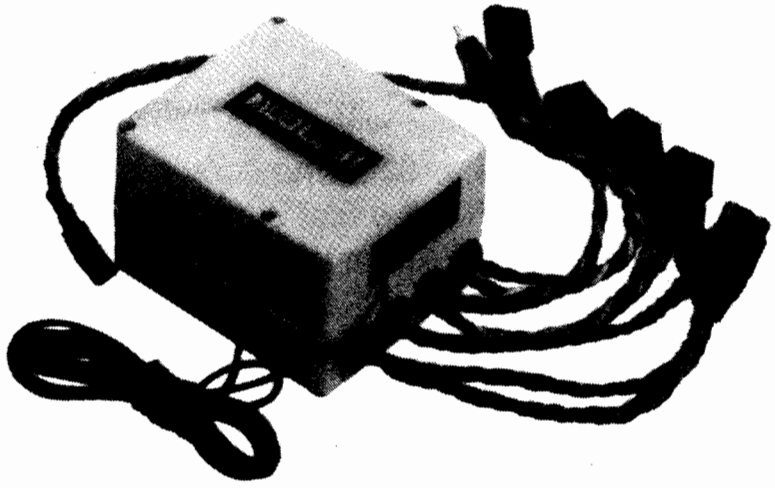
Model 91

Seven Channel Dual Conversion Narrow Band AM Receiver



Designed by Mike Dorffler

ACE R/C

(618) 584-7124

I. INTRODUCTION

The Model 91 represents several years of design, test, redesign, test, refine, and test. This process has produced a receiver that is truly superior in operation and dependability that will give outstanding performance in 1991 and beyond. Your receiver will work with any AM transmitter on the same frequency. If you have purchased an assembled receiver, it has been factory tuned to a bench standard but due to tolerance variations will need to be fine tuned to the transmitter with which it will be used. The instructions follow. Of course, if you have an assembled system, all has been tuned together and is ready for operation.

Also, it will operate any three wire positive pulse servos with up to seven channel capability. If you have purchased an assembled receiver with connectors, it is ready for tuning. If your receiver is assembled without connectors, the first step is to install the appropriate connectors. Refer to **Section VII, WIRING** then refer to **Section II, TUNING.** If you have purchased a kit, proceed to **Section V, RECEIVER PC BOARD CONSTRUCTION** to build the unit. You will return to the Tuning Section later.

WARNING AND DISCLAIMER
PLEASE READ

Improper use of this unit may cause serious personal injury to yourself, to others, or result in property damage. The user is urged to read and understand the information contained herein before operating the equipment. Prudent and reasonable conduct when operating this radio system is requested by the manufacturer.

Ace R/C, Inc. assumes no responsibility for accident, injury, property damage, or death, incurred as a result of any use of this equipment whatsoever. The user accepts the responsibility to comply with all safety requirements, including, but not limited to, those established by all federal, state and local governmental agencies, the regulations of the FCC (Federal Communications Commission) Part 95, and to abide by the rules and recommendations of all non-governmental bodies related to the use of this equipment, including but not limited to, those set forth by the Academy of Model Aeronautics.

Ace R/C will not give refunds on any kits once assembly has begun.

II. TUNING PROCEDURE

NOTE: A good voltmeter, an oscilloscope, or both can be used for tuning. A voltmeter will provide adequate tuning, but if you have access to a scope, it is recommended to use it. Work on a non-metallic surface. Be careful that nothing shorts out when power is applied to the receiver. Don't touch the receiver when tuning; use a pencil or other wooden device to hold the receiver in place when tuning. Use a non-metallic tuning wand to tune. If you don't have one, fabricate one from plastic or wood. Stretch out the receiver antenna wire so it's straight.

( ) Solder a 1KΩ (brown, black, red) resistor to the ground land of the receiver. This ground land runs around the perimeter of the receiver P.C. board. Anywhere near the 11.155 crystal is acceptable.

( ) Solder another 1KΩ resistor to the top of the 1KΩ between the 2N2925 transistor and the black I.F. can (see Fig.#1).

Fig.#1

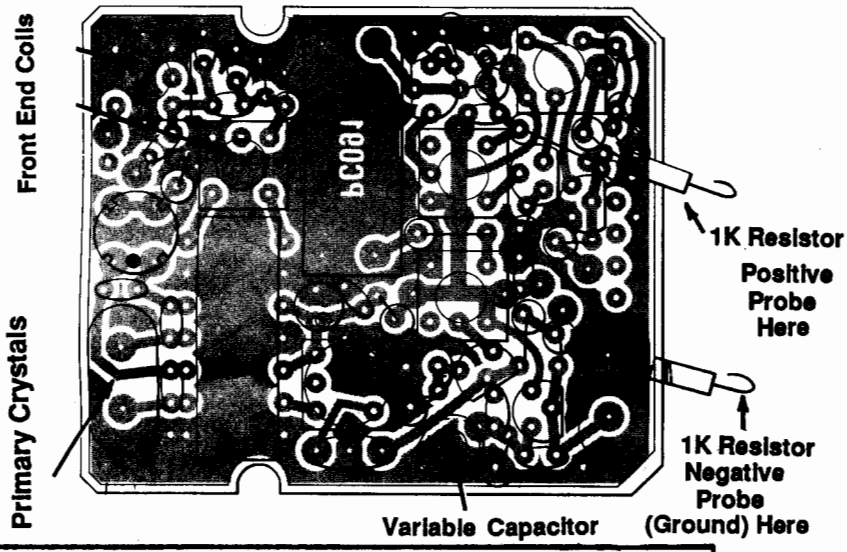


Fig.#1A

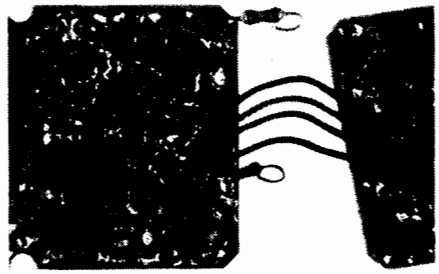
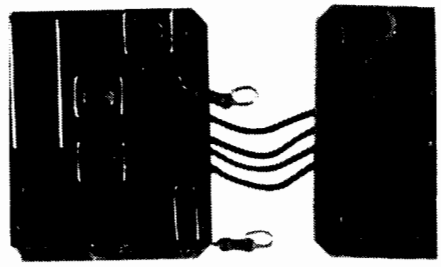


Fig.#1B



( ) Using a couple small rubber bands to hold them together and using the divider ring of the plastic case to keep them apart, assemble the receiver and decoder back-to-back, just as if they were installed in the case (see next photo). Be careful that nothing shorts together between the two PC boards. Note that the interconnect wires are worked up through the holes in the decoder and lay down on top of the decoder instead of the excess being in between the boards.

( ) Attach the negative scope lead and or voltmeter lead to the 1KΩ resistor on the ground land. Attach the positive scope lead and or voltmeter lead to the other 1KΩ resistor.

( ) Adjust the 9-50 pf. trimmer capacitor as shown (midrange).

( ) The vertical deflection on the scope should be set at 1V per division. The horizontal deflection should be set at 2ms per division. The voltmeter should be set on the lowest setting that will read 4 volts.

( ) Remove the antenna from the transmitter and set it about 5-10 ft. away from the receiver, do not turn on yet. (Caution - a transmitter without the antenna should be left on 5 minutes maximum! The power output transistor can overheat and be permanently damaged!).

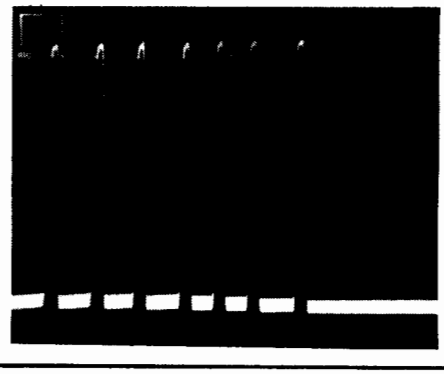
( ) Assuming the scope (if used) has been on and is warmed up, apply power to the receiver (5V).

( ) The signal on the scope should appear to be a flat line at 4.0V (+-.2V) and 4.0 V± .2 V on the voltmeter.

( ) Turn on the transmitter. A signal should now appear on the scope as illustrated below.

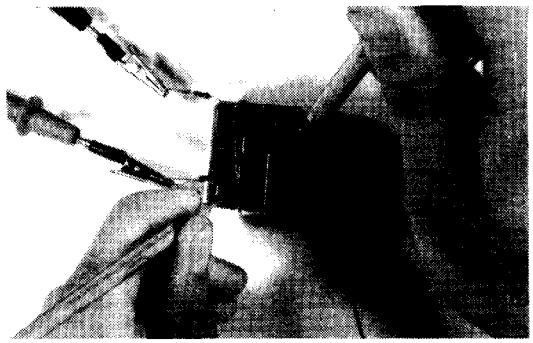
You should see a voltage drop on the voltmeter.

Fig.#2



( ) Begin tuning by adjusting the I.F. cans in the following order until the 'bottom' of the signal reaches 0 volts on the scope and or minimum voltage reading is achieved on the voltmeter.

1. Orange
2. Yellow
3. White
4. Black



( ) Move the transmitter another 10 ft. away and repeat the above tuning step.

