

## Automatic Antenna Tuners—A Sample of the Field

Joel R. Hallas, W1ZR  
Assistant Technical Editor

A few years back, we surveyed the antenna tuner market in these pages. All those tuners were manual ones. A few automatic tuners were available at that time, but they were the exception rather than the rule. Since then, a number of manufacturers have focused their attention on automatic antenna tuners and it seems as if there's now one for every application.

For this review we selected representative tuners from a number of manufacturers. There are two general configurations: those providing remote tuning, with the tuner intended to be near the antenna, and those intended to be colocated with the station equipment. For those manufacturers having models in each camp, we selected one of each.

As noted in the specifications, each tuner is different and they don't exactly line up head-to-head, so a direct comparison is not always appropriate. Still, for each we will provide the basic data you would need to decide if one of these is a good fit for your needs. If you like the looks of a particular manufacturer, but the tuner reviewed doesn't exactly meet your requirements, check their Web page or your dealer for other models at different power levels or with different features. For this review we stuck to those at the 100 to 200 W level and tried for a representative self-contained and remote tuner from each manufacturer.

For these tests, we looked at units designed to work with any radio. In addition to these, most HF radio manufacturers offer external auto tuners designed to operate exclusively with their radios. One manufacturer, LDG, also offers tuners with the capabilities to operate with specific radios' commands. Many HF radio manufacturers also offer internal autotuners as a part of their transceivers. We generally review these as a part of the radios. We elected to stick to general purpose models for this review. Those selected for this test include the RT-11 and Z-100 from LDG, the MFJ-991 and from SGC the SG-237 and MAC-200.

### Remote vs Colocated Autotuners

It's probably worth a paragraph or two to discuss the relative merits and appro-



Figure 1—Tuners from LDG, MFJ and SGC—ready for test.

priateness of the two configurations. If the antenna(s) to be matched terminate right at the station equipment, without a transmission line (or with a very short one), there is no particular advantage to having a remote tuner. On the other hand, that setup often results in problems with "RF in the shack," or EMI within the house. I have one antenna setup of that form and whenever I use it, the RF resets the kitchen FM radio, causing it to lose track of time and memory.

Most find it a better solution to have the antenna system stop somewhere outside the house and have a transmission line interconnect the radio and antenna. With a remote tuner, the matching can be at or near the antenna, resulting in a well matched transmission line coming back to the radio. With the tuner at the radio, the matching takes place near the radio, and the SWR on the line out to the antenna will often be high. Note that in both cases the radio will be provided a good match and will happily put full power into the system. With the remote tuner, often more of the power will be radiated by the antenna and less will be dissipated as heat by the transmission line. Some radios now come with automatic tuners as part

of the radio. These can be functionally equivalent to the local tuner. The separate tuner does offer two advantages over the internal tuner—it can support multiple radios, and most can match a higher SWR than many of the internal tuners.

The key factor in deciding between a local and a remote tuner then becomes how much of the transmitter power actually reaches the antenna system and how much will heat up the transmission line. This is a function of operating frequency, SWR and line length. The place to start the analysis is with *The ARRL Antenna Book*.<sup>1</sup> Figure 23 in Chapter 24 provides the attenuation in 100 feet of *matched* transmission line for each of the common types. Table 14 in the same chapter provides the *additional* loss for the non-matched case as a function of SWR and matched loss. Using the two tables, you can determine the total loss of your transmission line. If the loss is acceptable, you can tune at the transmitter end. If not, by tuning at the antenna end you can eliminate most of the additional loss due to mismatch.

An example might be helpful. A multi-band antenna such as my G5RV might have a 5:1 SWR on parts of 10 meters. If we feed it with 150 feet of RG-58 cable we have a matched loss of about 3.5 dB and the 5:1 SWR adds about another 2 dB for a total of 5.5 dB loss or about 71% of our power heating up the line! By moving the tuner to the antenna end of the coax, we reduce that to 55%. Another option is to change the transmission line (my solution immediately after making that calculation!). If we go with lower loss RG-8 instead, we have a

### Bottom Line

Automatic antenna tuners can provide a quick and easy method of matching multiband or nonresonant antennas quickly and effortlessly. Performance is on par with manual tuners and there is now a selection available providing a fit to most requirements.

matched loss of about 2 dB (1.3 dB per 100 ft) and the SWR adds about another 0.3 dB for a total of 2.3 dB, or a loss of about 41% of our power. With the tuner at the antenna, the total loss would be the 2 dB or 37%—not much of a difference. Note that I didn't consider the tuner losses here, under the assumption that they would be the same at either location. The numbers get much more grim as the SWR goes up, by the way.

