A114-3-1

Mini-MWDX-5X Phasing Unit

Mark Connelly - WA1ION - 21 SEP 1994

Organization of article

Table 1: Mini-MWDX-5X Controls and Input / Output Connectors

Controls

location	designation	operational description
left side	S4	Ground mode switch (FLOAT / COM)
top	C1	Line 1 tuning capacitor
top	C2	Line 2 tuning capacitor
top	R1	Input level balance pot
top	R2	Null vernier (Q-balance) pot
top	S1	Bandswitch
top	S2	Function switch
top	S3	Input coupling switch

Input / Output Connectors

location	designation	operational description	connector type
left side	J1	Line 1 wire input	red banana jack
left side	J2	Line 2 wire input	red banana jack
left side	J3	earth ground input 1	blk banana jack
left side	J4	earth ground input 2	blk banana jack
right side	J5	RF output	BNC jack

Table 2: S1 Bandswitch Settings Chart

Ranges are usually a bit greater than those shown. These ballpark values are for 50-m. / 164-ft. wires. Wire length and coupling mode affect the ranges somewhat.

The Mini-MWDX-5X phasing unit has frequency coverage characteristics as noted in the following table.

S1 Pos. #	S1 Knob Pointer "o'clock"	Min. Freq. kHz	Max. Freq. kHz	"Main" L ["Tap" L] Tank Inductor Values L#	uH	Mouser Part #
1	10:30	430	630	L1,L9	470	43LR474
["	"	"	"	L5,L13	100	43LR104]
2	11:30	630	880	L2,L10	220	43LR224
["	"	"	"	L6,L14	47	43LR475]
3	12:30	880	1260	L3,L11	100	43LR104
["	"	"	"	L7,L15	22	43LR225]
4	130	1260	1800	L4,L12	47	43LR475
["	"	"	"	L8,L16	10	43LR105]

Operating the Mini-MWDX-5X

Figure 1 is the schematic of the Mini-MWDX-5X. Please refer to it and to Figure 2 (the chassis outside views) during the discussion of phasing procedure.

Best results will be with two wires of at least 15m / 50 ft. length each. There should be some angular or distance separation between the wires for optimum results.

See Tables 2 and 4 for physical positioning of switches.

***** Mini-MWDX-5X Two Wire Phasing Procedure *****

1.0 Phasing Steps (2-wire)

Nulling procedures may sound complicated at first, but are quickly executed once learned. The user should practice during non-skip daylight conditions on "graveyard" and regional channels having discernible subdominants to get familiar with operation of the controls before attempting night-time nulls of unsteady signals. As with a loop, solid nulls of skip stations above 1 MHz in the 50 to 500 mile range can be difficult at times because of the rapid changes in vertical (and sometimes horizontal) arrival angles inherent when dealing with high-angle and multiple-mode skip. Such nulls are better when using phased Beverages than when using a loop or phased shorter wires.

1.1 ** INITIAL SET-UP **

< Left side of box >

Connect one antenna wire to J1 and the other antenna wire to J2. Set S4 to COMMON.

If "clean" grounds or counterpoise wires are available for noise-reduction capability, connect these to J3 and to J4 and set S4 to FLOAT. Refer to the discussion of noise-reduction later in this article.

< Right side of box >

Connect coaxial cable from J5 (RF out) to the receiver's input, or to the input of a preamplifier (placed between the phasing unit's output and the receiver's input).

< Top side of box >

Set frequency-range switch S1 to the correct range for the frequency of operation (see Table 2).

Set S2 Function switch to Line 1.

Set S3 Input Coupling switch to NORMAL (center). S3 may be set to SHORT if shorter-length wires (under 50 m) are being used.

Set balancing pots R1 and R2 to center (12 o'clock) positions.

1.2 ** PEAK LINE 1 **

Tune Line 1 by peaking desired-frequency signal strength with C1. At this time, leave C1 at its peaked-signal position.

NOTE THE SIGNAL STRENGTH (observe S-meter, if available, or note audible level).

1.3 ** PEAK LINE 2 **

Set S2 to Line 2. Tune Line 2 by peaking the desired-frequency signal strength with C2. At this time, leave C2 at its peaked-signal position. NOTE THE SIGNAL STRENGTH (observe S-meter, if available, or note audible level).

1.4 ** INPUT LEVEL BALANCING **

If the dominant-station signal level noted when peaking Line 1 with C1 (step 1.2) is comparable (within 6 dB on meter, or not audibly different) to the strength noted when peaking Line 2 with C2 (step 1.3), proceed to Step 1.5.

If the S2 = Line 1 (C1 peaked) level is considerably different from the S2 = Line 2 (C2 peaked) level, then set S3 to ATTEN. ADJUST and adjust R1 until the level (of the station to be nulled) as noted with S2 on Line 1 is approximately equal to the level noted with S2 on Line 2. C1 and C2 should be touched up for peak level each time you make a change to the R1 setting.

