

M.A.N. 2-3-4 DIGITAL SYSTEM

PART TWO

By DON BAISDEN . . . in this installment we lead through pitfalls of assembly and soldering of the kit of the M.A.N. 2-3-4 Digital system. For those who like the experimental advantages of assembling an electronic device we know this will go together well

► Last month we introduced you to the M.A.N. 2-3-4 system and guided you through the construction of the transmitter "semi-kit." This month for the more intrepid, we will do the kit version of the transmitter and the dual charger. Actually, all we must do is to bring the transmitter kit to "semi-kit" stage and refer you to last month's article.

Before we plug the soldering iron into the wall and start broiling components, permit us to indulge in some preliminary comments of a "how-to-do" nature, and a bit of our "philosophy."

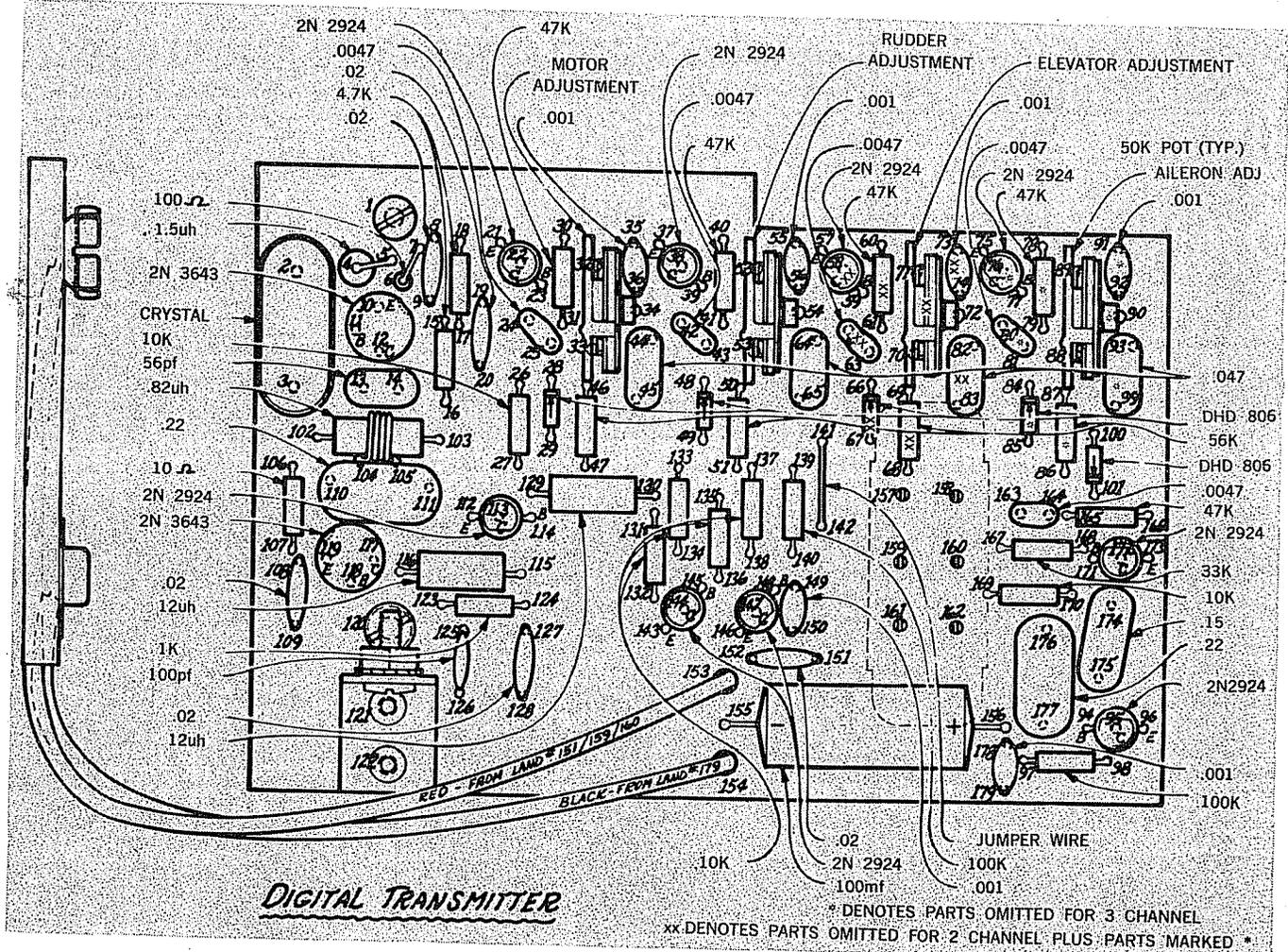
You may notice a difference between this series and comparable ones in other magazines. First, our articles are "tight", "concise", we would like to think ("skimp", our competitors might say). We do not engage in offering options, i.e., four stick possibilities, three configurations, elaborate sheet metal courses

