MWPx Phaser Variations

Dallas Lankford
8/26/05

Several variations of MW Phaser #2 (MWP2) are described below. The first variation is MW Phaser #3 (MWP3). It was an experiment to see if construction time could be reduced by using a single professional PC board for all components and MiniCircuits transformers for T1 - T7. However, the additional time required for interface wiring between the PC board and pots and rotary switch made up for any time which otherwise was saved. Also, the PC board wiring interface would make repairs, if they became necessary, more difficult for MWP3 than for MWP2. In other words, the experiment demonstrated that in terms of the time required to build this kind of phaser and the simplicity of potential repairs, the approach used for MWP2 is optimal. The aluminum box used for MWP2 and MWP3 is a Hammond 1590E diecast enclosure, 7.4 x 4.7 x 3.1 inches. I planned to build myself a phaser using the single PC board which I had developed for MWP3, but I needed both twinax antenna inputs because all of my antenna lead-ins are twinax, and I needed BNC (antenna) inputs to configure multi-phaser arrays. The 1590E box is not large enough for switchable twinax and BNC inputs. Fortunately, Mouser has a larger diecast box, a Deltron 459-0080, Mouser # 400-4589, 9.7 x 5.7 x 4.2, which I used to build MWP4, MWP4A, MWP4B, MWP4C, and MWP4D. The additional space was also useful for experimenting with configurations for mounting the antenna reverse toggle switch on the front panel, and for implementing Field Change 1. The variations 4, 4A, 4B, 4C, and 4D of MWP are described mainly with photos containing embedded text.

MW Phaser # 3

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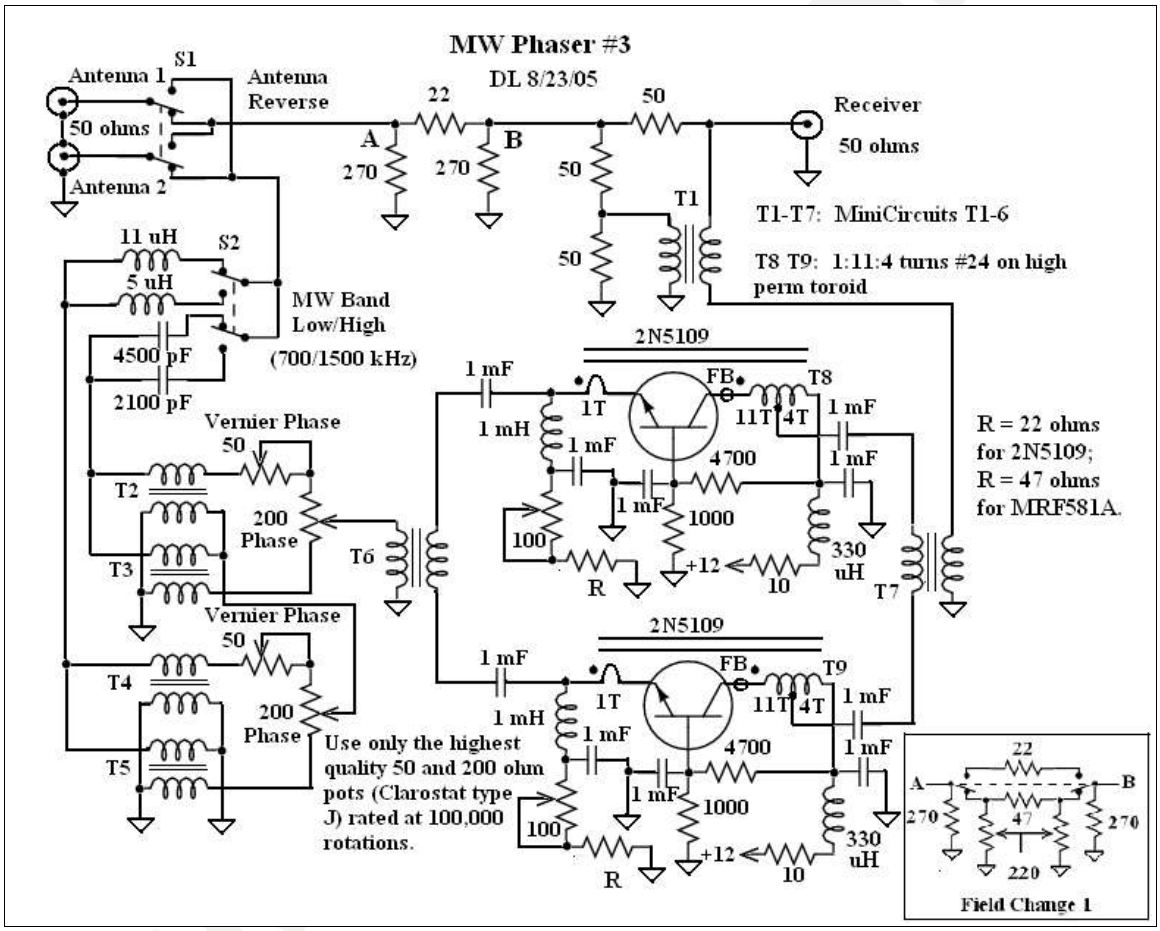
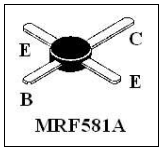
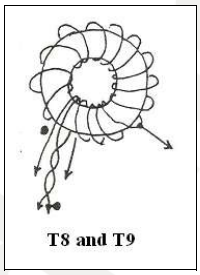
This purpose of this article is to provide information about MW Phaser #3 (MWP3). Additional detailed information about these kinds of phasers is found in the article MW Phaser #2 at www.kongsfjord.no.



