# USER's MANUAL
# and
# Knowledge Base



# *CommRadio*
## *CTX-10 Amateur Radio Transceiver*

AeroStream Communications – *CommRadio* Division
New Castle, Colorado USA



www.commradio.com

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# Revision Status

| REVISION | DATE | COMMENTS |
|---|---|---|
| PRELIM | 05/05/2018 | Pre-Release Copy |
| A1 | 05/15/2018 | Initial Release |
| B | 06/26/2018 | Added FAQs, added more Tech Notes |
| C | 07/27/2018 | Multiple Updates per revised Firmware |
| D | 07/28/2018 | Added ATU information |
| E4 | 11/15/2018 | [T] switch deactivation, non-iambic keyer, MEM, zero-beat TX ON_OFF elimination, AGC OFF |
| F3 | 08/14/2019 | Mic notes, W0CTX, 2.5>3.5mm plug diam, dual VFOs, MARS, 5>5.5mm power plug |
| G | 09/01/2020 | Incorporate firmware rev 1342, add mic details |
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# Contents

# IMPORTANT WARNINGS

**READ THIS MANUAL CAREFULLY** to learn all of the features of the CTX-10. Understanding that you'll want to use the radio immediately, we've included several Quick Start Guides right up front.

**SAVE THIS MANUAL** as it contains important safety and operating instructions.

**FCC INFORMATION** 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.

**CAUTION:** Changes or modifications not expressly approved by AeroStream/CommRadio could void the user's authority to operate this transceiver under FCC regulations.

**WARNING RF EXPOSURE**!  This device emits Radio Frequency (RF) energy. Extreme caution should be observed when operating this device. If you have any questions regarding RF exposure and safety standards please refer to the Federal Communications Commission Office of Engineering and Technology's report on Evaluating Compliance with FCC Guidelines for Human Radio Frequency Electromagnetic Fields (OET Bulletin 85).

**WARNING HIGH VOLTAGE!** NEVER touch an antenna or internal antenna connector during transmission. This may result in an electrical shock or burn.

**WARNING!** NEVER operate the transceiver while driving a vehicle. Safe driving requires your full attention—anything less may result in an accident.

**NEVER** apply more than 20 V DC, such as a 24 V battery, to the power input jack on the transceiver rear panel. This could cause a fire or damage the transceiver.

**NEVER** let metal, wire or other objects touch any internal part or connectors on the rear panel of the transceiver. This may result in an electric shock or could cause a fire or damage the transceiver.

**NEVER** expose the transceiver to rain, snow or any liquids.

**TEMPERATURE RANGE -** It is acceptable to charge and use the CTX-10 in the temperature range of 0° – 45° C (32° - 113°F). It is acceptable to store the CTX-10 in the temperature range of -20° to 45° C (-4° - 113°F). Be aware that temperatures on a vehicle's dashboard can exceed +80°C (+176°F), resulting in permanent damage to the transceiver if left there for extended periods.

## Introduction

Thank you for purchasing the CTX-10 amateur radio transceiver.  Tracing its evolutionary roots to the commercial/military/avionics worlds, and borrowing receiver and design elements from the highly successful CommRadio CR-1 and CR-1a receivers, the CTX-10 is the latest product from the mind of Don Moore, W0CTX.

The CTX-10 was designed to be rugged and user-friendly with a minimum number of user interface interactions to produce the desired system functional change. Standard equipment user replaceable internal Lithium Ion batteries provide power for a day's casual operation. The ability to provide operational power and simultaneously recharge the batteries from most *any* 5 to 20 VDC source provides low-cost portable expansion capability and *unlimited* field operation. Standard equipment internal wide-range Automatic Antenna Tuner, CW Keyer and CW Reader provide everything you need for full functionality in one lightweight, die-cast aluminum package with no need for supplementary cooling solutions during high duty cycle operations.

It is the purpose of this manual to provide you with one source for basic through advanced operations, trouble-shooting, fielding notes and FAQs.  This manual will be maintained as an up-to-date online PDF document, suitable for printing or viewing on most any electronic device. Be sure to always check the FAQs from each new revision for the latest and greatest information!

Manual authored by Bob Martin, WB2KTG.
Comments and questions regarding the manual or the CTX-10 in general may be addressed to me at: commradio.guru@gmail.com

## Firmware, Manual Updates and Social Media

Contact support@commradio.com or register online at www.commradio.com to register your warranty and to automatically receive automated email notices when updates to firmware or this manual are available.  The most recent version of this manual, system firmware, additional support information and related topics of interest can always be found on our website:  www.commradio.com

The direct dropbox link for the latest user's manual and system firmware and firmware update instructions is:
https://www.dropbox.com/sh/o52isgpavqz2org/AACRWiWTE5wNPN9pwO_PeMKYa?dl=0

If you're a friend of social media, CommRadio is on Facebook at "CommRadio CTX-10 Operators" and groups.io at "ctx-10".

## Actions, Abbreviations & Symbols Used in this Manual

- **[AGC]**             Automatic Gain Control – automatically adjusts RF gain
- **[ANG]**             Ambient Noise Gate – automatic SSB audio processing
- **[ATU]**             Antenna Tuning Unit – matches CTX-10 to antenna
- **[BAND]**            The **[BAND]** key on the keypad
- **Click**             Rotate the Control Knob **[M]** one detent **{CW}** or **{CCW}**
- **CW**             Continuous Wave, as in Morse Code
- **{CW}**             Clockwise rotation of a knob
- **{CCW}**            Counter Clockwise rotation of a knob
- **<LEFT ARROW>**   The lower left button on the key pad
- **LOCK**            A function of the **<RIGHT ARROW>** button to **LOCK** controls
- **LNA**             Low Noise Amplifier, first RF amplifier in the receiver
- **[M]**              Control Knob, or Menu Knob, the left knob on the front panel
- **[MEM]**            The **[MEM]** key on the keypad
- **[MODE]**          The **[MODE]** key on the keypad
- **PUSH**            Quickly push in and release (holding for less than ½ second)
- **<RIGHT ARROW>** The lower right button on the key pad
- **[RX]**              Receive, Receiver
- **[STEP]**          The **[STEP]** key on the keypad
- **[T]**               Tuning Knob, the right knob on the front panel
- **[TX]**             Transmit, Transmitter
- **UNLOCK**          Opposite of **LOCK**  Returns radio to normal operations

# Quick Start Guides

## Quick Start Guide - Receiver Setup

Connect a suitable 5 – 20 VDC power source to the Power Input jack on the rear panel using a standard 5.5mm barrel, 2.5mm pin plug. An external power source is not necessary if the internal batteries have sufficient charge. See below for determining battery charge status.



Connect an antenna cable to the BNC **HF** jack on the rear panel. The use of a suitable SO-239 Female to BNC Male adapter may be required to connect from an existing antenna cable to the CTX-10's BNC connector. These adapters are available in right angle as well as straight configurations as illustrated below.



Press Control Knob **[M]** in for two seconds and release. You will see INITIALIZING, the WELCOME! Screen, then the standard frequency display screen.

When first turned on while battery powered, if you do not adjust any controls within the first twenty seconds, the radio will enter Auto-Shutdown Mode and display the following screen.



This is done to prevent accidental battery discharge when the radio is stowed. Within the first twenty seconds of operation, simply turn either knob or push any button to enable normal operation. This screen will not appear if external power is supplied to the radio.

Looking at the display, you see a small battery shaped icon and a number in the lower right corner. The battery will appear all filled-in when it is holding 100% charge. The amount of fill-in is a quick indication of the amount of charge. In addition, two digits are shown to the right of the battery. Those digits give an approximate indication of the charge status, where 90 represents 90%, 80 represents 80%, etc. NOTE: Battery 100% charge just shows solid icon, no numbers. NOTE: When battery charge is less than 20%, battery icon shows an "X".

Turn Control Knob **[M] {CW}** until a suitable audio volume level is heard. Select desired mode by pressing keypad button **MODE** repeatedly. Select the desired amateur band by pressing the keypad button **BAND** repeatedly. For non-amateur band reception, select the nearest amateur band and tune up or down selecting an appropriate tuning step size.

The selected tuning step size is shown by the highlighted digit on the display. To change the selected tuning step size press the **<LEFT ARROW>** or **<RIGHT ARROW>** to move the selected digit Left or Right. Tuning step sizes of 1MHz, 100, 10, 1 kHz, 100, 10 Hz may be selected.



Turn Tuning Knob **[T]** to select the desired frequency.

Enjoy!

To turn OFF, Press Control Knob **[M]** in for two seconds and release.

If, for some reason the radio does not turn OFF, press and hold Control Knob **[M]** for six seconds and the radio will turn off.
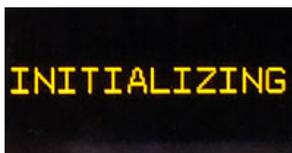
## Quick Start Guide – CW Transceiver Setup

Connect a suitable 5 – 20 VDC power source to the Power Input jack on the rear panel using a standard 5.5mm barrel, 2.5mm pin plug. An external power source is not necessary if the internal batteries have sufficient charge. See below for determining battery charge status.
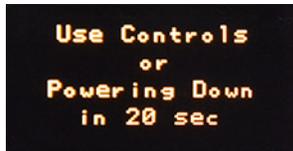


Connect an antenna cable to the **BNC HF** jack on the rear panel. The use of a suitable SO-239 Female to BNC Male adapter may be required to connect from an existing antenna cable to the CTX-10's BNC connector. These adapters are available in right angle as well as straight configurations as illustrated below.



Press Control Knob **[M]** in for two seconds and release. You will see INITIALIZING, the WELCOME! Screen, then the standard frequency display screen.

When first turned on while battery powered, if you do not adjust any controls within the first twenty seconds, the radio will enter Auto-Shutdown Mode and display the following screen.



