TuneMatic EZ-Tune

Owner's Manual / Operating Instructions

Ver. 062825 R5

Software version 1.x

NOTICE TO CONSUMER:

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, as of date of manufacture. 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 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, you are 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 electronics technician for help.

ABOUT THIS MANUAL:

This manual is divided into chapters which are arranged in logical, operational order. The items in **Bold** are important notes, ***Italicized bold*** are even more important, and ***Italicized bold underlined*** notes are critical informational statements. Section "G" contains a quick start guide for users already familiar with the product.

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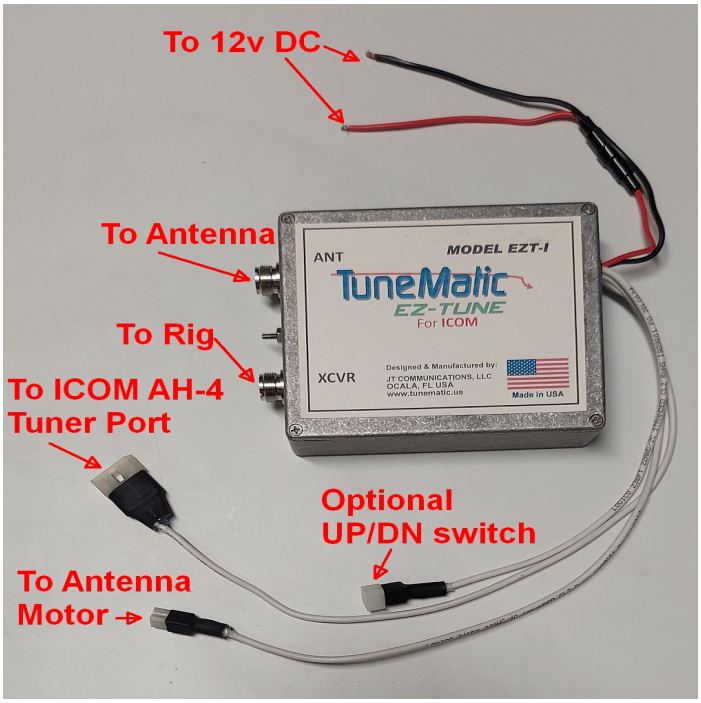
PRODUCT DECRIPTION:

TuneMatic EZ-Tune is a self-contained antenna controller which will automatically adjust the resonant frequency of a screwdriver/motorized antenna. TuneMatic operates over a frequency range between 1 and 60 MHz, and supports a wide variety of screwdriver-type tunable antennas. TuneMatic utilizes frequency, antenna current, and VSWR measurements of the antenna to perform the proper tuning, and utilizes the rig TUNE button to operate the tuning and park functions. TuneMatic EZTUNE will operate with either 2 or 4-wire antennas.

A) COMPONENTS / CONNECTIONS:



1) 12v power leads: These leads can be paralleled with radio power if desired, as they draw no current until TuneMatic is powered up by Radio Control cable.
NEGATIVE GROUND SYSTEM ONLY!

RED (with fuse): +12-15VDC- connect to +12v power capable of 3 amps of current.
BLACK- Ground- connect to negative ground source.
Note- these connections can remain 'hot' at all times and do not draw power from the battery until the rig power is turned on.

2) ICOM interface plug- Connect this plug into the ICOM AH-4 Tuner port.
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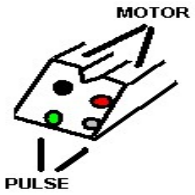
3) Coax connections- The two SO-239(UHF) connections are identified as follows:
RIG - Connection for the radio through any PL-259 jumper.
ANT - Connect this to either the antenna, *or input of amplifier if using an external amp, connect amp input to ANT connection on TuneMatic,and amplifier output to antenna lead. Disable external amp when tuning the antenna.*



