TEN-TEC 506 Open Source Qrp Transceiver Instruction Manual

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Your New Rebel 506
Introduction: The Open-Source Concept
The TEN-TEC Rebel model 506 is designed with the purpose of providing Ham Radio operators a platform for developing and writing code using the open-source Arduino programming environment. It is a factory-built QRP radio with a chipKIT™ Uno32™ Arduino compatible processing unit that holds the operating program. The radio is provided with programming for basic operating functions that allow it to be used immediately as a basic QRP transceiver. Additional operating functions can be programmed by the user, either by writing the code or copying/adapting code developed by members of a growing number of Arduino special interest groups. It is this sharing of programming routines and ideas for functionality that is the heart of the Arduino open-source concept.

Unpacking Your Rebel 506

Examine the unit for signs of shipping damage. Should any damage be apparent, notify the delivering carrier immediately, stating the full extent of the damage. Save all cartons and packing materials to document the damage.
Liability for any shipping damage rests with the shipping carrier. Note that no accessories are included with the Rebel 506. The assembled radio is the only item of hardware. All power, antenna, keying, and programming connectors are standard types. No specialized cables or adapters are required. This manual and any purchase-related paperwork are the only other items packed with the unit.

About this Manual
This Operator's Manual includes a complete description of the features and functions of the Rebel 506. The latest version of this manual is also available at www.tentec.com. Also avail-able online are additional technical resources, including schematic diagrams and a list of resources to help users get started with Arduino programming.

Power, Antenna, Keying, and Audio Connectors
The DC power connector is a 2.1 mm coaxial power connector with the center pin positive (+). A user-provided power source of 10-15 VDC is required. The antenna connector is a female BNC connector. The impedance is 50 ohms.
The Key/Paddle connector is a 1/8" stereo jack. As provided by the factory, only a key or external keyer may be

used, with a connection to the tip and sleeve. Tip, ring, and sleeve are available if the user chooses to include a CW keyer when programming the chipKIT Uno32. The Speaker/Headphone connector is a 1/8” stereo jack. The factory setting is for headphones, and either monaural or stereotypes may be used. If a speaker is preferred, an internal jumper may be moved, which will drive a speaker connected between the ring and sleeve. See Sections 3 and 4 for additional details.

Internal Connections
With the cover removed, several additional connections are accessible: The chipKIT Uno32 Arduino processing card has an onboard mini-USB connector, accessible at the rear of the PC board. On the main PC board are the band selection jumpers, the speaker enable jumper, and four pin-type connector blocks that provide access to the interface and monitoring functions of the processor card.

Front Panel
(Refer to the photo above)

Basic Radio Controls

The power switch is located at the upper left of the front panel. DC power from the external power supply is switched to the radio circuitry. The radio is protected from reverse voltage polarity by protection diodes that are placed between the power source and switch. The VOL (volume control) knob at the lower left of the front panel operates in a typical manner, controlling the audio level of the headphones or speaker. At the lower right is the RIT (Receiver Incremental Tuning) knob, which controls the frequency offset in the receive mode. The RIT control has an adjustment range of approximately ±0.5 kHz, which allows the operator to tune the receiver to signals that are slightly off frequency, without changing the transmit frequency. When the indicator on the knob is centered — aligned with the “I” of RIT — the radio has a normal receive offset of approximately 800 Hz.

SELECT and FUNCTION Pushbuttons
Three functions, and three settings for each function, are selected using the front panel FUNCTION and SELECT pushbuttons. Green, yellow, and red LEDs indicate which function or setting is currently selected.
Using the FUNCTION button, the user may choose among the following:
BW: I.F. filter bandwidth
STEP: Tuning step size
USER: User-programmed functions

The SELECT pushbutton chooses the programmed setting for each function:BW: W (wide ~ 2.5 kHz)
M (medium ~ 1.5 kHz)
N (narrow ~ 800 Hz)
STEP: 100 (Hz), 1K (Hz), 10K (Hz)
USER: U1, U2 or U3 (user programs)

Tuning Procedure

As programmed at the factory, when power is turned on the Rebel 506 will be tuned to the QRP calling frequency on the band selected: 7.030 MHz on the 40-meter band, or 14.060 MHz on the 20 meter band. Note that the front panel does not have a frequency display. (Such a display may be one of the Arduino programming and interface functions added by the user.) The TUNE knob controls the operating frequency in the following manner: As the TUNE knob is turned, the LED in the center of the TEN-TEC logo at the upper right of the front panel will flash with every tuning step, as selected by the user. For example, if the 100 Hz step size is selected and the user wishes to tune to a frequency 1 kHz higher than the startup frequency the user would turn the knob clockwise and count ten flashes. Although this method may seem cumbersome, it allows the Rebel 506 to be operated immediately, without additional user programming.
The radio is factory-programmed to avoid operation outside the amateur bands. When tuned to the band edge, the LED remains lit to show that the tuning limit has been reached.