and "electronics" that few without an E.E. degree can comprehend. We do not believe that a couple of hundred dollars should buy our readers a "tinkerer's delight." It should purchase a reliable efficient system comparable to the best commercial units . . . and that's just what we've done. This series is a distillation . . . there is no more here than you need to build the system . . . and no less. Our problem, unlike others, is not "how to fill space."

If you're an "electronics" type, enjoy our circuit descriptions, and analyze the schematics. If you're a model airplane builder and flyer without interest or ability in electronics, make believe you're baking a cake, simply follow the recipe and enjoy the results . . . if you require a lot of "icing" perhaps you should try a different pastry chef. Two transmitters were built from this, and

the preceding article before we set type—both worked beautifully and immediately . . . and both were built by a type that still refers to the components as "colored beads."

You scratch builders are not going to love us we fear. All we are going to give you are essentials, i.e., circuit boards, schematics, and a general parts list (without manufacturers' names and numbers). You rugged types and others can lay out your own boxes, etc., and truly earn the medals you bestow on yourselves. We will repeat . . . our research indicates that you can't save enough to really make scratch building worthwhile, your chances of success are diminished, and, frankly, when your latest and most beloved creation splatters all over the landscape we don't want the name of "M.A.N." to be taken in vain.



Soldering is an art that is the key to successful electronics work. The vast majority of all electronic kit malfunctions are directly attributable to bad soldering. The following rules will, if followed, result in excellent solder connections. Incidentally, the transmitter board is, because of the relatively large size, an excellent training ground for the small receiver, decoder and servo boards yet to come.

1. Spring for a new roll of solder. Make sure it is "radio" solder, with a resin and not an acid core. Recommended are Ersin Multicore 60/40 and Kester's "44" resin core solder which is also a 60/40 alloy.

2. Obtain a soldering iron of 25-35 watts. The more powerful "guns" in the hands of the inexperienced will "cook" the colored beads. Unger's pencil irons are fine—the cheapest will do admirably.

3. Keep a damp rag handy and wipe the tip of your iron quite often.

4. Solder your leads to the board by placing your iron tip against the lead and the land from which the lead emerges. Immediately apply solder—which will flow instantly—and immediately remove the iron by sliding it up the lead and away from the board.

5. Solder rapidly, heat is your enemy!

6. Twist and "tin" all stranded wire ends before soldering to components and/or batteries.

7. All solder joints and connections must be shiny and smooth. Greyish, granular joints are "cold" and must be reheated till smooth and shiny since cold solder joints create great resistance.

TRANSMITTER KIT:

First thing to do is check all components against the parts list. In all likelihood they will all be there. If not, it is better to have replacements on order as rapidly as possible, so as not to delay that awesome moment known as the "smoke test."

It is relatively unimportant what "system" is used in mounting the components on the circuit board. Some prefer to work "across the board", i.e., from left to right or from top to bottom, others prefer to go down the component list, crossing off each component as it is soldered. But it is important that *some system* be used.

Whatever system you prefer, or devise, install the following components first . . . that's right, now! Plug your iron in, once you take the plunge the water is fine:

1. Install crystal in holes 20 and 30 and solder in place.

2. Find your .82uh choke (wide silver-gold-grey-red-silver bands) and wrap four turns of #24 enamel wire (supplied) around it. (See Figure.) Scrape enough of the enamel off the "tails" of the (Continued on page 46)