1.5 ** ESTABLISHING A NULL **

Observe the pointer position of the knob on R1. If it is at 12 o'clock (center), or counterclockwise from 12 o'clock (e. g. 10 o'clock), start nulling with C1. Otherwise, start with C2 (e. g. R1 clockwise of 12 o'clock).

Set S2 to Null-a and adjust the capacitor (C1 or C2) chosen above. Observe the depth and sharpness of any null found. Do the same with S2 set to Null-b. Leave S2 on the position that produced the deeper, sharper-tuning null; put the chosen tuning capacitor at the position yielding maximum null.

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Then, adjust the capacitor chosen above and R2 (the Null Vernier pot) to improve the rejection of the dominant station or noise. Subdominant signals, if present, should become audible.

1.6 ** NULL-FINALIZATION **

Make successive interactive adjustments of R2 and a capacitor determined by observing the pointer of R2's knob: if it is at 12 o'clock, or counterclockwise of 12 o'clock, adjust C1; otherwise adjust C2. When almost done, interactively make fine adjustments to C1, C2, and R2. Also, if S3 is set to ATTEN. ADJUST, small adjustments of R1 may also be blended into the interactive steps used to finalize the null.

Compatibility with noise-reducing antenna systems

Noise-reducing antenna considerations have been accommodated by the inclusion of two isolation transformers (T1, T2) on the inputs. When suitable "quiet" grounds or counterpoise wires are part of the antenna layout, reduction of local electrical noise is possible.

If the Ground Mode switch S4 is set to the FLOAT position, the phasing unit may be interfaced correctly with coaxial inputs from low noise antenna systems consisting of a wire antenna and a "field site" earth ground fed to the primary of a (field site) step-down transformer in the 4:1 to 12:1 range; either a Mini-Circuits T9-1-X65 or Nick Hall-Patch's home-brew version consisting of an Amidon FT50-43 core with 35 turns primary / 11 turns secondary will work well. The lower impedance output of this field-site transformer is paralleled with 270 to 330 ohms; one secondary lead goes to the shield of the coaxial cable going to the operator's "shack" and the other secondary lead goes to the center conductor of this coaxial cable through a small series resistor in the 5 to 12 ohm range. The resistors form a low-loss matching pad to reduce the degree of mismatch. Excessive mismatch can compromise the shielding effectiveness of the coaxial cable. One such low-noise set-up can be phased against a loop or, even better, against a second low-noise antenna system with different directional properties. In any event, the "shack end" of a Line 1 low-noise coaxial feed is connected to J1 (center) and J3 (shield) of the phasing unit; similarly, if such a coaxial feedline is to be used for Line 2, it should be connected to J2 (center) and J4 (shield).

For further discussion of noise-reduction schemes, the reader is advised to consult my articles "Another Look at Noise-Reducing Antenna Systems" (6 JUL 1992), "Bevmatcher" (15 JAN 1991), the Nick Hall-Patch / John Bryant article "Impedance Matching a Beverage Antenna to a Receiver" in Proceedings 1988, and the 1991 noise-reducing inverted-L articles by Dallas Lankford and Denzil Wraight. The reader should be advised that the noise being reduced is LOCAL electrical noise of the type caused by TV sweep oscillator harmonics, light dimmer buzz, and the like. These antenna systems cannot, singly, reduce static from lightning bolts. Such noise CAN be nulled by phasing two antennas if it is coming from far enough away as to approximate a point source not having great incoming-angle variation over time (it is then treated as a "dominant signal" as if it were a broadcast station interfering with desired DX).

Construction comments

Parts lists for the MWDX-5, Super-MWDX-5, and MWDX-6 phasing units, and the catalogues of the vendors noted therein, should be consulted (in conjunction with Figure 1 of this article) to determine parts required. Experienced builders will have no problem identifying required pieces not shown on the schematic (screws, washers, nuts, knobs, etc.).

