

**RT-11**  
**Automatic Antenna Tuner**  
**Manual** Version 1.2G

**LDG Electronics**

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**Introduction:** Congratulations on choosing the LDG RT-11 tuner. The RT-11 is a full-featured remote automatic antenna tuner designed for the HF and 6 meter ham bands (1.8 to 54 MHz), for use with transmitters or transceivers outputting between 0.1 to 125 watts. The tuner uses the highly versatile "Switched L" configuration with 256 capacitor, 256 inductor and High/Low impedance settings to provide over one hundred and thirty thousand possible tuning combinations. The "L" network will match practically any coax-fed antenna (dipole, vertical, sloper, beam, etc.) within its specified performance range. Long wires, and dipoles fed with ladder line can be matched using the LDG RBA-1 external balun, sold separately. Regardless of antenna type, tuning time is between 0.1 and 5 seconds, typically about 3 seconds.

### **Features and Specifications:**

- \* Designed for remote mounting and operation, on a tower or near the antenna
- \* Water resistant ABS plastic case with integral flange mounting bracket; protects circuitry from rain and other normal weather
- \* Microprocessor controlled, fully automatic
- \* Covers 1.8 to 54.0 MHz continuously
- \* Tunes 6 to 800 ohm loads, 10:1 SWR, 3:1 or less on 6 meters using switched "L" network tuning circuit
- \* Optional remote control head available. Remote size: 5" x 3" x 1"
- \* Optional Icom, Alinco and Kenwood TS-50 interface available
- \* Inductor range: to 20 uH
- \* Capacitor range: to 2700 pF
- \* Tuning time: 0.1 to 5 seconds, 3.0 seconds typical
- \* Current Consumption: 7 to 250 mA, 100 mA typical
- \* Power requirements: 11 to 20 VDC @ 250 mA max
- \* RF power range: 0.1 to 125 watts (50% duty cycle)
- \* For Dipoles, Verticals, Veeps, Beams or virtually any coax fed antenna
- \* Optional external balun available for longwires or antennas fed with twinlead
- \* Enclosure size: 8.5" x 5.5" x 3.0", weight 2.5 pounds

**Control Circuit:** The RT-11 requires external control circuitry, which is not provided with the basic tuner. You have three options:

1. You can use the optional LDG remote control unit.
2. You can use special cables, available from LDG, to interface your RT-11 to Icom, Alinco or Kenwood TS-50 transceivers. You can also make your own control cable for Icom or Alinco transceivers; complete wiring diagrams for these cables are available on the LDG web site.
3. You can “homebrew” your own controls. The RT-11 interface is designed with simplicity in mind; you can easily construct control circuitry to customize the tuner to your station and methods of operation.

You must employ one of these three options to control your RT-11. If none of these options are available, you can still use the tuner, but only in Auto mode with no direct control (see below under Pin 4 specifications for details).

**An important word about power levels:** The RT-11 is rated at 125 watts peak power. Many transmitters and transceivers output more than this, and even a small amplifier can output far more than 125 peak watts; this will *definitely* damage your RT-11. Be sure to observe the 125 watt peak power limitation for CW and SSB operation (50% duty cycle).

**A word about “foldback” circuits:** Many radios have automatic foldback circuits to protect their RF amplifier stage from excessive reflected power; the foldback circuit automatically reduces power when the SWR is high. If your radio lacks a foldback circuit, you must never exceed 25 watts while tuning your RT-11; higher power levels could damage the tuner. Most modern solid-state radios have foldback circuits. However, many older radios, any kind of tube radio, most solid state amplifiers and all Ten-Tec transceivers lack foldback circuits. Consult your radio’s manual to find if it has a foldback circuit, and observe the 25 watt tuning power limit if it does not.

**Control Interfaces:** The RT-11 has three connections: coax in from the transmitter, coax out to the antenna and the control interface. The coax in and out connectors are standard SO-239 sockets for use with standard PL-259 coax plugs. The control interface is a standard male DB-9 connector. The remote interface cable will connect using a standard female DB-9 connector.

The pinout for the DB-9 connector is:

- |   |   |
|---|---|
| 1 | +12 volts DC @ 250mA  |
| 2 | Bypass mode select  |
| 3 | Tune mode select  |
| 4 | Auto/Semi mode select   |
| 5 | Tune LED  |
| 6 | 1.5 LED   |
| 7 | Radio Out (used only when directly controlled by Icom or Alinco radios) |
| 8 | Ground  |
| 9 | Ground  |

Control functions are invoked by grounding the relevant control pin to ground at Pins 8 and 9. LED anodes are to be connected to pins 5 or 6. The LED cathodes are connected to ground.