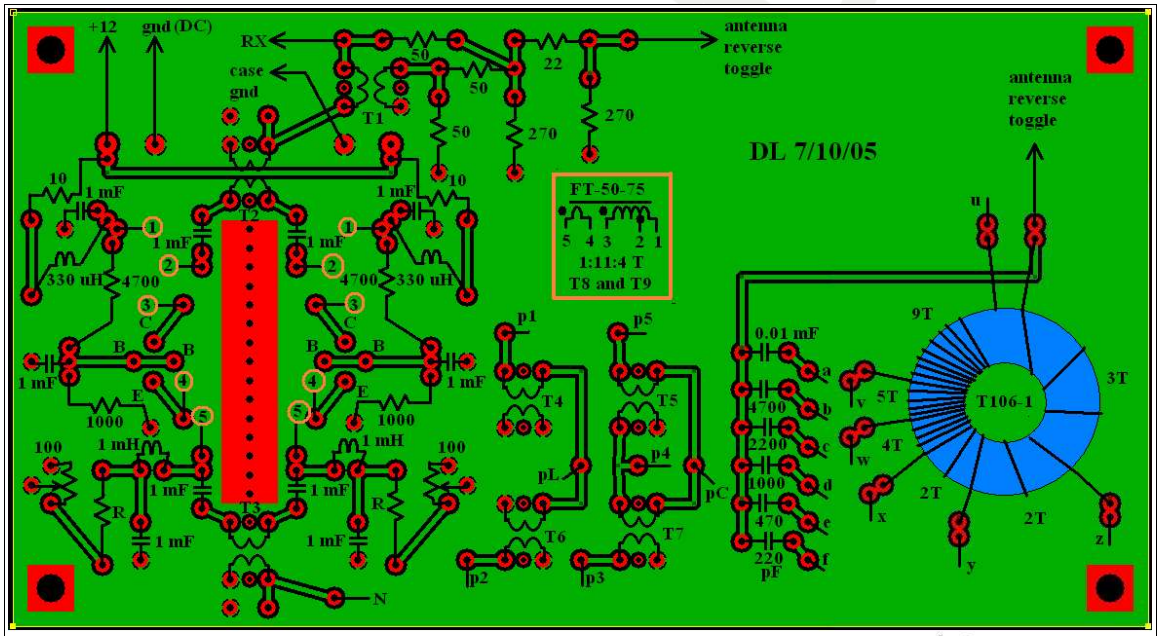
MWP3 is a variation of MWP1 and 2. MWP3 uses a PC board made by ExpressPCB http://www.expresspcb.com/ and Minicircuits T1-6 transformers; MWP1and 2 do not. Parts layout for the PC board and other information are given above below. The view of the PC board is a top view. The red color denotes plated copper on the top side of the PC board. The green color denotes plated copper on the bottom side, as if the board were transparent. Performance of MWP3 is the same as for MWP1 and 2, for given transistors. The PC board is etched for 2N5109 BJT's, but



Motorola MRF581A's may be used by bending leads and trimming an appropriate emitter lead for each MRF581A. The Motorolas MRF581A's are capable of higher 3rd order intercepts than the 2N5109's when driven at about 20 mA each. It is possible that off brand MRF581A's or MRF581's may also be used without degrading performance, but I cannot guarantee that. A sketch of the push-pull Norton transformers, T9 and T9, is given here. The windings should be spaced more or less evenly around the toroids. I often place the one turn feedback windings in other positions than shown.


