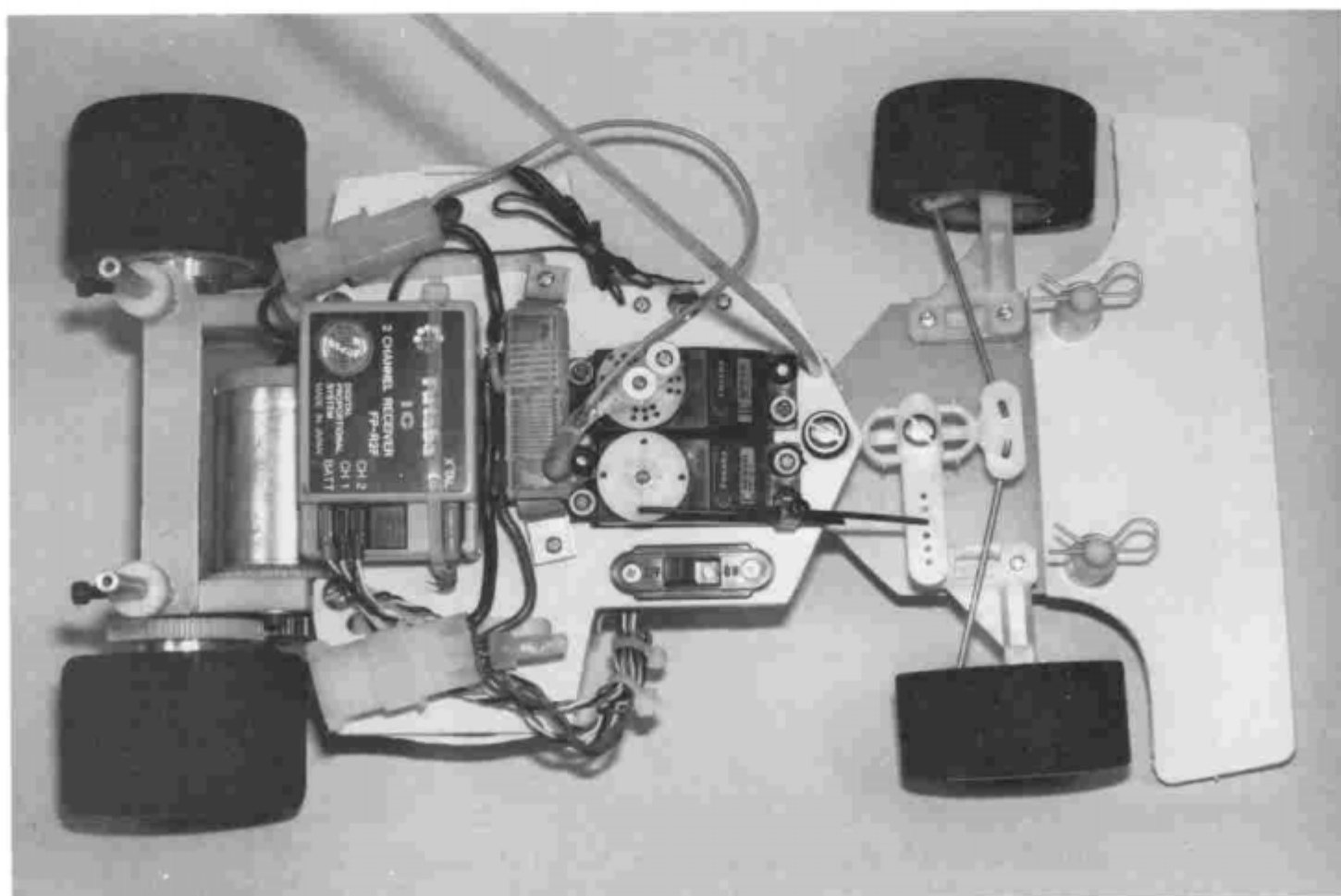
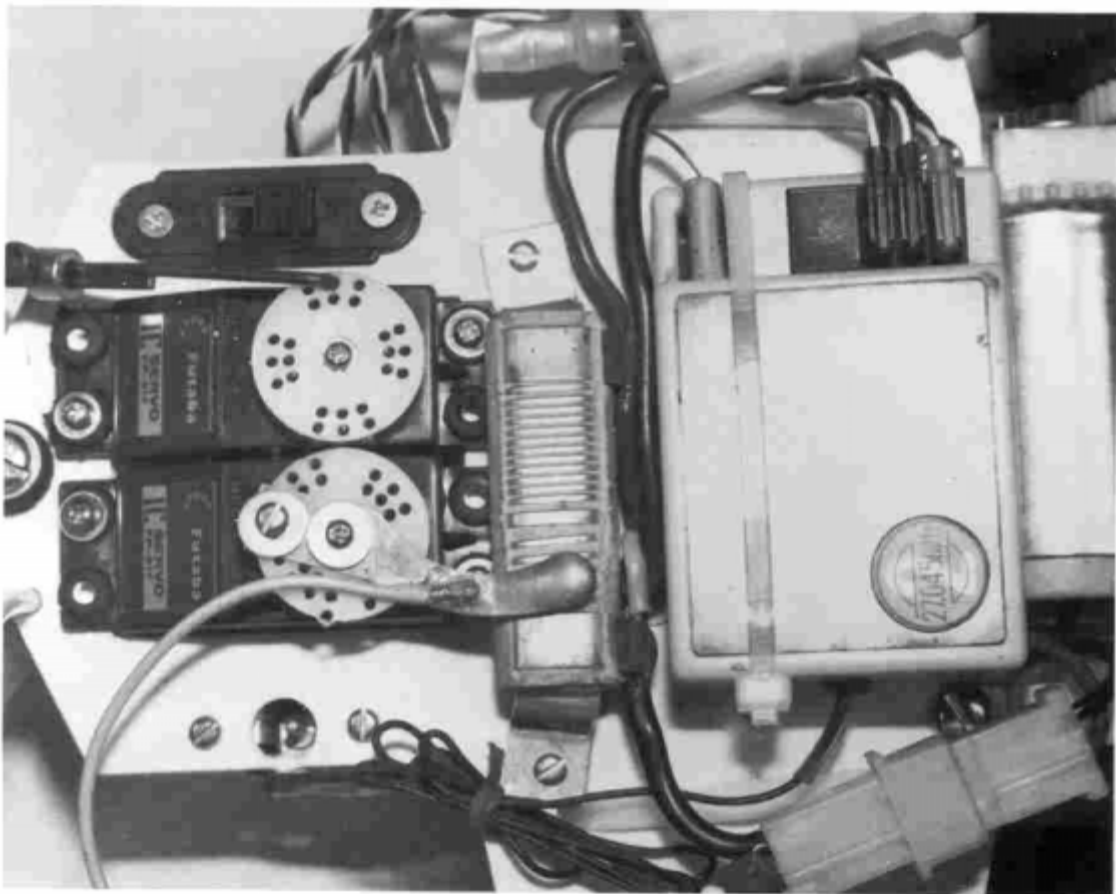




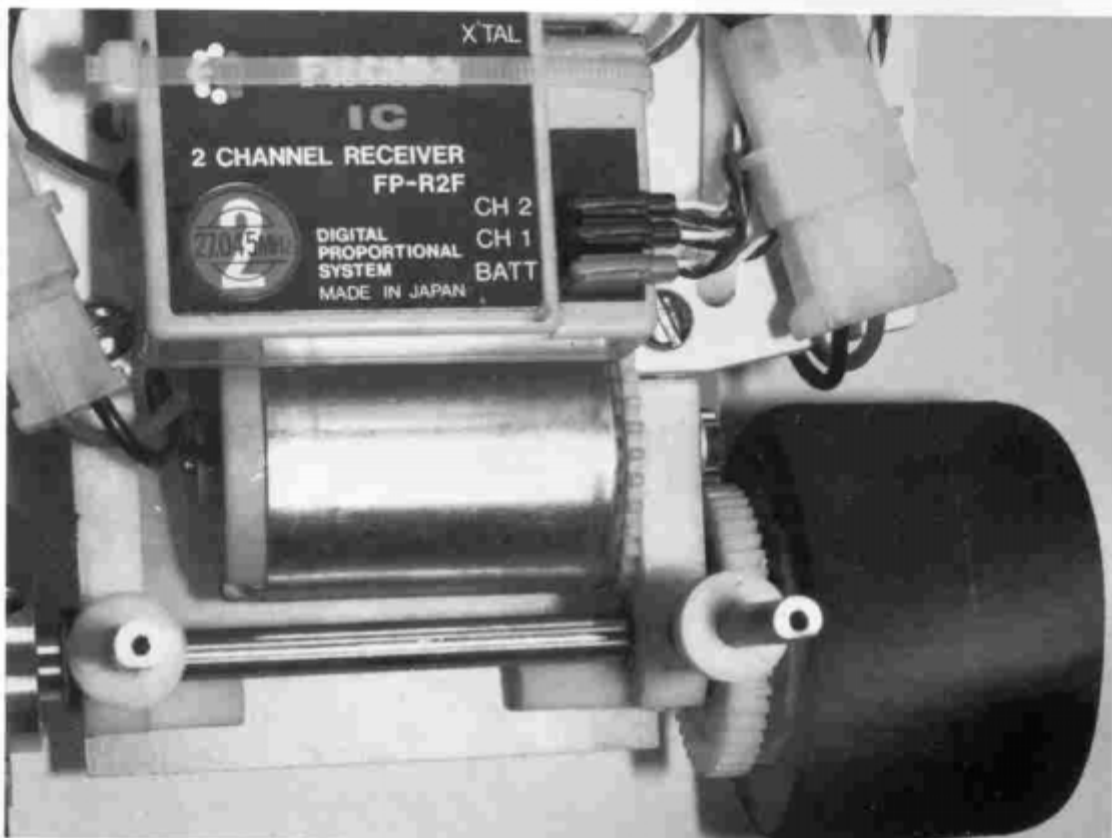
ASSOCIATED R/C12E

ASSEMBLY AND OPERATING INSTRUCTIONS





**RADIO AND RESISTOR INSTALLATION
SHOWING CORRECT ROUTING OF WIRES.**



**MOTOR INSTALLATION WITH CAMLOCK
ADJUSTING PLATE FOR EASY GEAR ADJUSTMENT.**

ASSOCIATED ELECTRICS, INC., 1928 E. EDINGER, SANTA ANA, CA. 92705 - U.S.A.

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NOTE

This manual is included with both kit and factory assembled versions of the RC12E race car, and contains instructions for assembly as well as operation of your car.

Owners of factory assembled cars should refer to the construction sections when making repairs or modifications.

WARNING

Nicad batteries are susceptible to damage when overcharged at a high rate, and can release caustic chemicals if the overcharge is severe. Read the battery charging instructions in this manual before attempting to run your car.

PLEASE READ THIS

Before you attempt to run your car.

You're probably anxious to run your new car, but you need to do the following first.

