

ASSEMBLY MANUAL

FOR YOUR

ACE

PHELPS PULSER



Ace R/C, Inc.

BOX 301
HIGGINSVILLE, MISSOURI

12/64

HELPFUL KIT BUILDING INFORMATION

Before you attempt to build your Ace R/C kit it would be most helpful to have you read the entire instruction manual through to thoroughly familiarize yourself with the general procedure. You will note the use of photographs and drawings throughout the instructions

This is offered primarily for the novice and will be definite assistance to those who lack a thorough knowledge of approved construction techniques. Even the advanced R/C enthusiast may benefit by a brief review of this material before proceeding with the construction of this kit. In the actual mechanical assembly of components for the chassis and related equipment it is important that the procedure as developed in the instructions be followed. Make sure that tube sockets are properly mounted in respect to the pin numbering location. The construction of Ace R/C kits does not necessarily require the use of a lot of specialized equipment and only basic tools in almost every R/C fan's home workshop are required. A good quality electric soldering iron is essential. A good supply of rosin core type solder of the Ersin Multi Core or similar type is recommended. Never use a separate flux, paste, or acid solder in any electronic work. The use of a long nose plier and a diagonal or side cutters is recommended. A small screwdriver will prove adequate although several additional assorted screwdrivers will be helpful.

When following wiring procedure make your leads as short and direct as possible. When removing insulation from the end of a length of hook up wire it is not necessary to expose more than 1/4" of wire. Excessive insulation removal may cause a short circuit condition in respect to near by components.

In mounting parts, such as resistors and capacitors trim off all excess lead lengths so that the components may be installed in a direct point to point manner. If necessary I use spaghetti over the exposed wires that may short to nearby wiring.

It is highly recommended that the parts layout as shown in the construction manual be followed exactly. The desirability of this arrangement was carefully determined through construction of a series of test models.

Much of the performance of an R/C kit depends upon the degree of workmanship used in making solder connections. Proper soldered connections are not difficult to make but it is advisable to observe some simple precautions. Before a connection is to be soldered the connection itself should be bright, clean, and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Excessive use of solder is to be avoided. Also avoid a flux flooding condition which could conceivably cause a leak between adjacent terminals

A check list of parts has been prepared for you and will be found in your kit. This contains a list of all components found in your kit. It is advisable for you after you have thoroughly studied the drawings, pictures, and instructions to check this list of components to make sure that all parts are in the kit.

In the event of a shortage please return the parts list to Ace Radio Control, Inc, Box 301, Higginsville, Missouri, detailing which parts you were short.

Best of luck on your R/C adventures.

PHELPS PULSER PARTS LIST

QUANTITY	DESCRIPTION
() 2	1 Meg resistors (brown, black, green, silver)
() 1	22K resistor (red, red, orange, silver)
() 1	10K resistor (brown, black, orange, silver)
() 2	2.2K resistors (red, red, red, silver)
() 1	1.2K resistor (brown, red, red, silver)
() 1	470 ohm resistor (yellow, violet, brown, silver)
() 1	10 ohm resistor (brown, black, black, silver)
() 3	10K potentiometers with a lock washer and nut
() 1	50K potentiometer with a lock washer and nut
() 1	15 mfd 25 volt electrolytic capacitor
() 1	5K standard Gem relay <u>OR</u> an Omega HR-1 Reed Switch
() 1	2N404 transistor
() 2	2N2926 transistors
() 1	2N1671 transistor
() 2	1N4009 diodes
() 1	1N3068 diode
() 1	SPST slide switch
() 2	Tini switches (1 red and 1 black)
() 1	Dual Protrol Package
() 2	80 tooth nylon gears
() 1	Trim pot. bracket
() 1	Littel Plug
() 1	Littel Jax
() 3	4/40 x 1" bolts
() 3	4/40 nuts
() 3	3/4" spacers
() 4	2/56 x 3/4" bolts
() 6	2/56 x 1/4" bolts
() 10	2/56 nuts
() 4	1/2" spacers
() 4	#4 black fibre washers
() 1	Small piece of shim stock
() 1	3/16" I.D. rubber grommet
() 1	Acme #13 battery box
() 1	Punched and screened metal case
() 1	PC base
() 1	Package of solder
() 1	Package of hookup wire
() 1	5 ft. length of shielded cable
() 1	Ace decal
() 1	Set of instructions

