M41-3-1 3

the irca technical column

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Review: the MWDX-2B Phasing Unit

by Jim Herkimer

In the November 21-28, 1981 issues of DXM, (Reprint A38) Mark Connelly published a comprehensive article describing construction of the MWDX-1 phasing unit. I built this unit and found it to be extremely useful. Results are described in the August 20, 1983 DXM, Reprint A49. It was my first experience with phased wires and it provided numerous DX catches that would have been difficult, if not impossible, with a loop.

Mark has since designed subsequent units offering several improvements over the original version. One of the latest of these, the MWDX-2B, was recently constructed here and I'm quite impressed with its performance. Among its advantages over the MWDX-1 are: substantially greater output (as a passive phasing unit), improved nulling capability, easier construction, and the addition of two features previously unavailable.

Substantially greater output: the inductive voltage divider system handles a wide range of input impedances without the adverse effects of tank loading. With the MWDX-1, some difficulty was experienced at times in obtaining a defined "peak" in each line leg. Additionally, the MWDX-1 called for J.W. Miller T-106-2 or F-87-1 cores for the transformers. It was later discovered that the T-106-2 was unsatisfactory at BCB frequencies, while the F-87-1, a far better choice, now sells for $6.34 each. At 90 cents, the Amidon 82-77 provides good performance at reasonable cost. The tighter coupling used in the MWDX-2B improves rejection of spurious responses with greater signal transfer.

Improved nulling capability results from the elimination of "cross-talk" between input sections. Fewer control manipulations are required in obtaining nulls, and null depth on locals is increased. The MWDX-2 (and 3) series utilize air variable capacitors which provide smoother operation than the miniature transistor radio type used in the MWDX-1. The latter were prone to early failure and dust entry. The reconfigured pot scheme (25 k is preferred to 50 k for the line level controls) also provides smoother operation, allowing simultaneous control of line level and Q-spoiling.

Although the various controls fill up the top of the enclosure, there is ample room inside for the associated wiring, making construction considerably easier. The earlier MWDX-1 provided series or parallel tuning of each line leg, plus choices of output: balanced, unbalanced-1 (one output side grounded) and unbalanced-2 (both outputs tied together). The newer version, lacking these features, requires less circuitry (12 controls/switches vs. 16) and construction time is therefore reduced.

Two additional features have been added to the MWDX-2 series phasing units: (1) a length switch, which allows antennas either capacitive or inductive in their reactance to be successfully tuned, and (2) provision for loop vs. wire phasing, for additional phasing flexibility. The latter provision also allows quick comparisons to be made between the phased wires or the loop alone. At times, one or the other will show better response depending on prevailing conditions. Finally, the sturdier construction in the MWDX-2 series is an obvious advantage, and it is likely that the MWDX-2B will see frequent use here.

(---Thanks to Mark Connelly for the design, and for help in obtaining some of the components.)

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The R71 Performance Manual is a publication of great interest to those who presently own or are thinking of purchasing an ICOM R71. Written by Don Moman, it provides many simple modifications that almost anyone could perform, each of which could be worth the price of the book to the R71 owner. Detailed instructions, including schematics and pictorials, are given on how to improve AM selectivity, increase medium wave sensitivity, enable the notch filter to function in the AM mode, tune below 100 kHz and much more. Alignment instuctions are also included so that you can adjust the R71 for maximum performance, with or without expensive test equipment.

This manual is available for $10 U.S. funds in the USA and elsewhere in the world, including airmail postage. Outside N. America, 25 IRC's will also do. In Canada, the price is $10 Canadian. Orders to: Shortwave Horizons, 6815 - 12 Ave., Edmonton, Alberta, Canada T6K 3J6.

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and still on ICOM...

ICOM IC-R70 Modifications

by Laurens B. J. Engel

Most owners of the ICOM IC-R70 communications appear to agree on at least two points: it is a very good receiver and it certainly can be improved. The manufacturer must have felt the same because it now produces an improved receiver, IC-R71, with the differences being mainly of an operational rather than a performance nature.

