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Automatic Remote Controlled Antenna Tuner for Balanced and Unbalanced HF Antennas Model AT-502



Antenna Tuner System AT-502 Description

This tuner is designed to match remotely, both balanced and unbalanced HF antennas. This unit features automatic selection of tuner settings based upon transmitted frequency. Unique to this tuner, no special cabling or adapters are required. The operator simply transmits into the antenna and the tuner detects the transmitted frequency and selects the correct settings from memory. The Ham bands are divided into 85 operator programmable memory locations. There are two banks of 85 memory locations that are user selectable. To best utilize this capability, a new antenna switch (ASU-502) has been designed as an accessory to the AT- 502 tuner. This switch is activated at the AT- 502 by the ANT1/ANT2 switch located on the front panel of the controller. This enables the operator to have complete tuner control for two different antennas. It will handle 200 watts of SSB or CW power, and it can be used in either automatic or manual mode.

The matching circuit consists of a remotely tuned balanced π circuit (no balun at tuner output!). An internal jumper selects the balance or un-balanced configuration. This jumper

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can be remotely controlled by the ASU-502 Antenna Switch. This unit features lightning protection and is built in a weather- proof UV resistant plastic cabinet.

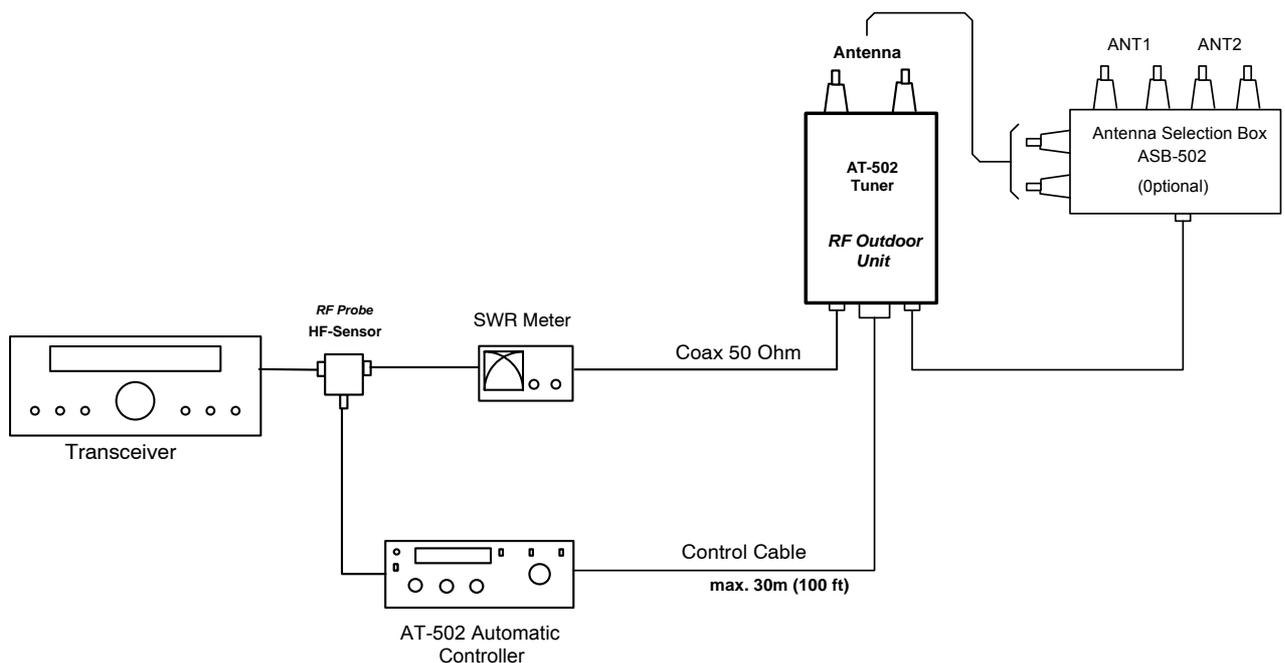
The Control Cabinet contains the tuning controls, memory bank and antenna selection, Automatic or Manual switching and a display that indicates the memory bank in use, the frequency range as well as the span, and the tuner settings.

Refer to the Tuner System Block Diagram in this document for system inter-connect information.