A HIGH STABILITY PULSER

By J.H.Phelps

Several years ago the progress in proportional control for R/C indicated the need for a pulser capable of precision, reasonable in cost, having immunity to drift with battery voltage and temperature, and featuring easily duplicated performance. In 1959 an initial circuit using a unijunction transistor was developed.

In response to requests from users, a smooth rate trim feature was added in 1960 to provide a trim function which did not dilute the effectiveness of the stick function on elevator. This modification proved to be a valuable one, and resulted in the further reduction in cost.

During 1961 and 1962 several equipment manufacturers incorporated the essential features of the pulser, and both the 1963 Intermediate Nationals Champion, Ralph Jackson, and the 1962 Intermediate winner, Don Dickerson, flew equipment using the pulser as part of their transmitting equipment.

This kit has been evolved from the most generally useful form of the Pulser, and has several important refinements in that the new high performance General Electric 2N2926 transistors are used in place of the physically larger 2N1694 units.

This pulser in this form is recommended for all so called single channel uses. This usage includes Kicking Duck, Galloping Ghost, etc. Since high rate is possible by changing the value of the electrolytic capacitor, the pulser will provide the precise accurate encoding signal needed for such systems to perform at an optimum level.

The pulser has a section that is responsible for the generation of the essential wave form, a rectangular wave whose duties cycle and repetition frequency are variable, independently, as control commands.

The first portion, a unijunction oscillator, furnishes a saw tooth beginning near ground and rising to approximately 12 volts. The frequency or period of the saw tooth is determined by the value of the timing capacitor, C, the intrinsic standoff ratio of the unijunction and the rate elevator stick pot setting. Since the period is defined by the relation among 3 variables, 2 of which are predetermined (unijunction transistor characteristics and timing capacitor tolerance) a trim provision of sufficient range is provided to absorb these variables.

The elevator stick pot is a standard 270 degree linear taper 50K ohm pot, and should be positioned on the stick assembly so that the moving wiper hits the pot stop with the stick all of the way forward. This position gives the greatest possible frequency change ratio (4:1) for the 80 degree stick travel. Less elevator control can be had (and a lower pulse frequency at center position) by rotating the pot away from this initial adjustment.

The two stage high gain squaring amplifier is a NPN PNP direct coupled pair. Both transistors are turned on and the PNP saturated by the one meg resistor in the plus 22 volt rail.

The stick pot in the emitter of the 2N2926 (a standard 10K linear taper 270 degree pot) sets a DC voltage which determines the voltage level at which the saw tooth turns off the squaring amplifier. The scheme of calling upon the saw tooth only for turn-off duty assures light saw tooth loading (22 micro amperes maximum) and assures a low control interaction and exceptional temperature stability. The result of squaring a various voltage levels, determined by the rudder stick pot, is a variable duty cycle square wave. Eighty degrees of stick travel changes the duty cycle from approximately 75 percent to 25 percent off, to 25 percent on, and 75 percent off. The duty cycle should be set from 50 percent with the trim pot at center travel, and the stick straight up. It should be pointed out here that because regular standard and not precision tolerance components are used, there will be some variations, but these will not effect the aircraft. The variation can be detected by listening for relay click change or more precise method may be used. The variations are normal, but adjustments should be made carefully. Some relay adjustment may be necessary if there is too great a difference detected in the dwell time at either stick extreme.