This is done to prevent accidental battery discharge when the radio is stowed. Within the first twenty seconds of operation, simply turn either knob or push any button to enable normal operation. This screen will not appear if external power is supplied to the radio.

Looking at the display, you see a small battery shaped icon in the lower right corner. The battery will appear all filled-in when it is holding 100% charge. The amount of fill-in is a quick indication of the amount of charge. In addition, two digits are shown to the right of the battery. Those digits give an approximate indication of the charge status, where 90 represents 90%, 80 represents 80%, etc. NOTE: Battery 100% charge just shows icon, no numbers. NOTE: When battery charge is less than 20%, battery icon shows an "X".

Turn Control Knob **[M] {CW}** until a suitable audio volume level is heard. Select desired mode by pressing keypad button **MODE** repeatedly. Select the desired amateur band by pressing the keypad button **BAND** repeatedly. For non-amateur band reception, select the nearest amateur band and tune up or down selecting an appropriate tuning step size.

The selected tuning step size is shown by the highlighted digit on the display. To change the selected tuning step size press the **<LEFT ARROW>** or **<RIGHT ARROW>** to move the selected digit Left or Right. Tuning step sizes of 1MHz, 100, 10, 1 kHz, 100, 10 Hz may be selected.



Turn Tuning Knob **[T]** to select the desired frequency.

**Connect either straight key or paddles to key jack. For use with an EXTERNAL keyer, configure CTX-10 as Straight Key – turn the internal keyer OFF.**
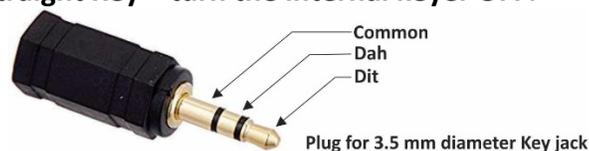


**Push [M]** momentarily to enter Menu Selection Mode, then rotate **[M]** one click **{CW}** to

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enter **TX_POWER** mode. **Push [M]** to select current Power. Rotate **[M]**
**{CW} or {CCW}** to select 1W, 5W or 10W. **Push [M]** to select the displayed status.
**Enjoy using your CTX-10!**

To turn OFF, Press Control Knob **[M]** in for two seconds and release.



If, for some reason, the radio does not turn OFF, press and hold Control Knob **[M]** for six seconds and the radio will turn off.
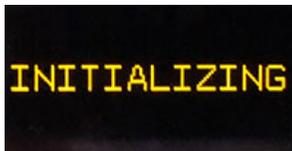
## Quick Start Guide – SSB Transceiver Setup

Connect a suitable 5 – 20 VDC power source to the Power Input jack on the rear panel using a standard 5.5mm barrel, 2.5mm pin plug. An external power source is not necessary if the internal batteries have sufficient charge. See below for determining battery charge status.
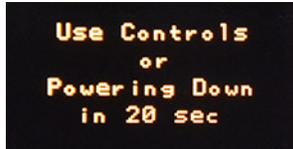


Connect an antenna cable to the **BNC HF** jack on the rear panel. The use of a suitable SO-239 Female to BNC Male adapter may be required to connect from an existing antenna cable to the CTX-10's BNC connector. These adapters are available in right angle as well as straight configurations as illustrated below.



Press Control Knob **[M]** in for two seconds and release. You will see INITIALIZING, the WELCOME! Screen, then the standard frequency display screen.

When first turned on while battery powered, if you do not adjust any controls within the first twenty seconds, the radio will enter Auto-Shutdown Mode and display the following screen.



This is done to prevent accidental battery discharge when the radio is stowed. Within the first twenty seconds of operation, simply turn either knob or push any button to enable normal operation. This screen will not appear if external power is supplied to the radio.

Connect compatible microphone to RJ-45 style **MIC** jack on rear panel. One suggested microphone is the Yaesu MH-31 A8J. Suggest setting switch on MH-31 at position "1". **Push [M]** momentarily to enter Menu Selection Mode, then rotate **[M]** one click **{CW}** to enter **TX_POWER** mode. **Push [M]** to select current Power. Rotate **[M]** **{CW} or {CCW}** to select 1W, 5W or 10W. **Push [M]** to select the displayed status.



**Push [M]** momentarily to enter Menu Selection Mode, then rotate **[M]** three clicks **{CW}** to enter **PTT AUDIO** mode. If required, rotate **[M]** to cycle to **ON. Push [M]** to select current **PTT AUDIO** mode. **PTT ON** enables pin 1 of **ACC** jack, and allows setting of audio level.



**Enjoy using your CTX-10!**

To turn OFF, Press Control Knob **[M]** in for two seconds and release.



If, for some reason, the radio does not turn OFF, press and hold Control Knob **[M]** for six seconds and the radio will turn off.
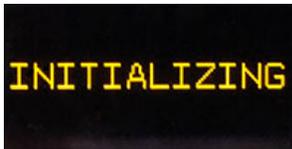
**Quick Start Guide – discussion of Digital Data Modes, directly connected to PC**

The CTX-10 has been tested using the most popular WSJT-X FT8 data mode. As of Sept. 2020, the starting point for WSJT (Weak Signal Joe Taylor) information is:

**https://physics.princeton.edu/pulsar/k1jt/**

Refer to the WSJT-X User Guide (all modes) and the FT8 Operating Guide.  Mode FT8 was launched in mid-2017 and rapidly became the most popular mode on HF.  It uses sequential 15 second windows to alternately receive and transmit, requiring accurately synchronized clocks amongst all stations. This is most easily accomplished by configuring your PC to automatically update system time using an Internet based time standard.

WSJT-X is user friendly and the interface to the CTX-10 is straight forward, requiring no third party interfacing hardware.

This mode has a 50% duty-cycle, transmitting 50% of the time, receiving 50% of the time. Since the CTX-10 is designed to be capable of 100% duty cycle, 50% is very easy duty with no internal or external fan required. The die cast aluminum CTX-10 enclosure is the heatsink for all power circuitry, providing excellent convection cooling to the ambient air.

**Program Installation:** WSJT-X is freeware and is installed on a PC.  Use your browser to search "WSJT-X Download" to locate.

**Connections:**  The only connections are conventional sound card audio (headset and Mic jacks) lines. No interface electronic box of any kind is required, (e.g. no *Signalink USB ™)*

1. Connect sound-out (received audio data from CTX-10) from either the headset jack or pin 5 of the Accessory jack (suggestion: use a commonly available Male-Male 6-pin mini-DIN cable, cut in half to give you two interconnect cables). Alternatively, a ready-made cable is available from XGGCOMMS.com, the "FT-Cable-7". See the FAQ for details.

2. Connect sound-in (from PC-transmitted data) to pin 1 of the Accessory jack.

3. PTT is available on pin 3 of the Accessory Jack if your PC has a serial port. However, this is unnecessary!  The CTX-10 includes an 'Audio – VOX' that is activated and set by the user.  Data modes use continuous audio during the entire transmission and the CTX-10 will turn-on the transmitter when audio is switched on the WSJT-X GUI.
4. See this User's Guide, section **Rear Panel – ACC** for the pin-out of the 6-pin mini-DIN connector.

5. Many new laptops do not have the legacy 3.5 mm stereo headset and microphone jacks. However, some third party laptop docking hubs (for USB 3.0, audio, monitors, Ethernet) do provide these.  An example is the Wavlink Universal USB 3.0 Docking Station that includes these legacy jacks. Another option is to use a readily available, very low cost USB audio dongle, example shown below.
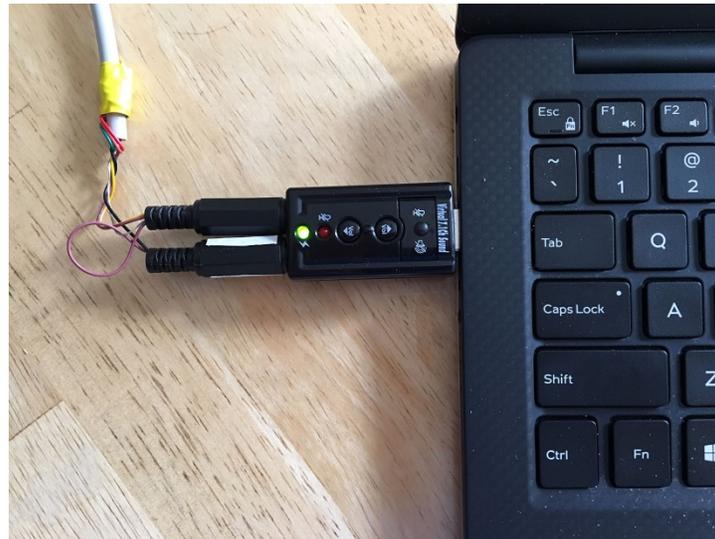


**Audio Levels: (One time settings):**

1. Audio-out to sound card (received data):  Use the audio level control on the left side of the WSJT-X GUI and set into the 'green' on the level bar.

2. Audio-in from sound card (transmitted data).  CTX-10 **[MODE]** must be set to either **USB** or **LSB** (not AM or CW) for the audio level to show on the **PTT_AUDIO** screen. The audio level will need careful adjustment. The audio level must be high enough for full power.  However, if set too high, the transmitter will over-modulate and cause interference.  The WSJT-X GUI has a level setting bar on the right side.  Note: The CTX-10 will not transmit when on the **PTT_AUDIO** screen while using the WSJT 'TUNE' button.

   a. Start with setting your sound-card audio level at approx. 35 % to 40 %.
   b. On the CTX-10, select the 'PTT AUDIO' Menu. Select ON (to enable). NOTE: when on this screen the screen will not 'time-out' and will not allow transmitting, thus enabling the user to use the TEST button on WSJT-FT8 to adjust the level without transmitting. To exit – push twice or rotate **[T]** Tuning Knob one click.
   c. Start the audio source (WSJT-X test signal) and advance the WSJT-X Power level until the CTX-10 screen reads 100 to 130.  (That corresponds is 100 to 135 mVrms audio level).

d. Preferred method is to use a dummy load to do this testing to avoid on-the-air interference. If you must test on-the-air, tune to an open (non data-mode) CW frequency and properly identify yourself.  The established data-mode frequencies are very busy especially during band openings. Your fellow operators will appreciate your consideration and courtesy.  As a reminder, The CTX-10 will not transmit when on the **PTT_AUDIO** screen while using the WSJT 'TUNE' button.

