

The AWA AM Slider - A Synthesized Signal Source

The AWA AM Slider is a low cost, synthesized signal source designed specifically for AWA's Low Power AM Transmitter. It replaces the DIP oscillator on the transmitter assembly, providing a TTL level output signal that can be programmed to any frequency between 530 and 1710 KHz. It allows the AWA Low Power AM Transmitter to operate on frequencies below 1 MHz, in which range standard DIP oscillators are not readily available.

Hobbyists who have already built the AWA Low Power AM Transmitter board can easily mount it to the AM Slider, and with a few soldered connections will be able to transmit on any of the AM broadcast frequencies. Changing the frequency of reference crystal will allow the AM Slider to generate frequencies in 9 KHz steps for use in Europe and Australia.

When used with the AWA Low Power AM Transmitter, the AM Slider derives its DC power from the 9 volt wall power supply used to power the transmitter.

The AM Slider can also be used in existing tube-type low power AM transmitters; in this stand-alone application a source of 5 volts DC derived from a 5.1 volt Zener diode in the oscillator cathode circuit can be used.

The AM Slider is based on the Polk synthesized signal source, with a few modifications:

- Use of HCMOS logic ICs to allow operation at 5 volt supply
- Use of coded rotary switches to easily select the desired operating frequency
- An on-board antenna tuning circuit to optimize antenna performance when used with the AWA Low Power AM transmitter
- Designed to fit into a standard plastic case for protection of the circuit boards

The component cost of the basic AM Slider used in a stand-alone application such as a tube-type transmitter, no enclosure, is under \$12, excluding the PCB. For use with an existing AWA Low Power AM Transmitter, component cost excluding the AM Slider PCB is under \$35 including the enclosure, \$25 excluding the enclosure.

Using the AM Slider with the AWA Low Power AM Transmitter

The Slider is operated from the 9 volt DC supply used for the AWA Low Power AM Transmitter, utilizing the same DC power connector. A regulator on the AM Slider assembly drops this voltage to the +5 volts required for the HCMOS logic. Because a wide range of frequencies can be utilized, an antenna tuning network consisting of variable inductors and a band selector switch is provided to allow optimum tuning of the antenna at any AM broadcast frequency. If used, this network will replace the fixed or adjustable L2 coil on the AWA Low Power AM Transmitter board.

The AWA Low Power AM Transmitter mounts onto the AM Slider board using four 4-40 x ¼ inch threaded standoffs, fastened with 4-40 x 3/16" screws and lock washers. The metal standoffs establish a good ground connection between the boards.

On the AWA Low Power AM Transmitter, resistor R4 and capacitor C2 must be removed from the circuit to completely isolate the on-board crystal oscillator.

Connections between the circuit boards are then made as follows:

- On the AWA Low Power AM Transmitter locate the pad of unused resistor R6 that is closest to the electrolytic capacitor C11. This pad connects to the pad marked "9 V" on the AM Slider board.
- The other pad of R6 (closest to L1) connects to the pad marked "OSC" on the AM Slider board.
- To use the antenna tuning circuit, an unused pad on the trace connecting L2/L102 and C7 on the AWA Low Power AM Transmitter connects to either pad marked "ANT" on the Slider.

Once the AWA Low Power AM Transmitter board is mounted on the AM Slider, cut-off resistor leads can be inserted through the pads as described above and soldered in place on both circuit boards.

Power and audio are then connected to the completed assembly using the connectors currently provided on the AWA Low Power AM Transmitter.

Stand-Alone Signal Source Operation

For existing tube-type low power AM transmitters the AM Slider can be used to generate a programmable frequency source in place of a crystal. Some of these transmitters use a crystal CMOS clock oscillator fed with +5 volts derived from a Zener diode in the cathode circuit of the transmitting tube.

For these applications, connect the +5 volts from the Zener to the Slider at E2, with ground connected to E3 or E5. The synthesized AM Slider output connects from E4 on the AM Slider to the grid of the transmitting tube. The AM Slider can be mounted in a convenient location using suitable hardware.