Shielded cable with the outer shield connected to both transmitter chassis and the pulser box is necessary to prevent transmitter RF from creeping into the pulse box and raising hob. Transistor choice and component values team together to guarantee 10 degrees Fahrenheit to a 140 degrees Fahrenheit pulser operation. Weak dry batteries are readily exposed by low temperatures, so check by cold soaking the battery. Pulsers will stop at a level determined by relay spring tension.

NOTE: While a #13 battery box for a battery of the Eveready 015 type is provided, there is room to use a larger 22 1/2 volt battery inside the pulser case. One or two parallel sections of an Eveready #45J may be used for power. The average drain is 10 milliamp, and larger batteries are recommended for heavy use.

Do not attempt any transistor substitutions over those supplied for the kit.

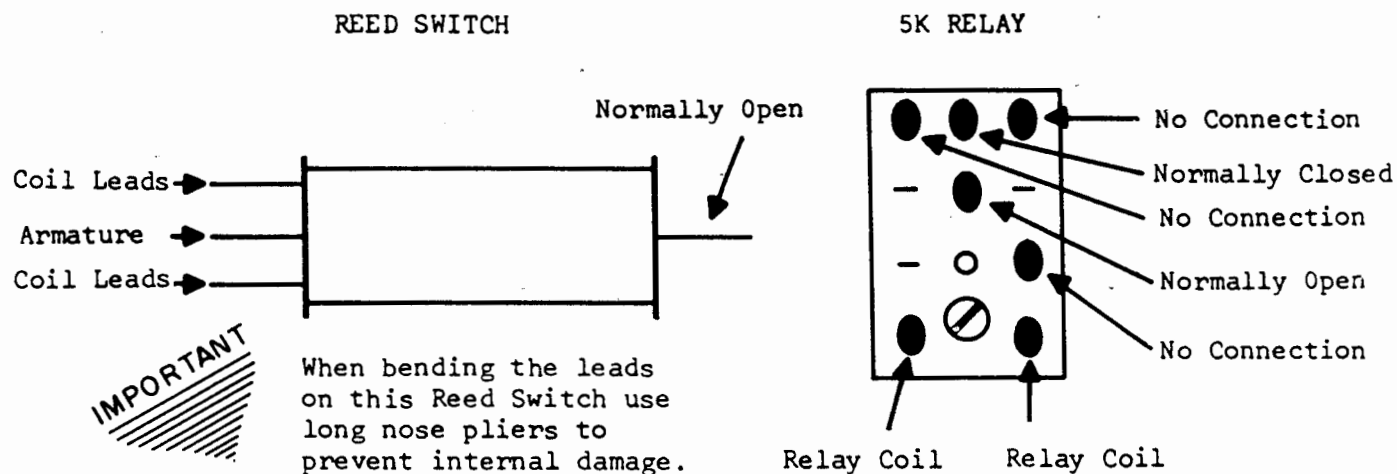
We believe you have the most sophisticated and best pulser available to the R/C fan today. It can be adapted for relayless operation or reed switch-operation as is.

Happy landings !

MOUNTING PARTS TO PULSER CASE

- 1 () Mount the SPST slide switch in the upper left hand hole of the pulser case mounting the switch with the 2/56 x 1/4 bolts and nuts. Make sure switch is mounted to coincide with the OFF ON which is screened on the pulser case.

- 2 () Mount the Acme #13 battery box using two 2/56 x 1/4 bolts and nuts in the two holes above the large hole in the middle of the pulser case.
- 3 () Assemble the dual protrol using the instructions in the dual protrol box. Use a 10K pot for the rudder and a 50K pot for the elevator.
- 4 () Mount the 10K pot on the Dual Protrol bracket, with a 80T nylon gear on the pot shaft. Use shim stock for wedge fit.
- 5 () Mount the Dual Protrol assembly to the pulser case using the three 4 x 40x 1 bolts and nuts and the three spacers.
- 6 () Mount the 10K pot on the rudder trim bracket. Slide an 80T nylon gear over pot shaft, using shim stock for wedge fit. Fasten this bracket to the pulser case with the 2-2/56 x 1/4 bolts and nuts.
- 7 () Glue the 80T nylon gears to their pot shaft, using a cement or epoxy that adheres anything to anything.
- 8 () Insert the 1/4 inch grommet in the center hole on the side of the pulser case.
- 9 () Mount the red push switch in the hole on the side of the case marked High.
- 10 () Mount the black push switch in the hole on the side of the case marked Low.
- 11 () The four remaining holes on the side of the case are used later for mounting the PC base in section "Wiring Pulser."