It seems possible to correct many of the R70's drawbacks by making available a reprogrammed microprocessor chip and hopefully ICOM will do that. In the meantime there are a few modifications that this owner found useful, and that can be made without irreversible effects such as drilling holes and uprooting p.c. cards. By utilizing the existing controls and inside space, circuitry can be added that taps into the original wiring at convenient locations. The board layout supplied with the set is used as primary reference for the following description of the modifications. Some part numbers, jack numbers etc. are slightly different on the board layout from the schematic diagram; when in doubt, refer to the board layout rather than the schematic.

The first change is of a protective nature and concerns the R.F. inputs. (see Figure 1). Its principle applies equally well to other receivers with diode bandswitching in the front end. These diodes produce lots of spurious responses under zero bias conditions and with strong R.F. signals present. This situation occurs when the set is switched off but is still connected to the antenna. These responses are then actually transmitted back out via the antenna! This is easy to demonstrate with another receiver close by or connected to the same antenna. The modification consists of the addition of a low power DPDT relay that disconnects the receiver from the antenna and shorts the input circuits to ground when the receiver is switched off. In combination with a lightning arrestor on the antenna, this provides reasonable protection.

Any small 12 V relay will work. From an energy saving point of view (power supply overloading and battery operation) it is best to select a sensitive relay and/or add as high value as possible series resistor with the coil. The relay is mounted directly to and behind the "Ant (1)" "Ant (2)" connectors by using stiff connecting wires to the antenna connectors and to the ground lugs of the RCA type "Scope" and "Converter" connectors. The original wires from the "R.F.Unit" board (located on the right side of the receiver) to the "Ant (1)" and "Ant(2)" connectors are soldered to the appropriate relay pins. The 13.8 V for the relay coil is taken from the blue wire connected to the R.F. board between L81 and C126.

The second modification concerns the R.F. preamplifier. As the preamp has (reduced) gain below 1.6 MHz, manual on/off switching is preferable. Referring to the "R.F. Unit" board layout, cut the long wire on the J3 side of R59 about 2 mm from the body of R59 (see Figure 2 for the schematic). Solder a short (10 mm) piece of bare wire from the 2 mm body side of R59 to the long wire on the C128 side of R57 (remember we're looking at the board, not the schematic), between Q2 and Q3, thus preventing Q2 from switching the preamp off when operating below 1.6 MHz. Beware of preamp overload in this mode!

The third modification consists of the partial elimination of the R18, R19 and R20 attenuator below 1.6 MHz, also on the "R.F. Unit" board. Cut the long wire on the C74 side of R20, about 2 mm from the body. Then short out R18 by soldering about 10 mm of bare wire from the long wire on R19 to the long wire of R18. This leaves R19 still in the signal path but without the "R.F. board" removal there seems no easy way to correct that.

The fourth modification improves the audio characteristics somewhat by reducing the low frequency response. Referring now to the "Main unit" board: cut the long wire on the C114 side of R153. Solder a 0.03 uF/25V ceramic capacitor between the remains of the long wire of R153 and the jumper directly on the other side of R153, along the heatsink. This reduces the effective value of the coupling capacitor C114. Next remove C111 by cutting or crushing this capacitor in order to leave as much as possible of its mounting leads available to solder a ceramic or polyester capacitor of 0.02 uF/25V to. See Figures 3 and 4 respectively for these modifications.

M41-3-2 3

Fig. 1 On "R.F. Unit" board.

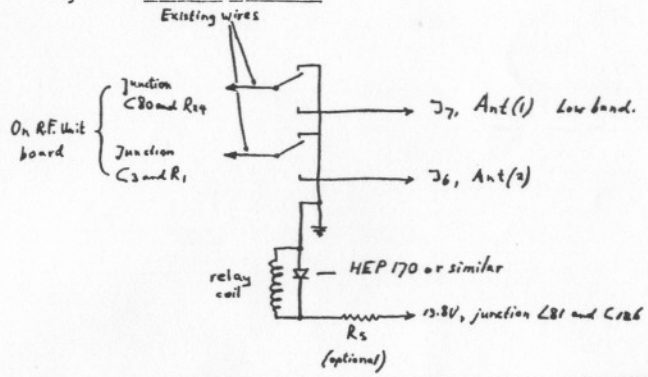


Fig 2 On "R.F. Unit board.