COMPONENT PLACEMENT

RESISTORS 1/4 WATT

VALUE	COLOR CODE	HOLE NUMBERS
100K	Brown-Black-Yellow	97 & 98
10K	Brown-Black-Orange	169 & 170
33K	Orange-Orange-Orange	167 & 168
47K	Yellow-Violet-Orange	165 & 166
47K	" " "	78 & 79
47K	" " "	60 & 61
47K	" " "	40 & 41
47K	" " "	30 & 31
4.7K	Yellow-Violet-Red	18 & 17
4.7K	" " "	15 & 16
100 ohm	Brown-Black-Brown	6 & 7
10 ohm	Brown-Black-Black	106 & 107
1K	Brown-Black-Red	123 & 124
10K	Brown-Black-Orange	26 & 27
10K	" " "	131 & 132
10K	" " "	133 & 134
10K	" " "	135 & 136
10K	" " "	137 & 138
100K	Brown-Black-Yellow	139 & 140
56K	Green-Blue-Orange	46 & 47
56K	" " "	50 & 51
56K	" " "	69 & 68
56K	" " "	87 & 86
50K	Trimmer Pot	88, 89 & 90
50K	" " "	70, 71 & 72
50K	" " "	52, 53 & 54
50K	" " "	32, 33 & 34

DIODES Note banded end position on Diagram.

DHD 806	100 & 101
DHD 806	84 & 85
DHD 806	66 & 67
DHD 806	48 & 49
DHD 806	28 & 29

TRANSISTORS

IDENTIFICATION NO.	HOLE NUMBERS		
	EMITTER	BASE	COLLECTOR
2N 2924	96	94	95
2N 2924	173	171	172
2N 2924	75	77	76
2N 2924	57	59	58
2N 2924	37	39	38
2N 2924	21	23	22
2N 2924	112	114	113
2N 2924	143	145	144
2N 2924	146	148	147
2N 3643	10	11	12
2N 3643	119	118	117

CAPACITORS

VALUE & DESCRIPTION	HOLE NUMBERS	VALUE & DESCRIPTION	HOLE NUMBERS
.22 Mylar	176 & 177	.001 Disc.	149 & 150
.15 Mylar	174 & 175	.001 Disc.	178 & 179
.047 Mylar	93 & 99	.001 Disc.	91 & 92
.047 Mylar	82 & 83	.001 Disc.	73 & 74
.047 Mylar	64 & 65	.001 Disc.	55 & 56
.047 Mylar	44 & 45	.001 Disc.	35 & 36
.0047 Mylar	163 & 164	.02 Disc.	19 & 20
.0047 Mylar	80 & 81	.02 Disc.	8 & 9
.0047 Mylar	62 & 63	.02 Disc.	108 & 109
.0047 Mylar	42 & 43	.02 Disc.	127 & 128
.0047 Mylar	24 & 25	.02 Disc.	151 & 152
.22 Mylar	110 & 111	100 pf. Disc.	125 & 126
56 pf Silver Mica	13 & 14	100 MF Tubular Electrolytic (Observe Polarity Shown)	155 & 156