T8 and T9

Photos of the inside bottom front and rear, and the front are given below. The wiring is #22 stranded, silver plated, with Teflon insulation. During construction of two (2) units of MWP3 (out of a total of three) one of these stranded wires in each unit broke near the PC board. I do not understand why this happened. The wire is mil spec silver plated stranded #22 with Teflon insulation. I have used this kind of wire for years and have never had any such breakages. In any case, if MWP3 fails to function correctly, all of the interior wiring should be visually inspected for obvious breaks near the PC board and wherever else the wires are soldered, and each wire should be gently (very gently) touched with a finger as an additional inspection for broken wires.

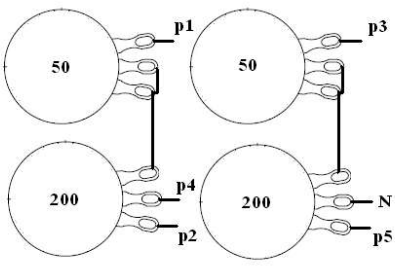


The two resistors R are 22 ohms for 2B5109's; 47 ohms for MRF581A's.

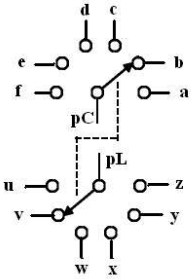
T106- 1 is wide spaced for 3T and the adjacent 2T; close spaced otherwise

A 1" H by 1.5" W PC board shield is soldered to the top ground plane (the red rectangle) between the two halves of the push pull Norton amp.

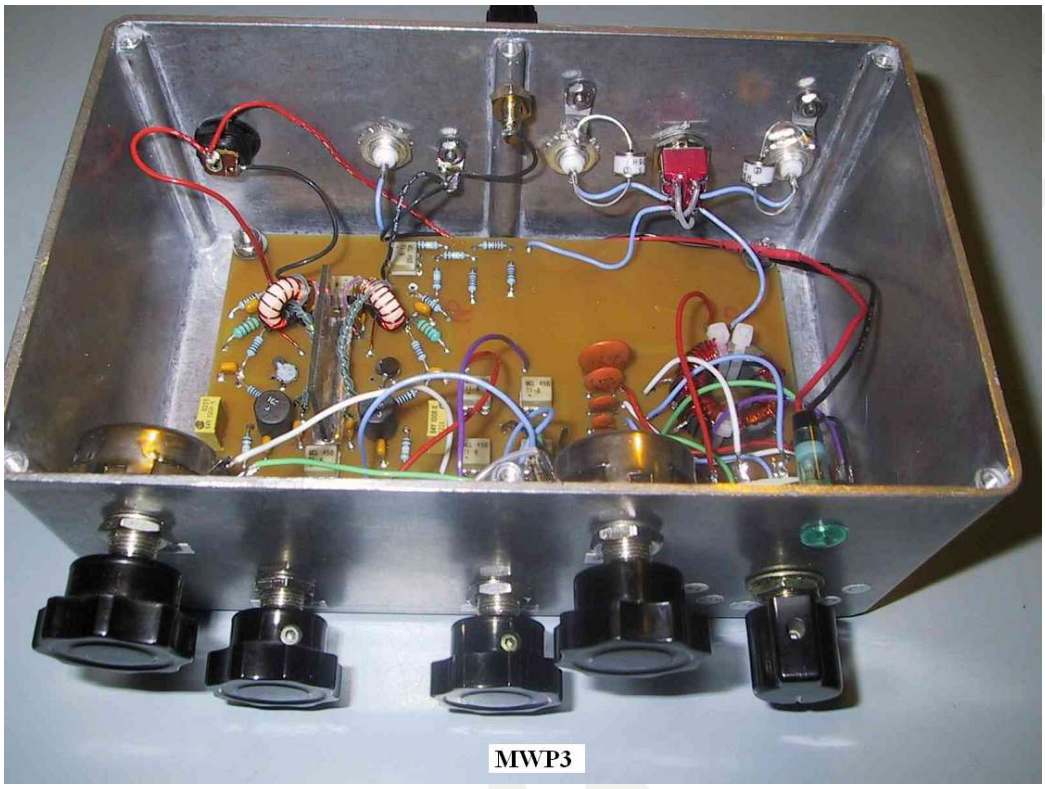
T1 - T7 are MiniCircuits T1-6 transformers.



