: KEYER FRONT (when programming from the front panel's keyer) or Menu Selection 76: KEYER REAR (when programming from the rear panel's keyer) be set to "ACS" during message storage, although you may prefer to use "EL" during manual sending once the desired messages are stored.

- ❒ Set the Menu Selection (60: CW MEMORY 1 through 64: CW MEMORY 5) which is corresponded with the message number to be programmed to "MESSAGE."
- ❒ Press the **[MEMO]** key, followed by message number key.
- ❒ Using your keyer paddle, send a CW message. Be careful to pause slightly after each word so as to leave a word space in the message string. (***Do not activates*** the CW break-in circuit unless you want to transmit at the same time you are programming)

Each message memories ([1] - [5] key) are programmed, played back, and transmitted in the same manner; however, you can enter up to 50 characters in each of these.

Note that if you want to send a message multiple times, you can press the playback key more than once; at the end of the first message segment, the message will restart and be sent again.

Message Recording (FROM THE FH-2's KEYPAD)

- ❒ Set the Menu Selection (60: CW MEMORY 1 through 64: CW MEMORY 5) which is corresponded with the message number to be programmed to "TEXT."
- ❒ Press the **[MEMO]** key, followed by message number key.
- ❒ Press the [▲]/[▼] keys to select the first digit of the CW message to be programmed.
- ❒ Press the [▶] key move the next digits.
- ❒ If you make a mistake, press the [◀] key to backspace the cursor, then re-enter the correct letter, number, or symbol.
- ❒ Repeat steps 3 through 5 to program the remaining letters, numbers, or symbols of the CW message (up to 50 characters).
- ❒ If you program the four digits number which is placed into "#" (such as #0001#) into the CW massage, this "four digits" number will automatically increment as the contest number when play back or transmit the message memory.

Message Monitor (PLAYBACK WITHOUT TRANSMITTING)

- ❒ To play back the message memory without transmitting, press the **[P/B]** key followed by the appropriate numbered button.
- ❒ When play back the message memory which is programmed the contest number, the contest number will automatically increment. Press the **[DEC]** key to return to the previous number. Remember that the number will have incremented automatically after you played back it.

Note: The **FTDX9000** abbreviste ("cut") the contest number; "One" to "A," "Two" to "U," "Nine" to "N," and "Zero" to "T" while play back the message memory. You may change the Contest Number "Cut" format via the menu selection 68: CONTEST NUMBER.

Message Transmission ("ON THE AIR" PLAYBACK)

- ❒ To transmit a message on the air, activates the CW break-in circuit by pressing the **BK-IN/SPOT** button (so that its red LED lights) first, then press the appropriate number button.
- ❒ When transmit the message memory which is programmed the contest number, the contest number will automatically increment.
- ❒ If the other station asks for a repeat of your contest exchange, remember that the number will have incremented automatically after you sent it. Press the **[DEC]** key to return to the previous number.

Note: The **FTDX9000** abbreviste ("cut") the contest number; "One" to "A," "Two" to "U," "Nine" to "N," and "Zero" to "T" while transmit the message memory. You may change the Contest Number "Cut" format via the menu selection 68: CONTEST NUMBER.

MEMORY STRUCTURE

The **FTDX9000** contains ninety-nine regular memories, labeled 01 through 99, nine special programmed limit memory pairs, labeled P-1L/1U through P-9L/9U, and five QMB (Quick Memory Bank) memories, labeled C1 ~ C5. Each stores various settings not only main band's (VFO-A) frequency and mode (See below). By default, the 99 regular memories are contained in one group; however, they can be arranged to 5 separate groups if desired.

Like during VFO operation, you can freely tune and change the mode or Clarifier settings and you can also copy settings from one memory to another. In fact, you can do nearly anything with a memory that you can with the VFOs, except for the special PMS memory pairs (P-1L/1U ~ P-9L/9U), described later.

The **FTDX9000** allows to edit the memory (such as memory swap, assign the Alpha/Numeric tag. etc) by the TFT Status/Information Display. See page ?? for detail the memory channel edit.

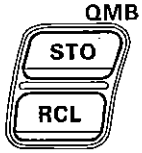
FTDX9000's memory channel enables to store the following data:

- Frequency
- Mode
- Clarifier status and its Offset Frequency
- ANT status
- IPO status
- μ-TUNE/VRF status
- Roofing filter status and its Bandwidth
- Noise Blanker status
- CONTUER status and its Peak Frequency
- EDSP Noise Reducer (DNR) status and its Reducing Frequency.
- EDSP Notch filter (NTCH) status
- NAR bandwidth status
- EDSP Auto Notch filter (DNF) status
- Repeater Shift Direction and Shift Frequency
- CTCSS status and its Tone Frequency

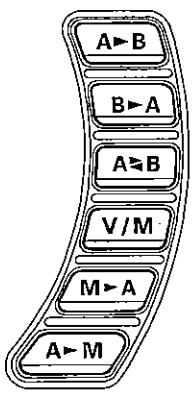
QMB (QUICK MEMORY BANK) OPERATION

The Quick Memory Bank is comprised of five memories (labeled C1 ~ C5) independent from the regular and PMS memories. These can quickly store operating parameters for later recall. You might find this handy to use when you have tuned a station of interest that you want to save, but don't want to overwrite your regular or PMS memories, especially if you have them organized a specific way.

You can use the QMB memories the same way you would a notepad in your shack - for jotting down (saving) frequencies and modes to come back to later.

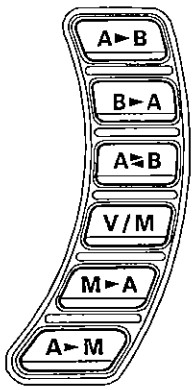


- To store a frequency into the first Quick Memory (C-1), simply press the blue **STO** button.
- Stored Quick Memories are recalled by pressing the blue **RCL** button repeatedly to select the desired memory (Quick Memory channel number ("C1" ~ "C5") will be displayed in the Multi Display Window).
- Additional settings will be entered directly into C-1, with previously-stored entries then being shifted to the next available Quick Memory. This "stacking" system keeps the most recent entry in the first memory, and automatically shifts older entries into the next consecutive memory. After all Quick memories have been filled, additional entries overwrite previous ones on a "first-in, first-out" basis (as shown inside the box below).
- To revert from QMB operation back to main band (VFO-A), simply press **V/M** button once.



REGULAR MEMORY OPERATION

The [V/M], [A▶M], and [M▶A] buttons and Main Tuning Knob are used to control various memory operations, as follows:



[V/M] button

This toggles control between memory or VFO operation. If a displayed memory has been re-tuned, pressing [V/M] button once returns to the originally-memorized frequency, and pressing it again returns to the last-used VFO.

[A▶M] button

When receiving on a VFO or re-tuned memory, pressing and holding in this key for 1/2 second stores the current operating data on the main band (VFO-A) into the currently selected memory. Two beeps sound, and any previous data in that memory register will be overwritten. Momentarily pressing this button activates memory checking ("frequency display" will blinks) for 3 seconds. This is described in the next section on memory storage and recall.

M▶A button

Pressing and holding in this button for 1/2 second copies the frequency and operating data stored in a selected memory into the main band (VFO-A). Momentarily pressing this button activates memory checking (frequency display" will blinks) for 3 seconds. This is described in the next section on memory storage and recall.