Two notes of caution—first, if you measure the SWR at the shack end of the cable, it will appear better than it is, due to the cable loss; second, the matched loss from Figure 23 is the *best* matched loss for new and dry cable. The actual loss can only go up from there, especially if the cable came from some dark corner of your basement, or worse, from an unknown source at a flea market.

Note that all of these tuners are designed for unbalanced (coax) cable between the tuner and the radio and, with the exceptions noted, unbalanced operation on the antenna side (coax or single wire antennas) as well. In order to use these tuners with a balanced load, it is best to decouple the ground side of the tuner from the transmission line. A coax choke can be used, or a balun (balanced to unbalanced transformer) can be employed. If you are using a balun, it is best

to keep the line impedance within a SWR of about 4:1 (with respect to the usual 200 Ω impedance of a 4:1 balun) to avoid heating, loss and possible balun damage. A subsequent planned review will look at the special class of unbalanced to balanced tuners that sidestep this issue in an elegant way and are once again appearing on the market.

A word or two about the data shown may be in order. Please note that we used the same precision resistive load set for each tuner. In most cases, this includes data outside the manufacturers' specification range. We measured at a single frequency in each band, and for 6 meters we just measured the case with a 1:1 load for all the tuners that claimed operation there.

## THE TUNERS—ALPHABETICALLY

### LDG RT-11 and Z-100

A look at LDG's Web page, [www.ldgelectronics.com](http://www.ldgelectronics.com), will show you their selection of tuners and accessories. In addition to the RT-11 remote control tuner and the Z-100 local tuner, tested, they offer an autotuner rated at 1000 W. As this review was being prepared, they also announced a much more feature rich desktop unit to complement the very basic, but lower cost Z-100.

#### LDG RT-11

The RT-11 is a rugged, weatherproof tuner designed to be used inside or outdoors. It has coax connectors on input and



Figure 2—LDG RT-11 (left) with control box and Z-100. A 12 ounce beverage container is included for scale.

**Table 1**  
**LDG RT-11 Remote Automatic Antenna Tuner**

#### Manufacturer's Claimed Specifications

Input SWR range: to 10:1 (3:1 on 6 meters).  
Output SWR range: not specified.  
Frequency coverage: 1.8 to 54 MHz.  
Input power: 0.1 to 125 W, 50 W on 6 meters.  
Power requirements: 11 to 14 V dc, 7 to 250 mA.

#### Measured in ARRL Lab

See below.  
See below.  
As specified.  
Tested at 50 W on HF, 20 W on 6 meters.  
Idle 0 mA, max 140 mA at 13.8 V dc.

Measured power loss into resistive loads (%) / Input SWR at match:

SWR	Load (Ω)	160 Meters	80 Meters	40 Meters	20 Meters	10 Meters	6 Meters
16:1	3.125	No Match	No Match	27 <1.5:1	22 2.6:1	<10 <1.5:1	
8:1	6.25	No Match	17 <1.5:1	17 <1.5:1	19 <1.5:1	20 <1.5:1	
4:1	12.5	11 <1.5:1	11 <1.5:1	12 <1.5:1	13 <1.5:1	26 <2:1	
2:1	25	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	23 2.1:1	
1:1	50	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	21 2.1:1
2:1	100	<10 <2:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	17 <1.5:1	
4:1	200	<10 <2:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	15 <1.5:1	
8:1	400	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	28 <1.5:1	
16:1	800	<10 <1.5:1	12 <1.5:1	<10 <1.5:1	<10 <1.5:1	19 <1.5:1	

**Table 2**  
**LDG Z-100 Desktop Automatic Antenna Tuner**

**Manufacturer's Claimed Specifications**

Input SWR range: to 10:1 (3:1 on 6 meters).  
Output SWR range: not specified.  
Frequency coverage: 1.8 to 54 MHz.  
Input power: 0.1 to 125 W, 50 W on 6 meters.  
Power requirements: 7 to 18 V dc, 250 mA.

**Measured in ARRL Lab**

See below.  
See below.  
See text.  
Tested at 50 W on HF, 20 W on 6 meters.  
Idle 0 mA, max 160 mA at 13.8 V dc.