Programming

Setting the AM Slider to a desired broadcast frequency is easy. Refer to the frequency chart to determine the N value corresponding to that frequency. Then set the rotary switches SW1 and SW2 to the N value from the chart. If the antenna tuning network is used, set the switches on SW3 to the corresponding band segment listed on the frequency chart and tune L1 and/or L2 for maximum output.

EXAMPLE: Suppose the desired frequency is 1080 KHz. Looking at the frequency chart we see that 1080 corresponds to an N of 6B, and is in Band 2. To program, set SW1 (tens) to 6 and SW2 (units) to B. If using the antenna tuning network, use the Band 2 switch settings of SW3A ON, SW3B OFF, and SW3C ON. Tune L2 for peak output.

N is the hexadecimal equivalent of $(F_o/10 - 1)$ where F_o is the desired operating frequency.

Construction Notes

Voltage at the junction of R4 and C9 should be 2.5 volts nominal with the frequency set to 1120 KHz (NA) or 1062 KHz (EU). The actual value is not critical but can be useful as a troubleshooting tool in case of difficulty.

Use a layer of electrical or Kapton tape under the crystal to keep its metal can from shorting to the top layer pads.

Threaded brass or aluminum standoffs will help minimize frustration when mounting the AWA Low Power AM Transmitter to the AM Slider board. Slightly longer standoffs may be used as long as the assembly fits inside the intended enclosure.

If using the antenna tuning circuit, connect a 10 foot piece of insulated wire to E1. Best tuning results will be obtained by connecting the circuit board pad E6 to a good ground. Be aware that the FCC includes the length of the ground wire in the total antenna length.

To tune the antenna circuit, loosely couple an oscilloscope to the base of the 10 foot antenna wire. This can be done by laying the probe near the antenna, or using the grabber hook on the end of the probe to hook onto the wire's insulation (not the wire itself.)

Make sure the band selector switch S3 is set properly (see frequency chart) and tune L1 or L2 for maximum indication on the scope. On bands 1 and 2, L2 has the most effect, while L1 tunes bands 3 and 4.

The orientation of the antenna, particularly its proximity to other metallic objects will affect the specified band tuning range, and some experimentation with the band switch settings may be necessary to compensate for these proximity effects and allow signal peaking.

The antenna tuning inductors should only be adjusted with a non-metallic hex tool. The core size is 10-32 and most vintage electronics tool boxes should have at least one hex "twiddle stick" in stock. Coilcraft sells the "Trituner" tool, part number 37-1409 in case you need to purchase one. Philmore and GC Electronics also sell them. Avoid the urge to tune the slugs with a small screwdriver, as this can crack the core and cause it to bind.

The power input to the final stage of the AWA Low Power AM Transmitter should be calculated by measuring the voltage drop across R5, calculating the resistor current, then multiplying the lower of the two voltage readings by the current to determine power input. This should be set

to 100 milliwatts maximum; L1 or L2 (as appropriate) should be detuned if necessary to adjust power input.

A Word about Hum

In debugging the AWA Low Power AM Transmitter/AM Slider combination some investigation into AC hum appearing on the transmit output was done. Originally thought to be related to AC ripple from the wall supply, the bigger issue was found to be the location of the antenna. Draping it casually over instruments, appliances and other AC wiring caused hum heard in the receiver. Dressing the antenna away from all other wiring reduced or eliminated the hum completely. Each installation is unique and some experimentation may be required to produce satisfactory results.

Specifications

Frequency range: 530-1710 KHz (North America version, 10 KHz spacing); 531-1602 KHz (EU version, 9 KHz spacing)

Programming: Frequency set by two rotary encoder switches

Output: 5 V HCMOS signal

Power requirement: 9 VDC at 75 mA (with LP AM Transmitter board) or 5 V at 20 mA (stand-alone mode)

Size: 4.6 x 2.75 inches

Tuning: Antenna tuning circuit to optimize range is provided

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