**Frequency Control:** WSJT-X can control the frequency of many brands of transceivers. However, at this time, this feature is not supported on the CTX-10.  Simply tune your CTX-10 to the typical frequencies shown on the WSJT GUI.   These frequencies may be stored in the CTX-10's memory for easy re-use. Please refer to **Key Pad - MEM** in this User's Manual for details. Note: Native USB data mode will not be supported by the CTX-10, only data via standard soundcard interface.

**Operating:**  The CTX-10 is now a slave to the WSJT-X GUI (except for frequency changes). Follow the WSJT-X user guides.  You can operate (using GUI displayed on PC) with a series of mouse clicks to answer establish contact by calling or answering a CQ, provide location and an automatic signal report, send 73, and then auto-log your contact.
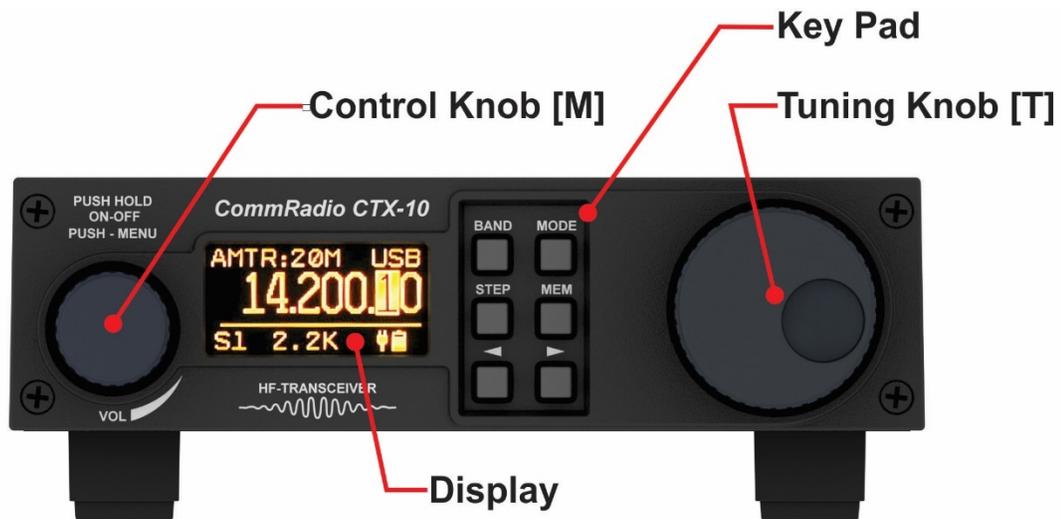
**Display**

The display is a low power, 64 x 128 pixel, 1.5" diagonal amber Organic Light Emitting Diode (OLED) component. The glass screen is Electromagnetic Interference (EMI) shielded. This adjustable intensity display was selected for it's extremely lower power consumption and easy viewing indoors in dark environments as well as outdoors under varying ambient lighting conditions. It is not intended for viewing under direct sun. The display uses very little power regardless of intensity setting. Set to your personal comfortable intensity.
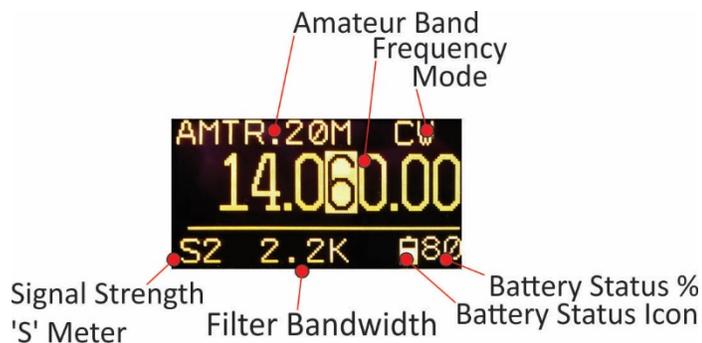


Above is an example of the display during normal receive conditions. The band selected is the Amateur 20 Meter band. The mode is CW. The signal strength on the digital 'S' meter is S2. The battery status is 80% charged. The audio filter bandwidth is 2.2 kHz. The display you see will probably be different based on your selection of operational parameters but the locations of the data will remain the same.   Note: 100% Battery Status shows only a solid battery icon. No numeric display will show for 100% charged battery.

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# Control Knob [M]

**Description:** Rotary Encoder, 12 detents per revolution with push-in switch. Selection will automatically time-out for all selections except PTT Audio.

**ON/OFF Control**

**Push and Hold [M]** two seconds to turn - ON
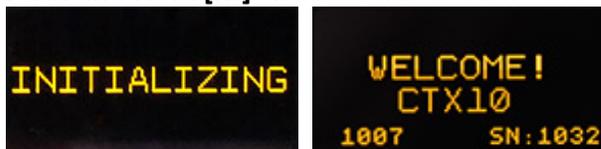


The two numbers at the bottom of the WELCOME! screen display are the software revision (left) and the radio's electronic serial number. The software revision will change if the software in the radio is revised. The electronic serial number is permanent for each radio, and is also shown on a label on the CTX-10's bottom cover.

**Push and Hold [M]** two seconds to turn - OFF



**Volume Control**

Simple rotation of the Control Knob **[M]** raises or lowers the headset and speaker volume.
NOTE: Separate audio levels are maintained for speaker and headphone jack.
There is no indication of the volume level on the display.

**Menu**

With power on, **Push [M]** momentarily to enter Menu Selection Mode. If you wait too long without action, the display will revert to **Display Frequency** mode.



The default, first Menu entry visible is the Antenna Tuning Unit (ATU).
**Push [M]** to **TUNE.** The ATU screen displays   **PUSH TO END**   until the ATU has finished tuning for the attached antenna, or until **[M]** is pushed again, **END**ing the tuning process. When **OUT-OF-BAND** is displayed, the selected frequency is outside the legal US amateur bands. Transmit and Tune functions are not allowed outside the legal US amateur bands.
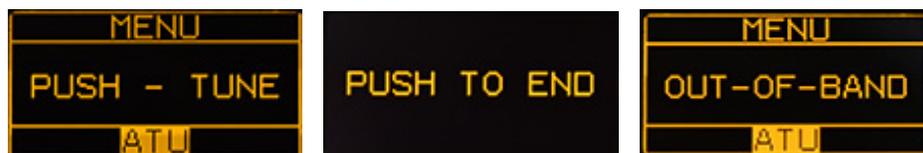
Other Menu selections are grouped by the selected rotation of **[M].**
**{CW}** rotation of **[M]** shows Transmit Menus
**{CCW}** rotation of **[M]** shows Receive Menus

| # Clicks {CW} | Menu Selection | Selection |
|:---:|:---:|:---:|
| 0 | TUNE | PUSH-TO-TUNE |
| 1 | TX POWER | 1W, 5W, 10W |
| 2 | KEYER | OFF, 5 - 50 WPM |
| 3 | CW SIDETONE | 0 (lowest) -7 (highest) |
| 4 | PTT AUDIO | ON, OFF |
| 5 | TUNING MODE | MANUAL, AUTOMATIC |

**{CW}** rotation of **[M]** showing Transmit Menu Selections

## Transmitter

**Push [M]** momentarily to enter Menu Selection Mode, **THEN:**

**TX POWER**
Rotate **[M]** ONE click **{CW}** to enter **TX POWER** mode. **Push [M]** to select current **TX POWER** level. Rotate **[M] {CW} or {CCW}** to cycle through the **TX POWER** levels: 1W, 5W, 10W. Stop rotating the knob when the desired power level is selected. **Push [M]** to select displayed **TX POWER** level.



**KEYER**
Rotate **[M]** TWO clicks **{CW}** to enter **KEYER** mode. **Push [M]** to select current **KEYER** speed, or **OFF.** Rotate **[M]** to cycle through the options – **OFF, 5 WPM** through **50 WPM** in one WPM increments. Select **OFF** if you will be using a straight key. The CTX-10 Keyer is non-Iambic. It is not possible to software switch right / left paddle inputs to switch between dits and dahs. Changing right / left function requires changing the wiring to the paddle.

**CW SIDETONE**

Rotate **[M]** three clicks **{CW}** to enter **CW SIDETONE** mode. **Push [M]** to select current **CW SIDETONE** level. The levels are 0 through 7. Level 0 is lowest, level 7 is loudest. Each digit incremental change is approximately 3 dB.  **CW SIDETONE** is emitted only while transmitting CW. To adjust levels, first select CW as the operational mode. Select a clear frequency or use a dummy load while adjusting volume level to avoid creating inadvertent interference. Use of 1W power output is suggested for this reason.



**PTT AUDIO**

Rotate **[M]** four clicks **{CW}** to enter **PTT AUDIO** mode. **Push [M]** to select current **PTT AUDIO** mode. Rotate **[M]** to cycle through **ON OFF**. **PTT ON** enables pin 1 of **ACC** jack, and allows setting of audio level. The digit(s) to the right of **ON** or **OFF** indicate the mV level of audio input to the radio.
Note: **PTT AUDIO** does not automatically time out. This allows easy setting of levels during setup of digital modes.



**TUNING MODE**

**TUNING MODE – Automatic** allows the CTX-10 to automatically switch operational  MODE (CW, AM, LSB/USB) in accordance with currently displayed frequency and USA band plan.
Note: In **Automatic** the cursor default step is always 0.1 kHz

**TUNING MODE – Manual** prevents the CTX-10 from automatically switching AM, CW, or LSB/USB.
Note: In **Manual** the cursor step will stay at the step size you select , including over power ON/OFF.