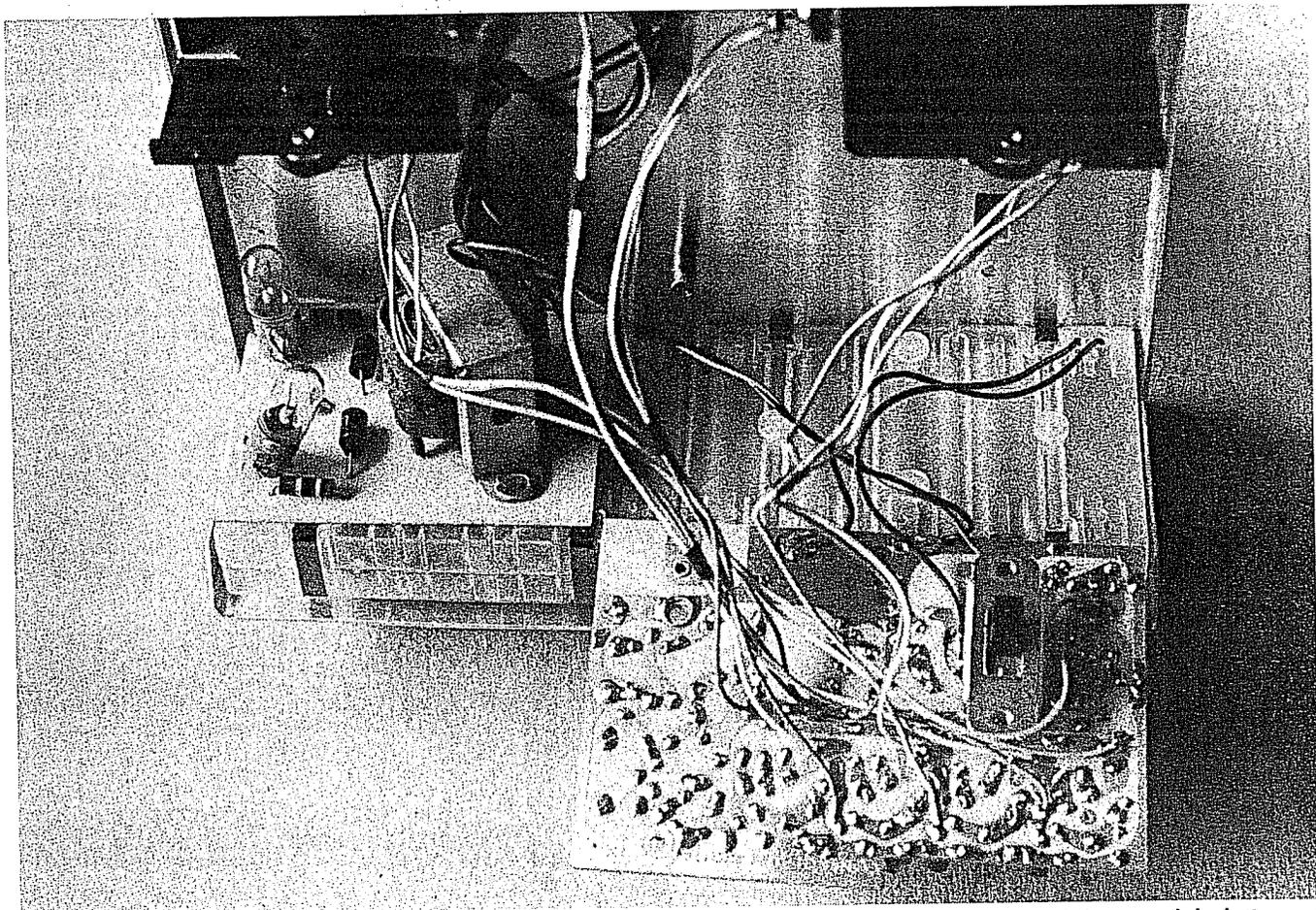
MOLDED CHOKES

VALUE	COLOR CODE	HOLE NUMBERS
1.5 uh	Wide Silver-Brown-Gold-Green-Silver	4 & 5
.82 uh*	Wide Silver-Gold-Grey-Red-Silver	102 & 103
12 uh	Wide Silver-Brown-Red-Black-Silver	115 & 116
12 uh	Wide Silver-Brown-Red-Black-Silver	129 & 130

* 4 turns of the #24 enameled wire should be wound on the body of this Choke before insertion.

MISC.

COMPONENT	HOLE NUMBERS
Crystal	2 & 3
Jumper Wire	141 & 142
DPDT Slide Switch	157 thru 162



In this photo we see the completed assembly of the M.A.N. 2-3-4 Digital kit. Inter-wiring between printed circuit board and stick pots is shown very clearly, plus the wiring of the separate dual charger and the battery pack. Main advantage of the system is room plus accessibility of all components.

coil you have just wound so that the portions that are to protrude through the board are bare and clean, and can thus be soldered. The scraping should be done gently with a razor. Bend the leads of the .82uh choke so that they fit into holes 102 and 103. Insert the scraped enamel wire "leads" through the unnumbered holes that will lie under the choke when it is in place. Insert the choke leads into holes 102 and 103 and solder all four of the leads (not that's a real pretty bead).

3. Install and solder the 100mf elec-

trolytic capacitor in holes 155 and 156, making sure the + lead in hole 156.

4. Install and solder the jumper wire from hole 141 to hole 142. You may use a lead clipped off the 100mf capacitor for this.

