KIT BUILDER'S HINTS

ACE R/C, Inc.
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INTRODUCTION

The following guide is furnished in order to give you, the kit builder, the basic information necessary to successfully construct your piece of Ace R/C equipment. Some of the information may go into more depth than is required for construction of your kit but it might help you in some future project.

We at Ace R/C hope you enjoy building and using your Ace kit. We take a good deal of pride in the quality of the design, components, and mechanical configuration; plus the completeness of the instructions. Your comments on our kit are welcome.

UNPACKING

While unpacking familiarize yourself with the contents of the kit. The components are logically organized in individual packages to give you a clue to their identity. Further information on component ID follows. Check the components off of the parts list to make sure the kit is complete; if not, write to Ace R/C, Box 511, Higginsville, Mo. 64037, and we will supply the missing part.

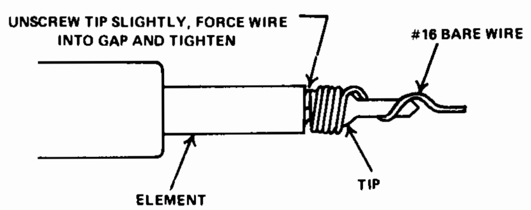
Keep the component categories together; muffin tins and egg cartons come in handy for this.

TOOLS

For most kits the basic tools needed are small diagonal cutters, a small needle nose pliers, wire strippers or a penknife, small screwdriver, fine steel wool, an old toothbrush, denatured alcohol, and a good 37½ watt or lower soldering iron with a tip not larger than 1/16" in diameter--do not use a solder gun. Use only the solder furnished in the kit, not acid core solder.

The following soldering iron is recommended and available at Ace R/C or through a local electronics supply house:

UNGAR No. 777 Handle (Ace 32K777)
" No. 1235 37½ W Element (Ace 32K1235)
" No. PL340 3/64" Spade Tip (Ace 32KPL340)

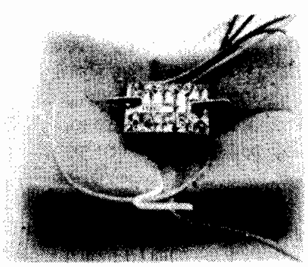


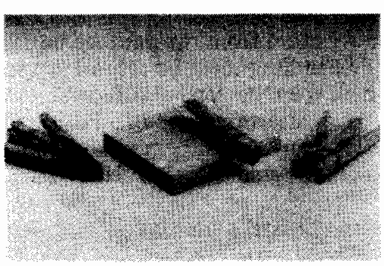
Substitute for a small soldering iron tip if one is not available.

A suitable tip may be fashioned as shown; however, a good quality iron tip is recommended.

A piece of foam, balsa block, and pins will hold the parts in place on the PC board while you solder.

Clothes pins can be modified to be used as holding fixtures.

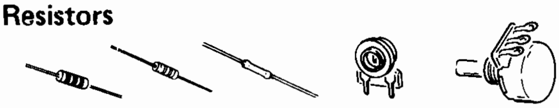




COMPONENT IDENTIFICATION

The following is provided so you can determine the type and value of the components in your kit. Sometimes, the process of elimination will be necessary to determine the value of a component. For example, you still need three .001 mf disc capacitors--everything else has been checked off. If there are three unmarked disc capacitors left that all look the same, it is safe to assume that these three components are .001 disc capacitors.

Resistors



There are four colored bands around the bodies of all the resistors. These will be discussed as the first, second, third, and fourth colors. The fourth color is always silver or gold, while the first color is never silver or gold. Thus, the first color band is quite simple to distinguish. In addition, the first color band is usually closer to the end of the resistor body than the fourth color.

The fourth color identifies the tolerance of the resistor; gold if 5 percent and silver is 10 per cent. A 5% resistor can replace a 10% one but not vise versa. The colors of the other three bands are identified by the following resistor color code:

Color	Number		
Black(Bk)	0	Green(Gn)	5
Brown(Br)	1	Blue(Bu)	6
Red(Rd)	2	Violet(Vi)	7
Orange(Or)	3	Gray(Gy)	8
Yellow(Ye)	4	White(Wt)	9

The preceding identify the value of the resistor, in ohm's, as follows: (a) The first band gives the first digit of the resistanc value; (b) The second band gives the second digit of the resistance value; (c) The third band gives the multiplier for the value, i.e., the number of zeroes which must be added.

As an example, consider a 270 ohm resistor; the first band is red, for a two, the second is violet, for a seven, and the third is brown for addition of one zero. A 15,000 ohm resistor is identified by brown (one), green (five), and orange (three zeroes). In the schematics, large values may have the multiplier 1000 identified by a k. such as 15K for 15,000 ohms, etc.

If the third color is gold, multiply by 0.1. If it is silver, multiply by 0.01. For example, red, violet, gold = 2.7 ohm.

Capacitors

VALUE MARKINGS

Capacitor markings vary considerably from type to type and from manufacturer to manufacturer. In Ace's instructions, capacitors are called out as to type and value in either pf (picofarads or micro-microfarads) or mf (microfarads).

Capacitors Cont.

The capacitor can be marked XX, pf, or mf. Sometimes a letter representing voltage will be substitued for a decimal. The pf or mf may not appear; ie, a 10 pf cap may be labeled "10" or a .05 mf cap may be labeled ".05". Quite often there may be a voltage rating stamped on the cap–don't confuse it with the value. Also there may be extraneous letters and numbers that tend to be confusing.

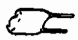
Another numbering system that is commonly used in all types of capacitors is a three digit designator. This numbering system is similar to resistors in that the first number is the first digit of the value, the second is the second digit, and the third is the multiplier. The following chart shows how that translates into mf.

XX2 = .00XX mf	Examples:
XX3 = .0XX mf	475 = 4.7 mf
XX4 = .XX mf	106 = 10 mf
XX5 = X.X mf	224 = .22 mf
XX6 = XX mf	
XX7 = XX0 mf	

TYPES

Disc 

These are usually tan or brown in color and are covered with a wax-type substance. Sometimes it may be necessary to trim the wax away where the lead exits the body of the capacitor. This is OK as long as the main body of the cap isn't fractured. Also it may be necessary to use a needle nosed pliers to bend the leads out or in to fit the hole spacing in the PC board. It's OK to break the wax that extends down onto the lead.

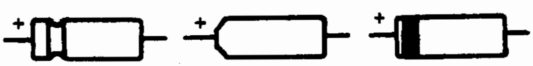
Monolythic Ceramic (Bluecaps) 

These are small capacitors that are usually blue or brown in color and have a hard, glass-like body. Their value is most commonly identified by the three digit system.

Electrolytic:

Tantalum Capactiors:

All axial lead tantalum capacitors are polarized so they have some sort of designation to show the positive lead. This may be a red band, red end, shouldered end, rounded end, or maybe a simple "+" or "-" stamped on the body (see ilustration):

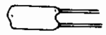


Axial lead tantalum electrolytic caps are usually black or silver, and are about the size of a resistor.

Dipped radial lead tantalum caps are encapsulated in a glob of epoxy. These have either a "+" sign or a dot to indicate the positive end; the positive lead is also longer than the negative lead. The value may be indicated with a three banded color code which corresponds to the three digit designation for capacitors and the resistor color code or the value may may be printed on the capacitor.

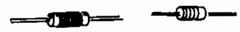
Aluminum Caps:

Aluminum electrolytic capacitors are usually larger in size than most tantalum electrolytics. The leads might come out both ends (Axial Lead), or both may come out one end (Radial Lead). Aluminum caps generally have the negative lead marked, not the positive.

Mylar 

These are usually larger capacitors and can be axial lead or radial lead. They are unpolarized and are identified by the same methods as other caps.

Chokes

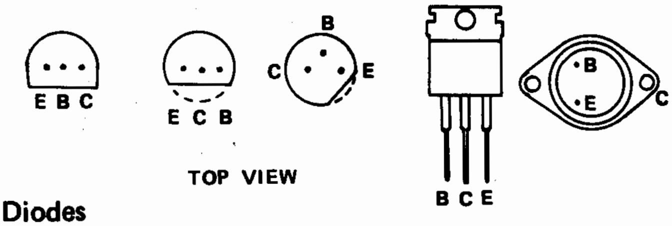


RF chokes are wire wound with either exposed wire or dipped in insulating material. If they are not marked and there is a possibility of confusion, there will be a distinction made in the kit--either the color of the wire or a color dot on the component body. If they are color coded with bands, the coding system is the same as resistors except the unit is microhenrys (uhy) instead of ohms.