4) Motor/pulse connection - This 4-pin female connector Contains the bi-directional motor leads (floating from ground) and pulse counter connections to the antenna motor. ***Be sure to follow the antenna manufacturers directions with regard to RF isolating this line at the antenna. If using other than TarHeel/Diamond antenna, a factory-supplied pigtail can be used to wire to your specific antenna. RED/BLACK are the motor leads, and the other remaining leads (not polarity sensitive) are the motor pulse leads. Observe connection to motor leads so that antenna moves to a LOWER frequency when pressing UP.*** *(+V on BLACK lead [pin 1]when pressing "UP" button)* ***NOTE: IF YOU ARE USING a Scorpion, HI-Q, or any non-standard connector type, It is advisable to contact the factory for the pigtail motor cable (no charge).*** *That eliminates the need to cut off any connectors on the TuneMatic.* ***DO NOT CONNECT ANY EXTERNAL DC TO THE MOTOR LEADS, THIS WILL DAMAGE THE TUNEMATIC AND VOID THE WARRANTY.***

If you are using a 2-wire antenna, you need to bypass the pulse detector, explained in Section C below.

4) Optional UP/DOWN motor control (male plug)- This connection will allow for manual up/down control, as well as remote tuning for non-Icom rigs. Connect either a SPDT center-off switch, or two SPST pusnbutton switches to a 6-15v DC connection, with the wiper as the center connection(or common one side of each pusbutton), with pin 1 as the UP direction, and pin 2 as the DOWN connection.*Any external up/down buttons function identically to the internal up/down buttons.* Connect the up/down switch DC return lead (-) to black power lead of the TuneMaic, if not a common ground is used (*highly recommended to keep them tied together).*
NOTE- Pins 3&4 can be used for a remote tune function using a normally open momentary pushbutton.

B) INSTALLATION:

a) Plug motor control cable from motor to TuneMatic Antenna Motor connector.
b) Connect 3' RF coax jumper from HF radio to RF connection labeled RADIO of TuneMatic,
c) Connect ICOM connector to the ICOM AH-4 tuner port connection on the rig.

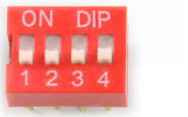
d) Connect DC power leads to **12-15V** DC ignition battery line-OBSERVE POLARITY! ***NEGATIVE GROUND ONLY!*** A good frame ground connection can be used to the vehicle chassis for added RF shielding from the threaded stud with a heavy braided lead.

e) Remove TuneMatic enclosure cover and locate motor current limit DIP switches on the PC board, Set switches for antenna manufacturer's recommended current limit setting. These switches select the antenna stall current, and are set as follows- ***note that 1=ON (UP) and 0=OFF(DOWN).***

Antenna	current	setting			
Switch number		1	2	3	4
Lowest setting	200mA	0	0	0	-
LittleTarheel/Little PRO	**250 mA**	**1**	**0**	**0**	**-**
Diamond SD330	300 mA	0	1	0	-
*Hi-Q	500 mA	1	1	0	-
*Scorpion	700 mA	0	0	1	-
*Tarheel Models 75 to 400,	900 mA	1	0	1	-
*Tarheel Models 1000 – 1200	1100 mA	0	1	1	-
Highest setting	1300mA	1	1	1	-

NOTE: DIP SWITCH #4 NOT USED

← FACTORY DEFAULT SETTING



*Most of the larger antennas can be set between 500- 1100 mA, depending on operating temperature.
NOTE: IT IS IMPORTANT TO SET THIS LIMIT PROPERLY, as damage can occur to the antenna motor if set too high, or will prematurely trip if setting is too low.