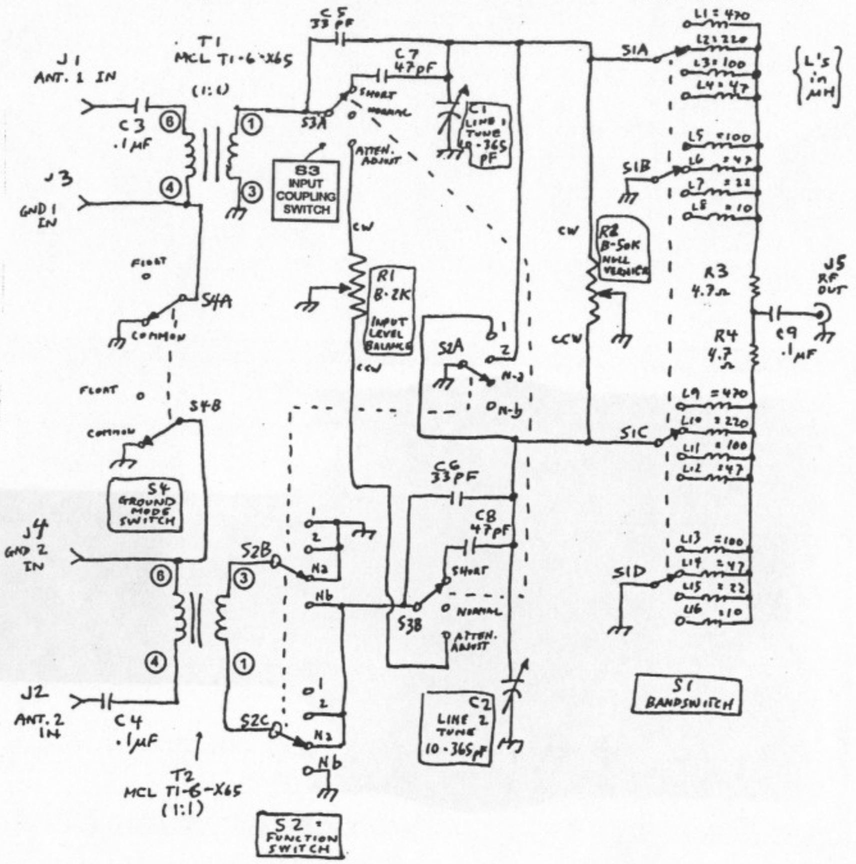
Table 4: control orientation conventions

Ensure that components are mounted and wired in accordance with this table; align knob pointers to clock positions indicated. Orientations are as viewed from outside the chassis box assembly.

Side	Control	Orientation Conventions
top	C1	CCW = minimum C = 9:00; CW = maximum C = 3:00
top	C2	CCW = minimum C = 9:00; CW = maximum C = 3:00
top	R1	CCW = maximum level Line 1 (min. Line 2)= 7:00 CW = maximum level Line 2 (min. Line 1)= 5:00
top	R2	CCW = maximum Q Line 1 (min. Line 2)= 7:00 CW = maximum Q Line 2 (min. Line 1)= 5:00
top	S1	[see Table 2]
top	S2	Line 1 = 10:30; Line 2 = 11:30; Null-a = 12:30; Null-b = 1:30
top	S3	SHORT = left; NORMAL = center; ATTEN. ADJUST = right
left	S4	COMMON = down; FLOAT = up

FIGURE 1

SCHEMATIC : MINI - MWDX - 5X PHASING UNIT



POSSIBLE SUBSTITUTIONS

T1, T2	MCL T2-1T-X65, INSTEAD OF T1-6-X65
R1	1K INSTEAD OF 2K
R2	100K INSTEAD OF 50K

Table 3: Mini-MWDX-5X hole-drilling list

X = Horizontal distance, in inches, from the vertical centerline (VCL) on the side observed. Negative values of X are left of VCL, positive values of X are right of VCL.

Y = Vertical distance, in inches, from the bottom horizontal edge of the side observed.

D = Hole diameter in inches.

Hole loci are first marked on the box with a scriber and are then drilled with a .125" bit. Subsequently, as required, the holes are enlarged to the proper size by using progressively larger bits up to that corresponding to the final desired diameter.

Chassis Box = Mouser 537-TF-779 (metal): 5" X 4" X 3"

LEFT SIDE

Hole #	Comp. Desig.	Description	X	Y	D
--	----	---------------------------	--.----	--.----	--.----
1	J1	Line 1 wire -red banana jack	-1.25	0.5	0.3125
2	J3	GND1 In - black banana jack	-0.5	0.5	0.3125
3	S4	Ground Mode switch - shaft	0.0	1.25	0.25
4	S4	Ground Mode switch - tab	0.0	1.0	0.125
5	G1	grounding H/W - int & ext lugs	0.0	0.5	0.125
6	J4	GND2 In - black banana jack	0.5	0.5	0.3125
7	J2	Line 2 wire -red banana jack	1.25	0.5	0.3125

TOP SIDE

Mounting holes on C1 & C2 must be tapped to 6-32 thread.