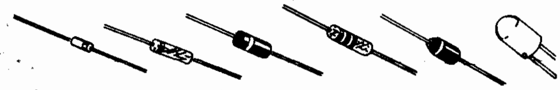
Transistors

The basing arrangement for transistors varies. The following views gives the various configurations.

When installing transistors in a PC board, make sure either the flat portion of the case matches the overlay drawing or the triangular relationship of the leads matches the triangular configuration of the holes in the PC board.



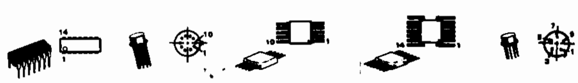
Diodes



Diodes are generally the same size as or smaller than resistors and always have either a black or white band or a shouldered end to indicate the cathode lead. When installing, make sure the cathode end is placed as instructed. Also, most diodes are glass, and are subject to breakage, so be careful.

Light Emitting Diodes (LED's) may come in various sizes and colors. Their cathodes will be identified by being a longer lead, a different colored lead, a notch in the case, or a flat spot in the case. Generally, if there is some doubt as to the cathode lead, try the LED in the circuit and if it doesn't light, reverse it and try again. Don't use too much heat when soldering; the plastic case will melt.

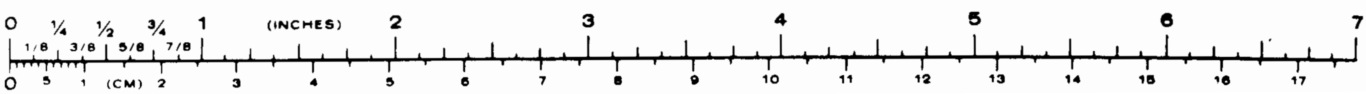
Integrated Circuits (IC's)



There is always a demarcation to identify pin number 1 of the IC. It is either a notch in the end, an indentation in the corner of the IC, or a tab on the case of a circular IC. Always position these markings as indicated on the overlay drawing.

If the unit is a CMOS type device, the instructions will say so and it will be packaged in aluminum foil. These CMOS devices can be damaged by spurious static electricity so don't remove them from the package until instructed to do so. Also, while handling them be careful not to drop them on the floor or pick them up after shuffling across a carpet.

When inserting them in a PC board if the leads are spread too far apart, bend them all in at once by pressing the entire row on one side against a flat surface.

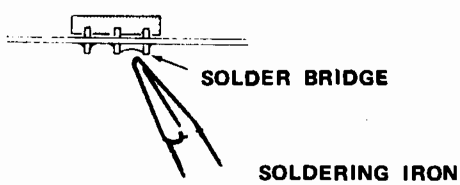


PC BOARD CONSTRUCTION

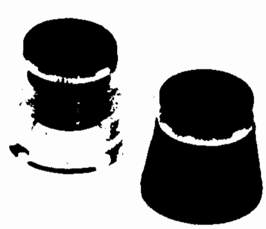
Gently clean the foil side of the PC board with fine steel wool to remove any oxidation. Insert the components as shown on the overlays and, except for transistors, mount them tightly to the board. Keep 1/8" between transistors and the board to avoid overheating. Parts should be inserted as instructed, and the leads bent outward slightly to lock them in place when the board is turned over.

The actual technique of soldering leads to a circuit board is quite simple. Position the tip of the soldering iron so that it firmly contacts both the circuit board foil and the wire to be soldered. Then the solder should immediately be placed between the iron and the joint to be soldered. Remove the solder as soon as it begins to melt and flow onto the lead and foil. Hold the tip of the iron in place only until the solder begins to flow outward over the foil; then remove the iron quickly. After soldering, clip the leads as close to the joint as possible, using a small, sharp pair of diagonal clippers. Clean the soldering iron tip after every few joints with a damp sponge.

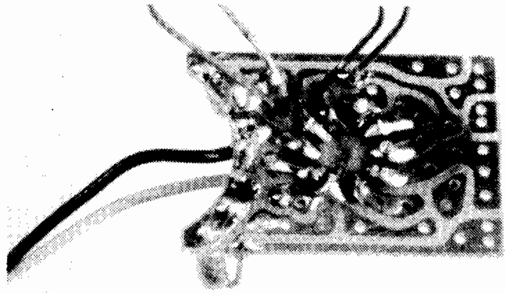
The use of an excessive amount of solder will increase the possibility of bridging between the PC lands or plugging holes which must be left open for wires which may be added later on. If solder is accidentally bridged across insulating areas between lands, it can be cleaned by heating the connection and quickly wiping the solder away with a soft cloth. Holes which become plugged can be cleared by heating the area immediately over the hole and gently pushing the lead of a resistor through the hole from the opposite side, and withdrawing the lead before the solder rehardens.



Place the tip of the iron against the solder bridge. With the tip pointed up, the solder will flow downward.

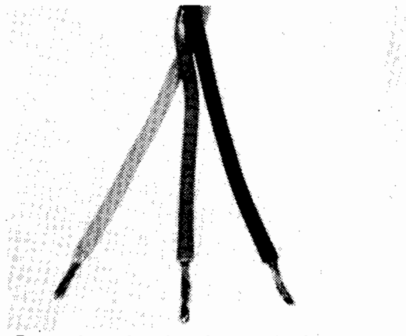


An 8X loupe or magnifier is needed to look for poor solder connections or solder bridges

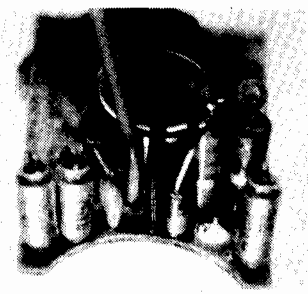


Proper solder joints--good flow of solder--leads clipped short--no solder bridges.

WIRE TINNING AND INSTALLATION



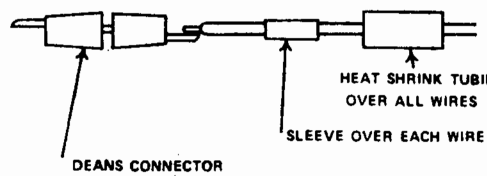
Properly twisted and tinned wires.



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

Before a wire is installed in a PC board or soldered to a terminal, it must be "tinned." Strip 1/8" of insulation from the end and twist the wire strands together tightly. Flow a small amount of solder on the wire and flip off any excess. Now the wire is ready to install.

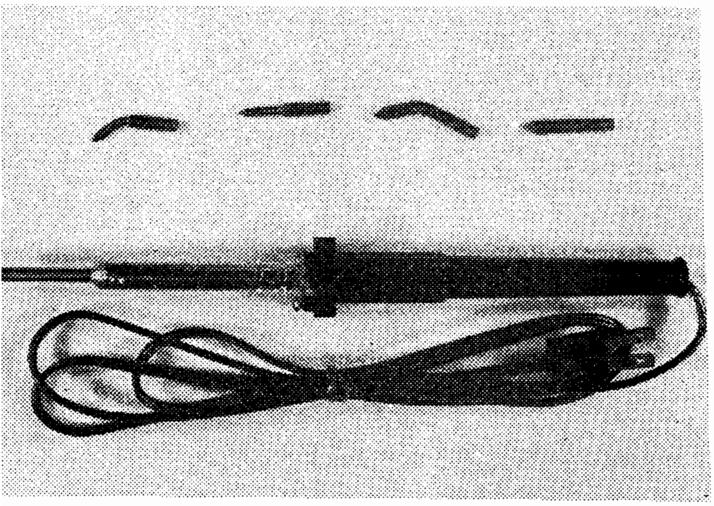
DEANS CONNECTOR WIRING



If your kit utilizes Deans connectors, an illustration is shown for proper hookup. Before soldering up to the connector always slip the wire through the appropriate sleeving, heat shrink, and grommet to avoid unsoldering later. Don't use too much heat or you'll melt the plastic. It's a good idea to mate the plugs together when soldering; this will help dissipate 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.

STEP BY STEP

The instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omission, especially if your work is interrupted.



SOLDERING IS SIMPLE!

