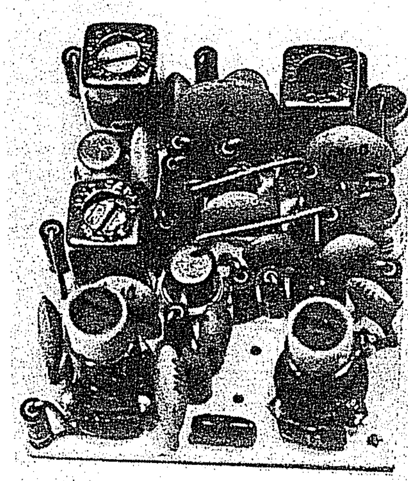
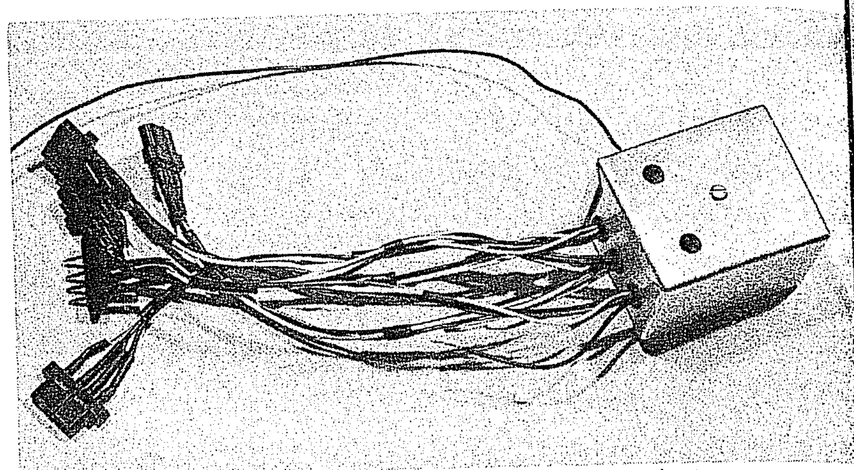
M.A.N. 2-3-4 DIGITAL SYSTE

The Receiver plus Battery B

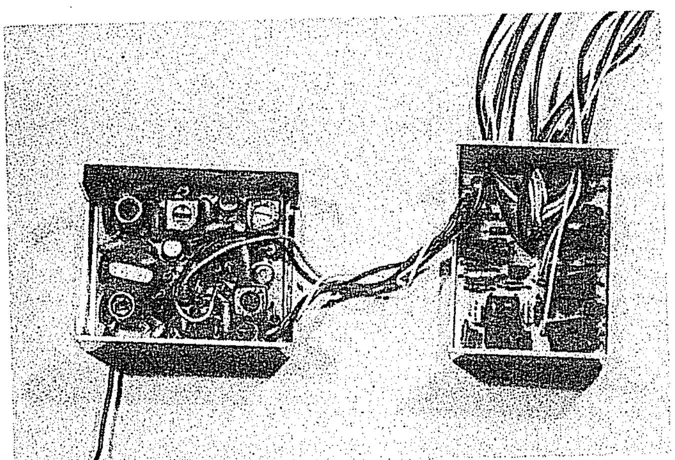
By DON BAISD



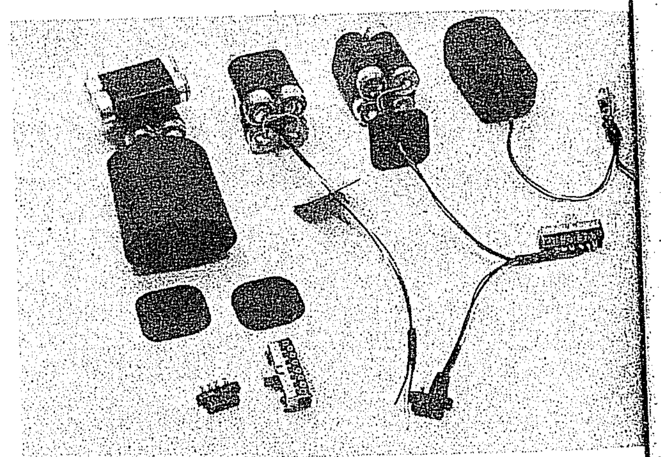
The semi-kit receiver prior to wiring in the plug leads, battery leads and the antenna.



Here we have the receiver complete with dust cover. Two holes in top of dust cover are for access to and tuning of the antenna and ing coils. Plugs are standard O.S. small u



Thought you might like a look inside of the completed receiver which includes the decoder. Note length of wire to permit opening the case.



Step-by-step photo of the assembly of the receiver battery pack. At lef bits and pieces and at the extreme right fully wired battery pack

Part four of the MAN digital system covers the assembly of the receiver semi kit and receiver bits and pieces for the man who must build it himself. In addition full details are included for receiver battery pack and the switch harness. Receiver and Decoder now complete

THE MAN 234 RECEVIER

▶ For the semi-kit builder the receiver will be the simplest of the MAN 234 componets; however, due to parts density, the kit or scratch builder may not find it so. All that is left to do in the semi-kit is install the crystal, attach six wires, put it in the case and match it to your Transmitter. Actually, the sequence of the presentation of the various MAN 234 components is arranged to satisfy two conditions simultaneously, first, you should have already completed a component (decoder) which will allow you to check out your current project and secondly, the more difficult construction should be placed near the end to allow you a little practice on the easier jobs. Keep in mind that here on out we'll be dealing with smaller, more closely spaced circuit lands which will naturally require more care in soldering and inspecting joints.

