

# INSTRUCTION MANUAL FOR R/C PROPORTIONAL CONTROL SYSTEMS

## GENERAL INFORMATION

### INTRODUCTION

This manual contains operating instructions for 1978 Models of R/C equipment. Of necessity, most information is general, but specific data is included where necessary.

Specific equipment descriptions and specifications are not included; this information is available in applicable sales literature.

### EQUIPMENT CHECK LIST

Components shipped with complete Systems are listed below. Flite packs do not include transmitter, charger or servo trays. Upon receipt of your equipment, check that each item is present and accounted for. Notify your dealer immediately in event of shortages.

#### SYSTEM COMPONENTS

- 1 Transmitter
- 1 Tx Antenna
- 1 Receiver (or Block)
- 1 Rx Nicad Battery or Dry Battery Holder
- 1 Nicad Charger (except/BASIC 810)
- \* Servos
- \* Servo trays
- 1 Instruction Manual

\* Quantity depending on purchase. Trays only with servos, not blocks.

### CHANNEL SEQUENCE

All Systems utilize the following control sequence, regardless of channel count.

Channel	Control Function	Rx Wire Color
1	Aileron (or Rudder)	Orange
2	Elevator	Yellow
3	Motor	Green
4	Rudder	Blue
5	Ldg. Gear (or Aux)	Purple
6	Aux (or Ldg. Gear)	Gray
7	Aux (or Ldg. Gear)	White

When using Flite Packs with other make transmitters, where their channel sequence is different, it may be necessary to rearrange the positions of the servo signal wires at the receiver I.C. to provide a control sequence compatible with your transmitter. (See next paragraph.) This service will be performed at the factory if your transmitter is supplied for tuning.

### BLOCK CONFIGURATIONS

On 2 and 3 Channel TINI-BLOCKS, Channel 1 servo (Rudder) is in receiver block. On 4-Channel Model, Channel 2 servo (Elevator) is in the block.

On 2 and 3 Channel TINI-TWINS and SUPER-MINIS, Channels 1 and 2 servos are in receiver block. On 4-Channel Model, Channels 2 and 4 servos are in the block.

## PREPARATION FOR USE

### UNPACKING

Open carton carefully to avoid damage to inner container. Save all cartons for possible reshipment. Check contents against equipment list above. If anything is missing, notify dealer immediately.

On all 4-Channel Dual Blocks an external switching plug allows shifting of servo functions. With switching plugs aligned in standard position, all 4 servos work normally. When plug position is reversed, control of rudder servo in block is transferred to the aileron control stick. If used together, the aileron servo will then work with the rudder servo for Coupled Aileron and Rudder (CAR) operation.

If another control arrangement is desired, this may be accomplished by exchanging positions of the servo signal wires (orange, yellow, green and blue) where they attach to the receiver-decoder. Be extremely careful when moving wires that no solder shorts remain, or parts damage may occur.

### AVAILABLE MODES

Two-channel transmitters are normally supplied with a 2-axis centering stick (with trims) on the right hand side. When specified, transmitter will be equipped with two single-axis sticks, RH for rudder, LH for elevator, both with trims.

Three-channel transmitters are built with a 2-axis centering stick (with trims) on the RH side, and a lever (no trim) on the LH side for any positionable control. If desired a one-axis positionable stick, with trim, can be supplied in the LH position. Cost is \$10.00 extra.

Two-stick systems with four or more channels are normally supplied as Mode II (Aileron and Elevator on RH stick), but are available as Mode I (Motor on RH stick) on Factory order. Field change-over between modes is relatively simple. All transmitters with five or more channels incorporate a separate retract switch for landing gear. Additional controls would be positionable levers, no trim.

Single Stick Models (4 Channels or more) provide aileron, elevator and rudder knob functions on right stick. Landing gear switch and non-trimmable levers provide other channel controls. Exception: Deluxe 4-Channel 810, 820 and 825 single stick transmitters have a trimmable motor stick on LH side of case.

### ADDING CHANNELS

All systems may be converted AT THE FACTORY to the maximum number of channels designated for that specific model. Exception: Do-it-yourself conversion kits as well as factory conversion are available for 810 and 830 systems. Cost for factory conversion is the DIFFERENCE in retail price for the model change, PLUS \$10.00 conversion charge. This includes additional servo(s), as applicable. Shipping, handling and repairs are extra.

### CHANGING FREQUENCIES

On 1978 Models, frequency change of Tx and Rx is relatively simple, even between different frequency bands. Entailed are replacement of crystals, coils and a few frequency sensitive parts, plus tuning by a qualified technician.