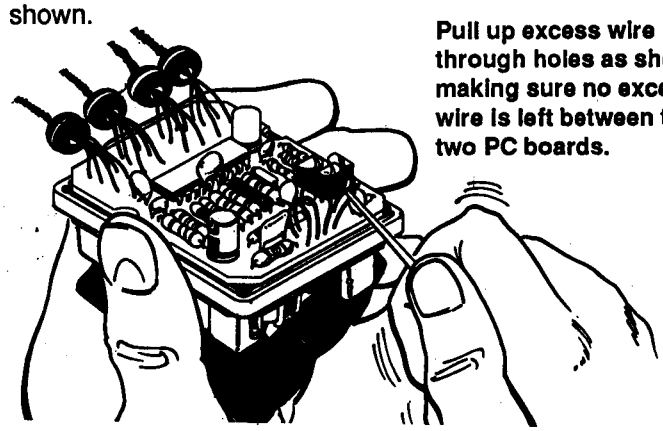
( ) Move the transmitter another 10 ft. and re-tune as above. Then adjust the two front end coils for maximum signal deflection on the scope and minimum voltage on the voltmeter.

( ) Move the transmitter 20 ft. further away and fine tune all coils for final adjustment.

( ) For absolute best tuning, the 10-50 pf trimmer should be adjusted for final tuning.

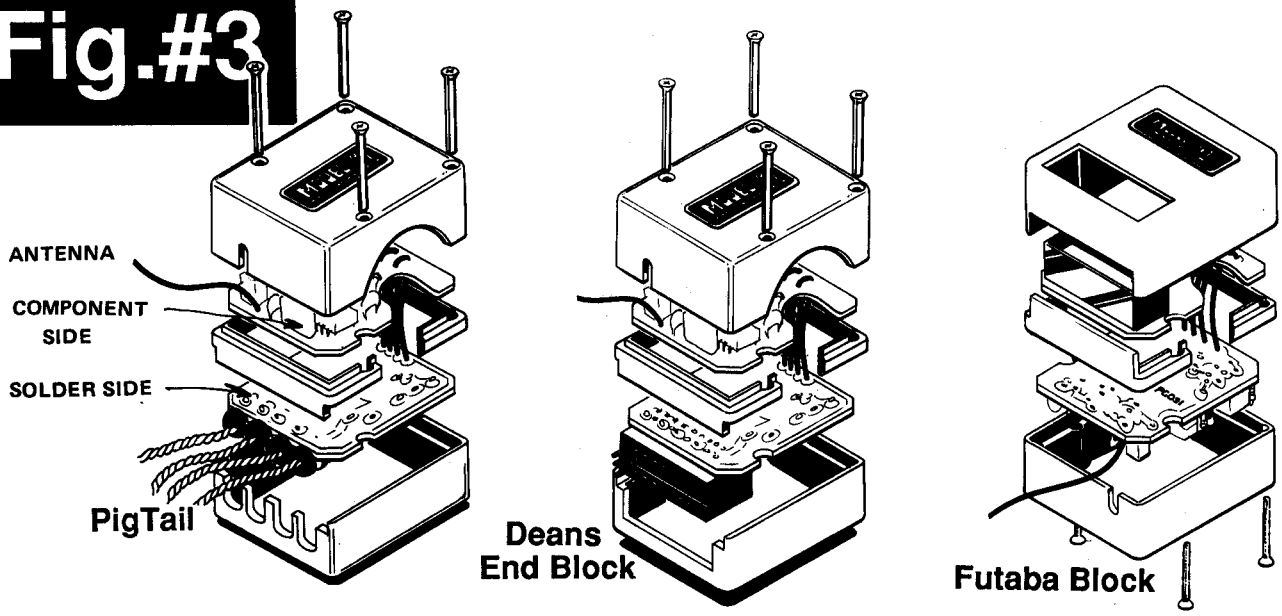
( ) Turn off the receiver and transmitter and re-install the transmitters antenna.

( ) Desolder the 1KΩ resistors from the receiver and unplug all cables. Install the receiver in it's case as shown in Figure 3. Affix the "Model 91" and FCC compliance sticker as shown.



Pull up excess wire through holes as shown making sure no excess wire is left between the two PC boards.

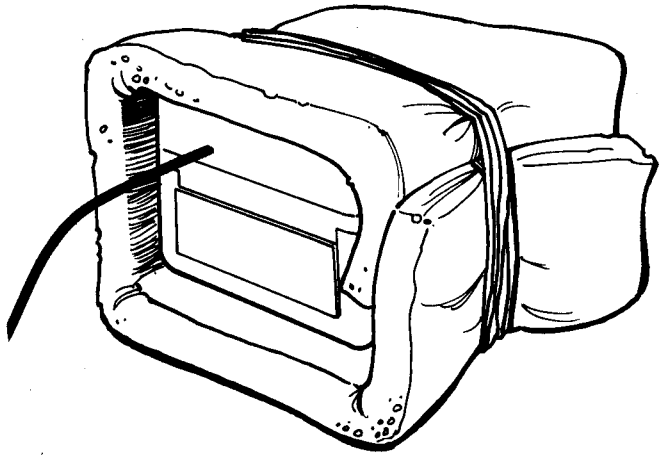
Fig.#3



III. OPERATION

Your Model 91 receiver is now ready for installation and operation. As with any R/C receiver, the same rules apply: pack in shock and vibration absorbing foam rubber in such a way that doesn't put a strain on the connectors. Route the antenna separate to and away from any other wiring or metallic components in the plane. Do not subject the equipment to temperature extremes when it can be avoided.

We hope you have many years of trouble free operation with your Ace Model 91 Receiver, another example of American Crafted Excellence from Ace R/C.



For protection in the airplane, wrap your receiver in foam rubber

IV. PARTS LIST

QUAN.	ACE P/N	DESCRIPTION
RX RESISTORS (ALL ARE 1/4W 5%)		
1	R4-101	100 Ω (brn, blk, brn)
6	R4-102	1K (brn, blk, red)
2	R4-103	10K (brn, blk, orn)
1	R4-151	150 Ω (brn, grn, brn)
1	R4-153	15K (brn, grn, orn)
2	R4-202	2K (red, blk, red)
1	R4-224	220K (red, red, yel)
1	R4-331	330 Ω (orn, orn, brn)
1	R4-471	470 Ω (yel, vio, brn)
RECEIVER CAPACITORS		
1	CD010	1pf Disc (010)
1	CD100	10pf Disc (100)
1	CD221	220pf Disc (221)
5	CO473	.047mf Monolythic (473)
1	CO103A	.01mf Monolythic (103)
1	CT106A	10mf Dipped Tantalum
1	CT226A	22mf Dipped Tantalum
1	CT475A	4.7mf Dipped Tantalum
1	CV950	9-50pf Variable
RECEIVER FILTERS AND INDUCTORS		
1	FT455	CFM455H Filter
1	FT107	SFE10.7A Filter
1	LL015	Black IF Transformer (4828)
1	LL016	Yellow IF Transformer (4827)
1	LL017	White IF Transformer (238)
1	LL018	Orange IF Transformer
RECEIVER AND DECODER SEMICONDUCTORS		
1	SS098	SO42P IC
1	SS094	NE5045 IC
4	SS006A	43144 Transistor
1	SS024	2N2925 Transistor
2	SS034	2N5088 Transistor
1	SS018	MPS6562 Transistor
7	SS121	1N4446 Diode
DECODER RESISTORS (ALL ARE 1/4W 5%)		
1	R4-103	10K (brn, blk, orn)
1	R4-104	100K (brn, blk, yel)
1	R4-122	1.2K (brn, red, red)
2	R4-332	3.3K (orn, orn, red)
1	R4-333	33K (orn, orn, orn)
1	R4-334	330K (orn, orn, yel)
1	R4-472	4.7K (yel, vio, red)
2	R4-473	47K (yel, vio, orn)
1	R4-561	560 Ω (grn, blu, brn)
1	R4-562	5.6K (grn, blu, red)
1	R4-563	56K (grn, blu, orn)
1	R4-681	680 ohm (blu, gry, brn)
1	R4-683	68K (blu, gry, orn)
DECODER CAPACITORS		
1	CD102	.001mf Disc (102)
2	CE336PI	33mf P.I. Electrolytic
1	CO103	.01mf Monolythic (103)
1	CO104	.1mf Monolythic (104)
1	CO224A	.22mf Monolythic (224)
2	CO473	.047mf Monolythic (473)
2	CT105A	1mf Dipped Tantalum (105)
RECEIVER CRYSTAL/COIL PACKAGE (72 mHz)		
1	XT(XXX)	Frequency Determining Xtal
1	XT11155	11.155 mHz Fundamental Xtal
2	LL050	2K256 Antenna Tuning Coils
2	CD180	18pf Disc Cap (180)
2	CD220	22pf Disc Cap (220)
1	CD270	27pf Disc Cap (270)
1	LL091	Wound Dumbell Inductor
RECEIVER CRYSTAL/COIL PACKAGE (50/53 mHz)		
1	XT(XXX)	Frequency Determining Xtal
1	XT11155	11.155 mHz Fundamental Xtal
2	LL051	2K241 Antenna Tuning Coils
1	LL395	3.9uhy Choke
4	CD100	10pf Disc Cap (100)
1	CD180	18pf Disc Cap (180)
1	CD300	33pf Disc Cap (300)

(See addendum sheet for changes)

MISCELLANEOUS		
1	PC091	Receiver PC Board (PC091)
1	PC091F	Decoder PC Board for Futaba Endblock and all Pigtail Connectors
1	PLA091P	Case Top (pigtail style)
1	PLA091S	Case Spacer
1	PLA091	Case Bottom
4	HW028	0-80 x 1" F.H. Case Screws
1	LB084	"Compliance" Label
1	LB082	Model 91 Label
4	RP004	No. 1 Grommet
96"		Black Hookup Wire
54"		Red Hookup Wire
8" (ea)		Brown, Orange, Yellow, Green, Blue, Violet, Gray and White Hookup Wire
48"		Solder
1"		Insulation Sleeving

