

**LDG IT-100
100-Watt Automatic
Tuner for Icom
Transceivers**



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INTRODUCTION

LDG pioneered the automatic, wide-range switched-L tuner in 1995. From its laboratories in St. Leonard, Maryland, LDG continues to define the state of the art in this field with innovative automatic tuners and related products for every amateur need.

Congratulations on selecting the IT-100 100-watt automatic tuner for Icom transceivers. The IT-100 provides semi-automatic antenna tuning across the entire HF spectrum plus 6 meters, at power levels up to 125 watts. It will tune dipoles, verticals, Yagis, or virtually any coax-fed antenna. It will match an amazing range of antennas and impedances, far greater than some other tuners you may have considered, including the built-in tuners on many radios.

The IT-100 is similar to previous LDG tuners, but is specially engineered to integrate with your Icom HF radio. The IT-100 connects to the external tuner port on the back of the radio. The IT-100 takes advantage of this interface to simplify the tuning process -- one button push is all that is needed in order to complete a tuning cycle!

The IT-100 is powered by the transceiver's tuner interface itself. There is no additional power cable required to use the IT-100. Latching relays are used, so the IT-100 consumes no power when not tuning.

JUMPSTART, OR “REAL HAMS DON’T READ MANUALS!”

Ok, but at least read this one section before operating the IT-100:

1. Turn off power to your Icom radio.
2. Connect the HF/50 MHz antenna jack on the transceiver to the “TX” jack on the IT-100, using the supplied 50 ohm coax cable jumper.
3. Connect a 50 ohm coax antenna feedline to the “ANT” jack on the IT-100.
4. Connect one end of the supplied radio interface cable to the tuner port on the back of your radio.
5. Connect the other end of the supplied radio interface cable to the “Radio” jack on the back of the IT-100.
6. Turn on the radio.
7. Select the desired operating frequency and mode.
8. Push and hold the **TUNER/CALL** button on the front of the radio for one second (until the **Tuning** LED comes on), then release. The transceiver automatically keys up with a minimal amount of power, and the IT-100 begins a tuning cycle. At the end of the tuning cycle, the original mode and power level is restored.
9. Wait for the tuning cycle to end; you're now ready to operate!

SPECIFICATIONS

- 0.1 to 125 watts SSB and CW peak power, 100W on digital modes and 6 meters.
- Latching relays for ultra low power operation.
- 2,000 memories for instantaneous frequency and band changing.
- Controlled from ICOM TUNER/CALL button on radio. Powered from ICOM radio.
- Works with most ICOM radios that are AH-3 or AH-4 compatible.
- Partial radio list: IC-7000, IC-706 (all), IC-718 (select AH-4), IC-746.
- Tuning time: 0.1 to 6 seconds full tune, 0.1 seconds memory tune.
- 1.8 to 54.0 MHz coverage. Built-in frequency sensor.
- Tunes 4 to 800 ohm loads (16 to 150 on 6M), 16 to 3200 ohms with optional 4:1 Balun.
- For dipoles, verticals, Vees, beams or any coax-fed antenna.
- Optional external Balun allows tuning of random length, long wire or ladder line fed antennas.
- Dimensions: 6.5L" x 6.5W" x 1.5H".
- Weight: 1.5 pounds

AN IMPORTANT WORD ABOUT POWER LEVELS

The IT-100 is rated at 125 watts maximum power input *at most*. Many ham transmitters and transceivers, and virtually all amplifiers, output well over 125 watts. Power levels that significantly exceed specifications will definitely damage or destroy your IT-100. If your tuner fails during overload, it could also damage your transmitter or transceiver. Be sure to observe the specified power limitations.

IMPORTANT SAFETY WARNING

Never install antennas or transmission lines over or near power lines. You can be seriously injured or killed if any part of the antenna, support or transmission line touches a power line. Always follow this antenna safety rule: the distance to the nearest power line should be at least twice the length of the longest antenna, transmission line or support dimension.

GETTING TO KNOW YOUR IT-100

Your IT-100 is a quality, precision instrument that will give you many years of outstanding service; take a few minutes to get to know it.

The IT-100 is designed specifically for use with Icom transceivers. Tuning is performed when the **TUNER/CALL** button is pushed on the front of the transceiver and held for one second. The tuner can be placed in bypass mode by pressing the **Tune** button on the front of the IT-100 momentarily.

