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THE MINI MWDX-3

A Simple, Effective Phasing Unit

Mark Connelly - WALION DX Labs - 05 DEC 1984

Introduction

This article describes the construction and use of a one-box antenna phasing unit far superior (in ease of construction and ease of operation) to any of my previous MWDX designs published in the DX press.

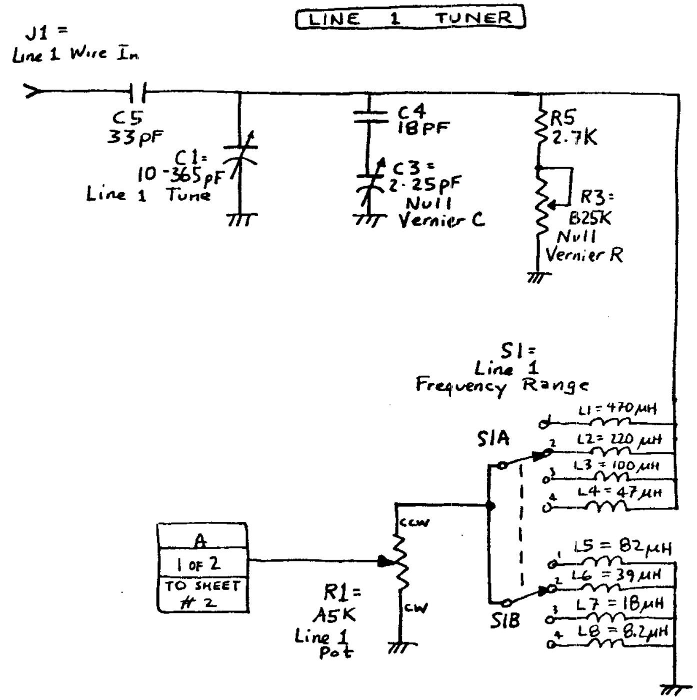
Although this article may best be appreciated by those who've used phasing units and who've read previous articles on phasing by me and by Hutton, DeFrancesco, Hall-Patch, Herkimer, and others; the article should be of use to anyone who wants to log new DX, possibly better than (or at least, different from) what they've been getting on their loops and simple longwires. The concept of phasing is that signals from two aerials are electrically manipulated (by tuning capacitor adjustment and by selectable transformer-produced phase reversal) so that the dominant-station component of the Wire 1 Tuner output is set to be equal in amplitude and opposite in phase (+/- 180 deg.) from that component on the Wire 2 Tuner output. When the two outputs are combined (usually by means of an RF transformer), cancellation of the dominant station results, thereby permitting reception of co-channel subdominants having a different (non-opposite) phase relationship. Clean reception of formerly-slopped adjacent channels is another benefit. The dominant "station" to be nulled can be a man-made noise source instead of an actual broadcast signal, if such noise is the principal object in the way of desired-signal reception. Phasing systems have been popular with MW BCB international-DX enthusiasts since the '60s; 160-meter hams and longwave DXers have found uses for them, as well. Broadcast-station directional arrays employ a specialised, single-frequency variety of phasing. A loop may also be employed in phasing systems, either against a wire or against another loop. (This is somewhat the concept of commercial radio direction-finders and of Ron Schatz's Loop-Sense-Cardioid-Array scheme.)

A design approach embodied in the Mini-MWDX-3 is a one-box system with available options. The types of options are outlined at the end of this article: most deal with coverage of frequencies such as longwave and tropical-band shortwave. The inductive-coupling option is designed to provide better coupling to some aerials, notably long ones.

It should be noted that phasing of very short (e. g. less than 50'/15 m. at 1 MHz) wires is best left to a modular (3 box) phasing system consisting of two Q-spoiled FET-input active wire tuners driving a phaser output module (POM) box having an amplifier (broadband, or (preferably) tunable) at the output of its balun transformer. For most applications where sufficiently-long wires WILL be available, the one-box approach to phasing is hard to beat. The Mini-MWDX-3 may easily be packed into a suitcase along with a Palomar loop, a couple of 100' rolls of wire, and one of the new synthesised portable receivers for an airline-portable DXpedition setup with maximum "bounce to the ounce". (Operation with portable receivers should be done with the Mini-MWDX-3 amplifier on, so that the unit's output will override stray pickup from the receiver's rod or whip antenna).

MINI - MWDX - 3 PHASING UNIT

MAIN SCHEMATIC SHEET 1 OF 2 (5 DEC 1984)



APPROXIMATE FREQUENCY RANGES

S1 (SHEET 1) / S2 (SHEET 2) POSITION #	FREQ. RANGE, KHZ
1	480 - 650
2	620 - 900
3	880 - 1300
4	1250 - 1700

RANGES SHOULD BE SOMEWHAT WIDER THAN THE ABOVE IF SHORT TO MEDIUM LENGTH (UNDER 100M / 328 FT) WIRES ARE USED. BEVERAGE USERS MAY FIND THE INDUCTIVE-COUPLING OPTION (OPTION #1) BENEFICIAL IN ENSURING A REASONABLE AMOUNT OF RANGE OVERLAP.