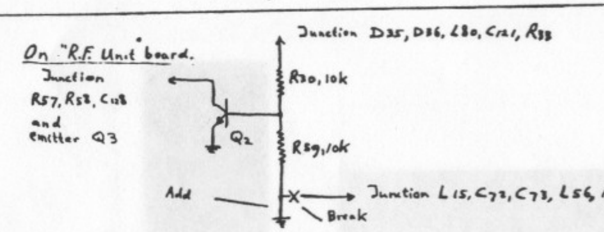


Fig. 3 On "R.F. Unit" board.

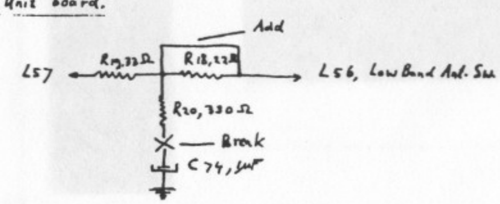
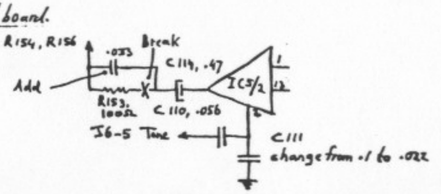


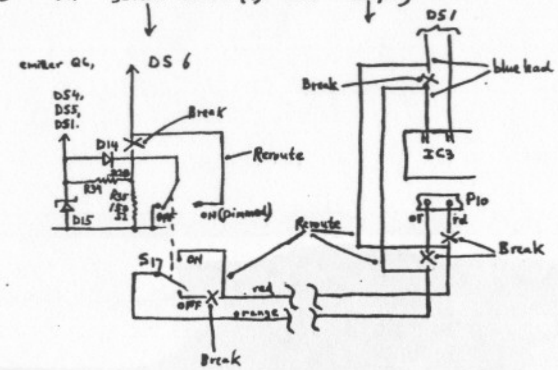
Fig 4 On "Main Unit" board.



The fifth modification provides switching between dimmed dial lights "ON" and "OFF", eliminating the much too bright lights. This saves both the fluorescent display and energy, important in case of battery operation. See Figure 5. Referring to the "Display" board, and working from above, locate the blue wire running behind the fluorescent display from "X" to "X". This is one of the filament leads. Cut it in the middle and strip both ends. Now cut the red and orange leads to pin 2 and pin 3 of J1 about 15 mm from the plug. Bend the 2 pigtails connected to the plug towards the rear and down. Strip the other red and orange leads and solder them to the blue leads. Use sleeving to insulate. Turn the set upside down and locate S17 on "Switch Board 1". The boards are pictured from the component side, so

is left-right reversed as viewed from the rear of the set. The red lead goes to "P10 2" and the orange lead to "P10 3". Towards the bottom of the set and directly under "P10 2" and "P10 3" are the 6 terminals of S17. Unsolder the red lead and connect it to the second (and unused) terminal of S17 from the tuning knob edge of the board. Next unsolder the white lead DS 6 (from the meter light), next to the original red lead connection, and solder it to the fifth (and unused) terminal of S17. With the "Dimmer" in the "ON" (pushed in) position everything will be on as before, i.e. dimmed. In the "OFF" position the digital display and the meter light will be off but the other LEDs will still be on in their original bright mode.

Fig. 5 On "Switch" board (1) and "Display" board.