The IT-100 is powered directly from the radio interface cable; no separate power supply is needed. The IT-100 automatically powers up at the start of a tuning cycle, and then goes into an ultra low-power sleep mode when tuning is complete. The latching relays hold the tuned configuration indefinitely, even when DC power is completely removed. Tuning memories are stored in FLASH memory.

The IT-100 has 2,000 frequency memories. When tuning on or near a previously tuned frequency, the IT-100 uses “Memory Tune” to recall the previous tuning parameters in a fraction of a second. If no memorized settings are available, the tuner runs a full tuning cycle, storing the parameters for memory recall on subsequent tuning cycles on that frequency. In this manner, the IT-100 “learns” as it is used, adapting to the bands and frequencies as it goes.

Front Panel

On the front panel there is one pushbutton and two LED indicator lights.



- **Tune Button:** Initiates either a memory tune or a full tune, and also toggles the tuner between “active” and “bypass” modes.
- **SWR LED:** Lights or blinks to indicate SWR condition.
- **Tuning LED:** Lights to give feedback on button presses, lights during tuning; gives tune status at the end of a tuning cycle.

Rear Panel

The rear panel of the IT-100 features four connectors.



- **ANT connector:** Connect the 50-ohm coax antenna feedline to this standard SO-239 connector.
- **GND connector** (wing nut): Connect to antenna system ground.
- **TX connector:** Connect the 50-ohm coax jumper cable from this standard SO-239 connector to the ANT jack on the back of the transceiver.
- **Radio connector:** This 6-pin mini-DIN connector connects to the supplied radio interface cable, which connects to the AH-4 tuner port on the transceiver. DC power is also supplied over this jack.

INSTALLATION

The IT-100 tuner is designed for indoor operation only; it is not water resistant. If you use it outdoors (Field Day, for example), you must protect it from the rain. The IT-100 is designed for use with coax-fed antennas. If use with longwires or ladder-line-fed antennas is desired, an external balun is required. The LDG RBA-4:1 or RBA-1:1 is ideal, depending on the antenna and transmission line used.

Always turn your radio off before plugging or unplugging anything. The radio may be damaged if cables are connected or disconnected while the power is on.

Compatible Transceivers

The IT-100 is designed to be used with any Icom 100 watt transceiver that supports the AH-3 or AH-4 Icom antenna tuners. Currently, this includes:

- IC-706
- IC-718 (select AH-4)
- IC-746
- IC-7000

Installation

Connect the HF/50 MHz antenna jack on the transceiver to the **TX** jack on the back of the IT-100, using the supplied coax jumper cable, or a similar 50 ohm coax cable rated 125 watts or greater.

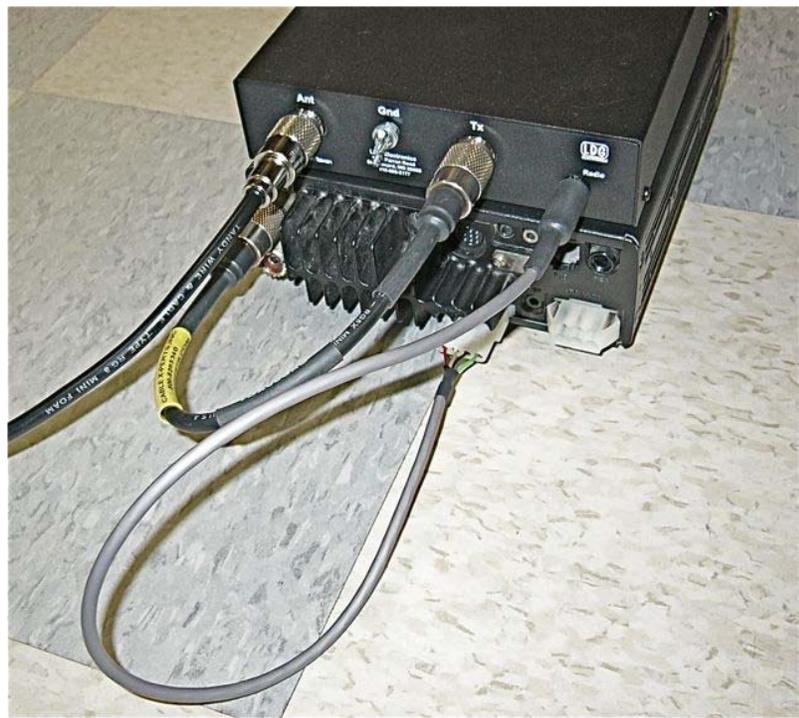
Connect the supplied radio interface cable to the mini-DIN 6-pin jack on the rear of the IT-100, marked "**Radio**". Connect the other end of this cable to the "**Tuner**" jack on the rear of the Icom transceiver.