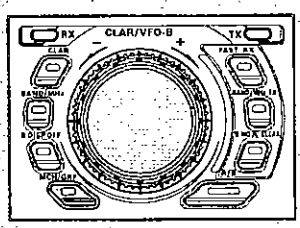
CLAR/VFO-B Knob

This knob selects the memory channel while memory operation.

Notice

Regarding the CLAR/VFO-B Knob

Under certain circumstance, the **CLAR/VFO-B** knob does not select the memory channel (such as the Clarifier offset setting). To enable memory channel selection by the **CLAR/VFO-B** knob, just press the **MCH/GRP** button momentarily; rotation of the **CLAR/VFO-B** knob will now allow you to select other memories.



Memory Programming

You can store the frequency and all operational settings for the displayed main band (VFO-A) into a memory channel by following this simple procedure:

- ❒ Set up all operating parameters and frequency as desired on the main band (VFO-A).
- ❒ Press the [A▶M] button momentarily ("frequency display" will start blinking), then rotate the **CLAR/VFO-B** knob to select the memory channel to stored.
- ❒ When you have chosen a channel into which to store the frequency data, press and hold in the [A▶M] button for 1/2 second so that two beeps sound. The main band (VFO-A) contents are now stored in the selected memory channel; at this point, you remain in the main band (VFO-A), so you can continue tuning around and/or storing additional memories.

Recalling & Operating on Memory Channels

- ❒ Press the [V/M] button to recall a memory stored. The last-utilized memory's contents will appear in the main frequency display field.
- ❒ While operating in the memory mode (if you haven't yet re-tuned it - see below), the "MR" notation and memory channel number is displayed in the Multi Display Window, and you can now rotate the **CLAR/VFO-B** knob or press the microphone **UP/DWN** buttons (if you are used the traditional YAESU microphone) to select any previously-stored memories for operation.
- ❒ To return to main band (VFO-A) operation, just press the [V/M] button once more; the VFO's contents will have remained undisturbed.

REGULAR MEMORY OPERATION

Memory Tuning

With this mode, you can emulate VFO tuning and operation on a memory channel and retain the memory checking feature: if you change frequency, mode, or Clarifier settings, "MR" notation is replaced with "MT" in the Multi Display Window. During memory tuning, the microphone **UP/DWN** buttons (if you use) now duplicate Main Tuning Knob functions like VFO operation (rather than select memory channels as before). Pressing the **[V/M]** button once cancels any re-tuning changes to the memory and reverts to the memory recall mode ("MR" displayed again). Pressing the **[V/M]** button once more returns the transceiver to VFO operation.

Memory Tuning makes operation on memories 1 to 99 just as flexible as the VFOs (memories P1 ~ P9 have special additional features, described later). If you want to save changes to a re-tuned memory channel, use the same procedure you use to store the VFOs to memory: Press the **[V/M]** button momentarily, and rotate the **CLAR/VFO-B** knob to select another memory (if desired), or just hold the **[A▶M]** button for 1/2 second until the double beep sounds (to overwrite the current memory with the re-tuned data).

The labeling and function of the **[A▶M]** button during memory tuning is somewhat deceptive as the VFO settings, which are hidden at this point, are not involved in this operation at all, since those of the recalled memory have taken their place.

Important Note: Computer software programs utilizing the CAT system interface port may presume that the transceiver is operating in the VFO mode for certain features like "band mapping" and/or frequency logging. Because the "Memory Tune" mode so closely resembles the VFO mode, be sure that you have the **FTDX9000** operating in a control mode compatible with your software's requirements.

Memory Checking

Before storing or recalling a memory, you will usually want to check its contents. Momentarily pressing either **[A▶M]** or **[M▶A]** also activates memory checking. As mentioned before, the frequency indicators change to show the contents of the last-selected memory with blinking. If you touch nothing else, the display reverts to your current operating parameters automatically after 3 seconds. By turning the front panel **CLAR/VFO-B** knob before the 3 seconds expires, you can select for display each of the general purpose and PMS memories. If the memory is vacant, nothing is displayed except two decimal points. Pressing these buttons restarts the 3-second timer, so as long as you are changing channels, memory checking mode persists.

Note: When checking memories, both vacant and filled memories are displayed. If you would like to skip over vacant memories, press the **FAST** button before memory checking.

Copying a Selected Memory to Main Band (VFO-A)

If desired, you can store the frequency and all operational settings for the selected memory channel into the main band (VFO-A). While operating in the Memory mode:

- ❒ Select the memory channel to be copied into the main band (VFO-A).
- ❒ Pressing and holding in the **[M▶A]** button for 1/2 second copies the current memory channel data into main band (VFO-A). You can now tune around on the main band (VFO-A), having used the memory channel's frequency as a starting point. When you press and hold in the **[M▶A]** button, you lose the previous contents of the main band (VFO-A), and if you were receiving on the main band (VFO-A), operation shifts to the frequency and mode just copied from the memory.
- ❒ Pressing the **[M▶A]** key momentarily shows you the contents of the memory, without overwriting main band (VFO-A) data.

REGULAR MEMORY OPERATION

Copying Between Memories

The same procedure for copying main band (VFO-A) into memories is also used to copy one memory to another. Like main band (VFO-A), one memory can be selectively copied; however, there are a few differences.

To copy from one memory to another (including PMS memories), first activate memory tuning by simply turning the Main Tuning Knob so that "MT" appears (and then tuning back to the desired frequency). Rotate the **CLAR/VFO-B** knob to select a memory to fill, then (within 3 seconds) press **A▶M** to copy the contents from the re-tuned (source) memory to the destination memory.

Grouping Memories

The 99 regular memories and PMS memories P-1L/1U ~ P-9L/9U can be grouped to five memory groups via the Menu Selection 111: MEM GRP, if desired. Each memory group holding up to 22 memory channels (the Group size is fixed). When the memory channel is grouped, the channel number changes to following.

MEMORY CHANNEL NUMBER	
GROUPING MEMORY "OFF"	GROUPING MEMORY "ON"
01 ~ 20	1-01 ~ 1-20
21 ~ 40	2-01 ~ 2-20
40 ~ 60	3-01 ~ 3-20
61 ~ 80	4-01 ~ 4-20
81 ~ 99	5-01 ~ 5-19
P-1L/1U ~ P-9L/9U	P-1L/1U ~ P-9L/9U

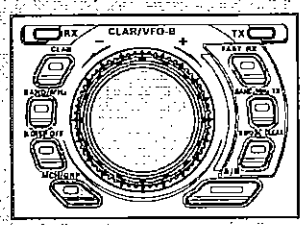
Limiting Memory Group Operation

If you have grouped the memory channel Menu Selection 111: MEM GRP, you can enable a particular group and limit memory recall and scanning operation (covered later) only to those memories in that selected group, if so desired.

To do this, press and hold in the **MCH/GRP** button for 1/2 second. The LED inside the **MCH/GRP** button will glow yellow and you will select the memory group by the **CLAR/VFO-B** knob. Then press the **MCH/GRP** button momentarily. The LED inside the **MCH/GRP** button change to red and you will find that only memories within that group are now available.