V. RECEIVER PC BOARD CONSTRUCTION

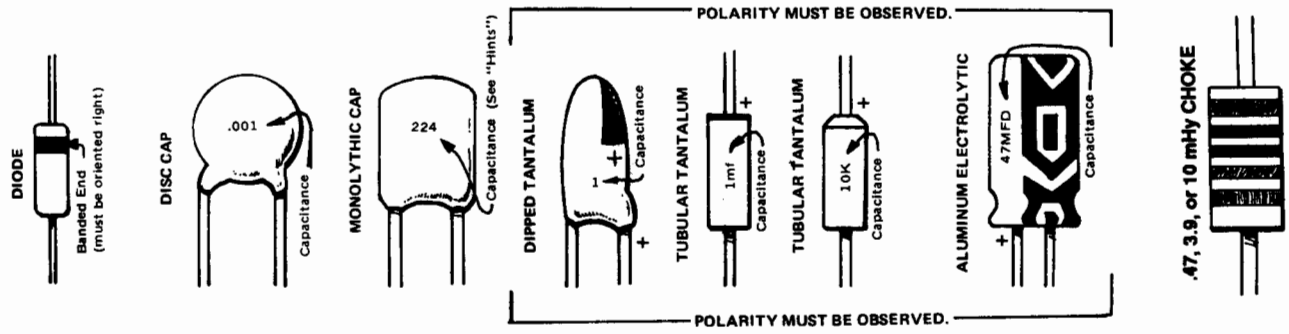
( ) Re-read the Kit-Builders Hints, especially the section on component ID and PC board construction. Check the parts against the Parts List. Notify Ace R/C of any shortages.

( ) Using the overlay drawings and Parts ID Legend, assemble the PC board in several stages, following the suggested procedure and always observing the footnotes for items requiring speical attention.

( ) Make sure the parts stay flat on the board and they remain perpendicular to the board, especially those components around the outside of the board; otherwise the case won't fit properly later.

( ) Install Stage One parts in the following order. You can install and solder parts one at a time or a few at a time - be careful to not miss any solder joints. Clip leads close to circuit board after soldering.

Component ID Aid



STAGE ONE PARTS ID LEGEND

( ) IC-1 S042P:
(NOTE PROPER ORIENTATION)

( ) C9 .047mf Monolythic Cap (473)

( ) C1 18pf Disc Cap (180)
( ) C2 18pf Disc Cap (180)
( ) C3 22pf Disc Cap (220)
( ) C4 22pf Disc Cap (220)
( ) C5 27pf Disc Cap (270)
( ) C7 1pf Disc Cap (010)
( ) C10 220pf (221)
( ) C12 10pf (100)
( ) C11 9-50pf Variable Cap:
(NOTE ORIENTATION)
( ) C8 10mf Dipped Tantalum:
(NOTE ORIENTATION)
( ) C13 22mf Dipped Tantalum:
(NOTE ORIENTATION)
( ) C14 .047mf Monolythic Cap (473)
( ) C15 .047mf Monolythic Cap (473)
( ) C16 .01mf Monolythic Cap (103)
( ) C18 .047mf Monolythic Cap (473)
( ) C19 .047mf Monolythic Cap (473)
( ) C17 4.7mf Dipped Tantalum:
(NOTE ORIENTATION)
( ) L3 Wound Dumbell Inductor:
(NOTE ORIENTATION OF RED DOT; KEEP UNIT FLAT ON THE BOARD)

( ) D1 1N4446 Diode:
(BANDED END DOWN)
( ) D2 1N4446 Diode:
(BANDED END UP)
( ) D3 1N4446 Diode:
(BANDED END UP)

Fig.#4

Stage #1 PC Board Construction

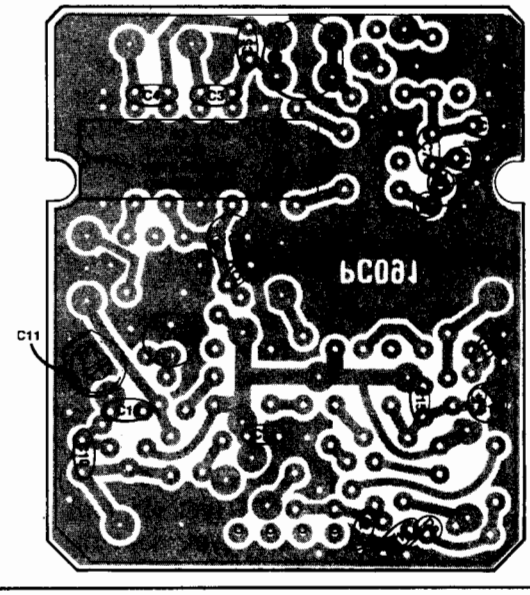
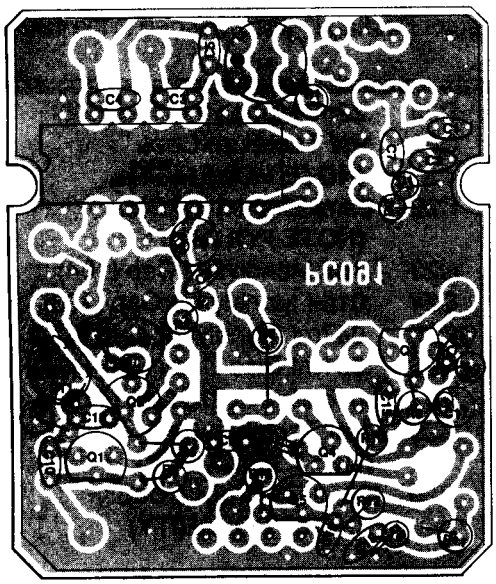


Fig.#5

Stage #2 PC Board Construction



( ) Install resistors and transistors in the following sequence either one at a time or in small groups. Make sure the flat side of the transistors are as illustrated and you leave about 3/16" space between the bottom of the transistor and the board.

STAGE TWO PARTS ID LEGEND

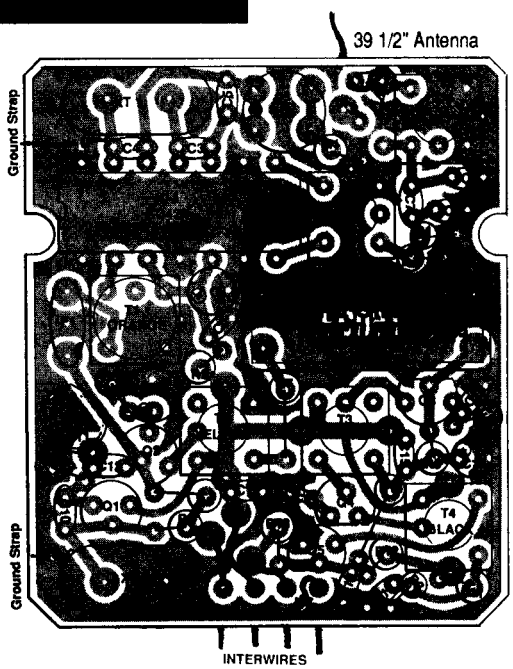
( )	R1	1K (brn, blk, red)
( )	R2	100 Ω (brn, blk, brn)
( )	R3	10K (brn, blk orn)
( )	R4	470 Ω (yel, vio, brn)
( )	R5	10K (brn, blk, orn)
( )	R6	1K (brn, blk, red)
( )	R7	2K (red, blk, red)
( )	R8	2K (red, blk, red)
( )	R9	330 Ω (orn, orn, brn)
( )	R10	220K (red, red, yel)
( )	R11	15K (brn, grn, orn)
( )	R12	1K (brn, blk, red)
( )	R13	1K (brn, blk, red)
( )	R14	150 Ω (brn, grn, brn): **(COVER EXPOSED LEAD WITH 5/16" INSULATION SLEEVING)**

Install the following transistors with the flat sides as shown and leave about 3/16" between the bottom of the transistor and the board.

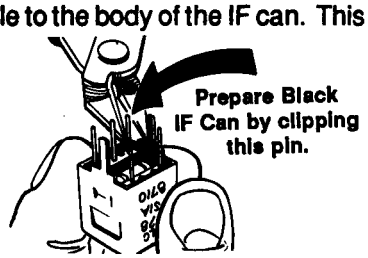
( )	Q1	43144
( )	Q2	43144
( )	Q3	43144
( )	Q4	43144
( )	Q5	2N2925

Fig.#6

Stage #3 PC Board Construction



( ) Prepare the black IF can by clipping off the lead illustrated as close as possible to the body of the IF can. This lead is not used.



( ) Solder the Stage Three components in place in the following sequence.

STAGE THREE PARTS ID LEGEND

( )	F1	SFE10.7A Filter: **(POSITION RED DOT AS SHOWN)**
( )	F2	CFM455H Filter
( )	T1	Orange IF Can
( )	T2	Yellow IF Can
( )	T3	White IF Can
( )	T4	Black IF Can
( )	L1	2K256 Antenna Coil
( )	L2	2K256 Antenna Coil
( )	XT1	Frequency Determining Crystal
( )	XT2	11.155 mHz Fundamental Crystal

DUAL CONVERSION RECEIVER CRYSTAL IDENTIFIER

CHANNEL	FREQ.	XTAL MARKING
12	72.030	61.330
38	72.550	61.850
40	72.590	61.890
42	72.630	61.930
44	72.670	61.970
46	72.710	62.010
48	72.750	62.050
50	72.790	62.090
52	72.830	62.130
54	72.870	62.170
56	72.910	62.210

( ) Use a scrap resistor lead as a ground strap for XT1 crystal. Insert the lead through the board with at least 3/8" left on the top of the board. Solder to the PC pad. Angle it over and solder to the crystal case.