WIRING PC BASE

Solder at each step unless specifically told not to.

Buff PC base before proceeding with the step by step instructions.

- 1 () Insert a 2N1671 transistor in holes 35, 37, and 38, with the emitter in hole 38, B1 in hole 35, and B2 in hole 37. When soldering transistors into the circuit use some type of heat sink to prevent damage to the transistors.
- 2 () Insert a 2N2926 transistor in holes 7, 46, and 47, with the emitter in hole 46, the base in hole 7 and the collector in hole 47. When soldering transistors into the circuit use some type of heat sink to prevent damage to the transistor.
- 3 () Insert a 2N2926 transistor in holes 12, 13, and 29, with the emitter in hole 29, the base in hole 13, and the collector in hole 12. When soldering the transistor into the circuit use some type of heat sink to prevent damage to the transistor.
- 4 () Insert a 2N404 transistor in holes 4, 15, and 16, with the emitter in hole 4, the base in hole 15 and the collector in hole 16. When soldering transistors into the circuit use some type of heat sink to prevent damage to the transistors.
- 5 () Insert a 1.2K resistor (brown, red, red) in holes 28 and 33.
- 6 () Insert a 10 ohm resistor (brown, black, black) in holes 24 and 34.
- 7 () Insert a 2.2K resistor (red, red, red) in holes 36 and 40.
- 8 () Insert a 22K resistor (red, red, orange) in holes 42 and 44.
- 9 () Insert a 10K resistor (brown, black, orange) in holes 43 and 49.
- 10 () Insert a 15 mf 25 volt electrolytic capacitor in holes 27 and 41, with the positive lead in hole 27, and the negative lead in hole 41.
- 11 () Insert a 470 ohm resistor (yellow, violet, brown) in holes 1 and 8 standing upright over hole 8.
- 12 () Insert a 1N3068 diode in holes 31 and 32, with the cathode lead in hole 32, standing upright over hole 32.
- 13 () Insert a 1N4009 diode in holes 9 and 11, with the cathode lead in hole 9, standing upright over hole 9.
- 14 () Insert a 1 Meg resistor (brown, black, green) in holes 2 and 10, standing upright over hole 10.
- 15 () Insert a 1 Meg resistor (brown, black, green) in holes 22 and 23, standing upright over hole 23.

- 16() Insert a 2.2K resistor (red, red, red) in holes 3 and 14, standing upright over hole 14.
- 17() Insert the 5K relay in holes 19 and 20, fastening the relay to the PC base with the 2/56 bolt. When using the Reed Switch, mount in holes 26, 52 50, and 25, using a long nose pliers when bending the leads to prevent internal damage.
- 18() Insert a 1N4009 diode in holes 17 and 18, with the cathode lead in hole 17, standing upright over hole 18.
- 19() Connect one lead from the coil of the relay in hole 25, and the other lead of the relay in hole 26, when using relay.
- 20() Connect a 6 inch red wire in hole 5.
- 21() Connect a 9 inch blue wire in hole 30.
- 22() Connect a 9 inch red wire on the P.C. side of the base, on the land where holes 1,2,3,4, and 5 are located.
- 23() Connect a 6 inch green wire in hole 6.
- 24() Connect a 6 inch violet wire in hole 48.
- 25() Connect a 6 inch brown wire in hole 45.
- 26() Connect a 6 inch white wire in hole 39.
- 27() Connect a 6 inch black wire on the PC side of the base on the land where holes 18,25,41,42, and 43 are located.
- 28() Connect a 4 1/4 inch grey wire in hole 21.
- 29() Connect a 3 inch black wire from land where holes 18, 25,41,42 and 43 are located.
- 30() Connect a 3 inch orange wire to the frame of the relay, or hole 53 when using the reed switch.
- 31() Connect a 3 inch yellow wire to the normally open position of the relay, or hole 51 when using the reed switch.
- 32() The four corner holes are for mounting the PC base to the pulser box; mount when called for under section "Wiring Pulser."