THIS BASIC SKILL IS A MUST IF YOU HOPE TO HAVE A SUCCESSFUL R/C EXPERIENCE -- EVEN IF YOU BUY "READY-TO-GO" EQUIPMENT

Illustrated here is the K & S Engineering Soldering Iron which comes with the choice of several tips. Among other irons that are recommended for radio control work are those manufactured by Weller, Wen, Ungar, X-Acto and others. These are all the light 25 to 50 watt units with a tip heat of 700 to 750 degrees Fahrenheit.

Many aspects of modeling depend on soldering and it can therefore be considered a basic skill. For the R/C fan it is a must. Even if you plan to use RTF (Ready To Fly) gear, some soldering will more than likely be required, if not in the basic installation then in the upkeep and maintenance that will come along. So whether you plan to build from scratch, to make a simple repair or do a maintenance check, your soldering iron should be considered as one of the most prized tools on your work bench, and its correct use should become second nature.

You can prevent many a malfunction, many a cry of "I ain't got it!, many an unexplained cause of "interference", if you'll take the little bit of time and practice that is required to master the technique.

There are many good soldering irons on the market today which are ideally suited for the R/C modeler and his needs. Among the manufacturers that have them are K & S Engineering, Weller, Wen, Ungar, X-Acto and others. The type of iron best suited for 90% of R/C work is the kind that has a small pencil type tip, or has a choice of a variety of tips for differing purposes. Basically, they are light, use current on the range of 25 to 40 watts, 110 volt, have tips that heat to 700 to 750 degrees Fahrenheit. They are easy to handle and get into the almost inevitable inaccessible places. Replacement parts for the tips are also available in case of old age or trouble. Some also have replacement elements.

While there are specific uses to which each type of tip fits best, generally you will find that the chisel tip and the pyramidal tips will cover the largest portions of your R/C needs.

The larger soldering type "gun" is not recommended as a rule for use in R/C work, since its use is generally for much heavier duty. Dangers in its use are too much heat, which can cause component damage, strip copper from base material, and in the case of actuators ruin magnetism because of the induction created by their built in transformer. They are much better suited for soldering music wire landing gears, struts, cabanes, skids, plumbing, etc.

Before we get into the actual process of soldering, let's discuss another item you'll be using to do the job--solder. For any radio work whether this be for a resistor or a receiver, or wiring harness, solder with a rosin core is the only kind that should be used. Shun acid core like the plague in R/C work. While acid core may be and is used quite successfully when soldering music wire for landing gears and so on, the acid used as a flux has a nasty habit of sticking in the intricate electronic guts of your R/C gear and causing corrosion and problems without end. As a matter of fact, most manufacturers of kits state flatly that they will not attempt to do any service work on a kit, when evidence of use of acid core solder is seen. Even when used on larger items and steel, acid core solder must be completely washed off after the job is done to prevent corrosion

So rosin core is the best. Rosin serves as a flux and melts at about the same time as the solder and flows onto your joint to help clean the surface and act as a sort of bonding agent to help solder become attached to the joint.

Rosin core solder is available in one core, three core, and a special Multicore (Trademark) which has five cores of rosin. It is available also in a Sav-Bit (TM) type, which does just that--saves the soldering bit of your iron. Use of your iron, under heat and soldering conditions, will eventually wear the point to where it must either be reshaped, or replaced. Sav-Bit helps cut this wear, but not eliminate it entirely.

The ideal rosin core solder for R/C work is known as 60/40. This means that it has 60 parts of tin and 40 parts of lead along with the rosin flux. The proportions of the tin and lead govern the strength of the solder joint to be made, and also the temperature at which the solder will melt. While it may be had in different ratios, the 60/40 has the most going for it in your R/C application. It represents the best compromise of both temperature and of strength.

Another solder is worth mentioning here. This is silver solder, and with the lifting of the price ceiling on silver will probably get even more expensive than it is at the time these lines are written. This melts at 460 degrees Fahrenheit and so is quite capable of being handled by the smaller irons. This comes with a liquid flux, which is applied to the areas to be soldered. While it is probably too exotic to use for straight and general R/C soldering; where strength is a factor, it can't be beat. It is especially useful in application where acid core might be used, and all danger of corrosion must be avoided. It is being men-

tioned here primarily because of the liquid flux. This is available as a separate item, and many builders use the liquid flux along with the rosin core solder for assurance that they start with 100% clean surfaces.

If yours is a new iron, it must be "tinned", before it can be used. You do this by melting a small amount of solder on the tip of the iron so that the entire tip of the iron is shiny with solder. Wipe with a cloth, and re-tin and rewipe. You can also shake excess solder off. Be careful! It is hot and a splatter of hot solder can burn through a pants and cause a blister. Also be careful where you shake it--your wife certainly will not appreciate bits of molten solder imbedded on the new vinyl floor in the kitchen.

The reason for tinning is that a well-tinned iron transfers heat quickly and efficiently. The faster you can complete a solder joint, remove the iron, the better off you will be. Continuous heating of a joint will only increase the area of heat and will cause damage to parts near the joint. The broad area of the tip blade should be used to transfer the heat as effectively as possible.

The object of soldering is just to heat the wires, or whatever you are mating, to the temperature at which the solder will flow around the joint, just as easily as it does on tip. Read that last sentence again. This is the secret. This is the amount of heat you need--no more, no less. To get the feel of this you will probably want to practice on scraps, before you solder in that connection on your dream R/C ship.

Heat the wire with the iron, then apply the solder to the place where the iron and wire intersect. Move the iron as necessary around the joint and continue to add solder to cover the joint. (This is done if the joint does require all of this solder, -- practice will teach you.)

When the needed area is soldered, use the heat of the iron and the surface tension properties of the melted solder--and draw off the excess solder. Do this by placing the hot iron on the lowest corner of the soldered joint. Any blob or excess solder will flow from the joint onto the iron, and you can then shake it off. Do not add solder unnecessarily. The strength of any soldered joint is not always increased by merely adding solder. The quality of the joint is the important thing. You must have just enough so that the two pieces are married, but -- adding superflous solder won't do a thing--even for the looks and it might bridge a printed circuit land and make a short.

When the joint is properly soldered it must be allowed to cool until the solder is again in a completely solid state. During the cooling process, make ABSOLUTELY sure the joint is not disturbed. If it is moved at all, you must reheat the joint and solder again. If any movement is made, the solder will crack internally and the joint will not be either electrically or mechanically sound. You can help the cooling process by blowing on the joint if you wish--just pretend it's coffee in a saucer! You will quickly learn when the joint is cool enough to be moved after you gain experience, but if you are just beginning remember this motto: "A solder joint is cool enough to be moved only when it can be held in the fingers without burning." A second saved here by hurrying, could be extremely hazardous in the long haul.

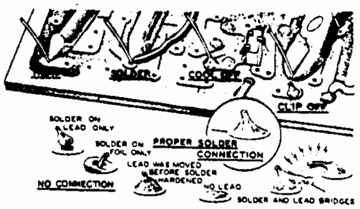
Heat sinks will also help speed the cooling process. A heatsink is any metallic object, such as a pair of pliers, piece of aluminum, or even commercial gadgets called just that, which touch or hold the wires near to the joint and absorb the heat, or allow the heat to sink into them away from the joint.

In soldering some electrical components it is usually advisable to use a heatsink to avoid damage to the components. This is especially true with transistors, diode, tantalums, extra small resistors, etc. The excessive heat can change their characteristics, or even destroy them completely. Proper cooling is important in all solder joints regardless of what is being joined to what.

This same procedure is used whether you solder a wire to a contact, such as on a plug, or whether you make a wire to wire connection. Always: Use just enough solder to do the job, do not move the wire until it is solid, and do make it as neat as possible!.

On printed circuit boards the technique becomes only slightly diferent. A printed circuit board is one which has "lands" of copper, with holes in them. The wires of the components come through the holes from the other side through [illegible] "lands" [illegible] the inter-wire between components, and are also used for mounting the components. The copper laminate is thin, and as a rule affords a small connection, so you must be very careful to apply as little a heat and solder as possible, and yet obtain a quick, clean joint. Also, the components generally are very near the solder joint, and therefore they must be protected from over heating.

Do the job as quickly as possible and use a heat sink tool, either during the operation or immediately after the iron is moved away. The smaller the joint area, the quicker the cooling, so be cautious and be sparing with the solder and the heat We show a cross-sectional drawing of a good and a poor solder connection to guide you so that you may have some idea of what you should look for in the finished joint.