*Measured power loss into resistive loads (%) / Input SWR at match:*

SWR	Load ( $\Omega$ )	160 Meters	80 Meters	40 Meters	20 Meters	10 Meters	6 Meters
16:1	3.125	No Match	No Match	15 <1.5:1	10 <1.5:1	<10 <1.5:1	
8:1	6.25	No Match	13 2.6:1	15 <2:1	15 <1.5:1	20 <2:1	
4:1	12.5	No Match	<10 <1.5:1	<10 <1.5:1	<10 <2:1	<10 <1.5:1	
2:1	25	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	17 <1.5:1	
1:1	50	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	20 <2:1
2:1	100	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	
4:1	200	<10 2.1:1	<10 2.2:1	<10 <1.5:1	11 <1.5:1	<10 <1.5:1	
8:1	400	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	11 <1.5:1	<10 <2:1	
16:1	800	11 2.2:1	14 2.3:1	15 <1.5:1	33 <1.5:1	43 <1.5:1	

output and is rated at 125 W from 1.8 to 30 and 50 W to 54 MHz. It is rated to match antennas with an SWR of 10:1 to 30 MHz and 3:1 from 50 to 54 MHz. This unit has an optional remote control designed to be used up to 100 feet from the tuner (15 foot cable supplied). The remote control provides the ability to force a new tune, set for semi or full auto operation, keep the unit from tuning and allows bypassing of the tuner (straight through operation for matched antennas or out of band receive). In addition, LED indicators let you know the status and whether the SWR is below 1.5:1. One caution with the remote, the mounting bracket screws are not captive so you may want to use double-sided tape to secure it to a surface. The RT-11 also has a jack to allow interfacing to radios designed to control proprietary tuners by emulating their commands. Special cables are offered to hook to various Alinco, ICOM, Kenwood and Yaesu radios for this purpose.

In my trials at home, I found that the RT-11 effortlessly tuned every antenna I had on all bands with a very low SWR, always well below 1.5:1. The tuning seemed to take about 5 seconds and hit the result the first time. While automatic operation is possible without radio interface or remote control, I would have

trouble imagining it and would suggest the remote for those without a compatible radio. For one thing, once tuned, it won't automatically restart the tuning process until the SWR reaches 3:1, a value that might cause many radios to "fold back" (reduce power) significantly.

The manual mentions that tuning should take place at the 25 W level, with full power applied only after tune is achieved, so that relay life will not be reduced. They also indicate that if a radio has the common power output fold back with high SWR it will automatically reduce power appropriately. I wouldn't count on that providing sufficient reduction, especially as the match is approached; I would instead manually reduce power while tuning.

**LDG Z-100**

The Z-100 is a self contained desktop unit with a 125 W rating (50 W on 6 meters). This unit is the first of a new series of tuners being released by LDG, with others providing additional features and controls. This is a basic unit corresponding to its low price, but none the less provides the needed tuning functions with straightforward "one button" operation. It includes memory of the settings for the last 200 matches made and tries those

before it branches to its "unknown tune" algorithm. This is a clever idea that avoids the need to measure frequency. It is particularly useful for the case in which more than one antenna is used, since it really doesn't care—if it made the match before it will do it again, in a fraction of a second. A feature of this unit is that it only draws power when actually tuning. Upon completion, the relays remain latched without power required until the next tune is requested. This is particularly appealing for portable low power operations in which every milliamp-hour is carried in.

The operation of this tuner is fundamentally different than the others in that it will only tune when the TUNE button is pushed. This has an advantage in that it will not start tuning inadvertently on high SWR, potentially applying full power during tune. Upon changing frequency, the operator can decide whether or not to initiate the tune cycle. By pushing the button for less than 0.5 seconds, the tuner goes to bypass. Between 0.5 and 3 seconds the tuner will attempt to find a match from memory (typically less than half a second), and only initiate a full tune if needed. If the button is pushed for more than 3 seconds a full tune cycle is initiated, ignoring any memorized settings. This is easier to deal with than it sounds

since the LEDs provide a confirmation of tuning mode. A green LED also indicates if the match is less than 1.5:1 or between 1.5 and 2:1. An early production unit exhibited some inconsistent tuning results on 6 meters. The manufacturer has developed a method of improved internal decoupling that solved this problem and the results reflect that change. LDG states that this will be included in future production units and that anyone having problems with 6 meter tuning on early units should contact them directly.