Rotate **[M]** four clicks **{CW}** to enter **TUNING MODE** mode. **Push [M]** to select current **TUNING MODE.** Rotate **[M]** to cycle through AUTOMATIC or MANUAL.
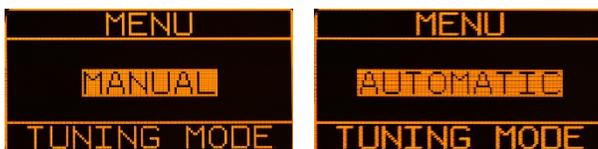
| # Clicks {CCW} | Menu Selection | Selection |
|---|---|---|
| 1 | FILTER | (bandwidth, per mode) |
| 2 | LNA | OFF, ON |
| 3 | AGC | OFF, SLOW, MEDIUM, FAST |
| 4 | HF SQUELCH | (adjustable, on screen bar) |
| 5 | BRIGHTNESS | (adjustable, on screen bar) |
| 6 | STEP TIMING | 250 MS, 500 MS, 1, 2, 5 10 SEC |
| 7 | TIMEOUT | 2, 3, 4, 5 (seconds) |
| 8 | RAPID TUNE | OFF. 2, 4, 6, 8, 10 revs. |

### {CCW} rotation of [M] showing Receive Menus

## Receiver

**Push [M]** momentarily to enter Menu Selection Mode, **THEN:**

**Filter**

Rotate **[M]** one click **{CCW}** to enter **FILTER** mode. **Push [M]** to select current receive **FILTER** bandwidth. Rotate **[M]** one click **{CW} or {CCW}** to cycle through bandwidths available based on the receiver mode selected (AM, CW, USB, LSB). **Push [M]** to select the currently displayed level.
AM 5/7.5/15 kHz       SSB (USB/LSB)1.8/2.2/2.6 kHz       CW 0.5/1/1.8/2.2/2.6 kHz



**LNA (Low Noise (RF) Amplifier)**

Rotate **[M]** two clicks **{CCW}** to enter **LNA** mode. The initial power-on default is **LNA OFF**. **Push [M]** to select current receive **LNA** mode. Rotate **[M]** to select either **LNA OFF** or **LNA ON. LNA** selection is maintained during power cycling.  The **LNA** provides 6-10 dB controlled gain when **ON.** S1 – S2 signals are generally readable with **LNA OFF.** If you need additional gain, turn the **LNA ON.** It has been reported that sometimes **LNA ON** may increase the background noise level with a 'crackling' sound (actually caused by the tuner IC). If this noise is objectionable, turn **LNA OFF.**

## AGC Speed

Rotate **[M]** two clicks **{CCW}** to enter **AGC Speed** mode. **Push [M]** to select current receive **AGC Speed**. Rotate **[M]** one click **{CW} or {CCW}** to cycle through **AGC Speeds** available. **Push [M]** to select the currently displayed level.  **AGC OFF** can be useful for weak signal work, however be aware that the receiver may overload with inputs greater than -70 dBm.     AGC Speeds: OFF SLOW MEDIUM FAST

```
       MENU
       SLOW
       AGC
```

## SQUELCH

Rotate **[M]** three clicks **{CCW}** to enter **SQUELCH** mode. **Push [M]** to select current **SQUELCH** level. Rotate **[M] {CW} or {CCW}** to change the **SQUELCH** level based on the lighted bar on the screen. **Push [M]** to select the currently displayed level. NOTE: Setting the **SQUELCH** control too high may make the radio appear to be 'deaf' with normal signal levels.

```
       MENU
  [▯              ]
  HF  SQUELCH
```

## BRIGHTNESS

Rotate **[M]** four clicks **{CCW}** to enter **BRIGHTNESS** mode. **Push [M]** to select current **BRIGHTNESS** level. Rotate **[M] {CW} or {CCW}** to change the **BRIGHTNESS** level based on the lighted bar on the screen. **Push [M]** to select the currently displayed level. The display uses very little power regardless of intensity setting. Set to your personal comfortable intensity.

```
       MENU
  [              ]
  BRIGHTNESS
```

## STEP TIMING

**STEP TIMING** is the dwell time at each frequency step during stepping or MEM stepping. Rotate **[M]** five clicks **{CCW}** to enter **STEP TIMING** mode. Push **[M]** to select current **STEP TIMING** selection. Rotate **[M] {CW}** or **{CCW}** to change **STEP TIMING**. Push **[M]** to select the currently displayed time.
Selectable STEP times: 10s, 5s, 2s, 1s, 500ms, 250ms

```
       MENU
      2 SEC
   STEP  TIMING
```

**TIMEOUT**

**TIMEOUT** is the period of time a menu selection will stay active prior to returning to the Frequency Display screen.

Rotate **[M]** six clicks **{CCW}** to enter **TIMEOUT** mode. **Push [M]** to select current **TIMEOUT** selection. Rotate **[M] {CW} or {CCW}** to change **TIMEOUT. Push [M]** to select the currently displayed time. Selectable TIMEOUT times: 5s, 4s, 3s, 2s

```
      MENU
    4 SEC
    TIMEOUT
```

**RAPID TUNE**

**When AUTOMATIC** Tuning Mode is selected**, RAPID TUNE** is the number of high speed revolutions of the **[T]** knob before it 'shifts gears' from 0.1 kHz to 1.0 kHz and automatically increases the tuning rate. **RAPID TUNE** reverts back to 0.1 kHz speed when the knob is slowed down or stopped. **RAPID TUNE** does not work while using **MANUAL** Tuning Mode.

Rotate **[M]** seven clicks **{CCW}** to enter **RAPID TUNE** mode. **Push [M]** to select current **RAPID   TUNE** selection. Rotate **[M] {CW} or {CCW}** to change **RAPID TUNE. Push [M]** to select the currently displayed **RAPID TUNE**.

Rapid Tune Options: 10, 8, 6, 4, 2, OFF Revolutions before beginning to **RAPID TUNE**

```
      MENU
    2 REVS
   RAPID TUNE
```

## KEY PAD



80, 60, 40, 30, 20, 17, 15, 12, 10 meters

FREQUENCY STEP

LEFT ARROW

USB, LSB, CW, AM

MEM

RIGHT ARROW
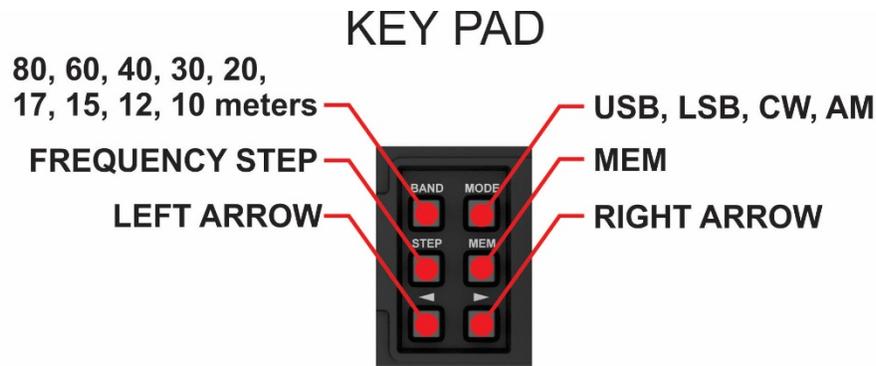
**Key Pad**

The Key Pad is a set of six position momentary contact push button switches. Each of the buttons' functions are described below.

**Key Pad - BAND**

With the current frequency displayed, pressing the **BAND** button will change the active frequency to the amateur radio band displayed in the upper left corner of the display. The options are: AM RADIO/160M/80M/60M/40M/30M/20M/17M/15M/12M/10M
NOTE: 160M and AM RADIO are receive only.

**Key Pad – MODE (MODE select function)**

With the current frequency displayed, pressing the **MODE** button will change the demodulation method used by the DSP. The currently active mode is displayed in the upper right corner of the display. The options are: AM/CW/LSB/USB
NOTE: AM mode is receive only.

**Key Pad – MODE (Morse Code reader function)**

With the current frequency displayed, pressing and **HOLD**ing the **MODE** button will bring up the Morse Code Reader screen. At the top of the screen will be a small digit active display of the currently tuned frequency. In the main body of the screen will be the decoded Morse code text. This function works best on machine sent code with high signal-to-noise ratio. Generally, the more narrow the audio filter, the better results you will see. To turn off Morse reader, press **MODE** again. Please refer to Technical Notes section for further info.

**Key Pad – STEP (Frequency STEPPING and Dual VFO)**

**Frequency Stepping:** With the current frequency displayed, pressing the **STEP** button causes the receiver to immediately begin incrementing the displayed frequency (frequency **STEPPING).** The size of the **STEP** is determined by the location of the highlighted digit on the displayed frequency immediately before pressing the **STEP** button. To terminate the **STEP** function, either rotate **[T]**, the Tuning Knob or press the **STEP** key again. This function is useful for casually listening to an amateur band to determine how active it is. Appropriate selection of **STEP** size allows you to select your desired level of resolution. The upper and lower frequency limits for each amateur band selected for

the **STEP** function cannot be changed by the user. NOTE: When on a **MEM** page, **STEP** will cycle through saved memories, with **[<]** and **[>]** reversing **STEP** direction. Press **STEP** again to stop.

**Dual VFO:** The CTX-10 has two separate VFOs, one for transmit, one for receive, which are normally synchronized together and displayed as one frequency on the display. To display and operate on two separate frequencies in the same band proceed as follows. Dual VFOs function as RIT and/or XIT.