- STEP 1 – INSTALL BATTERIES IN TRANSMITTER.** The radio transmitter is supplied without batteries. Open the back of the transmitter case and install the correct number of cells. Most transmitters use seven "AA" size penlight cells. If you have purchased a rechargeable pack for your transmitter it should be slow charged overnight before use.
- STEP 2 – TEST CHARGE YOUR CAR BATTERY.** Disconnect the 3-pin battery connector on the right side of the car. Connect your fast charge cord (or a charger designed for R/C cars) to the battery pack. A 12 volt automobile battery should be used as a charging source. Connect the RED clip to the POSITIVE (+) terminal, and the BLACK clip lead to the NEGATIVE (–) terminal of the automobile battery. This first charge should be for FIVE MINUTES ONLY. It is normal for the charge cord to become warm while charging.
- STEP 3 – TEST THE RADIO.** When the five minute charge is complete unplug the charging cord and reconnect the battery to the radio tray plug. Turn on the transmitter first and then the receiver. Hold the rear wheels of the car off the ground and test steering and throttle action. Having determined that the steering and throttle are working properly, you can drive the car.
- STEP 4 – RUN THE CAR.** Pick a safe area away from automobile traffic, dirt, and water puddles. With this initial five minute charge, the car will operate for about two to four minutes. Run the car until it slows down noticeably, or until the radio stops functioning. When you stop operating the car, turn off the receiver switch first, then the transmitter. Unplug the battery connector to prepare for recharge.
- STEP 5 – FULL BATTERY CHARGE.** The fast charge cord supplied with your car will charge the battery in 15 minutes. DO NOT attempt to fast charge longer than 15 minutes, as permanent battery damage can occur. DO NOT continue charging if the battery becomes excessively warm.
- STEP 6 – READ THE OPERATING INSTRUCTIONS.** To get the best performance from your car read Section III of this manual for tips on battery charging, driving, tuning, and modifying your car.

SECTION I

INSTRUCTIONS — RC12E Basic Kit

This section applies to the assembly of the No. 3000 basic kit. Builders of more complete kits (No. 3010 — 3015) should follow the instructions in this section and then proceed to Section II.

Welcome to the world of radio controlled model car racing. We thank you for buying our car, and we hope that you get great satisfaction and fun from it.

1/12 scale electric R/C cars are the newest development in the sport of model car racing, following in the footsteps of 1/8 scale gas powered cars. Electric cars offer the challenge and excitement of gas cars together with the silence, cleanliness, and convenience inherent to electric power. Although electric R/C cars are relatively new, your RC12E is the product of a company with 15 years experience in building high performance model race cars — ranging from slot cars to World Champion 1/8 scale R/C cars. A year of testing has gone into the RC12E and the result is a race car that is fast, durable, and versatile.

To insure maximum performance from your car we recommend that you read and follow the assembly instructions carefully. Your task will be made easier and you might pick up a few "speed secrets" along the way.

GENERAL INFORMATION

PARTS LIST FOR BASIC KIT (No. 3000)

Small parts are grouped in bags numbered as follows:

1. Front end
2. Rear end
3. Servo saver
4. Chassis parts
5. Wheel parts
6. Radio tray parts
7. Gears

In addition the following larger parts are included separately:

Chassis plate
Bumper
Radio tray parts
Front and rear wheels/tires

Complete kits (No. 3010 — 3015) contain additional parts. Refer to Section II.

To eliminate confusion the small parts should be left in their individual bags until you are ready to assemble them on the car. This is very important because there are mounting screws ranging in length from 3/8" to 1-1/4" and these must be used in the correct parts.

8-32 panhead screws are used to hold the nylon parts to the chassis. These screws form their own threads as they are run into the hole, and the resulting attachment is firm and self-locking. The screws can be removed and replaced many times without any loss of locking action. It is important to start the screws pointing straight into the hole. DO NOT use a power screwdriver for assembly.

Tools required for assembly are a pair of pliers, a screwdriver with a 3/16" wide blade, and a ruler to aid in parts identification. A 3/32" allen key is supplied with this kit that will fit all of the allen cap screws and set screws on the car. However, a 3/32" allen wrench with a screwdriver handle (Assoc. No. SP73) will make tire and motor changes much easier and faster, and is really necessary if you plan to race your car. A penknife with a small blade is needed to remove and replace the front wheel "E"-clips. A sheet of medium to fine grit emery cloth and a hobby knife with a small pointed blade are useful for deburring plastic parts. A gear puller (Assoc. No. 3810) will be useful if you plan to experiment with different gear ratios.

Since all the parts on the RC12E are symmetrical it is possible to build the car with either right-hand or left-hand drive to the rear axle. Up to this point the convention for 1/12 scale electrics has been right-hand drive (gears on the right side of the car); and motors that are currently available rotate in the proper direction for right-hand drive (counter-clockwise) when the red motor lead is connected to the positive battery terminal. Future modified class motors will probably be designed to run faster in the counter-clockwise direction. For these reasons we recommend that you build your car with gears on the right side as shown in the assembly instructions.

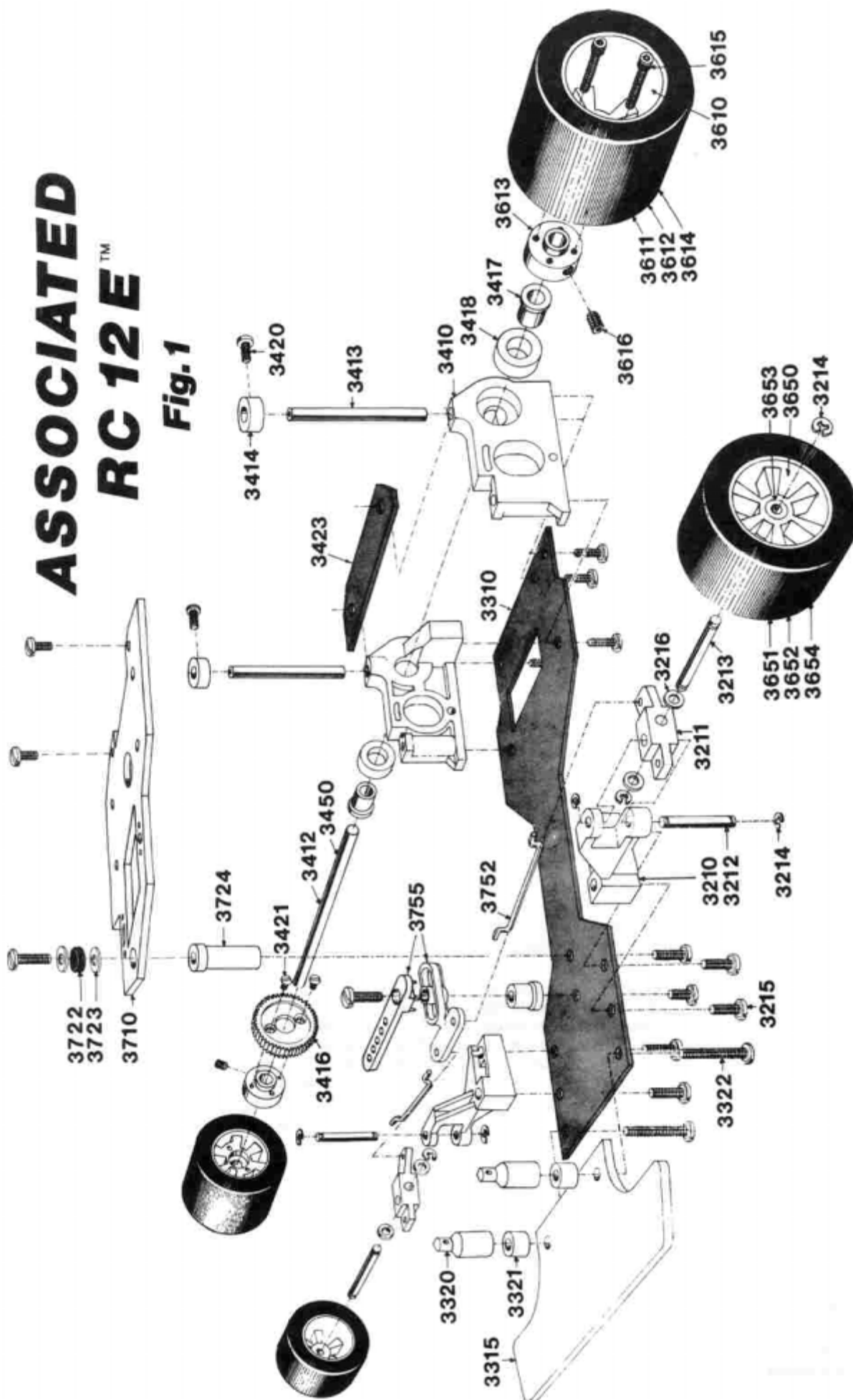
Some of the plastic parts may have a small amount of flash. In most cases this will not interfere with the function of the part, but you may wish to remove the flash for cosmetic reasons.

The small protrusion left by the gate in the molding process can be sliced off with a sharp knife. Flash along the edge of a part can be removed by scraping with a sharp hobby knife, using a light, rapid, back-and-forth motion while holding the blade perpendicular to the edge of the plastic so that it has no tendency to "dig in". DO NOT attempt to carve or slice the flash from the part.

Flash on flat surfaces can be removed by wiping the part lightly on a piece of emery paper that is laying on a flat table. This method leaves a sanded finish that will tend to get dirty easily, so don't use it on surfaces that show.

ASSOCIATED RC 12E™

Fig. 1



SERVO SAVER

Locate the 5/8" long nylon post and a 3/8" long 8-32 panhead screw from the servo saver bag. Orient the chassis plate so that the square hole for the motor will be on the right side of the car. Place the nylon post, flange down, over the forwardmost hole along the center line of the chassis. Secure with the 3/8" screw. You will need pliers to hold the post while tightening. Use a folded piece of cloth in the jaws of the pliers if you don't want marks on the post.

Fit the remaining two plastic parts (pitman arm and servo arm) together as indicated in Fig. 1. Install the tie rods to the underside of the pitman arm and mount the assembly to the post on the chassis using a 5/8" screw. Take care to start the screw squarely. Tighten the screw all the way down and then back off one-half turn to allow the servo saver to swivel freely. The servo saver is designed to protect the steering servo through the action of a built-in plastic spring. This action can be made smoother by applying **silicon** oil, grease, or spray to the mating surfaces between the two servo saver parts, particularly to the square hub and two spring-bars.

FRONT END

Open the front end bag and locate two steering blocks (No. 3211), two kingpins (No. 3212), and two stub axles (No. 3213). Refer to Fig. 1, Pg. 1-3 to identify the parts. The stub axles are slightly longer than the kingpins, and are made of harder steel, so don't mix them up. Insert the stub axles into the steering blocks from the **inside** of the blocks. The fit will be tight so start the axles in by hand and then drive them part way through by tapping on the axle with the plastic handle of a screwdriver. Put one washer and an "E"-clip on the inside end of the axle and drive it the rest of the way through until the washer and clip are tight against the inside surface of the steering block.

Run a kingpin completely in and out of the kingpin hole of each steering block several times. This will remove burrs and tight spots, and allow the block to swivel freely on the pin. Wipe the top and bottom surfaces of the blocks on emery paper to remove any flash. Press the kingpins into the underside of the suspension arms (No. 3210) until they just begin to show in the gap. Position the steering blocks in the gap with the angled arm on the block pointing to the back of the car. Align the holes and press the kingpin through the blocks and upper portion of the suspension arms. Place "E"-clips on both ends of the kingpins. Check that the steering blocks swivel freely.

Hook the tie rods into the underside of the angled arms on the steering blocks, and mount the suspension assemblies over the second and third holes back from the front of the chassis. Use the 8-32 x 1/2" screws supplied.

If you plan to use ball bearings (No. 3655) in your front wheels they can be installed at this time (two per wheel). Otherwise follow the directions in the following paragraph.

Locate the front wheel bushings (No. 3653) from the wheel parts bag. They should be installed in the side of the wheel with the deep recess. The best way to install the bearings is to slip them over the shaft of a small screwdriver (a phillips screwdriver with a 1/8" shaft and plastic handle is excellent), support the wheel on two books or a block of wood with a hole in it, and press the bearing in by pushing down on the handle. Hammering on the bushing can deform the hole causing it to bind on the axle. Place a 1/8" washer on each stub axle and slide the front wheels in place. Note that the deep recess goes to the inside of the car. Retain each wheel with a "E"-clip.