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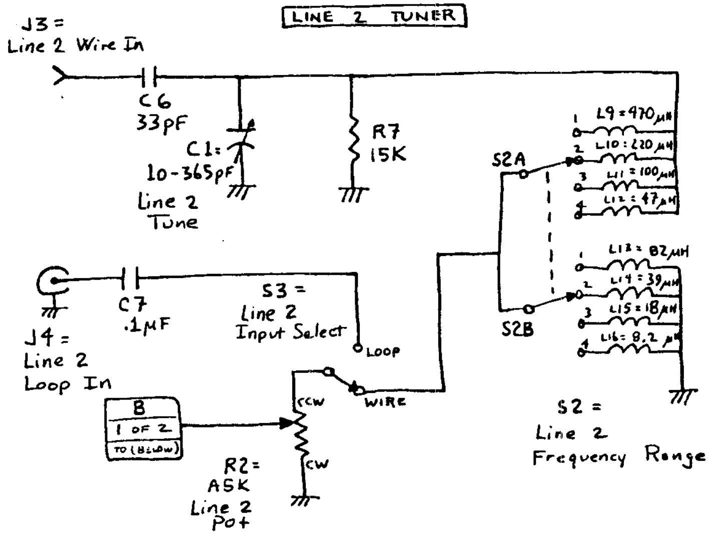
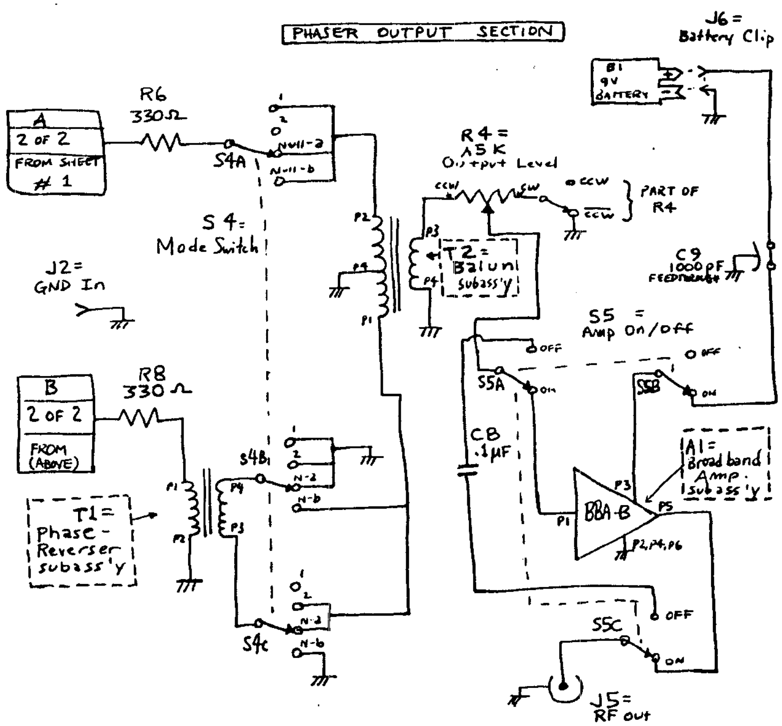
Mini - MWDX-3 Phasing Unit

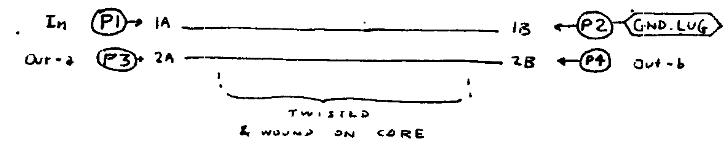
Main Schematic Sheet 2 of 2 (5 Dec 1984)



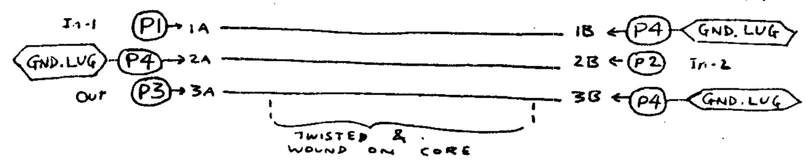


Subassemblies used in Mini-MWDX-3

T1 = 30 turns (bifilar) on Amidon FT-82-77.

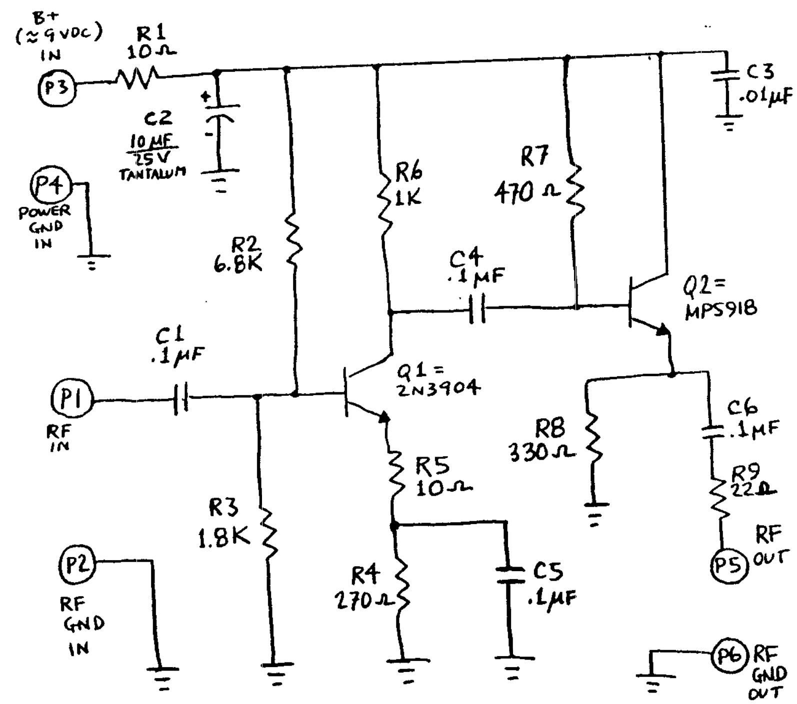


T2 = 30 turns (trifilar) on Amidon FT-82-77



A1 = BBA-B Broadband Amplifier Card

NOTE: Component designations on A1 are a completely separate entity from component designations on the main Mini-MWDX-3 schematics.



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The MWDX-3 family of phasing units

The Mini-MWDX-3 is the latest model to evolve from the overall MWDX-3 design philosophy. This design has done away with the cumbersome ungrounded tuning-capacitor subassemblies of the MWDX-1, 2, and 2A. The use of rotor-grounded tuning capacitors in parallel LC tanks eliminates the problem of hand capacitance once and for all. Loose coupling of wire aerials to the input tuners provides tuning that is predictable and less influenced by wire length. Inductive voltage division is used as a simple means of converting impedance from high (at tank) to medium (coming out of the input tuner). Q-spoiling is incorporated to provide manageable changes in phase angle-per-pF of tuning capacitance shift away from resonance; phase shift-per-kHz frequency change from resonance is reduced by this scheme in such a fashion that, on moderately strong AM signals, both sidebands (on the dominant station) as well as its carrier are adequately suppressed to permit subdominant DX station reception. The loose coupling, inductive division, and Q-spoiling all help to provide ease of construction and use. The other side of the coin, however, is that maximum achievable output level (as a passive phaser) is less than what can be achieved by tight-coupling of aerial to tank and transformer-type tuner-output-impedance transformation. Luckily, gain at the frequencies of interest is cheap. The Mini-MWDX-3 has incorporated a built-in 20 dB broadband amplifier which can be kicked in when wanted stations (left after nulling, the "pest" dominant station) are down at the receiver noise floor. The amplifier module can recover all of the gain lost by design simplification and then some. The classic tightly-coupled approach, on the other hand, costs a lot more when you realise that molded inductors would have to be replaced by a multitude of bulky hand-wound tapped coils on toroids or rods (not to mention the "klugey" ungrounded tuning capacitors).