Keep in mind, current draw is dependent on supply voltage, and current may not reach trip point with lower supply voltage. *These are recommended settings, and the actual setting may vary slightly.*

f) Disable any auto-tune functions in the ICOM menu settings, so that the rig is not sending a tune command each time the band is changing. You will have to refer to your rig manual for specific information on disabling this feature,

C) OPERATION:

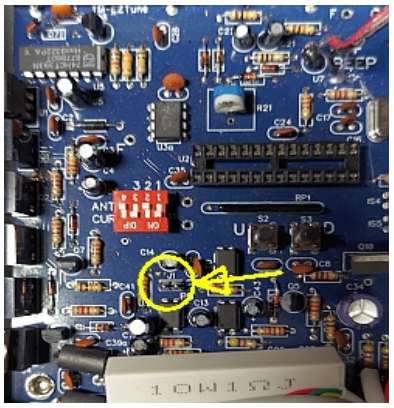
NOTE= MAKE SURE YOU FULLY DISABLE ANY INTERNAL OR EXTERNAL ANTENNA TUNERS YOU MAY HAVE WITH YOUR SETUP, OTHERWISE THE EZ-TUNE WILL BE UNABLE TO PROPERLY TUNE YOUR ANTENNA.

Apply power to radio. TuneMatic will automatically power on. Upon power-up, TuneMatic will spell out "OK" **(--- -·-)** in Morse code tone.

Locate the Up/Down pushbuttons inside the unit. Press the UP button to assure the antenna is moving up, DN button for downward movement of the antenna. When first pressing the button, the motor will travel in a reduced speed, then after 4 seconds, change to full speed. If motor does not move, re-check wiring from TuneMatic to the antenna.

During movement, If you reach either end of the antenna travel, the antenna motor current will increase dramatically, and the TuneMatic will current limit as determined by the DIP switch settings in step 1(h) above. Once TuneMatic senses over-current, it will stop the motor, and spell out "CL" in Morse code tone. ***DO NOT CONTINUE TO MOVE ANTENNA IN CURRENT LIMIT POSITION EACH TIME YOU CLEAR THE LIMIT, AS CONTINUED FORCED MOVEMENT IN THE LIMIT DIRECTION MAY CAUSE MOTOR WEAR OR DAMAGE.***

TuneMatic EZ-TUNE detects motor movement through the sensor feedback connection from the antenna. If the TuneMatic does not sense pulses during movement after 15 seconds, it will stop the motor, and send a "PE" message, indicating loss of pulses. If your antenna does not use this feature(or the sensor is failing), you can bypass the sensor inside the unit(with the slide jumper) so that the pins are shorted on the connector, see photo on right for the location of the slide jumper. ----------→



C-1 TESTING ANTENNA OPERATIONAL LIMITS:

You can manually tune the antenna, by using an external VSWR meter, or the rig internal VSWR meter. This will give you a good indication as to the operational frequency range of the antenna, and will help you determine the expected performance of the system. The make and model of the antenna, and its physical properties, ground system, and overall installation will determine the usable operational range of the TuneMatic. It is advisable to check the limits of the antenna system, so that you will know what to expect during operation. Otherwise the TuneMatic may attempt to tune a frequency that is outside the operational parameters of the antenna with little or no success, or not even tune properly. You can either use an external up/down switch wired to the TuneMatic male up/down switch connection, or the internal buttons on the PC board.

Using the rig(or external) VSWR meter, use *low levels* of RF power (10 watts in AM mode) so that you do not cause interference on the air, or damage to radio and antenna. While adjusting the UP/DN buttons, check the parameters of the system, by alternately moving the antenna, and spot-checking the VSWR, by keying the rig. Start at the highest band , and work down to the lowest. This check will assure you that the system will tune properly, and to what frequency range it will perform over.