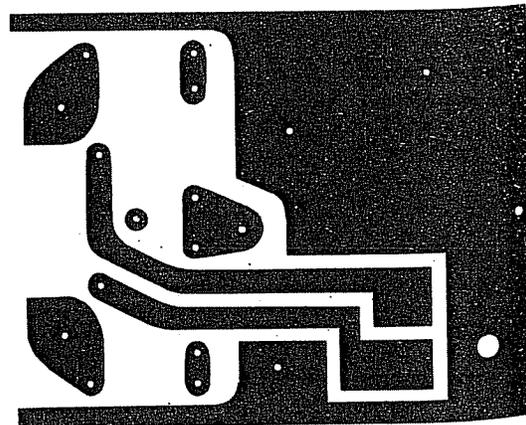
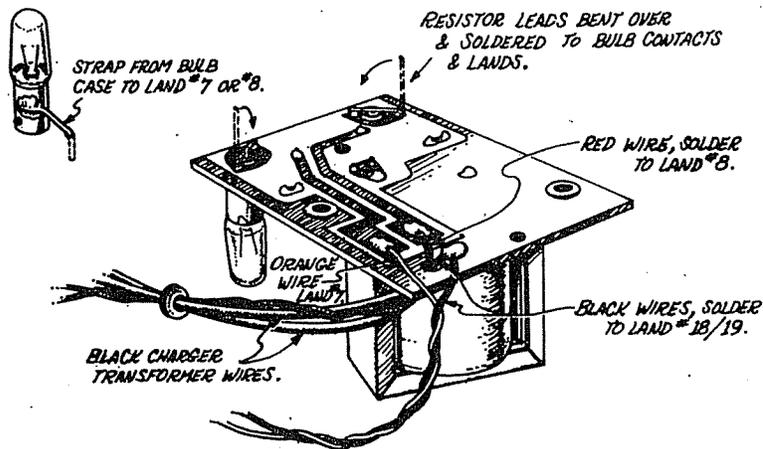
5. Install and solder diode DHD 806 in holes 84 and 85 making sure that the "marked" end is at hole 84. Polarity must be observed in the installation of all diodes.

These specific instructions were given to place a few components on the board so as to give you orientation in

the placement of parts and because we wanted to make sure that you scraped your enamel, observed polarity on your diodes and electrolytic, and did not overlook your jumper which is easy to overlook since it is not a "pretty bead."

The rest is a "piece of cake" albeit without "icing" so decide on your system and start soldering. Just follow the component diagram and the component placement list and you cannot miss—provided that you *do not work when you are fatigued.*

After all your components are



DIGITAL SYSTEM CONTINUED

semi-kit and kit. You will then appreciate the magnificent miniaturization of this system . . . and wait till you see the M.A.N. 2-3-4 mini-servos. One of our contributors is planning on putting the system in a Minnie Mambo—with ailerons yet!

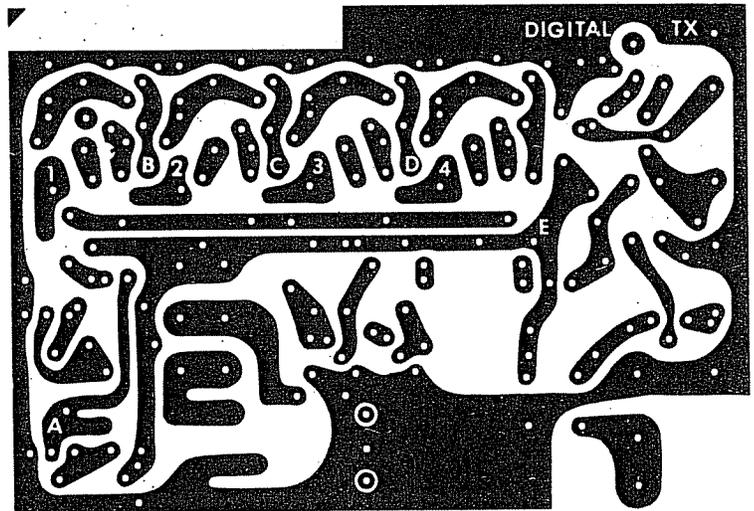
M.A.N. 234 TRANSMITTER PARTS

	4	3	2
	CHAN. CHAN. CHAN.		
RESISTORS			
100 ohm	1	1	1
1K	1	1	1
4.7K	2	2	2
10K	6	6	6
33K	1	1	1
47K	5	4	3
56K	4	3	2
100K	2	2	2
POTS			
5K AB Type	4	3	2
50K Trimmer	4	3	2
MYLAR OR SM CAPS.			
56pf	1	1	1
.0047 MF	5	4	3
.047	4	3	2
.15	1	1	1
.22	2	2	2
TUBULAR ELECTROLYTIC			
100 M.F.	1	1	1
DISC. CAPACITORS			
100 pf	1	1	1
.001 MF	6	5	4
.02	5	5	5
TRANSISTORS			
2N 3643	2	2	2
2N 2924	9	8	7
DIODES			
DHD 806	5	4	3
MOLDED CHOKES			
.82 uh	1	1	1
1.5 uh	1	1	1
12 uh	2	2	2
HARDWARE			
(SAME FOR 2, 3 & 4)			