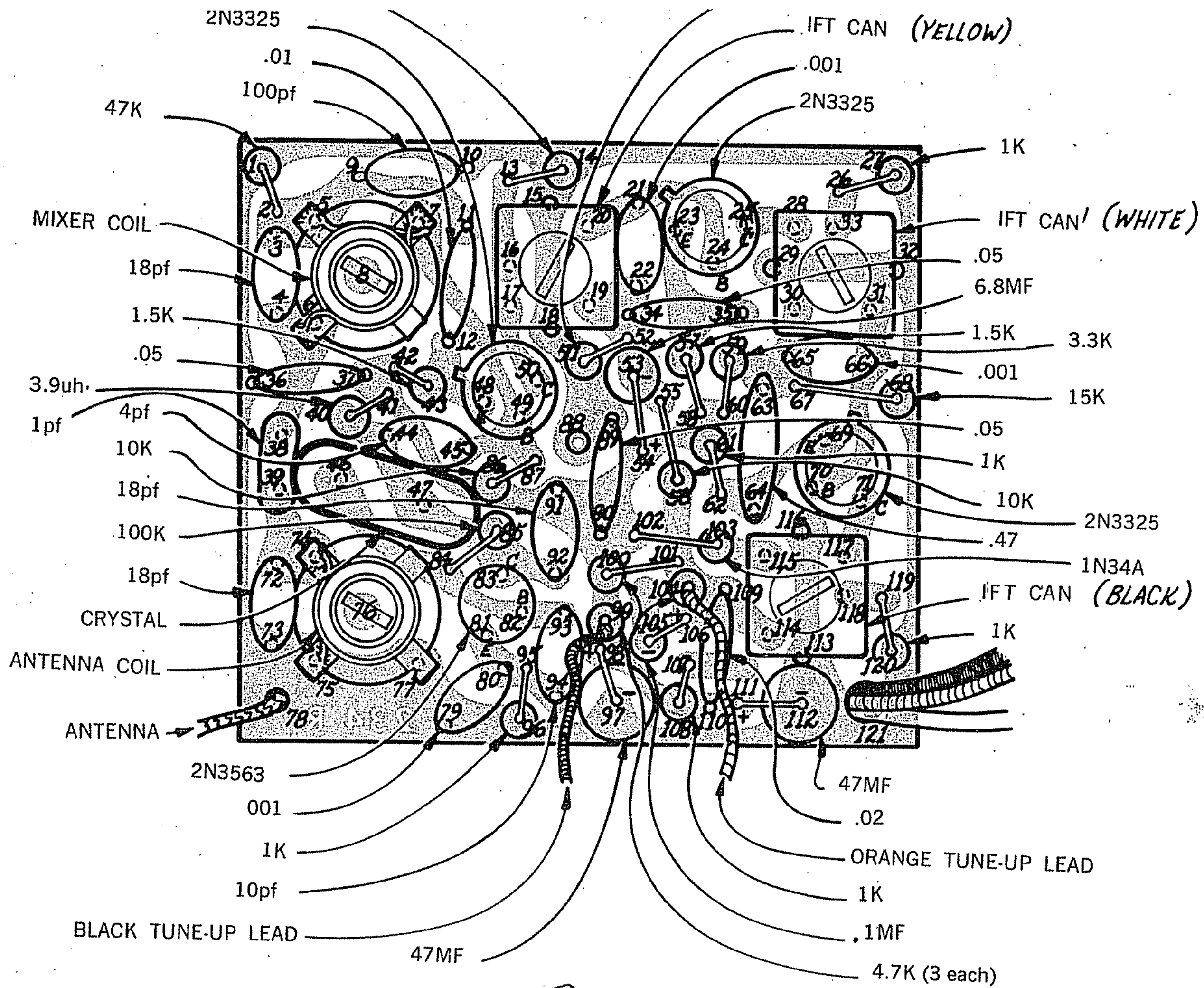
KIT CONSTRUCTION

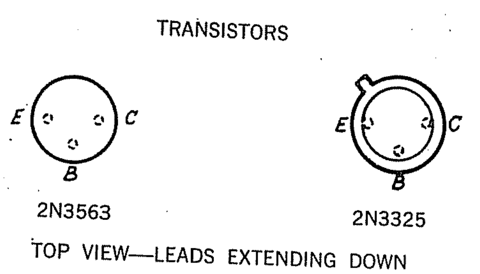
As per usual lets bring the kit builders even with the semi-kit builders and then proceed together.

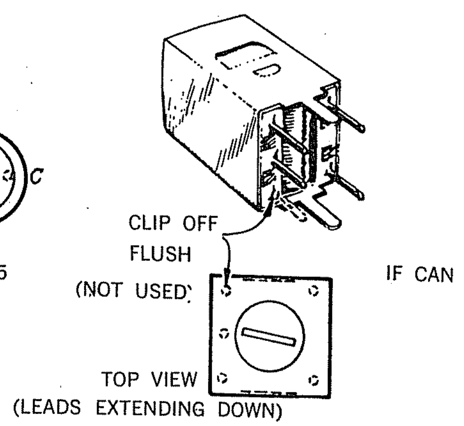
There is an old carpenters saying, "measure twice, cut once". It is equally appropriate in building the MAN 234 receiver if changed slightly: "look twice, clip once". This adage applies especially to the clipping off of the spare IF pins and the coil lugs as per the accompanying skitches.

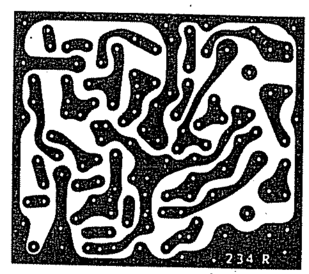
Once again we will forget a "step by step" in favor of our placement drawing and parts placement list. If you follow the "tips" below you should have no problems.

1. The winding of the coils per the drawing is not hard if you remember to scrape the enamel from the wire before attempting to solder it. This can be done quite effectively after the wire is wrapped around the lugs and avoids the difficulty in anticipating exactly which portion of the wire should be scrap









ACTUAL SIZE

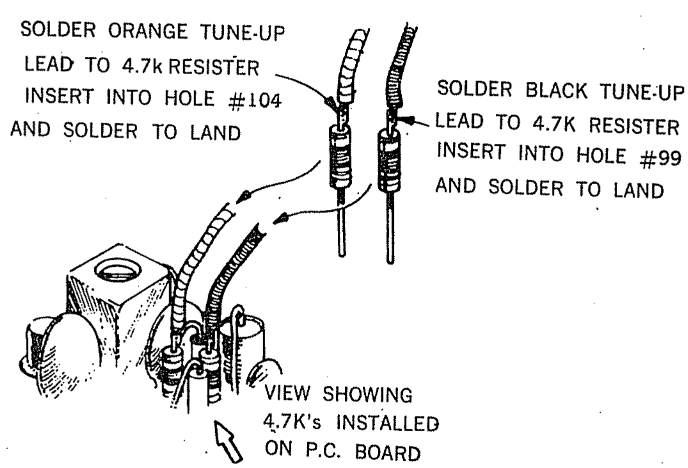
before you start winding. The counting of "turns" is much easier if you use a magnifying glass. Make sure you have the right number of turns—an approximation will not do.