C-2 AUTOTUNING

The autotuning feature of the TuneMatic allows the unit to automatically tune the antenna The Autotune process is is initiated by pressing the rig TUNE button. When pressed, TuneMatic will key radio will key, measure power and frequency parameters, and will begin moving the antenna towards the transmit frequency. While the ICOM rig is in the tune mode, the tune light will flash. As the antenna moves, the speed of the antenna will reduce in speed as the SWR decreases. TuneMatic will then search for the lowest VSWR, and sweep through an VSWR 'null'. Once the fine tune null is found , and the SWR is satisfactory (<=1.5:1) ,the antenna position is stored for the selected transmit frequency memory 'window', in the same way the MANUAL STORE mode operates (with the 'M M' Morse message), and will also send the Morse message "T C" indicating a completed tune. Once the tuning is complete, the ICOM tune light will stop flashing and will remain on, unless the band is changed or the button is depressed to turn off the tune.

In the event TuneMatic is unable to find a tune at or below 1.5:1, it will find the lowest VSWR match possible.
If the VSWR null is at or below 2:1, it will stop at the lowest VSWR point, and send a "T I" message once the motor stops, and the radio unkeys, indicating this is the LOWEST VSWR Tunematic is able to find at the transmit frequency. If a null of at least 2:1 cannot be reached, TuneMatic will continue to search until it reaches the antenna limit then it will reverse the direction until it travels the entire length of the antenna. If no such tune is available, it will unkey the radio, and send a series of "E"s , meaning there is NO TUNE possible for the selected transmit frequency. The antenna will then park at the lowest resting position.

You should be aware that the best tune is dependent directly on the antenna performance; if there are dropouts, antenna installation issues, or any outside parameters that can cause false/multiple nulls in the tuning process, etc, it may affect how TuneMatic adjusts the match.

When using an ICOM rig, if at any time you want to stop TuneMatic while autotuning,you can press the rig TUNE button, or turn off power on the radio.

Once the TuneMatic EZ-TUNE stops tuning, you can manually adjust the antenna (with the external up/down switch) for a more refined match. Exact tuning can vary if the antenna is tuning when operating in a moving vehicle.

Internal motor speed adjustment compensation control
Located on the main PC board inside the TuneMatic control unit (just behind the socketed microprocessor) is a variable adjustment, which will adjust the factory slow/medium speeds. This adjustment is used when the drive signal to the motor does not have sufficient energy to physically move the antenna due to colder weather conditions, or when the antenna moves too fast or slow during fine-tuning. This is a potential issue on the larger antenna designs with higher voltage motors (Scorpion) and HI-Q antennas (less pulses per rotation). Clockwise rotation of the control increases the speed. The factory setting is 12 o'clock position.

C-3 Antenna Parking

During non-tuning modes, the TuneMatic can park the antenna, to the lowest resting position, by pressing the TUNE button on the radio twice within one (1) second of each press. TuneMatic will send a "P" message, then lower the antenna to the resting position, until it reaches the current limit point. Once you hear the "CL" message, the antenna is fully parked. **When using the external tune button, press and HOLD the button for *at least* 1 second to enable the park function.**

D- FACTORY RESET / SPECIAL FUNCTIONS:

If you want to clear settings(last stored frequency and park status), and return unit to factory default condition:

1) Press and hold both 'UP' and 'DOWN' buttons either on the PCB or the remote, then apply power, hold until TuneMatic responds in step (2).
2) TuneMatic will send out 'M R M R', indicating a master reset, and start the memory erase process. Release the 'STORE' and 'INIT' buttons at this point.
3) During the reset process, several beeps will be heard When complete, unit will spell out 'O K' in Morse tone, indicating factory reset is complete.

E- SAFETY FEATURES:

The safety features of the TuneMatic keep the antenna protected against catastrophic and accidental conditions. These safety features include:

a) *Antenna current limiting*- This forces all movement to stop once current limit is reached. You can move the antenna in the opposite direction from the current limit position to resume operation. Once the TuneMatic is initialized, the current limiting only operates in case one of the other safety devices fails. ***This current limit must be properly set prior to operation. Otherwise damage to antenna could occur, including damaging the motor windings.***

b) *Missing pulse detection*- Once initialized, this detector keeps track of pulses during movement. If the antenna is moving, and the pulses stop, TuneMatic will stop the motor, and spell out 'P E' in Morse tone, indicating pulse detection has failed. It will also force TuneMatic to un-initialize.