REAR END

Mount the right and left rear axle brackets (No. 3410) onto the chassis using three 8-32 x 1/2" screws for each bracket. Remove any burrs or sharp edges from the ends of the wing tubes (No. 3413). Drive the wing tubes partially into the wing tube brace. (No. 3423) so that the ends barely protrude. (It might be necessary to trim some excess fiberglass from the end of the brace so that the brace doesn't rub against the gear after the car is assembled.) Place the tube/brace assembly over the rear brackets and tap the tubes into the holes in the brackets until they bottom, leaving the brace resting directly on top of the brackets.

If you plan to use ball bearings (No. 2222) they should be installed at this point. Otherwise the nylon bearing adapters (No. 3418) and oilite bushings (No. 3417) should be pressed in place. Run the axle through one bushing and up to, but not through, the other bushing. It should point exactly at the center of the bushing. If it does not, loosen the screws holding the rear bracket containing the axle and swivel the bracket slightly until alignment is achieved. Retighten the screws. Repeat the alignment operation with the other bracket. The axle should now slide freely through both bearings at once.

REAR WHEELS AND GEAR

Thread two 5-40 x 3/4" allen cap screws into the mounting holes of each rear wheel. Start the screws into the outside of the wheel (the deep recess is the outside). Run the screws in far enough that they begin to poke through the back side of the wheels.

Mount the nylon gear (in gear bag) on an aluminum hub (No. 3613) using the special 5-40 flathead shoulder screws supplied. The side of the gear imprinted with "A" and the number of teeth should face **away** from the hub. It is not necessary to remove the two gate protrusions on the gear because these will drop into holes in the hub.

Slide the hub onto the axle gear side first, follow with a wheel, align the wheel mounting screws with the two holes not being used by the gear, and tighten each screw alternately a few turns at a time so that the wheel and hub are drawn together evenly. Position the end of the axle so that it is flush with the outside (recessed) surface of the wheel. Rotate the axle until the flat lines up with the setscrew hole in the aluminum hub. Install and tighten a 10-32 setscrew. Slide the axle through the bearings on the car, gear to the right side; place the other aluminum hub on the axle, position the setscrew hole over the flat and install the setscrew. Before tightening the screw adjust the hub so that there is a small amount (about 1/64") of end play in the axle. Install the left rear wheel and tighten the mounting screws.

BUMPER AND BODY MOUNTS

The bumper mounts on top of the chassis and is held down by the screws that secure the front body mounts. Use the appropriate screws and spacers for the body you plan to run. In general Can Am and Sports Car bodies will require the short screws and one or two washers as spacers. GT bodies will require the long screws, the tall nylon spacers, and possibly some washers too. Make the final adjustment when you have finished mounting the body.

The wing tubes act as rear body mounts. Slide the nylon collars supplied in the rear end bag over the wing tubes and lock with the 1/4" long 5-40 screws. Set the height according to the body you are using.

RADIO TRAY

Install the tray mount (No. 3724) in the hole directly behind the servo saver, with the flange away from the chassis. Use the shorter (1/2") screw supplied. Be sure that the screw starts squarely into the mount.

Do not mount the radio tray at this time, since the radio must be mounted to the tray first. However, note that the tray mounts at two points in the rear (one on each rear bracket) using the short 3/8" screws, and at one point in front. The front is held down by a 5/8" screw. Slip a washer, rubber grommet, and another washer over the screw before installing it. The flex of the chassis can be changed by adjusting the tightness of this front mounting point.

COMPLETING YOUR CAR

At this point you have completed construction of the chassis and basic kit. If you are working with the No. 3000 kit, the only remaining unmounted major parts you should have are the radio tray, battery cup, and motor adjusting plate. Items you will need to complete your car, along with construction advice, are noted further on in this section. You can also refer to Section II if you wish to duplicate a factory car. Builders of complete kits (No. 3010 through 3015) can skip the rest of this section and go on to Section II.

MOTOR

Use an Associated 05 motor (No. 3500) or equivalent. Follow the motor mounting instructions in Section II.

BATTERY

Four or six sub-C nicad cells arranged in two or three cell sticks can be installed in the battery cup. Cells must be matched in sets and capable of fast charge rates. Not all nicads have this capability, so to be safe you should use batteries offered by electric car manufacturers. ASSOCIATED No. 3717 six-cell pack and No. 3718 four-cell pack are in unassembled form and you will need to follow the instructions in Section II for wiring the pack. Use No. 3729 hookup wire and No. 3740 connector. Or you can use ASSOCIATED No. 3727 six-cell or No. 3728 four-cell packs which come completely assembled with connector.

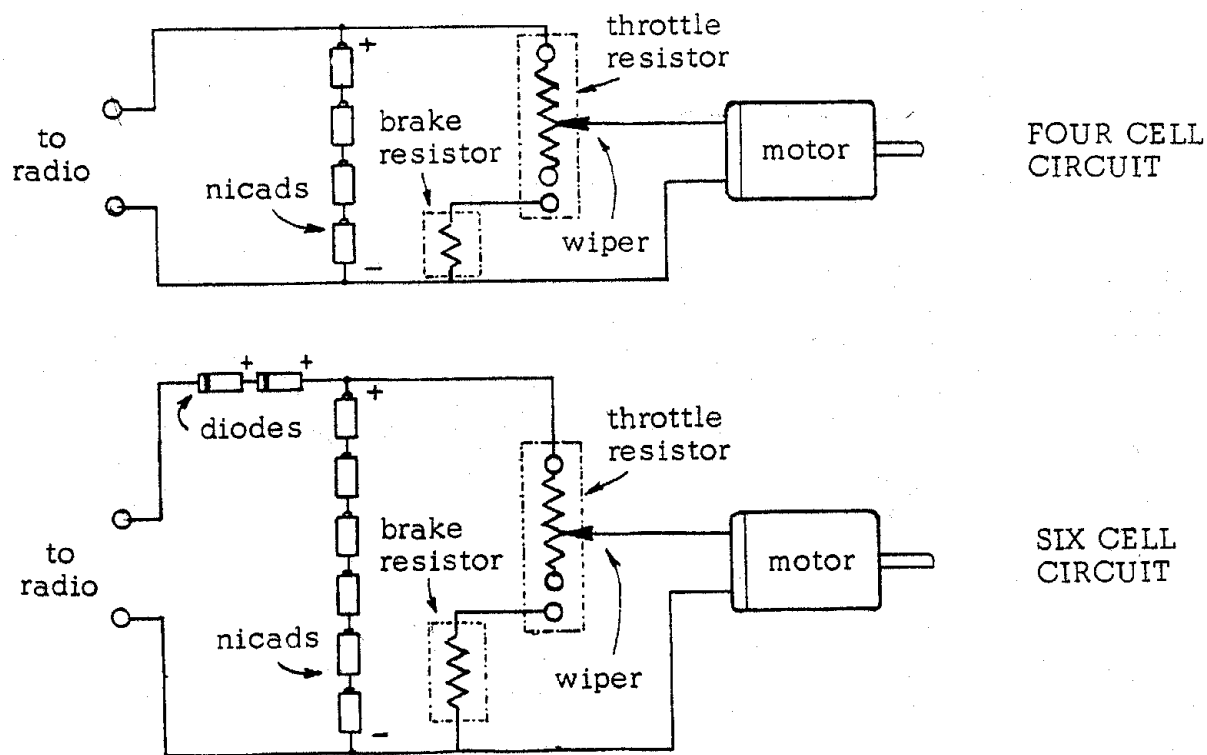
Follow the instructions in Section II for installation of your completed battery pack.

ELECTRICAL CIRCUIT — (resistor controlled cars)

Fig. 2 shows the basic circuit used by all resistor controlled electric cars. Connectors, charging jack, radio noise filter, etc., are not indicated on this diagram because they vary from manufacturer to manufacturer. The resistor wiper is moved by a servo and controls the amount of power available to the drive motor by varying the resistance between the battery and motor. The same wiper can be used to shunt the motor with another resistor for dynamic braking. Power for the radio receiver is drawn from the battery that drives the car, but in the case of a six-cell car it is necessary to reduce the voltage slightly before it reaches the receiver. This is done with two forward biased silicon diodes (No. 3715) which together drop the voltage by about 1.5 volts.

The schematic for the RC12E is shown in fig. 5, Pg. II-2 of Section II. This circuit offers a number of advantages over the basic circuit:

- No circuit changes are necessary in switching back and forth between four cell and six cell operation. Simply plug in the battery you want; the radio dropping diodes are automatically switched in or out by the battery connector.
- By having both the throttle and brake resistor on the same core the braking can be varied to suit the race track by adjusting the throttle trim on your transmitter.



BASIC ELECTRIC CAR CIRCUITS

Fig. 2

The adjustable brake feature is very important since otherwise it is necessary to physically change the brake resistor every time you want to change the amount of braking the car has on the race track.

If you want to use this circuit you will need the following items: No. 3711 throttle control resistor; No. 3712 wiper; No. 3713 mounting bracket; No. 3730 wire harness (includes diodes, capacitor, and radio tray connectors); and No. 3714 charging jack (optional). You will also need connectors for the motor and battery if yours are not so equipped: No. 3505 motor connector; No. 3740 battery connector; and No. 3729 hookup wire.

Follow the directions in Section II on completing the wire harness and radio tray.