( ) Repeat for XT2.

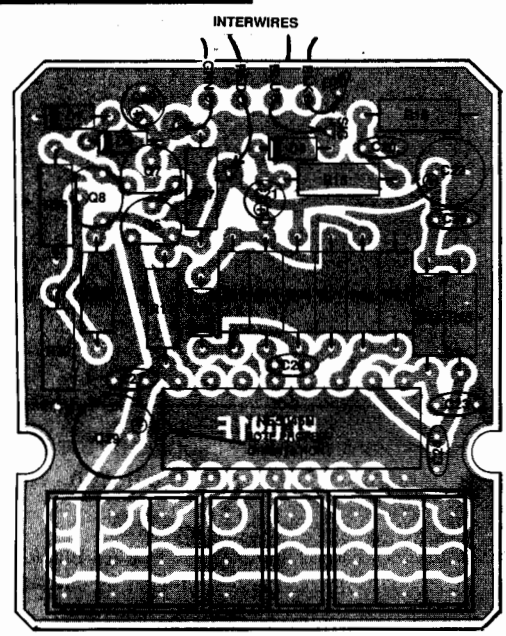
VI. DECODER PC BOARD CONSTRUCTION

( ) Decision time: You will use one of the two Decoder boards furnished.

Use PC091E if you are going to install Pigtail Connectors of any type (Kraft, Airtronics, etc...) OR if you are going to use our 19G706 Futaba Endblock Connector Package. It is furnished with your kit.

Use PC091D if you are going to use our 19G705 Deans Endblock Connector Package. It is furnished in the 19G705 Connector Pkg.

Fig.#7 **Decoder PC Board Construction**



( ) Install, solder and clip the components onto the selected PC board using the Decoder Overlay Drawing and the Decoder Parts ID Legend. Use the following sequence: IC-2, Diodes, Resistors, Capacitors, Transistors.

( ) IC-2 NE5045N:
(NOTE PROPER ORIENTATION)

( ) D4, D5, D6, D7 IN4446 Diode:
(NOTE ORIENTATION OF BANDED END)

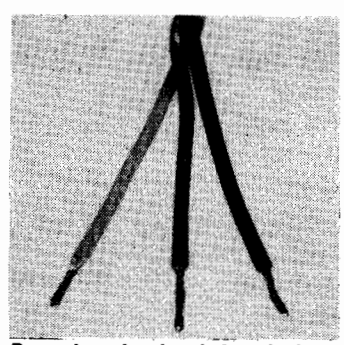
( ) R15 10K (brn, blk, orn)
( ) R16 100K (brn, blk, yel)
( ) R17 680 Ω (blu, gry, brn)
( ) R18 56K (grn, blu, orn)
( ) R19 5.6K (grn, blu, red)
( ) R20 1.2K (brn, red, red)
( ) R21 3.3K (orn, orn, red)
( ) R22 330K (orn, orn, yel)
( ) R23 4.7K (yel, vio, red)
( ) R24 47K (yel, vio, orn)
( ) R25 47K (yel, vio, orn)
( ) R26 560 Ω (grn, blu, brn)
( ) R27 3.3K (orn, orn, red)
( ) R28 68K (blu, gry, orn)
( ) R29 33K (orn, orn, orn)
( ) C20 .22mf Monolythic Cap (224)
( ) C21 1mf Tantalum Cap:
(NOTE POLARITY)
( ) C22 33mf Electrolytic Cap:
(NOTE POLARITY)
( ) C23 .1mf Monolythic Cap (104)
( ) C24 .01mf Monolythic Cap (103)
( ) C25 .047mf Monolythic Cap (473)
( ) C26 .001mf Disc Cap (102)
( ) C27 .047 Monolythic Cap (473)
( ) C28 1mf Tantalum Cap:
(NOTE POLARITY)
( ) C29 33mf Electrolytic Cap:
(NOTE POLARITY)

On the following transistors, position the flat side as shown; keep the bottom of the transistor 3/16" from the board.

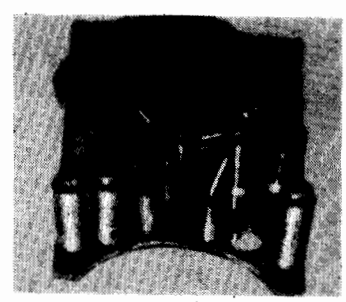
( ) Q6 MPS6562
( ) Q7 2N5088
( ) Q8 2N5088

VII. WIRING

A. TECHNIQUE



Properly twisted and tinned wires.



Properly installed wires-- no fraying--insulation flush on the board.

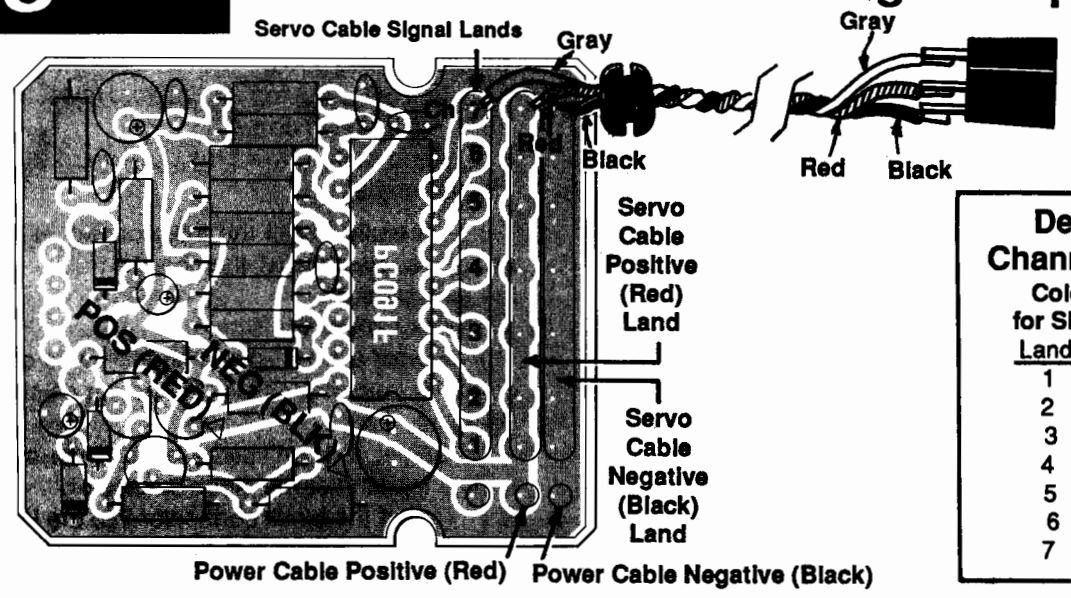
When preparing a wire for installation in a PC board or soldering to a connector, strip 1/8" of the insulation form the wire, twist the strands together and apply a small amount of solder to the wire. This is called "tinning". Be sure not to cut any of the wires when you strip off the insulation.

B. CONNECTOR WIRING

There are three basic ways to wire up the connectors: (1) Pigtail Fashion with Deans, Kraft, Futaba, Airtronics, etc... ; (2) Deans Endblock; (3) Futaba Endblock. For wiring up in the Endblock fashion, you will need to obtain either a Deans Endblock Connector Package (Ace P/N 19G705) or a Futaba Endblock Connector Package (Ace

Fig.#8

Servo Cable Wiring Example



Decoder Channel Color

Color Chart for Signal Wire

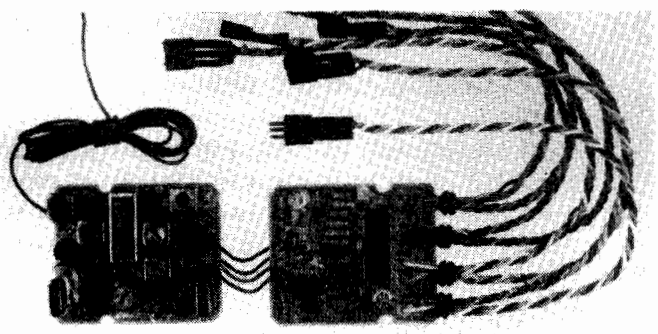
Land	Wire
1	BRN
2	ORN
3	YEL
4	GRN
5	BLU
6	VIO
7	GRY

P/N 19G706). **NOTE**: If you are building a complete system from Ace R/C, parts are supplied for, and the unit is to be wired in the Deans Endblock configuration. If you are wiring in the Pigtail configuration, you will need to obtain a suitable number of connectors to mate with the servos you are using and wire them in according to the following instructions. If you have difficulty in finding connectors, we suggest using Deans connectors; they are easily installed and very dependable. You will also need to get a power connector to mate with your switch harness.

1. Pigtail Connector Wiring: Deans

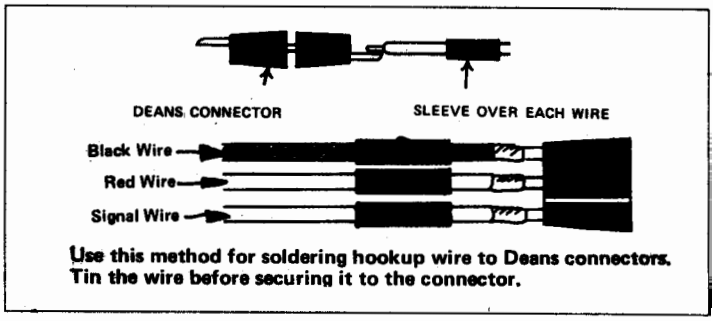
Begin by soldering up cables to the decoder deck using the wire furnished. You will need one two wire cable (red & black) for power and one three wire cable (red, black, and any third color) for each channel you are going to use (one through seven). The length of the cable is up to you.