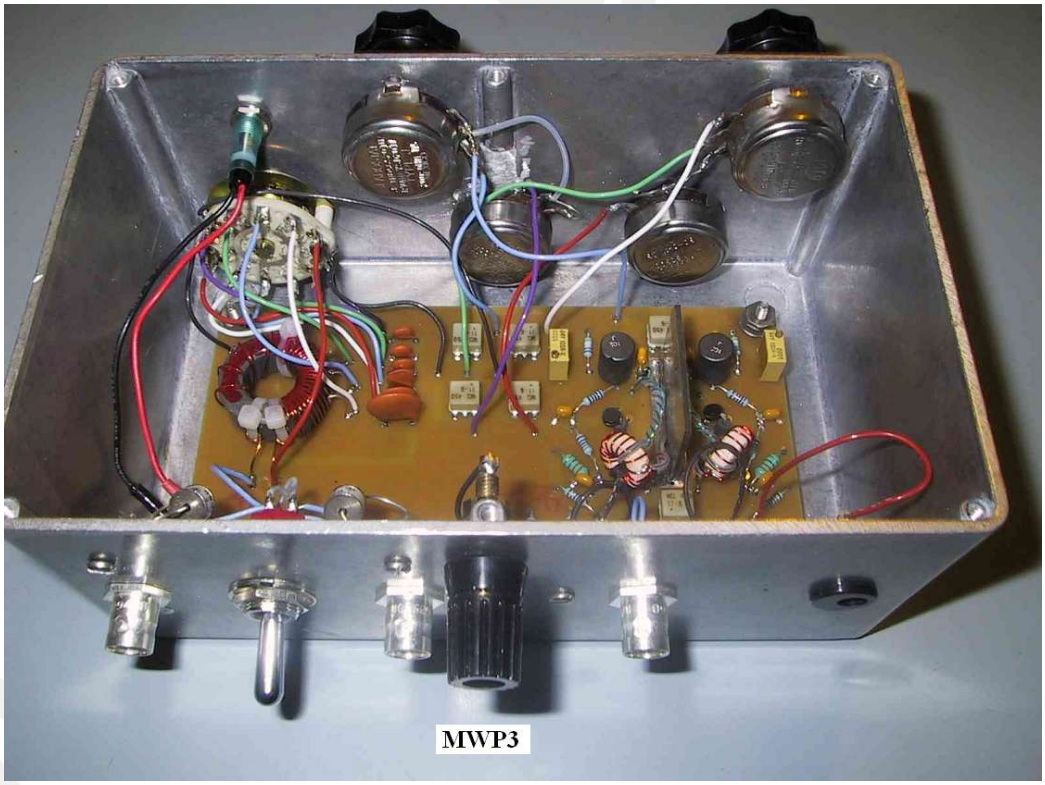
AB / Clarostat / Honeywell Type J Pots



Electroswitch D4C0206N



MWP3



MWP3

MWP 4, 4A, 4B, 4C, and 4D