**Pin 1:** DC power input to the RT-11. The power should be regulated, and provide between 11 and 20 VDC at 250 mA. This DC power must be present whenever the tuner is in operation. Your RT-11 features latching relays that retain the last tuned configuration on power up. However, if your RT-11 is connected to an Icom or Alinco radio by an interface cable, the radio sends a Bypass command to the tuner on radio power up, requiring you to execute a tuning cycle each time you turn on your radio.

**Pin 2:** Tuner bypass. Momentarily grounding this pin bypasses the tuner; RF from your transmitter or transceiver goes directly to the antenna with no matching. When the line is grounded, the 1.5 LED on the optional remote unit will be on.

**Pin 3:** Tune control. When Pin 3 is *momentarily* grounded while RF is present, the tuning process starts. If Pin 3 is grounded, but no RF is present, the 1.5 and Tune LED on the optional remote control box will flash to indicate low or no power. Once the tuning cycle starts, Pin 3 should not be held low; if Pin 3 is held low until the tuning cycle completes, another tuning cycle will immediately start. This pin is also used in the tuner interface for Icom and Alinco radios.

**Pin 4:** Semi/Auto mode control. In semiautomatic mode, the tuner will begin a tuning cycle only when Pin 3 is momentarily grounded. In automatic mode, the tuning cycle will begin any time the SWR exceeds 3:1 during a transmission. At power-up, the RT-11 defaults to semiautomatic mode; you can set it to automatic mode by momentarily grounding Pin 4. The 1.5 LED on the optional remote unit will flash slowly when the RT-11 is in semiautomatic mode and Pin 4 is grounded. When in automatic mode, the 1.5 LED will flash fast while Pin 4 is grounded.

Even if you provide no control circuit for your RT-11, you can still use it by putting the tuner into fully automatic mode. This is done by grounding the Auto/Semi pin during power up. The tuner is then in Auto mode, without needing a control circuit. LDG does *not* recommend this method, as it affords the operator little control over the tuner, but it can be useful in some circumstances.

**Pin 5:** Tune LED. An LED (typically red) may be placed between this pin and ground. The LED will light while the tuner is in the tuning cycle. A Tune LED is provided on the optional remote unit.

**Pin 6:** 1.5 LED. An LED (typically green) may be placed between this pin and ground. The LED will light continuously when RF is present and the SWR is below 1.5:1. The LED will dim when RF is present and the SWR is between 1.5 and 2.2:1. When there is no RF present, the LED is used to indicate Bypass, Auto/Semi and Tune modes. A 1.5 LED is provided on the optional remote unit.

**Pin 7:** Radio out. This line is used in the tuner interface with Icom and Alinco radios.

**Pin 8 and 9:** Grounds. These lines are used for DC input ground, ground for the input lines and ground for the LED outputs.

**Operation:** Operation varies somewhat depending on the control circuitry used. Three control options are available: custom interface cable to an Icom or Alinco radio, the optional LDG remote unit, or user-provided control circuitry.

**LDG RT-11 Remote unit:** This optional remote unit will control the RT-11 through a 15 foot DB-9 cable supplied with the unit. You can extend the DB-9 cable by up to 100 feet; shielded cable works best in a high RF environments (be sure that all wires in the extension are straight-through (pin 1 to pin 1, pin 2 to pin 2, etc.), and not “null modem” or some other specialized configuration).

The remote unit has front panel controls for Bypass, Semi/Auto mode select and Tune, as well as indicator LEDs for 1.5 SWR and Tune mode. Connections for the DB-9 control line to the RT-11 tuner, DC power input for the RT-11 tuner and a connection for a radio interface are on the back of the unit. The radio interface is the same as used in the AT-11MP, and can use the MP-IC or MP-AL cable as an alternate interface to Icom or Alinco radios.

The remote unit would typically be used when the radio you are using has no direct tuner interface. The remote unit is also required when using the FT-100D One Touch Tune from W4RT Electronics. See [www.w4rt.com](http://www.w4rt.com) for more information.

**Radio Interfaces:** LDG supplies optional custom interface cables to connect the tuner to Icom or Alinco radios (RT-IC for Icom or RT-AL for Alinco). To install the cable, turn off the radio and connect the DB9 connector to the matching port on the RT-11. Connect the Molex connector on the other end to the radio's tuner port. Connect a coax lead from the radio to the Transmitter input port on the RT-11, and a coax cable from the Antenna port to your antenna. Turn the radio on; the RT-11 will power up along with the radio -- no external power source is required. On Icom radios, the Tuner LED will light to show that the tuner is connected.