( ) Referring to Fig. 8, the power cable (red & black) installs in the holes indicated; make sure the red wire goes in the positive land and the black in the negative



( ) The servo cables consist of a red wire in the positive land, a black wire in the negative land, and a third color wire in one of the signal lands (Chs. 1 through 7). With the wires exiting out the end of the PC board, twist each of the two and three wire cables together.

( ) Group the cables into four (or less) groupings. Slip a No. 1 grommet over each of these groups.



Use this method for soldering hookup wire to Deans connectors. Tin the wire before securing it to the connector.

( ) Before soldering up to the connector, always slip the wire through the appropriate sleeving toprevent having to unsolder the wire later. Don't use too much heat or you'll melt the plastic. It's a goodidea to mate the plugs together when soldering; this will help dissapate heat, make sure you're soldering to the correct end of the pins, and help prevent wiring errors. If both the wire and connector pin are "tinned" before soldering, the joint forms quickly and little heat is needed. A clothespin is a handy holding fixture for the connectors.

2. Pigtail Connector Wiring: Other Connectors

( ) When using connectors other than Deans, it is necessary to determine which wire is positive (+), negative (-), and signal. Usually, the cable will consist

of a red, black, and a third color wire, so this determination is easy. If it deviates from this, use a voltmeter to check the wires coming from the original receiver that the servo was used with to establish **proper polarity.**

( ) Putting No. 1 grommets over the cables (you can use up to four groupings), install the servo connector wires in the decoder with the positive to the positive land, negative to the negative land and signal to appropriate signal land (Ch. 1 through 7). Refer to Fig. 8.

( ) Install a power connector so negative (0V) goes to the negative land and positive (+4.8V) goes to the positive land.

Note: Four wire servos and negative pulse servos can be used under the following conditions. Four wire servos usually have a white wire that supplies battery center tap (+2.4V) to all the servos; you will have to devise a way to deliver 2.4V to all the servos.

If you are using negative pulse servos, a pulse inverter 14G18 will have to be used on each servo to work with this receiver.

3. Deans Endblock

Note: The following assumes you have either a complete system kit or have obtained a 19G705 Deans Endblock Connector Package.

A. Block Connector Assembly

( ) Note the white stripe on the connector body - it is the polarization mark to aid in assembly and to help plug the servo connectors in properly later. The white stripe is on the FRONT of the connector body and is closest to the BOTTOM.

( ) Begin by inserting the middle row of pins into the body. Insert from the front with the offset of the lug to the LEFT. Notice that the last pin on the left as you face the front is a male. Check that all the ends of the female pins are flush with the front of the body.

( ) Repeat for the top and bottom rows. Make sure the offset is correct.

( ) Bend bottom row pins downward to a 90 degree angle.

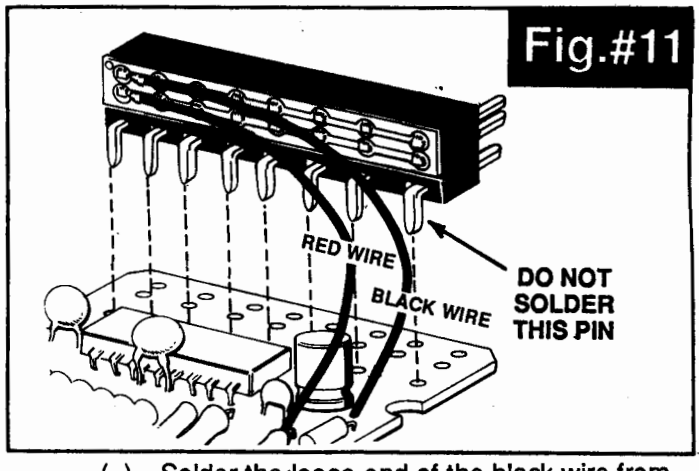
( ) Carefully install the interconnect PC board into place. **Be careful**, the board is fragile. Clip off the excess pins

b. Block Connector Wiring

( ) Solder a 1-1/4" piece of black wire onto the outer PC land of the block connector as shown in figure 11.

( ) Solder a 1-1/4" piece of red wire onto the middle PC land of the block connector.

( ) Insert the block connector into the Decoder PC board and solder, making sure it lays flat on the board. Do not solder the male pin.



( ) Solder the loose end of the black wire from the block into the hole marked "NEG (BLACK)" in the Decoder Board and the red wire into the hole marked "POS (RED)" . (Fig. 8)

4. Futaba Endblock

a. Block Assembly

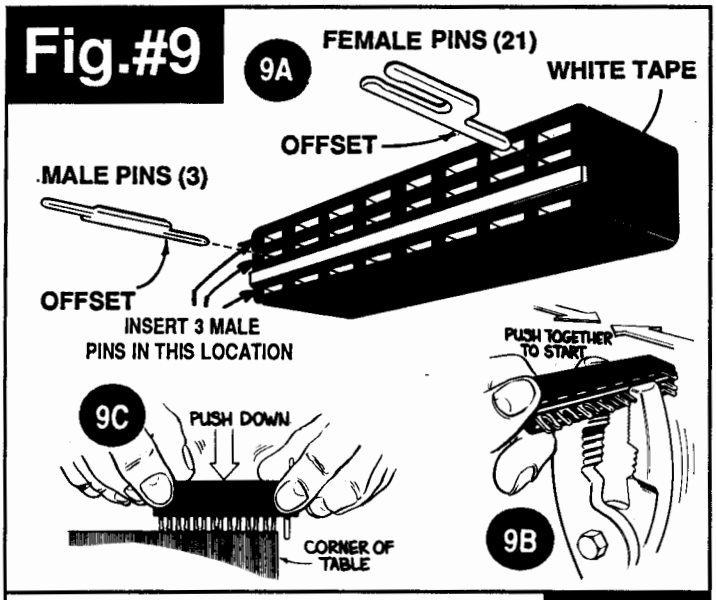
Note: The following assumes you have a Ace PN19G706 Futaba Endblock Connector Package.

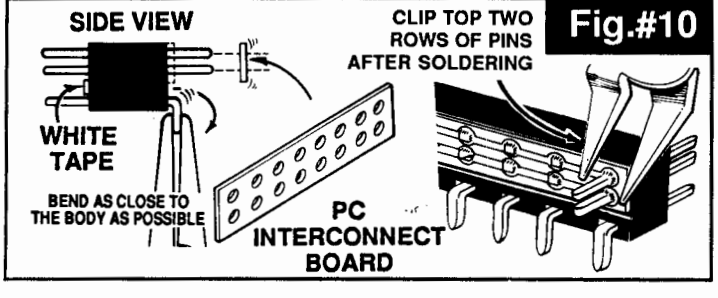
( ) Work over a large sheet of clean, white paper until the blocks are assembled so parts don't get lost. You will be building four blocks; 2 each of a three position block,and 2 each of a one position block.

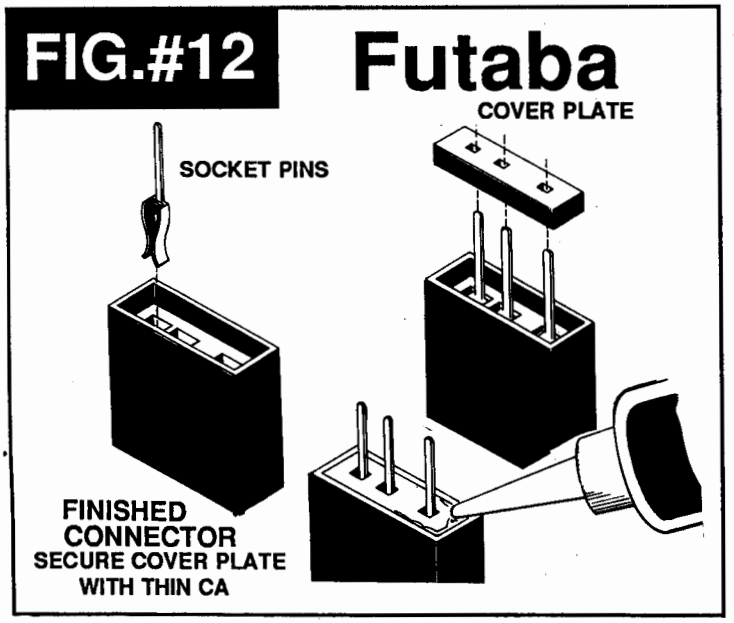
( ) Carefully trim any flashing off the plastic parts.

( ) Begin with the single position blocks and insert the socket pins in the plastic body as shown.

( ) Install the cover plate over the pins to hold them in place. Carefully secure the plate with thin CyA glue or plastic model cement.







( ) Repeat for the other single position blocks and then do the two three position blocks, installing 9 socket pins in each of them.

b. Futaba Block Installation

( ) Install the four blocks in the Decoder PC board with the two single position blocks in the middle. Fig.#7 Make sure they stay flat on the board while soldering. Clip off the excess socket pins.

VIII. INSPECTION AND CLEAN-UP

( ) Gently file off all sharp points from the back of the Decoder PC board. Make sure no solder joints/component leads protrude any more than 1/16" from the board's surface. Clean the solder side of the board with thinner or alcohol and an old toothbrush.

( ) Repeat for the Receiver PC board.

( ) Carefully inspect both boards for poor solder joints, solder bridges, or misplaced components. **Now do it again!** Most problems occur from inadequate inspection at this point.

IX. RECEIVER/DECODER INTERWIRING

( ) From the wire supplied, cut a 1-1/2" length of wire from the following colors: Red, black, blue and green. Strip and tin both ends of each 1-1/2" wire.