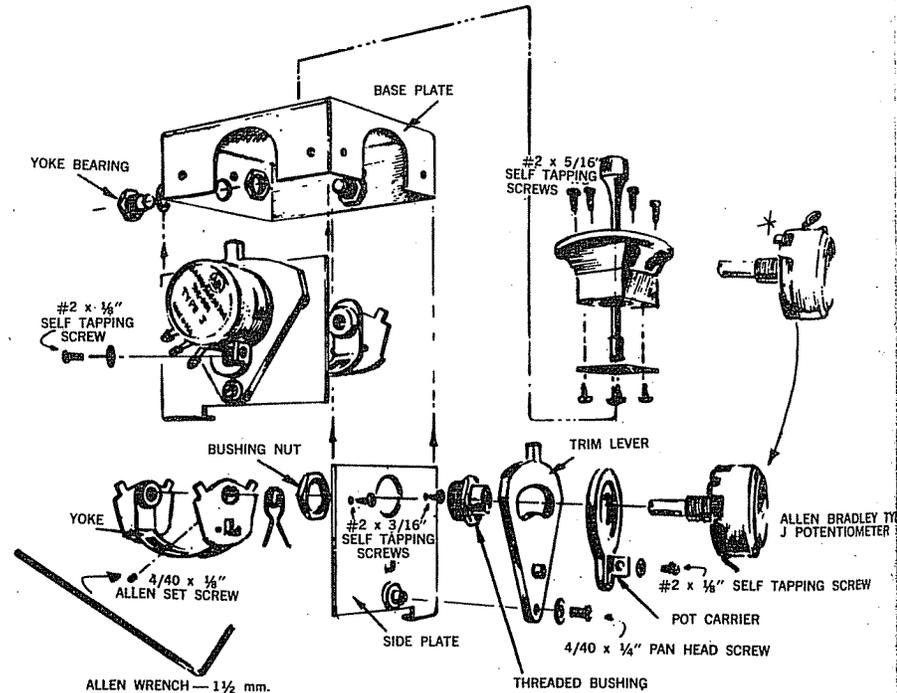
SWITCH GUARD	1
BRASS STANDOFF	1
NYLON STANDOFF	1
DPDT SLIDE SWITCH	1
BATTERY SNAP & CABLE	1
HANDLE ASSEMBLY	1
ANTENNA FEED THRU	1
CENTER LOADED ANTENNA	1
STICK-ON RUBBER FEET	4
FIELD STRENGTH METER KIT	1
(Meter .02 Cap, IN 34 Diode & 12uh Choke)	
1/4" GROMMET (Rubber)	1
#4 x 1/4 SHEET METAL SCREWS	6
4-40 x 1/4 SCREWS	2
4-40 x 5/16 SCREWS	3