(1) Select the desired Band, Mode, Filter, and Tuning Resolution. You cannot change them while in Dual VFO mode.
(2) Press and hold the **STEP** button for > 2 seconds. The display will show two frequencies, the upper identified as TX (transmit), the lower identified as RX (receive). Initially, TX will be highlighted indicating that the transmit frequency may be adjusted with the Tuning knob. **While the TX is highlighted, you are listening to the TX frequency** so you hear whether not there are other signals present where you are planning to transmit.
(3) To adjust the RX frequency, press the left arrow **[<]**. The RX will now be highlighted. Adjust to desired frequency using the Tuning knob. Press again to toggle frequency selection.
(4) You can now transmit and receive, and adjust both frequencies by following these instructions.
(5) To revert to single frequency operation, press and hold the **STEP** button for > 1 second. The screen won't change until you release the **STEP** button.

**Remember: While in 2 VFO mode, you are listening to the frequency corresponding to the lighted TX or RX indication.**



**Key Pad - MEM**
With the current frequency displayed, pressing the **MEM** button button brings up the Memory screen. Memory is divided into eight pages of eight entries for a total of 64 separate memory locations. With the Memory screen active, use the **<LEFT ARROW>** and **<RIGHT ARROW>** to select the desired page of memory. The currently tuned frequency is displayed in the upper right corner of the display. When you are on the desired memory page, press **MEM** again to jump down to the memory entries. Using the **<LEFT ARROW>** and **<RIGHT ARROW>** jump through the eight memory entries on the page. If you go too far, you will cross the page boundary and jump to the next (or previous) page. To go back to the original page, simply press the other arrow button.

To save the frequency in the upper right corner of the display into a memory location, select the memory page, select the desired memory entry on the page, press **MEM** and hold for 2 seconds. The frequency will be stored in the desired memory location. Repeat until you have populated the memory page(s) with your selected frequencies.

To recall a frequency to the display, go to the desired memory entry, and press **MEM.** The selected frequency will now become the active frequency on the screen.

To **STEP** through (scan) the memory entries on a page, select the page you want to **STEP** through by pressing the **MEM** button and the **<LEFT ARROW>** and **<RIGHT ARROW>** . Press **MEM** again to select any memory entry on the page. Press the **STEP** button to begin stepping through all eight memory entries on the page. If you have less than eight frequencies on the page, only the NON-EMPTY entries will be scanned. To stop stepping press the **STEP** button again. The **STEP** time (the dwell time at each frequency) is set using the receiver setting **STEP TIMING**.
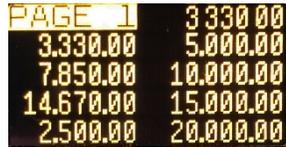


Above is an example of a completely filled out memory page. I've added all of the Canadian CHU and United States' WWV frequencies. When I want to get a sense of HF propagation, I'll **STEP** through these frequencies continuously, listening for the time signals. The upper right corner shows 3.330.00, the frequency currently on the general display screen. At this time, there is no capability to erase one or more entries on a memory page. A workaround is to have duplicate entries of the same desired frequencies. These memories are safely retained even after re-flashing or upgrading the system operational firmware.

**Key Pad - <LEFT ARROW>**
With the current frequency displayed and one digit highlighted with a rectangular lighted box, pressing the **<LEFT ARROW>** causes the highlighted box to move one digit to the left.
This highlighted box indicates the digit to be changed when rotating **[T]** the Tuning Knob.
Tuning Resolutions:  1MHz, 100, 10, 1 kHz, 100, 10 Hz. Additionally, **BAND** and **MODE** can be changed once their function is selected. The direction of **STEP** may also be changed.

**Key Pad - <RIGHT ARROW> (Tuning resolution function)**
With the current frequency displayed and one digit highlighted with a rectangular lighted box, pressing the **<RIGHT ARROW>** causes the highlighted box to move one digit to the right.
This highlighted box indicates the digit to be changed when rotating **[T]** the Tuning Knob.
Tuning Resolutions:  1MHz, 100, 10, 1 kHz, 100, 10 Hz. Additionally, **BAND** and **MODE** can be changed once their function is selected. The direction of **STEP** may also be changed.

**Key Pad - <RIGHT ARROW> (Tuning Knob lock function)**
During normal operation of the radio, pressing and holding the **<RIGHT ARROW>** key for 2 seconds **LOCKs** control of the **[T]** Tuning Knob and **[M]** Main Knob except for **[M]** still controlling audio volume. This can be useful, for example, if you want to operate the radio while stowed in your rucksack, and not have to worry that the frequency may accidentally change.  The radio will allow volume adjustment, and normal transmit function with the Tuning Knob Locked. To **UNLOCK** the radio, simply press **<RIGHT ARROW>** for 2 seconds.

## Tuning Knob [T]

Is a precision low torque digital optical encoder. Also, **[T]** incorporates an axial momentary push button switch. This switch function is not presently used by the CTX-10. Rotation of **[T] {CW}** increases the displayed frequency with a step size as indicated by the highlighted display digit. Similarly, rotation of **[T] {CCW}** decreases the displayed frequency. It is normal for the **Tuning Knob** to have a small amount of radial (side-to-side) play. As long as the knob turns smoothly the encoder is working properly mechanically.

# REAR PANEL



**Power Input**
The power input jack is a standard 2.5mm pin x 5.5mm barrel, pin positive (+) power receptacle. Recommended input voltage range is 5 – 20 VDC, 20 VDC is the absolute maximum. A recommended power supply should provide at least 35 W.

**USB**
The USB receptacle is a standard mini-B 2.0 jack. This USB receptacle is the input jack for software updates to the CTX-10. Additionally, the jack provides IQ data out from the receiver, and provides bi-directional radio control capabilities. NOTE: USB receptacle does not provide power out and does not accept power in.

**Headphone**
The headphone jack is a standard 3.5mm stereo jack providing volume controlled output levels adjusted by rotation of Control Knob **[M]**. A stereo connected jack is provided so you can hear the same audio on both L and R channels.
NOTE: Use this headphone jack as signal source for external **POWERED** speakers, **POWERED** monitor speakers, or any other active circuitry.

**SPKR**

The SPKR jack is a standard 3.5mm stereo jack providing volume controlled output levels adjusted by rotation of Control Knob **[M]**. Inserting a suitable plug into this jack automatically disconnects the internal speaker, allowing all output

NOTE: For use of external passive (**NON-POWERED**) speakers only. To achieve maximum efficiency and minimal power drain, the internal speaker and this SPKR jack are powered by a differential (non-ground referenced) amplifier. **Damage can occur if this output is connected to a ground-referenced device. DO NOT connect to any powered circuitry.**



**Speaker Return**
**Speaker Output**

**Plug for 3.5 mm diameter External Speaker Jack**
**External Speaker typically 4 - 8 Ohms**
**Speaker Return NOT Grounded**
**Speaker Output and Return must not be Grounded**
**Not for use with External Powered Speakers**
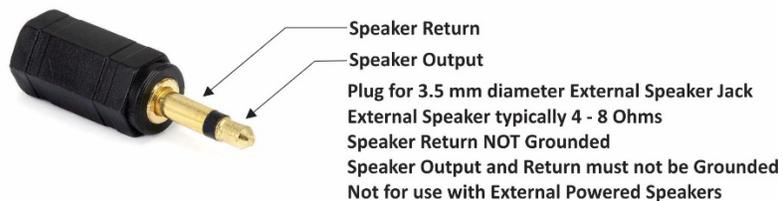
**KEY**

The KEY jack is a standard 3.5mm stereo jack and is the input port for either a straight key or a three wire paddle. Using a straight key, the key turns the CW signal on and off. Using a paddle, the paddle is the input to an electronic keyer which turns the CW signal on and off. To use an EXTERNAL electronic keyer, configure the KEY input to straight key.



**Common**
**Dah**
**Dit**

**Plug for 3.5 mm diameter Key jack**
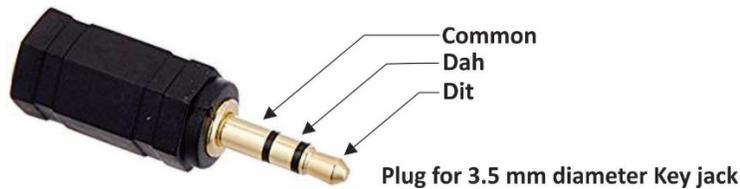
**ACC**

The ACC or accessory jack is a standard 6 pin (female) mini-DIN receptacle, sometimes referred to as a PS/2 connection. Wiring diagram for the ACC receptacle:
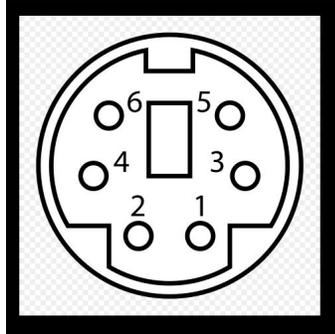
**Pin 1, AUDIO IN,** 100 – 125 mV RMS audio from PC soundcard (TX Data). Used with data-mode transmissions. This line is monitored to enable transmit mode (no separate PTT required).
**Pin 2, GROUND**
**Pin 3, PTT,** Push-To-Talk, Pull-low (Ground) this pin to enable SSB transmission. (Optional, see pin 1)
**Pin 4, MUTE,** Pull-low (Ground) this pin to mute receiver. (Pins 1 and 3 also mute receiver)
**Pin 5, AUDIO-OUT,** Line-level audio output to PC soundcard (RX Data)
**Pin 6, KEY-OUT,** Used with compatible linear amplifier to operate the amplifier's T/R relay during TX. This pin is an open-collector and will ground the linear amplifier's T/R relay. This line will handle up to 225 mA current and up to 50VDC (13.6 VDC nominal). The internal resistance of the amplifier's T/R relay is expected to be high enough to limit the current (greater than 60 Ohms at 13.6 VDC) Check with your amplifier's manufacturer for relay resistance and other parameters.