Connect the antenna feedline coax to the "**ANT**" jack on the rear of the IT-100.

Grounding the IT-100 tuner will enhance its performance and safety. LDG recommends that you connect your tuner to a suitable ground; a common ground rod connected to buried radials is preferred, but a single ground rod, a cold water pipe, or the screw that holds the cover on an AC outlet can provide a serviceable ground. LDG strongly recommends the use of a properly installed, high quality lightning arrestor on all antenna cables.

NOTE: If using with an IC-718, be sure to select AH-4 mode. See the IC-718 owner's manual for details.

Installation is now complete!



OPERATION

Power-up

The IT-100 is powered by the transceiver over the radio interface cable. The IT-100 is “on” when the radio is turned on, and “off” when the radio is off.

Basic Tuning Operation

The IT-100 is operated from the front panel **TUNE** button on the IT-100, or via the **TUNER/CALL** button on the front of the transceiver. Two types of tuning cycles are available; a memory tuning cycle and a full tuning cycle.

The **memory tuning cycle** attempts to tune quickly based on having previously tuned on the present frequency selection. If the tuner previously was successful in tuning on the currently selected frequency, the settings for that match will be loaded into the tuner relays, and checked to see that an acceptable SWR match is found.

A **full tuning cycle** “starts from scratch” and begins a fixed tuning sequence where the IT-100 rapidly tries varying combinations of inductance and capacitance values, and then zeroes-in on the best match possible. When the tuning cycle is complete, if an acceptable match was found, the inductance and capacitance settings are saved in a memory associated with the selected frequency, so that they may be recalled quickly in the future via a memory tuning cycle.

In this manner, the IT-100 “learns”; the longer you use it, the more closely it adapts itself to the bands and frequencies used. Most users will probably use memory tuning most of the time; it takes advantage of any saved tuning settings, but automatically defaults to a full tuning cycle if no stored data is available.

In both cases, at the end of the tuning cycle, the carrier is held for 1.5 seconds after tuning is complete, so that the final SWR may be read on the transceiver’s internal SWR meter or another inline SWR meter, and the front panel LEDs will indicate the status of the tuning cycle.

The tuner may also be placed in “bypass” mode where it is electrically removed from the antenna system.

Operation From the ICOM Transceiver Front Panel

To initiate a tuning sequence from the ICOM transceiver, press and hold the **TUNER/CALL** button for one second. The radio will switch to CW mode, reduce power, and begin to transmit a carrier. The IT-100 will begin a memory tuning sequence as described above. If an acceptable SWR match is found in the memory tuning cycle, the tuning cycle ends. Otherwise, the IT-100 automatically begins a full tuning cycle in an attempt to find a good match. If the full tuning cycle is then successful, the match is stored in a memory associated with the selected frequency.

When the tuning cycle is complete, an indicator on the display of the transceiver will show that the tuner is active. This indicator varies by model; consult the transceiver owner’s manual for details on operation with an external automatic tuner.

To bypass the tuner via the ICOM transceiver front panel, press the **TUNER/CALL** button momentarily. The Tuning LED on the IT-100 will blink once to indicate it is in bypass mode. The tuning indicator on the front panel of the transceiver will also extinguish.

Operation From the IT-100 Front Panel

Normally, the IT-100 is best operated from the transceiver's front panel **TUNER/CALL** button, but there are certain circumstances in which operating from the IT-100 front panel gives more control. There are three operations which can be carried out by use of the front panel button on the IT-100: Toggle bypass mode, start a memory tune, or force a full tune:

Toggle Bypass Mode

To toggle between bypassed and active mode, press the front panel Tune button on the IT-100 momentarily. The Tuning/Status LED will flash three times to indicate that the tuner is in bypass mode. Press the front panel Tune button momentarily again to recall the previous tuner settings. The Tuning/Status LED will flash once to indicate that the tuner is no longer bypassed. This function may be useful if you wish to compare antenna performance with and without the benefit of the tuner's matching network.