Notice
Regarding the CLAR/VFO-B Knob

Under certain circumstance, the **CLAR/VFO-B** knob does not select the memory. To enable memory channel selection by the **CLAR/VFO-B** knob, just press the **MCH/GRP** button momentarily; the LED inside the **MCH/GRP** button will glow red and rotation of the **CLAR/VFO-B** knob will now allow you to select other memories.



VFO SCANNING

The **FTDX9000**'s scanner activates on the main band (VFO-A).

- ❒ Set the main band (VFO-A) **SQL** knob to the point where background noise silenced.
- ❒ Press and hold the microphone's **UP** or **DWN** button for 1/2 second to initiate upward or downward scanning.
- ❒ The scanner will now cause the transceiver to increment in the chosen direction until a signal is detected. When a signal is encountered which opens the Squelch, it will do different things, depending on the operating mode:
  - ○ ***In the SSB/CW modes***, the scanner will slow down (but won't stop).
  - ○ ***In the FM/AM modes***, the transceiver pauses on the signal and stays locked on its frequency for five seconds. Thereafter, scanning will resume whether or not the other station's transmission has ended. While the transceiver is in the "Pause" condition, the decimal points in the frequency display area will blink. See "Scan Resume Mode" on the page ?? for details of how to customize the resumption of scanning.
- ❒ Press the **PTT** switch on the microphone to cancel scanning.

Information: The scan step is same as the tuning step of the Main Tuning Knob, and scan speed is 200 step/sec in the SSB/CW modes or 20 step/sec in the AM/FM modes.

MEMORY SCANNING

The 99 memories in the **FTDX9000** offer some choices regarding how they are scanned, and, after the following brief description, you can decide how to tailor scanning for your operating needs.

- ❒ Select the Memory mode by pressing the **V/M** button, if necessary.
- ❒ Press and hold the microphone's **UP** or **DWN** button for 1/2 second to initiate upward or downward scanning.
- ❒ If and when the scanner encounters a signal strong enough to open the squelch, the transceiver pauses on the signal and stays locked on its frequency for five seconds. Thereafter, scanning will resume whether or not the other station's transmission has ended. While the transceiver is in the "Pause" condition, the decimal points in the frequency display area will blink. See "Scan Resume Mode" on the page ?? for details of how to customize the resumption of scanning.
- ❒ Press the **PTT** switch on the microphone to cancel scanning.

Note: When Memory Group feature is engaged, the scanner sweep only memory channels in the current memory group.

SCAN RESUME MODE

There are two choices that determine how scanning will respond when activity is detected. Scan resume operation is configured by recalling Menu Selection 119: SCAN RESUME, and select the desired mode. Below is an outline of each scan resume mode and how it operates.

TIME (default action): In this mode, the transceiver pauses on the signal and stays locked on its frequency for five seconds. Thereafter, scanning will resume whether or not the other station's transmission has ended.

PAUSE: In this mode, the scanner will halt until the other station's transmission ceases (at which point the squelch will close). One second after the squelch closes, scanning resumes automatically.

PROGRAMMED MEMORY SCANNING PMS MEMORIES P-1L/1U ~ P-9L/-9U

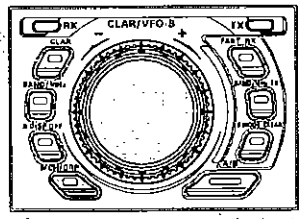
To limit scanning (and manual tuning) within a particular frequency range, you can use the Programmable Memory Scanning (PMS) feature, which utilizes nine special-purpose memory pairs ("P-1L/P-1U" through "P-9L/P-9U"). The PMS feature is especially useful in helping you to observe any operating sub-band limits which apply to your Amateur license class.

Example: Limit tuning and scanning to the 17-m amateur band's limits.

- ❒ Press the [**V/M**] button as necessary, to display main band (VFO-A) frequency.
- ❒ Tune to the low edge of the 17-m band: 18.068 MHz, and select the desired mode (here, USB or CW).
- ❒ Press the [**A▶M**] button momentarily ("frequency display" will start blinking), then rotate the CLAR/VFO-B knob to select the memory channel to P-1L.
- ❒ Now (while "frequency display" is still blinking), press and hold in the [**A▶M**] button for 1/2 second to write the VFO's frequency into P-1L.
- ❒ Tune to the high edge of the 17-m band (18.168 MHz). Be sure that the operating mode has not changed.
- ❒ Press the [**A▶M**] button momentarily ("frequency display" will start blinking), then rotate the **CLAR/VFO-B** knob to select the memory channel to P-1U.
- ❒ Now (while "frequency display" is still blinking), press and hold in the [**A▶M**] button for 1/2 second to write the VFO's frequency into P-1U.
- ❒ Press the [**V/M**] key momentarily to switch to the memory mode, then rotate the **CLAR/VFO-B** knob to select memory channel P-1L.
- ❒ Turn the Main Tuning Knob slightly (to activate memory tuning). Tuning and scanning are now limited to the 18.068- to 18.168-MHz range until you press the [**V/M**] button to return to memory channel or main band (VFO-A) operation.

Notice
Regarding the CLAR/VFO-B Knob

Under certain circumstance, the **CLAR/VFO-B** knob does not select the memory. To enable memory channel selection by the **CLAR/VFO-B** knob, just press the **MCH/GRP** button momentarily; the LED inside the **MCH/GRP** button will glow red and rotation of the **CLAR/VFO-B** knob will now allow you to select other memories.



Customization: You may disable the scanning feature even if you press and holding the microphone's **UP** or **DWN** button for 1/2 second which prevent to wrong operation of the scanner via the menu selection 118: MIC SCAN.

MENU ("SET") MODE

The programming menu allows precise configuration of many aspects of transceiver performance, so you may set up the FTDX9000 just the way you like. A total of 129 transceiver settings are contained in the programming menu.

Menu Operation

1. To enter the "Menu" mode, just press the [**MNU**] key, located at the bottom right side of the TFT display.
2. Rotating the Main Tuning Knob, or pressing the [p(GEN)]/[q(ENT)] key, will permit display of the various menu selections.
3. Rotating the **CLAR/VFO-B** knob, once you have selected a menu item, lets you choose between the various settings available for that particular menu selection.
4. If you decide to exit to normal operation without saving the new setting, just press the [**MNU**] key monetarily.
5. After completing your selection and adjustment, press and hold in the [**MNU**] key for 1/2 second to save the new setting and exit to normal operation.

AGC GROUP

1. AGC-MAG

Function: Selects the gain curve of the AGC amplifier.
Available Values: FLAT/LOG
Default Setting: FLAT
FLAT: The AGC output level will follow a linear response to the antenna input level, while AGC is activated.
LOG: The AGC output level will increase at 1/10 the rate of the antenna input level, while AGC is activated.