## MIC

The **MIC** or microphone jack is the input port for a microphone for SSB communication. The eight conductor modular (RJ-45 type) receptacle has been tested and found compatible with Yaesu MH-31 A8J and MFJ-290MY push to talk microphones. Suggest setting switch on MH-31 to position "1". Best results have been found with the FlexRadio HFM-3-RJ45 microphone. Please refer to FAQ for details.
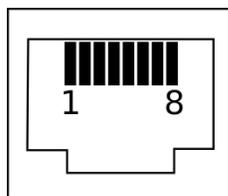


**Pin 3, +5V electret bias**
**Pin 4, MIC Ground**
**Pin 5, MIC In**
**Pin 6, PTT,** Push-To-Talk, Pull-low (Ground) this pin to enable SSB transmission.
**Pin 7, Ground**

## HF

The **HF** connector is the RF 50 Ohm impedance input/output connection to the CTX-10 transceiver. It is a female BNC (Bayonet Neill–Concelman) controlled impedance 50 Ohm

connector. For connection to a standard male UHF plug cable termination, a UG-225/U (SO-239 (UHF) to BNC male adapter) is suggested.

**Ground**

A Ground (chassis) connection is provided on the CTX-10. The topic of whether or not, and how to ground your radio is well beyond what can be written in a few sentences or a few pages. Popular knowledge and personal recommendations on the topic are frequently wrong. A recommended practical reference on the topic is: *ARRL's Grounding and Bonding for the Radio Amateur,* available directly from the ARRL or most Amateur Radio resellers. One common use of the Ground connection is to connect to the ground terminal of the three-wire outlet providing power to the CTX-10 power supply. In addition to providing a Safety Ground, this connection may reduce background noise when listening to the radio.

# CTX-10 Technical Notes

**CTX-10 Power**

Three (3) Tenergy model 30006, type 18650 cylindrical Li-Ion cells, rated at 3.7V @ 2600 mAhr are connected in series. These batteries are easily user replaceable after removing eight screws securing the CTX-10 case bottom cover. Soldering is not required. Batteries fit into 3 slot holder.

The total battery-pack capacity is:

7800 mAhr (3 cells x 2600/ea.)

32,760 mWhr (4.2V x 7800).  (4.2 V is the cell voltage when 100% charged.)

**Battery Protection Circuit**

Each individual battery cell has an internal protection circuit to avoid excessive charging-discharging current and over or under voltage conditions. The internal battery protection circuits will trip and the radio will drop off-line without warning if the batteries become fully discharged. This condition is avoided by the CTX-10's PIC24 microcontroller monitoring battery voltage. However, if any of the batteries trip, the batteries will reset when external power is applied. The CTX-10 will then power-up normally.

**Internal Li-ION Battery Charger**

The batteries are maintained by a combined switch-mode converter with internal charge-controller that maintains a charge rate of approximately 10 to 12 Watts into the battery stack regardless of external power-source voltage. Optimal charging performance with less than 1 Amp current draw requires between 10 – 20 VDC. Charging with as low as 5V is possible but will require up to 2 Amps current draw. Be aware of the current output capability of your power source.

The cells are fully charged at 4.2 V (12.6 VDC battery bus) and 90% discharged at 3.5V (10.5 VDC battery bus).  See table below.

| Voltage: 3 Cells in Series (VDC) | Percent (%) Remaining |
|---|---|
| 12.2 - 12.6 | 100 RX-TX |
| 11.9 | 90  RX-TX |
| 11.7 | 80  RX-TX |
| 11.4 | 70  RX-TX |
| 11.1 | 50  RX-TX |
| 10.95 | 30  RX-TX |
| 10.8 | 20  RX-TX |
| 10.5 | 10  RX Only |
| <10.5 | Shutdown by controller |

**Monitoring Voltage Input at power jack and Battery Charging**
The presence of a voltage greater than (>) 0.3 VDC indicates the presence of the power source (power supply, battery, etc.).  Any voltage in the range of 5.0 – 20V will allow charging. When a power source is present, the batteries will be charged with the CTX-10 either **ON** or **OFF**.  **You may connect the CTX-10 directly to a solar panel as long as maximum input voltage is not exceeded. You do not need an external charge controller!**

The internal micro-processor will prevent transmitting (at any RF power setting), once the battery charge state has fallen below 20% remaining capacity. Receiver-only operation can continue down to 10% capacity before an orderly shut-down (with data saved) is initiated.

**The Beauty of a COLD BOOT**
As anyone who has ever used a computer will tell you, the longer it runs the more likely it is that something will get corrupted and the performance will suffer, until you perform a COLD BOOT. The design of the CTX-10 intentionally removes power from all software driven processes upon power down.  Upon power up all processes are initialized, all functional parameters reset, and everything performs 'just like new'. Your last operational settings, which were stored in flash memory during the graceful power off, are reloaded from flash storage saving you setup time.  Therefore, in the highly unlikely event that the radio ever *locks-up* or *misbehaves,* turning the power OFF and back ON should resolve the problem. If the radio won't shut off after a normal OFF push, holding the **[M]** in for 6 seconds **will** turn power off.

**Morse Code Reader**
A handy feature for those of us who are not fluent in Morse is a built-in Morse Code reader. To use this feature, tune around to some frequency with Morse Code activity. Press and hold the **MODE** key and the screen will change to show the active frequency in the upper right portion of the display, and the decoded Morse Code in the larger portion of the screen. Adjust the tuning knob, and filter bandwidth for best results. One method that works it to listen around using 1.0 to 2.6kHz audio filter. When you find a signal of interest switch down to 0.5kHz bandwidth for best copy. No, it isn't as good as a finely tuned Mark V Mod 0 brain/ear combo, but then again, nothing is. This function works best on machine sent code with high signal-to-noise ratio.

**Beware of interrupting a …*Powering Down…* Process**
Holding the **[M]** down will initiate a Powering Down process. If you press and/or hold **[M]** while the display shows Powering Down, you may (or may not) stop the process. Stopping the process mid-way through like this may result in the audio or some other function not performing properly. If this should happen, simply press and hold **[M]** again, allowing the process to gracefully complete. Once again, **The Beauty of a COLD BOOT**.

**The LOCK function**
When using the radio, sometimes you just want to stay on one frequency and monitor or communicate. An easy way to ensure the frequency doesn't change is to press and hold

the **<RIGHT ARROW>** on the Key Pad. After holding for about two seconds, a small LOCK icon appears on the bottom of the display. When the LOCK is shown, rotation of **[T]** will not cause the frequency to change. This may be helpful when you want to operate with your CTX-10 in your rucksack, or if little fingers may get curious… Pressing and holding **<RIGHT ARROW>** again will remove the LOCK icon and restore function of **[T]**.

**USB Power Bricks for the CTX-10?**
The CTX-10 will accept a power input of as low as 5VDC. I have several USB Power Bricks from Radio Shack and SOLIO. A couple provide as low as 3.1VDC output. These are not acceptable, you really need about 5VDC, ideally at 2A. If you are experiencing difficulty with a particular Power Brick, measure the output voltage to make sure it is at least 5VDC. Also remember that the mini-USB jack on the rear panel of the CTX-10 is for Data I/O only. Power must be input to the 2.5mm pin x 5.5mm barrel, pin positive (+) power receptacle. Although I haven't tried it, hooking two, less than 5 VDC power bricks in series would probably work just fine. **NOTE:** For best results, if using a good 5V power brick, the batteries should be pre-charged to at least 60%. During transmit, lower than expected output power may result. **NOTE:** An external power source will **ALWAYS** charge the battery with power ON or OFF, or if TRANSMITTING or RECEIVING.

**Dual VFOs? How do I access Dual VFOs?**
Please refer to:   **Key Pad – STEP (Frequency STEPPING and Dual VFO)**   for details.

**Support Products for CTX-10**

As a good product gains popularity and field acceptance, companies notice, and provide complementary products to enhance the user experience. A synergistic relationship develops between these products and the end user benefits from the resulting ecosystem. So far, the CTX-10 has received support from two benchmark companies, Begali and Portable Zero.

**Begali**, arguably, produces the finest looking best performing Morse code paddles and keys in the world. Comparable to Ferraris and Stradivari, Begali produces products with the perfect blend of styling and performance. We are very pleased that they chose to make a custom bracket for the CTX-10 which will allow use of their Adventure Mono or Dual paddle on either the right or left side of the radio, either with or without Portable Zero Escort side rails. Begali:  https://www.i2rtf.com/

**Portable Zero** has set the standard for tactical accessories for the CTX-10 and other popular radios. The Portable Zero Escort side rails provide superb protection for the front and rear panels of the radio, while not interfering with normal operation. The rails are laser cut, powder coated alum alloy for a long service life. Installation takes no more than a few minutes and looks great too. They even allow installation of the Begali custom bracket for the Adventure paddles, right or left side. The external battery box more than doubles the endurance of the CTX-10 for about one pound increase in weight.
Portable Zero: http://www.portablezero.com/





The CTX-10 Escort is fully Compatible With the Begali Key and Mount





CTX-10 ESCORT
WITH FIELD POWER 3 BATTERY CASE
(SOLD SEPARATELY)

**A Peek inside the CTX-10!**

The CTX-10 is designed so that the user may remove and replace the internal batteries as required. Three Li-Ion #18650 batteries are secured in a ruggedized socket as shown in the right picture. To access the batteries, turn the radio upside down and lay on a soft smooth surface, perhaps a piece of cloth. The left picture shows the location of the eight #4-40 screws which secure the bottom plate to the die cast chassis. Each screw is adjacent to a red arrowhead. Remove all eight screws using a #1 cross-point or Phillips screwdriver. Carefully set the screws aside, they are easy to lose.



The batteries are press-fit into the holder, and will not readily come out. They can be lifted using your fingers, a small flat-blade screwdriver or a plastic tool such as a *spudger,* frequently used to open cellphone cases. I do not recommend taking the batteries out without having a good reason, but when you do, I do recommend adding 'tape handles' to make battery removal easier next time. Clear packing tape or other thin tape may be used, I used a piece of Kapton tape. Start with a short, maybe 1" long tail. Wrap one loop around the battery continuing to cover the exposed tail with the end of the tape. That's it! From then on, just pull each tail and the battery will follow. The pictures below provide some detail, showing one battery with the tape handle. Note that all batteries are aligned in the same positive-negative orientation, as is marked on the battery socket.