( ) With these wires, interwire the receiver and decoder. Thread them up through the larger hole in the PC board before inserting the tinned end in and soldering in the hole indicated. This gives the wire strain relief. Refer to Stage Three Overlay and Decoder Overlay for proper hookup. (Figs. 6 and 7)

( ) Cut a length of black wire 39" long and strip and tin one end. This is the antenna. Thread the stripped end through the large hole indicated (Stage Three) and insert and solder where indicated.

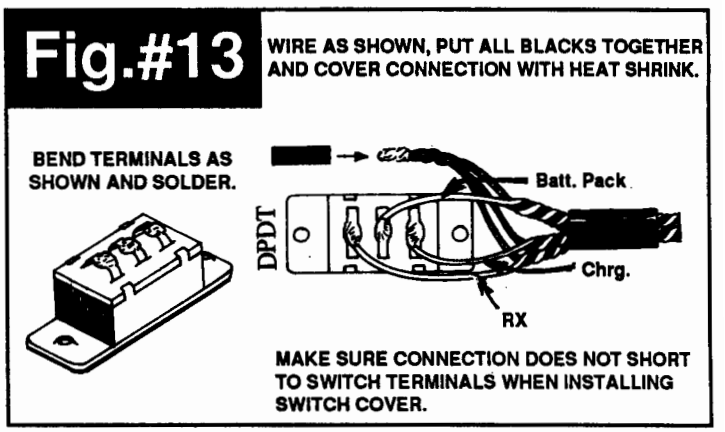
( ) This completes assmbly of your Model 91 Receiver. Now it's time to tune it up. Return to the front of the book and proceed with the tuning instructions, unless you are building a complete system; if so proceed with Switch Harness and Battery Pack Wiring instructions.

X. SWITCH HARNESS WIRING

The following assumes you have a complete system kit or have obtained the 19G702 Switch Harness Kit.

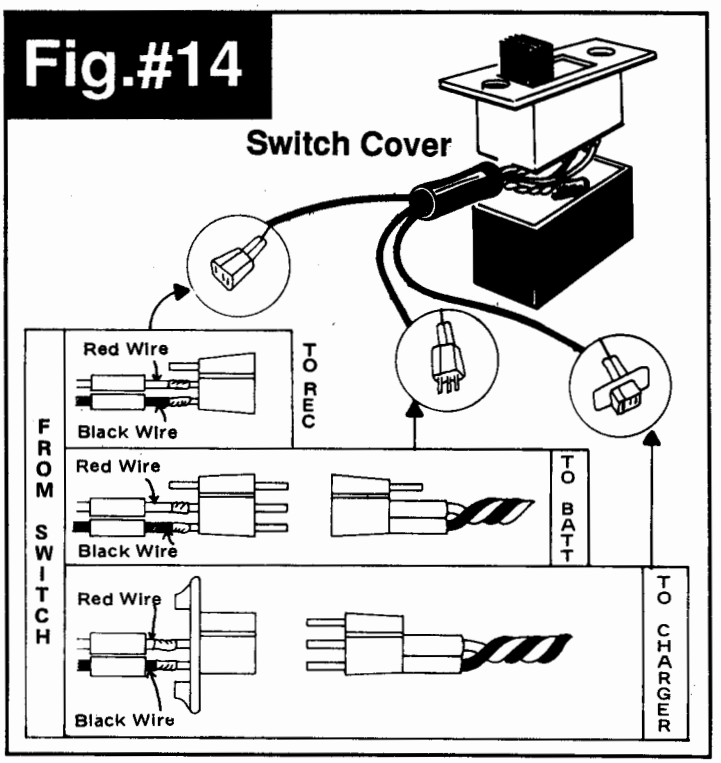
( ) Prepare three 8" cables of twisted red and black wire. Slip a 1" piece of 3/16" heat shrink over them.

( ) Solder to the Noble Switch as shown in Fig. 13. Make sure you have good joints with no frayed wires. It would be helpful



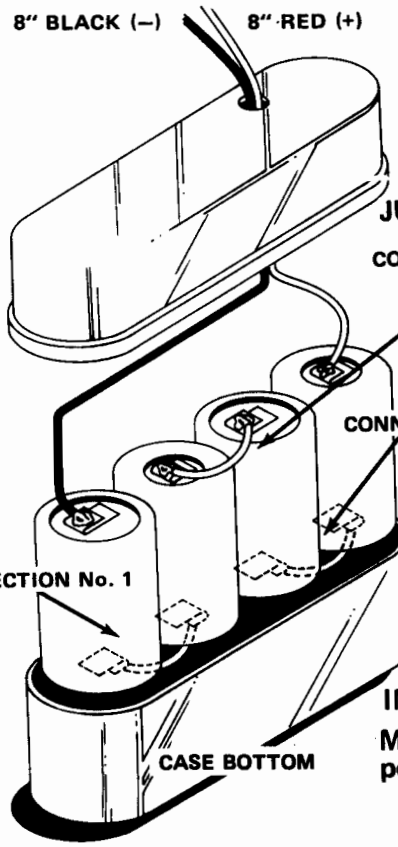
to use a piece of masking tape to label the opposite end of the cables: "battery", "receiver", "charger". Slide the tubing up to the terminals and shrink down with a lighter or heat gun.

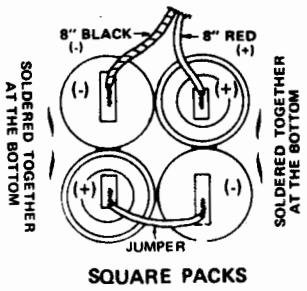
( ) Refer to Fig. 14 and solder the appropriate connector onton each of the proper cables from the switch.

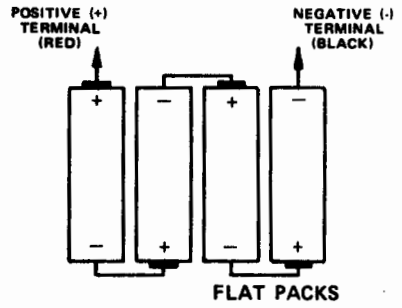


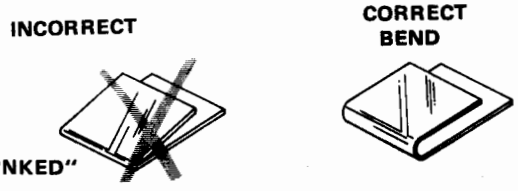
( ) Install the switch cover into place, it may be necessary to apply a small drop of CyA glue to hold it in place. Be very careful not to get any in the switch.

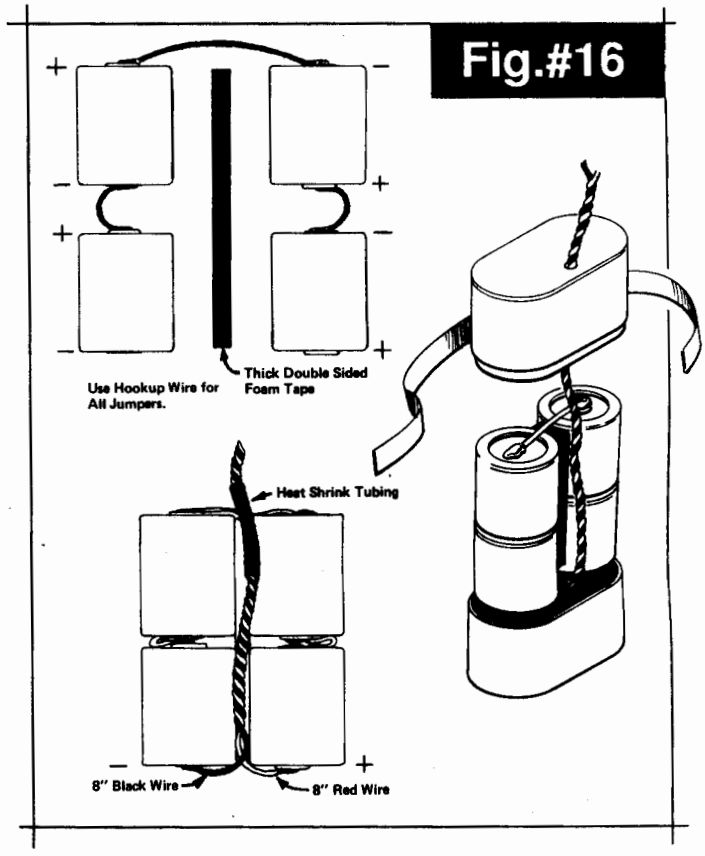
Fig.#15











XI. BATTERY PACK WIRING

Batteries for the flight pack are furnished in complete systems only. Depending on the size and type you have, wire the pack up accordingly. Note - some of the wiring may be done; ie. the cells may already be joined in pairs or even fours.

Several things must be kept in mind when working with the batteries: Be careful not to short the batteries out; make good secure solder joints—a bad one can come loose in the air and cause disaster; and always watch that proper polarity (+ and -) is maintained.

For all packs except 550 mah pack, follow the following steps to build the pack. For the 550 mah pack, build it according to the drawing specific for it. (Fig. 15A)

( ) Bend tabs over upon themselves on both ends of each cell, making sure the bends are rounded and not "kinked" (Fig. 15). Then clip off the excess.

( ) Make connections No. 1 and No. 2 (Fig. 15) by soldering jumper wires from the positive (+) tabs to the negative(-) tabs [the shouldered end is positive (+), the flat end is negative (-)].

( ) Slip the batteries into the case bottom as shown and make connection No. 3 in the same fashion.

BE SURE TO MAINTAIN PROPER POLARITY, FAILURE TO DO SO COULD RESULT IN A DAMAGED BATTERY PACK!

