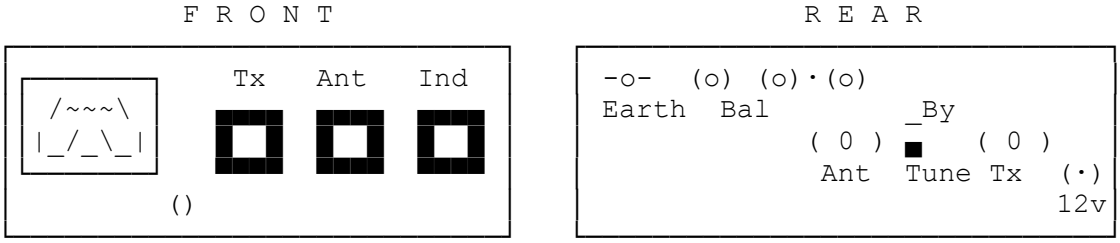
# HF ATU and SWR Bridge MFJ-904H

By G8MNY (Updated Dec 17)

(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)

I was given a broken "Deluxe Travel Tuner" from one of my students.

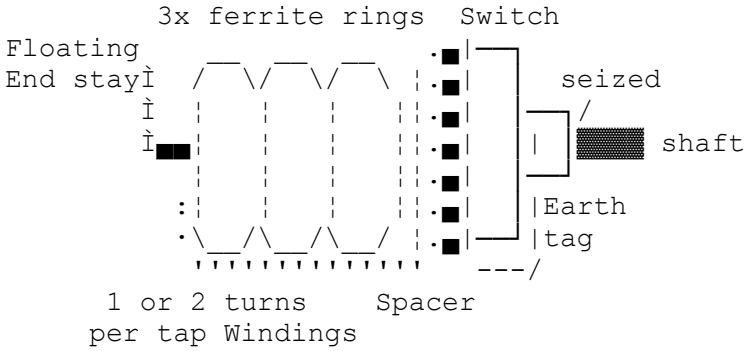



It is a small cheaply made unit, the 2 tuning Cs are "preset types" with only 1 bearing, so they will soon short out with wear or by a dropping on their knobs!

The L indutance switch shaft had never been greased, & it had seized up solid. Aluminium on Aluminium is not a good bearing surface!

REPAIR

Removing the L & switch, & putting the shaft in a large vice & applying a spray grease (not thin WD40), I was able to free it all up OK.



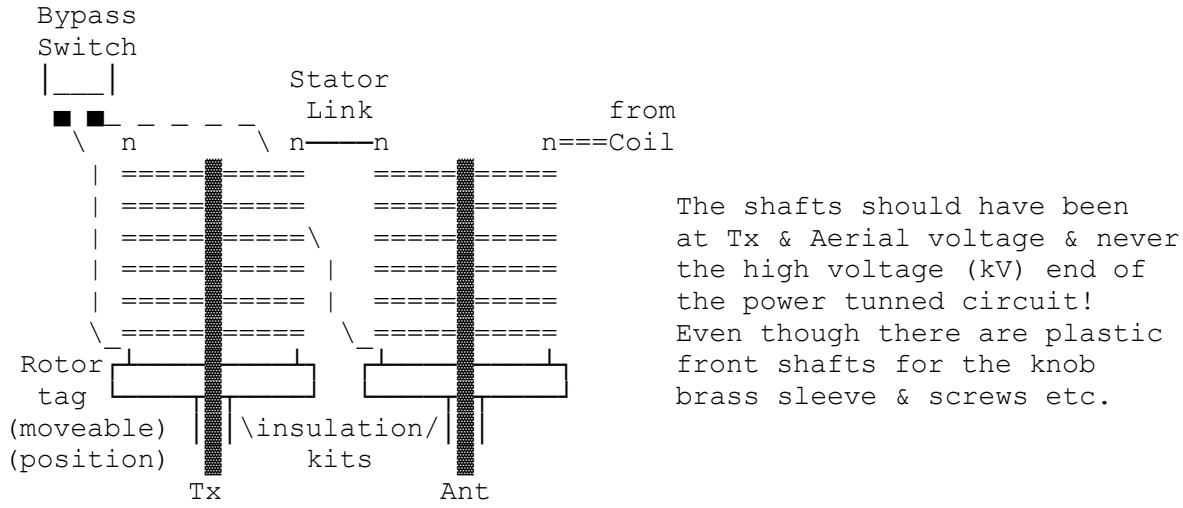

OTHER PROBLEMS FOUND

1/ Was the lack of inductance on the 3 ferrite cored L for 160m (not designed for 160m?) So I added 2 turns to the unconnected switch post (making the full 12 options) & moving the earth connection to it. This helped 160m tuning without both Cs at Max (not always an option with aerial Z).