**Ambient Noise Gate (ANG) – SSB Audio Processing**

A feature unique to the CTX-10 is the Ambient Noise Gate. With the opposite functionality of an audio compressor, the CTX-10 noise gate strongly attenuates audio signals that register below an automatically determined threshold. What that means, is when you key the Push-to-Talk (PTT) microphone, the transmitter is enabled. With the transmitter enabled, the processor looks for audio coming from the microphone. If the audio level being detected is below an automatically determined level, transmitter output is gated OFF. When audio level being detected is above the threshold level, transmitter output is gated ON after 10ms. For normal speaking levels with a standard microphone everything works as you would normally expect. If however, you pause for greater than 400ms, the output will be gated OFF, preventing background ambient noise from being transmitted. As soon as speech is resumed, normal power output is restored. This all happens very quickly, without any adjustments or human intervention. A beneficial effect of the ANG is battery life will be extended slightly, depending on the particulars of an individual's speech pattern and ambient noise levels. The ANG feature can not be disabled. The FlexRadio HFM-3-RJ45 microphone has been found to give the best results with ANG. Please read the FAQ for details.

**Antenna Tuning Unit – ATU – Some details!**

The standard-equipment, built-in ATU is one the features which separates the CTX-10 from many other radios. ALL ATUs use a combination of switched inductances and capacitances to provide an impedance match between the connected antenna and the power amplifiers. The 'secret-sauce', the difference between various manufacturer's ATUs is the software – the algorithms which drive the switching functionality. The CTX-10's algorithm is finely tuned, yielding an optimum matching solution with a minimum of intermediate steps.

The matching chain is as follows:
Transmitter (Power Amplifier) > Series Inductor(s) (L) > Shunt Capacitor(s) (C) > Antenna
The 6 switched-discrete-stepped Inductors can total up to 4.184 uH.
The 8 switched-discrete-stepped Capacitors can total up to 2146 pF.
The algorithm has as inputs: Vf (forward voltage), Vr (reflected voltage) and Vph (phase voltage). The phase voltage is minimum when antenna impedance is purely resistive. As it is impossible to actually achieve a 1:1 SWR under all conditions, a targeted 1.5:1 SWR is deemed optimal (4% loss), with a 2.0:1 SWR being acceptable (11% loss). An operational SWR limit set for the CTX-10 is 3.0:1 (25% loss) since this allows operation without concern for damage to the radio. (SWRs as high as 8.0:1 **during tuning** will not cause unnecessary wear and tear to the relays or circuitry since the power level during tuning is limited to 2 W. During power down, all relays are returned to de-select condition. If the ATU is not utilized, all relays remain in de-select condition. If a band change occurs, all relays are returned to de-select. If the operator returns to a band where a solution is available, the relays are returned to that selected configuration. No harm is done to the radio by using the ATU as often as you wish. A sanity-check can be run on the ATU by running after connecting a suitable 50 Ohm dummy load. The ATU should match at ~1:1.

# CTX-10 Frequently Asked Questions (FAQ)

**Q. What microphone(s) do you recommend using with the CTX-10?**

**A.** At CommRadio, we greatly appreciate the comments and suggestions provided by the user community. The microphone input jack on the rear of the CTX-10 is compatible with the Yaesu standard wiring configuration. We originally recommended the Yaesu MH-31 A8J (dynamic) microphone. While about half the users like the performance of this microphone, we have had a significant number of comments reporting broken-up or 'clipped' sounding audio. After testing numerous microphones in the lab and in the field, we find that the CTX-10 works best with a higher level (electret) microphone. The best microphone we've found is the FlexRadio HFM-3-RJ45, available directly from FlexRadio.

https://shop.flexradio.com/flexradio-fhm-3/

This is an electret microphone and is fully compatible with the CTX-10, obtaining its bias voltage from pin 3 of the microphone jack. For those who already have a Yaesu MH-31, we can fully recommend the 'W2ENY Replacement Electret Element Kit' as a quick Do-It-Yourself project.

https://www.w2eny.com/YaesuMic/

This kit provides the electret element and instructions for installation into the MH-31 casing. If you already have a soldering station set up, the whole job will probably take no more than 15 minutes. From numerous reports of great performance, we can fully recommend either the FlexRadio HFM-3-RJ45 or the W2ENY modified Yaesu MH-31.

**Q. What cable should I use between my computer and my CTX-10 for digital modes?**
A. As an alternative to making a custom cable in the shop, we can fully recommend the **FT-Cable-7** from **xggcomms.com**. Several CTX-10 owners, myself included, are happy with the quality and performance of these cables. The company is in the UK, and has been around many years providing Yaesu accessories. As of Sept 2020, the price is $15. Each. Shipping is $8.00 and it takes about a week.  And yes, he does take PayPal.

**Q. When I select the cursor step size (1 kHz, 10 kHz, etc.) it does not stay the same, it keeps jumping to 0.1 kHz. How do I fix this?**
A. If TUNING MODE is set to AUTOMATIC the default cursor step size is 0.1 kHz. If Rapid Tune is ON it jumps to 1kHz after X (selected number) revolutions. If TUNING MODE is set to MANUAL the cursor remains in the selected location.

**Q. The rear of the radio is marked 10 – 20 VDC for power input, but the User's Guide says 5 – 20 VDC. Which is it?**

**A.** The general recommendation is 10 – 20 VDC, since the current draw on the power supply will be about 1 Ampere at 10 VDC. The radio can charge at 5 VDC but would like to see about 2 Amperes to charge at the full rate. Lower current availability at 5 VDC will result in longer charging times.

**Q. When I whisper into the microphone nothing is transmitted. Is my radio broken?**

**A.** Please refer to the Technical Notes - Ambient Noise Gate (ANG) – SSB Audio Processing for details.

**Q. How should I clean and protect the finish of my radio?**

**A.** The chassis is finished with a very durable powder coated paint finish. Surface dust can be removed with a lightly dampened soft cloth. Dust in the external heatsink grooves on the chassis can be removed with a dry or lightly dampened soft paint brush which will get to the bottom of the grooves. I can recommend a product such as *303 (30308) Aerospace Protectant for Plastic, Vinyl and Rubber* (or equivalent) available from Walmart. Use this to slightly dampen the cloth or paintbrush. These products should not leave a film or coating on the chassis. I do not recommend *Armor All* as I've found it leaves a nasty film that never seems to go away. Never spray any finish directly on the chassis. Use only a dry cloth or a LensPen (like you use on your camera lens) on the display screen. Treat your radio like you would your camera or binoculars.

**Q. How do I 'Zero Beat' an incoming CW signal that I want to answer?**

**A.** The CTX-10 transmits and receives on the exact frequency displayed, no offset. The CW sidetone is an internally generated ~710 Hz tone to indicate a key-down, transmitting condition. The receiver audio output is fixed at ~710 Hz offset from the received frequency. The sidetone frequency produced by the CTX-10 when transmitting CW is the same as the offset tone of the receiver. If you adjust the received signal's pitch to be the same as the sidetone pitch, you will be transmitting on the same frequency as the station you are receiving. This is sometimes called Zero Beating, or more accurately Sidetone Matching.

# CTX-10 Specifications

Transmit Bands:  80, 60, 40, 30, 20, 17, 15, 12, 10 meters (no 160m).

Transmit Modes: USB/LSB/CW/Data (sound card) (no AM, no FM)

RF Power Output:  1, 5 or 10 Watts

Receive Coverage:  150 kHz - 30 MHz

Receive Modes:  USB/LSB/CW/AM

Receive Bandwidths:  AM 5/7.5/15 kHz;  SSB 1.8/2.2/2.6 kHz;  CW 0.5/1/1.8/2.2/2.6 kHz

Receive Auto Bandwidths:  AM 5/7.5/15 kHz;  SSB 1.8/2.6 kHz;  CW  1/0.5 kHz

Pre-Selectors:  .15-.54, .54-1.71, 1.7-4, 4-7.5, 7.5-14.5, 14.5-21, 21-30.0 MHz

Tuning Resolution:  1MHz, 100, 10, 1 kHz, 100, 10 Hz.

Sensitivity MDS:  Above 1.800 MHz:  -135 dBm ( 500 Hz CW) Sensitivity SSB:  -110 dBm
(2600 Hz SSB)      Below 1.800 MHz: -115 dBm ( 500 Hz CW)

Audio System:  0.8 watts @ 8 Ohm to  1.2 x 1.6" Internal Speaker or External Speaker jack

AGC Attack Time:  Slow/Medium/Fast/Off      Antenna Input:  BNC 50 Ohm

Display Type:  OLED 64 x 128 1.5" diagonal, EMI coated glass protective cover installed

DC Power Jack:  5 - 20 VDC   2.5 x 5.5mm, center positive. 20 VDC absolute maximum.

DC Power:  5 – 20 VDC   Normal charging draws with power OFF: 10 -12 W. Current
required is a function of voltage. Examples: 12 VDC ~1 A, 18 VDC ~0.65 A, 5 VDC ~2 A.

Batteries:  3 pc.  #18650  Li-ion 4.2 V @2.6 Ah (each)

USB Mini-B 2.0 Jack:  Firmware updates, I-Q data & radio control, Windows spectrum
scope. No power input or output from mini-USB jack.

ESD Protection:  ESD diodes at antenna, power jacks, USB port, keys and knobs.

