THE RACAL AUTOMATIC AERIAL MATCHING UNIT TYPE VRA 549C

The Racal auto-ATU type VRA 549C is a professional high quality unit, intended to match end fed aerials to 50 ohm RF input impedance, with a VSWR of less than 2:1, over a frequency range of 1.6 to 30 Mc/s.

Once tuned, the maximum through power is 1KW CW. Insertion loss is less than 3db, tuning time less than 2 seconds, with a power supply requirement of 24 volts nominal, at 3.5 amps maximum.

The unit dimensions are 348mm x 612mm x 271 mm, weight about 39 Kg. It comes in military type colours and enclosure. The RF input is via a 50 ohm "C" type connector; the RF output is via a screw connector surrounded by a huge porcelain insulator. Supply and control connections are via a 4-pin, "military" type connector. There are no externally accessible tuning or other controls. Provision for memorising pre-entered frequencies is incorporated, but is intended for use with a companion control unit or other compatible equipment, which is not available.

The unit was primarily designed to tune large whip aerials, but matches my 240 ft end-fed inverted Vee over all amateur bands 160 to 10 metres. In addition, it matches a 132 ft doublet, fed with open wire feeder via a 4:1 toroidal balun, on all amateur bands 80 to 10 metres.

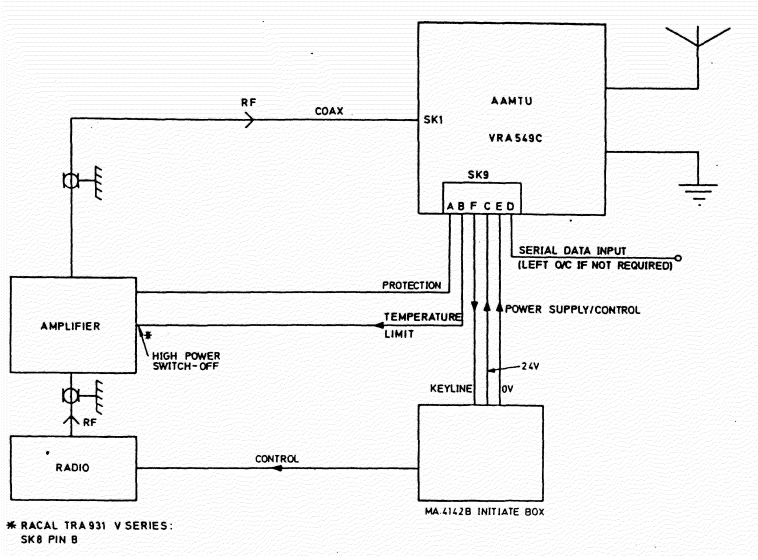
Remote operation

The matcher was obtained to operate remote from the shack, namely in a garden shed at the end of an approximate run of 100 ft of cable. A 24 volt power supply was constructed using surplus components. Since a maximum of 40 watts RF input is required during the tuning cycle, it was intended to devise an automatic switched power attenuator, built unto the power supply box. Applying more than 40 watts during the tuning cycle is likely to damage the tuner logic circuit. This project was unsuccessful due to widely varying input impedances appearing during the tuning cycle resulting in a 6dB power attenuator failing to pass sufficient drive from a 100 watt solid state rig for the tuner to sense. Consequently that idea was abandoned, and the tuning cycle in progress line available at the 4 pin connector on the matcher was used to activate a piezo sounder, giving audible remote indication of tuning in progress at the operating position. As soon as 24 volts is applied, the unit is ready to sense RF. To change the matcher's frequency, the supply is removed and then re-applied. Up to 40 watts of RF can then be applied for the matcher to sense and for the tuning sequence to be activated.

In practice, using a modern solid state rig (my case a Trio TS430S), the likelihood of giving the matcher an overdose of RF during the tuning cycle appears minimal, because the rig provides a reduced RF power output into a mismatch, a good precaution incorporated to protect the output stage transistors. Nevertheless, with practice one becomes accustomed to using the minimum required amount of carrier insertion in the CW position. Using the matcher with a valve rig or amplifier could be problematical, since valve equipment does not have similar protective systems, nor always a means of varying (reducing) power output. I have no difficulties however when using a KW2000A, but with valve AM equipment, the procedure is to pre-tune the matcher on the required band using the TS430, then switching input to the AM transmitter.

Dealing with a long supply lead

Another factor was the varying DC load current required by the matcher, this depending on the frequency required to tune. Since various values of inductance and capacitance are introduced by switching via Jennings vacuum relays, the total current taken by the relay coil