Neil Kazaross has been using a MWDX-3 family tuner dubbed the "proto(type) MWDX-3"; George Hakiel and Marc DeLorenzo have MWDX-3 units, and Robert LaMorgese has an MWDX-3P (passive; used in conjunction with external APT-style tunable output amplifier). The main difference between these units and the Mini-MWDX-3 is that the non-Mini units are housed in a 10"X6"X3.5" chassis box instead of the 7"X5"X3" box used by the subject of this article. Electrical differences are minimal (slight differences in pot scheme, inductive coupling option to Mini-MWDX-3 is standard on MWDX-3, component nomenclatures may differ, etc.). The DXers involved seem to be satisfied with their units; Neil Kazaross has gotten MWDX on his phased Beverages that could not be heard with a loop or with the Beverages used without phasing.

Mini-MWDX-3 Assembly

Outline

1. Read article thoroughly. Make an extra copy to be kept at the workbench (to be marked-up, checked-off, etc.)

2. Ensure that you have necessary tools: drill bits (per hole list), drill or drill press, diagonal cutters (large & small), wire stripper, needle-nose pliers, slip-joint pliers, screwdriver sets (slotted & Phillips), nutdriver set, soldering pencil (~ 25 W), ohmmeter (to check switches & pots), jeweller's screwdriver set (for knob setscrews), metal file, accurate ruler (preferably steel) or micrometer/caliper, sharply-pointed scriber/awl or centrepunch, and bench vise.

3. Purchase all necessary parts (per Level 1 & 2 parts lists). When all parts are acquired, organise parts & tools in a spacious, well-lighted work area.

4. If substitute mountable components are used, adjust hole list as required. Accurately mark chassis box hole locations (per hole list) with scriber. Drill each hole initially with a .113" bit; then drill holes listed as larger with the actual specified size bit. Holes larger than .25" should be drilled to .25" as an interim step to prevent jumping of the subsequently-used larger bit.

5. Assemble ground hardware to the chassis as follows: (Locations per hole list)

	OUTSIDE BOX	INSIDE BOX
G1 =	head of 4-40X.25 screw	#4 solder lug, 4-40 nut on screw shaft
G2 =	head of 4-40X.25 screw, #4 solder lug	4-40 nut on screw shaft

6. Mount battery holder J6 at right side holes 5 & 6. The holder is mounted on the outside of the box so that its terminals point downward. At each hole, a 4-40X.25" screw is inserted through the battery holder & the chassis so that its head is outside and its threads are inside the box. On the inside threads, place a #4 split lockwasher (against the chassis); then secure the washer with a 4-40 nut. Torque tight.

7. Mount C1 inside the box so that its shaft protrudes out through top side hole 2. Mounting hardware (consisting of 6-32X.25" screw, a #6 split lockwasher between screw head & flat washer, and a #6 flat washer between split washer & chassis external surface) should be installed at top side holes 1, 3, & 4 once the capacitors threaded holes have been aligned to mate with these three holes.

8. Mount C2 inside the box so that its shaft protrudes out through top side hole 21 and its threaded holes line up with top side holes 20, 22, & 23. Use hardware (of the same type used to mount C1) to mount C2 to the chassis at top side holes 20, 22, & 23.

9. Mount the following components with the hardware supplied with the components: A1, C3, C9, J1, J2, J3, J4, J5, R1, R2, R3, R4, S1, S2, S3, S4, S5, T1, T2. It's probably a good idea to apply a few drops of Loctite to C3's threads as it is only mounted at one location and might slip after repeated adjustment. "Loctiting" the threads of J1 through J5 is also recommended. Orient A1, T1, and T2 by consulting the drawings supplied with these subassemblies in conjunction with the Mini-MWDX-3 hole list. These subassemblies are, of course, mounted inside the chassis box: spacers should contact inside chassis surface; mounting screw heads & lockwashers are on the outside of the box.

10. Assemble molded inductors onto S1 & S2 in accordance with schematic and wiring/component connection list. Keep leads as short as possible.

11. Perform all operations on wiring/component connection list (other than those of assembly step 10). The schematic and the parts list should be kept handy for reference. Use of an ohmmeter is suggested to establish pin orientation on pots and switches.

12. Blow all solder splash and loose wire fragments out of the chassis box with high-pressure air, if available. Clean flux from solder joints with alcohol or another suitable solvent.

13. Inspect finished unit for proper connections, correct component values, and quality of workmanship.

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14. Install knobs (refer to Level 1 parts list).
Suggested orientations:

Knob pointer line position (control fully CCW)	
C1	9 o'clock
C2	9 o'clock
C3	9 o'clock = fully meshed
R1	8 o'clock
R2	8 o'clock
R3	8 o'clock
R4	8 o'clock

Numbered knobs (on S1, S2, S4) should be set to approx. 1.3 with control fully CCW. Numbered knob on S5 should be set to 1.1 with S5 set fully CCW (off).

15. Label controls & jacks.

16. Proceed to Operation Instructions and, hopefully, to some good DX!

Parts List for Mini-MWDX-3 phasing unit

NOTES: Prices (current DEC 1984) are subject to change.
Fixed resistor prices are per pack of 5 pieces.

Level 1 list = electrical & major mechanical components
Level 2 list = small hardware (total estimated price given instead of item-by-item listings)

RS = Radio Shack
me = Mark Connelly - 30 William Road - Billerica, MA 01866

For addresses of other suppliers, consult recent Supplier List in DX News & DX Monitor and consult the Electronic Design Gold Book (at most technical college libraries).