2/ I found the 2 minimum L positions (1 turn each) were too little inductance, for 10m band! So I permenently added 2 turns of enammelled copper wire in insulation, as this is the high voltage coil end, after the last switch post to the tuning Cs so minimum L is now 2 turns. This gave much better 160m tuning too. :-)

Both of these mods give the 12 steps more usable options from 160m-10m bands.

3/ Wiring of the 2 tuning caps was incorrect & UNSAFE! The shaft & mounting nuts with insulation system, were wired at the VERY RF HOT (several kV) end of the tuned circuit! I rewired mine (see below) for much lower RF voltage on the shafts of just the Tx & aerial!

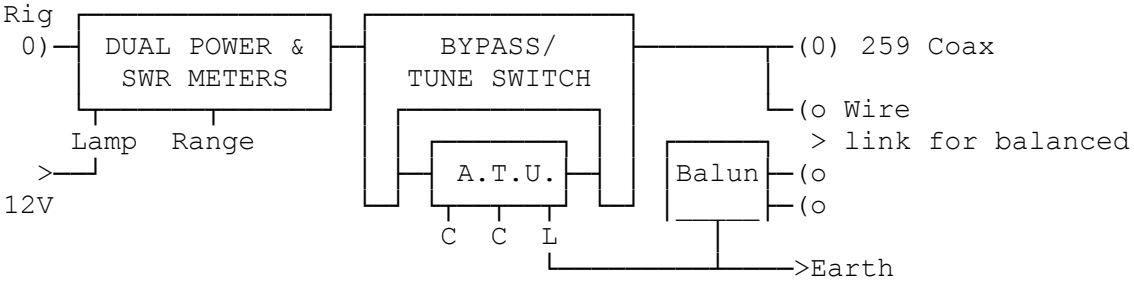



The shafts should have been at Tx & Aerial voltage & never the high voltage (kV) end of the power tunned circuit! Even though there are plastic front shafts for the knob brass sleeve & screws etc.