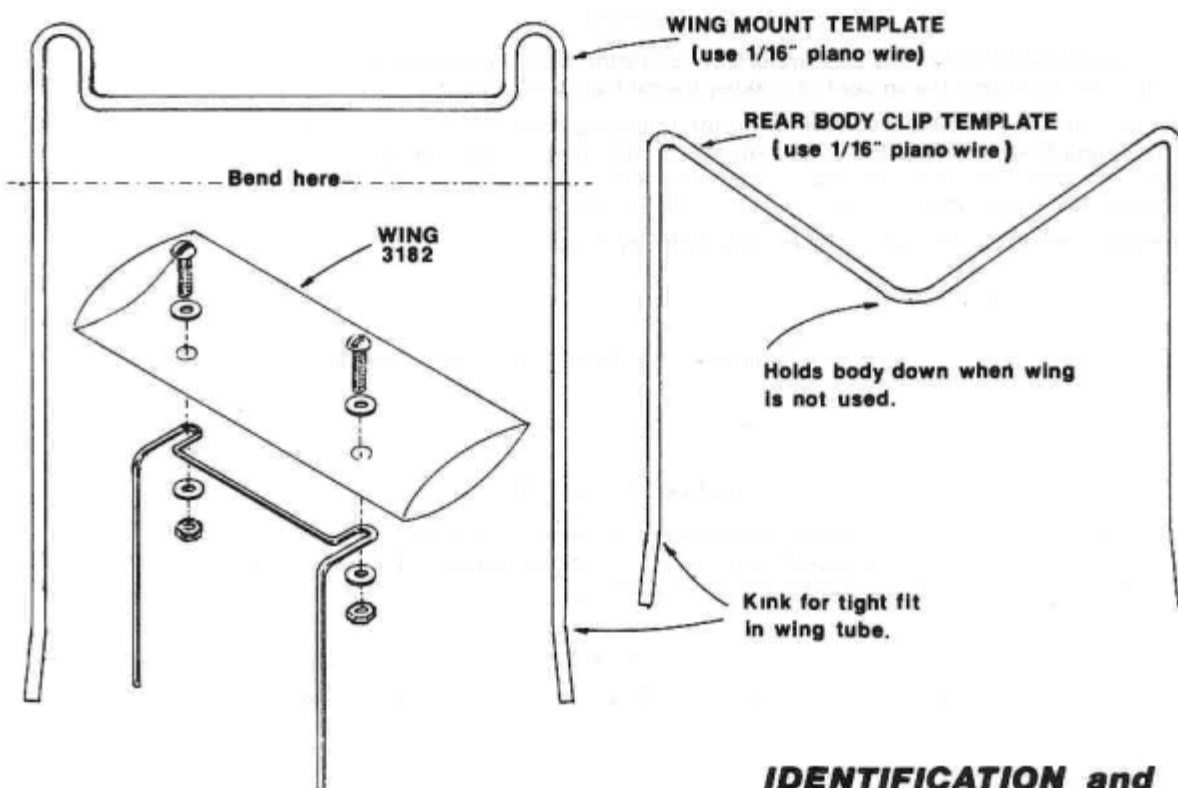
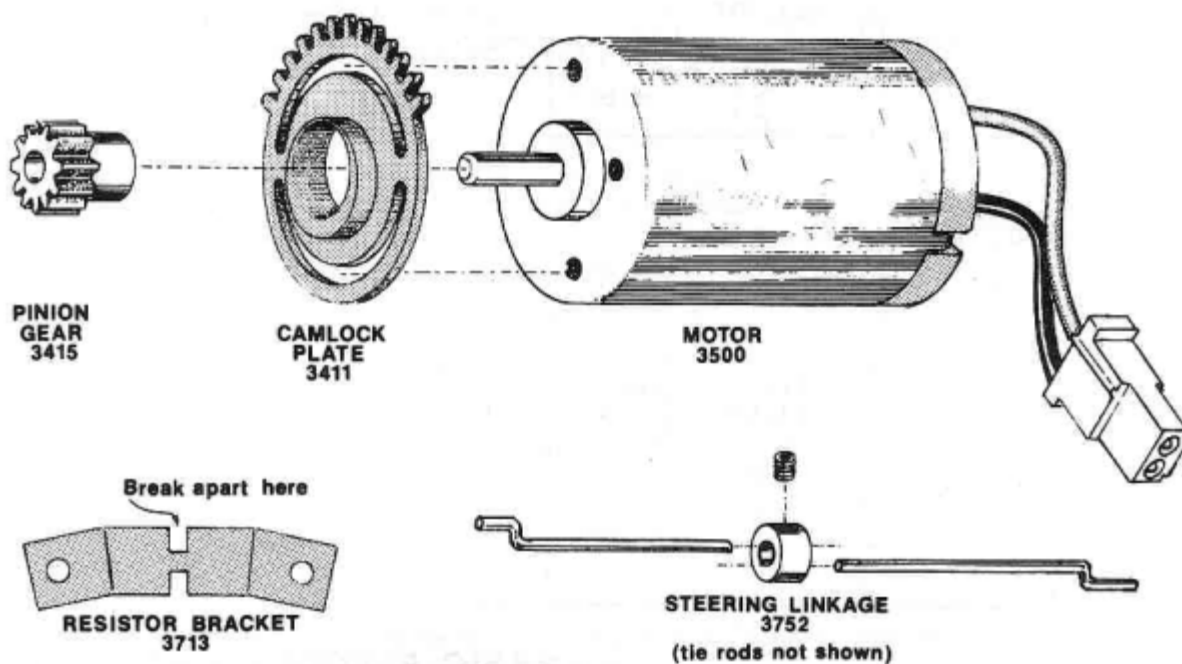
ELECTRONIC SPEED CONTROLS — See Section II

BATTERY CHARGERS

All kits and RTR's except No. 3000 come equipped with a charging cable (No. 3850 or 3851) designed to fast-charge the nicad pack in 15 minutes when connected to a 12 volt automobile battery. This cord plugs directly into ASSOCIATED nicad packs. See Section III for additional information on chargers.

BODY

Any of the 1/12 scale bodies listed in the ASSOCIATED catalog will fit your car. Follow the instructions in Section II for mounting and painting.



**IDENTIFICATION and
TEMPLATE CHART**
Fig. 3

SECTION II

FINAL ASSEMBLY FOR No. 3010 — 3016 KITS

INTRODUCTION

Tools required for final assembly include the following:

- soldering iron (approx. 50 watts)
- 60-40 resin core radio solder
- vinyl electrical tape
- fiber reinforced (strapping) tape or spool of heavy sewing thread
- 1/16" drill bit
- pin vise or drill motor for above
- coping saw

The wire supplied with your kit has a special high temperature insulation, and other types of wire should not be substituted unless rated for 150° C or more. In particular, standard automotive or electrical hookup wire should not be used.

In addition to the parts for the basic kit listed on page I-1, the complete kits include additional items arranged in bags numbered as follows:

KIT No. 3010, 3011, 3012, 3013

Bag No.	Contents
8	Charging cord kit
9	Linkage kit
10	Wire harness
11	Battery & connectors

KIT No. 3014, 3015

8	Charging cord kit
9	Linkage kit
11	Battery & connectors
12	Misc. electrical items

All No. 3010 through 3015 kits contain the following separate items:

- motor
- antenna tube & mtg. nuts
- 1/16" linkage wire
- servo tape

MOTOR INSTALLATION

Press the pinion gear onto the motor shaft until 1/8" of shaft is left showing between the motor and gear. The backside of the shaft **must** be supported while pressing on the gear; otherwise you will push the shaft out of the motor!! The best way to accomplish this is in a small vise with one jaw against the backend of the shaft and the other against the gear. Use a gear puller (No. 3810) to remove the gear. Attempts to remove the gear by prying between the gear and motor case will only result in pulling the shaft out of the motor.

Check for and remove any burrs on the metal boss on the motor case behind the gear. See Fig. 3, page I-6 to identify the camlock adjusting plate (No. 3411). Slip the adjusting plate over the gear flat-side-first and onto the boss so that it lays flat against the motor case. Check to see that it rotates freely on the boss. Position the plate so that the mounting holes in the motor are approximately centered in the slots of the plate. Install the motor and plate assembly into the right-hand rear bracket of the car, with the "cogs" of the adjusting plate pointing up. If the gear mesh is too tight at this point to complete the installation, simply swivel the adjusting plate for a looser mesh by pushing forward on the cogs with your thumb. Rotate the motor slightly until you have the lower mounting hole in the motor aligned with the corresponding hole in the bracket. Install a 4-40 x 1/2" allen cap screw and washer, but do not tighten completely. Install the other 4-40 screw and washer through the slotted opening on the bracket and tighten part way.

Preliminary gear mesh adjustment can be made by rotating the adjusting plate until there is just a small amount of lash and then locking down the mounting screws. Final adjustment can be made after you have the motor hooked up and running.

WIRING INSTRUCTIONS

BATTERY PACK

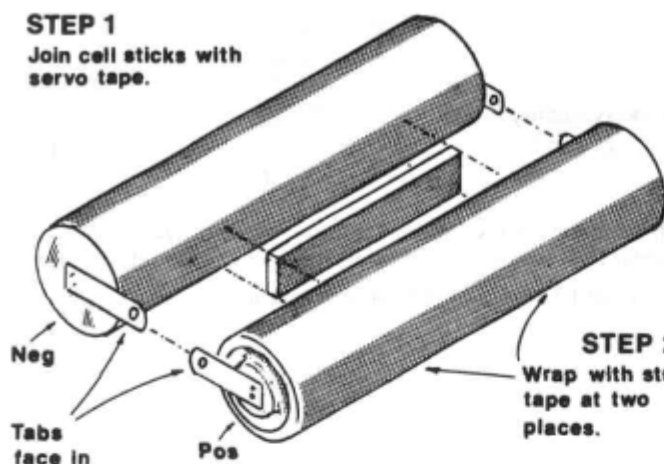
With a two inch length of servo tape, tack together the two battery sticks (either four cell or six cell), such that opposite polarities occur at each end, and the solder tabs point inward (see Fig. 4, page II-2). Then wrap each end with strapping tape to pull the sticks tightly together. Overlap the tabs at one end and solder together. Be sure that the tabs are off of the surface of the cells. This care is needed because it is possible to short out a cell if the white insulation is broken through or solder runs under it.

Solder the connector wires on the other end of the pack as shown in Fig. 4, pg. II-2, with the red lead connected to the positive battery tab. The positive end of the battery can be recognized by the raised center section. Tape the ends of the battery as shown, again using strapping tape if possible.

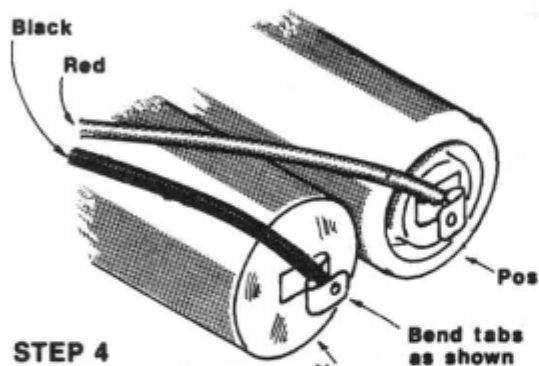
Pin one is shorted to pin two in the connector for the four cell pack only. This allows the radio to receive the proper voltage with either four cell or six cell battery packs.

STEP 1

Join cell sticks with
servo tape.

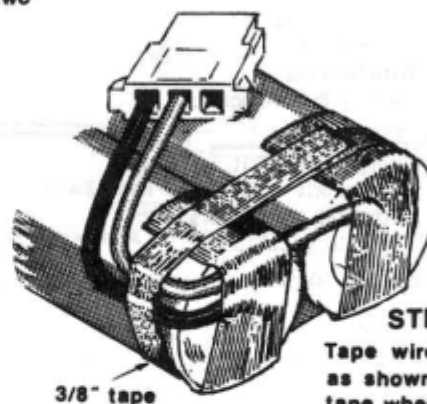
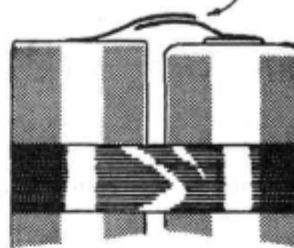
**STEP 2**

Wrap with strapping
tape at two
places.

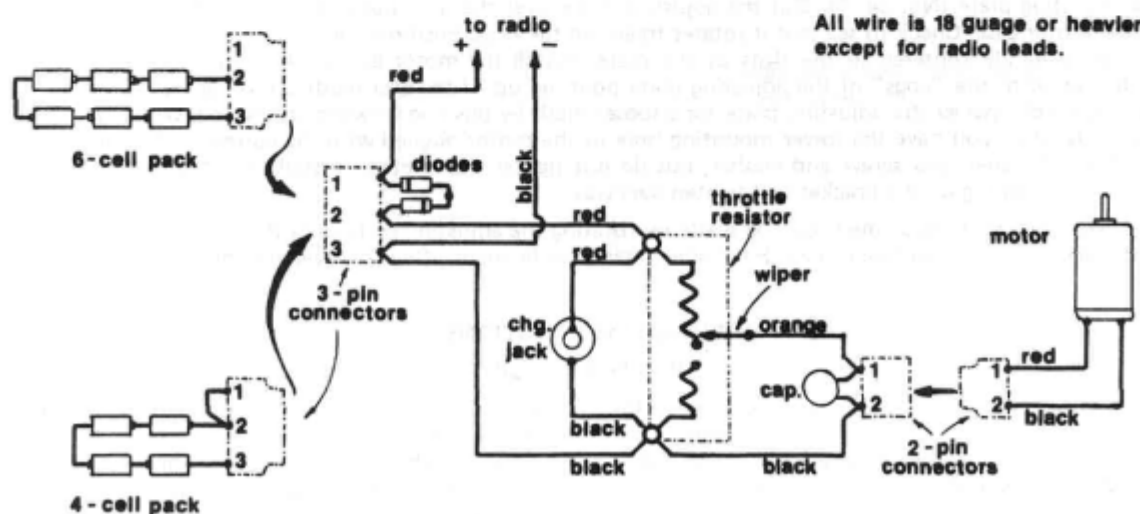
**STEP 4**

Solder connector wires
to tabs at other end.

STEP 3 Join and solder
tabs at one end of pack.