NOTE- If the sensor switch for the pulse detector fails, or you only have a 2-wire antenna motor, you can bypass the missing pulse detector by inserting the jumper (shown above), which disables this feature.NOTE- THIS WILL DEFEAT THE PULSE DETECTION ABILITY TO DETECT IMPROPER CURRENT SETTING IF ANTENNA GETS STUCK MECHANICALLY.

c) *Reverse DC power polarity protection*- contains internal circuitry to protect TuneMatic from voltage spikes or momentary reverse DC polarity. Reversed polarity will cause the 3A in-line fuse to fail***. DO NOT REPLACE FUSE WITH LARGER THAN 3A, OR WARRANTY WILL BE VOIDED SHOULD DAMAGE OCCUR.***

F- APPENDIX:

a) Morse code messages –listed by priority and operation:

note: the messages marked with "" are the main messages to remember*
Power-up messages:

*** OK** ***startup message:*** Sent on power-up and re-set- This will be heard each time TuneMatic is powered up, and after memories have been cleared.

TU **test mode-** used to troubleshoot antenna sensor (see *special functions* section above).

Initial movement and initialization:

* **CL** ***Current limit:*** Antenna reached current limit. This message will be heard if antenna is moved into the ends of travel for the motor, and motor has reached the current limit point, as determined by the current limit DIP switch settings inside the TuneMatic chassis

* **PE** ***Pulse error:*** No pulses detected during motor movement. This message will be heard if TuneMatic fails to detect any motor pulses during movement after initialization.

P ***Parking:*** Antenna parking. Message will be heard any time TuneMatic is placed into a park mode,

Storing and memory operations:

* **MM** ***Memory write:*** Valid tune found. This message will be heard upon any successful autotune process.

PWR ***Power error:*** RF power out of range/no power. This message will be heard if you are attempting to store or autotune TuneMatic with too little/no or too high power (5-30w). Make sure radio RF power is within this range.

FR ***Freq error:*** Transmit frequency out of range or no frequency read. This message will be heard if you are attempting to either store or tune TuneMatic outside the operational frequency range (1-60 MHz), or no frequency data is read.

Tuning operations:

TC ***Tune Complete:*** Autotune is completed. This will be heard after a successful tune at the current position.

TI ***Tune Incomplete:*** Unsuccessful full autotune. This will be heard when TuneMatic is able to find an SWR between 1.5:1 - 2:1 at the transmit frequency, AND after stopping at the lowest SWR tune position in that range.

TS ***Tune Stopped:*** Tune canceled by user or rig power interrupted…

EEEEE ***Error-No Tune:*** Unable to autotune across entire antenna range; TuneMatic is unable to find a VSWR below 2:1 at the transmit frequency.

b) Troubleshooting:

1) Unit will not power up-

   a) Check in-line fuse (**3 or 3.15 A *standard* GMA 5x20mm** fuse, **not SLO-BLO**). ***DO NOT USE LARGER RATING!!***

   b) Check power connections. A poorly crimped connector is a common fault.

c) Make sure radio is supplying power through radio interface cable. If the remote keypad is NOT lit, this indicates no power to the TuneMatic interface connection.

1a) No motor movement when UP or DN buttons are pressed (pulse error may also occur).
a) check antenna motor leads

2) Unit tunes erratically or not tuning on a VSWR null-
   a) Check antenna internal connections, contacts, reed switch, oxidation, etc.
   b) Check for loose/intermittent coax connections, or connector contamination.
   c) Check for good RF and DC grounding.
   d) Antenna may be tuning on a harmonic, usually caused by poor grounding.
3) Unable to find a good VSWR or get any frequency to tune-
   a) Check all antenna connections. (use radio VSWR meter to verify)
   b) Make sure antenna system is designed/resonant for the operating frequency.
   d) Make sure antenna installation is satisfactory, including grounding, counterpoise, etc.
   c) Re-park antenna and try again.
4) TuneMatic hangs at end of antenna movement, and/or gives “P E” error-
   a) current limit may be set too high- check DIP switch settings.
9) Antenna sends current limit (“C L”) message with any movement-
   a) Antenna DIP switch current setting too low, set to lower setting
   b) If increased current setting still results in “CL”, check for excessive load or shorts on antenna.