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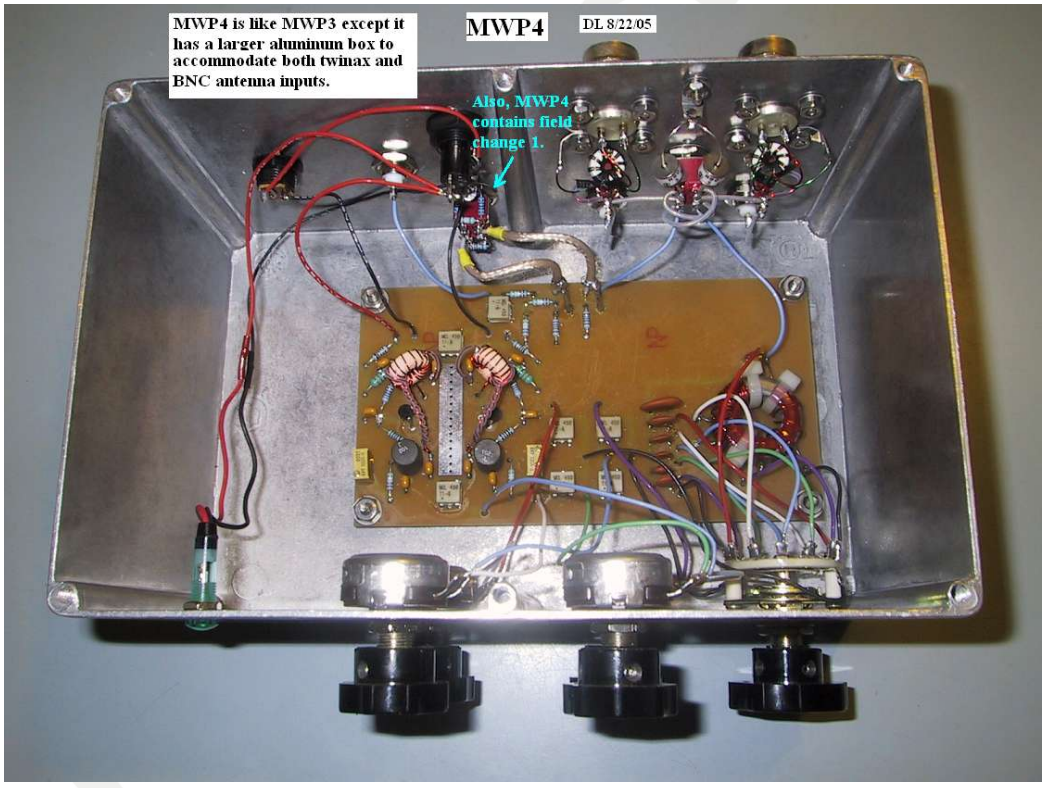
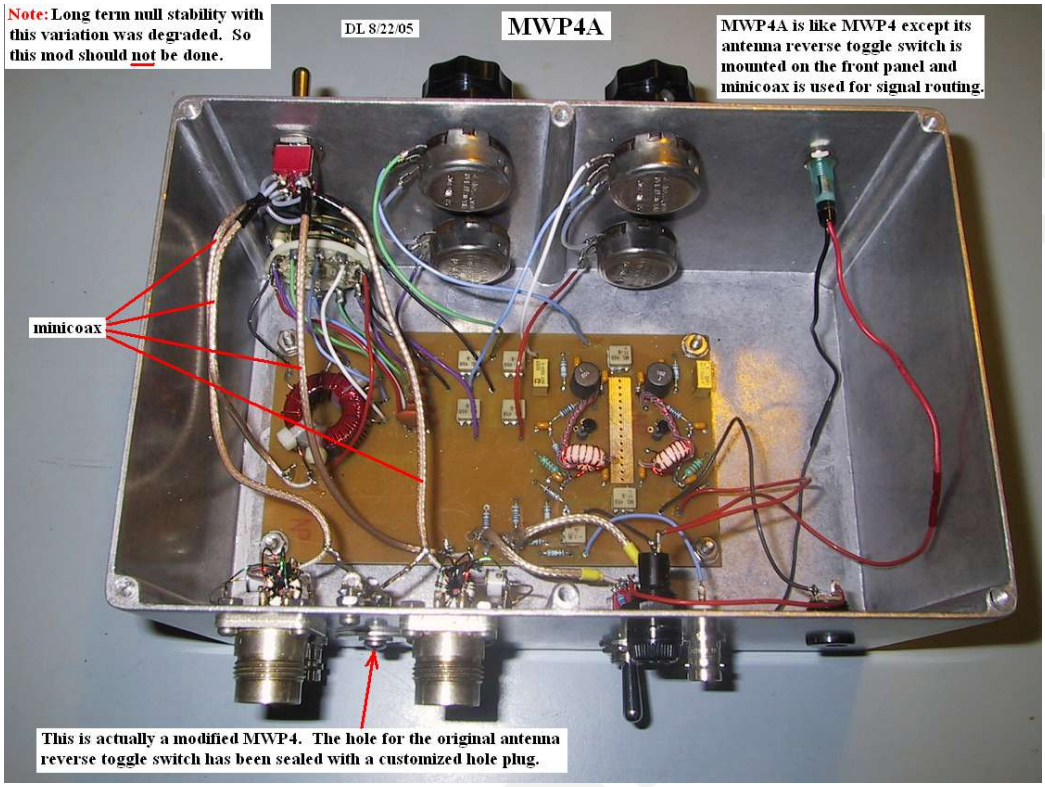
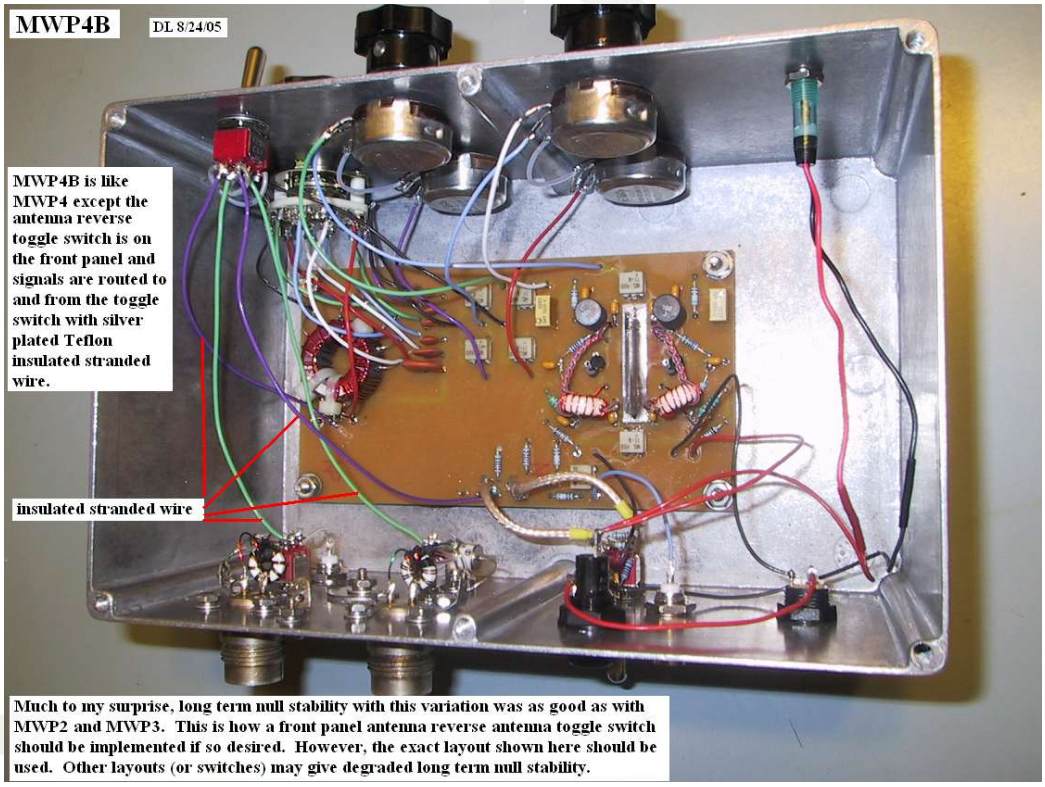
8/26/05