Earlier R/C Systems sometimes require more extensive work to shift frequencies. For further info, send Model No. of your equipment, plus a No. 10 self addressed stamped envelope for more detailed information and prices.

### FREQUENCIES AND FLAGS

Most equipment is available on 27, 53 and 72 MHz. bands. Each frequency is assigned a specific FREQUENCY FLAG color code for field identification. Flags are usually attached to the transmitter antenna. PLEASE BE CAREFUL not to turn your transmitter on when someone is flying on your frequency!! Observe local field rules for frequency control. Frequency flag color codes are:

Frequency	Flag	Frequency	Flag
26.995	Brown	53.400	Black-Yellow
27.045	Red	53.500	Black-Green
27.095	Orange	72.080	White-Brown
27.145	Yellow	72.160	White-Blue
27.195	Green	72.240	White-Red
53.100	Black-Brown	72.320	White-Purple
53.200	Black-Red	72.400	White-Orange
53.300	Black-Orange	72.960	White-Yellow
		75.640	White-Green

#### EQUIPMENT CHECKOUT

1. Charge receiver and/or transmitter nicad batteries for 12 to 14 hours before initial use or demonstration.
2. On dry cell transmitters, install one Eveready 276 9V battery or seven ALKALINE pencils, as applicable. Observe correct battery polarity. Note: Model 810 dry TX has one cell jumpered out; remove this jumper when installing eight 1.2V nicads in place of Alkalines.
3. Install four 1.5V ALKALINE "AA" pencils in Rx dry battery holder. Observe battery polarity. Nicad "AA" 1.2V cells may be used, if desired. Be sure nicads are sintered cells. Use only ALKALINE BATTERIES on dry installations.
4. Wrap receiver battery pack in 1/2" foam and secure with several rubber bands to hold cells firmly in place.
5. Plug battery into matching receiver plug. Connect servos to other plugs. A 7" aileron extension cable is available if

needed. OBSERVE PLUG KEYWAYS, DO NOT FORCE PLUGS, OR EQUIPMENT DAMAGE MAY RESULT.

6. Extend receiver antenna full length, hanging vertically if possible. Turn Rx switch ON momentarily, noting that servo arms move slightly (normal).

7. Install transmitter antenna - do not extend.

8. Turn transmitter ON, then receiver. Servos on self-centering channels should move to neutral position; other servos (motor, landing gear, Aux.) should move to positions determined by transmitter control settings.

9. Operate each transmitter control in both directions to check servo response. Observe servo travel direction to determine mounting position in vehicle. Note: On 4-channel systems, one servo is furnished with reverse rotation. Use this servo in position best suited to installation.

10. If necessary, reverse servo directions, or adjust centering, as required.

11. Before installation, cycle equipment for three to four hours to "burn-in" components.

12. Turn receiver OFF, then transmitter. Always follow this sequence in operation.

13. Equipment is now ready for installation.

**CAUTION: DO NOT OPERATE TRANSMITTER FOR PERIODS IN EXCESS OF TWO OR THREE MINUTES WITH ANTENNA DOWN OR OFF, OR OUTPUT TRANSISTOR OVERLOAD MAY CAUSE BURN OUT!**

## INSTALLATION INSTRUCTIONS

#### RECEIVER INSTALLATION (AIRCRAFT)

Locate receiver in the airplane where it is least subject to crash damage. For protection, wrap discrete receiver in 1/4" to 1/2" soft rubber or foam, secured with rubber bands. Route antenna through side of fuselage and attach to top of aircraft vertical fin. Use rubber band at fin to maintain antenna tautness. If too long, let antenna trail behind aircraft. NEVER CUT ANTENNA OFF OR FOLD IT BACK UPON ITSELF. Use of an antenna quick-disconnect, such as Shove-IT, is recommended. Provide strain relief at receiver to prevent antenna being pulled loose.

"Blocks" are usually mounted in trays or attached to hardwood mounting rails in fuselage, using rubber grommets and standard mounting hardware such as small screws and washers (not supplied).

Total recommended antenna length for standard receiver is 36"; for Super-Mini's it is 30"; for smaller systems 18" - 24". Full length antenna should be utilized wherever possible for maximum range.

Keep antenna completely away from other wires or metal objects to reduce possibility of noise pick-up. DO NOT use solid wire for control rods. Avoid metal-to-metal linkage wherever possible.