Physical:  Size: 5.61"W x 1.55"H x 6"D     Weight: 2.2 lbs.
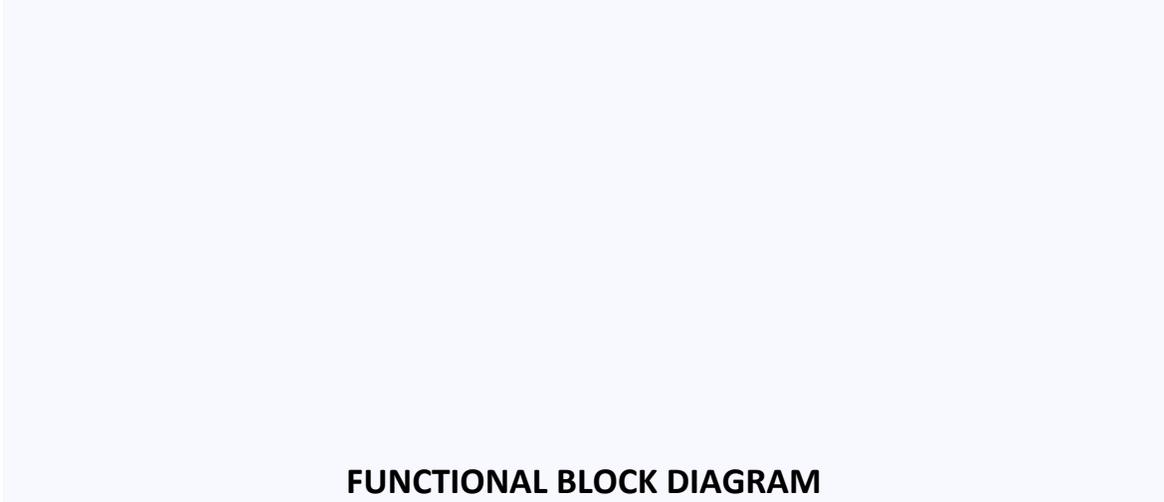
**FUNCTIONAL BLOCK DIAGRAM**

# CommRadio

## CTX-10 Amateur Radio Transceiver
## Functional Block Diagram

HF+83.0 MHz → **DDS** (6) → 249.0 MHz

CW Bypass

**Dual PLL** (8)

ATU Switched L-Section

Phase Detector

Directional Coupler

Band Switched Low Pass Filters

BNC

T/R (1)

6x / 8x (1)

Ø (Phase Detector)

$V_{PH}$

$V_{REF}$

$V_{FWD}$

(1) Band Switched Low Pass Filters

(2) (3) Output Power Transistor

(4) Driver

(5) Mixer

(7) Mixer

19.2 MHz

83.0 MHz

IQ

**XMTR CODEC** (9)

ACC. JACK AUDIO (DATA) IN

EXT'L MIC IN (10)

19.2 MHz

**Master Distributed Frequency Reference 0.2 ppm TCXO**

19.2 MHz

150 - 550 KHz (1)
540 - 1710 KHz (2)
1.7 - 4.0 MHZ (3)
4.0 - 7.5 MHZ (4)
7.5 - 14.5 MHZ (5)
14.5 - 21.0 MHZ (6)
21.0 - 30.0 MHZ (7)

7x Band Pass Filter Pre-Selector Auto-Switched

(17) Rx Solid State Switch

(11) RF Tuner — IQ

(12) ADC / ADC — Dual 14 bit ADC

19.2 MHz

**FLASH RAM**

Optical Tuning Knob [T] and Switch

**DSP** (13)

**PIC 24F** (14) — 24 MHZ CLOCK

Accessory Jack
CW Key / Paddles
Control Knob [M] and Switch
Keypad 6 position
GPIO / RELAY & SWITCH CONTROL

**FRONT PANEL OLED DISPLAY**

**FTDI UART** (15) → USB

**RCVR CODEC** (16)

19.2 MHz

HEADPHONES
INTERNAL SPEAKER
EXTERNAL NON-AMPLIFIED SPEAKER
ACC. JACK AUDIO (DATA) OUT

## LEGEND

| XMTR | RCVR | CTRL |
|------|------|------|

**PWR MGMT** (18)

$e_{in}$ = 5 to 20 VDC @ 12W

$e_{out}$ SYSTEM BUS

3x #18650 Li-ion
2.6 Ah Internal Battery
3.7 VDC nominal,
4.2 VDC max. full charge
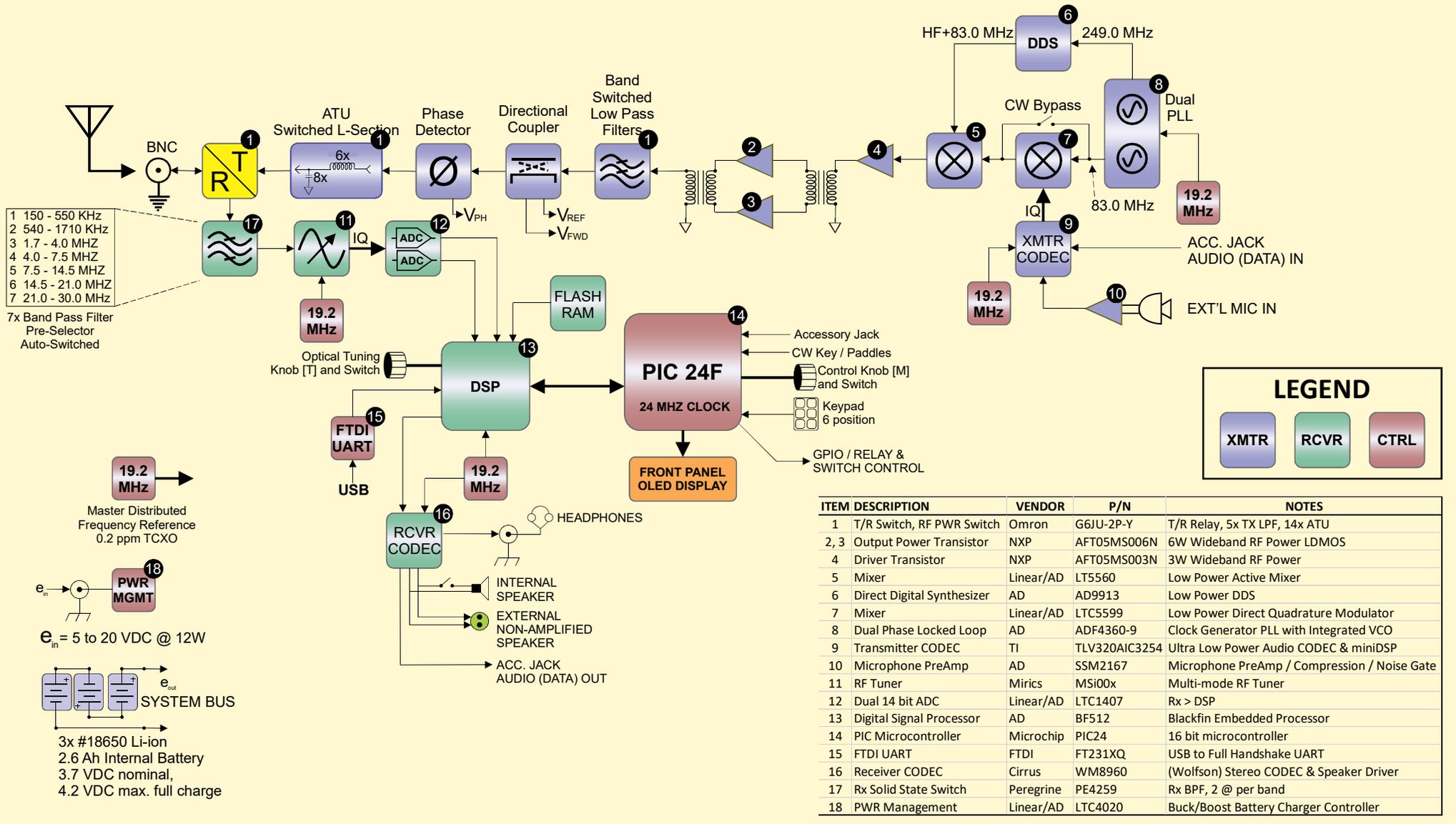
| ITEM | DESCRIPTION | VENDOR | P/N | NOTES |
|------|-------------|--------|-----|-------|
| 1 | T/R Switch, RF PWR Switch | Omron | G6JU-2P-Y | T/R Relay, 5x TX LPF, 14x ATU |
| 2, 3 | Output Power Transistor | NXP | AFT05MS006N | 6W Wideband RF Power LDMOS |
| 4 | Driver Transistor | NXP | AFT05MS003N | 3W Wideband RF Power |
| 5 | Mixer | Linear/AD | LT5560 | Low Power Active Mixer |
| 6 | Direct Digital Synthesizer | AD | AD9913 | Low Power DDS |
| 7 | Mixer | Linear/AD | LTC5599 | Low Power Direct Quadrature Modulator |
| 8 | Dual Phase Locked Loop | AD | ADF4360-9 | Clock Generator PLL with Integrated VCO |
| 9 | Transmitter CODEC | TI | TLV320AIC3254 | Ultra Low Power Audio CODEC & miniDSP |
| 10 | Microphone PreAmp | AD | SSM2167 | Microphone PreAmp / Compression / Noise Gate |
| 11 | RF Tuner | Mirics | MSi00x | Multi-mode RF Tuner |
| 12 | Dual 14 bit ADC | Linear/AD | LTC1407 | Rx > DSP |
| 13 | Digital Signal Processor | AD | BF512 | Blackfin Embedded Processor |
| 14 | PIC Microcontroller | Microchip | PIC24 | 16 bit microcontroller |
| 15 | FTDI UART | FTDI | FT231XQ | USB to Full Handshake UART |
| 16 | Receiver CODEC | Cirrus | WM8960 | (Wolfson) Stereo CODEC & Speaker Driver |
| 17 | Rx Solid State Switch | Peregrine | PE4259 | Rx BPF, 2 @ per band |
| 18 | PWR Management | Linear/AD | LTC4020 | Buck/Boost Battery Charger Controller |