Main Features

- Automated tuner control based on transmitted frequency. No special cabling.
- Remote Matching of balanced or unbalanced antennas within the Amateur bands 1.8 to 30MHz.
- True balanced Pi Tuner to match dipoles, loops, inverted Vee's etc. (no lossy balun between tuner and antenna)
- Un-balanced Pi Tuner to match any un-balanced antenna
- Antenna Switch ASU-502 is an option to allow 2 different antennas either balanced or unbalanced or mixed to be selected remotely
- LC Display at the Controller for indication of remote matching values of the π -filter, the memory location and the number of the antenna in use as well as other occasional service information.
- Automatic choice of the tuner settings controlled by the transmitting frequency
- Alternative manual control of the remote tuner
- Built in lightning protection
- Built in over voltage protection.
- DC power feed from station's power supply 13.8 V, 1.5 Amps.

Tuner System Block Diagram



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Technical Description

RF Unit:

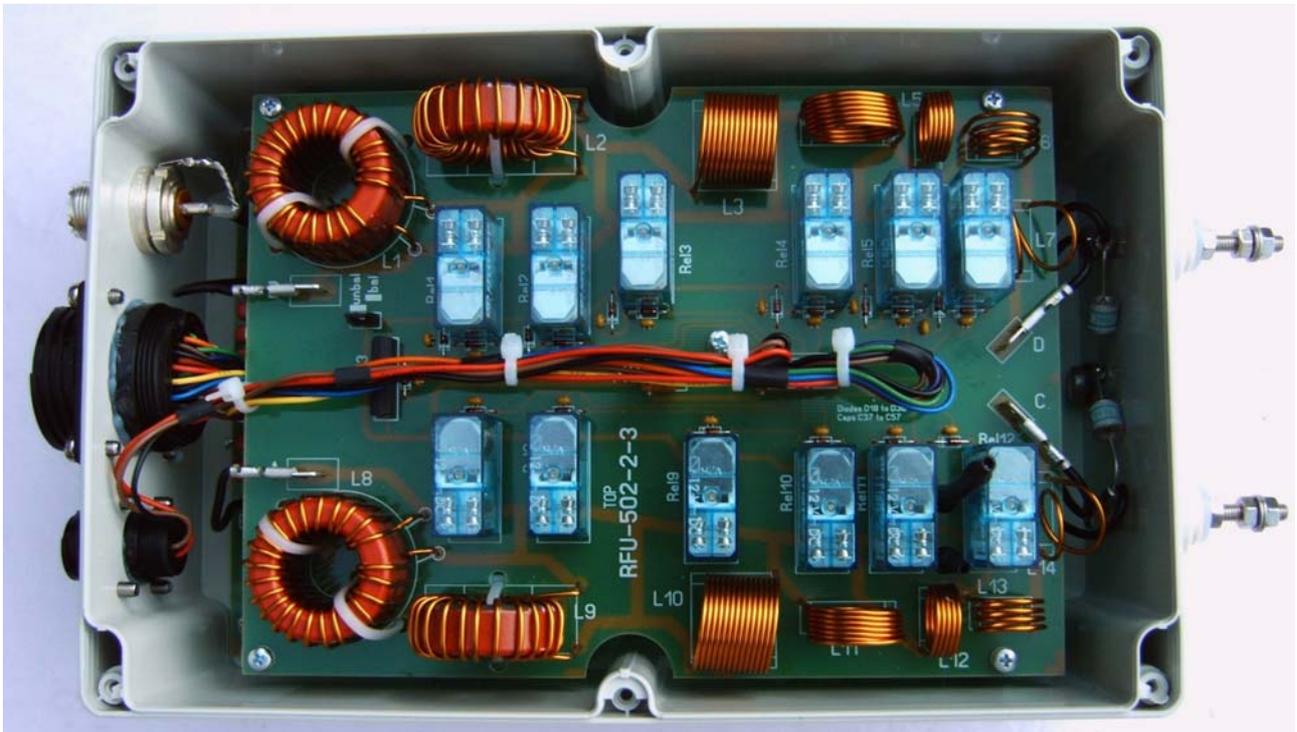
The RF Unit is housed in a weatherproof and UV resistant plastic cabinet. There are two ceramic feed-through insulators where a balanced antenna or a balanced feeder line can be attached

The LC network is a Balanced Pi. At the front end of the network there is a balun transformer that matches the un-balanced coax cable to the balanced tuner elements. This is the only place where the impedance of the system is purely resistive (when matched) and is the ideal place for the Balun. The regular station SWR meter is used as an indicator to match the antenna.