To operate the tuner, simply press the tuner button on the radio. The radio will automatically change to CW mode, set output power to 10 watts and command the RT-11 to begin a tuning cycle. The RT-11 will automatically complete the tuning cycle, and send a command to the radio to signify it is finished with tuning. The radio will then revert to its previous mode and power settings.

The LDG cables for Icom and Alinco radios are typically 15 feet long. For longer lengths, extend them using standard DB-9 cables (again, be sure that all wires are straight through (pin 1 to pin 1, pin 2 to pin 2, etc.), and not "null modem" or some other specialized configuration).

The LDG K-OTT interfaces directly to the Kenwood TS-50's ACC port. Power for the RT-11 is provided through the TS-50. The AT Tune button on the front panel of the TS-50 is then used to initiate a tune. Operation is similar to the Icom and Alinco interfaces.

**User-provided control:** You can easily build a custom interface for your particular installation. You can use all, or as little as two control wires to the tuner. For two-wire control, only DC power and ground are required. The tuner will automatically execute a tuning cycle if RF is present at power-up. You can simply insert a momentary open switch at the control location on the +12 DC power line to control the tuner. Cycling power to the tuner with RF present will execute a tuning cycle.

**A word about tuning etiquette:** Be sure to pick a vacant frequency to tune. With today's crowded ham bands, this is often difficult. However, do your best to avoid interfering with other hams as you tune. The RT-11's very short tuning cycle, usually only a few seconds, minimizes the impact of your tuning transmissions.

**Care and Maintenance:** Your RT-11 tuner is essentially maintenance-free, and rugged enough for normal outdoor use. The outer case may be cleaned as needed with a soft cloth slightly dampened in household cleaning solution. As with any modern electronic device, the RT-11 can be damaged by temperature extremes, water, impact or static discharge.

**Technical Support:** We are happy to help you with your RT-11. Telephone technical support is available at 410-586-2177 weekdays from 9 am to 5pm Eastern time. Inquiries by Fax at 410-586-8475 are welcome, and prompt e-mail support is available at [ldg@ldgelectronics.com](mailto:ldg@ldgelectronics.com).

**Warranty and Service:** Factory assembled units are warranted against defects in parts or workmanship for one year from purchase. Kits are warranted against defects in parts only for one year from purchase. This warranty applies to the original purchaser only; it is not transferable. A copy of the receipt showing the purchaser's name and the date of purchase must accompany units returned for warranty service. All returns must be shipped to us pre-paid; we will not accept units with postage due. A return form is provided on our web site for your convenience.

If you need to return your RT-11 to us for service, package it carefully, keeping in mind that we will re-use your packaging to return the unit to you. Include a full description of the problem, along with your name, address and a phone number or e-mail address where we can reach you with any questions. Repair turnaround time can vary from 2 to 6 weeks.

We will be glad to service your RT-11 after the warranty period. We will notify you of repair charges by phone or e-mail, and bill you after repairs are completed.

**Firmware upgrades:** From time to time we will release upgraded firmware for the RT-11, refining operation and adding features. Your RT-11 is not field programmable; you will have to remove the present chip and replace it with the upgrade chip. To remove the chip (68HC11, U1) you will need an appropriate tool.

A PLCC extraction tool is ideal, but if you don't have one you can fashion a substitute from an ordinary paperclip. Straighten the paper clip, and then bend it into a "U" shape. Use pliers to bend the last 1/8" of each end toward the center (see illustration).

The extraction tool fits into opposite corners of the 68HC11 socket; the bent ends will lift the chip from beneath. Touch a ground point to avoid static discharge damage, and remove the case top. Insert the tool and pull gently and evenly on both sides to extract the chip. Press the upgrade chip into the socket, observing the small diagonal corner key. Replace the case top; your upgraded RT-11 is ready to use.

You will return the old processor chip to LDG; the upgrade is sold by exchange only. The processor chips are recycled and reprogrammed to minimize future upgrade costs. Upgrades will cost about \$10-20 with chip exchange, and will be announced on our web site when available.

**Feedback:** If you have an idea to improve our software or hardware, please send us a description. If we incorporate your idea in the RT-11, we'll send you a free upgrade as a "thank you".

We encourage everyone who uses the RT-11 to contact us (card, letter or e-mail preferred) telling us how well it works for you. We are also always looking for photographs of the RT-11 in use; we frequently place such pictures on our Web site ([www.ldgelectronics.com](http://www.ldgelectronics.com)).