BOTTOM VIEW



2N2926



2N1671

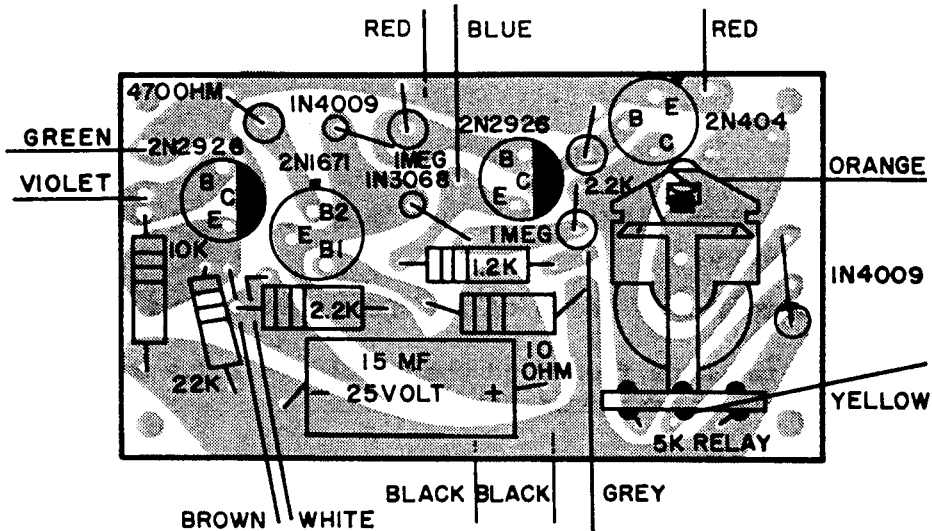


2N404

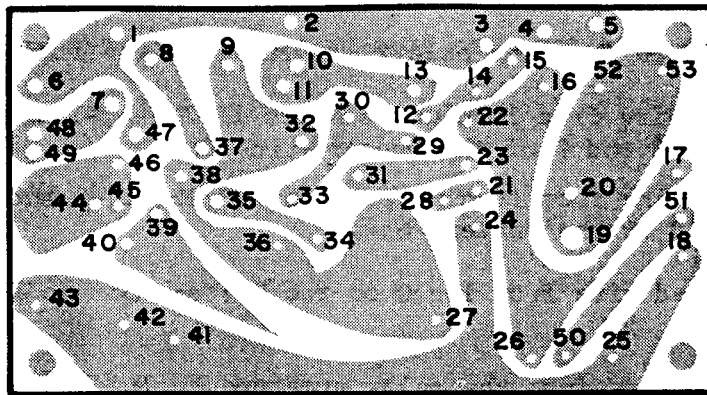
E=EMITTER
B=BASE
C=COLLECTOR



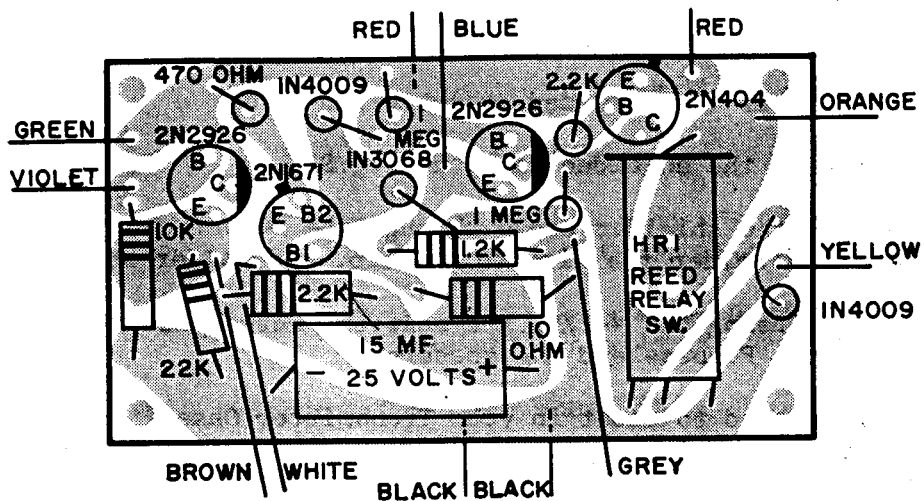
