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Palstar AT1KM and AT1500CV antenna tuners

One capacitor or two? Chris Lorek reviews two different high-power ATUs from Palstar.

Many amateurs active on the HF bands use resonant antennas such as dipoles, trapped beams and verticals. But these have a finite bandwidth, and although you'd normally assemble them to the correct dimensions to give a good 50Ω match at your favourite part of the band, on other frequencies the match could start causing problems to your transceiver or linear amplifier output stages. Low band enthusiasts (eg 160m and 80m) will invariably be using wire antennas, either dipoles or various types of long wire, and here an antenna tuner is usually a necessity. Built-in auto-antenna tuners within transceivers can often help with a small mismatch, typically of up to 3:1, but they'll rarely be able to match something like a long wire.

The latest high-power tuners from Palstar have been designed with this in mind, and are especially suitable for operation up to and beyond the UK legal limit of output power. Solidly-built, there're designed to provide a match to your 50Ω transmitter from an antenna impedance of anywhere between 20Ω and 1500Ω over the frequency range of 1.8 to 30MHz. The AT1KM is rated at 1000W PEP SSB (800W continuous carrier) and the AT1500CV is rated at 1500W PEP SSB (1200W continuous carrier), although with each tuner Palstar says that the power should be reduced for low impedance ranges.

CIRCUITRY

Each tuner uses a 'T' configuration matching circuit, with series variable capacitors together with a variable inductor to earth at the capacitor junction. The inductor in each tuner is a 24µH roller inductor, with a ceramic former and thick (12SWG) tin-plated wire. A silver-plated bar and roller wheel are used for the variable tap. The inductor is thus continuously variable, and it's driven by a crank handle on the front of the tuner, a mechanical five-digit counter next to the crank handle shows the relative position of this accurate to the three digits closest to the bottom of the display.

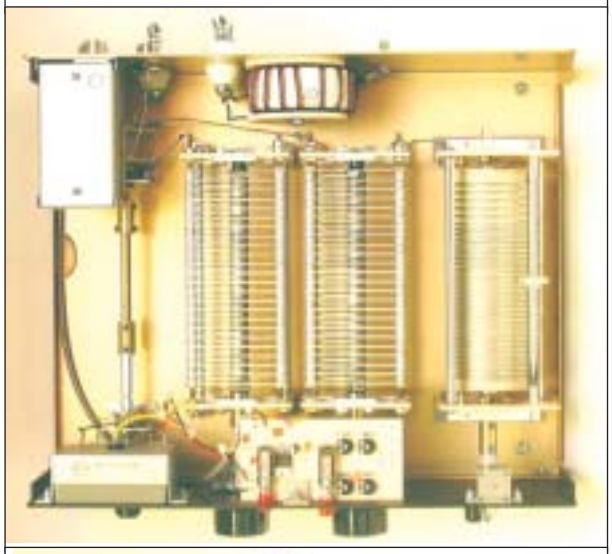
The AT1KM uses a single capacitor adjustment knob by employing a dual-stator differential variable capacitor, of 440pF in each section and rated at 3kV, together with a 6:1 precision Vernier drive and analogue 'dial' type indication concentric to the front-panel tuning knob. The AT1500CV uses two independently variable capacitors each of 315pF and rated at 4.5kV.

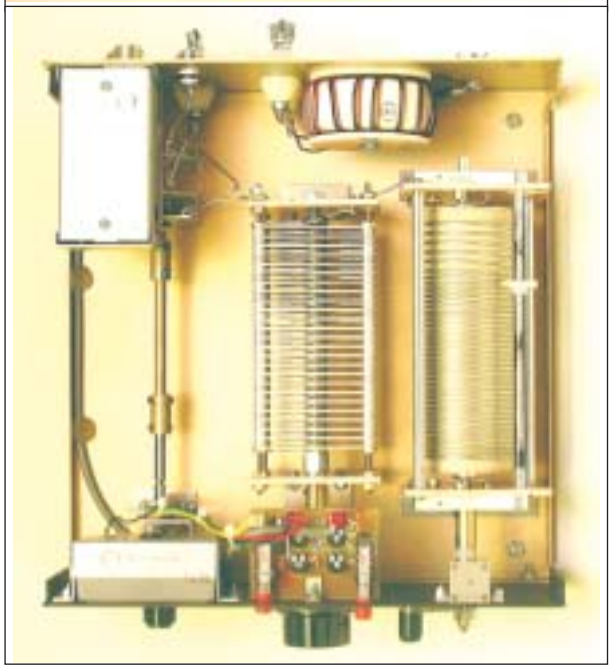
The AT1KM measures 135 x 266 x 583mm and weighs 3.6kg, the AT1500CV measures 114 x 317 x 304mm and weighs 5.5kg. Apart from the size, power rating and tuning method, each tuner has similar operating controls and antenna connection arrangements.