Level 1

Component Designation	Description	Vendor	Stock #	Approx. Price $
A1	broadband amp. subass'y	me	BBA-B	12.00
B1	9V battery	RS	23-553	1.99
C1	10-365 pF var. capacitor	Mouser	524-A1-227	12.00
C2	10-365 pF var. capacitor	Mouser	524-A1-227	12.00
C3	2-25 pF var. capacitor	Mouser	530-189-0569-1	3.00
C4	18 pF mica capacitor	Mouser	586-DM018	0.40
C5	33 pF mica capacitor	Mouser	586-DM033	0.40
C6	33 pF mica capacitor	Mouser	586-DM033	0.40
C7	.1 uF monolithic cap.	Digi-Key	P4525	0.18
C8	.1 uF monolithic cap.	Digi-Key	P4525	0.18
C9	1000 pF feedthrough cap.	Newark	19F2861	3.18
J1	banana jack (red)	RS	274-662	1.39
J2	banana jack (black)	RS	274-662	1.39
J3	banana jack (red)	RS	274-662	1.39
J4	BNC jack	RS	278-105	1.69
J5	BNC jack	RS	278-105	1.69
J6	battery holder	Acme (NJ)		1.50
L1	470 uH molded inductor	Mouser	43LS474	0.39
L2	220 uH molded inductor	Mouser	43LS224	0.39
L3	100 uH molded inductor	Mouser	43LS104	0.39
L4	47 uH molded inductor	Mouser	43LS475	0.39
L5	82 uH molded inductor	Mouser	43LS825	0.39
L6	39 uH molded inductor	Mouser	43LS395	0.39
L7	18 uH molded inductor	Mouser	43LS185	0.39
L8	8.2 uH molded inductor	Mouser	43LQ826	0.38

Level 1 -- continued

Component Designation	Description	Vendor	Stock #	Approx. Price $
L9	470 uH molded inductor	Mouser	43LS474	0.39
L10	220 uH molded inductor	Mouser	43LS224	0.39
L11	100 uH molded inductor	Mouser	43LS104	0.39
L12	47 uH molded inductor	Mouser	43LS475	0.39
L13	82 uH molded inductor	Mouser	43LS825	0.39
L14	39 uH molded inductor	Mouser	43LS395	0.39
L15	18 uH molded inductor	Mouser	43LS185	0.39
L16	8.2 uH molded inductor	Mouser	43LQ826	0.38
R1	5K audio-taper pot	Mouser	31CB305	0.99
R2	5K audio-taper pot	Mouser	31CB305	0.99
R3	25K linear-taper pot	me	R-B25K	1.50
R4	5K audio-taper pot	Mouser	31CB305	0.99
R5	2.7K resistor	Digi-Key	2.7KQ	0.25
R6	330 ohm resistor	RS	271-1315	0.39
R7	15K resistor	RS	271-1337	0.39
R8	330 ohm resistor	RS	271-1315	0.39
S1	3-pole, 4-pos. switch	Mouser	10WW034	1.08
S2	3-pole, 4-pos. switch	Mouser	10WW034	1.08
S3	SPDT on/on toggle switch	RS	275-326	1.99
S4	3-pole, 4-pos. switch	Mouser	10WW034	1.08
S5	6-pole, 2-pos. switch	RS	275-1386	1.19
T1	phase-reversing xfmr.	me	T1	7.00
T2	balun xfmr. subass'y	me	T2	8.00
--	knob for C1	Mouser	45KN017	0.54
--	knob for C2	Mouser	45KN017	0.54
--	knobs for S1,S2	RS	274-413 (pk 2)	1.39
--	knobs for S4,S5	RS	274-413 (pk 2)	1.39
--	knob for C3	Mouser	45KN013	0.42
--	knob for R1	Mouser	45KN013	0.42
--	knob for R2	Mouser	45KN013	0.42
--	knob for R3	Mouser	45KN013	0.42
--	knob for R4	Mouser	45KN013	0.42
--	chassis box (7"X5"X3")	Mouser	537-TF-782	4.33

Level 2 -- Small Hardware

NOTE: Mounting hardware is supplied with the following Level 1 components: A1, C3, C9, J1, J2, J3, J4, J5, R1, R2, R3, R4, S1, S2, S3, S4, S5, T1, T2, knobs, and chassis box.

The builder must provide hardware as follows:

Components(Qty.) where used	Total Qty.	Description	Vendor	Stock #
C1(3), C2(3)	6	6-32X.25" screw	Mouser	572-01888
C1(3), C2(3)	6	#6 flat washer	Mouser	565-1150
C1(3), C2(3)	6	#6 split lockwasher	Mouser	572-00650
J6(2)	2	#4 split lockwasher	Mouser	572-00649
J6(2),G1(1),G2(1)	4	4-40X.25" screw	Mouser	572-01880
J6(2),G1(1),G2(1)	4	4-40 nut	Mouser	572-00484
G1(1),G2(1)	2	#4 solder lug	Mouser	565-1416-4
throughout box	as req'd	wire, #22 insulated	RS	278-1294
throughout box	as req'd	wire, #24 bare buss	RS	278-1341
throughout box	as req'd	solder	RS	64-006

Mechanical hardware stock numbers sometimes represent packs with a greater number of pieces than required. Cost of Level 2 items actually used to construct one Mini-MWDX-3 is approximately $ 6.

Based upon the foregoing Level 1 & Level 2 parts listings, the estimated total cost of components required to build the Mini-MWDX-3 phasing unit is in the vicinity of $ 110 (US) as of DEC '84.

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Hole List for Mini-MWDX-3 Phasing Unit

BOX USED = 7" X 5" X 3" aluminium (Mouser 537-TF-782, or equiv.)

X = horizontal distance in inches from the vertical centreline (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, inches.

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L E F T   S I D E

Hole #	Comp. Desig.	Description	X	Y	D
1	J1	Wire 1 In, banana jack	-0.75	0.5	0.3125
2	J2	Earth GND In, ban. jack	0.0	0.5	0.3125
3	J3	Wire 2 In, banana jack	0.75	0.5	0.3125
4	G1	GND hardware (int. lug)	0.0	1.125	0.113
5	S3	Line 2 Input Select, shaft	1.125	1.125	0.25
6	S3	Line 2 Input Select, tab	1.375	1.125	0.113
7	J4	Loop In, BNC	1.5	0.5	0.375