RELAY VERSION



When installing the 2N2926 transistors, make sure the flat side is towards the relay.



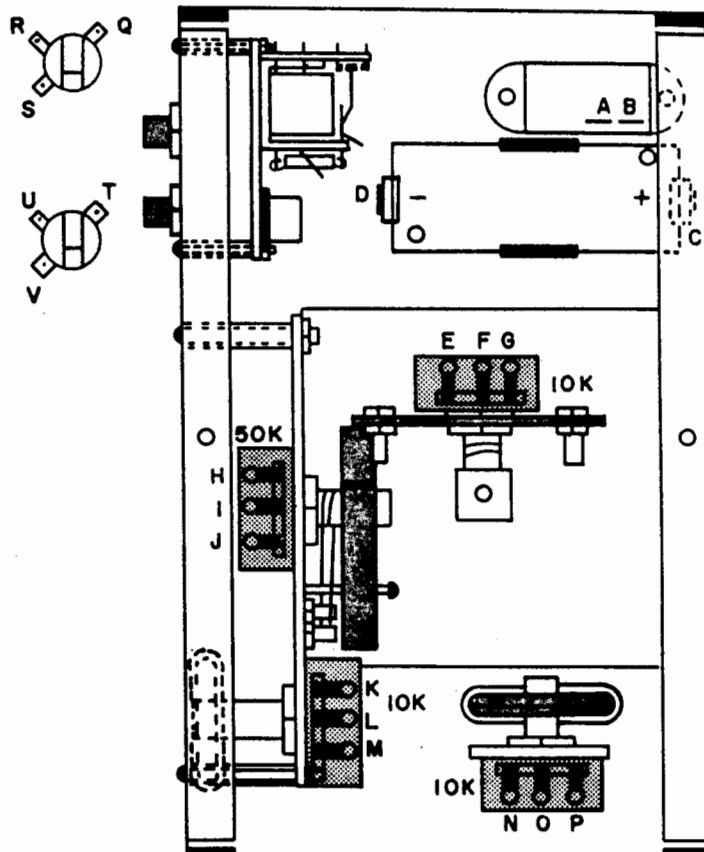
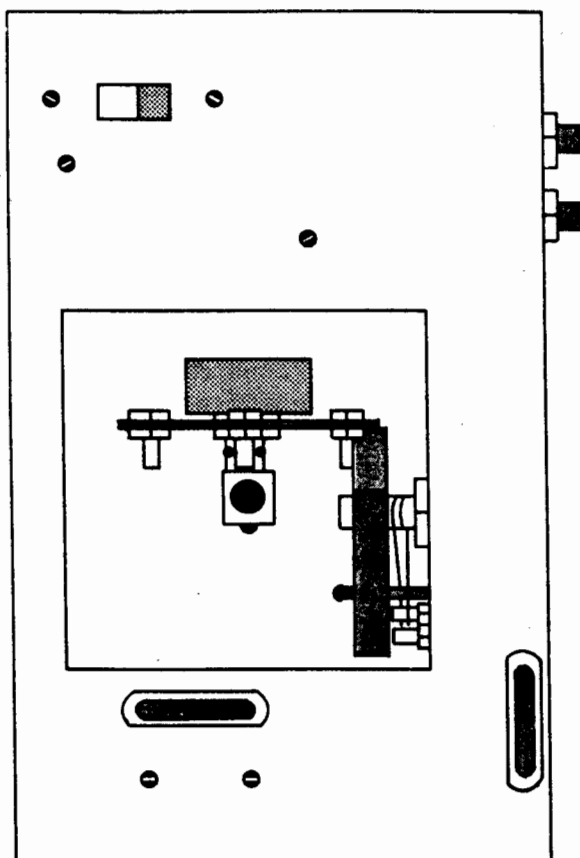
REED SWITCH VERSION