In printed circuit work, after the leads are soldered they should be clipped off as close to the board as possible. While not absolutely essential, it is advisable to clean off the rosin or other flux using dope thinner and ordinary rag. This will allow you to inspect all solder joints closely and to look for accidental bridging of "lands" and so on. If there remain any component leads which are more than 1/16" long they may be filed down--carefully! Again use dope thinnner to remove all sediment and filings. Your PC board should appear nice and shiny.

Practice is required to make good solder joints, and we urge you to practice on scraps you may have available, until your solder joints look and act the way they should. Most repair departments of kit manufacturers claim that the majority of the units would not have had to be returned had correct soldering techniques been used. In the comment of one service man, "We have to resolder virtually all connections on some jobs that we get in. Most of our service jobs could be avoided if the builder would only learn how to solder before he begins to tackle the building of a receiver or related item."

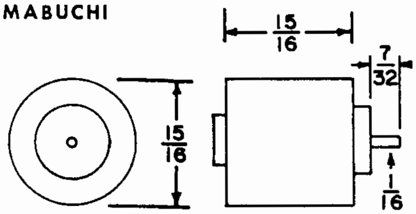
There are many fine points to the soldering art. But if you are willing to observe the fundamental things, and practice, the result will be professional joints, which will take many of the question marks out of performance of your finished unit.

R/C Data

MOTOR FACTS

Ace R/C Inc.
HIGGINSVILLE, MO. 64037

MABUCHI



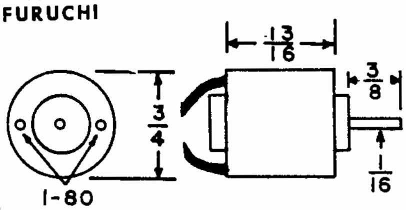
VOLTAGE	MA DRAIN	
	IDLE	STALL
1.2 V	23	140
2.4 V	30	270
1.5 V	22	150
3.0 V	30	280

WEIGHT 27.4 GRAMS

The Mabuchi motor has a direct output, no internal gear reduction. The output shaft is 7/32" long and 1/16" diameter. The housing is metal with no mounting holes provided but with care holes can be drilled and tapped in the case.

RESERVED

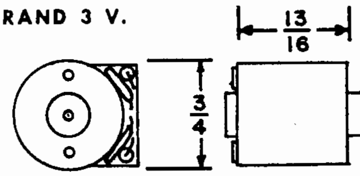
FURUCHI



VOLTAGE	MA DRAIN	
	IDLE	STALL
1.2 V	80	240
2.4 V	95	460
1.5 V	80	280
3.0 V	100	400

The Furuchi motor has a direct output, no internal gear reduction. The output shaft is 1/6" by 3/8". It has two drilled and tapped holes for 0/80 bolts for mounting

RAND 3 V.

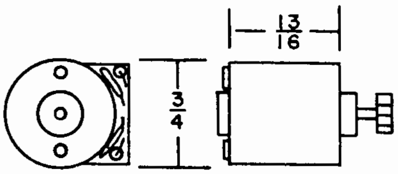


VOLTAGE	MA DRAIN	
	IDLE	STALL
1.2 V	50	125
2.4 V	70	250
1.5 V	60	130
3.0 V	75	260

WEIGHT 24.3 GRAMS

The Rand 3 Volt motor has a direct output, no internal gear reduction. The pinion gear and arc suppression on the motor furnished. 2/56 x 1/4" mounting bolts are provided.

RAND 1.5V.

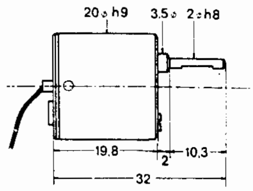


VOLTAGE	MA DRAIN	
	IDLE	STALL
1.2 V	60	200
2.4 V	70	330
1.5 V	60	200
3.0 V	70	360

WEIGHT 25.5 GRAMS

The Rand 1.5 Volt motor has a direct output, no internal reduction. The pinion gear and arc suppression furnished. 2/56 x 1/4" mounting bolts are provided

MICRO MO TO-3

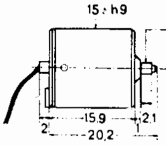


with ratio 59:1
Type 033/015

VOLTAGE	MA DRAIN	
	IDLE	STALL
1.2 V	20	300
2.4 V	60	725
1.5 V	22	380
3.0 V	60	775

Diameter		20 mm
Length of casing		17 mm
Weight		20 g
Armature resistance	R_o	1,75 Ohm
Measuring voltage	U	2 V
No-load running speed	n_L	16 700 rpm
Specific speed	n_s	8610/V.min
Starting torque	Md_k	12,70 cmp
Friction torque	Md_R	0,39 cmp
Specific torque	Md_s	11,40 cmp/A
Max. efficiency	η	69 %
Armature moment of inertia	Θ	$4{,}85 \cdot 10^{-4}$ cmps²
Starting time constant	τ	$77 \cdot 10^{-3}$ s

MICRO MO TO-5



Measures of pinion:
z = 9 teeth
m = 0.20
D tip = 2.34 – 0.015
D root = 1.42 – 0.015
correction factor: x = + 0.35
α = 20°, involute

VOLTAGE	MA DRAIN	
	IDLE	STALL
1.2 V	12	210
2.4 V	18	420
1.5 V	14	260
3.0 V	24	380

Diameter		15 mm
Length of casing		16 mm
Weight		12 g
Armature resistance	R_o	4 Ohm
Measuring voltage	U	2 V
No-load running speed	n_L	16300 rpm
Specific speed	n_s	8450/V.min
Starting torque	Md_k	5,6 cmp
Friction torque	Md_R	0,2 cmp
Specific torque	Md_s	11,6 cmp/A
Max. efficiency	η	71 %
Armature moment of inertia	Θ	$1{,}9 \cdot 10^{-4}$ cmps²
Starting time constant	τ	$57 \cdot 10^{-3}$ s

Slip-on reductor ratios: 41:1; 141:1

1 OZ. = 28.35 GRAMS

R/C Data

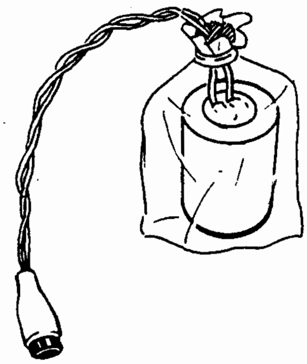
FREQUENCY FLAG COLOR STANDARD

The use of frequency flags has become mandatory in many flying areas. To assist all R/Cer's we present the color coding which seems to be the most universally adopted. The coding has been approved by the AMA Frequency Committee, and variations from it will be found to be local in nature.

26.995	Brown	51.20	Black/Blue	72.08	White/Brown
27.045	Red	53.04	Black/Violet	72.24	White/Red
27.095	Orange	53.10	Black/Brown	72.40	White/Orange
27.145	Yellow	53.20	Black/Red	72.96	White/Yellow
27.195	Green	53.30	Black/Orange	75.65	White/Green
27.255	Blue	53.40	Black/Yellow		
		53.50	Black/Green		

BATTERY PROTECTION AND INSTALLATION

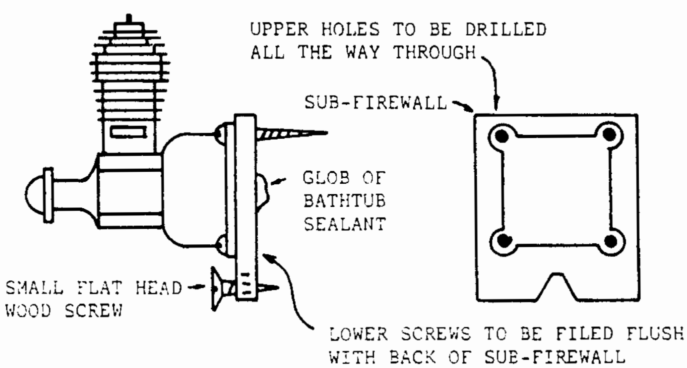
One problem that a small percentage of modelers seem to over-look, is proper receiver battery protection and installation. Most all of us at one time or another have had a fuel tank rupture and flood the battery compartment. The resulting mess leaves us frustrated and in a hurry to get it dried out and back in the air. Haste generally makes waste and everything ends up in the trash barrel! A simple solution to this is to first place your battery pack in a heavy plastic sack and wrap a rubber band around the end where the wires exit. Then to make sure you have complete protection, coat the wires in the area of the bag opening with G.E. Clearaseal or Dow Corning Silastic.