Momentary Press



1 Blink = Active



3 Blinks = Bypass

Initiate a Memory Tune Cycle

To initiate a memory tuning cycle, press and hold the Tune button on the front of the IT-100 until the Tuning/Status LED lights up. A memory tuning cycle will begin. The IT-100 will force the transceiver into AM mode, change the power level to one that is appropriate for tuning, and key the radio. When tuning is complete, the transceiver will return to the operating mode and power level previously set.

Press and hold until Tuning LED lights.



Release when Tuning LED lights to begin memory tune.

Force a Full Tune Cycle

Most of the time, the IT-100's memory tuning will allow a good match to be found quickly, if transmitting on the same frequency as a previously stored match. But sometimes, especially when using a different antenna, the memory tuning will recall a previous match which is acceptable, but isn't the best match possible for this different situation. In this case, forcing a full tune will cause the IT-100 to seek a better match than the match already stored in memory for this frequency.

To force a full tuning cycle, press and hold the **Tune** button on the front panel of the IT-100 until the **Tuning/Status LED** lights up, and keep holding until the **Tuning/Status LED** goes out again. Release the **Tune** button once the **Tuning/Status LED** goes out. A full tuning cycle will begin. When tuning is complete, the transceiver will be restored to its previous operating mode and power level.

Press and hold until Tuning LED lights.



Continue holding until Tuning LED extinguishes.



Release Tune button to begin Full Tune cycle.

Status of LEDs

The **SWR LED** and **Tuning LED** are used to indicate both operating modes, tuning status, and error codes. The following table lists the LED status codes and their meaning.

LED Indication	Meaning
Tuning LED on.	Tuner is tuning.
Tuning LED goes out, SWR LED comes on solid.	Tuner has completed a tuning cycle; a good SWR match was found.
Tuning LED goes out, SWR LED blinks 5 times.	Tuning cycle is complete, tuning match is between 1.5:1 and 3.0:1 SWR.
Tuning LED goes out, no SWR LED.	Tuning cycle is complete, tuning match is greater than 3.0:1 SWR.
Tuning LED blinks 4 times.	Tuning cycle failed, no RF was detected.
Tuning LED blinks 5 times.	Tuning cycle failed, RF was lost in the middle of the tune.

OPERATING HINTS

This section describes a few practical tips on using the IT-100 tuner with ICOM transceivers.

Transceiver Tuner Status Indication

The various models of ICOM transceivers all indicate the status of the external tuner a little differently. Most will show an graphical or textual icon on the screen to indicate that the tuner is engaged and has properly tuned. For example, the IC-7000 displays a  icon while tuning, and a solid  icon when tuning is complete. This icon disappears when the tuner is bypassed, and blinks if a tuning cycle failed to find a good match. Other ICOM transceivers behave similarly. Consult your transceiver operating manual's section on use with external tuners for more information.

IC-718 Installation

Note that on the IC-718 transceiver, you must select AH-4 operation in order to operate with the IT-100. To do this, turn off the IC-718. Then, while holding [SET], push [PWR] to turn power on. Push [UP] or [DN] several times to select [TUNER]. Rotate the main dial to select the "4" setting, which selects AH-4 mode. Turn the power to the IC-718 off and back on again.

Automatic Bypass on Band Change

Most Icom transceivers will send a bypass command to the IT-100 any time the operating band is changed. This is a feature of the Icom transceiver, and not a design feature of the IT-100.