<u>There are additional troubleshooting techniques on the tech support portion of the website.</u>

G- <u>GENERAL SPECIFICATIONS:</u>

Operating Frequency range:	1-60MHz, continuous
Insertion loss:	typ. <0.3 dB @ 50MHz
Max power rating:	200W CW
Operating voltage range:	10-18v DC (motor dependent)
Max. motor load:	1.2A (software limited, plus 3A safety fuse)
Max. PTT load :	0.5a
Operating Temp. range:	-10 to +50 degrees C

<u>ONE-YEAR LIMITED WARRANTY ON PARTS AND LABOR-</u>

Covers Product purchased as new only.

*JT COMMUNICATIONS LLC provides a warranty to the original purchaser of new Products against defects in materials and workmanship for a period of **One (1) year** of normal consumer (non-commercial) usage.*

This warranty is not transferable.

If a Product covered by this warranty is determined to be defective within the warranty period, JT COMMUNICATIONS LLC will, unless otherwise required by applicable law, either repair or exchange the Product at its sole option and discretion.

<u>How to Obtain Warranty Service</u>

(An RMA required) To obtain warranty service, contact JT COMMUNICATIONS LLC Technical Support via email: TechSupport@jtcomms.com or by telephone at 352-236-0744(USA) from 8:00AM to 6:00PM Monday through Friday (holidays excluded), Eastern Time zone. PRE-AUTHORIZATION MUST BE OBTAINED BEFORE SENDING PRODUCT TO A JT COMMUNICATIONS LLC SERVICE CENTER. Proof of purchase in the form of a purchase receipt or copy thereof is required to show that a Product is within the warranty period.

Exchange: Should JT COMMUNICATIONS LLC elect to exchange a Product due to a covered defect during the warranty period, the replacement unit may at JT COMMUNICATIONS LLC's Sole option and discretion, be new or one which has been recertified, reconditioned, refurbished or otherwise re manufactured from new or used parts and is functionally equivalent to the original Product.

Repair: Parts and Labor There will be no charge for parts or labor to repair a Product for a covered defect during the warranty period. Replacement parts may, at JT COMMUNICATIONS LLC's sole option and discretion, be new, used, reconditioned, refurbished or otherwise re manufactured or recertified as functionally equivalent replacement parts.

Remaining Warranty: Repaired or exchanged units are warranted for the remaining portion of the Product's original warranty or for ninety (90) days from warranty service or exchange, whichever is longer. Any upgrade to the original Product will be covered only for the duration of the original warranty period.

Returning a Product for Warranty Service: After obtaining per-authorization from JT COMMUNICATIONS LLC Technical Support (see above), defective Products within the warranty period must be sent to a JT COMMUNICATIONS LLC service center to obtain warranty service. JT COMMUNICATIONS LLC is not responsible for transportation costs to the service center, but JT COMMUNICATIONS LLC will cover return shipping to the customer. Products returned to JT COMMUNICATIONS LLC's service centers must be shipped in either the original carton box and shipping material or packaging that provides an equal degree of protection. JT COMMUNICATIONS LLC Technical Support will provide instructions for packing and shipping the covered Product to the JT COMMUNICATIONS LLC service center.