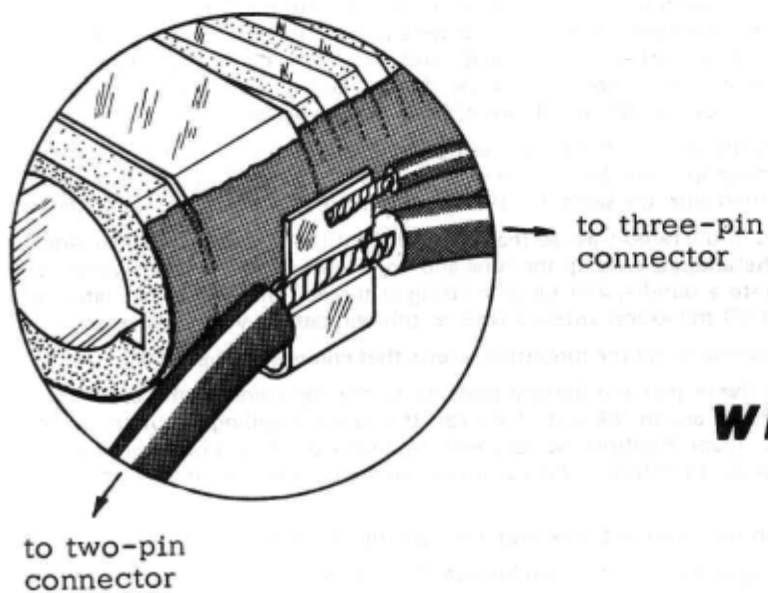
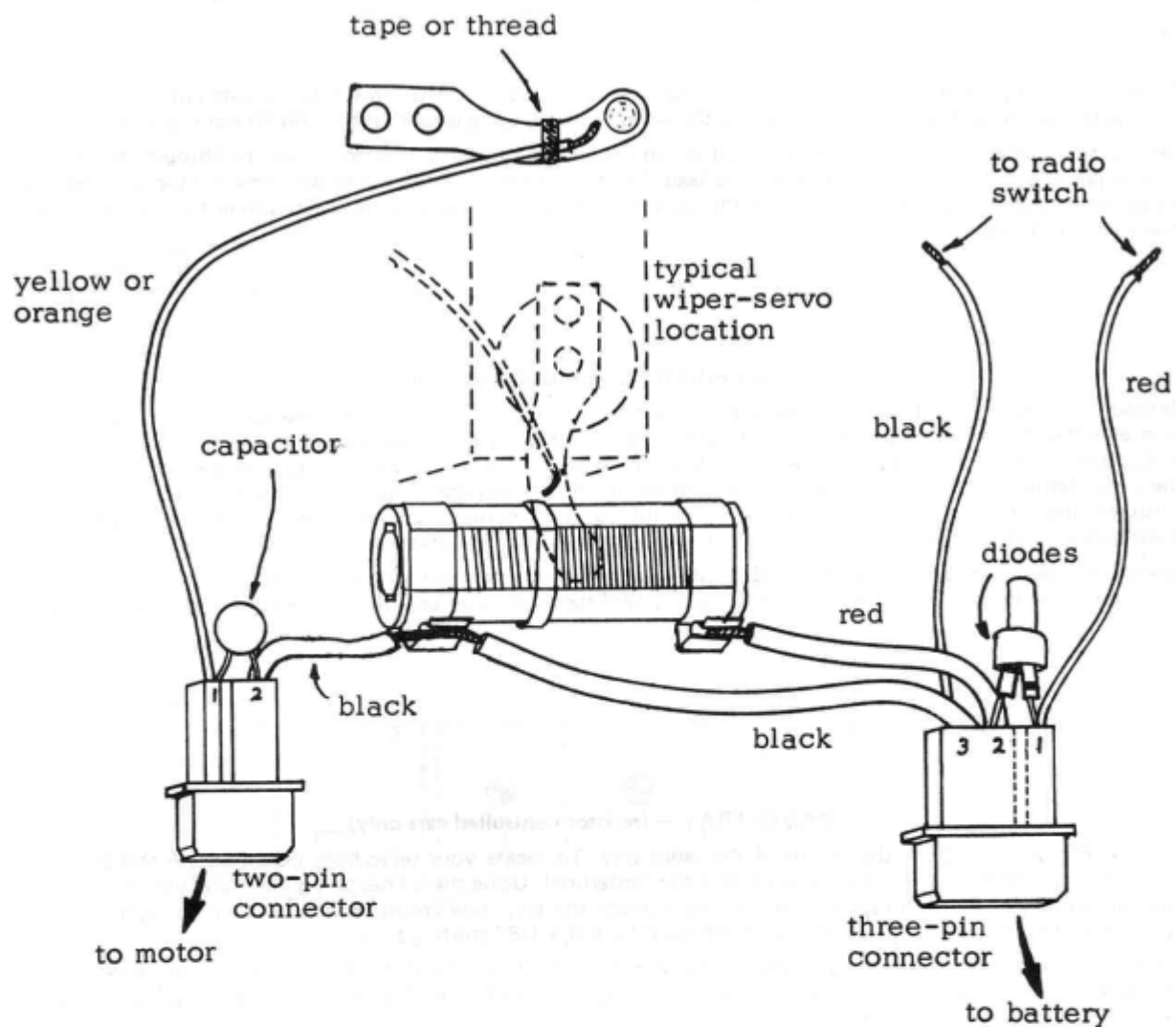
**STEP 5**

Tape wires to pack
as shown. Use 3/8"
tape where indicated.

BATTERY WIRING**Fig. 4**

All wire is 18 gauge or heavier
except for radio leads.

RC12E CIRCUIT DIAGRAM**Fig. 5**



WIRING HARNESS

Fig. 6

RESISTOR HARNESS — (resistor controlled cars only)

Refer to the Fig. 6, pg. II-3 pictorial diagram for the remainder of the wiring on your car. All parts are in the bag marked No. 10.

Scrape any excess insulation (yellow or orange ceramic coating) from the terminals of the control resistor (No. 3711), and bend the terminals up as shown in the inset of Fig. 6, pg. II-3. Lay the resistor and the wiring harness (No. 3730) on a flat surface oriented as follows: resistor flat side up with terminals toward you; harness three-pin connector on the right, two-pin connector on the left as shown in the drawing.

Tin the stripped portion of the heavy red and black leads. Lay the tinned wires in the V-notch of the resistor terminals, black on the left terminal, red on the right. Solder the wires in place, using a good quality 60-40 resin core radio solder.

The flexible orange (or yellow) lead attached to pin one of the two-pin connector should be stripped, tinned and soldered to the wiper arm. Don't attempt to solder the lead directly over the button; the solder there is a special type. Tape or tie the orange lead to the wiper directly behind the solder joint, using a narrow strip of strapping tape or by wrapping with common string or thread.

RECEIVER POWER CONNECTION

Method 1 — The small red and black leads, connected to pins one and three of the three-pin connector, supply power for the radio and take the place of the battery normally used. These leads should be spliced to the leads on the radio's on-off switch. Cut the wires at a point about three inches from the switch. Be sure the wires you cut are the ones that normally plug into the radio battery. Then strip these wires and those on the harness and solder them together, red to red and black to black. Insulate the connection with vinyl tape or shrink tubing. If the wires on your radio are not red and black, then you will need a voltmeter to determine the correct polarity (or consult the radio manufacturer).

Method 2 — An alternative to soldering the radio switch directly to the harness is to install a plug on the harness wires that mates with the plug on the switch. You can usually find such a plug on one of the accessory items that comes with your radio.

RADIO TRAY — (resistor controlled cars only)

Refer to Fig. 7, pg. II-5 for the layout of the radio tray. To locate your servo hole, pencil lines A and B on the tray (A joins the two inside corners on the tray outline; B is the centerline). Using these lines as a guide stand your servos side by side and make an outline of the two together where they contact the tray. Saw around this outline with a coping saw. If there is no servo hole in the tray to start from, then you will need to drill a 1/8" starting hole.

Mount the servos in the tray using hardware that comes with the servos. A 1/16" drill bit in a pin vise can be used to make holes for mounting screws. Some types of servos (for instance the Futaba S-6) have low mounting flanges and should be mounted to the underside of the tray.

Mount the wired throttle resistor in the position shown in Fig. 7, pg. II-5. (If you have a charging jack connected to your resistor, it should be passed through the large round hole in the tray first; mount the jack with No. 2 self-tapping screws from the top of the tray). The resistor mounting brackets are connected at the center and must be broken apart before use. Note that the brackets are angled slightly in order that the top surface of the resistor ends up level with the tray. You'll have to try both brackets at one end of the resistor to get the correct orientation. Screw the brackets to the tray using the No. 2 self tapping screws provided. The resistor should end up about 3/16" to 1/4" away from the servo case.

Mount the receiver behind the resistor and in the center of the tray, using servo tape. Leave 1/4" of space between the resistor and the receiver so that the heat won't damage the case. Secure the receiver with the long 8" nylon ties, using the two holes in the tray. A Futaba receiver should be oriented with the servo and battery connectors on the right side of the car.

Push the antenna tube into the hole provided in the radio tray, so that about 3/8" sticks through the under side. Thread a 6-32 nut onto the tube to act as a lock. Run the antenna wire up the tube and knot the wire at the top. Gather the excess wire between the antenna tube and the receiver into a bundle, and tie with string or thread. This bundle can later be tied to the strap that holds the battery pack. DO NOT cut off the excess antenna wire, as this will detune your receiver.

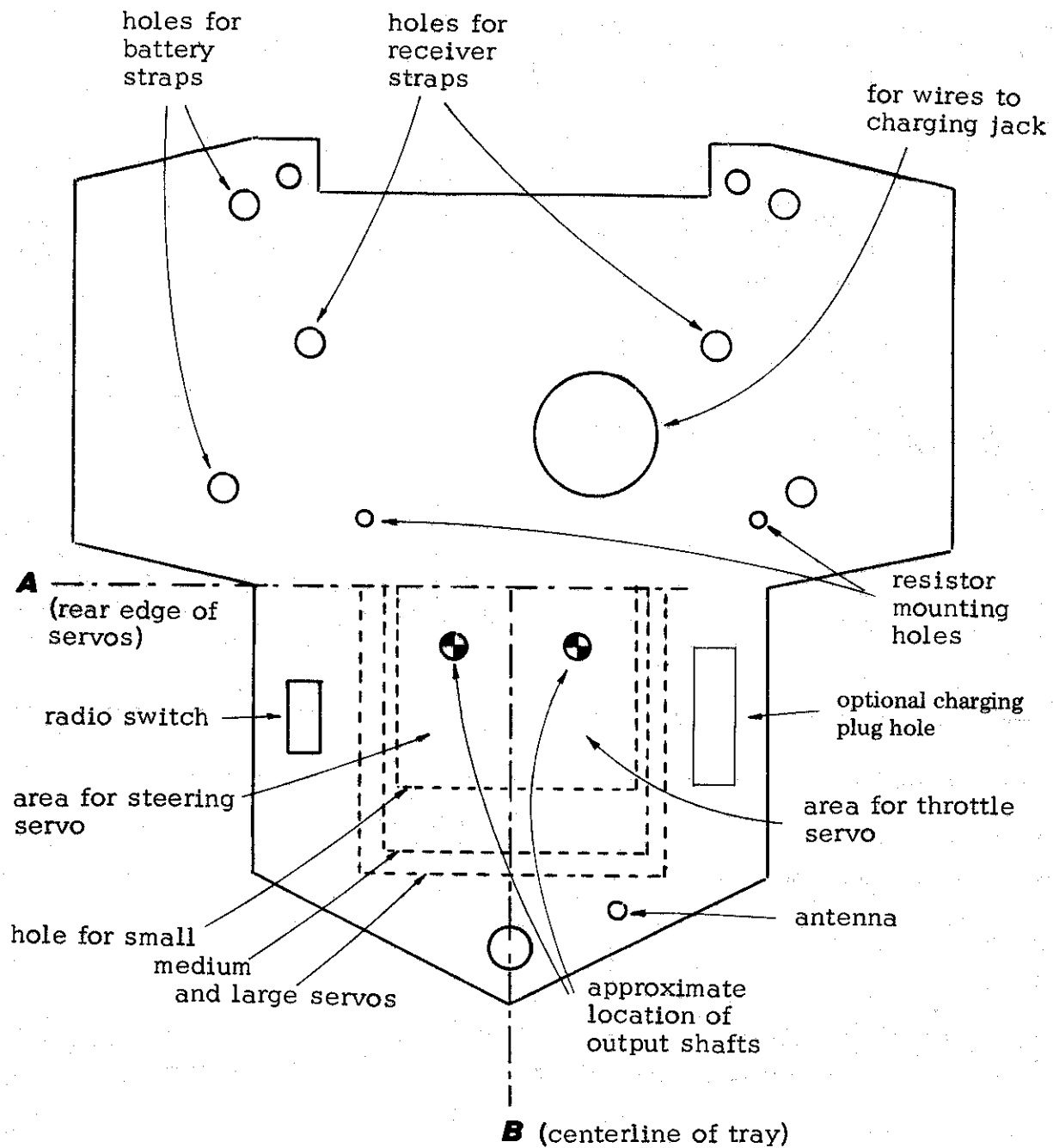
Install your radio on-off switch in the hole provided using the mounting screws that come with the switch.