2. Mount one of the larger parts in each quadrant of the board—to serve as reference points for the mounting of the remaining parts. This is particularly desirable in the receiver because of the high parts density.

3. Get your parts as close to the board as you can—the closer they are to the board the further away they will be from the decoder parts and the possibility of interference will be diminished.

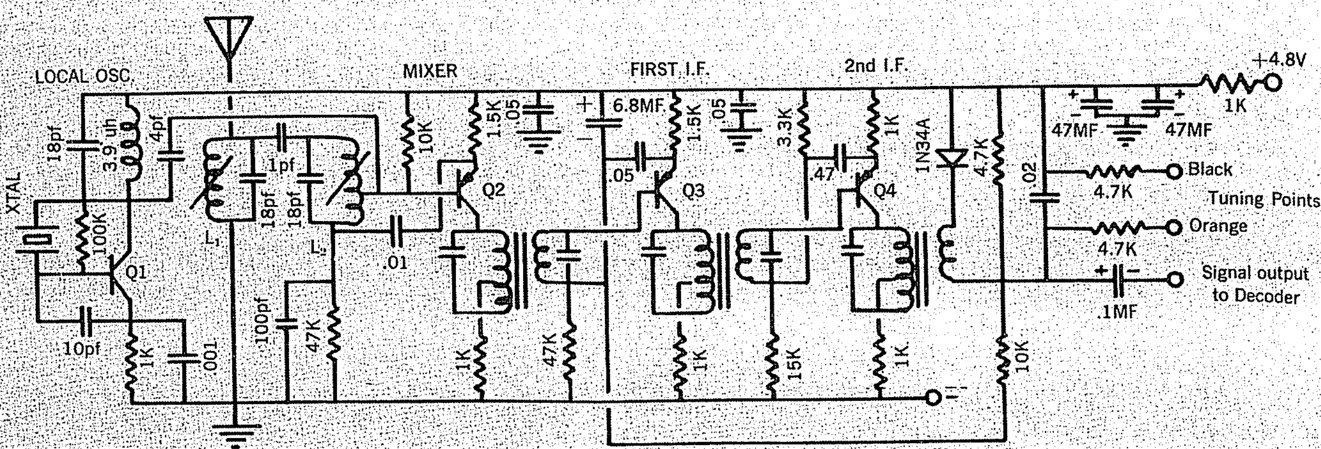
4. If any part is really difficult to fit into place or if you must mangle a lead its "even money" that you are making a mistake—check again.

5. Notice that one lug of the (*Continued on page* 46)



M.A.N. 2-3-4

M.A.N. 2-3-4 RECEIVER



Antenna Coil (L_1) —— $13\frac{1}{4}$ turns #26 wire

Mixer Coil (L_2) —— $15\frac{3}{4}$ turns #26 wire, tapped @ $1\frac{1}{4}$ turns.

Q2 Q3 Q4 - 2N3325 Q1 - 3563

CONTINUED FROM PAGE 43

antenna and mixer coils must be clipped —also clip or remove the wire tab associated with the clipped lug. Clip this lug when you are "bright eyed and bushy tailed" . . . it is very painful to wind a perfect coil and then to clip the wrong lead.

6. It is very irritating to have to order a new IF can because you clipped the wrong pin. One pin of each I.F. can is removed in accordance with the sketch. The same pin is clipped with regard to each can. If you have *any* doubt trial fit the can to the board and clip the pin for which there is no hole.

7. If any of the disc capacitors have excessive insulation extending down the leads, scrape it off so that the capacitor can be mounted close to the board.

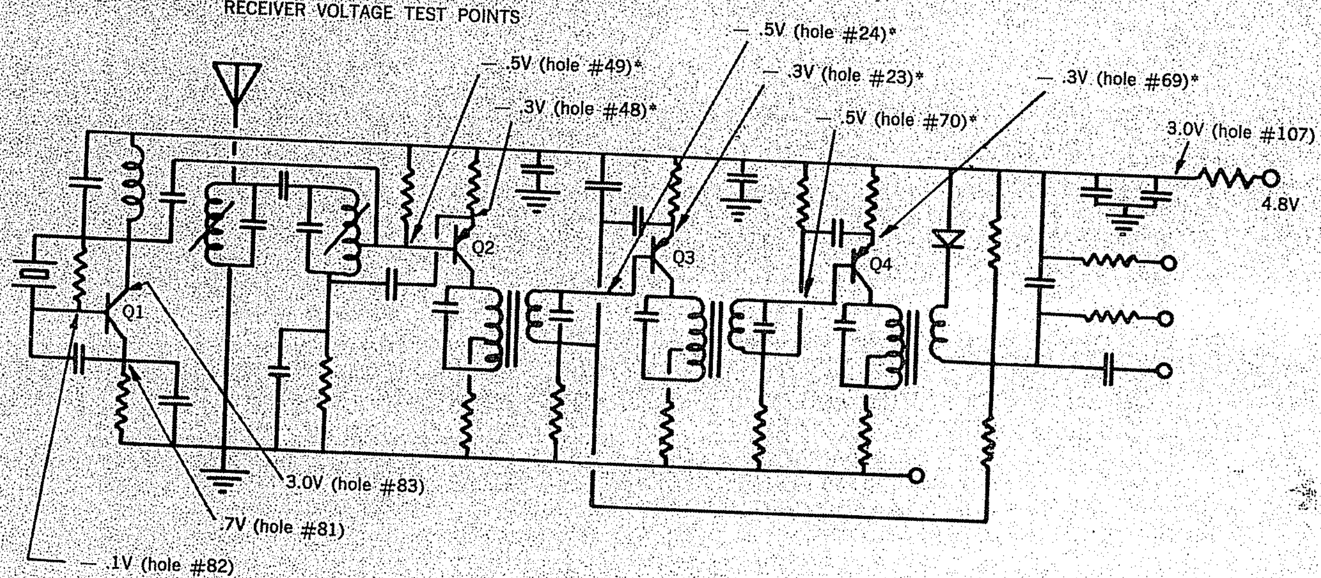
8. In mounting the Tantalytic capacitors note well that polarity is important—follow the negative and positive lead hole numbers on the parts placement list. All Tantalytics are mounted with their red (+) ends visible from the top of the board.