**Manufacturer:** LDG Electronics Inc, 1445 Parran Rd, PO Box 48, St Leonard, MD 20685; tel 877-890-3003; fax 410-586-8475; [www.ldgelectronics.com](http://www.ldgelectronics.com). Price: RT-11 Tuner, \$209; Remote head, \$39; Z-100, \$149; 12 V power cube for either tuner, \$10.

### MFJ-991

MFJ has recently announced a series of autotuners. All are in the typical indoor/co-located configuration, but with the available remote kit (ordered, but not received in time for the review) can be used as a remote tuner if kept out of the weather. They offer the MFJ-991 (tested) 150 W rated tuner, a tuner with similar features rated at 600 W and a 300 W autotuner with digital display, balun and



Figure 3—MFJ-991 Autotuner.

two port antenna switch. As with the LDG, the MFJ tuners require their tuning be accomplished at reduced power.

The MFJ-991 front panel provides full control capability and forward and reflected power metering with “crossed-needle” SWR measurement display. Two features of the '991 are not found on other tested units and are worth mentioning. First, the '991 has the capability to allow manually adjusting the C and L values of the tuner while in receive. This is helpful if you are using your radio for receive only and wish to attempt to match to increase signal strength. The second feature is the ability to select the SWR threshold at either 1.5 or 2:1. In our testing the tuner went to the best match it could find in either case. The difference was in how far you could change frequency before it

would automatically retune when you transmitted. If your radio can tolerate a 2:1 SWR, this could provide a benefit. The '991 could tune my G5RV on all bands and remembered the last setting for each frequency (1000 memories), with a one-click reset. Tuning the first time on a frequency was typical of the cycle time of the other units. This unit sounded somewhat louder (it has 18 heavy duty relays) than the other test samples, although not an issue for the single click associated with a memorized tune.

The MFJ-991 can interoperate with ICOM and Alinco tuner control commands. Appropriate interface cables are available from MFJ.

In addition to the obvious controls and indicators, there are some subtle ones as well. There are a number of meter “sig-

**Table 3**  
**MFJ-991 Desktop/Remote Automatic Antenna Tuner**

#### Manufacturer's Claimed Specifications

Input impedance range: 6 to 3200  $\Omega$ .  
Output SWR range: 1.5:1 or 2:1 selectable.  
Frequency coverage: 1.8 to 30 MHz.  
Input power: 5 to 150 W.  
Power requirements: 12 to 15 V dc, 1.0 A.

#### Measured in ARRL Lab

See below.  
See below.  
As specified.  
Tested at 50 W.  
Idle 90-300 mA, max 500 mA at 13.8 V dc.

Measured power loss into resistive loads (%) / Input SWR at match:

SWR	Load ( $\Omega$ )	160 Meters	80 Meters	40 Meters	20 Meters	10 Meters
16:1	3.125	No Match	27 <1.5:1	20 <1.5:1	15 <1.5:1	<10 <2:1
8:1	6.25	12 <1.5:1	14 <1.5:1	15 <1.5:1	24 <1.5:1	19 2.6:1
4:1	12.5	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	12 <1.5:1
2:1	25	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1
1:1	50	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1
2:1	100	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1
4:1	200	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1
8:1	400	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	11 <1.5:1	11 <1.5:1
16:1	800	<10 <1.5:1	16 <1.5:1	<10 <1.5:1	<10 <1.5:1	23 <1.5:1

nals” sent to the operator that will not be clear without a cruise through the manual. For example, if you forget to reduce power before tuning, the power meter swings to full scale and the tuner is bypassed. If you toggle between 1.5 and 2:1 SWR threshold, the meter briefly jumps up to indicate that SWR.

To order, or for your nearest MFJ dealer, call MFJ Enterprises at 800-647-1800 or order at [www.mfjenterprises.com](http://www.mfjenterprises.com), fax 662-323-6551; or write MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759. Price: \$220.

### SGC SG-237 and MAC-200

SGC has been making automatic antenna tuners for many years, and offers a wide selection. Until recently, they concentrated on remote tuners, usually the weatherproof type, at power ratings of 100 to 500 W. More recently, they have introduced a number of variations of their SG-237, a board version to build into your own radio or antenna cabinet, an open enclosure model for remote but indoor use and one with controls and indicators intended for portable use. They have recently released a Multiple Antenna Controller, MAC-200. The units we tested were an SG-237 (one that has fed the backstay of my sailboat for

some years) and a relatively new combination unit, the MAC-200.