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T O P   S I D E

Hole #	Comp. Desig.	Description	X	Y	D
1	C1	Line 1 Tune - screw 1	-2.78125	3.875	0.14
2	C1	Line 1 Tune - shaft	-2.25	3.875	0.5
3	C1	Line 1 Tune - screw 2	-2.25	3.34375	0.14
4	C1	Line 1 Tune - screw 3	-1.71875	3.875	0.14
5	S1	Line 1 Freq.Range - shaft	-0.5	4.0	0.375
6	S1	Line 1 Freq.Range - tab	-0.5	3.5	0.14
7	R1	Line 1 Pot - tab	0.625	3.875	0.14
8	R1	Line 1 Pot - shaft	0.9375	3.875	0.3125
9	S4	Mode Switch - shaft	2.25	4.0	0.375
10	S4	Mode Switch - tab	2.25	3.5	0.14
11	C3	Null Vernier C - shaft	-1.0	2.5	0.28
12	R3	Null Vernier R - tab	-0.1875	2.5	0.14
13	R3	Null Vernier R - shaft	0.125	2.5	0.25
14	R4	Output Pot - tab	0.6875	2.5	0.14
15	R4	Output Pot - shaft	1.0	2.5	0.14
16	A1	BBA-B Amp. - hardware 2	2.0	3.0	0.113
17	A1	BBA-B Amp. - hardware 1	3.0	3.0	0.113
18	A1	BBA-B Amp. - hardware 4	2.0	2.0	0.113
19	A1	BBA-B Amp. - hardware 3	3.0	2.0	0.113
20	C2	Line 2 Tune - screw 1	-2.78125	1.5	0.14
21	C2	Line 2 Tune - shaft	-2.25	1.5	0.5
22	C2	Line 2 Tune - screw 2	-2.25	0.96875	0.14
23	C2	Line 2 Tune - screw 3	-1.71875	1.5	0.14
24	S2	Line 2 Freq.Range - shaft	-0.5	1.0	0.375
25	S2	Line 2 Freq.Range - tab	-0.5	0.5	0.14
26	R2	Line 2 Pot - tab	0.625	1.125	0.14
27	R2	Line 2 Pot - shaft	0.9375	1.125	0.3125
28	S5	Amp. On/Off - shaft	2.25	1.0	0.375
29	S5	Amp. On/Off - tab	2.25	0.5	0.14

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R I G H T   S I D E

Hole #	Comp. Desig.	Description	X	Y	D
1	T1	phase-rev. - hardware 2	-2.0	1.875	0.113
2	T1	phase-rev. - hardware 1	-1.0	1.875	0.113
3	T1	phase-rev. - hardware 4	-2.0	0.375	0.113
4	T1	phase-rev. - hardware 3	-1.0	0.375	0.113
5	J6	battery holder - screw 1	-0.48438	2.75	0.113
6	J6	battery holder - screw 2	0.48438	1.875	0.113
7	C9	B+ in feedthrough cap.	0.0	1.1875	0.188
8	G2	GND hardware (ext. lug)	0.75	1.1875	0.113
9	J5	RF out to RX., BNC	0.0	0.5	0.375
10	T2	balun - hardware 2	1.0	1.875	0.113
11	T2	balun - hardware 1	2.0	1.875	0.113
12	T2	balun - hardware 4	1.0	0.375	0.113
13	T2	balun - hardware 3	2.0	0.375	0.113

Wiring / Component Connections for standard Mini-MWDX-3 phasing unit

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NOTES: W = insulated wire (approx. #22 AWG)
BW = bare solid (buss) wire
TP = twisted-pair of insulated wires

C1 stator pins closest to J1 will be referred to as side A.
C2 stator pins closest to J3 will be referred to as side A.

Use "spaghetti" (plastic insulation) on all component leads longer than 0.5".

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OUTSIDE BOX:

From	To	Description
J6 + pin	C9 external pin	1" W
J6 - pin	G2 external lug	1.5" W

INSIDE BOX:

From	To	Description
J4	S3 "Loop" pin	C7
J3	C2 side A stator 1	C6
C2 side A stator 1	C2 side A stator 2	1" BW
C2 side B stator 1	C2 side B stator 2	1" BW
C2 side B stator 1	jct. L9/L10/L11/L12	3" W
S2A pin 1	jct. L9/L10/L11/L12	L9
S2A pin 2	jct. L9/L10/L11/L12	L10
S2A pin 3	jct. L9/L10/L11/L12	L11
S2A pin 4	jct. L9/L10/L11/L12	L12
jct. L13/L14/L15/L16	jct. L9/L10/L11/L12	R7
jct. L13/L14/L15/L16	C3 rotor	3" W
S2B pin 1	jct. L13/L14/L15/L16	L13
S2B pin 2	jct. L13/L14/L15/L16	L14
S2B pin 3	jct. L13/L14/L15/L16	L15
S2B pin 4	jct. L13/L14/L15/L16	L16
S2A arm	S2B arm	0.5" BW
S2A arm	S3 "Wire" pin	4" W
J2	G1 internal lug	1.5" BW
J2	R2 CW pin	6" W (TP)
S3 arm	R2 CCW pin	6" W (TP)

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Mini-MWDX-3 Wiring/Component Connections, continued

From	To	Description
R2 CW pin	R3 CCW pin	4" W
R3 CCW pin	C3 rotor	1.5" BW
R3 CCW pin	R1 CW pin	4" W
R3 arm	R3 CW pin	0.5" BW
R1 CCW pin	S1A arm	3" W
S1A arm	S1B arm	0.5" BW
jct. L5/L6/L7/L8	R3 arm	R5 + 2" W
S1A pin 1	jct. L1/L2/L3/L4	L1
S1A pin 2	jct. L1/L2/L3/L4	L2
S1A pin 3	jct. L1/L2/L3/L4	L3
S1A pin 4	jct. L1/L2/L3/L4	L4
S1B pin 1	jct. L5/L6/L7/L8	L5
S1B pin 2	jct. L5/L6/L7/L8	L6
S1B pin 3	jct. L5/L6/L7/L8	L7
S1B pin 4	jct. L5/L6/L7/L8	L8
C1 side A stator 1	C1 side A stator 2	1" BW
C1 side B stator 1	C1 side B stator 2	1" BW
J1	C1 side A stator 1	C5
C1 side B stator 1	C3 stator	C4
C1 side B stator 1	jct. L1/L2/L3/L4	3.5" W
R2 arm	T1 "In" pin (P1)	R8 + 3" W
R1 arm	S4A arm	R6 + 3" W
T1 "Out a" pin (P3)	S4C arm	4" W
T1 "Out b" pin (P4)	S4B arm	5" W
S4B "1" pin	S4B "2" pin	0.5" BW
S4B "2" pin	S4B "Null-a" pin	0.5" BW
S4B "1" pin	S4C "Null-b" pin	2.5" W
S4C "Null-b" pin	T2 ground lug	3" W
T2 "In 2" pin (P2)	S4A "Null-b" pin	3" W
S4A "Null-a" pin	S4A "Null-b" pin	0.5" BW
S4A "1" pin	S4A "Null-a" pin	1" W
S4B "Null-b" pin	S4C "2" pin	1" W
S4C "2" pin	S4C "Null-a" pin	0.5" BW
S4C "Null-a" pin	T2 "In 1" pin (P1)	1.5" W
T2 "Out" pin (P3)	R4 CCW pin	4" W
R4 CW pin	R4 switch side nr CCW pin	1.5" W
A1 pin P2	R4 switch side nr CW pin	1" BW
R4 arm	S5A arm	3" W
S5A "off" pin	S5C "off" pin	C8
S5A "on" pin	A1 pin P1	3" W
S5B arm	A1 pin P3	2" W
S5B "on" pin	C9 internal lead	3" W
S5C arm	J5	3" W
S5C "on" pin	A1 pin P5	2" W