Rear and Side Panels

(Refer to the photo above)
Rear Panel Connections
DC POWER (2.1 mm coaxial power connector): Connect an external regulated DC power source of 10-15 volts to this The center pin is positive (+). HEADPHONE/SPEAKER (1/8” stereo phone jack): Accepts standard stereo headphones, with monaural audio routed to left and right earpieces. When a speaker is desired (see Section 4.2), the audio is routed to the tip and sleeve of the connector. ANTENNA (BNC female): Connect a nominal 50 ohm impedance antenna. KEY/PADDLE (1/8” stereo phone jack): The Key/Paddle connector is a 1/8” stereo jack. As provided by the factory, only a key or external keyer may be used, with a connection to the tip Model 506 Rebel Schematic Diagram and sleeve. If the user wishes to add a keyer as part of the Arduino programming, both tip and ring connections are accessible to the processor for the paddle inputs.

Sidetone Level Adjustment
A sidetone level adjustment potentiometer can be reached via an access hole on the left side panel (visible in the photo at the beginning of this manual).

User-Programmable Potentiometer

An additional internal potentiometer is available for user programming (e.g., CW keying speed), and is accessible via a second access hole on the left side panel.

Internal Adjustments and Connections
(Refer to the photo above)

Meter Band Selection
To select the desired band, the user must move five (5) jumpers located in the right rear area of the main PC board. The outer pins of the 3-pin headers are labeled “20M” and “40M” to indicate the proper position of the jumper. Be sure that all five jumpers are in position for the desired band before applying power.

Speaker/Headphone Selection
A 2-pin header and jumper for speaker/headphone selection is located in the left rear portion of the PC board. The jumper is placed over both pins for speaker operation. This bypasses a resistor that reduces the volume for the headphone

Table 1
listening. The jumper is removed for headphone operation. When using headphones, the jumper can be stored in place by moving it so that it covers just one pin.

Connections to the Processor Board

In the left-center portion of the PC board are connections to the ChipKit Uno32 processor board, which is located under the radio PC board. Sockets on the top of the board-to-board connectors provide access to the process connections. Table 1 above lists the functions for each connector pin. Some are used for radio control, others are available for user-defined functions.

Additional Connections
As noted in Section 3.3, a potentiometer is located adjacent to the 6-pin inline socket in the left-center portion of the PC board. This adjustment is included for user programming of a function that requires adjustment. It is not used with factory default programming.

Schematic Diagram
(See pages 6-7)

Specifications

- Key Jack: 1/8” stereo
- Power Connector: 2.1 mm coaxial
- RF Output Connector: BNC female
- Headphone/Speaker Jack: 1/8” stereo
- Frequency Range: 7.000-7.300 MHz 14.000-14.350 MHz
- Antenna Impedance: 50 ohms
- DC Power Requirement: 10-15 volts
- Operating Temperature Range: 0-50º C
- Dimensions (H×W×D): 2.0”×6.0”×4.0” (not including feet, knobs, connectors)
- Weight: 1.33 lbs.
- Construction: Painted steel enclosure
- RF Power Output: Approximately 5 watts at 13 VDC; reduced output at
- lower supply voltages
- Harmonic & Spurious Outputs:
- Meets FCC specifications

In Case of Difficulty

Typical procedures should be followed when the unit does not operate or when one or more functions do not work properly: Check power supply voltage and polarity, loose connections, and correct connector. Check that ALL band selection jumpers are in either the “20M” or “40M” positions. Verify that a proper antenna is connected to the selected band. Programming-related problems are best handled with the assistance of members of Rebel and Arduino user groups. Remember, you may restore the unit to its original factory-provided operation with the official TEN-TEC released software. TEN-TEC service may be contacted by e-mail at: **service@tentec.com**, or by telephone at (865) 428-0364.

Warranty and Return Policy

The warranty policy for Ten-Tec products is covered on the last page of this manual. Return Policy for Equipment Manufactured by TEN-TEC: TEN-TEC factory-built radio equipment is sold under a 30-day risk-free trial period. Any piece of equipment manufactured by TEN-TEC may be returned, undamaged, within 30 days of purchase for a full purchase price refund, less shipping charges (customer pays shipping both ways). If you want to return a piece of equipment purchased from TEN-TEC, please call the sales department at (865) 453-7172 from 8 a.m. to 5 p.m. Eastern time, Mon-Fri, and obtain a return merchandise authorization number. Calling in advance for an RMA number allows us to quickly process your return and refund once your item arrives. Ship return items with a letter enclosed inside the box noting the RMA number and your name, address, and telephone number. Return items are shipped to: TEN-TEC Inc., 1185 Dolly Parton Pkwy, Sevierville, TN 37862 USA.