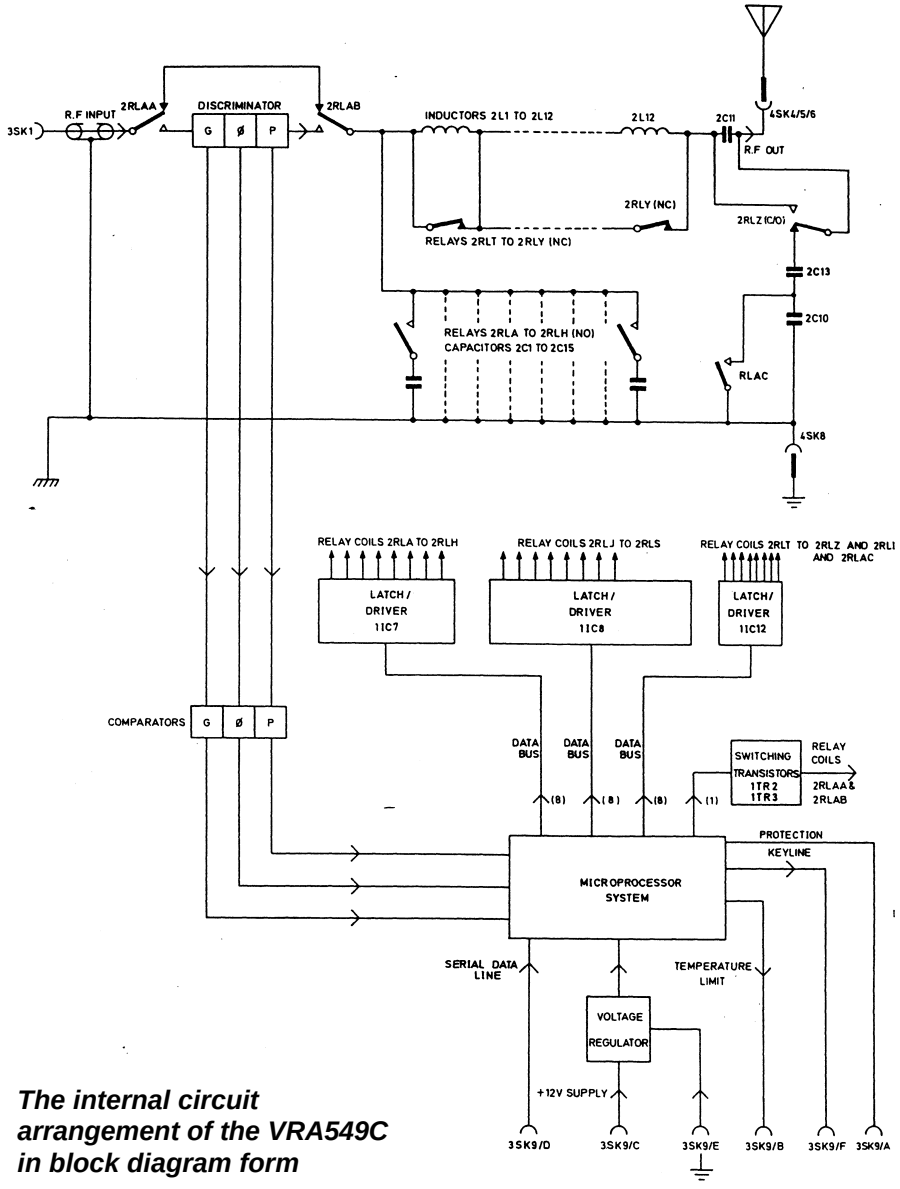
The original application of the VRA549C with the TRA931 radio – not all connections are essential: see text

is dependent on the permutation of L and C required. Although the 24 volt psu was capable of supplying the stated maximum load, the resistance of the long control cable meant that on some lower frequencies like 160 metres, when maximum L and C are required thus more relays are energised, the supply volts dropped to around 17 at the remote end. The effect of volts drop in the cable is poor contact resistance in the Jennings relays resulting in erratic performance. The cure is to increase the psu voltage to 28 or even 30 and use heavier duty cable. The use of 4-core telephone cable is not recommended for long runs!

Working principles

The matcher operates on the pi network principle. The tuning sequence depends on the frequency applied, and is controlled by a micro-processor. For example on 2 Mc/s series inductors are first introduced, then parallel capacitors are added, whilst on 10 Mc/s shunt/series capacitors are first introduced followed by inductance, and then by parallel capacitors. One can hear the relays sequencing when standing near the unit during its tuning ritual. A detector monitors the RF power input and compares the current or voltage sample, whichever is the larger, with a fixed value. The fixed value sets the minimum RF power level required for the tune sequence, normally 10 watts.

This matcher is ideal for anyone who has a remote non-coaxial aerial feed position. Mine has operated reliably for several months, and during that time has revealed shortcomings in some solid state equipment which does not give optimum power transfer into 50 ohms, possibly a symptom arising from inadequate band pass filters in that equipment. It has been used regularly with valve 150 watt AM transmitters on the 80 metre net. (Bear in mind a fully modulated 150 watt AM transmitter operating at 67% pa efficiency equates to 400 watts PEP RF output) Where required it could be operated in outdoor conditions, the box being sealed and capable of being pressurised. This might not be the ideal way to treat a relatively expensive piece of equipment, though they are cheaper and of much higher quality than the imported lower power versions currently on sale for the amateur radio market.



The internal circuit arrangement of the VRA549C in block diagram form

Howard Aspinall G3RXH

[Any one interested in obtaining one of these units, should contact Howard in the first instance, as he may be able to suggest a source – Ed]