The capacitors at the input are switched in 256 steps of 17 pF per step. The capacitors at output are switched in 256 steps of 1.8 pF per step. The inductors are switched in 64 steps increasing exponentially. Switching is done by power relays. With the circuit components used it is possible to match very short antennas up to an unlimited antenna length within the RF range from 1.8 to 30 MHz.

When matching an unbalanced antenna, one insulator is used for the hot side or centre conductor of the antenna; the second insulator is used for shield or ground.

The accessory antenna switch (ASU-502) can be plugged into the Tuner unit when two antennas are used. This will configure the tuner for balanced or un-balanced operation and select the appropriate antenna. The selection is done from the Controller unit ANT1/ANT2 switch.



Interior view of the RF unit looking at the inductor board, the board with the capacitor banks is located below

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Controller Unit:

Antenna matches can be stored for 2 different antennas into 2 separate memory banks. Each bank has 85 memory locations. Each memory location is a fraction of an amateur band. Refer to the technical section for the fractional segments for each band. As shown in the picture below, the upper line of the LCD shows the actual memory location chosen (lower edge frequency 7120 kHz) with its span (30 kHz). The control settings for this frequency are shown in the lower line of the LCD. In the Automatic Mode the memory location and its stored settings is selected by the transmitted input frequency. The input frequency is obtained from an RF probe. The memory location contents can be erased by a push button on the back of the controller.

The Ant 1/ Ant 2 switch selects the appropriate memory bank that stores the tuning information for the antenna selected. It also provides control of the ASU-502 Antenna Switch.

The controller contains 3 rotary encoders that control the tuner elements TRX, L, and ANT. TRX controls the Input Capacitance, L controls the Inductance and ANT the output capacitance values. The lower line on the display shows these values.

A manual selector switch is provided for memory selection in the Manual mode.



Front View of the Controller

Antenna Selection Unit ASU-502 (optional)

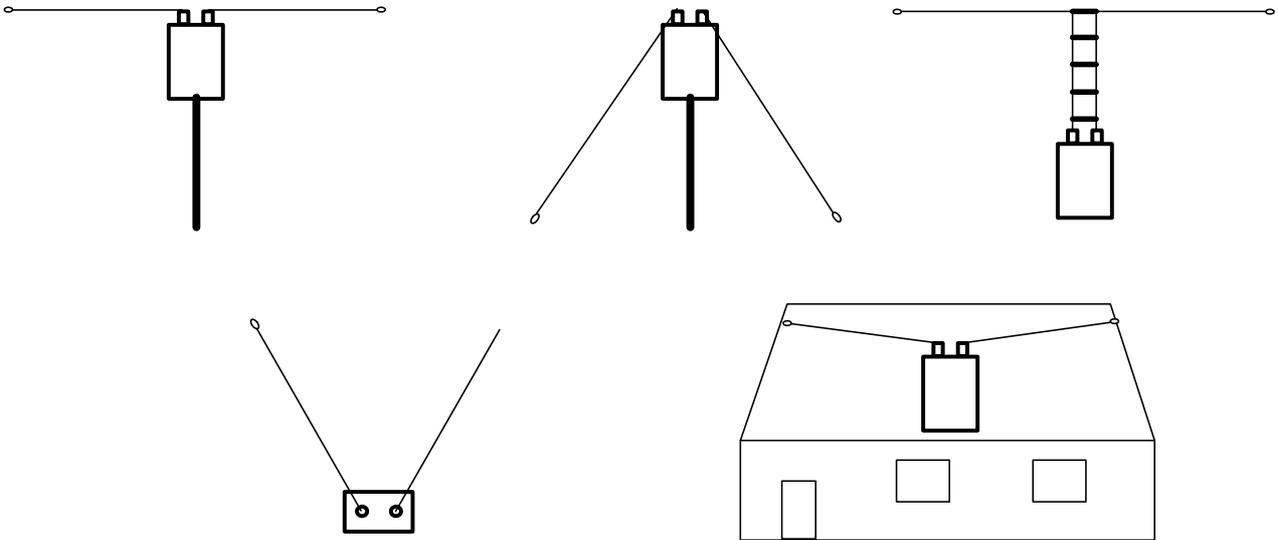


For Details see separate Document

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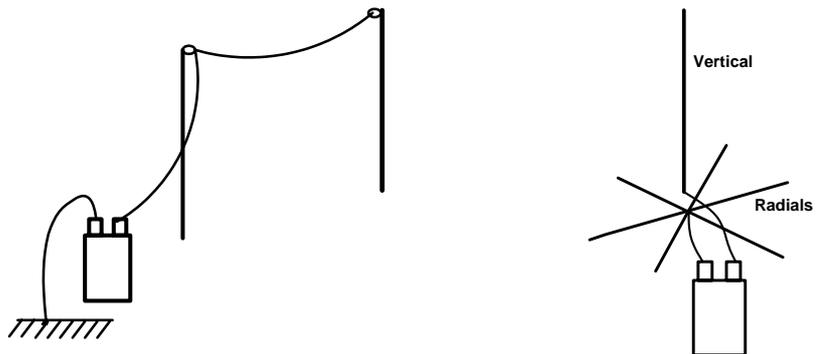
Possible Tuner Applications