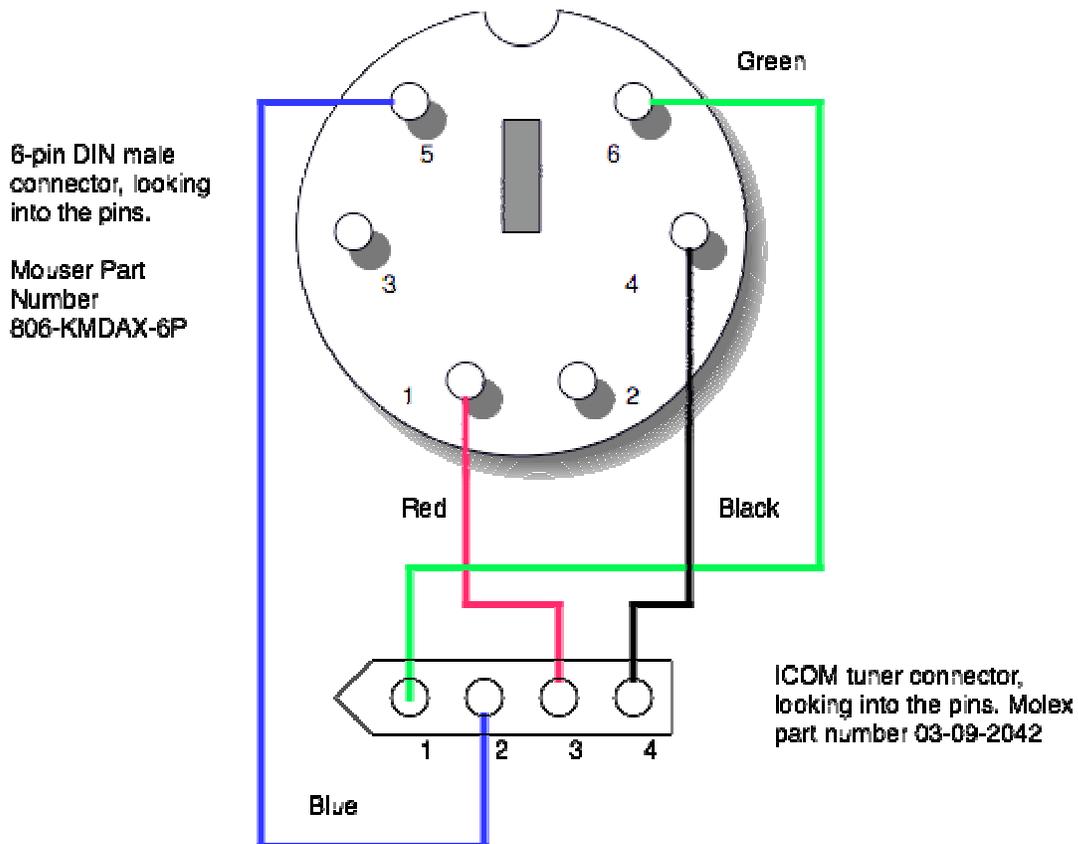
APPLICATION INFORMATION

Mobile Operation

The IT-100 is perfectly suited to mobile operation. It can be installed under the dashboard along with the transceiver, or mounted remotely. The only requirement is that the tuner remain dry.

The supplied radio interface cable is 14 inches long. If it is desired that the IT-100 is positioned farther from the transceiver than this cable length allows, a custom cable will need to be constructed. This can be accomplished in two ways: Cut the supplied cable and solder a jumper wire between all the connections, or purchase new connectors and cable to construct a custom-length interface cable from scratch.

The 4-pin AH-4 interface connector is Molex part number 03-09-2042, available from several online component vendors, such as DigiKey¹ and Mouser². The connector also requires four pins, Molex part number 02-09-2103. The 6-pin IT-100 interface connector is Kycon Connector Part Number KMDAX-6P, available from <http://www.mouser.com/> as Mouser part number 806-KMDAX-6P.



¹ <http://www.digikey.com/>

¹ <http://www.mouser.com>

² For a very complete treatment of this subject, see any edition of the *ARRL Handbook for Radio Communications* (previously the *Handbook For Radio Amateurs*).

MARS/CAP Coverage

The IT-100 provides continuous tuning coverage over its specified range; not just in the ham bands. This makes it useful for MARS or CAP operation, or any other legal HF operation.