### SGC SG-237 Autotuner

The SG-237 was the first in a series of SGC tuners that were much more compact than their previous (and continuing) line, the SG-230 (200 W, 1.6-30 MHz), SG-231 (100 W, 1-60 MHz) and SG-235 (500 W, 1.8-30 MHz). The SG-237 is rated at 100 W PEP, both for operation and for tuning (40 W continuous carrier power). The transmitter connection is via a 9 foot combined RF, control and power cable (25 and 50 foot extensions available), while the antenna connection is via a single ceramic insulated terminal. While the tuner is designed to feed a single wire against ground, I have successfully employed mine into coax fed

antennas as well as loops and single wires. This is a rugged unit in a compact waterproof aluminum enclosure that can slide in almost anywhere. It needs no remote control box to work, and I’ve used mine that way for years. An optional remote control is offered (and we tested with it) to provide a positive indication of match and to allow a lockout or a forced reset. The lockout can be handy in a portable or mobile environment to avoid the tuner attempting to retune due to the temporary proximity of outside objects while in motion, for example. The ’237 provides a memory function that uses the measured transmitter frequency to result in the tuner settings last used to successfully tune to that frequency. This means that instead of taking 5 to 10 seconds to tune, the previously stored



Figure 4—SGC SG-237 (left) and MAC-200.

**Table 4**  
**SGC SG-237 Remote Automatic Antenna Tuner**

#### Manufacturer’s Claimed Specifications

Input SWR range: corresponding to a minimum 7 foot antenna above 3.5 MHz, 23 feet above 1.8 MHz.  
Output SWR range: 1.4:1 typical.  
Frequency coverage: 1.8 to 60 MHz.  
Input power: 3 to 100 W.  
Power requirements: 10.5 to 18 V dc, 300 mA.

#### Measured in ARRL Lab

See below.  
See below.  
As specified.  
Tested at 50 W.  
Idle and tuning 270 to 480 mA at 13.8 V dc.

#### Measured power loss into resistive loads (%) / Input SWR at match:

SWR	Load ( $\Omega$ )	160 Meters	80 Meters	40 Meters	20 Meters	10 Meters	6 Meters
16:1	3.125	21 <1.5:1	21 <1.5:1	19 <1.5:1	No match	<10 <1.5:1	
8:1	6.25	16 <1.5:1	18 2.1:1	20 <1.5:1	24 <1.5:1	23 <1.5:1	
4:1	12.5	11 <1.5:1	12 <1.5:1	15 <1.5:1	17 <1.5:1	23 <1.5:1	
2:1	25	<10 <1.5:1	11 <1.5:1	21 <2:1	18 <2:1	26 <1.5:1	
1:1	50	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	12 <1.5:1	29 <1.5:1
2:1	100	<10 <2:1	<10 <2:1	<10 <1.5:1	13 <1.5:1	14 <1.5:1	
4:1	200	No match	<10 2.1:1	<10 <1.5:1	16 <1.5:1	10 <1.5:1	
8:1	400	No match	<10 2.1:1	10 <1.5:1	16 <1.5:1	18 <1.5:1	
16:1	800	<10 <1.5:1	<10 <1.5:1	14 <1.5:1	30 <1.5:1	58 <2:1	

**Table 5**  
**SGC MAC-200 Desktop Automatic Antenna Tuner and Controller**

**Manufacturer's Claimed Specifications**

Input impedance range: 5-1000 Ω (feed line)  
 0.2-5000 Ω (long wire).  
 Output SWR range: 2:1 typical.  
 Frequency coverage: 1.8 to 60 MHz.  
 Input power: 1.5 to 200 W.  
 Power requirements: 10 to 18.5 V dc, 230 mA.