2. MAIN-AGC-FAST DELAY

Function: Sets the delay time for the AGC FAST mode of the main band (VFO-A) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 100 msec

3. MAIN-AGC-FAST HOLD

Function: Sets the hang time of the AGC peak voltage for the AGC FAST mode of the main band (VFO-A) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 20 msec

4.MAIN-AGC-MID DELAY

Function: Sets the delay time for the AGC MID mode of the main band (VFO-A) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 500 msec

5. MAIN-AGC-MID HOLD

Function: Sets the hang time of the AGC peak voltage for the AGC MID mode of the main band (VFO-A) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 100 msec

6. MAIN-AGC-SLOW DELAY

Function: Sets the delay time for the AGC SLOW mode of the main band (VFO-A) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 2000 msec

7. MAIN-AGC-SLOW HOLD

Function: Sets the hang time of the AGC peak voltage for the AGC SLOW mode of the main band (VFO-A) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 300 msec

8. SUB-AGC-FAST DELAY

Function: Sets the delay time for the AGC FAST mode of the sub band (VFO-B) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 100 msec

9. SUB-AGC-FAST HOLD

Function: Sets the hang time of the AGC peak voltage for the AGC FAST mode of the sub band (VFO-B) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 20 msec

10. SUB-AGC-MID DELAY

Function: Function: Sets the delay time for the AGC MID mode of the sub band (VFO-B) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 500 msec

11. SUB-AGC-MID HOLD

Function: Sets the hang time of the AGC peak voltage for the AGC MID mode of the sub band (VFO-B) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 100 msec

12. SUB-AGC-SLOW DELAY

Function: Function: Sets the delay time for the AGC SLOW mode of the sub band (VFO-B) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 2000 msec

13. SUB-AGC-SLOW HOLD

Function: Sets the hang time of the AGC peak voltage for the AGC SLOW mode of the sub band (VFO-B) receiver.
Available Values: 20 ~ 2000 msec (20 msec/step)
Default Setting: 300 msec

AUDIO GROUP

14. Audio REV

Function: Replaces the function of the AF GAIN (VFO-A) knob with that of the AF GAIN (VFO-B) knob.
Available Values: OFF/ON
Default Setting: OFF
When this menu is set to "ON," it reverses the paths of the main (VFO-A)/sub (VFO-B) receiver audio, which normally are adjusted using the **AF GAIN** knob and the **AF GAIN** (VFO-B) knob, respectively.

15. Headphone Mix (MIX,AMIX)

Function: Selects one of three audio mixing modes when using headphones during Dual Receive operation.
Available Values: OFF/MID/FULL
Default Setting: MID
OFF: Audio from the main (VFO-A) receiver is heard only in the left ear, and sub (VFO-B) receiver audio solely in the right ear.
MID: Audio from both main (VFO-A) and sub (VFO-B) receivers can be heard in both ears, but sub (VFO-B) audio is attenuated in the left ear and main (VFO-A) audio is attenuated in the right ear.
FULL: Audio from both main (VFO-A) and sub (VFO-B) receivers is combined and heard equally in both ears.

16. Speaker OUT (AFPA)

Function: Selects audio mixing modes for the "sub" (secondary) speaker during Dual Receive operation.
Available Values: SEP/MAIN
Default Setting: SEP
SEP: Audio from the main (VFO-A) receiver is fed to the main speaker, and sub (VFO-B) receiver audio is fed to the "sub" speaker.
MAIN: Audio from both main (VFO-A) and sub (VFO-B) receivers is combined and split equally between the main and sub speakers.

EQ GROUP

17. MAIN-CONT-GAIN

Function: Adjusts the parametric equalizer gain of the main band (VFO-A) receiver Contour filter.
Available Values: –10 ~ +10
Default Setting: –5

18. MAIN-CONT-Q

Function: Adjusts the Q-factor of the main band (VFO-A) receiver Contour filter.
Available Values: 0 - 10
Default Setting: 1

19.SUB-CONT-GAIN

Function: Adjusts the parametric equalizer gain of the sub band (VFO-B) receiver Contour filter.
Available Values: –10 ~ +10
Default Setting: –5

20. SUB-CONT-Q

Function: Adjusts the Q-factor of the sub band (VFO-B) receiver Contour filter.
Available Values: 0 ~ 10
Default Setting: 1

21. MICF-EQ-FREQ1

Function: Selects the center frequency of the lower range for the front panel's parametric microphone equalizer.
Available Values: OFF/1 ~ 7 (x100 Hz)
Default Setting: OFF
OFF: The equalizer gain and Q-factor are set to factory defaults (flat).
1 ~ 7: You may adjust the equalizer gain and Q-factor at this selected audio frequency via menu items 22: MICF-EQ-GAIN1 and 23: MICF-EQ-Q1.

22. MICF-EQ-GAIN1

Function: Adjusts the equalizer gain of the low range of the front panel's parametric microphone equalizer.
Available Values: –10 ~ +10
Default Setting: +5

23. MICF-EQ-Q1

Function: Adjusts the Q-factor of the low range of the front panel's parametric microphone equalizer.
Available Values: 0 ~ 10
Default Setting: 1

EQ GROUP

24. MICF-EQ-FREQ2

Function: Selects the center frequency of the middle range for the front panel's parametric microphone equalizer.
Available Values: OFF/7 ~ 15 (x100 Hz)
Default Setting: OFF
OFF: The equalizer gain and Q-factor are set to factory defaults (flat).
7 ~ 15: You may adjust the equalizer gain and Q-factor at this selected audio frequency via menu items 25: MICF-EQ-GAIN2 and 26: MICF-EQ-Q2.

25. MICF-EQ-GAIN2

Function: Adjusts the equalizer gain of the middle range of the front panel's parametric microphone equalizer.
Available Values: –10 ~ +10
Default Setting: +5

26. MICF-EQ-Q2

Function: Adjusts the Q-factor of the middle range of the front panel's parametric microphone equalizer.
Available Values: 0 ~ 10
Default Setting: 1

27. MICF-EQ-FREQ3

Function: Selects the center frequency of the high range for the front panel's parametric microphone equalizer.
Available Values: OFF/15 ~ 32 (x100 Hz)
Default Setting: OFF
OFF: The equalizer gain and Q-factor are set to factory defaults (flat).
15 ~ 32: You may adjust the equalizer gain and Q-factor in this selected audio frequency via menu items 28: MICF-EQ-GAIN3 and 29: MICF-EQ-Q3.

28. MICF-EQ-GAIN3

Function: Adjusts the equalizer gain of the high range of the front panel's parametric microphone equalizer.
Available Values: –10 ~ +10
Default Setting: +5

29. MICF-EQ-Q3

Function: Adjusts the Q-factor of the high range of the front panel's parametric microphone equalizer.
Available Values: 0 ~ 10
Default Setting: 1

30. MICR-EQ-FREQ1

Function: Selects the center frequency of the low range for the rear panel's parametric microphone equalizer.
Available Values: OFF/1 ~ 7 (x100 Hz)
Default Setting: OFF
OFF: The equalizer gain and Q-factor are set to factory defaults (flat).
1 ~ 7: You may adjust the equalizer gain and Q-factor in this selected audio frequency via menu items 31: MICR-EQ-GAIN1 and 32: MICR-EQ-Q1.

31. MICR-EQ-GAIN1

Function: Adjusts the equalizer gain of the low range of the rear panel's parametric microphone equalizer.
Available Values: –10 ~ +10
Default Setting: +5

32. MICR-EQ-Q1

Function: Adjusts the Q-factor of the low range of the rear panel's parametric microphone equalizer.
Available Values: 0 ~ 10
Default Setting: 1

33. MICR-EQ-FREQ2

Function: Selects the center frequency of the middle range for the rear panel's parametric microphone equalizer.
Available Values: OFF/7 ~ 15 (x100 Hz)
Default Setting: OFF
OFF: The equalizer gain and Q-factor are set to factory defaults (flat).
7 ~ 15: You may adjust the equalizer gain and Q-factor at this selected audio frequency via menu items 34: MICR-EQ-GAIN2 and 35: MICR-EQ-Q2.