Battery damage can also result if the pack is mounted firmly against a bulkhead or fuselage wall. Continual motor vibration can cause the mechanical connection between cells to fracture, which results in all kinds of intermittent problems hard to locate. Continual vibrations can cause another mechanical failure of the nickel-ribbon straps routed along the side of the cells or an actual fracture of the strap. Either one of these failures can cause momentary or complete loss of control and yet the set will work on the bench. The best cure is an ounce of prevention. Wrap the battery pack with foam and make sure it is not pressing hard against fuselage walls or bulkheads.

--EK TECH TOPICS

MOUNTING IDEA

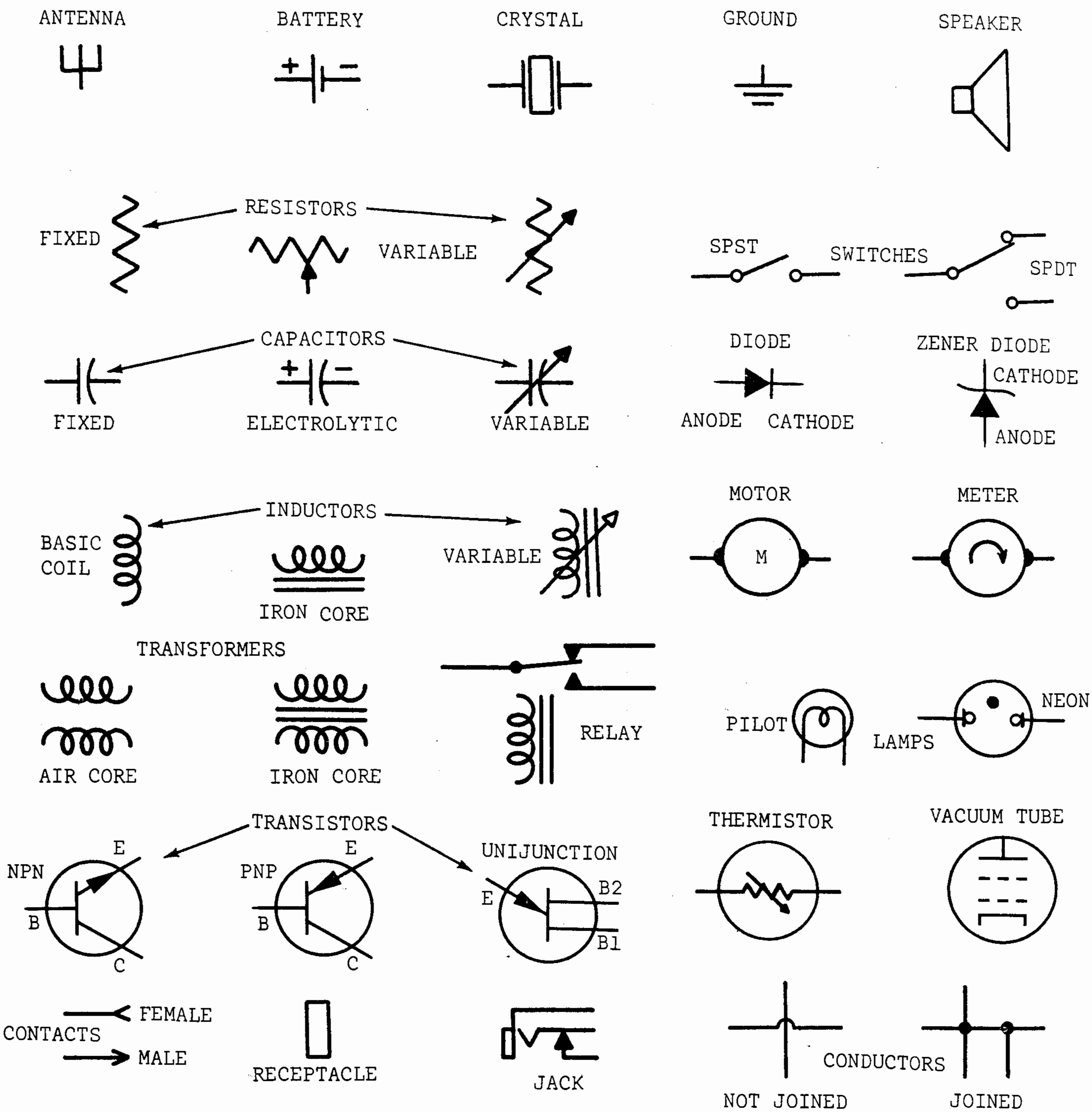


Here is a mounting idea for a Cox .020 Pee Wee in small planes. The unit as shown can be slipped down into place on flat head wood screws. The upper screws can then be tightened into regular firewall to obtain amount of side thrust desired. Size of glob determines amount of downthrust. I use wood screws for everything. The idea is quite simple to make. The engine can be removed in less than a minute for cleaning etc. I have used this same set-up on several small models with great success.

R. H. Pearson
Cassadaga, N.Y.

R/C Data

SCHEMATIC SYMBOLS



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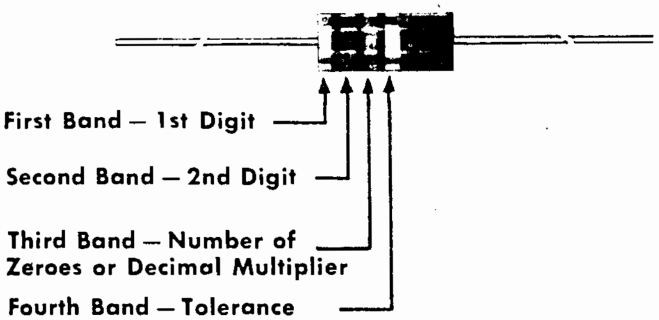
R/C Data

RESISTOR COLOR CODE



Color	Digit	Multiplier
Black	0	1
Brown	1	10
Red	2	100
Orange	3	1000
Yellow	4	10,000
Green	5	100,000
Blue	6	1,000,000
Violet	7	10,000,000
Gray	8	100,000,000
White	9	1,000,000,000
Gold	± 5% Tolerance	0.1
Silver	± 10% Tolerance	0.01
No Color	± 20% Tolerance	

METRIC EQUIVALENTS OF U. S. CUSTOMARY MEASURES AND WEIGHTS
(Based on National Bureau of Standards)

Length

Cm	=0.3937 in.	In.	=2.5400 cm
Meter	=3.281 ft.	Ft	=0.3048 m
Meter	=1.0936 yd.	Yd	=0.9144 m
Km	=0.6214 mile	Mile	=1.6093 km

Area

Sq cm	= 0.1550 sq in.	Sq in.	= 6.4516 sq cm
Sq m	=10.764 sq ft	Sq ft	= 0.0929 sq m
Sq km	= 0.3861 sq mile	Sq mile	= 2.590 sq km

Volume

Cu cm	= 0.06102	Cu in.	=16.387 cu cm
Cu m	=35.31 cu ft	Cu ft	= 0.02832 cu m

Capacity

Liter	=61.025 cu in	Cu in.	= 0.0164 liter
Liter	= 0.0353 cu ft	Cu ft	=28.32 liters
Liter	= 0.2642 gal. (U.S.)	Gal.	= 3.785 liters
Liter	= 0.0284 bu (U.S.)	Bu	=35.24 liters

Liter = { 1000.027 cu cm; 1.0567 qt. (liquid) or 0.9081 qt (dry); 2.2046 lb of pure water at 4 C = 1 kg }

Weight

Gram	=15.4324 grains	Grain	= 0.0648 g
Gram	= 0.03532 oz avdp	Oz avdp	= 28.35 g
Kg	= 2.2046 lb avdp	Lb avdp	=0.4536 kg
Kg	= 0.00110 ton (sht)	Ton (sht)	=907.2 kg

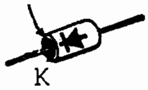
Pressure

Kg per sq cm	=14.223 lb per sq in.
Lb per sq in.	= 0.0703 kg per sq cm
Kg per sq m	= 0.2048 lb per sq ft
Lb per sq ft	= 4.882 kg per sq m
Kg per sq cm	=0.9679 normal atmosphere