9. Check the land side of the board with a magnifying glass to make sure there are no solder bridges or other mechanical shorts and clean the board with dope thinner or other solvent to remove excessive flux residue.

SEMI- KIT COMPLETION

Begin work by installing the crystal in holes 46 & 47, push the crystal can down flush with the circuit board and clip off the excess pin material after soldering. Strip 3/32" of insulaion from one end of the 30 inch Antenna wire and pre-tin it. Refer to the sketch of the circuit side of the board and solder the Antenna to the land containing holes #39, 72 and 74; route the wire to the component side of the board thru hole #78. Refer to the sketch concerning the orange and black tuning leads attached to 4.7K resistors. These resistors have already been installed but the leads were left long so that your Receiver could be prechecked. Clip off the excess lead material leaving about 3/32" protruding above the body of the resistors and pre-tin these stubs. Strip 3/32" insulation from one end and ¼" from the other end of the six inch lengths of orange and black wires. Pre-tin all four ends. Solder the short tinned ends of these leads to the stub resistor leads with the orange wire going to the resistor located at hole #104. Bring the red, black and yellow wires from the Decoder to the curcuit side of the board thru hole 121. Space the Receiver and Decoder boards about two case height apart and route the wires as shown in the sketch. You'll have to judge this length by eye since you want enough slack to be able to open your case easily but not so much that it causes a routing problem when you're trying to put it together. Cut these wires to length and strip about 1/16 inch of insulation from each wire and pre-tin the end. For ease of installation, push a good bit of slack up thru the hole and attach the black wire first, then the red, and finally, the yellow. Check very carefully to see that you don't have any stray strands near adjacent lands and scrape or wash off any solder flux residue between the lands generated by your soldering.

Inspect the circuit side of the board and clip off any leads or solder spikes which seem excessively long. Check for any solder flux or other foreign material between lands which might cause trouble at a later date. When you're satisfied with the board, place the insulator board in the Receiver half of the case and install the board with the #2 x ¼" sheet metal screw provided. Route the Antenna wire thru the 1/16 hole in the case and the orange and black tuning wires thru the left hand grom-



*The voltage readings taken with VTVM ground lead attached to the black receiver tuning lead; all other voltage readings are made with the meter ground lead attached to the outside circuit land.

met in the end of the Decoder case.

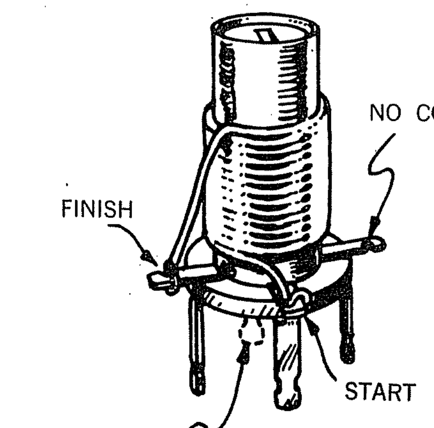
Your Receiver and Decoder are now ready for check out and you'll have to start thinking seriously about your Receiver battery supply. For check-out purposes, obviously any 4.8 volt source will do, but if you're thinking ahead to that airplane or boat in which you intend the installation, perhaps one of the battery configurations has an advantage over the other. Square packs seem to fit better in the space available in the smaller airplanes, while the flat packs lend themselves more to the larger models. The commercially assembled General Electric flat packs will be available for those who prefer them; these feature 500 MAH cells with spotwelded straps used between cells. Square packs will necessarily have to be fabricated from 500 or 600 MAH cells using large size heat-shrink tubing as shown in the photos.

RECEIVER CHECK OUT AND TUNING

For this tuning sequence it will be necessary to use your completed and operating transmitter as a signal source. With the Receiver-Decoder case opened up and the battery attached but off; attach the test leads of a VTVM or good quality VOM to the orange and black tuning leads. The ground or negative lead of the VTVM should be attached to the black tuning lead. Set the meter on a low voltage scale (typically, +1.5 Volts D.C.), and turn the Receiver on. Without a signal from your transmitter, the needle of the meter will tend to move below zero in the negative direction. This is normal and is not enough to harm your meter movement but serves to indicate that the battery voltage is reaching the receiver board correctly. With the Receiver antenna hanging down over the edge of your work bench, (I hope you don't have a steel work bench,) and the main antenna of your transmitter collapsed; turn on the transmitter and note the meter reading. Under normal conditions, the meter indication should have jumped to 5 or 6 tenths of a volt which indicates general operation of the receiver. If your receiver is far out of tune, it may be necessary to bring the transmitter antenna within a foot of the receiver antenna to get a meter indication.

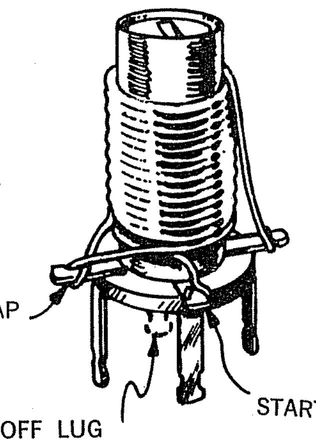
Remove the main transmitter antenna and use the small sub-antenna protruding thru the grommet in the case back as a weak signal source for tuning. Note that as you bring the sub-antenna near the receiver antenna, the meter needle will rise toward the reading achieved in the previous test. With the transmitter positioned such that you are indicating about .2 Volts on the meter, use a non metalic tuning wand and screw the slugs in or out of the antenna coils to achieve the highest meter reading. As the meter reading rises, progressively back the transmitter away from the receiver antenna to lower the meter indication back to about .2 Volts. Now tune the mixer, first and second I.F. cans (yellow, white and black slugs, respectively) in the same manner. At this point, go back and touch up the tuning at all five points to adjust for loading as you tuned sucessive stages. Notice that the tuning on the I.F. cans is more critical or "sharper" than on the mixer and antenna coils; it is very important that the I.F.'s be tuned right on their peak. With the transmitter sub-antenna positioned about half way down the receiver antenna, back the transmitter away until the meter reading drops to about .1 Volts and note the distance between the two antennas. Under normal conditions, the Decoder quits functioning when this voltage falls somewhere between .1 Volts and zero, so this distance will be an indication of your re- (*Continued on next page*)