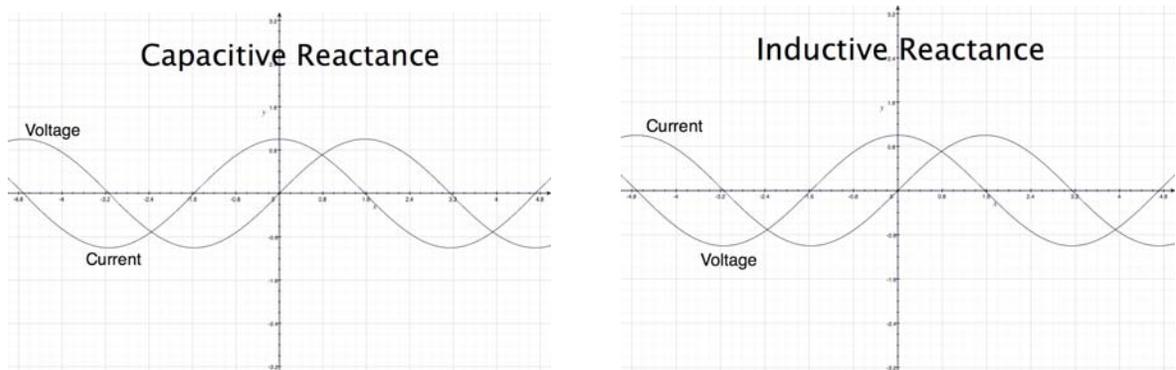
THEORY OF OPERATION

Some basic ideas about impedance

The theory underlying antennas and transmission lines is fairly complex, and in fact employs a mathematical notation called “complex numbers” that have “real” and “imaginary” parts. It is beyond the scope of this manual to present a tutorial on this subject³, but a little background will help in understanding what the IT-100 is doing, and how it does it.

In simple DC circuits, the wire resists current flow, converting some of it into heat. The relationship between voltage, current, and resistance is described by the elegant and well-known “Ohm’s Law”, named for Georg Simon Ohm of Germany, who first discovered the principle in 1826. In RF circuits, an analogous but more complicated relationship exists.

RF circuits also resist the flow of electricity. However, the presence of capacitive and inductive elements causes the voltage to lead or lag the current, respectively. In RF circuits, this resistance to the flow of electricity is called “impedance”, and can include all three elements: resistive, capacitive, and inductive.



The output circuit of a transmitter consists of inductors and capacitors, usually in a series/parallel configuration called a “pi network”. The transmission line can be thought of as a long string of capacitors and inductors in series/parallel, and the antenna is a kind of resonant circuit. At any given RF frequency, each of these can exhibit resistance, and impedance in the form of capacitive or inductive “reactance”.

Transmitters, transmission lines, antennas, and impedance

The output circuit of a transmitter, the transmission line, and the antenna, all have a characteristic impedance. For reasons beyond the scope of this document, the standard impedance is nominally 50 ohms resistive, with zero capacitive and zero inductive components. When all three parts of the system have the same impedance, the system is said to be “matched”, and maximum transfer of power from the transmitter to the antenna occurs. While the transmitter output circuit and transmission line are of fixed, carefully designed impedance, the antenna presents 50-ohm, non-

³ For a very complete treatment of this subject, see any edition of the ARRL Handbook for Radio Communications (previously the Handbook For Radio Amateurs).

reactive load only at its natural resonant frequencies. At other frequencies, it will exhibit capacitive or inductive reactance, causing it to have an impedance other than 50 ohms.

When the impedance of the antenna is different from that of the transmitter and transmission line, a “mismatch” is said to exist. In this case, some of the RF energy from the transmitter is reflected from the antenna back down the transmission line and into the transmitter. If this reflected energy is strong enough, it can damage the transmitter’s output circuits.

The ratio of transmitted to reflected energy is called the “standing wave ratio”, or SWR. An SWR of 1 (sometimes written 1:1) indicates a perfect match. As more energy is reflected, the SWR increases to 2, 3, or higher. As a general rule, modern solid state transmitters must operate with an SWR of 2 or less. Tube excitors are somewhat more tolerant of high SWR. If a 50 ohm antenna is resonant at the operating frequency, it will show an SWR close to 1. However, this is usually not the case; operators often need to transmit at frequencies other than resonance, resulting in a reactive antenna and a higher SWR.

$$SWR = \frac{1 + \sqrt{R/F}}{1 - \sqrt{R/F}} \quad \text{where F = Forward power (watts), R = Reflected power (watts)}$$

SWR is measured using a device called an “SWR bridge”, inserted in the transmission line between the transmitter and the antenna. This circuit measures forward and reflected power from which SWR may be calculated (some meters calculate SWR for you). More advanced units can measure forward and reflected power simultaneously, and show these values and SWR at the same time.

An antenna tuner is a device used to cancel out the effects of antenna reactance. Tuners add capacitance to cancel out inductive reactance in the antenna, and vice versa. Simple tuners use variable capacitors and inductors; the operator adjusts them by hand while observing reflected power on the SWR meter until a minimum SWR is reached. The LDG Electronics IT-100 automates this process.