Normal atmosphere = { 1.0332 kg per sq cm; 1.0133 bars; 14.696 lb per sq in. }

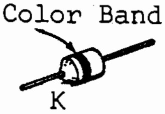
DIODE CODE

Color End



Color Dot

Color Band



DECIMAL AND METRIC EQUIVALENTS OF COMMON FRACTIONS OF AN INCH

Fraction	Decimal	Mm	Fraction	Decimal	Mm
1/64	0.01562	0.397	33/64	0.51562	13.097
1/32	0.03125	0.794	17/32	0.53125	13.494
3/64	0.04688	1.191	35/64	0.54688	13.891
1/16	0.06250	1.588	9/16	0.56250	14.288
5/64	0.07812	1.984	37/64	0.57812	14.684
3/32	0.09375	2.381	19/32	0.59375	15.081
7/64	0.10938	2.778	39/64	0.60938	15.478
1/8	0.12500	3.175	5/8	0.62500	15.875
9/64	0.14062	3.572	41/64	0.64062	16.272
5/32	0.15625	3.969	21/32	0.65625	16.669
11/64	0.17188	4.366	43/64	0.67188	17.066
3/16	0.18750	4.763	11/16	0.68750	17.463
13/64	0.20312	5.159	45/64	0.70312	17.859
7/32	0.21875	5.556	23/32	0.71875	18.256
15/64	0.23438	5.953	47/64	0.73438	18.653
1/4	0.25000	6.350	3/4	0.75000	19.050
17/64	0.26562	6.747	49/64	0.76562	19.447
9/32	0.28125	7.144	25/32	0.78125	19.844
19/64	0.29688	7.541	51/64	0.79688	20.241
5/16	0.31250	7.938	13/16	0.81250	20.638
21/64	0.32812	8.334	53/64	0.82812	21.034
11/32	0.34375	8.731	27/32	0.84375	21.431
23/64	0.35938	9.128	55/64	0.85938	21.828
3/8	0.37500	9.525	7/8	0.87500	22.225
25/64	0.39062	9.922	57/64	0.89062	22.622
13/32	0.40625	10.319	29/32	0.90625	23.019
27/64	0.42188	10.716	59/64	0.92188	23.416
7/16	0.43750	11.113	15/16	0.93750	23.813
29/64	0.45312	11.509	61/64	0.95312	24.209
15/32	0.46875	11.906	31/32	0.96875	24.606
31/64	0.48438	12.303	63/64	0.98438	25.003
1/2	0.50000	12.700	1/1	1.00000	25.400

TAP DRILLS AND CLEARANCE DRILLS FOR MACHINE SCREWS

Screw Size	Coarse Thread TPI	Coarse Thread Drill	Fine Thread TPI	Fine Thread Drill	Clearance Drill	Body Dia
0			80	3/64	52	.060
1	64	53	72	53	48	.073
2	56	50	64	50	43	.086
3	48	47	56	45	37	.099
4	40	43	48	42	32	.112
5	40	38	44	37	30	.125
6	32	36	40	33	27	.138
8	32	29	36	29	18	.164
10	24	25	32	21	9	.190
12	24	16	28	14	2	.216
14	20	10	24	7	D	.242
1/4	20	7	28	3	F	.250
5/16	18	F	24	I	P	.3125
3/8	16	5/16	24	Q	W	.375
7/16	14	U	20	25/64	29/64	.4375
1/2	13	27/64	20	29/64	33/64	.500

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GLOSSARY OF COMMON R/C TERMS

With the exception of the terms that have been added or deleted to update these definitions, we are indebted to Hayden Book Companies who specify this credit: From Radio Control for Model Builders, by William Winter, John F. Rider Publisher, Inc.; a division of the Hayden Publishing Company, Inc.