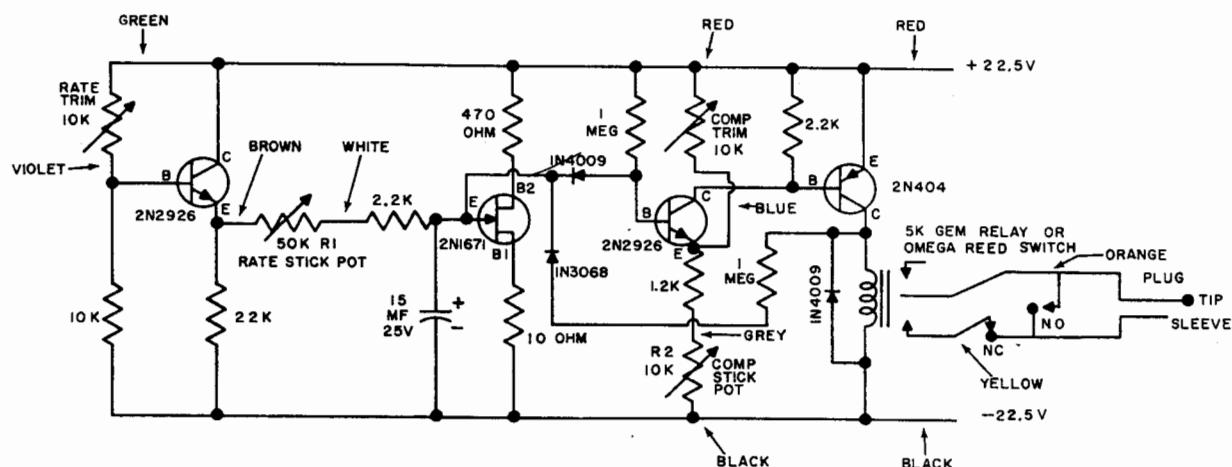
When installing the 2N2926 transistors, make sure the flat side is towards the reed switch.