This sequence of variations of MW Phaser #3 began with two larger aluminum diecast boxes in order to accommodate antenna inputs using both twinax connectors and BNC connectors because all of my antennas use twin lead, and because I wanted to connect multiple phasers with BNC fitted coax to experiment with multi-phaser arrays. I also wanted to investigate the feasibility of putting the antenna reverse toggle switch on the front panel.

Skywaves were unsettled last night, so comparisons could not be made between my 3 phasers. However, I left them all set up for nulling KMOX 1120 using my two spaced verticals when I went to bed . This morning two of the phasers, MWP1 and MWP4 with rear panel antenna reverse toggle switch, had severely degraded KMOX nulls, while MWP4 with front antenna reverse toggle switch had only slightly degraded KMOX null. So MWP4 with front panel toggle switch and insulated stranded wire for routing signals to and from the toggle has the best long term null stability of my 3 phasers, at least for nulled KMOX using spaced verticals with twin lead feed.




Note: Long term null stability with this variation was degraded. So this mod should not be done.
DL 8/22/05
MWP4A
MWP4A is like MWP4 except its antenna reverse toggle switch is mounted on the front panel and minicoax is used for signal routing.
minicoax
This is actually a modified MWP4. The hole for the original antenna reverse toggle switch has been sealed with a customized hole plug.