****

"Mini-MWDX-3" Phasing Unit Operation

Case 1: Two-Wire Phasing

1.0 Initialise Controls

1.1 Set C1, C2, C3, & R3 to midrange (pointers at 12 o'clock).

1.2 Set R1, R2, R4 to fully CCW (pointers at approx. 8 o'clock).

1.3 S1, S2, & S4 will be set in sections 2.0 & 3.0.

1.4 Set S3 to Wire and set S5 to Amplifier Off.

1.5 Connect wire antenna #1 to J1, earth ground to J2, wire antenna #2 to J3, receiver to J5, and a 9-volt battery to J6. (No connection to J4)
Wires used should be of similar length; minimum suggested length = 50 ft./15 m.

2.0 Line 1 Tune

2.1 Set S4 to 1.

2.2 Set S1 to position with strongest wanted-frequency signal, or set S1 according to "look-up table".

2.3 Adjust C1 for maximum signal at frequency of operation.
If the peak is near the CCW (fully meshed) position of the C1 knob, set S1 to the next CCW position; then repeat C1.
If the peak is near the CW (fully open) position of the C1 knob, set S1 to the next CW position; then repeat C1.

3.0 Line 2 Tune

3.1 Set S4 to 2.

3.2 Set S2 to position with strongest wanted-frequency signal, or set S2 according to "look-up table".

3.3 Adjust C2 for maximum signal at frequency of operation.
If the peak is near the CCW (fully meshed) position of the C2 knob, set S2 to the next CCW position; then repeat C2.
If the peak is near the CW (fully open) position of the C2 knob, set S2 to the next CW position; then repeat C2.

4.0 Equalise Levels

4.1 Switch S4 between 1 and 2; note (on S-meter or audibly) which S4 position yields the stronger signal from the STATION TO BE NULLED (hereafter to be defined as the "pest" station).

4.2 If S4 position 1 yielded a stronger pest level, adjust R1 until the S4 position 1 & position 2 pest station strengths are approximately equal.

4.3 If S4 position 2 yielded a stronger pest level, adjust R2 until the S4 position 1 & position 2 pest station strengths are approximately equal.

5.0 Initiate Nulling

5.1 Switch S4 between Null-a & Null-b positions. Leave S4 on the position which offers the lower level of pest signal / greater evidence of subdominant stations.

5.2 If you had used R2 (step 4.3) or had used neither R1 or R2 in section 4.0, tweak C1 to get a "dip" (null of pest).
Leave C1 at dip point & fine-tune dip further by successive adjustments of R2 & C1. Then tweak C2 for any additional further nulling.

5.3 If you had used R1 (step 4.2), tweak C2 to get a dip.
Leave C2 at dip point & fine-tune dip further by successive adjustments of R1 & C2. Then tweak C1 for any additional further nulling.

6.0 Finalise Nulling

6.1 Use Null Vernier controls C3 & R3 to obtain as complete a pest-null as possible.

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7.0 Amplification

7.1 Adjust R4 to fully CW (minimum output).

7.2 Set S5 to Amplifier On.

7.3 Turn R4 gradually CCW to obtain maximum signal at operating frequency, consistent with no spurious signal products from strong off-channel stations. In most areas, R4 may be set to fully CCW (maximum output).

7.4 If null is partially lost when amplification is applied (an unlikely occurence with a shielded receiver), re-iteration of steps 5.2, 5.3, and 6.1 should re-establish the null.

****

Case 2: Wire vs. Loop Phasing

1.0 Initialise Controls

1.1 Set C1, C3, & R3 to midrange (pointers at 12 o'clock).

1.2 Set R1, R2, R4 to fully CCW (pointers at approx. 8 o'clock).

1.3 S1 & S4 will be set in subsequent sections.

1.4 Set S3 to Loop and set S5 to Amplifier Off.

1.5 C2 and S2 are not used; their positions are irrelevant.

1.6 Connect wire antenna (50 ft. / 15 m. minimum length) to J1, earth ground to J2, loop amp. output (coax. cable) to J4, receiver to J5, and a 9-volt battery to J6. (No connection to J3)

1.7 NOTE: Loop to be used should have a "Q-spoiling" resistor (suggested value = 15K) across its main L-C tank. This resistor should be in series with a toggle switch so that the loop may be used in its normal high-Q state during non-phasing applications.

2.0 Line 1 Tune

2.1 Set S4 to 1.

2.2 Set S1 to position with strongest wanted-frequency signal, or set S1 according to "look-up table".

2.3 Adjust C1 for maximum signal at operating frequency. If the peak is near the CCW (fully meshed) position of the C1 knob, set S1 to the next CCW position; then repeak C1. If the peak is near the CW (fully open) position of the C1 knob, set S1 to the next CW position; then repeak C1.

3.0 Line 2 Tune

3.1 Set S4 to 2.

3.2 Turn loop power on; position loop for direction of desired DX stations. Switch Loop "Q-switch" (see section 1.7) to High Q (e. g. open).

3.3 Adjust the loop tuning capacitor for maximum signal at the frequency of operation.

3.4 Set loop Q-switch to Low-Q (15K loop tank shunt).

4.0 Equalise Levels

4.1 Switch S4 between 1 and 2; note (on S-meter or audibly) which S4 position yields the stronger signal from the STATION TO BE NULLED ("pest" station).

4.2 If S4 position 1 yielded a stronger pest level, adjust R1 until the S4 position 1 & position 2 pest station strengths are approximately equal.

4.3 If S4 position 2 yielded a stronger pest level, adjust R2 until the S4 position 1 & position 2 pest station strengths are approximately equal.

5.0 Initiate Nulling

5.1 Switch S4 between Null-a & Null-b positions. Leave S4 on the position which offers the lower level of pest signal / greater evidence of subdominant stations.

5.2 If you had used R2 (step 4.3) or had used neither R1 or R2 in section 4.0, tweak C1 to get a "dip" (null of pest). Leave C1 at dip point & fine-tune dip further by successive adjustments of R2 & C1. Then tweak the loop tuning capacitor for any additional further nulling.