Install your battery pack in the battery cup. Note that the battery leads go to the right side of the car. Also the cup should be turned so that the bulges for lead clearance are to the rear of the car. If you are installing a four cell pack, fill the voids at each end of the cup with wadded paper or foam. Position the pack and cup under the tray. Loop a six inch nylon tie through the holes provided and partially tighten. Mount the tray to the car following the instructions in Section I, then finish tightening the nylon ties.

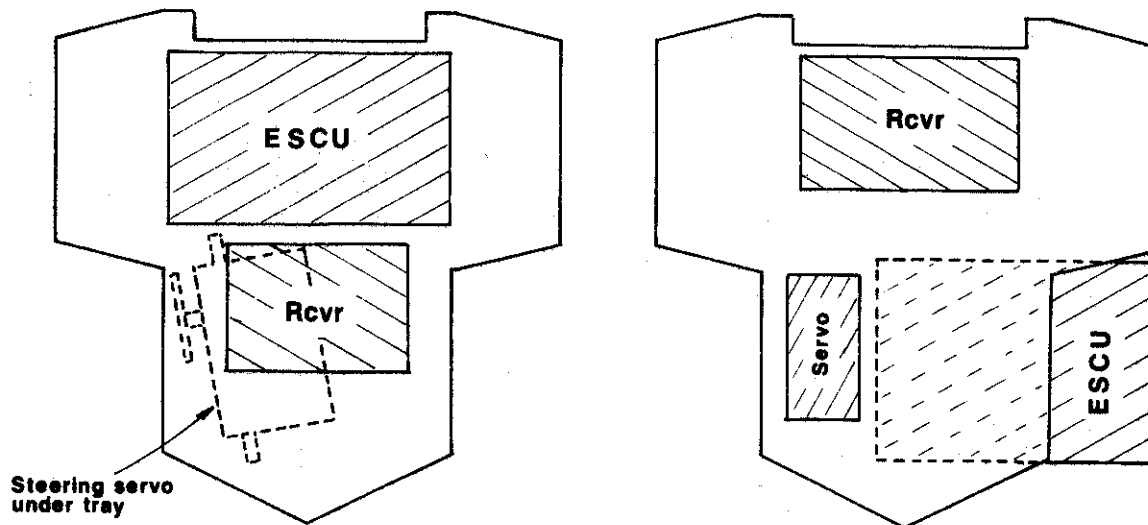
Plug the servos and switch into the receiver and tie the excess wire into a bundle under the tray.

Complete the linkage connection to the steering servo using the two linkage rods and set screw collar. It will be necessary to bend the rods slightly as shown in Fig. 7, pg. II-5.

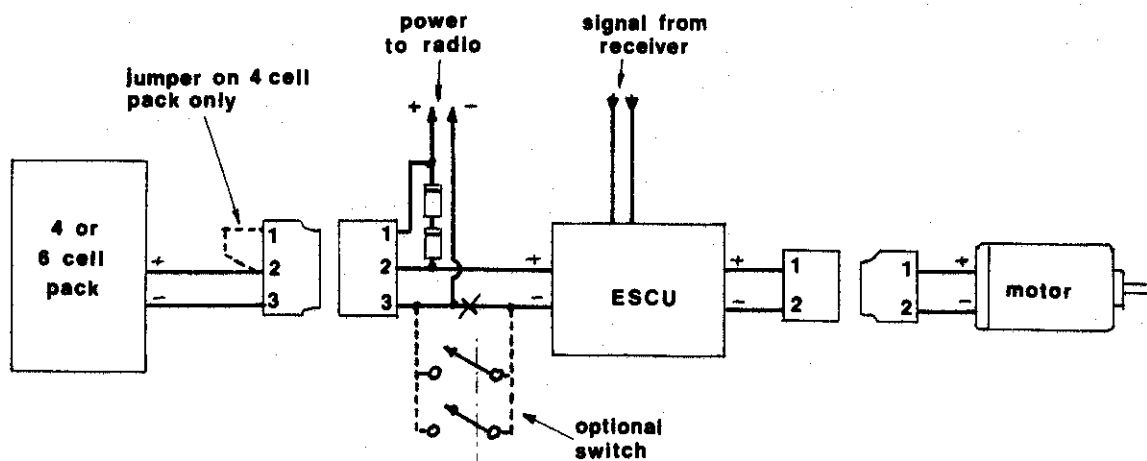
The resistor wiper is still hanging loose at this point, and will be mounted after the radio has been tested.



RADIO TRAY LAYOUT
Top view
Fig. 7



**SUGGESTED ELECTRONIC
SPEED CONTROL LAYOUTS**
Fig. 8



**CIRCUIT FOR ELECTRONIC
SPEED CONTROL UNIT**
Fig. 9

CHARGE CORD

Parts are in the bag marked "charge cord". It will be necessary to solder the alligator clips on to the cord before it can be used. Remove the insulation boots from the clips and slide the RED boot onto the SILVER-colored wire with the CLEAR insulation. Slide the BLACK boot onto the BLACK wire. Strip the insulation 1/4" back on both wires and solder a clip to each. Slide the boots back on the clips after they have cooled.

The clear-insulated silver wire is a resistance element that controls the charging current. DO NOT shorten the length of this wire.

FINAL ASSEMBLY AND ADJUSTMENT

Refer to page (iii) of this manual and follow the FIRST THREE STEPS in order to prepare your car for final assembly. Make sure that the wiper does not make electrical contact with anything after the pack has been charged and plugged into the radio tray connector.

Before proceeding with the following steps make sure the motor connector is unplugged. Install an output disk on the throttle servo. Since the two servos are close together it may be necessary to cut off the unused part of the steering servo output disk (or arm). Set the throttle trim on your transmitter in the maximum brake position (the position that rotates the servo clockwise to its maximum). While the servo is in this position mount the wiper to the disk in the location shown in Fig. 7, pg. II-5. The wiper should be deflected upward about 1/16" to 1/8" by the resistor to give proper tension to the wiper. Use No. 2 self-tapping screws and 1/8" washers to secure the wiper. You may have to drill 1/16" holes in the disk if there aren't any in the right position. If one of the wiper mounting holes ends up over the center of the disk, use the disk mounting screw with a 1/8" washer as one mounting point.

Check the swing of the wiper as the servo rotates to make sure it stays in contact with the flat surface of the resistor over its full length. In particular make sure that the wiper makes good contact with the wide band at the full-throttle end of the resistor. If the servo has too much travel put a stop on the transmitter to limit the travel of the lever. A piece of servo tape can be used for this purpose.

You should by now be able to set the trim so that the wiper comes to rest at any point in the braking portion of the resistor that you wish. This is particularly useful when you are tuning the car to a race track since you can make the adjustment while the car is running.

ELECTRONIC SPEED CONTROL KITS (No. 3014 and 3015)

These kits are intended for use with electronic speed control units (hereafter referred to as ESCU), and do not include a resistor or harness. However mating two and three-pin connectors, and radio dropping diodes are provided so that you can wire your speed control unit to plug into the battery and motor. Wiring should be done after you have determined a location for the ESCU.

Fig. 8, pg. II-6 shows two possible layouts, one with the steering servo mounted vertically (in the same position as the resistor cars) and one mounted horizontally under the tray. Use servo tape and two nylon ties for the horizontal mounting. The remaining area on top of the tray can be used for the receiver and ESCU. Most ESCU manufacturers specify that their unit receive a flow of cooling air. This requirement is usually met so long as some air space is left around the unit's heat sink. Ideally a vent in the body should direct air to the unit.

Fig. 9, pg. II-6 shows how a ESCU would typically be wired using the connectors supplied. Since most controls currently on the market do not provide power for the receiver, that power must be supplied directly from the batteries if a four cell pack is used, or **through the radio dropping diodes** if a six cell pack is used. The circuit in Fig. 9 pg. II-6 automatically brings the diodes in or out depending on the battery pack used. Consult the ESCU manufacturer's literature for color codes and special instructions; and follow their instructions completely if they appear to be at variance to what is given here, (the Jomac unit for instance contains its own receiver). Some controller manufacturers specify that an on-off switch be inserted in the battery circuit. Use a high quality double-pole single-throw (dpst) slide switch of high current capacity (10 amps) and wire as shown with the two poles in parallel. Add filter capacitors to the motor circuit if recommended by the manufacturer.

BODY

PAINTING CLEAR BODIES

Place the body over your car and position it by centering the wheels in the wheel wells. While looking straight down on the body mark the locations of the front body mounts, the wing mounting tubes, and the antenna, with a marking pen. These marks will be used to locate mounting holes in the body after painting.

Lexan bodies are the strongest, most impact resistant bodies on the market, but the exotic plastic requires special care in painting. Sand the **INSIDE** of the body with 220 grit sandpaper (except the windshield). Painting should be done on the inside of the body before the body is trimmed. Mask the window areas with masking tape or preferably SCOTCH MAGIC TRANSPARENT TAPE and rub the edge of the tape with your fingernail to make sure it seals so the paint cannot seep under it.

There are few paints that will stick to Lexan at all. Enamel and hot fuel proof dope just fall off and very few lacquers will work either. One nationally available spray-can paint that we have found to be foolproof is RUST-OLEUM. RUST-OLEUM sticks very well, does not warp the body in any way, and is fairly fuel-proof. Some care should be taken in its use, however. It is a very "runny" paint and will seep under masking tape if it is not pressed down extremely well. It would probably be a good idea to use the SCOTCH TRANSPARENT tape instead of masking tape. RUST-OLEUM dries very slowly and should be allowed to dry completely between coats to avoid having different colors run together.

Most vinyl upholstery paints can also be applied directly to Lexan. They stick well and dry quickly, but since brands vary, they should be tested first.

In order to use other types of paint it is necessary to apply a clear "primer" such as CLEAR No. 2500 "SPEEDY DRY" RUST-OLEUM (not to be confused with regular RUST-OLEUM) or No. 1302 CRYSTAL CLEAR ACRYLIC — KRYLON brand. The "SPEEDY DRY" sticks the best but it contains a stronger solvent and will etch or distort Lexan if it is applied in too wet a coat. The Krylon can be applied very wet without any body damage. After painting with the clear, let it thoroughly dry, preferably overnight. Then mask it off in whatever pattern or design you choose. You can spray almost any kind of enamel or lacquer over the clear but if you spray enamel — spray all enamel, and if you spray lacquer — spray all lacquer. Do not try to mix lacquer and enamel together. It is always a good idea to practice on a piece of the body you'll be cutting out, such as wheel wells or back paneling, to check paint compatability. Most automotive touch up paints in spray-cans will work over the clear. If you like candy colors you can use CAL CUSTOM CANDIES, but remember to spray the colors first and gold base last — just the opposite from the instructions on the can. Experiment on a piece of Lexan for the correct candy coloring.