ANTENNA COIL



13¼ TURNS
#28 WIRE

MIXER COIL



START TO TAP, 2¼ TURNS
TAP TO FINISH, 14½ TURNS
TOTAL TURNS—16¾ #28 WIRE

M.A.N. DIGITAL . . . continued

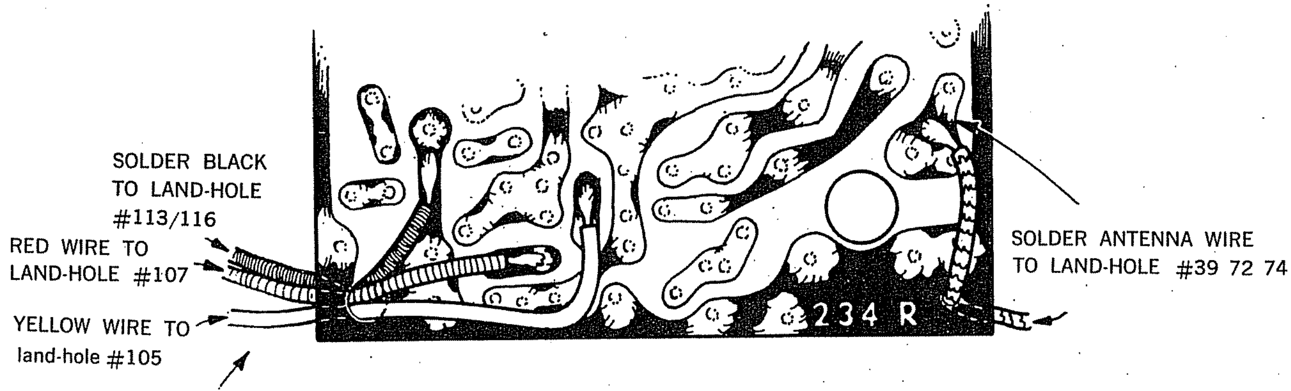
ceiver range or "sensitivity". If you have a foot or more of range at this point, you can be pretty sure that your receiver has adequate sensitivity. Later on, when you have your servos, the dropout point of operation will serve as a good indication. In the meantime, if you have a scope, connect the ground lead to the black tuning lead, and use a 10K resistor in series with the probe connected to any of the yellow channel output wires to note the dropout point and check the operation of each of the outputs. In the unlikely event that your receiver does not work try the unscientific procedure of touching each solder mound on the board with a hot iron—it may just work after that.

CIRCUIT DESCRIPTION & EXPLANATION

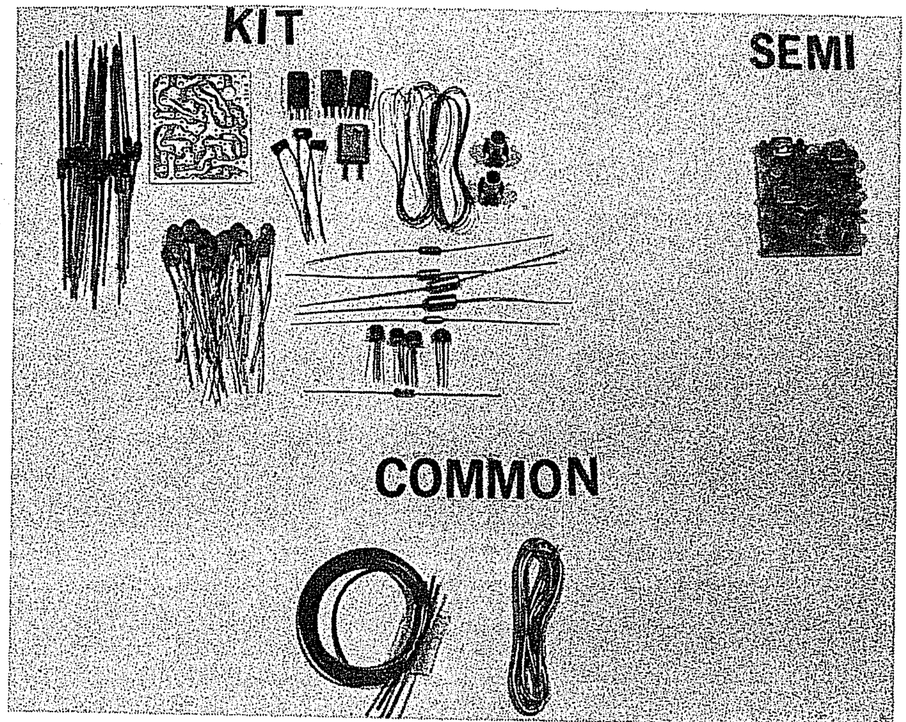
The basic receiver circuit is very standard in appearance and has evolved over several years of development and useage. Germanium transistors are used in the I.F. strip because of their uniformity and good low-voltage characteristics. A silicone transistor is utilized in the local oscillator since it's high frequency characteristics insure good oscillator voltage output. A standard Diode detector is employed to demodulate the I.F. signal which drives the Decoder and furnishes the reverse A.G.C. to the base circuit of the first I.F. stage.

The "front end" or antenna & mixer stage circuits use the popular double-tuned RF concept. This arrangement gives a very high rejection (50 to 60 db) to harmonics and images sometimes present from local F.M. stations. A small capacitor (lpf) is used to stabilize the coupling between these coils and reduce the detuning effect of the metal case. The mixer coil is tapped very near the bottom (2¼ turns) which not only makes it sharper tuning (higher coil "Q") but also aids in electrical noise rejection and overload of "swamping" protection.