Balanced Antennas

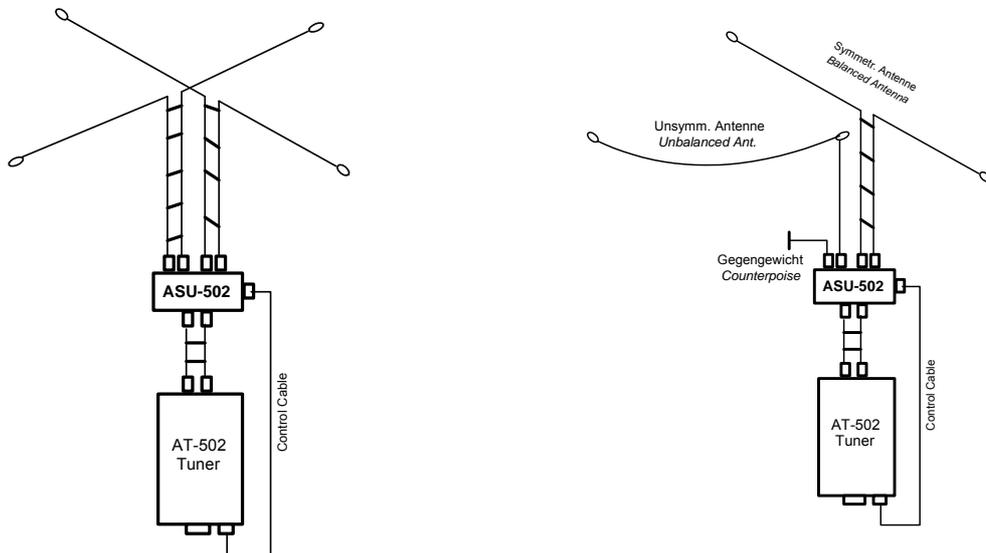


Unbalanced Antennas

The ground connection should be made as short as possible



Application with Antenna Selection Unit ASU-502 for 2 Antennas



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Specifications

RF Unit

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| Frequency Range | Amateur Radio Bands within 1.8 to 30 MHz |
| RF Power | 100 Watts tuning 200 Watts SSB/CW when tuned |
| Circuit | Balanced Pi with un-balanced input. Un-balanced antenna mode: unbalanced Pi |
| Reactance Control | Input Capacitance = 256 steps of 17 pF each Inductance = 64 steps increasing exponential Output Capacitance = 256 steps of 1.8 pF each |
| Lightning Protection | 2.5 Kilo Volt, 10 Kilo Amps |
| Over voltage Protection | 2.5 Kilo Volts |
| Weather protected Cabinet | IP65, UV resistant ABS plastic |
| Dimensions | 9.8"W X 3.6"H X 6.3"D |
| RF Terminals | RF input = SO-239 Antenna terminals = Ceramic Insulators |
| Control Cable Connector | Male plug 25 poles, weather proof |
| Connector for optional Antenna Selection Box ASB-502 | Female plug 3 poles, weather proof |

Control Unit

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| Antenna Matching Memory | Two banks of 85 Memory Locations |
| Frequency Span per Memory Location | 1.8 MHz = 20 kHz 3.5 MHz = 30 kHz 7.0 MHz = 30 kHz 10.1 MHz = 30 kHz 14.0 MHz = 30 kHz 18.0 MHz = 40 kHz 21.0 MHz = 50 kHz 24.9 MHz = 50 kHz 28.0 MHz = 100 kHz |
| Automatic Mode (10 to 200W) | Frequency controlled memory selection. |
| Display | Memory Bank, Frequency and Span in kHz, Antenna matching values |
| Control Cable Terminal | DB-25 female |
| Control Cable Length | 100 ft. # 20 conductor |
| Power Requirement | 13.8 V DC, max. 1.5 Amp. |
| Metal Bench Cabinet | 7.8"W X 3.2"H X 9.8"D |