( ) Solder an 8" length of red wire to the positive terminal of one pair and an 8" length of black wire to the negative terminal of the other pair.

( ) Twist these wires together and tie a knot in them about 1/2" from the battery terminals—this knot will serve as a strain relief.

( ) Assemble the battery pack by threading the wires through the hole in the top of the case and securing the case top and bottom together with vinyl or "Scotch" tape.

( ) Now wire the battery pack to the female connector as

shown in figure 14. **MAKE SURE proper polarity is maintained.** If it is not you can damage the batteries, receiver and/or servos!

Although these batteries will accept a quick charge (4-6 hours.) or a fast charge (15 min), Ace R/C recommends that for all normal operation, they be charged at the overnight rate (12 to 16 hrs.) which is a 45-50 mah charge rate (C/10). This way you don't run the risk of damaging the batteries by overcharging them.

For the first charge in the battery pack's life, leave it on for a full 24 hours. Subsequent charges can be 12-16 hours.

XII. CIRCUIT DESCRIPTION

The Ace "Model 91" is a dual conversion superhetrodyne AM (amptitude modulation) radio control receiver.

Dual conversion is required to eliminate the possibility of image interference from transmitter operating within 10 MHz of the operating frequency of the receiver. This is achieved by using a two-step conversion (Dual) of the received signal by way of two oscillators rather than one as found in receivers such as the Silver Seven. This requires two crystals with very tight tolerances and their associated components. The result is superior unwanted signal rejection over single conversion type receivers. An SO42P balanced mixer integrated circuit, double tuned front end coils and a crystal whose value is 10.70 MHz less than the transmitted frequency from the first converter, usually called a down converter. When the received signal, which is impressed on the antenna and the 61 MHz oscillator are mixed, the result (10.7 MHz), is optimized and tuned by the orange I.F. transformer. This completes the first conversion. The 10.7 MHz resultant frequency is then further optimized by a 10.7 MHz crystal filter (the little brown rectangle you see next to the orange I.F. transformer).

The 'processed' 10.7 MHz frequency is then injected into the second converter which mixes it with 11.155 MHz. The result is 455 KHz (11.155 MHz-10.7 MHz=.455 MHz). This 455 KHz signal is then tuned, filtered and amplified before it reaches the signal detector. The very large (and expensive) CFM455H ceramic filter plays a major role in the final signal processing and the excellent interference rejection of the "Model 91" receiver.

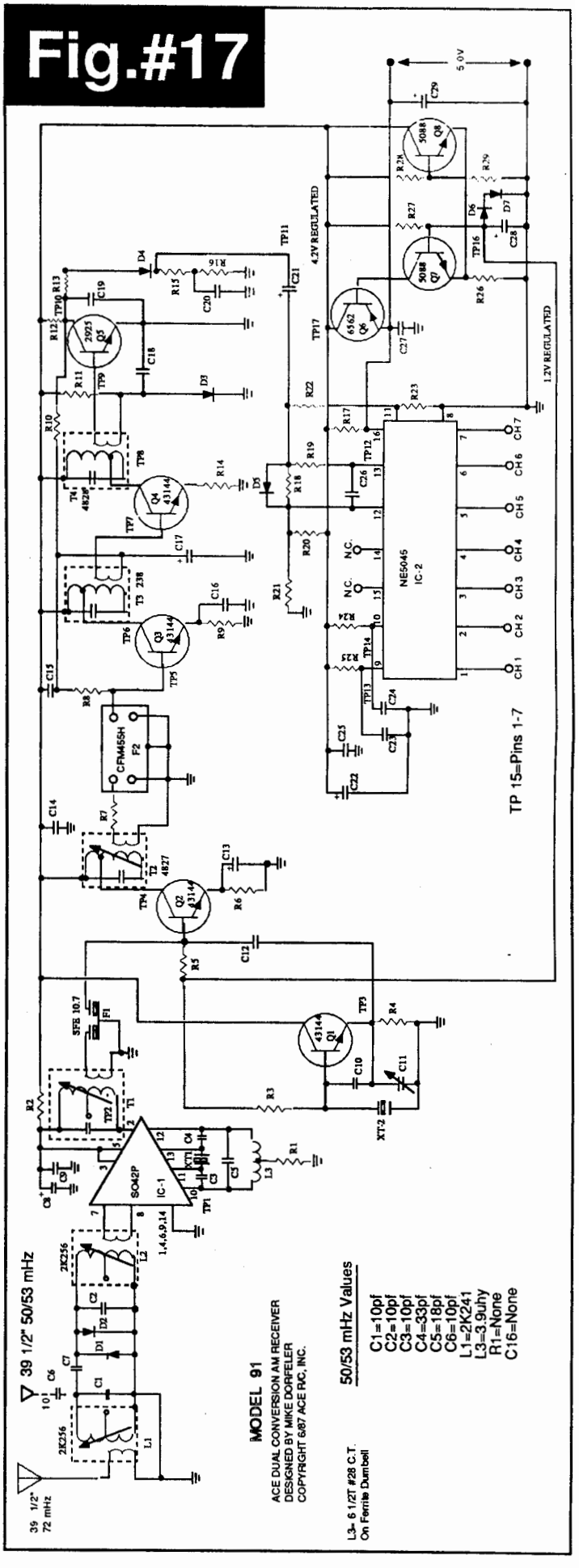
The 2N2925 transistor acts as the 'door' to the decoder by rectifying the final filtered signal and reproducing the transmitted pulse train in very clear form. As if this isn't enough, the signal is then passed through a "flutter" circuit whose purpose is to help average sudden changes in signal

XIII. TROUBLESHOOTING

The basic equipment required to troubleshoot your receiver is a VOM and/or an oscilloscope.

Always begin the troubleshooting by first cleaning the solder resin form the PC board with denatured alcohol and a tooth brush, if this hasn't already been done. Next inspect the PC board for cold solder joints and solder bridges using a magnifying glass. Compare your board to the circuit board shown in firgure 19., this will aid you in locating potential solder bridges. Also double check your component placement to

Fig.#17



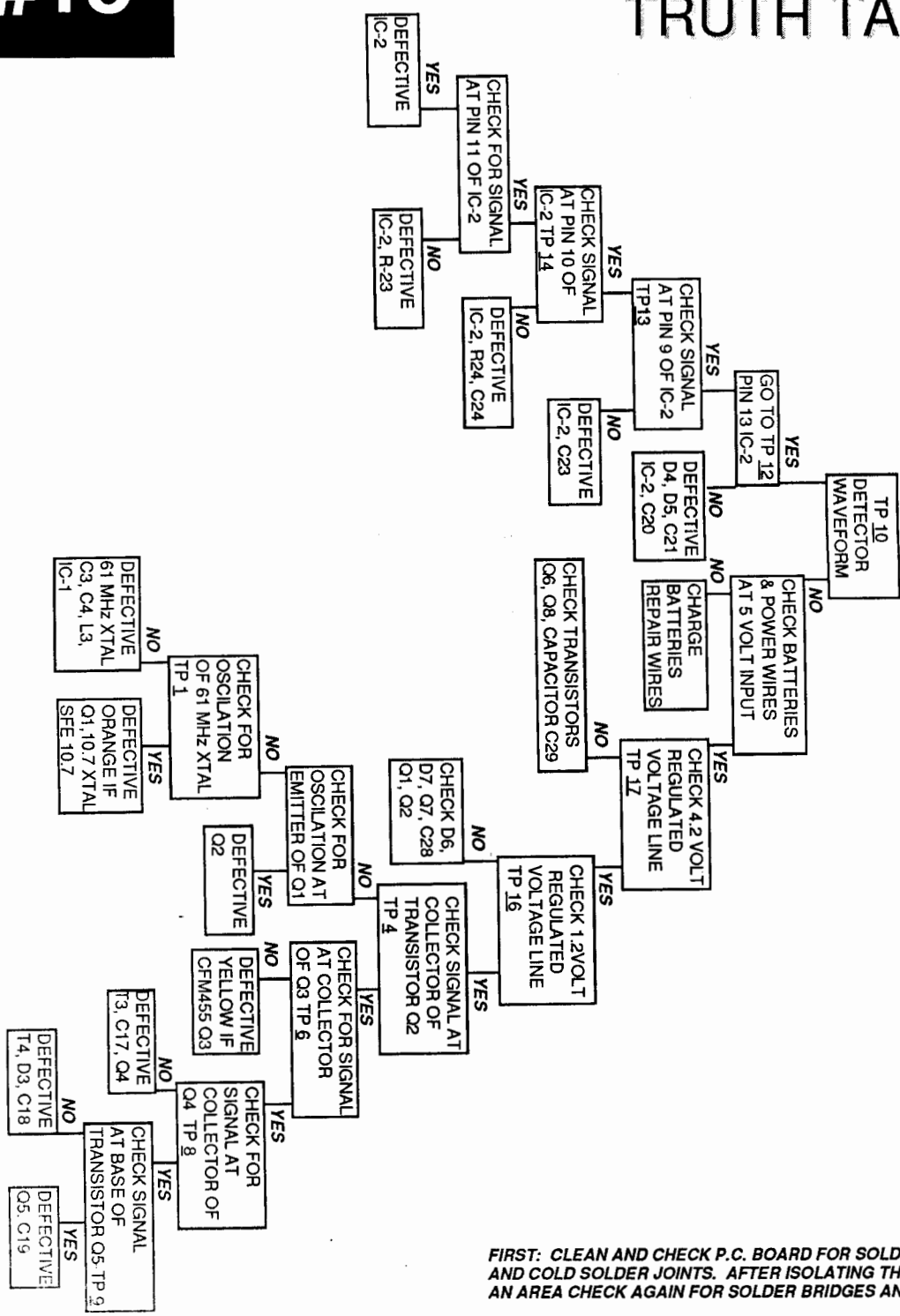
make sure all of the components are in their proper location.