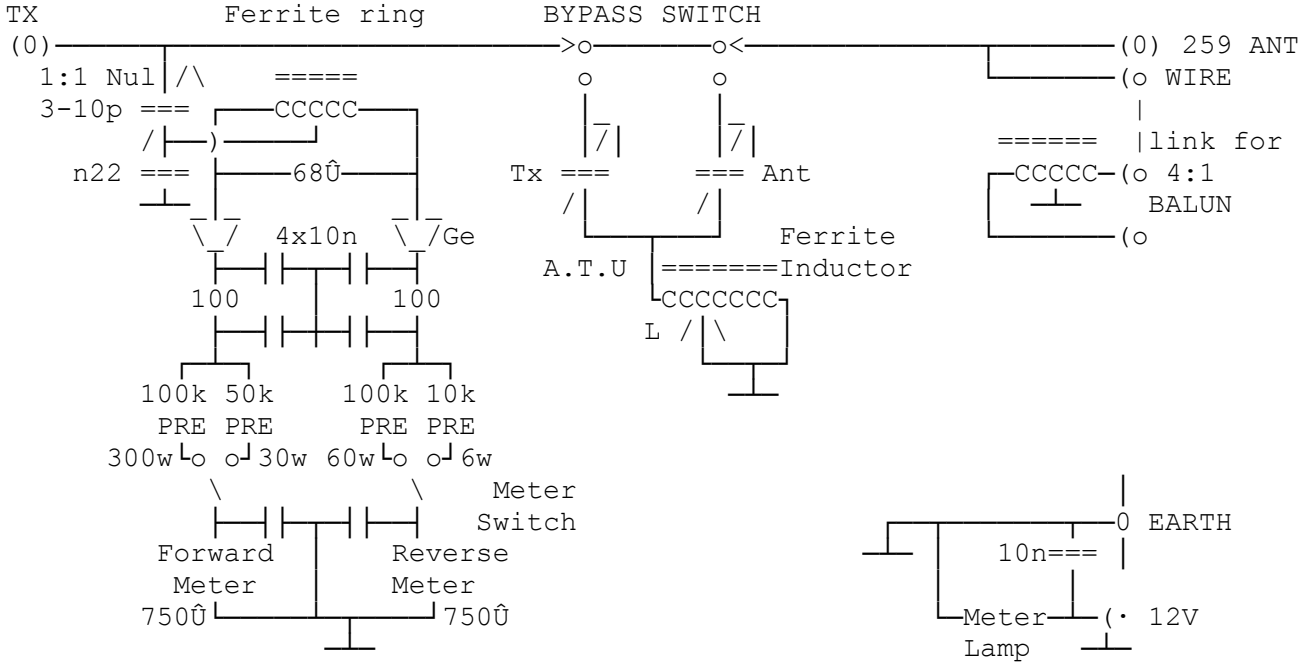
FEATURES

150W max. now 160m to 10m (no sign of satuation @ 100W on all bands)
ATU is "T" Type, 12 tapped ferrite inductor, 2 tuning Caps (<300V rating? &) (will flash over @ 100W peaks on 160m into a load).
30W & 300W Forward scale small cross needle power meter.
6W & 60W Reverse power scales, for increased SWR sensitivity.
4:1 BALUN option for balanced aerials (linked from wire ant post)
12V Meter scale Lamp.

BLOCK DIAGRAM



CIRCUIT
The SWR bridge is quite conventional.




CONSTRUCTION
It uses thick 2 U part aluminium case, thick open wire for all internal connections. N.B. The short screw is beside the meter!

The toroid ferrite inductor (now) has 12 taps to a 12 way switch.

A single PCB provides for all the component mounting for the SWR bridge.

TUNING UP
If doing this on someones operating frequency, DO QSY 3kHz first! The best tuning method is to use the ATU at LOW POWER (between 10 & 30W) & pre-tune it, set the ATU with both Cs @ 50% & adjust the L tap for initial minimum SWR. Then tweak (rock too & throw) both the Cs for a perfect 1:1 match. This can take time & fiddly especially with no reduction verniers & the small knobs. The 2 adjustments are interdependent as their combined capacitance tunes the L for the frequency used. On 50Û Tx & Ant load the Cs will be equal in value.

N.B. always use some Ant C & an Antenna connected, failure to have a load can result in arcing, & possably damage even at quite low powers!

LOW POWER is kindest tuning method for the ATU & also for minimum on band QRM. A very briefly re-tweaking of Cs only, at full power may be an advantage as the meters are more accurate (sensitive) with more power.

Both the bypass switch & the ATU variable L, should not be changed if there is any great power flowing, as the contacts can easily be damaged with arcing!

"Aerial Tuning Units" are also called "Aerial Matching Units", but the best aerial is one that is already tuned by design (cut to length) & a good match (tap point for right Z)!

IN USE
The ferrite balun & tapped ATU inductor, can suffer saturation losses if used in-appropriately. But in general there is much less loss with a ferrite cored device, than the much much bigger air spaced equivalents, as there is many times less wire used & associated copper loss. Typically power loss is only 5% (0.2dB) @ 100W (100W in 95W out) on any band at any SWR (due to the "T" type ATU's high Q) which is quite low for a combined ATU & SWR bridge.

If the random wire aerial won't tune up to give 1:1 SWR, then try a different length wire (shorter or longer by a metre or so) or add a series cap (200pF) or L (20 turns).

The "T" type ATU is easy to use, but is not so good at removing Tx harmonics as the Ò (pi) type. But it does an excellent job of protecting the Rx from DC static, & strong signals on lower bands (e.g. removing MW Broadcast signals as it is >-18dB for each frequency halving.)

See also my Tech buls on "HF ATU & SWR Bridge VC300LP/QT-1", "Palstar AT1500CV ATU", "Drake WH7 QRO HF SWR Bridge", "A Homebrew HF SWR Bridge", "PEP Meter modification", "Meter Damping & Speed Up" & "QRP SWR Bridge".

Why don't U send an interesting bul?

73 De John, G8MNY @ GB7CIP