34. MICR-EQ-GAIN2

Function: Adjusts the equalizer gain of the middle range of the rear panel's parametric microphone equalizer.
Available Values: –10 ~ +10
Default Setting: +5

35. MICR-EQ-Q2

Function: Adjusts the Q-factor of the middle range of the rear panel's parametric microphone equalizer.
Available Values: 0 ~ 10
Default Setting: 1

EQ GROUP

36. MICR-EQ-FREQ3

Function: Selects the center frequency of the high range for the rear panel's parametric microphone equalizer.
Available Values: OFF/15 ~ 32 (x100 Hz)
Default Setting: OFF
OFF: The equalizer gain and Q-factor are set to factory defaults (flat).
15 ~ 32: You may adjust the equalizer gain and Q-factor at this selected audio frequency via menu items 37: MICR-EQ-GAIN3 and 38: MICR-EQ-Q3.

37. MICR-EQ-GAIN3

Function: Adjusts the equalizer gain of the high range of the rear panel's parametric microphone equalizer.
Available Values: –10 ~ +10
Default Setting: +5

38. MICR-EQ-Q3

Function: Adjusts the Q-factor of the high range of the rear panel's parametric microphone equalizer.
Available Values: 0 ~ 10
Default Setting: 1

FILTER GROUP

39. AM-TX-BPF

Function: Selects the audio response tailoring of the Enhanced DSP modulator on the AM mode.
Available Values: 10-3000/100-2900/200-2800/300-2700/400-2600
Default Setting: 200-2800

40. FM-TX-BPF

Function: Selects the audio response tailoring of the Enhanced DSP modulator on the FM mode.
Available Values: 10-3000/100-2900/200-2800/300-2700/400-2600
Default Setting: 200-2800

41. IF-NOTCH

Function: Selects the bandwidth of the DSP NOTCH filter
Available Values: NARROW/WIDE
Default Setting: WIDE

42. MAIN-CW-FIL-PASSBAND

Function: Selects the passband characteristics of the main band (VFO-A) DSP filter for the CW mode.
Available Values: MAG/PHA
Default Setting: PHA
MAG: Primary importance attached to amplitude of the filter factor.
PHA: Primary importance attached to phase of the filter factor.

43. MAIN-CW-FIL-SHAPE

Function: Selects the shape factor of the main band (VFO-A) DSP filter for the CW mode.
Available Values: 1.3/1.5/1.8
Default Setting: 1.5

44. MAIN-CW-FIL-NARROW

Function: Selects the passband of the main band (VFO-A) DSP filter for the CW "narrow" mode.
Available Values: 25/50/100/200/300/400/500/1000/2400
Default Setting: 300

45. MAIN-PSK-FIL-PASSBAND

Function: Selects the passband characteristics of the main band (VFO-A) DSP filter for the PSK mode.
Available Values: MAG/PHA
Default Setting: PHA
MAG: Primary importance attached to amplitude of the filter factor.
PHA: Primary importance attached to phase of the filter factor.

FILTER GROUP

46. MAIN-PSK-FIL-SHAPE

Function: Selects the shape factor of the main band (VFO-A) DSP filter for the PSK mode.
Available Values: 1.3/1.5/1.8
Default Setting: 1.5

47. MAIN-PSK-FIL-NARROW

Function: Selects the passband of the main band (VFO-A) DSP filter for the PSK "narrow" mode.
Available Values: 25/50/100/200/300/400/500/1000/2400
Default Setting: 300

48. MAIN-RTTY-FIL-PASSBAND

Function: Selects the passband characteristics of the main band (VFO-A) DSP filter for the RTTY mode.
Available Values: MAG/PHA
Default Setting: PHA
MAG: Primary importance attached to amplitude of the filter factor.
PHA: Primary importance attached to phase of the filter factor.

49. MAIN-RTTY-FIL-SHAPE

Function: Selects the shape factor of the main band (VFO-A) DSP filter for the RTTY mode.
Available Values: 1.3/1.5/1.8
Default Setting: 1.5

50. MAIN-RTTY-FIL-NARROW

Function: Selects the passband of the main band (VFO-A) DSP filter for the RTTY "narrow" mode.
Available Values: 25/50/100/200/300/400/500/1000/2400
Default Setting: 300

51. MAIN-SSB-FIL-PASSBAND

Function: Selects the passband characteristics of the main band (VFO-A) DSP filter for the SSB mode.
Available Values: MAG/PHA
Default Setting: PHA
MAG: Primary importance attached to amplitude of the filter factor.
PHA: Primary importance attached to phase of the filter factor.

52. MAIN-SSB-FIL-SHAPE

Function: Selects the shape factor of the main band (VFO-A) DSP filter for the SSB mode.
Available Values: 1.3/1.5/1.8
Default Setting: 1.5

53. MAIN-SSB-FIL-NARROW

Function: Selects the passband of the main band (VFO-A) DSP filter for the "narrow" SSB mode.
Available Values: 200/400/600/850/1100/1350/1500/1650/1800/1950/2100/2250/2400/2550/2700/2850/2900/2950
Default Setting: 1800

54. SSB-TX-BPF

Function: Selects the audio response tailoring of the Enhanced DSP modulator on the SSB mode.
Available Values: 10-3000/100-2900/200-2800/300-2700/400-2600
Default Setting: 300-2700

55. SUB-CW-FIL-PASSBAND

Function: Selects the passband characteristics of the sub band (VFO-B) DSP filter for the CW mode.
Available Values: MAG/PHA
Default Setting: PHA
MAG: Primary importance attached to amplitude of the filter factor.
PHA: Primary importance attached to phase of the filter factor.

56. SUB-CW-FIL-SHAPE

Function: Selects the shape factor of the sub band (VFO-B) DSP filter for the CW mode.
Available Values: 1.3/1.5/1.8
Default Setting: 1.5

57. SUB-CW-FIL-NARROW

Function: Selects the passband of the sub band (VFO-B) DSP filter for the CW "narrow" mode.
Available Values: 25/50/100/200/300/400/500/1000/2400
Default Setting: 300

58. SUB-PSK-FIL-PASSBAND

Function: Selects the passband characteristics of the sub band (VFO-B) DSP filter for the PSK mode.
Available Values: MAG/PHA
Default Setting: PHA
MAG: Primary importance attached to amplitude of the filter factor.
PHA: Primary importance attached to phase of the filter factor.

59. SUB-PSK-FIL-SHAPE

Function: Selects the shape factor of the sub band (VFO-B) DSP filter for the PSK mode.
Available Values: 1.3/1.5/1.8
Default Setting: 1.5

FILTER GROUP

60. SUB-PSK-FIL-NARROW

Function: Selects the passband of the sub band (VFO-B) DSP filter for the PSK "narrow" mode.
Available Values: 25/50/100/200/300/400/500/1000/2400
Default Setting: 300

61. SUB-RTTY-FIL-PASSBAND

Function: Selects the passband characteristics of the sub band (VFO-B) DSP filter for the RTTY mode.
Available Values: MAG/PHA
Default Setting: MAG
MAG: Primary importance attached to amplitude of the filter factor.
PHA: Primary importance attached to phase of the filter factor.