**Measured in ARRL Lab**

See below.  
 See below.  
 As specified.  
 Tested at 50 W.  
 Idle 280 mA, max 530 mA at 13.8 V dc (meter light on)  
 Idle 240 mA, max 490 mA at 13.8 V dc (meter light off)

*Measured power loss into resistive loads (%) / Input SWR at match:*

SWR	Load (Ω)	160 Meters	80 Meters	40 Meters	20 Meters	10 Meters	6 Meters
16:1	3.125	No Match	39 <2:1	24 <2:1	<10 <1.5:1	<10 <1.5:1	
8:1	6.25	No Match	16 <1.5:1	18 <1.5:1	15 <1.5:1	30 <1.5:1	
4:1	12.5	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	18 <1.5:1	27 <1.5:1	
2:1	25	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	25 2:1	
1:1	50	<10 <2:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	12 <2:1	27 <2:1
2:1	100	<10 <1.5:1	<10 <2:1	<10 <2:1	<10 <2:1	14 <1.5:1	
4:1	200	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	<10 <1.5:1	14 <2:1	
8:1	400	<10 <1.5:1	<10 <1.5:1	13 <1.5:1	15 <1.5:1	17 <1.5:1	
16:1	800	No match	22 <1.5:1	14 <1.5:1	25 <1.5:1	31 <1.5:1	

settings for a frequency are applied in milliseconds and used if the resulting SWR is less than 2:1. In some cases they won't be right (and a new tune will be initiated), if a different antenna is used, for example, but their concept is that this tuner is out where the antenna is and thus should see the same impedance for a given frequency each time that frequency is employed.

**SGC MAC-200 Multiple Antenna Controller**

This device combines a 200 W autotuner, a five port automatic or manual antenna switch, power and SWR meters and a balun in one compact package. This is a nice unit and quickly grew on me in operation. It has enough controls and indicators to keep me entertained even when the bands aren't open.

For some time, most manual tuners have had provisions for switching antennas as well as tuning them. This is very handy, since even those with just one antenna should have a dummy load to switch to for tune up. I have no numbers, but I would guess more hams have more than one HF antenna than have only one. I don't have fancy HF antennas, but I have a G5RV I use on 80 through 10, a Lazy-H, perpendicular to the G5RV for 30 through

10 meters and a 70 foot wire vertical for use when it makes sense (not often in my part of New England). With the MAC-200, I can memorize which antenna to use on which band. It switches antennas on the first dot of a CW string (full power—no problem) and I'm there. As noted, at my station, on some bands the antenna is a function of the direction to the distant station, I can just touch the MANUAL button and I can select a different antenna by touching a button numbered 1 to 5.

As configured, antenna one is intended for balanced feed, antenna two has a terminal for a single wire feed, and three through five are terminated in UHF (SO-239) coax connectors.

The separate meters for power and SWR are handy. The SWR meter is especially convenient in that it computes and indicates SWR independent of power level without an adjustment. The manual warns that the meters are not of the precision type and I can attest to that. Their meter indicated 80 W while my Bird 43 showed 100. This is still very useful to let you know if all is well.


This is a handy unit, in a cabinet matching the cross section of the SGC-2020 transceiver (but somewhat longer), it can be made to fit in most shacks. In mine it can slide beneath the shelf that

holds my equipment three inches above the desk, for example. The one limitation some may have is it provides a "typical" match of 2:1. Well 2:1 is fine for some transmitters, while others may start to "fold back" above 1.5:1 and this may be a problem if yours is in that group. On the other hand, looking at the data it is clear that most of the time it was below 1.5:1 with our loads.

Our original unit remembered which antenna to use on each band, but didn't memorize tuner settings. A warranty replacement unit had a flawless memory function.

*Manufacturer:* SGC Inc, 13737 SE 26th St, Bellevue, WA 98005; tel 425-746-6310; fax 425-746-6384; [www.sgcworld.com](http://www.sgcworld.com). Price: SG-237, \$360; Smartlock remote control, \$59; MAC-200, \$360.

Many thanks to ARRL Lab Engineer Mike Tracy, KC1SX, for taking all this data and to QST Technical Editor Stu Cohen, N1SC, for his comments and encouragement. After a few weeks of living with autotuners, neither Stu nor I are sure we can ever go back to cranking our rotary inductor tuners!

See the Product Review auction at [www.arrl.org/prauction](http://www.arrl.org/prauction) for the latest equipment up for bid. 