AC: Alternating current. Current that flows in one direction and then in the other direction.
ACTUATOR: Device for moving or operating a control or surface.
AF: Audio frequency, which see.
ALKALINE BATTERY: Generally the same size and configuration as zinc-carbon types (pen, medium "D"), these usually have longer shelf-life, deliver higher amperage with constant output over longer period, service over wider temperature range.
AMPERE: A unit of measure for establishing the amount of electrical current flow.
AMPLIFICATION: An increase in voltage or current of a signal. The signal may be an audio frequency (up to 16,000 cycles), or a radio frequency. In radio-control, amplication often refers to an increase in relay-operating current.
AMPLIFIER: One or more tubes or transistors, and associated circuitry, used to increase signal strength.
AMPLITUDE: The strength of a radio wave or signal. For example, 6 volts is of a greater amplitude than 5 volts.
ANTENNA: In radio-control, a music wire "rod", or a stretched wire or telescoping "mast", for propagating (emitting) or intercepting (receiving) radio waves.
ARC: Visible electrical spark between electrical contacts, such as in a relay, due to the collapse of the magnetic field of the actuator when signal is cut off.
ARC SUPPRESSION: Arrangement of a capacitor (condenser) and/or resistor or diode "across" the relay contacts to reduce or eliminate arcing.
ARMATURE: A hinged or movable portion of a relay or escapement which is attracted to an electromagnet (magnetic core) when the electromagnet is energized.
AUDIO FREQUENCY: Sound frequencies that can be heard by the ear. This is usually considered the range between 20 and 16,000 cps.
BATTERY: A combination of two or more cells. Its function is to produce an electrical voltage.
BIAS: A voltage that is applied to an electrode of a tube or transistor to make that device operate in a desired manner. In a tube, grid bias is most common.
BYPASS FILTER: A combination of resistors, coils, and capacitors used to pass certain frequencies and prevent the passage of others.
CABLE: Group of wires twisted or grouped to follow a common path.
CAN: Metal box, housing, or container (usually aluminum) enclosing receiver or other circuitry.
CAPACITANCE: The property of a capacitor to hold or retain an electrical charge or voltage.
CAPACITOR: An electrical combination that can hold or retain an electrical charge. Its capacitance is usually measured in microfarads.
CARRIER WAVE: Transmitted radio frequency, or r-f, turned on and off for control, and upon which audio frequency transmitted signals may be imposed.
CASCADE: To join certain actuators to increase the number of sequential controls.
CATHODE: The electrode or filament in a tube which, when heated, emits a stream of electrons.
CB: CITIZEN'S BAND: Frequencies where radio control and communications are accomplished without need of an Operator's test (Station License is required).
CELL: A device for converting chemical energy into electrical energy. Two or more cells make a battery.
CHANNEL: An avenue of control intelligence to the actuator.
CHARGE: The process of restoring the electrical energy available in a secondary battery.
CHARGER: A device to restore secondary battery voltage.
CHASSIS: Base of a receiver or transmitter on which components are mounted.
CHOKE: A coil of wire used to choke off or obstruct certain frequencies.
CLOSED LOOP: Usually a servo in which the electronics is a definite complement to the receiver (also called feedback servo); servo used in multi-control proportional, aligns control surface with transmitter stick position—not an averaged left-right (for ex.) action typical of single-channel magnetic-type actuator.
COIL. A winding of wire on a core, or of heavier wire on a form (which may be removed). Examples: relay coil, tank coil.
COMMON: A wire or point used as a reference point for all voltages in a circuit. Very often the metal chassis of a receiver or transmitter acts as the common point. This term is often used interchangeably with "ground."
COMMUTATOR: A device for changing the direction of a current in an electric circuit.
COMPOUND ACTUATOR: An actuator having an electrical or mechanical means of operating a second, auxiliary circuit or control.
CONDENSER: Common term for a capacitor, which see.
CONTACT: A point at which an electrical circuit may be closed or opened, commonly the relay contacts.
CONVERTER (Power): A circuit and component arrangement that supplies a higher d-c voltage output than the original a-c voltage—possibly eliminating B batteries in tube-type receiver or transmitter.
CORE: Normally understood to mean the iron inner piece, center, etc., upon which a wire coil is wound to develop a stronger magnetic field when energized, as in a relay or escapement. Also, movable iron piece in frequency tuning coil.
CPS: Cycles per second.
CRYSTAL: Precisely shaped and sized quartz used to control the frequency of an oscillator, or as frequency-selective filter in superhet.
CURRENT: Electrical flow measured in terms of amperes.
CURRENT CHANGE: An increase or decrease in amperage in receiver (or relay) circuit as a result of signal reception.
CYCLE: Period of time required for an alternating or oscillating current to repeat original flow direction.
CW: Carrier wave, which see. (Its more precise meaning is continuous wave. Often, these terms are used interchangeably.)
DC: Direct Current. Current that flows in only one direction.
DETECTOR: Section of receiver that picks up signal. (In electronics, the detector is the receiver circuit that separates the modulation on a carrier wave from the carrier wave itself.) In radio-control work, the entire tuner is sometimes referred to as the detector.
DIODE: Tub or crystal designed to pass current in one direction only.
DISCHARGE: Expenditure of electrical energy—as from a battery.
DRAIN: Current drawn or consumed by a tube, actuator, or other electrically operated device, considered in terms of battery capacity.
DROP-OUT: That point at which electrical current flowing through a relay or escapement does not overcome spring tension, thus permitting the armature to pull away from the core piece.
ELECTRODE: An operating element of a tube or transistor.
EMISSION: The process of sending or transmitting radio signals from an antenna.
END-VOLTAGE: Minimum voltage below which battery failure takes place, usually well below useful minimum voltage.
ESCAPEMENT: Mechanical-electrical device or actuator for moving controls or control surfaces.
F.C.C. Federal Communications Commission.
FIELD-STRENGTH METER: Simple circuit arranged with a meter to give relative reading of signal strength. For transmitter tuning.
FILAMENT: An electrode in a vacuum tube heated electrically to cause a flow of electrons to the plate of the tube.
FILTER: A component or coil permitting passage of only desired currents or frequencies. Also, capacitors and/or inductance coils to smooth out electrical currents, as in transmitter power supplies.
FINAL STAGE: Output stage of the transmitter, coming after oscillator amplifier stages: relay stage of a receiver.
FREQUENCY: An oscillating current expressed in cycles per second. (See Audio Frequency; Radio Frequency.)
FREQUENCY TOLERANCE: The plus or minus variation from a stated frequency given as permissible limits for transmission by FCC.
FRONT-END: A tuner for frequency selector section of a receiver.
FSM: See field-strength meter.
GALLOPING GHOST: Simplified form of dual proportional control, giving rudder and elevator action.
GAP (AIR): Distance between armature contact and fixed contact on a relay, and between armature and coil piece on an escapement.
GRID: An element placed between the filament and plate of a vacuum tube to control current flow between the two.
GROUND: Rarely refers to actual connection to the earth; ground point in a circuit is usually considered to be common point where many other parts of circuit connect; in vacuum tube circuits, almost always point (or wire) to which the negative side of B battery, and one side of A battery (either positive or negative) are connected; referring to transmitter antenna circuits, sometimes actual connection to earth.
GROUND CHECK: Checking and tuning of receiver for range by walking it the desired distance away from transmitter.
HARD TUBE: Vacuum tube.
HARNESS: Complete wiring system when arranged as a removable unit, prewired and connected outside the vehicle.
HORN: A fixed arm attached to a control surface—connects to pushrod.
IDLE: Plate current of the receiver when no signal is received.
IMPEDANCE: A characteristic of an electrical circuit to oppose the flow of current.
INDUCTANCE: Electrical property of a coil to oppose a change in current flow through the coil.
INPUT: Voltage or current fed into power supply receiver, transmitter, power converter, etc.
JACK: A kind of "socket" placed in an electrical line to receive a phono-plug, etc., for reading of current, or for attachment of earphones, etc.
KEY: Loosely speaking, any form of switch used to make and break the transmitted carrier and/or audio frequencies.
KEYING SWITCH (AND LEAD): The key, and any cable and plug connection to the transmitter.
KICK-UP: Mechanical feature of some compound actuators to move an elevator to the up position.
LEAD: A wire or other conductor, connected to battery, component, receiver, etc.
LEAD-ACID CELL: An electrical cell using dissimilar lead plates and acid. This cell is a rechargeable or secondary type, and has a voltage of approximately 2.
LINKAGE: Mechanical arrangement between actuators and controls.
LOAD: The amount of current being drawn from the battery or other power source.
MA: Milliampere, which see.
MAGNETIC ACTUATOR: Control moving device (usually rudder) incorporating permanent magnet(s) which slaves to variations in pulsed signals from transmitter.
MAGNETIC FIELD: Magnetic lines of force produced by a permanent magnet or current flow in an electromagnet.
MAH: Milliampere-hours.
MEGAHERTZ or MEGACYCLE: A frequency of 1,000,000 cps.
MEGACYCLE: A frequency of 1,000,000 cps.
MEGOHM: A resistance value of 1,000,000 ohms.
MERCURY-CELL: An electrical cell sometimes used, having long life, but not rechargeable.
METER: Device to measure and read voltages, currents, resistances, etc.
METER JACK: See Jack.
MICROSWITCH: High sensitivity precision switch of small size suitable for keying purposes.

MILLIAMPERE: Abbreviated ma or mil. A measurement of current 1/1000 of an ampere, which see.
MIL: Short for milliampere.
MINUS: Negative voltage.
MODULATION: Imposition of an audio frequency on carrier frequency.
MODULATOR: A circuit used in a transmitter to superimpose an audio or low frequency signal on the carrier wave. In radio-control work, the modulator often consists of an audio oscillator.
MOPA: Master-oscillator power-amplifier circuit used in transmitters.
MULTI: Radio-control class of operation using more than one channel.
MULTIMETER: A test-meter permitting reading of voltages, resistances, currents, etc.
MV: Microvolt, a millionth of a volt, usually a measure of receiver sensitivity.

NEUTRAL: No-control position of an actuator or surface.
NICAD: General term used to describe nickel-cadmium cell. The word Nicad is actually a registered trade-mark of the Nicad Division of Gould National Batteries, but it is frequently used as a term to describe nickel-cadmium cells.
NICKEL-CADMIUM BATTERY: Sealed secondary wet cell, rechargeable; has high discharge rates and long life.
NOISE: Random, audible (on earphones), scratching sounds resulting from electrical discharges—as between vibrating metal parts—which interfere with receiver operation.
NO-LOAD VOLTAGE: Commonly understood to mean the voltage reading of a battery, part of a circuit, when no work is being performed, hence, no current flow (drain) is evident.
NPN: Type of transistor (negative, positive, negative).
NULL: Certain areas in which transmitted signal is weak, or cannot be detected by receiver, due to the antenna type and position—as overhead, with a whip antenna.

OHMS: A unit of electrical measurement for resistance.
OSCILLATOR: A vacuum tube or transistor circuit capable of generating a continuous stream of alternating current.
OUTPUT: The outgoing voltage, current, or signal from an electrical circuit, battery, or generator.

PACK: An assembly of batteries, taped together as an integral power supply for a receiver, servo, etc.
PADDING: Generally refers to special tailoring of a circuit, usually addition of capacity to an audio circuit.
PARALLEL: The joining together of batteries, plus, minus to minus, not to increase voltage, but to increase battery life. Components may also be mounted in parallel, or in series, but not necessarily within the precise meaning of this definition.
PENTODE: A tube having five electrodes—namely, cathode, control grid, screen grid, suppressor grid, and plate.
PHONOPLUG: Metal plug, as used in telephone switchboard, earphones, etc., that can be inserted into a jack. (As with meter jack, transmitter keying cable, etc.)
PIN: Metal prong, as on tube base, for insertion of object in socket.
PLATE: The electrode in the vacuum tube to which electrons are attracted.
PLUG: A device for connecting a cable (as from receiver) into a current—providing tabs for soldered wire connections, and pins for insertion into socket.
PLUS: Positive voltage.
PNP: Type of transistor (positive, negative, positive).
POSITIONABLE SERVO: One which moves to desired control setting, without self neutralization; used for motor control and elevator trim adjustments. (Also called trim servo.)
POT: Short for potentiometer.
POTENTIOMETER: A kind of rheostat for varying resistance of a circuit, as when checking relay operation. A voltage divider.
POWER CONVERTER: See converter.
POWER SUPPLY: Any device used to supply power to an electrical circuit. Most commonly, this is in the form of a cell or battery; it could however, also include a generator.
PPS: Pulse rate per second.
PRINTED CIRCUIT: An etched circuit upon suitable base or chassis eliminating wire connections between components.
PROPORTIONAL CONTROL: Movement of control surfaces, positions corresponding exactly to degree of control stick movement.
PULL-IN: The current value at which a relay or escapement armature will be attracted to the magnetic core piece.
PULSE: Quick, brief signal, either carrier or audio.
PULSE OMISSION DETECTOR: A circuit, either part of receiver, or complementary thereto, used for actuation of motor control in many pulse and proportional systems.
PULSER: Mechanical or electronic device generating as required, transmitted signal pulses of varying widths and rates.
PULSE RATE: Number of pulses per second (pps).
PULSE WIDTH: Duration of individual signal-on pulses.
PUSHROD: Dowel or balsa wood strip, or metal tubing, connecting actuator with control surface.