No tuner will fix a bad antenna. If the antenna is far from resonance, the inefficiencies inherent in such operation are

	FWD Power (watts)								
REV	20	30	40	50	60	70	80	90	100
2	1.92	1.70	1.58	1.50	1.45	1.41	1.38	1.35	1.33
4	2.62	2.15	1.92	1.79	1.70	1.63	1.58	1.53	1.50
6	3.42	2.62	2.26	2.06	1.92	1.83	1.75	1.70	1.65
8	4.44	3.14	2.62	2.33	2.15	2.02	1.92	1.85	1.79
10	5.83	3.73	3.00	2.62	2.38	2.22	2.09	2.00	1.92
12	7.87	4.44	3.42	2.92	2.62	2.41	2.26	2.15	2.06
14	11.24	5.31	3.90	3.25	2.87	2.62	2.44	2.30	2.20
16	17.94	6.42	4.44	3.60	3.14	2.83	2.62	2.46	2.33
18	37.97	7.87	5.08	4.00	3.42	3.06	2.80	2.62	2.47
20		9.90	5.83	4.44	3.73	3.30	3.00	2.78	2.62
22		12.92	6.74	4.94	4.07	3.55	3.21	2.96	2.77
24		17.94	7.87	5.51	4.44	3.83	3.42	3.14	2.92
26		27.96	9.32	6.17	4.85	4.12	3.65	3.32	3.08
28		57.98	11.24	6.95	5.31	4.44	3.90	3.52	3.25
30			13.93	7.87	5.83	4.79	4.16	3.73	3.42
32			17.94	9.00	6.42	5.18	4.44	3.95	3.60
34			24.63	10.40	7.09	5.60	4.75	4.19	3.80
36			37.97	12.20	7.87	6.07	5.08	4.44	4.00
38			77.99	14.60	8.80	6.60	5.44	4.71	4.21
40				17.94	9.90	7.19	5.83	5.00	4.44
42				22.96	11.24	7.87	6.26	5.31	4.68
44				31.30	12.92	8.65	6.74	5.65	4.94
46				47.98	15.08	9.56	7.27	6.02	5.22
48				97.99	17.94	10.63	7.87	6.42	5.51
50					21.95	11.92	8.55	6.85	5.83

inescapable; it's simple physics. Much of the transmitted power may be dissipated in the tuner as heat, never reaching the antenna at all. A tuner simply "fools" the transmitter into behaving as though the antenna were resonant, avoiding any damage that might otherwise be caused by high reflected power. For best performance, the antenna used should always be as close to resonance as is practical.

THE LDG IT-100

In 1995, LDG Electronics pioneered a new type of automatic antenna tuner. The LDG design uses banks of fixed capacitors and inductors, switched in and out of the circuit by relays under microprocessor control. An additional relay switches between high and low impedance ranges. A built-in SWR sensor provides feedback; the microprocessor searches the capacitor and inductor banks, seeking the lowest possible SWR. The tuner is a "Switched L" network, consisting of series inductors and parallel capacitors. LDG chose the L network for its minimum number of parts and its ability to tune unbalanced loads, such as coax-fed dipoles, verticals, Yagis, and, in fact, virtually any coax-fed antenna.

The series inductors are switched in and out of the circuit, and the parallel capacitors are switched to ground under microprocessor control. The high/low impedance relay switches the capacitor bank either to the transmitter side of the inductor bank, or to the antenna side. This allows the IT-100 to handle loads that are either greater than or less than 50 ohms. All relays are sized to carry 125 watts continuously.

The SWR sensor is a variation of the Bruene circuit. This SWR measuring technique is used in most dual-meter and direct-reading SWR meters. Slight modifications were made to the circuit to provide voltages instead of currents for the analog-to-digital converters that provide signals proportional to the forward and reflected power levels. The single-lead primary through the center of the sensor transformer provides RF current sampling. Diodes rectify the sample and provide a DC voltage proportional to RF power. These two voltages are read by the ADCs in the microprocessor, and are used to compute SWR in real time.

The relays are powered by the 12VDC input provided by CAT interface cable. The relays are a latching type, and so they consume no current when not actively switching.

Although the microprocessor's oscillator runs at 8 MHz, which allows the main tuning routine to execute in only a few milliseconds, the relays require several milliseconds of settling time for every combination of inductors and capacitors. Thus, it may take several seconds before all relay combinations are exhausted, in the case of a difficult tune.

The tuning routine uses an algorithm to minimize the number of tuner adjustments. The routine first de-energizes the high/low impedance relay if necessary, then individually steps through the inductors to find a coarse match. With the best inductor selected, the tuner then steps through the individual capacitors to find the best coarse match. If no match is found, the routine repeats the coarse tuning with the high/low impedance relay energized. The routine then fine tunes the inductors and capacitors. The program checks LC combinations to see if a 1.5:1 or lower SWR can be obtained, and stops when it finds a good match.