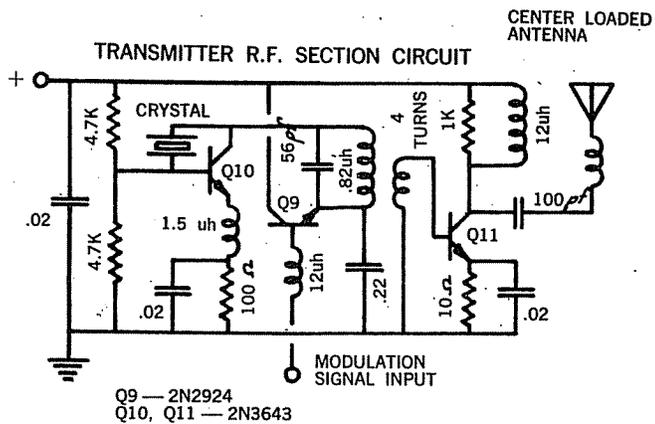
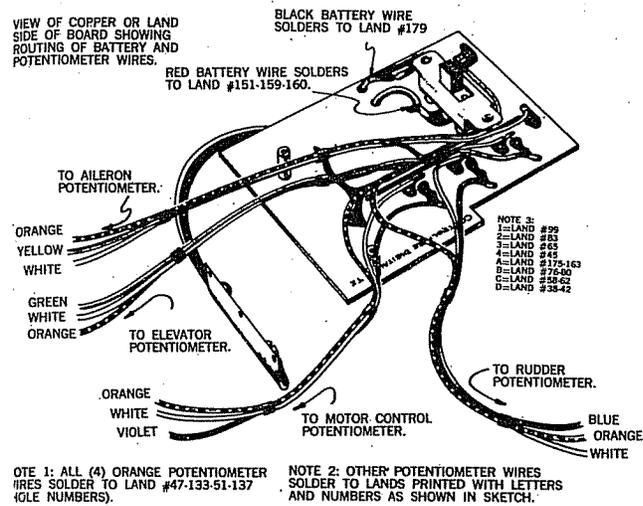
4-40 x 1/4 SELF-TAP SCREWS	6
4-40 LOCKING NUT	1
CHARGING SOCKET ASSEMBLY	1
1.5 MM ALLEN WRENCH	1
O.S. STICK ASSEMBLY KIT	
(1 ea. for 2 & 3 Chan.)	
(2 for 4 Chan.)	
5—M.A.N. 2-3-4 DIGITAL SYSTEM SPECIAL HARDWARE	
TX CASE	1
PC BOARD	1
TRANSMITTER CRYSTAL	1
SPECIAL HARDWARE	
2 CHANNEL PLASTIC COVER PLATE &	

2 #4 x 1/4 SHEET METAL SCREWS	1
3 CHANNEL POT BRACKET, PLASTIC	
MOTOR CONTROL LEVER & (2) #4 x 1/4 SHEET METAL SCREWS	1
WIRE & SLEEVING PACKAGE	1
(4) 10" white	
(4) 10" orange	
(1) 10" yellow	
(1) 10" violet	
(1) 10" blue	
(1) 10" green	
(1) 2" shrink tubing	
(1) 2" #16 Buss wire	
(1) 4" #24 Wire (Link)	

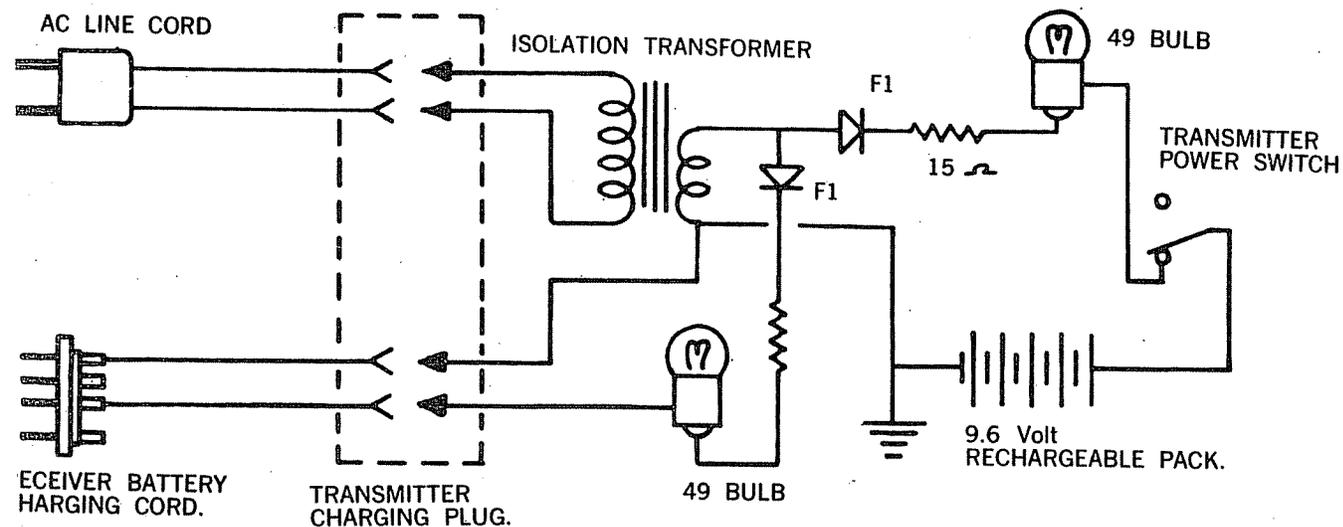


O.S. STICK ASSEMBLY





TRANSMITTER POWER PACK AND DUAL CHARGER CIRCUIT



R.F. DEMODULATOR