QUICK-BLIP: Very brief signal used to trip motor control, etc.

RANGE: Distance at which receiver reliably detects signal and provides adequate current change for actuator operation.
RECEIVER: The "radio"; detects, amplifies, and routes signal to appropriate actuator.
REED: Thin, metallic finger that vibrates in harmony, or resonates with particular audio frequency of appropriate cycles per second.
REED BANK: A grouping of reeds to route transmitted and detected tones to proper actuators in multicontrol.
RF: Radio frequency. A frequency that is usually higher than 100,000 cps.
RELAY: An electromagnetic device that is operated by variation in the conditions of one electric circuit to affect the operation of other devices in the same or other electric circuits, by either opening contacts or closing contacts, or both.
RESISTOR: A component to provide any desired number of ohms resistance in a circuit.

SN: Self-neutralizing.
SELECTIVITY: A measure of a range of radio frequency signals within which the receiver will function—the narrower the range the greater the selectivity.
SELF-NEUTRALIZING: Escapement, servo, or actuator that returns to neutral position with no signal.
SENSITIVITY: The quality, or degree of ability of a receiver to detect a transmitted signal.
SEQUENCE: Control responses occurring one after the other in set order, but never selective, as with certain actuators.
SEQUENCE SWITCHER: An auxiliary switching device for closing additional control circuits with a series of pulses. Common to model boats and cars.
SERIES: Usually the connection of batteries, plus to minus, with separate minus and plus leads on respective sides of the pack or box lineup, to boost voltage. Also applies to component hook-ups, but not precisely in this sense.
SERVO: An electric-motor driven control actuator.
SHORT: Accidental, direct contact of parts or conductors having opposite polarities. "Short circuit."
SHORTING PLUG: Converted (both sides connected) phonoplug, or other miniature plug, inserted and remaining in open-circuit jack to maintain closed circuit. Sometimes placed in closed-circuit jack in airplane to ensure reliable circuit through jack when contacts have poor pressure.
SIGNAL: Controlled transmission of carrier or audio frequency.
SILVERCEL: Miniature, secondary wet cell, rechargeable battery capable of high discharge rates and extreme battery life. Usually employed for high-drain servo operation. (Registered trade name of Yardney Electric Corp.)
SIMPL-SIMUL: Simplified form of pulse control for proportional simultaneous movement of elevators and rudder.
SIMULTANEOUS: Two controls at a time, as with multi, by transmission of two tones.
SINGLE-CHANNEL: System in which receiver provides only one path of intelligence to actuator, or primary actuator.
SINGLE-STAGE: Transmitter having oscillator but no amplifying stage.
SLUG: In a relay a slug is a highly conductive sleeve placed over the core to help increase or decrease the magnetic lines of forcve within the magnetic path. The slug is also taken as a metal core whose position can be varied inside the coil.
SOCKET: Device, part of circuit or circuits, to receive the plug connecting the receiver, etc.
SPAGHETTI: Thin-wall tubing.
SPRING TENSION: The amount of pull exerted on a relay or escapement armature by the return spring.
STAGE: That portion of a circuit in a transmitter or receiver performing one function of the operation, as detection, amplification.
SUPERHETERODYNE: A radio receiver having high amplification and selectivity. It contains its own oscillator, the output of which mixes with the incoming signal to produce an intermediate frequency signal.
SUPERREGENERATIVE: Commonly used radio-control receiver with good sensitivity, relative simplicity, but poor selectivity—susceptible to interference.

TANK: Coil and capacitor circuit employed in receiver and transmitter to help establish natural frequency of the radio circuit.
TERMINAL: Soldering lug, post, etc., to which connection may be made.
TOLERANCE: Permissible deviation, plus or minus, expressed in a percentage, as for crystal, resistor, capacitor, etc.
TONE: An audio frequency, expressed in so many cycles per second, superimposed on a carrier wave.
TORQUE ROD: Balsa wood, dowel, or metal piece extending from an escapement to a surface, for transmitting the actuator movement to the control. (Rocking motion contrasting linear motion of a pushrod.)
TRANSMITTER: The electronic circuitry that generates and sends out a controlled radio frequency, or both this r-f and audio frequencies, or tones.
TRANSISTOR: Basically, a semiconductor for specific purposes, such as signal detection, power amplification—has many properties of a vacuum tube, but low current consumption.
TRIM: Final adjustment and balance of a model plane to realize proper flying characteristics; precise non-neutralizing actuation of a control.
TRIODE: Type of vacuum tube having three electrodes, for filament (cathode), grid and plate.
TRICKLE-CHARGE: To charge at a very low rate for a long period—common in radio-control work with nickel-cadmium batteries, etc.
TUBE, VACUUM: Glass bulb from which air has been exhausted, having varying, required electrodes for specific function, such as detection, amplification, modulation, oscillation.
TUNER: Usually, a variable capacitor—coil combination for adjusting capacitances or inductances to facilitate proper operation of a transmitter or receiver.

VIBRATOR: A power pack consisting basically of a vibrator and transformer, capable of changing a low value d-c voltage into a high value a-c voltage. Often the word "vibrator" alone, is used to describe the entire pack.

VOLT: A unit, or measure of electricity indicating pressure.

VOM: Volt-ohm meter, a measuring instrument with multiple ranges and scales.

VTVM: Vacuum tube voltmeter.

WATT: A unit or measure of electricity indicating power consumed (volts × amperes).

WAVE: An actual diagrammatic representation of a radio wave to illustrate frequency, amplitude, etc.

WET CELL: A form of battery, rechargeable.

WHISKER WIRE: Tiny contact wire attached to revolving shaft of an escapement to close auxiliary circuit.

YOKE: Formed steel wire, as a loop, placed about a drive pin inserted into the surface to be moved.

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 sheet through to thoroughly familiarize yourself with the general procedure. You will note the use of many photographs and line drawings throughout the instructions.

This is offered primarily for the novice and will be of 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. 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 type that can be highly recommended is the Ungar with the 37½ watt chisel point. This will be found to be quite adequate for most transmitter and measuring devices as well as the tiniest of receivers. A good supply of rosin core type solder of the Ersin Multi Core or similar type is recommended. Never use separate fluxes, paste or acid solder in any electronic work. The use of a long nose pliers 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 inch of wire. Excessive insulation removal may cause a short circuit condition in respect to nearby components.

In mounting parts, such as resistors or condensers, trim off all excess lead lengths so that the component may be installed in a direct point to point manner. If necessary, use spaghetti over the exposed wires that might 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 the construction of a series of pilot models.

Much of the performance of an R/C kit depends upon the degree of workmanship used in making soldered 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 clean and mechanically strong. You can not depend on solder alone to hold a connection together. The tip of your soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joints. An excessive use of solder is to be avoided. Also avoid a flux flooding condition which could conceivably cause a leak between adjacent terminals on tube sockets and so forth.

A check list of parts has been prepared for you and will be found in your kit. This contains a list of the hardware, grommets, resistors, capacitors, sockets, switches, tubes, crystal, coils, wire and miscellaneous components found in your kit. It is advisable for you after you have thoroughly studied the drawings, instructions, and pictures, to check this list of components to make sure that all parts are in the kit and that you familiarize yourself with each part.

While every effort is made to pack your kit with 100% complete parts, with human fallability being what it is, errors can occur. In the event of a shortage please return the parts list to Ace Radio Control, Box 301, Higginsville, Missouri detailing which parts you were short. We must have your parts list in order to make a replacement. This will also identify for us in what department the error occured.

Best of luck on your R/C adventures.

Ace Radio Control

Box 301
Higginsville, Mo.