62. SUB-RTTY-FIL-SHAPE

Function: Selects the shape factor of the sub band (VFO-B) DSP filter for the RTTY mode.
Available Values: 1.3/1.5/1.8
Default Setting: 1.5

63. SUB-RTTY-FIL-NARROW

Function: Selects the passband of the sub band (VFO-B) DSP filter for the RTTY "narrow" mode.
Available Values: 25/50/100/200/300/400/500/1000/2400
Default Setting: 300

64. SUB-SSB-FIL-PASSBAND

Function: Selects the passband characteristics of the sub band (VFO-B) DSP filter for the SSB mode.
Available Values: MAG/PHA
Default Setting: PHA
MAG: Primary importance attached to amplitude of the filter factor.
PHA: Primary importance attached to phase of the filter factor.

65. SUB-SSB-FIL-SHAPE

Function: Selects the shape factor of the sub band (VFO-B) DSP filter for the SSB mode.
Available Values: 1.3/1.5/1.8
Default Setting: 1.5

66. SUB-SSB-FIL-NARROW

Function: Selects the passband of the main band (VFO-A) DSP filter for the "narrow" SSB mode.
Available Values: 200/400/600/850/1100/1350/1500/1650/1800/1950/2100/2250/2400/2550/2700/2850/2900/2950
Default Setting: 1800

MESSAGE GROUP

67. BEACON TIME

Function: Sets the interval time between repeats of the beacon message.
Available Values: OFF/1 ~ 255 sec
Default Setting: OFF

68. CONTEST NUMBER

Function: Select the Contest Number "Cut" format for sending.
Available Values: 1290/AUNO/AUNT/A2NO/A2NT/12NO/12NT
Default Setting: AUNT
1290: Does not abbreviated the Contest Number
AUNO: Abbreviste to "A" for "One," "U" for "Two," "N" for "Nine," and "O" for "Zero."
AUNT: Abbreviste to "A" for "One," "U" for "Two," "N" for "Nine," and "T" for "Zero."
A2NO: Abbreviste to "A" for "One," "N" for "Nine," and "O" for "Zero."
A2NT: Abbreviste to "A" for "One," "N" for "Nine," and "T" for "Zero."
12NO: Abbreviste to "N" for "Nine" and "O" for "Zero."
12NT: Abbreviste to "N" for "Nine" and "T" for "Zero."

69. CW MEMORY 1

Function: Permits entry of the CW message for message register 1.
Available Values: TEXT/MESSAGE
Default Setting: MESSAGE
TEXT: You may enter the CW message from a keyboard connected to the rear-panel Keyboard jack (keyboard not supplied).
MESSAGE: You may enter the CW message from the CW keyer.

70. CW MEMORY 2

Function: Permits entry of the CW message for message register 2.
Available Values: TEXT/MESSAGE
Default Setting: MESSAGE
TEXT: You may enter the CW message from a keyboard connected to the rear-panel Keyboard jack (keyboard not supplied).
MESSAGE: You may enter the CW message from the CW keyer.

71. CW MEMORY 3

Function: Permits entry of the CW message for message register 3.
Available Values: TEXT/MESSAGE
Default Setting: MESSAGE
TEXT: You may enter the CW message from a keyboard connected to the rear-panel Keyboard jack (keyboard not supplied).
MESSAGE: You may enter the CW message from the CW keyer.

MESSAGE GROUP

72. CW MEMORY 4

Function: Permits entry of the CW message for message register 4.
Available Values: TEXT/MESSAGE
Default Setting: MESSAGE
TEXT: You may enter the CW message from a keyboard connected to the rear-panel Keyboard jack (keyboard not supplied).
MESSAGE: You may enter the CW message from the CW keyer.

73. CW MEMORY 5

Function: Permits entry of the CW message for message register 5.
Available Values: TEXT/MESSAGE
Default Setting: MESSAGE
TEXT: You may enter the CW message from a keyboard connected to the rear-panel Keyboard jack (keyboard not supplied).
MESSAGE: You may enter the CW message from the CW keyer.

MODE-AM GROUP

74. AM MIC GAIN

Function: Sets the microphone gain for the AM mode.
Available Values: MCVR/FIX (0 ~ 255)
Default Setting: 128
When this menu is set to "MCVR," you may adjust the microphone gain using the front panel's **MIC** knob.

75. AM MIC SEL

Function: Selects the microphone to be used on the AM mode.
Available Values: FRONT/REAR/DATA/PC
Default Setting: FRONT
FRONT: Selects the microphone connected to the front panel's **MIC** jack while using the AM mode.
REAR: Selects the microphone connected to the rear panel's **MIC** jack while using the AM mode.
DATA: Selects the microphone connected to pin 1 of the **PACKET** Jack while using the AM mode.
PC: Selects the microphone connected to the rear panel's **AUDIO IN** 3.5-mm jack while using the AM mode.

MODE-CW GROUP

76. CW AUTO MODE

Function: Enables/disables CW keying while operating on SSB.
Available Values: OFF/50M/ON
Default Setting: OFF
OFF: Disables CW keying while operating on SSB.
50M: Enables CW keying only while operating SSB on 50 MHz.
ON: Enables CW keying while operating on SSB.
Note: This feature allows you to move someone from SSB to CW *without having* to change modes on the front panel.

77. CW BFO

Function: Sets the CW carrier oscillator injection side for the CW mode.
Available Values: USB/LSB/AUTO
Default Setting: USB
USB: Injects the CW carrier oscillator on the USB side.
LSB: Injects the CW carrier oscillator on the LSB side.
AUTO: Injects the CW carrier oscillator on the LSB side while operating on the 7 MHz band and below, and the USB side while operating on the 10 MHz band and up.

78. CW BK-IN

Function: Sets the CW "break-in" mode.
Available Values: SEMI/FULL
Default Setting: SEMI
SEMI: The transceiver will operate in the semi break-in mode. The delay (receiver recovery) time is set by the front panel's CW DELAY knob.
FULL: The transceiver will operate in the full break-in (QSK) mode.

79. CW FREQ

Function: Frequency Display Format for the CW mode.
Available Values: FREQ/PITCH
Default Setting: PITCH
FREQ: Displays the actual carrier frequency, without any offset added. When changing modes, the frequency display remains constant.
PITCH: When changing the modes, the frequency display changes to reflect the added BFO offset.

80. CW KEY F

Function: Selects the keyer paddle's wiring configuration of the **KEY** jack on the front panel.
Available Values: NOR/REV
Default Setting: NOR
NOR: Tip = Dot, Ring = Dash, Shaft = Ground
REV: Tip = Dash, Ring = Dot, Shaft = Ground

81. CW KEY R

Function: Selects the keyer paddle's wiring configuration of the **KEY** jack on the rear panel.
Available Values: NOR/REV
Default Setting: NOR
NOR: Tip = Dot, Ring = Dash, Shaft = Ground
REV: Tip = Dash, Ring = Dot, Shaft = Ground

82. CW SHAPE

Function: Selects the CW carrier wave-form shape (rise/fall times).
Available Values: 1/2/4/6 msec
Default Setting: 4 msec

83. CW WEIGHT

Function: Sets the Dot:Dash ratio for the built-in electronic keyer.
Available Values: (1:) 2.5 ~ 4.5
Default Setting: 3.0

84. KEYER FRONT

Function: Selects the desired keyer operation mode for the device which is connected to the front panel's **KEY** jack.
Available Values: OFF/BUG/EL/ACS
Default Setting: EL
OFF: Disables the front panel's keyer ("straight key" mode for use with external keyer or computer-driven keying interface).
BUG: Mechanical "bug" keyer emulation. One paddle produces "dits" automatically, while the other paddle manually produces "dahs."
EL: Iambic keyer with ACS (Automatic Character Spacing) disabled.
ACS: Iambic keyer with ACS (Automatic Character Spacing) enabled.