The local oscillator crystal resonate frequency is 455 Kilohertz (455,000 cycles per second) less than your transmitter crystal frequency. If you examine your receiver crystal prior to installation, you will notice your 27 mega-

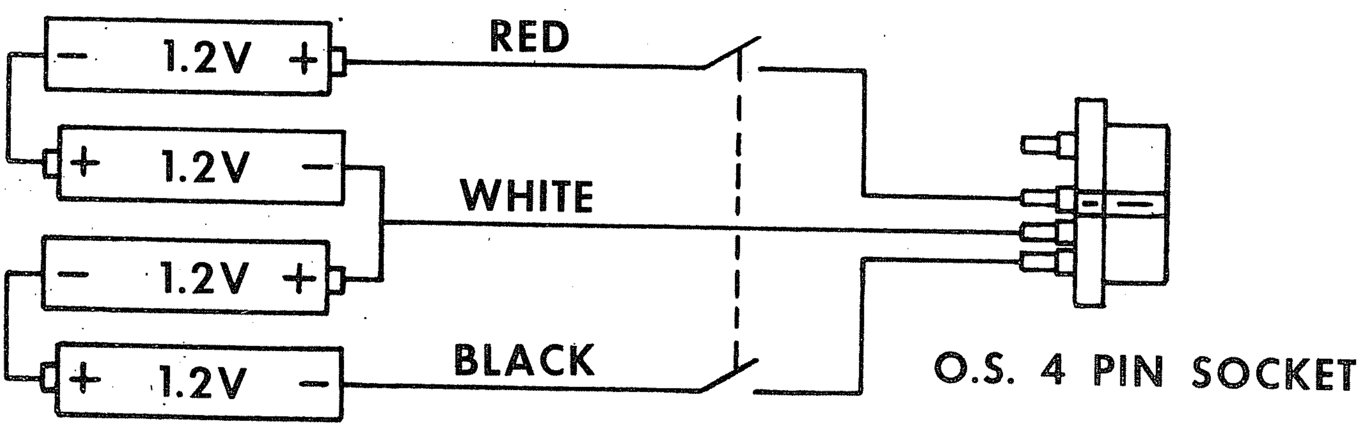


WIRING SKETCH—LAND (COPPER) SIDE OF PRINTED CIRCUIT BOARD top of the can (26.995, 27.045, 27.095 etc.) and another lower number stamped on the side of the can which represents the actual frequency at which your local oscillator is operating. Subtraction of the side number from the top will give .455 Megahertz which is 455 Kilohertz. Many of you know the principle of super hetrodyning for signal selectivity but for the benifit of those who don't, here's a quick rundown on what goes on and why we go to all this trouble in a receiver. For a moment, lets suppose that you're operating at the bottom of our radio control band, at 26.995 Megahertz; this means that your receiver local oscillator is running at 26.540 Megahertz. The transmitted signal and the signal from the local oscillator are fed into the base of the mixer transistor and are amplified and mixed in this stage. When two different frequency signals are mixed, four different frequencies result: the two frequencies which we had to begin with plus the sum of these two frequencies, plus the difference in these two frequencies. The I.F. cans are actually transformers which have tiny capacitors across the primary windings which allow them to resonate at a frequency which is adjustable over a narrow range by turning the colored slug accessible thru the top of the can. When you tune the primary windings of a transformer, the maximum transfer of voltage to the secondary windings will occur when the incoming signal frequency is at the resonate frequency of the primary windings. Since the I.F. cans are designed to resonate near 455 Kilohertz, of the four signals presented to the mixer I.F. can, the two primary frequencies and the sum of the primary frequencies are rejected, to a degree, and the strongest signal on the I.F. can secondary is the difference in the two primary frequencies. By adding successive stages (the first and second I.F. stages) we are able to further reject the unwanted frequencies. Now, the frequency going down the I.F. strip is at 455 Kilohertz, which is referred to as the I.F. or Intermediate frequency.



Here we have all the elements that comprise semi-kit and bits and pieces kit with common parts.

At this point you're probably saying "well so what, we're operating at 455 Kilohertz now instead of 27 Megahertz, but what have we gained?" A little math will make it clear; first convert your transmitter frequency to Kilohertz: 26.995 Megahertz = 26,995 Kilohertz. Now suppose that your buddy is operating his transmitter on the adjacent channel, 27.045 Megahertz, (that's 27,045 Kilohertz) or 50 Kilohertz away from you. Fifty Kilohertz represents less than .2% deviation from your signal, which is pretty small. Now if you look at your I.F. stages, the difference in frequency between your Bud's transmitter signal and your local oscillator is 505 Kilohertz, still 50 Kilohertz. Since this represents over a 10% deviation from the frequency that the I.F. can would like to see, it can reject this signal easily. While we're this deep into the mechanics of the front end, let's take a look at what a frequency "image" is and how it affects you. From our previous investigation of the frequency mixing phenomena, it might occur to you that an incoming transmitter signal 455 Kilohertz below the local oscillator frequency (26.085 Megahertz) would also yield the desired I.F. signal. Four times 26.085 (*Continued on page* 70)



500. OR 600. MAH NICKLE CADMIUM PACK

basically a CL pilot, and holder of the Jr. A-Speed record. The '68 world speed champ happens to be Bill's father. Bill aced out everyone in the Time Target Gas event by hitting the 2 minute target time within 3 seconds, twice, yet.

Balloon burstwise, Billy Elliott, Tom Collier, and Mike Atzei picked off the places in that order. Scores were very high, and in 45 flights the kids destroyed 2 gross of balloons and 200 sticks. The place looked like an explosion in a basket factory around 4:00 PM. The kids did an excellent job of proofing our "ZING-ER" ½A Profile Proto design. None of them were even touched in performance, and all flights were smooth as glass. We have apparently solved the problems of take-off and grooved flight by using natural aerodynamics and proper rigging. This is made even more significant since the kids built their own ships, fixed and adjusted their own engines, and handled the entire operation on the field by themselves. The solid nose versions for mounting Babe-Bee type engines were turning over 60 in the air, giving them average speeds around 48 mph with a pit stop. This was great in the Solo Race. It also turned out that the Sport Race was dominated by ½A equipment. You haven't seen happy kids until you see ours dragging home those $20, 15 and 10 merchandise awards. I'm going to let them buy ME stuff for a while. We trust that the overall meet total of 189 event entries will convince the NAVY that we are trying to reach the Junior flyers.