5.3 If you had used R1 (step 4.2), tweak the loop tuning capacitor to get a dip. Leave the loop cap. at dip point & fine-tune dip further by successive adjustments of R1 & the loop tuning cap. Then tweak C1 for any additional further nulling.

6.0 Finalise Nulling

6.1 Use Null Vernier controls C3 & R3 to obtain as complete a pest-null as possible.

6.2 Slight physical re-positioning of the loop may assist in establishing the final null.

7.0 Amplification

7.1 Adjust R4 to fully CW (minimum output).

7.2 Set S5 to Amplifier On.

7.3 Turn R4 gradually CCW to obtain maximum signal at operating frequency, consistent with no spurious signal products from strong off-channel stations. In most areas, R4 may be set to fully CCW (maximum output).

7.4 If null is partially lost when amplification is applied (an unlikely occurence with a shielded receiver), re-iteration of steps 5.2, 5.3, 6.1, and 6.2 should re-establish the null.

Model "Mini-MWDX-3P" Passive Phaser

This is a simplified version of the Mini-MWDX-3 having no amplifier. It is intended to be used with an external tunable or broadband amplifier, or (with no external amplification) directly to the input of a sensitive receiver.

The following Mini-MWDX-3 components are deleted: A1, C9, J6, R4, S5, and associated hardware.

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C8 is then routed from the T2 balun output to RF-out jack J5.

Top side holes 14 through 19, 28, & 29 need not be drilled; similarly, delete right side holes 5, 6, & 7. Adjust all other documentation in similar fashion.

Options for Mini-MWDX-3 Phasing Unit

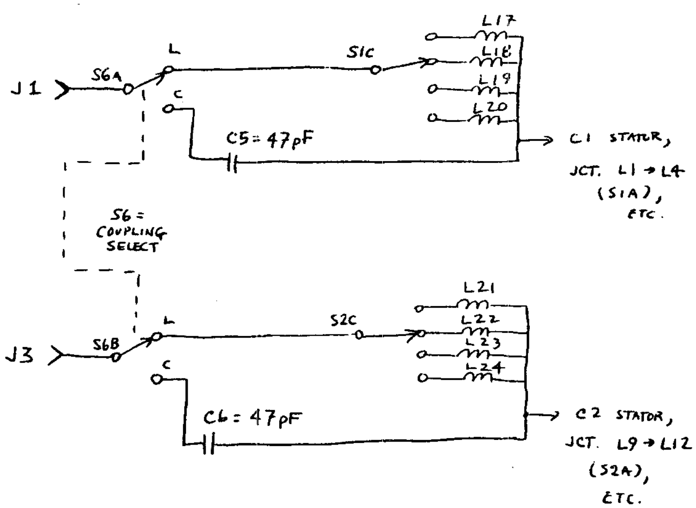
1. Inductive Coupling

This option is intended to improve tuner operation with longer aerials whose reactance may be inductive. It entails the addition of a switch S6 (DPDT on/on toggle) at left side loci (-1.5, 1.0, 0.25 = shaft; -1.5, 1.25, 0.113 = tab); the addition of 4 inductors to S1 (designated L17 through L20) and 4 inductors to S2 (designated L21 through L24); and increasing C5 & C6 to 47 pF. Coil values are as follows:

	Longwave (Opt. 2)	Medium Wave (Standard)	Tropical Bands (Opt. 3)
L17, L21	18000	1800	120
L18, L22	8200	820	56
L19, L23	3900	390	27
L20, L24	1800	180	12

(I N D U C T A N C E in u H)

Option 1 schematic:



2. Longwave coverage instead of MW

A phasing unit capable of 140-600 kHz operation is the result of this modification. J. W. Miller F-87-1 cores are used instead of the Amidon FT-82-77 cores on T1 & T2. Coils on S1 & S2 are changed to the following values (uH):

L1, L9	4700	L5, L13	820
L2, L10	2200	L6, L14	390
L3, L11	1000	L7, L15	180
L4, L12	470	L8, L16	82

3. Tropical-Band coverage instead of MW

A phasing unit capable of 1600-6400 kHz operation is the result of this modification. Coils on S1 & S2 are changed

to the following values (uH):

L1, L9	33	L5, L13	5.6
L2, L10	15	L6, L14	2.7
L3, L11	6.8	L7, L15	1.2
L4, L12	3.3	L8, L16	0.68

4. Extended Range coverage (6-position S1 & S2)

S1 & S2 are changed to 6-position 2-pole rotary switches. This cannot be combined with options 1, 2, or 3. Coils are changed in accordance with the following tables:

Option 4A: 140-390; 480-1700 kHz

S1	S2	uH	S1	S2	uH
L1	L13	4700	L7	L19	820
L2	L14	2200	L8	L20	390
L3	L15	470	L9	L21	82
L4	L16	220	L10	L22	39
L5	L17	100	L11	L23	18
L6	L18	47	L12	L24	8.2

Option 4B: 140-1800 kHz

S1	S2	uH	S1	S2	uH
L1	L13	4700	L7	L19	820
L2	L14	1800	L8	L20	330
L3	L15	680	L9	L21	120
L4	L16	270	L10	L22	47
L5	L17	100	L11	L23	18
L6	L18	39	L12	L24	6.8

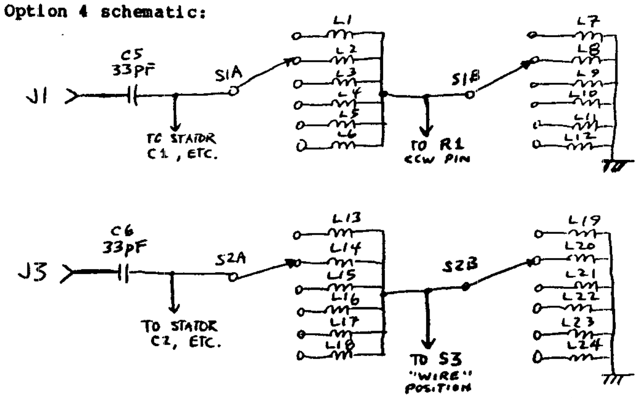
There is a slightly greater chance that ranges may not meet when long aerials are used if option 4B is used instead of option 4A.

Option 4C: 500-6400 kHz

(Use external 33 pF capacitor in series with each antenna wire if frequency ranges do not meet.)