TRIMMING

Using a very sharp knife or scissors, or a small tipped soldering iron, follow the trim lines around the sides and cockpit area and clean up with a sanding block, coarse file, or a burr on a hand grinder. Note that some of the older style bodies have a spoiler outlined on a portion of the rear plastic that is normally cut away. Take care not to damage this while trimming. The spoiler can be mounted to the body with contact cement or the appropriate plastic glue.

Locate the marks you made before painting and drill 3/16" holes at each point. Enlarge the antenna hole to 3/8" approximately, and then place the body on the car. Check the position and fit of the holes to the mounting posts and wing tubes, and enlarge or elongate the holes as necessary to allow the body to drop freely onto the mounts. The rear mounting holes should be elongated lengthwise so that the body does not restrict the up-and-down flex of the chassis. The body is held in place by body clips in front (No. 2207 or 2208) and a wing (No. 3182) or a hold-down clip in the rear. See Fig. 3, pg.1-6 for a hold-down clip that can be bent from .063 or .047 piano wire.

Peel and stick sponsor decals (No. 3820), vinyl racing numbers (No. 3821), or other types of decorations such as MONOCOTE stripes can be applied to the outside of the body to give a realistic appearance.

SECTION III

OPERATION

The instructions on page (iii) of this manual will get you started running. However, before too long you should read this section. The information here will help you maximize the performance of your car, and will introduce you to the exciting sport of organized R/C car racing.

THE NATURE OF NICADS

It is important to understand the characteristics of the battery pack in your car because how you use it will greatly affect both its performance and life. With proper care your pack will give you top performance for many hundreds of cycles.

The R.O.A.R. legal battery supplied with your car is composed of either four or six "sub-C" size cells with a maximum rated capacity of 1.2 amp-hrs. This means that the cells will supply 1.2 amperes for one hour, or 0.6 amperes for two hours, etc. This capacity rating drops to about 1.0 amp-hrs. at high drain rates. For instance at six amperes (a typical **average** current drain for an electric car) the cells would discharge in 1/6 of an hour or ten minutes. This charge capacity is the same regardless of the number of cells in the pack because the cells are connected in series and the same current passes through each one. In other words, the charge capacity of a four pack is the same as a six pack. The total energy storage of a six cell pack is higher, of course, because the voltage is higher.

Nicads are very efficient and they give back almost as much charge as you put in, as long as you don't try to put more charge in than they will hold. If you start with a completely dead pack and charge at four amperes for 1/4 hour, you will have put a total of one amp-hr ($4 \times 1/4$) into the cells. More than 95% of the charge would be recovered if the pack were then discharged at the one hour rate.

WHY YOU SHOULD NOT OVERCHARGE

There is no way to make a nicad cell accept more charge than it is designed to hold. This means that the charging efficiency begins to drop off as the cell approaches a fully charged condition; and the portion of charging current not being stored becomes heat and pressure. If charging continues after the cell is fully charged, all of the current is converted to heat and pressure — about 40 watts worth — or the equivalent of the heat produced by a medium sized soldering iron.

UNFRIENDLY HEAT AND PRESSURE

Either excessive heat or excessive pressure is harmful to the cells; and getting rid of one doesn't help the other. For example, cooling the battery with a fan **while** it's being **overcharged** will do nothing to stop the pressure build-up.

Excessive pressure momentarily opens a safety vent in the cell and a small amount of electrolyte is lost in the process. One such occurrence is not harmful, but frequent venting will permanently reduce the performance of the cell. Excessively high temperature can permanently damage the separators. However, high temperature also has temporary (and bad) effects that will be explained later.

Nicad cells have a built-in process for recombining the accumulated gas (actually oxygen) produced by overcharge, but the process produces heat and takes a lot of time. If you overcharge your battery and it seems to take a long time to cool down, it's because this pressure reducing reaction is taking place. Once the gas is recombined the temperature drops.

A hot nicad pack cannot be fully charged. At 130° F (a temperature uncomfortable to touch for more than a few seconds) the cells will only accept about 50% of a full charge. This doesn't mean that a fully charged battery will lose charge if it's heated; it just won't accept a new charge efficiently. For this reason it is always better to allow the battery to cool before charging. A fan is helpful to speed the cooling process.

EXCESSIVE DISCHARGE

When a nicad pack is deeply discharged it is inevitable that one cell will run out of charge before the rest. When this happens the remaining cells continue to supply current to the motor but this current passes through the dead cell and "over-discharge" it, or actually tries to charge it in the reverse direction. The cell won't accept a reverse charge and begins to evolve a gas (this time it's hydrogen). There is no chemical reaction to get rid of the hydrogen, so once it is formed it stays until the cell vents. Usually the same cell is reversed whenever the pack is over-discharged, and hydrogen pressure builds each time until the cell vents. Repeated venting will eventually dissipate the cell's electrolyte.

CHARGERS

All fast-chargers and fast-charge cords do basically the same thing: supply a charging current of about 3 to 5 amperes. Where they differ is in the power source they use (either 12 volts d.c. or 115 volts a.c.), and in frills and accessories. Some chargers have timers that offer a certain amount of protection against accidental overcharge. Some have ammeters and discharge circuits. Others are capable of charging either four or six cell packs. Features like fault detection, slow-charge, voltmeters, and constant-current are all convenient, but naturally the more features a charger has the more expensive it becomes. There are no chargers on the market right now that have all of these features; and above all, there is no charger that "knows" when to stop charging. The operator has to know that.

HOW TO TELL WHEN YOU'RE CHARGED

One of the problems with nicads is their inherent voltage stability; the voltage of a fully charged cell is not much different from one that's about dead. For that reason several indicators, along with some common sense, are needed in order to get the most out of your battery. The following is a list of indications you should use to detect full charge.

— Temperature Method —

This only works if you start with a cool battery pack. As the pack charges, frequently check its temperature by feeling the cells directly (you'll need a hole in the battery cup). As soon as you notice an increase in temperature stop charging. If the cells become too hot to hold on to, you are way overcharged. Let them cool.

— Timed Charged Method —

This only works if you have confidence in the timing accuracy of your charger. Many chargers on the market only approximate a constant charging current; they may vary from six amps when you first start charging all the way down to two amps if the nicad pack is nearly charged and the voltage of the charging source (automobile battery) is low. If the charging current varies, it becomes difficult to estimate the average current. However, if your charger is reasonably dependable you can use the following method.

Cycle your pack several times using the "temperature method" above. After you run the car the last time let the pack cool. Charge again using the temperature method but this time keep track of the time required to reach full charge. Once you have established the time you can use it as a setting for the timer on your charger. To be safe use a setting about a minute less than what you established. This method allows you to charge without constantly monitoring the battery temperature.

If you charge a battery that is still hot from running, **reduce** the time about 20%. Then, after the pack has cooled, finish charging with the temperature method. The reason for this will be explained later.

— Voltage Method —

As mentioned earlier, voltage is a poor indication of a cell's state of charge. The change in voltage from 10% charged to 100% charged is usually less than 0.1 volts per cell. In fact other things like temperature, current drain, and "cell memory" have a greater effect on voltage than the state of charge does. However, if current flow and temperature are held constant, it is possible to see the cell voltage gradually climb during the charging process. The absolute value of this voltage isn't much use, but how the voltage **changes** is an excellent indication. To use this method you will need a **digital** voltmeter or an expanded-scale voltmeter capable of resolving 0.01 volts on the 10 volt range.

Connect the voltmeter across the nicad pack, preferably right at the cell terminals, or if that's not possible, across the terminals of the throttle control resistor. Don't try to read the voltage at the output of the charger because you'll end up reading the voltage drop through all the connectors and cables between the charger and the nicad pack; and that can sometimes mask the effect you're looking for. You should start with a nicad pack that is less than 1/2 charged. Connect your charger and begin charging at four amps. If your charger is adjustable set the current now, but don't try to change it later. A constant current charger is preferable here, but if yours gradually drops off during charge, that's okay; as long as it doesn't drop below three amps.

Watch the voltage as the pack charges. Notice that the voltage climbs rapidly at first, and then very slowly in the middle of the charging cycle. This voltage will most likely be in the range of 8-1/2 to 9 volts for a six cell pack and 5-1/2 to 6 volts for a four cell pack. As the pack approaches full charge, the voltage will begin to climb more rapidly; and as it goes into overcharge the climb will slow down and stop. This is where you stop charging: at the point where the voltage **stops** climbing. If you left the charger on, the voltage would begin to fall as the pack went deeply into overcharge and started to heat up. The maximum voltage reached will probably be in the nine to ten volt region; the actual value is unimportant. Do not try to use a conventional voltmeter. Even a good quality VOM with a large, taunt-band, mirrored-scale meter movement is not adequate; by the time you could see that the voltage had stopped rising, it would be too late.

— Slow Charge Method —

Slow or "over-night" charging is a method you are not likely to use often. However, it is a good way to equalize the cells in your pack, and to bring the pack to absolutely full charge.

The charging current must be between 0.05 and 0.12 amperes. Any less and the pack will never reach full charge; any more and the pack will overheat. The time required to reach full charge ranges from 15 to 40 hours depending on the current used. The charger can be left on for a much longer time without harming the cells, but the output voltage of the pack will be temporarily lowered by an extremely long overcharge. The voltage returns to normal after a discharge-charge cycle.

LAST WORDS ON CHARGING

Quite a few charging methods have been presented here in an attempt to satisfy the needs of everyone from the weekend hobbyist to the serious racer. Getting that last 5% of charge is the hard part, and obviously if you're just out driving for fun it isn't necessary to try for that last little bit all the time. Properly cared for, your packs will last many hundreds — even thousands — of cycles. Pushing them into overcharge constantly will definitely reduce their life.

GETTING MAXIMUM VOLTAGE (POWER) TO THE MOTOR

The paragraphs that follow are really for the benefit of serious racers only, since they deal with factors that influence the voltage and available power of a nicad pack. We're talking about a difference of maybe 15% at the most, so if you're just out having fun, don't worry about it.

The output voltage of a fully charged pack can vary considerably depending on the temperature and recent activity of the pack. These effects are listed below.

— Hot Means Slow —

Again high temperature has its bad effects, this time by lowering the output voltage under load. Less voltage means less speed. At normal 130° F the voltage of a six cell pack can be almost a volt less than normal.

Too low a temperature is bad too. Near freezing the internal resistance of the cells goes up considerably; and high charging currents cannot be used without risk of damage.

— Memory —

There are three "memory" effects that can affect the output voltage. One is caused by overcharge. The cells "remember" that they were overcharged and put out less voltage near the end of the discharge cycle. This is particularly noticeable if the pack is slow-charged for too long a time.

The second memory effect is caused by repeatedly not using up all of the battery's stored charge before recharging. The cells "remember" that they aren't fully used and let the voltage drop off to about one volt at the point where discharge usually stops. An example would be where you run a series of five minute heats, recharging between each heat, and then try to run an eight minute heat. The battery voltage will be low for the last three minutes of the race. The cure is to fully discharge the pack before recharging. "Full discharge" means the point where the first cell goes dead. Never discharge beyond that point.

The third memory effect is the "topping-up" effect of recent charging. The cells remember that they were recently charged and will produce a little more voltage early in the discharge cycle. Racers take advantage of this by putting the last minute or two of charge into their pack just before the race starts.