ANOTHER DIESEL CETANE IMPROVER

Eugene Hindenburg sent along a batch of technical data from the ETHYL CORPORATION on HEXYL NITRATE. This fuel additive appears to be superior to the conventional AMYL NITRATE used in our diesel fuels. It is expected that one could use less of it to obtain the same anti-knock characteristics. Mr. J. D. Baillie, Sales Manager, Petroleum Additives Division has kindly made arrangements for modelers to obtain Hexyl Nitrate in one-gallon lots. The order must be placed through him and be accompanied by a money order in the amount of $4.56. This quantity is a small sample based on their normal volume of sales, and is actually more of a nuisance than a money-maker. What I'm saying is, we won't make them richer by buying from them. However, since the offer has been extended, a rather large group could get together and order a gallon, since the rate of 2 to 4 percent required to use in diesel fuel will let a gallon take care of 25 to 50 gallons of fuel. You could spill a lot and still be ahead. Address: ETHYL CORPORATION, 100 Park Avenue, New York, N. Y. 10017. Please say thank you.

WHICHAWAY DID SHE GO?

W.A.M. rules have required that the engine in combat ships be attached to the bellcrank bolt by a safety cable. If you get "bellcranked" the heavy stuff will at least hit close to you. The SCCA combat troops have been doing this for about a year, and Rat troops are beginning to show up with the same fix. Now we hear from St. Louis that the Carrier boys are talking up the same safety feature. In every case, these ideas spring up AFTER an engine has gone bye-bye. Anyhoo, R&R is spreading the word that you would do well to incorporate a cable between the bellcrank bolt and/or platform and the engine cylinder of any plane powered by a racing 35 and up. The startling fact is: even a lightly nicked prop, like from take-off, will unbalance the system sufficiently to set up the conditions for throwing a blade. Once a blade is shucked the complete destruction of the airplane is completed in several milliseconds. The fix is reasonably simple, and may just save someone's head from an extra hole. YOURS PERHAPS. The game right now is to have it become an AMA regulation, so think about it carefully. Then act.

FINAL THOUGHT

"Anyone can become angry—that is easy; but to be angry with the right person, and to the right degree, and at the right time, and for the right purpose, and in the right way—that is not within everybody's power and is not easy."—Aristotle—

We rest our case—for at least 30 days.

M.A.N. 2-3-4 Digital System

(*Continued fom page* 49)

Megahertz = 104.34 Megahertz which lies right in the middle of the FM band and therefore a strong subharmonic of a station on this frequency might give you trouble. This is where your "Double tuned front end" comes in to help reject all but the strongest of signals remotely located from your particular operating frequency. The same phenomenon occurs when you have strong signals which are multiples of your local oscillator frequency.

Traveling back to the subject at hand, during the signal-off portion of your transmitted signal, no mixing occurs and therefore nothing is transferred to the secondary windings of the I.F. cans. If you looked at the signal at the collectors of the I.F. transistors with an oscilloscope, you would see a pattern similar to the transmitter modulation envelope, with the amplitude getting greater as you progressed down the line. When the signal reaches the secondary of the second I.F. can, it is rectified by the detector Diode and filtered by the .02 MF capacitor so that the only thing that appears here is a D.C. voltage level in proportion to the magnitude of the I.F. signal and short negative pulses which represent the off-time of the transmitter signal. The negative pulses are capacitively transferred to the Decoder and serve to direct the information pulse-sorting taking place there. The D.C. voltage level on the detector Diode is transferred back to the base bias network of the first I.F. transistor to provide A.G.C. (Automatic Gain Control). If you trace out the first I.F. base bias circuit and ignore the 4.7K detector resistor since it is shunted (by-passed) by the detector Diode and I.F. secondary, essentially what you have is a 10K resistor going to positive and a 47K resistor to negative which puts the first I.F. transistor in a high-gain operation region. Due to the orientation of the detector Diode and its grounding action of the second I.F. secondary to the positive receiver voltage source, as the I.F. signal increase, the D.C. Voltage at the Diode goes more positive than the positive receiver voltage source. Since the first I.F. transistor is getting its positive (limiting) base bias from this point, as the I.F. signal at the detector Diode increases, the gain of the first I.F. transistor is reduced. The 6.8 MF tantalytic capacitor serves to filter out the negative pulses which would otherwise appear on the base bias network due to the signal at the Diode.

Notice that each stage has an un-bypassed 1K resistor coupling the I.F. cans to the positive voltage source. Since the receiver and Decoder have no voltage regulation, these resistors, along with the 1K positive voltage decoupling resistor serve to isolate the stages from electrical noise generated by the servo motors and voltage variations taking place in the Decoder.

TROUBLESHOOTING

The probability of general operation can be easily checked by a few voltage measurements. Refer to the schematic for the voltage measurements you should obtain at the various points; keep in mind that these values may vary as much as 20% due to parts tolerances and a slight variation from the value given should not concern you. These measurements should be taken with a VTVM (Vacuum Tube Voltmeter) or good quality Volt-Ohmmeter to keep from loading down the circuit and presenting erroneous readings. Notice that the voltage readings on the bases and emitters of the mixer and I.F. transistors are taken with respect to the decoupled positive voltage. For these readings connect the meter ground lead to the black lining lead and use your minus D.C. voltage scales. The decoupled voltage determination and the Oscillator stage voltages are taken with respect to ground potential which is the perimeter circuit land on the board.

One of the more important checks on your receiver is that of the Oscillator stage. If you have a Super-Regen monitor you can check general operation of the oscillator by holding the monitor near your receiver antenna; if the Oscillator is operating. It will quieten the characteristic Super-Regen hiss of the monitor. This makes a good quick-check after a "wipe-out" to see if the crash got to the crystal. For a deeper inspection of the Oscillator, note that the transistor is biased on thru the base to collector resistor. Since the collector voltage is essentially the same as the decoupled positive, if the transistor is functioning but not oscillating, the base voltage will read higher than the emitter and the crystal is probably at fault. If the base voltage reads very close to the emitter voltage, you might suspect that either the transistors emitter-base function is shorted or that you have a very low activity crystal. If the emitter voltage is near ground potential, you should suspect an open circuit or blown transistor. On the other hand, a correctly operating stage will show a reasonable voltage drop across the emitter resistor, which indicates conduction, and the base voltage will be somewhat lower than the emitter voltage (perhaps even slightly negative with respect to ground).