MWP4B
DL 8/24/05
MWP4B is like MWP4 except the antenna reverse toggle switch is on the front panel and signals are routed to and from the toggle switch with silver plated Teflon insulated stranded wire.
insulated stranded wire
Much to my surprise, long term null stability with this variation was as good as with MWP2 and MWP3. This is how a front panel antenna reverse antenna toggle switch should be implemented if so desired. However, the exact layout shown here should be used. Other layouts (or switches) may give degraded long term null stability.


MWP4C is like MWP4 except the mini coax used for Field Change 1 has been replaced by insulated stranded wire. Also, the top two fluted knobs (vernier phasing) have each been drilled slightly near the edges with a 1/16 inch bit and the holes painted with white enamel (for position indicators). I used a tooth pick to apply a small amount of white paint to each hole, wiped off the excess with a paper towel, and carefully removed any residual paint outside the holes with a Q Tip dampened with rubbing alcohol. And a pointer for the large knob (band switch) was made with small copper tubing painted red. A hole the same size as the tubing was drilled in the rear side of the lip of the knob to affix the pointer. The pointer is easily seen when parallel to the shaft, but may be bent outward if so desired.
MWP4C
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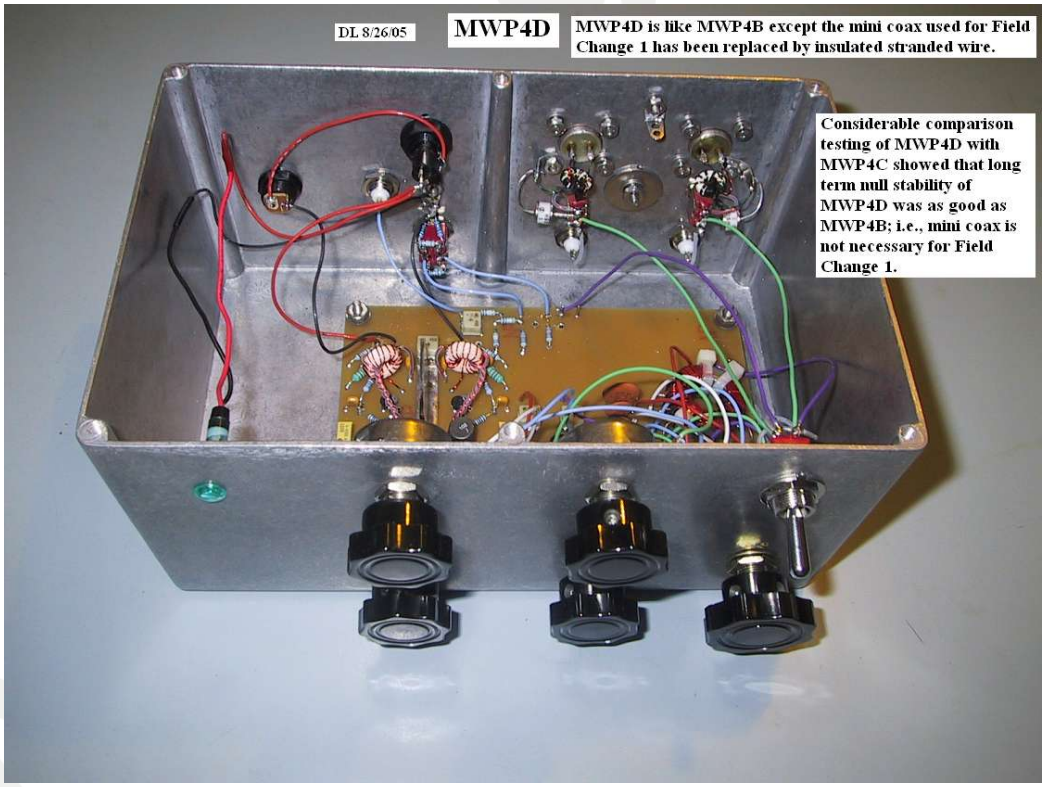
Considerable comparison testing of MWP4C with MWP4B showed that long term null stability is as good when insulated stranded wire is used with Field Change 1 as when mini coax is used with Field Change 1.


DL 8/26/05
MWP4D
MWP4D is like MWP4B except the mini coax used for Field Change 1 has been replaced by insulated stranded wire.
Considerable comparison testing of MWP4D with MWP4C showed that long term null stability of MWP4D was as good as MWP4B; i.e., mini coax is not necessary for Field Change 1.