MODE-CW GROUP

85. KEYER REAR

Function: Select the desired keyer operation mode for the device which is connected to the rear panel's **KEY** jack.
Available Values: OFF/BUG/EL/ACS
Default Setting: EL
OFF: Disables the front panel's keyer ("straight key" mode for use with external keyer or computer-driven keying interface).
BUG: Mechanical "bug" keyer emulation. One paddle produces "dits" automatically, while the other paddle manually produces "dahs."
EL: Iambic keyer with ACS (Automatic Character Spacing) disabled.
ACS: Iambic keyer with ACS (Automatic Character Spacing) enabled.

86. PC KEYING

Function: Enables/disables CW keying from the "DATA IN" terminal on the rear panel's **PACKET** jack while operating on the CW mode.
Available Values: OFF/ON
Default Setting: OF

87. QSK

Function: Selects the time delay between when the PTT is keyed and the carrier is transmitted during QSK operation when using the internal keyer.
Available Values: 10/15/20/25/30/35/40 msec
Default Setting: 10 msec

MODE-DATA GROUP

88. DATA IN SEL

Function: Selects the data input to be used on the PKT mode.
Available Values: DATA/PC
Default Setting: DATA
DATA: Uses the data input line which is connected to the rear panel's **PACKET** jack while using the PKT mode.
PC: Uses the data input line which is connected to the rear panel's **AUDIO IN** jack while using the PKT mode.

89. DATA GAIN

Function: Sets the data input level from the TNC to the AFSK modulator.
Available Values: 0 ~ 255
Default Setting: 128

90. DATA OUT (AFDT)

Function: Selects the receiver to be connected to the data output port (pin 4) of the **PACKET** jack.
Available Values: Main/Sub
Default Setting: Main

91. DATA VOX DELAY

Function: Adjust the "VOX" delay (receiver recovery) time on the PKT mode.
Available Values: 30 ~ 3000 msec
Default Setting: 300 msec

92. DATA VOX GAIN

Function: Adjusts the "VOX" gain on the PKT mode.
Available Values: 0 ~ 255
Default Setting: 128

93. PC OUT (AFPC)

Function: Selects the receiver to be connected to the rear panel's **AUDIO OUT** jack on the PKT mode.
Available Values: Main/Sub
Default Setting: Main

MODE-FM GROUP

94. FM MIC GAIN

Function: Sets the microphone gain for the FM mode.
Available Values: MCVR/FIX (0 ~ 255)
Default Setting: 128
When this menu is set to "MCVR," you may adjust the microphone gain using the front panel's **MIC** knob.

95. FM MIC SEL

Function: Selects the microphone to be used on the FM mode.
Available Values: FRONT/REAR/DATA/PC
Default Setting: FRONT
FRONT: Selects the microphone connected to the front panel's **MIC** jack while using the FM mode.
REAR: Selects the microphone connected to the rear panel's **MIC** jack while using the FM mode.
DATA: Selects the microphone connected to pin 1 of the **PACKET** Jack while using the FM mode.
PC: Selects the microphone connected to the rear panel's **AUDIO IN** 3.5-mm jack while using the FM mode.

96. RPT SHIFT (28MHz)

Function: Sets the magnitude of the repeater shift on the 28 MHz band.
Available Values: 0 ~ 1000 kHz
Default Setting: 100 kHz

97. RPT SHIFT (50MHz)

Function: Sets the magnitude of the repeater shift on the 50 MHz band.
Available Values: 0 ~ 4000 kHz
Default Setting: 1000 kHz

MODE-PKT GROUP

98. PKT DISP (SSB)

Function: Sets the packet frequency display offset.
Available Values: –3000 ~ +3000 Hz (10 Hz/step)
Default Setting: 0 Hz

99. PKT GAIN

Function: Adjusts the audio input level from the TNC to the AFSK modulator.
Available Values: 0 ~ 255
Default Setting: 128

100. PKT SHIFT (SSB)

Function: Sets the carrier point during the SSB Packet operation
Available Values: –3000 ~ +3000 Hz (10 Hz/step)
Default Setting: +1000 Hz

MODE-RTTY GROUP

101. POLARITY-R

Function: Selects normal or reverse Mark/Space polarity for RTTY receive operation.
Available Values: NOR/REV
Default Setting: NOR

102. POLARITY-T

Function: Selects normal or reverse Mark/Space polarity for RTTY transmit operation.
Available Values: NOR/REV
Default Setting: NOR

103. SHIFT

Function: Selects the frequency shift for the FSK RTTY operation.
Available Values:170/200/425/800 Hz
Default Setting: 170 Hz

104. TONE

Function: Selects the mark tone for RTTY operation.
Available Values: 1275/2125 Hz
Default Setting: 2125 Hz

MODE-SSB GROUP

105. LSB RXCAR

Function: Adjusts the receiver carrier point for LSB mode.
Available Values: –200 Hz ~ +200 Hz (10 Hz step)
Default Setting: 0 Hz

106. LSB TXCAR

Function: Adjusts the transmitter carrier point for LSB mode.
Available Values: –200 Hz ~ +200 Hz (10 Hz step)
Default Setting: 0 Hz

107. SSB MIC SEL

Function: Selects the microphone to be used on the SSB mode.
Available Values: FRONT/REAR/DATA/PC
Default Setting: FRONT

FRONT: Selects the microphone connected to the front panel's **MIC** jack while using the SSB modes.

REAR: Selects the microphone connected to the rear panel's **MIC** jack while using the SSB modes.

DATA: Selects the microphone connected to pin 1 of the **PACKET** Jack while using the SSB modes.

PC: Selects the microphone connected to the rear panel's **AUDIO IN** 3.5-mm jack while using the SSB modes.

108. USB RXCAR

Function: Adjusts the receiver carrier point for USB mode.
Available Values: –200 Hz ~ +200 Hz (10 Hz step)
Default Setting: 0 Hz

109. USB TXCAR

Function: Adjusts the transmitter carrier point for USB mode.
Available Values: –200 Hz ~ +200 Hz (10 Hz step)
Default Setting: 0 Hz

OPERATE GROUP

110. ANT Select

Function: Sets the method of antenna selection.
Available Values: Band/Stack
Default Setting: Band
Band: The antenna is selected in accordance with the operating band.
Stack: The antenna is selected in accordance with the band stack (different antennas may be utilized on the same band, if so selected in the band stack).

111. BAR GRAPH

Function: Selects one of three parameters to be viewed on the Tuning Offset Indicator.
Available Values: CLAR/CW TUNE/VRF-μTUNE
Default Setting:
CLAR: Displays relative clarifier offset.
CW TUNE: Displays relative tuning offset between the incoming signal and transmitted frequency.
VRF-μTUNE: Displays the peak position of the VRF or μTUNE filter.