S1	S2	uH	S1	S2	uH
L1	L13	390	L7	L19	68
L2	L14	150	L8	L20	27
L3	L15	56	L9	L21	10
L4	L16	22	L10	L22	3.9
L5	L17	8.2	L11	L23	1.5
L6	L18	3.3	L12	L24	0.56

Option 4 schematic:



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5. Alternative Potentiometer Configuration

In this option, the main pots R1 & R2 "skew the Q" as well as the level. Smoother null adjustments, in some circumstances, may result. This option is included here for the experimentally-inclined. In reading the following description, refer to the standard Mini-MWDX-3 schematic. The term "B25K" will be used hereinafter to mean "0 to 25 kilohm linear taper potentiometer".

(a) Change R6 to 270 ohm.

(b) Remove existing R1 pot.

(c) Connect side of R6 (that had gone to former R1 arm) to S1B arm.

(d) Remove connection between other side of R6 and S4A arm.

(e) Remove existing R2 pot.

(f) Connect side of R8 (that had gone to former R2 arm) to S3 arm.

(g) Remove R3 pot and R5 (2.7K).

(h) Remove R7 (15K).

(i) Install B25K (to be designated R1) in former R1 mechanical chassis location.

(j) Install B25K (to be designated R2) in former R2 mechanical chassis location.

(k) Install 100 ohm linear pot (to be designated R3) in former R3 mechanical chassis location.

(l) Connect arm & CCW pin of new R1 to S1A arm.

(m) Connect CW pin of new R1 to chassis ground (e. g. C3 rotor lug).

(n) Connect arm & CCW pin of new R2 to S2A arm.

(o) Connect CW pin of new R2 to chassis ground (e. g. C3 rotor lug).

(p) Connect arm & CCW pin of new R3 to free end of R6 (from step d).

(q) Connect CW pin of new R3 to S4A arm.

(r) Replace 15K fixed Q-spoiling resistor on loop antenna with a B25K pot. You'll still want to be able to switch the pot out for non-phasing, high-Q loop applications.

Procedurally, the only change to the operation notes is that in loop vs. wire phasing, the pot installed on the loop is to be used instead of R2.

END

IRCA REPRINT LIST (No. PB-2)

Quite a few articles have appeared in DX Monitor since the club started in 1964. They offer a wide variety of information on broadcast band DXing. This is the list of reprints and other items which are currently available. Numbers in parenthesis are the total number of pages contained in the reprint. Designations in parenthesis following the descriptions are other IRCA publications in which the reprint appears (or was taken from). Descriptions of these other IRCA publications appear at the end of the list.

ANTENNAS

A1 Construction of a Directional Spiral Loop Antenna (1) Dallas John/Keith Birlingmair. Construction details for a simple inexpensive loop antenna. 9/73 (NMP/T2)

A2 Construction of a "Box" Loop Antenna (2). Plans for a large unamplified four foot box loop. 3/69

A3 DCL Construction Plans (1) Dave Fischer. Schematic for a Direct Coupled Loop Antenna. Some receiver modification required. 1/70

A4 Roll Your Own (1) Dave Fischer. Hints on the construction of a simple two-foot box loop antenna. 12/69

A5 The Loop-Sensor Cardioid Array (LSCA) (1) Ron Schatz. Introductory thoughts about combining signals from a loop and a longwire or vertical, which can produce a heart-shaped pattern. See A6, A7 and A18. 5/71

A6 Some Comments on the Loop-Sensor Cardioid Array (2) Gordon Nelson. Discusses some shortcomings of the theory described in A5. 8/71

A7 The Loop-Sensor Cardioid Array (7) Ron Schatz. In depth description of the LSCA, with construction hints and examples of reception. See A5. 9/73

A8 Two-Foot DCL Plans (3) Ralph Sanserino/Nick Hall-Patch. Updated construction plans for a two-foot box loop and pre-amplifier, the "Sanserino Loop". Very well done. 10/80

A9 The Shielded Ferrite Loop: Principles and Practice (4) Joe Worcester. Theoretical description of a Ferrite rod loop antenna, used by many DXers because of its small size. See A10 for construction details, also A31. 2/70

A10 How to Build the SPACE MAGNET Shielded Ferrite Loop (6) Joe Worcester. Very thorough plans for constructing the antenna described in A9 (SM-1/2). Includes photo. 1/71

A11 The Super Signal Snatcher (4) Dave Fischer. Theory on the set up and operation of a Beverage antenna (a very long wire), with tables and graphs. See A15, A16, A19, A23, A42 and A46. 12/72

A12 Using Two Loop Antennas to Generate Asymetrical Receiving Patterns (1) Mike Levintow. Describes how the simultaneous use of two loop antennas can distort the pattern of a single antenna, possibly nulling out some stations otherwise unnullable. 12/73

A13 The Wedge (3) Charles Wolff. Detailed plans on a space saving wedge-shaped air-core loop. Includes tuning instructions and base construction. 11/75

A15 NEBE (3) Dave Fischer. Describes the construction and results of a Beverage antenna DXpedition in the middle of Nebraska. 3/75

A16 Report on the Beverage Antenna DXpedition (1) Don Kenney. Describes a DXpedition to the Mojave Desert using two Beverage antennas, one 2800'/850m, the other 6000'/1830m. Results are discussed. See A11. 9/72

A17 Loops for the Barlow Wadley, (or anything else) (1) Grant Manning/Ralph Sanserino. Directions for modifying a XCR-30 so it can be used with a ferrite rod antenna. Also includes two schematics for single ended FET preamplifiers. 8/75

A18 LSCA-2 (4) Ron Schatz. Construction plans for an updated version of the LSCA (described in A7) which is easier to build and use. 3/76

A19 Some Thoughts on Beverages (1) H. John Clements. An experienced Beverage user gives some hints to potential Beverage antenna builders. See A11. 4/78

A20 4 Commercially Available Ferrite Loops (1) Michael Sapp. Author compares the performance of the SM-2, MW-1, DA-5/7 and Palomar ferrite core antennas. Several areas of concern to the DXer are addressed, and each antenna is rated. 6/78 (T2)

A21 Amplifiers/Tuners for Longwires (1) Brian Sherwood. Two circuits for amplifying the signal from a coupled longwire to a receiver. See A27. 1/79

A22 MW-1 vs SM-2 (1) Mark Connelly. Two popular ferrite core loop antennas are compared by an experienced DXer. See A35. 3/79

A23 The Jordan River Beverage Expedition (1) Nick Hall-Patch. DXers brave the wilds of Vancouver Island in order to hear DUs on a Beverage. See A11. 8/79