Hole #	Comp. Desig.	Description	X	Y	D
--	----	---------------------------	--.----	--.----	--.----
1	R1	Input level bal. pot - tab	-1.9375	3.375	0.144
2	R1	Input level bal. pot - shaft	-1.625	3.375	0.3125
3	S3	Input Coupling switch-shaft	-1.625	2.25	0.25
4	S3	Input Coupling switch - tab	-1.375	2.25	0.125
5	S2	Function switch - shaft	-1.625	1.0	0.375
6	S2	Function switch - tab	-1.125	1.0	0.144
7	C1	Line 1 Tuning Cap.-Mtg.H/W 1	-0.463	3.3125	0.144
8	C1	Line 1 Tuning Cap. - shaft	0.0	3.0625	0.5
9	C1	Line 1 Tuning Cap.-Mtg.H/W 2	0.463	3.3125	0.144
10	C2	Line 2 Tuning Cap.-Mtg.H/W 1	-0.463	1.375	0.144
11	C2	Line 2 Tuning Cap. - shaft	0.0	1.125	0.5
12	C2	Line 2 Tuning Cap.-Mtg.H/W 2	0.463	1.375	0.144
13	R2	Null vernier (Q) pot - tab	1.3125	3.375	0.144
14	R2	Null vernier (Q) pot - shaft	1.625	3.375	0.3125
15	G2	grounding H/W - internal lug	1.625	2.25	0.125
16	S1	Bandswitch - shaft	1.625	1.0	0.375
17	S1	Bandswitch - tab	2.125	1.0	0.144

RIGHT SIDE

Hole #	Comp. Desig.	Description	X	Y	D
--	----	---------------------------	--.----	--.----	--.----
1	J5	RF out - BNC jack	0.0	0.5	0.375

FIGURE 2: MINI-MWDX-5X CHASSIS PICTORIALS (OUTSIDE VIEWS)

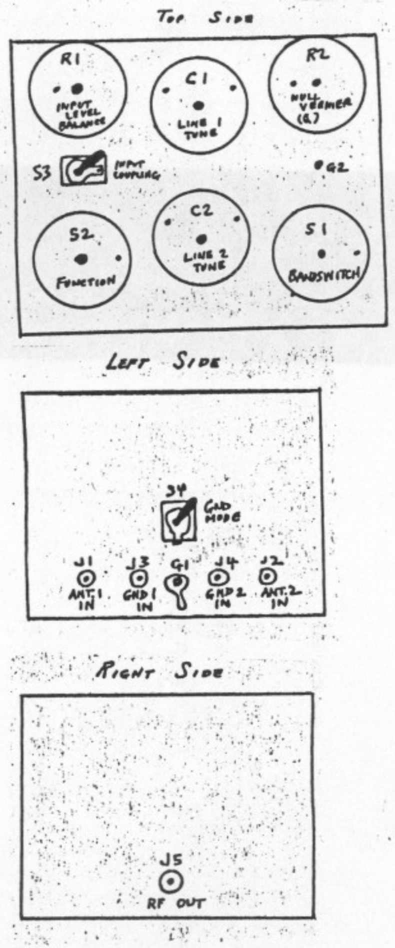
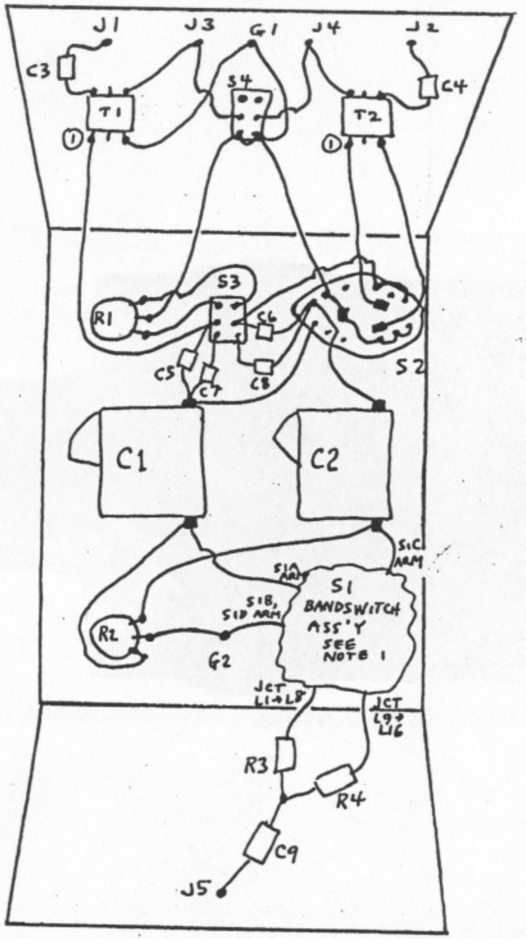


FIGURE 3: INSIDE (WIRING) VIEW OF MINI-MWDX-5X
NOT TO SCALE



NOTE 1: BANDSWITCH = MOUSER 10WR064 OR EQUIV.
4 SECTIONS USED OUT OF 6
WIRING PER FIGURE 1 AND TABLE 2