#### RECEIVER BATTERY AND SWITCH INSTALLATION

Mount switch on side of fuselage opposite motor exhaust. FORWARD position should be ON. Be certain slot is long enough to permit switch to fully open and close. Mark ON position with red paint.

Wrap battery pack securely in 1/4" - 1/2" thickness of foam rubber, or plastic, bound with rubber bands to hold cells in place. A small plastic bag around pack will serve to keep out water and engine fuel. Install battery pack forward of radio compartment; below receiver if forward location is not possible. Route wires as far from receiver as possible.

#### CHARGE RECEPTACLE INSTALLATION

Some nicad batteries and switch harnesses are provided with an external charge receptacle which permits receiver battery charging without wiring disconnections.

Install the 3-pin charge receptacle in a rectangular hole of matching size cut in outer skin of vehicle. Attach with plate and 2 screws.

When charging, plug mating charger cable into charge receptacle. Receiver battery switch must be OFF to charge.

#### WIRING

Install all wiring as neatly as possible, making sure it does not interfere with or become entangled in the servos or control linkages. Check wiring occasionally, particularly at plugs, for signs of fraying, breakage or poor connections.

#### SERVO INSTALLATION

Select servo(s) which provide correct direction of output arm travel for control surface actuation.

Mount servos on hardwood rails or with plastic trays. Rubber grommets provide necessary shock mounting; servos are secured with screws (wood or machine, as applicable) and flat washers. Do not overtighten screws, or vibration isolation will be destroyed.

Super-Mini or smaller servos may be attached to airframe with servo tape or snap-in trays (\$1.49 each). Servos must be positioned in tray before mounting the tray with standard hardware. Another satisfactory method of mounting small servos is with Velcro.

All neutral adjustments of control surfaces must be made through linkage adjustments, not by servo or transmitter centering adjustments.

Always use an override device on motor and auxiliary channel servos to prevent possibility of servo stall-out in case of incorrect linkage adjustment.

#### CENTERING SERVOS

If necessary, center each servo to its individual channel as follows:

1. Place all transmitter controls, including trims, in neutral position.

2. Turn on transmitter and receiver. Plug servo into Rx channel to be centered.

3. Remove screw holding servo output arm.

4. Insert centering tool into hole in output gear until it bottoms. A 1/16" Allen wrench is centering tool needed for RS-4D, CE-6, CE-7, older CE-4 and older white Tini-Block and Tini-Twin servos. All ivory Tini-Blocks, D&R servos, plus newer CANNON servos and Blocks, center with a 1/16" jewelers screwdriver.

5. Apply pressure on tool in direction opposite desired direction of centering change. Output arm will rotate to a new center position. Adjustment is quick and touchy, so a few tries may be needed before correct centering is obtained.

6. Carefully withdraw centering tool so as not to change



servo center. Replace output arm screw.

#### REVERSING SERVO DIRECTION

To reverse rotational direction of servos, reverse the connections of the two motor wires (not the ground connection). Also, reverse positions of the two outer pot wires (not the yellow wire). Re-center servos as necessary after these changes.

#### CAR AND BOAT INSTALLATIONS

Basically the same as for aircraft, except antenna should be a vertical whip of music wire. Total combined length of receiver leadout wire and whip antenna should be as close to

standard antenna length as possible, or receiver retuning may be required.

Car installations require extra care to protect equipment from vibration, dirt, fuel and engine exhaust oil. Use of plastic bags around units is recommended. Shock-absorbing linkage should be used between servo output and steering rod to reduce possibility of damage to servo mechanics.

For boats we recommend a waterproof box to house the equipment, complete with waterproof pass-through fittings for the push rods. Unit can be fabricated of plastic or plywood. Lid should have a water-tight seal. Plans have appeared in model magazines for such boxes; commercial models are also available.

## FIELD TESTING

#### CHECKING INSTALLATION

Once your equipment is installed in the vehicle, it should be checked at home, then at the operating site for proper functioning. For the beginner, we strongly recommend obtaining the help of an experienced R/C modeler to check over the installation and to help in the initial phases of equipment operation, such as flight instructions, etc. Perform field tests as follows:

1. Recheck your installation for possible mistakes. For the new R/C flyer, have an experienced modeler look your unit over. He can probably spot problems a beginner would not.

2. Turn ON the transmitter, then the receiver. Check operation of all controls. Make certain that control movements respond in the proper direction. Many an airplane has gone up on its first flight with reversed controls and consequent disaster. Check control surfaces for binding. Be sure servos are not in a stalled condition at their extremes, which could result in premature battery depletion and loss of control.