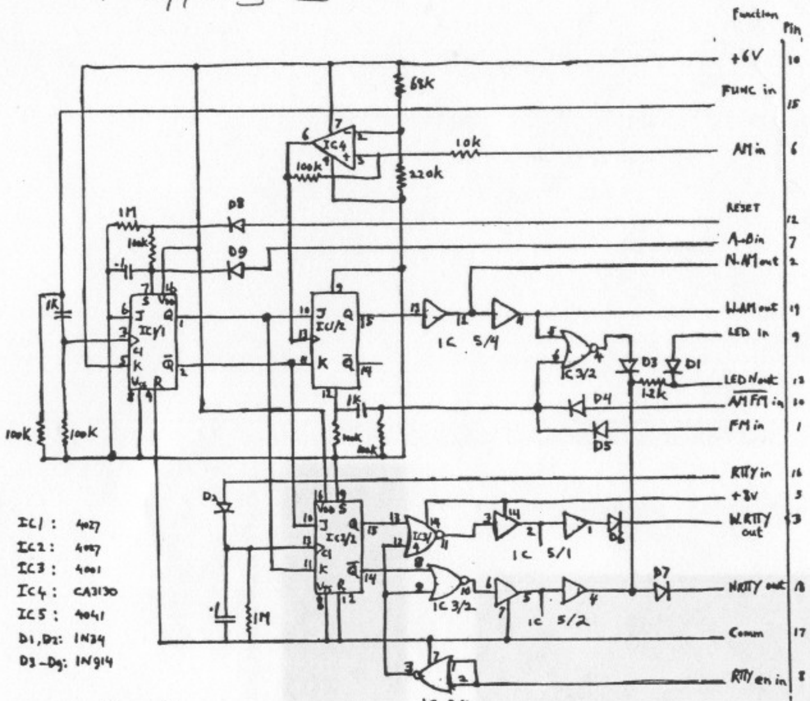


The sixth change provides a convenient way of selecting the RTTY "Narrow" and "Wide" modes as well as improved AM selectivity by using the existing "Function" button with the appropriate "AM" or "RTTY" mode buttons for narrow band selection. Already built-in to the set are a ceramic 455 kHz filter with a 2.6 kHz bandwidth, used for SSB, and a ceramic 455 kHz filter with a 6 kHz bandwidth, used for AM, as well as an internal RTTY "W-N" switch. All these modes are electrically activated. By interrupting the signals and re-routing them through some control logic (a new circuit which is constructed and then connected up inside the R-70) together with additional signals and utilizing some unused contacts of the "Function" and "A→B" switches, these changes can be implemented quite nicely, with the "CW N" LED providing a similar indication for the AM "Narrow" and RTTY "Narrow" modes. By using the "always on" 6 V power supply of the logic unit the selected modes are "remembered" when the set is switched off. The internal RTTY N-W switch is disabled by positioning its slide button exactly in the center of its travel. The use of CMOS logic limits the current drain to a few milliamps.

The control logic consists of a flip-flop IC 1/1, controlled by the "Function" button and it in turn controls two flip-flops, IC 1/2 and IC 2/2, one each for the AM and the RTTY signals respectively, together with the already existing signals. See Figure 6. In addition there is a waveshaping comparator, IC 4, and some inverters and buffers IC3, drivers, IC5, and isolation and rectifier diodes. For ease of construction and modification prototypes were wire wrapped onto 2.5" x 1.5" perforated boards with a 0.1" hole pattern. A 20 conductor ribbon cable, plugged to the perf board and soldered to the respective boards of the R70, provides a neat and convenient means of connecting the circuit. The perfboard is mounted in the logic board compartment by means of a spacer and a 3.5 mm bolt to the existing 3.5 mm threaded hole near the center of the vertical metal partition between the logic and the PLL board compartments.

(AM "Narrow" filtering in the R70 can be accomplished more simply, but it involves adding a switch to the radio. See the technical column in the August 20, 1983 DXM.)