112. BEEP LEVEL

Function: Sets the beep level.
Available Values: 0 ~ 255
Default Setting: 128

113. CAT RATE

Function: Sets the transceiver's computer-interface circuitry for the CAT baud rate to be used.
Available Values: 4800/9600/38400 bps
Default Setting: 4800 bps

114. DIM-MTR

Function: Setting of the meter brightness level when "DIM" is selected.
Available Values: 0 ~ 15
Default Setting: 8

115. DIM-VFD

Function: Setting of the frequency and TFT display brightness level when "DIM" is selected.
Available Values: 0 ~ 15
Default Setting: 8

116. EMERGENCY

Function: Enables Tx/Rx operation on the Alaska Emergency Channel, 5167.5 kHz.
Available Values: OFF/ON
Default Setting: OFF
When this Menu Item is set to "ON," the spot frequency of 5167.5 kHz will be enabled. The Alaska Emergency Channel will be found between the Memory channels "P-1" and "01 (or 1-01)."

114. EXT DISP

Function: This menu is always set to "ON."
Available Values: OFF/ON
Default Setting: ON

118. EXT TX-GND

Function: Enables/Disables the **TX GND** jack on the rear panel.
Available Values: ENABLE/DISABLE
Default Setting: DISABLE

119. FULL DUP

Function: Enables/Disable the full duplex operation.
Available Values: SIMP/DUP
Default Setting: SIMP
When this menu is set to "DUP," you may receive on the sub band (VFO-B) frequency while transmitting, during dual receive operation, on a different band on the main band (VFO-A).

120. MEM GROUP

Function: Enables/Disables Memory Group Operation.
Available Values: OFF/ON
Default Setting: OFF

121. PWR CONT

Function: Configure the RF PWR knob.
Available Values: ALL/CW
Default Setting: ALL
ALL: The **RF PWR** knob is enabled on all modes.
CW: The **RF PWR** knob is enabled in all modes except SSB. In this configuration, the SSB output power will be set to maximum, regardless of the **RF PWR** knob's position.

122. QUICK SPLIT

Function: Selects the tuning offset for the Quick Split feature.
Available Values: –10/–5/0/+5/+10 kHz
Default Setting: +5 kHz

123. ROTATOR

Function: Select the starting point of your controller's indicator needle.
Available Values: 0/90/180/270°
Default Setting: 0°

124. ROTATOR Offset ADJ

Function: Adjust the indicator needle to preciselt to the starting point.
Available Values: –30 - 0
Default Setting: 0

OPERATE GROUP

125. TOT

Function: Sets the Time-Out Timer countdown time.
Available Values: OFF/5/10/15/20/25/30 min
Default Setting: OFF

126. TRV OFFSET

Function: Set the 10's and 1's of the MHz digits display for operation with a transverter.
Available Values: 30 ~ 49 MHz
Default Setting: 44 MHz
If you connect a 430 MHz transverter to the radio, set this menu to "30" (the "100 MHz" digits are hidden on this radio).

127. µTUNE

Function: Select the µTUNE mode.
Available Values: AUTO/MAN
Default Setting: AUTO

SCAN GROUP

128. MIC SCAN

Function: Enables/disables scanning access via the microphone's **[UP]**/**[DWN]** keys (only available at the rear panel's **MIC** Jack).
Available Values: ON/OFF
Default Setting: ON

129. SCAN RESUME

Function: Selects the Scan Resume mode.
Available Values: PAUSE/TIME
Default Setting: TIME
PAUSE: The scanner will hold until the signal disappears, then will resume after one second.
TIME: The scanner will hold for five seconds, then resume whether or not the other station is still transmitting.

TUNING GROUP

130. 1MHz/100kHz

Function: Selects the tuning steps for the **CLAR/VFO-B** knob when the **BAND/MHz** button is pressed.
Available Values: 1 MHz/100 kHz
Default Setting: 1 MHz

131. AM CH STEP

Function: Selects the tuning steps for the microphone's **[UP]/[DWN]** keys in the AM mode.
Available Values: 2.5/5/9/10/12.5 kHz
Default Setting: 5 kHz

132. CW FINE

Function: Setting of the Main Tuning Knob's tuning speed in the CW mode.
Available Values: ON/OFF
Default Setting: OFF
ON : Tuning in 1 Hz steps on the CW mode.
OFF: Tuning according to the steps determined via menu item 127: DIAL STEP.

133. CLAR-DISP

Function: Selects the frequency step per the one digits of the Tuning Offset Meter.
Available Values: 100/250/500 Hz
Default Setting: 100 Hz

134. DIAL STEP

Function: Setting of the Main Tuning Knob's tuning speed on the SSB, CW, and AM modes.
Available Values: 1 or 10 Hz
Default Setting: 1 Hz

135. FM CH STEP

Function: Selects the tuning steps for the microphone's **[UP]/[DWN]** keys in the FM mode.
Available Values: 5/6.25/10/12.5/25 kHz
Default Setting: 5 kHz

136. FM DIAL STEP

Function: Setting of the Main Tuning Knob's tuning speed in the FM mode.
Available Values: 10/100/1000 Hz
Default Setting: 100 Hz

137. SKIP BAND

Function: Programs a band to be skipped while selecting bands using the CLAR/VFO-B knob.
Available Values: None/1.8 ~ 50/GEN/TRV
Default Setting: TRV
To programming the skipped band, rotate the **CLAR/VFO-B** knob to recall the band to be skipped while selecting bands via the **CLAR/VFO-B** knob, then press the **[ENT]** key to select this setting to "ON." Repeat same procedures to cannel the setting (skipped "off"). The skipped band is high lighted on the TFT display.

VDD MTR GROUP

138. Vdd MTR

Function: Selects the Sub meter function
Available Values: NOR/Vdd
Default Setting: NOR
NOR: Indicates incoming signal strength on the sub band (VFO-B) while receiving, and indicates the ALC (Automatic Level Control) operating range while transmitting.
Vdd: Indicates the Vdd (final amplifier drain voltage) at all times.

VOX GROUP

139. VOX SEL

Function: Selects the audio input source for triggering TX during VOX operation.
Available Values: MIC/DATA
Default Setting: MIC

MIC: The VOX function will be activated by microphone audio input.

DATA: The VOX function will be activated by data audio input.

NOTE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate 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 interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

1. Changes or modifications to this device not expressly approved by VERTEX STANDARD could void the user's authorization to operate this device.
2. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions; (1) this device may not cause harmful interference, and (2) this device must accept any interference including interference that may cause undesired operation.
3. The scanning receiver in this equipment is incapable of tuning, or readily being altered, by the User to operate within the frequency bands allocated to the Domestic public Cellular Telecommunications Service in Part 22.

DECLARATION BY MANUFACTURER

The scanner receiver is not a digital scanner and is incapable of being converted or modified a digital scanner receiver by any user.

WARNING: MODIFICATION OF THIS DEVICE TO RECEIVE CELLULAR RADIOTELEPHONE SERVICE SIGNALS IS PROHIBITED UNDER FCC RULES AND FEDERAL LAW.

YAESU

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