Exclusions- This warranty does not cover, for example: abuse, accident, acts of God, and protective coatings, cosmetic damage (e.g. scratches, dents, cracks), odor, damage caused by misuse with other products (e.g. accessories, housing, parts or software), damages from shipping, improper installation or operation, failure to follow installation/operation instructions, improper voltage supply or power surges, operating with higher than rated fuse, lack of reasonable use, misuse, modifications or alterations, normal wear and tear or aging, as well as installation and set-up issues or any tampering. Product repairs attempted by anyone other than by a JT COMMUNICATIONS LLC authorized service center. Products with unreadable or removed serial numbers or requiring routine maintenance are not covered. This one year limited warranty does not cover Products sold "AS IS", "FACTORY RE-CERTIFIED", or by a non-authorized reseller.

Limitations- THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE LISTED OR DESCRIBED ABOVE. ANY IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL BE LIMITED IN DURATION TO THE PERIOD OF TIME SET FORTH ABOVE. JT COMMUNICATIONS LLC'S TOTAL LIABILITY FOR ANY AND ALL LOSSES AND DAMAGES RESULTING FROM ANY CAUSE WHATSOEVER INCLUDING JT COMMUNICATIONS LLC'S NEGLIGENCE, ALLEGED DAMAGE, OR DEFECTIVE GOODS, WHETHER SUCH DEFECTS ARE DISCOVERABLE OR LATENT, SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OF THE PRODUCT. JT COMMUNICATIONS LLC SHALL NOT BE RESPONSIBLE FOR LOSS OF USE, IINFORMATION OR DATA INCLUDING THAT CONTAINED IN OR STORED ON ANY DEVICE RETURNED TO JT COMMUNICATIONS LLC, WORK STOPPAGE, SYSTEM FAILURE OR MALFUNCTION, FAILURE OF OTHER EQUIPMENT OR PRODUCTS TO WHICH THE PRODUCT IS CONNECTED, COMMERCIAL LOSS, LOST REVENUE OR LOST PROFITS, LOSS OF GOODWILL, LOSS OF REPUTATION, OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES.

NO ORAL OR WRITTEN REPRESENTATIONS MADE BY JT COMMUNICATIONS LLC OR ANY SELLER, RESELLER OR DISTRIBUTOR OF THE PRODUCT, INCLUDING EMPLOYEES AND AGENTS THEREOF, SHALL CREATE ANY ADDITIONAL WARANTY OBLIGATIONS, INCREASE THE SCOPE, OR OTHERWISE MODIFY IN ANY MANNER THE TERMS OF THIS LIMITED WARRANTY. TO THE EXTENT PERMITTED BY APPLICABLE LAW, JT COMMUNICATIONS LLC DOES NOT WARRANT THAT THE OPERATION OF ANY PRODUCTS OR SOFTWARE COVERED UNDER THIS LIMITED WARRANTY WILL MEET THE REQUIREMENTS, WORK IN COMBINATION WITH ANY HARDWARE OR SOFTWARE APPLICATIONS OR THIRD PARTY SERVICES, BE UNINTERRUPTED, ERROR FREE, OR WITHOUT RISK TO, OR LOSS OF, ANY INFORMATION, DATA, SOFTWARE OR APPLICATIONS CONTAINED THEREIN, OR THAT DEFECTS IN THE PRODUCTS OR SOFTWARE WILL BE CORRECTED.

SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION S OR EXCLUSIONS MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RADIOHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE. THIS LIMITED WARRANTY IS SUBJECT TO CHANGE WITHOUT NOTICE.

In the event that any term or provision contained in this limited warranty is found to be invalid, illegal or unenforceable by a court of competent jurisdiction, then such provision shall be deemed modified to the extent necessary to make such provision enforceable by such court, taking into account the intent of the parties. The invalidity in whole or in part of any portion of this limited warranty shall not impair or affect the validity or enforceability of the remaining provisions of this limited warranty.

JT Communications LLC 579 NE 44th Ave. Ocala, FL 34470 USA 352-236-0744
www.tunematic.us email: tunematicsupport@jtcomms.com