The microprocessor runs a fine tune routine just after the tuner finds a match of 1.5:1 or less. This fine tune routine now tries to adjust the SWR as low as possible (not just to 1.5); it takes about half a second to run.

A WORD ABOUT TUNING ETIQUETTE

Be sure to use a vacant frequency when tuning. With today's crowded ham bands, this is often difficult. However, causing interference to other hams should be avoided as much as possible. The IT-100's very short tuning cycle, as little as a fraction of a second, minimizes the impact of tuning transmissions.

CARE AND MAINTENANCE

The IT-100 tuner is essentially maintenance-free. Power limits in this manual should be strictly adhered to. The outer case may be cleaned as needed with a soft cloth slightly dampened with household cleaning solution. As with any modern electronic device, the IT-100 can be damaged by temperature extremes, water, impact, or static discharge. LDG strongly recommends the use of a good quality, properly installed lightning arrestor in the antenna lead.

TECHNICAL SUPPORT

The LDG Customer Support Center staff is ready to answer your product question by telephone and over the Internet. We know that you will enjoy your product even more knowing LDG is ready to answer your questions as the need arises.

Visit the Support Center at: <http://support.ldgelectronics.com>

Our website links you to the on-line Customer Support Center where you can send us a question, do your own research in the LDG Product Knowledge Books, and read through lists of frequently asked product questions. LDG regularly updates on-line information so the best on-line support information is available all day and every day.

The LDG website provides links to product manuals, just in case you lose this one! When you are thinking about the purchase of other LDG products our website also has complete product specifications and photographs you can use to help make your purchase decision. Don't forget the links to all of the quality LDG Dealers also ready to help you make that purchase decision.

TWO-YEAR TRANSFERRABLE WARRANTY

Your product is warranted against manufacturer defects in parts and labor for two full years from the date of purchase. This two-year warranty is also transferable. When you sell or give away your LDG product give the new owner a copy of the original sales receipt and the two-year warranty goes with the new owner.

There is no need to complete a warranty card or to register an LDG product. Your product receipt establishes eligibility for warranty service so save that receipt. Send your receipt with the product whenever you send your product to LDG for repair. Products sent to LDG without a receipt are considered requests for out-of-warranty repair.

LDG does not warranty against product damage or abuse. This means that a product failure, as determined by LDG, to be caused by the customer or by other natural calamity (e.g. lightning) is not covered under the two-year warranty. Damage can be caused by failure to heed the product's published limitations and specifications or by not following good Amateur practice.

OUT OF WARRANTY SERVICE

Any time a product fails after the warranty, LDG wants to help you get it fixed. Send the product to us for repair. We will determine what needs to be done, and, based on your prior

instruction, either contact you with an estimate or fix it and contact you with a request to pay any repair charges. Please contact LDG if you have any questions before you send us an out-of-warranty product for repair.

RETURNING YOUR PRODUCT FOR SERVICE

Returning a product to LDG is easy. We do not require a return merchandise authorization, and there is no need to contact LDG to return your product. Visit the Customer Support Center and download the LDG Product Repair Form. On the Repair Form tell the LDG technicians exactly what happened or didn't happen and why you believe the product needs servicing. The technician attempts to duplicate the problem(s) you had based on how well you describe it so take the time to be accurate and complete.

Ask your shipper for a tracking number or a delivery verification receipt. This way you know the product arrived safely at LDG. Be sure to give us your email address so our shipper can alert you online when your product is en-route back to you. Periodic updates on the status of the repair are not available. We can only indicate the repair is in process until it ships back to you. Please be assured that our staff makes every effort to complete repairs ahead of our published wait time. Your patience is appreciated.

Repairs can take six to eight weeks, but are usually faster. The most recent information on returning products for service is found at the LDG Customer Support Center. Send your carefully packaged unit with the Repair Form to:

LDG Electronics, Inc.
Attn: Repair Department
1445 Parran Rd
St. Leonard, MD 20685

PRODUCT FEEDBACK

We encourage product feedback! Tell us what you really think of your LDG product. In a card, letter, or email (preferred) tell us how you used the product and how well it worked in your application. Send along a photo or even a schematic or drawing to illustrate your narrative. We like to share your comments with our staff, our dealers, and even other customers at the LDG website.

<http://www.ldgelectronics.com/>