SUMMARY

- Don't overcharge — use the "voltage method" of charging, if possible.
- Don't over-discharge.
- Keep your battery as close to room temperature as possible.
- Fully cycle your battery before a long race.
- "Top-up" just before the start of a race.

TUNING YOUR CAR

As you begin to run your car in competition you will want to take advantage of some of the design features and accessories that can make your car the fastest on the track.

GEAR RATIOS

A total of three axle (nylon) gears and three motor gears are available. These can be used in the following combinations to give the ratios indicated.

PINION	AXLE	RATIO
12	48	4.00
12	46	3.83
13	48	3.69
13	46	3.54
14	48	3.43
14	46	3.28
14	44	3.14

The "lower" gear ratios (4.00 etc.) will give a lower top speed and a longer run time per charge. High gear ratios (near 3.14) will give the highest top speed at the expense of acceleration and run time. The choice of ratio depends on the track you run on. Usually a track with a long straight and high speed turns will require the higher ratios.

SERVO SAVER

The servo saver on your car can be adjusted to give more or less steering depending on which hole you use on the arm. Move the linkage to the outside holes to reduce the steering on a slippery track. On high traction tracks move the linkage to the inside holes.

The "Z" bend on the tie rods, where they attach to the servo saver, can be twisted to point to the front of the car. This will make it possible to take the servo saver on and off without disassembling the front end.

TWEAK

If your car seems to turn better in one direction than the other, or if it tends to pull to one side under acceleration, you should check the "tweak" of the chassis. Neutral tweak is when all four wheels sit on the ground with equal force. When one front wheel presses down harder than the other, the car will tend to veer in the direction of the "heavy" wheel. The condition can be caused by unequal tire sizes, a slightly twisted chassis plate, or by unequal heights of the front suspension arms.

Tweak can be corrected by replacing the tires if that is the cause, or by equalizing the height of the suspension arms by shimming or by lightly sanding the underside of the appropriate arm.

You can check for tweak by placing your car on an absolutely flat surface and then lifting each front wheel separately. Each wheel should come up the same distance before the other wheel lifts. This test should be performed with the front radio tray mounting screw (the one with the rubber grommet) completely loose. You'll be able to detect large tweaks this way, but small ones may be noticeable on the race track. Some racers purposely tweak their car one way or the other to suit a particular track.

FRONT TRAY MOUNTING SCREW

The tension of the front radio tray mounting screw has an effect on the car's handling. Tightening this screw stiffens the chassis and in turn gives the car slightly more steering. Loosening the screw has the opposite effect. Be sure the hole in the tray is exactly centered over the mounting post, otherwise the screw could bind on the side of the hole and cause a chassis tweak.

BODY AND WING

Believe it or not, the aerodynamic effects of the body and wing are more important than you could possibly imagine. It works the same way on model cars as it does on full sized cars: formula bodies have less drag and can achieve higher speeds with less horsepower; blunt, scoop-nosed, Can Am sports car bodies like the Porsche 917-30KL have more steering than round-nosed bodies like the Ferrari 312PB; all Can Am bodies are more stable and generally faster than all coupe and GT bodies; etc., etc. The better a driver you become, the more you will notice, and be able to use, these effects.

Even a beginning driver can notice the effect of a wing. Wings aren't used on 1/12 scale cars as often as they are on 1/8 cars because the additional drag is more noticeable on the smaller cars; but on a slippery surface there are times when a wing is indispensable for good handling. A high, steeply angled wing gives great stability, at the expense of top speed and steering.

TIRES

The handling of the car can also be affected by changing to a different front tire rubber. Kit cars come with No. 3654 medium traction front tires which are good for most track conditions. However, on some commercial tracks where the bite is very high, you can use the additional steering provided by No. 3654-S (soft) tires. You can even get "in-between" steering by putting a No. 3654 on one side and a No. 3654-S on the other. Generally it is best to put the soft tire on the inside of the high speed turns.

WORKING ON DETAILS

Like any competitive sport, the more time you spend on details the better will be your chances of winning. Anything that reduces the rolling friction, air drag, or weight; anything that increases the power to the motor; or improves the handling in the turns, will give you a competitive edge. Here are a few examples.

Reduce bearing friction as much as possible. You can do this by making sure the rear brackets are perfectly aligned. Polish the front and rear axles with crocus cloth. Use a good quality, extremely light, moly and graphite oil for the bushings and motor. Polish the sides and reduce the O.D. of the thrust washers on the front and rear axles.

Work for the best possible gear mesh. Make sure that the gear fits properly on the gear hub: without the two gear mounting screws in place, the gear should turn easily on the hub. Sand the hole if the fit is too tight. At the same time make sure there are no burrs or bumps on the side of the gear that goes against the hub. After two mounting screws are installed and tightened, the gear should be able to rotate slightly on the hub. Doing this will insure an absolutely quiet and friction-free gear mesh. Set the mesh carefully, listening to the sound and checking the lash. The final setting should have very little lash and yet be very quiet. On the track other noises such as the sound of the tires scrubbing on the ground, or the body rattling on the mounts should be louder than the gears.

RACING ACCESSORIES

The TUBULAR STEEL AXLE (No. 3450) is less than half the weight of the stock axle, and is legal for all classes of racing including stock.

A WING (No. 3182) can be very useful on slippery tracks and is legal in all racing classes.

BALL BEARINGS are available (No. 3655, 2222) for the front and rear wheels, and can be fitted to the car in a few minutes. Ball bearings have less friction than bushings and increase the speed of the car considerably. A lighter bearing (No. 897) can also be used in the rear (with adapter No. 3418). Ball bearings are not legal to use in stock class racing.

PRECAUTIONS

Do not stall the motor under power. If the car stops suddenly on the track, or fails to move forward when you attempt to accelerate, push the throttle control on your transmitter to the brake position immediately and attend to the car. A small rock can stall the gears, and if the throttle is left in the on position the result can be a burned out motor or resistor (or electronic speed control unit).

If you run your car to the point where more than one cell in the pack is completely discharged, it is possible to lose radio control of the car before the drive motor stops completely. For this reason you should not operate your car in an area where it could be harmed, such as near a busy roadway or a pool of water. Usually radio control will be regained as soon as you pick up the car and the motor is allowed to free-run. If you still don't have control, then you should unplug the motor.

Don't operate your car on thick pile or shag carpets. Long fibers from the carpet can wrap around the axle and motor shaft causing them to bind.

When you stop running your car, turn off the radio at the car first (with the resistor in the off position) before turning off the transmitter.

Be sure that the resistor is in the off position while you are charging the battery.

A partially burned-out or shorted motor can make the car appear to have radio problems. If the car slows down suddenly and the radio acts erratically even with a full battery charge, then the cause is probably the motor. Check the range of the radio with the motor unplugged. A shorted motor will draw extremely high current even under no-load conditions.

HOW TO START RACING

Although R/C car racing is growing very fast, there are still many areas that are not organized yet, to the point of having clubs and regularly scheduled events. Even in areas where there is strong club activity, it's hard for the beginners to find clubs and racing events.

You can write to R.O.A.R., 12008 Welland, Cumberland, IN 46229 and ask them for the name and address of the club nearest you. R.O.A.R. (Radio Operated Auto Racing), the National Organization, keeps a record of clubs in the USA. New clubs can also send in their name and address to R.O.A.R. to add to this list so that new racers in their areas know where to contact them. Also, you can join R.O.A.R. and receive a copy of Revup every other month. Revup is a R.O.A.R. publication that keeps the members informed of what's happening around the country.

If there is no organized activity in your area yet, it would be very easy for you to start it up. Ask your local hobby dealer if it would be alright for you to post a small 8" x 11" notice in his shop about R/C cars. On the notice, you could have a photo of an R/C car. You could also state something to the effect that "Every Sunday afternoon, at 1 pm, there will be a demonstration of R/C cars in the parking lot at Main St. Shopping Center, at Main and Broadway Streets. For further information call Joe Racer at 637-7654". Change the wording around to suit yourself. The important thing is to take the first step and get the notice posted in the hobby shop. Pick a location to run on that has a lot of exposure to people walking by. There are an awful lot of would-be car racers that would like to race, if they only knew that there was such a thing as an R/C car. If you run on a parking lot where no one can see you, then there will be no new people to join your fun.

Wherever you run, try to keep some kind of safe crowd control. Don't let the people get too close to where you're actually driving. And it's not necessary to show the crowd how fast you can go. It's much better to set up a simple course and just drive around on it. When you stop running, be prepared to answer a million questions. This is a VERY IMPORTANT step. The interested spectator is what it takes to become a future R/C car racer. You'll be answering the same questions a hundred times, but if you can get 4 or 5 guys really interested, you've got your club started.

Once you get 2, 3, 4 or 5 guys running at the same time, then it's a lot easier to get more new people interested. It's fun running by yourself, but it's a whole lot more fun running with other racers.

Most hobby shops would be glad to let you post notices of your R/C car activities. It wouldn't cost them anything to do so, and they know that you would be helping them by bringing in new customers for them.

Some hobby shop owners are a little apprehensive about R/C cars, mainly because they're quite familiar with airplanes, but they don't know anything about the cars. Clean up your car and show it to the hobby shop owner. He would be glad to take the time to look over your car while you explain the different parts to him. As soon as he finds out the cars are a lot easier to understand than he might have thought, he'll be much easier to work with.

Don't expect him to rush right out and put in a huge stock of R/C cars. It doesn't work quite that way. In the beginning he'll be glad to order whatever parts you need, as well as a complete car for a new customer. When there are 4 or 5 racers in his area, he'll probably start to stock a few parts for them. As the number of racers grow in an area, you'll also start to see the stock of R/C car parts growing in the hobby shop.

When you get up to 5 or more racers, it's time to form a club. With your club formed it's then time to have regularly scheduled events. Normally a two week spread between races is good, but you can vary this to suit your club. In So. Calif., between the 1/8 and 1/12 scale clubs, there are from 1 to 4 races every weekend, year round, between nine clubs. And it's still growing.

With your club formed, you should start to collect dues. Don't make it too much to begin with, you don't want to scare anyone off. You'll need some money to make boards to surround the track, to protect the spectators from your overly enthusiastic driving lines. As your club gets larger you'll want to buy clocks and a P.A. (public address-loudspeakers) system.

For your first races you should also present trophies. About one trophy for every 4 or 5 competitors is enough. Trophies are very important because there's nothing else in the world like winning your first trophy. The trophies are paid for by the race entry fees, the amount of which is determined by your club members, \$2, \$3, \$4 or whatever you decide on. Trophies should be awarded at the conclusion of the day's events.

Some of the largest, fastest growing clubs hold their races in parking lots located on large shopping malls. Some of these malls have advertising funds that they use to pay the clubs \$50 to \$150 a race. This money is then used to buy the race trophies. The club is then free to use the entry fees to buy a trailer to haul the boards or for whatever purpose they need. The shopping mall manager should be approached by someone in your club who can give the appearance of being a responsible person. Your club representative can bring along a nice clean car and maybe some photos of races, so the mall manager knows what you're talking about. In the beginning, it's best to just ask for permission to use part of the parking lot which is least used. They'll not be in a hurry to give you a parking lot that is used regularly. Don't ask for money right away. Run a few races first to see if you attract an audience. Then you can ask the mall manager if they would like to contribute to the trophy fund. Also, at your initial presentation to the mall manager, you can tell them that you will be getting site insurance for yourself, your club and site insurance from R.O.A.R., Inc. Write to them for details. Naturally, you'll want to clean up the area after the day's racing, because this is also very important to the mall manager.

You will also need insurance if you plan to compete in a R.O.A.R. sanctioned race such as the Nationals. The insurance is not expensive and can be handled in conjunction with your membership in R.O.A.R.