WIRING PULSER

- 1 () Connect the red wire from hole 5 of the PC base to lug A of the off-on switch.
- 2 () Connect the blue wire from hole 30 of the PC base to lug N of rudder trim.
- 3 () Connect the 9 inch red wire from land where holes 1,2,3,4 and 5 are located to lugs P and O of the rudder trim Pot.
- 4 () Connect the green wire from holes 6 to lugs M and L of the elevator trim.
- 5 () Connect the violet wire from hole 48 to lug K of the elevator trim.
- 6 () Connect the Brown wire from hole 45 to lug H of the elevator pot.
- 7 () Connect the white wire from hole 39 to lugs I and J of the elevator pot.
- 8 () Connect the grey wire from the hole 21 to lug G of the rudder pot.
- 9 () Connect the black wire from land where holes 18,25,41,42 and 43 are located and solder to lugs E and F of the rudder Stick Pot.
- 10 () Connect the black wire from land where holes 18,25,41,42 and 43 are located and solder to lug D of the battery box.
- 11 () Connect a 2 inch red wire from lug C of the battery box to lug B of the off and on switch.
- 12 () Connect the orange wire from the relay armature to lug R of the red push switch.
- 13 () Connect the yellow wire from the normally open position of the relay to lug T of the black push switch.
- 14 () Connect a jumper wire from lugs S and V.
- 15 () Connect the shield of the shielded cable to lug R.
- 16 () Connect the wire of the shielded cable to lug S.
- 17 () Insert the end of the shielded cable through the rubber grommet, and solder on the Littel Plug. Solder the wire to the tip, and solder shield to the plug.
- 18 () Mount the PC base using the 4-2/56 x 1 bolt and nuts, placing the four fiber washers between the PC base and the spacers.
- 19 () The Littel Jax is used to mount in your Transmitter Case. Connect it in parallel with the transmitter push button. By plugging in the pulser to your transmitter, your pulser becomes an electronic thumb and keys your transmitter for you.



HIGH STABILITY, INTERACTION-FREE PULSER WITH SMOOTH TRIM (RATE/COMPOSITION)



Both stick pots are arranged to traverse a 90° pot segment ($\pm 45^\circ$ from center). For R1, this segment is the last 90° of its travel so that full down (stick forward) removes all pot resistance. Rate trim does not alter the ratio of highest rate to lowest rate. It trims low center and high rates equally. The total rate change available may be altered by rotating the stick pot from the recommended position to decrease the amount of rate change. The change can be increased by dropping the 2200 ohm series resistor to 1000 ohm.

SERVICE INFORMATION

If, after applying the information contained in this manual and your best efforts, your Ace R/C kit does not give you the proper performance, we suggest you take advantage of the facilities of our Servicenter, at Box 301, Higginsville, Missouri, #64037.

The Ace Servicenter is manned by personnel that has been trained in the art of servicing R/C equipment. There are problems encountered in R/C equipment that are not encountered in ordinary Radio and Television, and these problems may be difficult for the ordinary Radio and TV Serviceman to spot, unless he has personal knowledge acquired from personal use of R/C equipment.

Service applies only to completed equipment, which has been constructed in accordance with the instructions as contained in this manual. Equipment which has been modified, may sometimes not be accepted for service. IF THERE IS EVIDENCE OF ACID CORE SOLDER OR PASTE FLUXES, THE EQUIPMENT WILL BE RETURNED WITHOUT ANY ATTEMPT TO REPAIR--since such an attempt would be a waste of time.

Attach a tag with your name and address to the equipment when it is returned for service. Pack carefully in a carton large enough to contain enough packing so that no damage from handling in the mails will result. Include with the transmitter a letter stating briefly what in your opinion is wrong with the equipment.

On the outside of the parcel be sure to include your name and address. Use a mailing tag, and plainly write in the following address:

Ace Service Center
Box 301
Higginsville, Missouri
#64037

On the package itself, because of your letter, write "Letter Enclosed" and add a stamp to cover the postage for this, in addition to the postage the package requires under regular parcel post rates. If available, add stickers such as "Fragile" or "Handle With Care". Your unit will be given prompt attention.

The service charge will be a reasonable fee plus the replacement of defective components, if in the opinion of the Ace Technician, they were good to begin with. If, in his judgment, they were faulty as you received the kit, they will be replaced without charge.

PLEASE NOTE: Service jobs will be returned to you via COD, since this will allow figuring the exact cost of the service and the return postage. If you wish you may send more money than you feel will be necessary in THE FORM OF A CHECK OR MONEY ORDER ONLY, and we will issue credit. THERE IS A MINIMUM of \$3.00 plus return postage for any single channel device, and a MINIMUM of \$6.00 for any multi channel device. Parts and labor are added to the minimum fee.

Ace R/C, Inc.

BOX 301
HIGGINSVILLE, MISSOURI