ANTENNA SELECTION

Each tuner has a six-position antenna selector, allowing you to switch between three rear-panel output coax sockets (Coax 1 tuned and Coax 1 tuner bypass, Coax 2 tuned and Coax 2 tuner bypass, and a third 'straight through' socket labelled "Bypass") plus a balanced antenna. The last of these can either be a single wire fed against ground, or a balanced feed antenna, an internal 4:1 Ruthroff balun being fitted for this. Linking two of the nylon-insulated rear panel high-voltage antenna wire terminal posts, using a supplied wire strap, changes between a single wire and balanced feed output. A single SO-239 coax socket is used for the 50Ω nominal transceiver / linear amplifier input connection. A further rear panel socket is provided for a 12V DC input using a 2.1mm socket, this being used purely for the front panel meter illumination bulb.

A cross-needle forward and reflected power meter is used to show you what's going on RF-wise. This has two switched ranges, of





Real panel connections on the AT1KM (the AT1500CV is very similar).

Internal view of the AT1500CV: note the dual variable capacitors in addition to the 'roller coaster' inductor.

Internal view of the AT1KM.

WEB SEARCH

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300W forward and 60W reflected, or 3000W forward and 600watts reflected. The SWR is easily read, whatever power you're transmitting, by where the two meter needles cross over. The Power / SWR meter is always in circuit whenever the tuner is connected, even when the front panel antenna selector is switched to one of the direct or bypass positions.

CONNECTING

Installing either tuner is a very easy affair, by simply connecting it in series with the coaxial output from your transceiver or linear amplifier. Your antenna coaxes are in turn simply connected to the relevant output coax sockets on the rear panel. If you're using a long wire antenna, this is simply connected to the lower wire post nearest the SO-239 coax sockets. Alternatively, for a balanced antenna feed, this is connected to the two other posts and a wire link added between the two lower posts.

For the benefit of readers who aren't familiar with a manually-operated tuner such as this, after finding a clear frequency you first transmit a carrier at relatively low power, and adjust the front-panel capacitor and inductor knobs to achieve the lowest possible reflected power as viewed on the meter. At first this takes a degree of practice and needs a little patience, but after a while it becomes second nature. When you've successfully tuned the antenna, it's useful to note down the various settings from the front panel adjustment knobs for each band and antenna you use so that the next time you tune to that band, you've a good 'starting point'. In fact, the operating manual for each tuner provides such a table, with initial 'suggested' settings and room for your own settings to be noted down. Alternatively, you could even make a list of settings for various sub-segments of the bands you operate on, to give a pre-operation adjustment so you can get on the air straight away without needing to perform the manual 'tune for maximum smoke' operating each time you change frequency!

Here, I found the accurate calibration readouts on the tuners were excellent for my on-air operations, especially that of the roller inductor. At first I had reservations about the single capacitor adjustment on the AT1KM tuner, thinking this could have problems in matching some antenna impedances. This would probably indeed have been the case if a switched inductor were used, as is the case with many antenna tuners (usually for economic reasons, ie it is cheaper than a continuously-variable roller inductor). However, with the roller inductor I could always get a good match. I even tried my best to simulate widely-ranging impedances and phases using a combination of resistors and varying coax lengths, and testing the tuner with an RF network analyser to gain a Smith chart and VSWR graph indication of the eventual match obtained which was normally very acceptable. A further test using a Henry 5K Classic linear amplifier, feeding 800W and 1kW constant carrier respectively into the AT1KM and AT1500CV and then into a terminated load in each case, showed the power handling specification to be fully justified.

CONCLUSIONS

The tuners aren't a 'dirt cheap' budget price; you get what you pay for. In my opinion the Palstar tuners I tested are certainly in the upper class league in terms of operation, build quality and performance, yet at a price that shouldn't break the bank. I found using them on-air a real pleasure.

The AT1KM is priced at £249 with the AT1KD digital meter version at £329, and the AT1500CV is priced at £329. Our thanks go to Vine Antenna Products, tel: 01691 831111, e-mail: info@vinecom.co.uk, for the loan of the review tuners. ■