M41-3-3



IC1 : 4027
IC2 : 4027
IC3 : 4001
IC4 : CA3130
IC5 : 4041
D1, D2 : 1N34
D3 – D9 : 1N914

Fig. 6

Wiring connections:

From Pin #	To:	Connect to:
10	Logic board	Jumper near J12, next to D18
15	Switch board (1)	Unused S15 contact nearest PBT, grey. Also connect a short jumper from other unused S15 contact directly above R 3 2 1/P8 2 to R3 2 1/P8 2 (is +8 volts)
6	Switch board (1)	P5 1, beige
12	Logic board	Jumper near IC3, pin 13-14
7	Switch board (1)	Unused S8 contact between P5 2, red and P6 10, black
2	Main unit	Cut R75 wire, connect to body side. See AMFM
19	Main unit	Cut R81, connect to wire side next to R78
9	Logic board	Cut jumper near C94 in middle, connect to stub near IC16. See LED N out.
13	Logic board	Jumper half near C94. See LED in.
10	Main unit	Connect to R75 wire side next to R87. See N.AM out
1	Main unit	2nd jumper "above" R130 near J9
16	Switch board (1)	P6 3, orange
5	Switch board (1)	P8 2, grey, and bare wire to R3-1 RF gain, R3-2 AF gain
3	Main unit	Cathode D41, away from J10
18	Main unit	Cathode D43, next to RTTY W-N switch, N side.
17	Switch board (1)	R3 1 2, black, board mounting bolt near phone jack
8	Logic board	L16 coil wire nearest J11

MWDX-2B & MWDX-2C PHASERS

(Design Enhancements to the MWDX-2A Phasing Unit)

Mark Connelly -- WA1ION DX Labs -- 11 FEB 1985

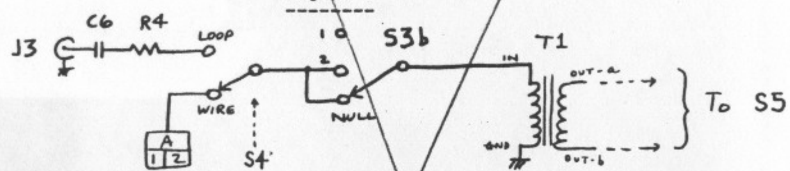
The MWDX-2A phasing unit design (released 25 JUN 1984) provides good output level without, in most cases, the need for amplification. (The recently-described Mini-MWDX-3, on the other hand, usually does require the use of its output amplifier.)

Some recent experimentation has given rise to several improvements and consequent (generally minor) modifications to the MWDX-2A design. The units having these modifications will be referred to as MWDX-2B and MWDX-2C.

MWDX-2B MODIFICATIONS

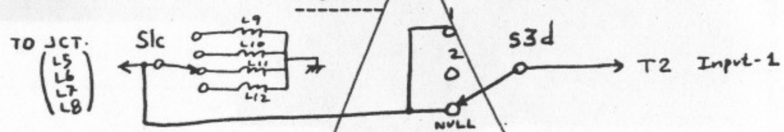
1. Put the b section of S3 between the S4 arm and the T1 input: C6 will then be routed directly to R4. See Figure 1.

Figure 1



2. Use (previously-unused) d section of S3 between S1c arm and T2 Input 1. See Figure 2.

Figure 2



3. Delete 330 ohm resistors R5 & R6. (Replace with open.) Modifications 1 & 2 eliminate a possible cross-talk problem (Line 1 to Line 2, and vice versa) which these resistors attempted to "band-aid".

4. Connect the S6a arm to the 1 & N pins of S3a instead of to the S3a arm. The S3a arm remains connected to the R3 pot CCW pin. This reduces propagation of Wire #1 load-change effects across to Wire #2 when S3 is switched.

5. Connect the S6b arm to 2 & N pins of S3c instead of to the S3c arm. Reason: same as for Modification 4.

These are the differences that distinguish the MWDX-2B from the earlier MWDX-2A. None of the hole locations is changed; none of the usage instructions is changed. An additional change that some may want to implement is the use of 25K linear pots, rather than 50K linear pots, for R1 & R2: this may give somewhat smoother adjustments. The presence of the vernier R and C controls should, however, provide sufficiently smooth nulling. Use of Q-pots less than 20K will not allow sufficient phase-shifting; use of pots of 100K or more will yield excessively touchy nulling.