# Byonics TinyTrak3 GPS Position Encoder

Reviewed by Stan Horzepa, W1LOU  
QST Contributing Editor  
1 Glen Ave, Wolcott, CT 06716-1442  
wallou@arrl.net

TinyTrak3 (TT3) packs many features in a tiny footprint ( $2\frac{1}{4} \times 1\frac{5}{8} \times \frac{3}{4}$  inches). Developed by Byon Garrabrant, N6BG, the TT3 allows you to interconnect a global positioning system receiver to a transceiver for transmitting your position as calculated by the GPS. TT3 massages the position data received from the GPS and puts it into a packet format. When transmitted and received, the data can be properly decoded to indicate your position, for instance on a map displayed by a computer running APRS (Automatic Position Reporting System) software in another ham shack.

The TT3, GPS and radio equipment combination makes up a “system” commonly referred to as a “tracker” in APRS parlance. Trackers are typically installed in vehicles that are critical in various operations like emergency and public service scenarios so that the current position of the vehicle is available to those in the operation who need to know.

The advantage of TT3 is that it eliminates a TNC (terminal node controller) that normally performs the massaging and packet building function. Unlike a TNC, TT3 does not decode received packets; it only transmits packets.

## Building and Installation

I built the kit and it was a simple and quick task. With the assistance of the kit’s excellent set of instructions, anyone who knows the business end of soldering iron should be able to build the kit in an hour or less. The builder needs to make only two decisions during kit construction: (1) whether to trim the PC board so that its connectors have a lower profile when installed in the optional case and (2) whether to install resistor R8, which is not needed if TT3 will be used with a transceiver that does not key its transmitter via current through the microphone line. By the way, if you decide to trim the PC board for a lower profile, you should trim before you begin populating the board with components.

After you build the board, you connect it to the serial port of your computer and configure it using *TinyTrak3Config.exe*, a Windows application you download from the manufacturer’s Web site ([www.byonics.com](http://www.byonics.com)) in a ZIPed file that also contains a .pdf version of TT3’s documentation. A Mac OS TT3 configuration application is downloadable from [mdco.net/irving/tinytrak.html](http://mdco.net/irving/tinytrak.html).

Configuring TT3 is straightforward if you are familiar with configuring an APRS station. If in doubt, just configure your call sign and use the default settings of the other parameters.

By the way, you can configure TT3 with two different configurations (“Primary” and “Secondary”) and (1) select the desired configuration with switch SW1 or (2) configure TT3 to alternate call sign and digi path from one transmission to the next (by enabling the Alternate Digi Paths parameter).

Time Slotting, Power Switch and SmartBeaconing are three features of the TT3 that merit full descriptions.

Time Slotting allows you to preset the transmission times of multiple trackers. Each tracker can be configured to transmit at a different specified time to avoid two trackers transmitting at the same time, which results in the receiving station being unable to receive one or both of the tracker’s transmissions.

When enabled, the Power Switch feature turns on the GPS and transceiver at a user-specified time, sends a position packet, then turns off the GPS and transceiver. This option can be configured to wait until a second transmission is completed before powering off the equipment in case the first transmission does not contain a valid position packet due to the GPS not being locked on to the GPS satellites. The Power Switch feature

requires the addition of a relay to toggle power on and off when commanded by TT3. The relay must be able to handle the power requirements of the transceiver and GPS.

SmartBeaconing is my favorite feature and as far as I’m concerned, worth the price of admission. When enabled, SmartBeaconing varies the rate of transmission depending on changes in the speed and heading of the tracker. For example, as the tracker increases speed, the TT3 increases the transmit rate. Without this option, the transmission rate would remain the same as the tracker goes

faster, resulting in widening gaps and less accurate position information on the maps of APRS stations receiving the tracks of the tracker. For additional position accuracy, SmartBeaconing also uses CornerPegging, which forces a new position packet transmission each time the tracker turns a corner.

TT3 uses a female DB-9 for the connections to the transceiver (audio in and out, ground and PTT, if needed) and a male DB-9 connector for the connections to the GPS (data from the GPS and ground). You also use the male DB-9 to connect TT3 to your computer during configuration.

For this review, my APRS station at home monitored the TT3 using street-level maps. It was refreshing to see my tracker turn each corner on the map instead of occasionally cutting across the virtual lawns, which typically occurs with my normal APRS mobile station that is without the CornerPegging feature.

Manufacturer: Byonics, 8378 Granite Mountain Ln, Las Vegas, NV 89129; [www.byonics.com](http://www.byonics.com). TT3 kit \$30; TT3 kit and case \$36; TT3 board built and tested \$54; TT3 built and tested with case \$60.