The mixer and I.F. stages are all biased slightly into their conduction regions and voltage readings which vary widely from those shown are usually the result of a short or a mis-oriented transistor. The 2N 3325 transistors are quite hardy and consistent but I've noted that the 2N 3563 used in the Oscillator is sometimes sensitive to excess heat so you might use a bit of care here.

RESISTORS ¼ WATT	VALUE	NO. REQ.
	1K	6
	1.5K	2
	3.3K	1
	4.7K	3
	10K	2
	15K	1
	47K	2
	100K	1
DISC. CAPACITORS		
	4pf	1
	10pf	1
	18pf	1

100pf	1
.001MF	3
.01 MF	1
.02 MF	1
.05 MF	3
.47 MF	1
SILVER MICA CAPACITORS	
1 pf	1
18pf	2
TANTALYTIC CAPACITORS	
0.1MF	1
6.8MF	1
47MF	2
TRANSISTORS & DIODES	
2N 3563	1
2N 3325	3
1N 34A	1
MISC.	
Receiver Crystal	1
3.9 uh choke	1
Coil Kit	2
Wire Kit	1
(1) 30" Antenna	
(1) 6" Black	
(1) 6" Orange	
MAN 234 CASE LABEL	
IFT Can Set	1 ea.
(1) yellow	
(1) white	
(1) black	
P.C. Board	1

COMPONENT PLACEMENT

MISCELLANEOUS PARTS

Part & Description	Hole No.'s
Untapped Antenna Coil	74, 75 & 77
Tapped Mixer Coil	5, 6 & 7
Mixer IFT Can (yellow slug)	15, 16, 17 18,
First IF Can	19 & 20
(white slug)	28, 29, 30, 31, 32 & 33
Second IF Can (black slug)	113, 114, 115, 116, 117 & 118
Crystal	46 & 47
3.9 uh	40 & 41

DISC. CAPACITORS

18 pf Silver Mica	3 & 4
1 pf " "	38 & 39
18 pf " "	72 & 73
.05 Disc.	36 & 37
4 pf Disc.	44 & 45
100 pf Disc.	8 & 9
.01 Disc.	11 & 12
.001 Disc.	21 & 22
.05 Disc.	34 & 35
.001 Disc.	65 & 66
.47 Disc.	63 & 64
.02 Disc.	109 & 110
.05 Disc.	89 & 90
18 pf Disc.	91 & 92
10 pf Disc.	93 & 94
.001 Disc.	79 & 80

Tantalytic Capacitors	Negative Lead Hole	Positive Lead Hole
47 MF	97	98
47 MF	112	111
0.1 MF	112	111
6.8 MF	53	54

RESISTORS

Value	Color Code	Hole Numbers
47K	yellow-violet-orange	1 & 2
1K	brown-black-red	13 & 14
1K	brown-black-red	26 & 27
1.5K	brown-green-red	42 & 43
10K	brown-black-orange	86 & 87
47K	yellow-violet-orange	51 & 52
1.5K	brown-green-red	57 & 58
3.3K	orange-orange-red	59 & 60
15K	brown-green-orange	67 & 68
100K	brown-black-yellow	84 & 85
10K	brown-black-orange	55 & 56
1K	brown-black-red	61 & 62
4.7K	yellow-violet-red	100 & 101
"	" " " 99 see	99⎱ see
4.7K	" " "	104 sketch
1K	brown-black-red	95 & 96
1K	" " "	107 & 108
1K	" " "	119 & 120
		100∫ sketch

TRANSISTORS & DIODES

Component	Hole Numbers
2N 3325	48(E), 49(B), 50(C)
2N 3325	23(E), 24(B), 25(C)
2N 3325	69(E), 70(B), 71)C)
2N 3563	81(E), 82(B), 83(C)
1N 34A Diode	102 (Anode), 103(Cathode) (Banded End)

VTO

(*Continued from page 9*)

ger wing area too.

I noticed that you called the models (DC 9 and 727) ducted fan rather than prop. It might have stunned a few readers and it would be interesting to know if you had any questions or remarks about it?

Talking to hobby-shop owners and distributors the model should be a success. Always the same reaction: "That's just what we need to stir up the market, when can we get it????" Well, who knows, some say it will be a revolution like the big jets over the prop-planes, not impossible. . . . It's a pretty wild guess, and we just wait and see.

So far I still cannot find anything like it, could you? Even the Russians (who did all the inventing in the last 300 years!!) have not cooked up something like that, or are they hiding it.

Naturally there is more to the aerodynamics than just a tube. The planes have lift from other parts than the wing to make them fly, but that is still a secret, and any smart character has a job just to copy it. Anybody is welcome to try it, as long as there are no intentions of commercial exploitation; what about that!!

During my visit to the Air-Show in Las Vegas in May I was quite surprised to find so many people interested in the models and I showed the movie to people of NASA, Lear Jet, etc.

After the Concorde I do not think there is a real jet I could not scale down to a flying model. My model flew the first time on May 11th, '68 here in Honolulu; the real one has not made it yet. I am thinking now of the Lockheed SR 71 (twin-jet, needle nose), the weirdest thing in the air and a real challenge. Besides that I can go into the multi-engine prop field like a Liberator or F 27, putting one engine in the fuselage and have the real engines just sit there and have a free ride; well, I am not joking. Another market wide open, just watch.

Aloha,
George

NORDIC DESIGN PART II (DES JARDINS) PLANFORMS AND CONFIGURATIONS:

This aspect of glider design leaves the most room for individuality. Traditionally elliptical surfaces have been thought to provide superior performance. Theoretically minimum drag and maximum efficiency will be provided by the lift drag distribution or an elliptical tip shape. In actual practice proper attention to airfoil shape, tip washout and warps has a much greater effect on performance. A good example of this factor is Hirschel's 1967 winner.

The effort to find a tip shape which does provide some benefit to flight performance has resulted in many varied tip shapes. In my opinion the only really effective shape so far is the tapered tip section with a swept back leading edge and an anti vortex tip. This configuration has several benefits over being easy to build. A wing tip of this type seems to have an unusual ability to center itself in light thermals and retain good stability in really turbulent air. Stabilizer shapes are not particularly critical; however, the tapered dihedraled stal

(*Continued on page 74*)