If no building errors are found after inspecting the PC board, refer to the troubleshooting Truth Table (fig. 18), voltage chart and waveforms when troubleshooting the receiver. The waveforms and voltages shown are using a seven channel transmitter. Waveforms and voltages may vary slightly due to battery voltage, amount of signal being received and the tolerance of the components.

If after troubleshooting your receiver, you still can't find the problem, refer to the service policy sheet included with this manual for the address of a service center near you and pricing information.

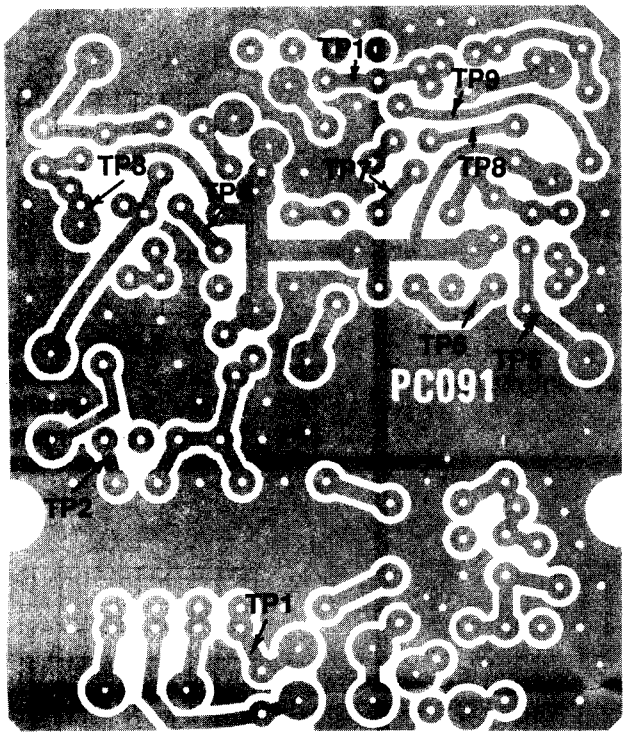
Fig.#18

TRUTH TABLE

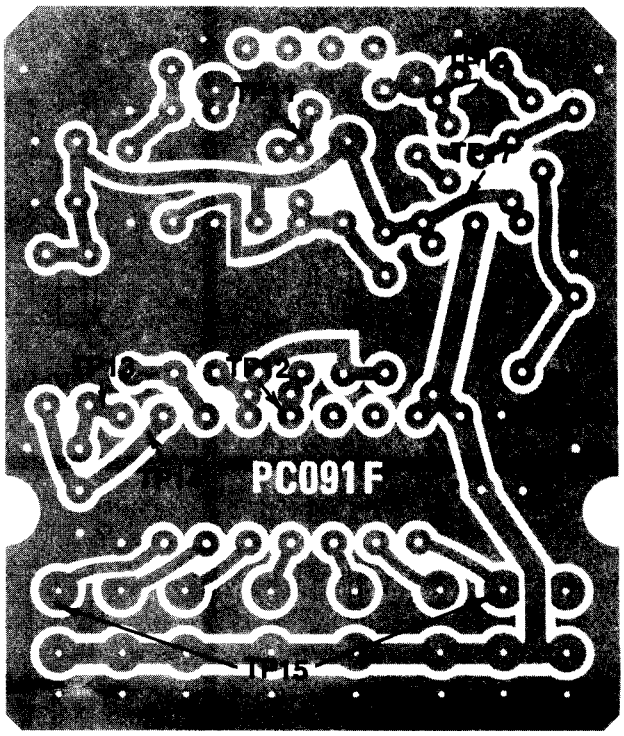


FIRST: CLEAN AND CHECK P.C. BOARD FOR SOLDER BRIDGES AND COLD SOLDER JOINTS. AFTER ISOLATING THE PROBLEM TO AN AREA CHECK AGAIN FOR SOLDER BRIDGES AND COLD JOINTS.

Fig.#19 Test Points



Receiver

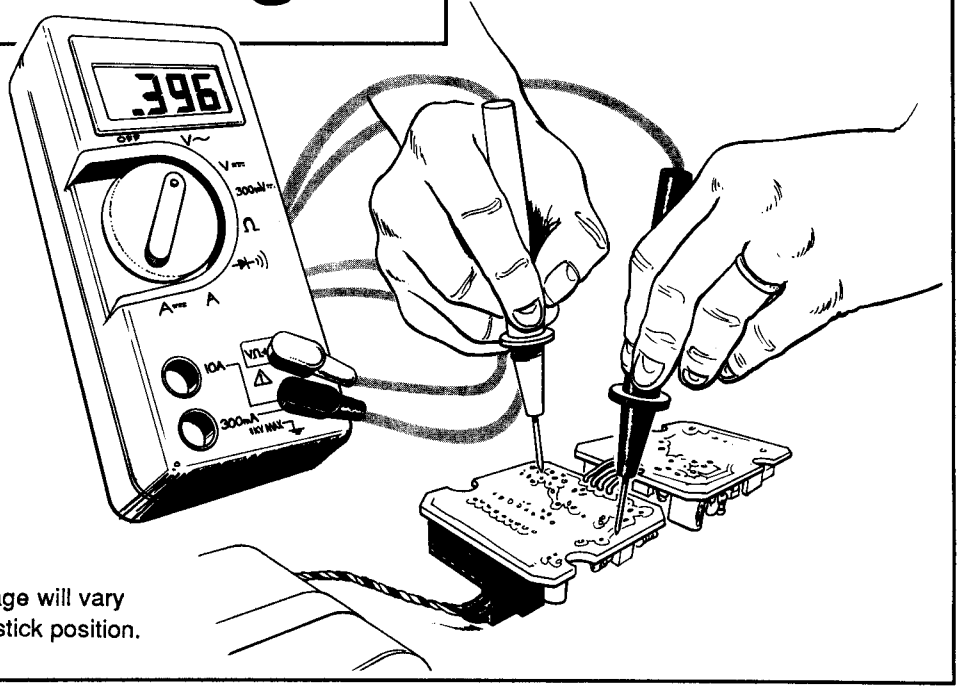


Decoder

Test point voltages

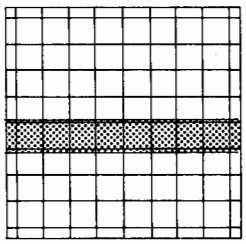
TEST POINT	W/ SIGNAL	W/O SIGNAL
TP1	.646V	.648V
TP2	3.82V	3.85V
TP3	.396V	.396V
TP4	4.00V	4.03V
TP5	.578V	.813V
TP6	4.00V	4.03V
TP7	.585V	.825V
TP8	4.00V	4.03V
TP9	.522V	.527V
TP10	.815V	3.92V
TP11	2.19V	3.45V
TP12	2.5V	2.6V
TP13	1.38V	3.98V
TP14	.297V	.055V
TP15	.45V*	.1V
TP16	1.2V	1.2V
TP17	4.2V	4.2V

*Voltage will vary with stick position.

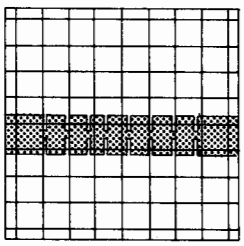


WAVEFORMS

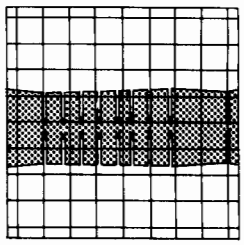
All readings taken with X10 probe



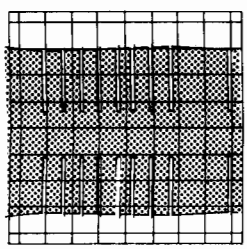
TP1 .2V/div 1 div amplitude
TP3 .5V/div 2.5 div amplitude



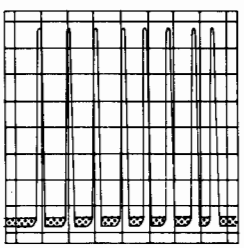
TP2 .5V/div .8 div amplitude



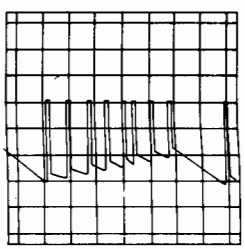
TP4 2V/div 3.5 div amplitude
TP5 .2V/div 2 div amplitude
TP7 .1V/div 3 div amplitude
TP9 .2V/div 2 div amplitude



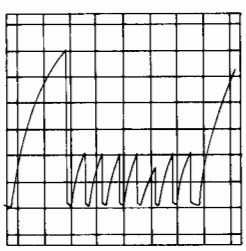
TP6 .5V/div 4 div amplitude
TP8 .5V/div 5 div amplitude



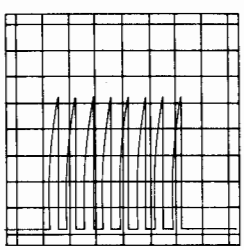
TP10 .5V/div 7.8 div amplitude



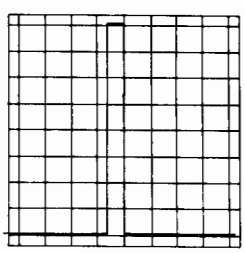
TP11 .5V/div 3 div amplitude
TP12 .5V/div 3 div amplitude



TP13 .5V/div 7 div amplitude



TP14 .5V/div 5 div amplitude



TP15 .5V/div 8 div amplitude

TP16 1.2V Constant

TP17 4.2V Constant

ACE R/C

116 W. 19th St., P.O.Box 511, Higginsville, MO 64037