Appendix: Getting Started with Arduino
Purpose and Capabilities
The TEN-TEC Model 506 Rebel is controlled by a chipKIT Uno32 Arduino-compatible processing unit. Arduino is a microcontroller hardware/software environment that is designed for open-source, collaborative programming and associated hardware development. Various user groups have been established to share programming code and hardware implementation. The 506 Rebel is a basic radio platform, provided as a factory-assembled unit that enables users to immediately proceed with the development of programming and hardware accessories. This section of the Operating Manual is intended to assist a new Rebel owner in finding information about Arduino, the chipKIT Uno32, and the community of users. We recommend that you explore the websites listed below to become familiar with Arduino. As you learn more, locate and download development tools and documentation. Also, there are other Arduino-related sites that you can find through user group discussions or with an Internet search engine.
IMPORTANT NOTE: Support is provided only for operating software officially released by TEN-TEC. The

company does not provide support for user programming or modifications.

Web-based Resources
Arduino:

Web-based Resources
Arduino:

- **http://www.arduino.cc/**
- **http://forum.arduino.cc/** (user discussion forum) chipKIT Uno32 (Digilent, Inc.):
- **http://www.digilentinc.com/Products/Detail.cfm?Prod=CHIPKIT-UNO32**
- **http://www.digilentinc.com/** (home page)
- **http://www.chipkit.org/forum/** (user discussion forum) 506 Rebel Yahoo Group:
- **http://groups.yahoo.com/group/TenTec506Rebel/**

Rebel Source Files (Source Code Project and Eagle Board files):
http://groups.yahoo.com/group/TenTec506Rebel/files/

References
Roger Shipley, KA9NAH, “Microcontrollers — No Experience Necessary,” QST, May 2013. This article provides an example of how Arduino is used in a practical first project. Leigh L. Klotz, Jr, WA5ZNU, editor, Ham Radio for Arduino and PICAXE, ARRL 2013, ISBN 978-0-87259-324-4. **http://www.arrl.org/shop/Ham-Radio-for-Arduino-and-PICAXE/** There are many other books on general Arduino development. Recommendations and reviews
are included in the various user forums.

TEN-TEC, Inc.
1185 Dolly Parton Parkway
Sevierville, TN 37862
Repair Service: (865) 428-0364

LIMITED WARRANTY AND SERVICE POLICY, U.S.A. AND CANADA
TEN-TEC, Inc., warrants this product to be free from defects in material and workmanship for a period of one (1) year from the date of purchase, under these conditions:

THIS WARRANTY APPLIES ONLY TO THE ORIGINAL OWNER
It is important that the warranty registration card be sent to us promptly.

READ THE MANUAL THOROUGHLY. This warranty does not cover damage resulting from improper operation. Developing a thorough understanding of this equipment is your responsibility.
IF TROUBLE DEVELOPS we recommend that you contact our customer service group directly at the address or phone number shown above. It has been our experience that factory direct service is expeditious and usually results in less downtime on the equipment. Some overseas dealers do offer warranty service and, of course, have our complete support.

EQUIPMENT RETURNED TO THE FACTORY
must be properly packaged, preferably in the original shipping carton(s). You pay the freight to us and we prepay surface freight back to you. Canadian customers must have proper customs documentation sent with incoming repair equipment. Duties or fees charged due to improper documentation are the responsibility of the owner of the equipment. EXCLUSIONS. This warranty does not cover damage resulting from misuse, lightning, excess voltages,
polarity errors, or damage resulting from modifications not recommended or approved by TEN-TEC. In the event

of transportation damage, a claim must be filed with the carrier. Under nocircumstances is TEN-TEC liable for consequential damages to persons or property caused by the use of this equipment. TEN-TEC RESERVES the right to make design changes without any obligation to modify equipment previously manufactured or to notify owners of changes to existing equipment. THIS WARRANTY is given in lieu of any other warranty, expressed or implied.

SERVICE OUTSIDE OF THE U.S.A. OR CANADA

Many of our international dealers provide warranty service on the equipment they sell. Many of them also provide out-of-warranty service on all equipment whether they sell it or not. If your dealer does not provide service or is not conveniently located, follow the procedure outlined above. Equipment returned to us will be given the same attention as domestic customers but round-trip freight expense, customs, and broker fees will be paid by you.

Documents / Resources

	TEN-TEC 506 Open Source Qrp Transceiver [pdf] Instruction Manual 506 Open Source Qrp Transceiver, 506, Open Source Qrp Transceiver, Source Qrp Transceiver , Qrp Transceiver, Transceiver