#### RANGE CHECKS

It is important that a ground range check be performed to establish a standard for your system and provide a relationship between ground range and air (or distance) range. At future flying sessions, should the range check under identical conditions vary significantly from the established standard, locate and rectify the problem before attempting further operation.

1. Position the model away from obstructions, preferably on a box, 2 or 3 feet above ground level, so that the nose is pointed away from the operator and one major control function, such as rudder, is easily seen by the controller.

Turn equipment ON, and with Tx antenna retracted, back away from the model while operating the control under test. Continue to operate the Tx control while backing away and observing control surface action. When the point is reached

where action becomes erratic, consider this to be your limit of range. Measure the distance, note the test conditions, and use this as your standard for all future range tests.

2. For powered models, repeat this test with engine running at full throttle. If any significant reduction in range is apparent, investigate and correct the problem before further operation.

3. Range may vary widely with different systems and between different makes of equipment. Factors which cause variations in range include transmitter tuning, antenna length, type of Tx case, antenna orientation, position in which transmitter is held, height of transmitter and receiver above ground, equipment installation, surface over which test is made, etc. Once a standard is determined for antenna - down range, this can be used as a quick-check reference of equipment operation. The real test is ground-to-air range, without "glitches".

4. Average range, antenna down, will vary from 100-500 feet, depending on surface and test conditions. Antenna-up ground range should be 1000 feet or more. Air range should be 2 to 3 times your ground range. If all field tests are positive, equipment is ready to place in operation.

#### RECEIVER TUNING

Factory-tuned receivers are sealed, and tuning is not recommended unless an out-of-tune condition is suspected.

If tuning is required, perform this operation with servos plugged into the first two receiver channels.

To tune receiver, remove Tx antenna and have one person slowly move away from airplane while operating Channel 1 control on transmitter. Using the spade end (like a small screwdriver) of a plastic tuning wand, carefully peak the two front coils until maximum operating range is obtained. This will vary from 4-20 feet or more. Once tuned, use a small amount of candle wax to lock tuning slugs in position. Caution: Do not touch the I. F. transformer tuning.

## EQUIPMENT OPERATION

It is beyond the scope of this manual to presume to teach the "hows" of flying, and flight maneuvers. For information of this nature refer to one of many R/C training manuals currently available.

#### BUDDY BOX OPERATION

For flight trainer operation, two appropriately equipped matching transmitters and a special connecting cable (not furnished) are required. Each transmitter must be wired in the Buddy Box configuration with a 6-pin female receptacle and a Buddy Box push button switch. Certain models can be modified for this purpose, even if not standard.

Mode I and Mode II transmitters will not work together because of control variations, but any other properly equipped two-stick or single-stick transmitters, regardless of frequency, can be used. Operation is as follows:

1. Select as the Master Transmitter the unit to which the aircraft installation is matched.

2. Plug Master end of cable into 6-pin charge receptacle on transmitter, other cable end into Student Transmitter.

3. Extend antenna on Master Transmitter, leave antenna off or down on Student Transmitter.

4. Turn both transmitters ON. RF meter on Student Unit should show no indication (RF section is dead). Master unit should be normal.

5. Adjust trim controls on Master Transmitter for correct aircraft trim. Check that all controls operate properly.

6. Press button on Master Transmitter. Check control operation with Student Transmitter. Adjust Student trims so control surface positions match those of step 5 above.

7. Perform initial take-off and flight operations with Master Transmitter.

8. To transfer control to Student Transmitter, depress and hold down the Buddy Box pushbutton switch on Master Transmitter. Student controls are now operational. Release switch to return control to Master Transmitter.

9. Either transmitter may be used as Master or Student, depending on cable connections, and providing aircraft equipment is tuned to the Master Unit.

#### CHANGING TRANSMITTER STICK MODES

Should your transmitter be a 4-channel Mode II and you desire to change it to a Mode I (or visa-versa), proceed as follows:

1. Remove the Tx rear cover. Take out the four screws holding each rear stick cover. Slide off both covers.
2. Slip out the two outside bails and end plates, being very careful not to change position of adjustment levers. Position these assemblies to one side.
3. Carefully slip out the two inner bail assemblies. Do not change adjustment lever positions!
4. Transpose positions of the two inner bail assemblies in the two sticks. Place what was the LH bail in the inner bail position on the RH stick. Put RH bail in LH stick. The attached wires are normally long enough for this change-over. It is possible that cable lacings may require cutting to permit sufficient cable displacement.
5. Reassemble the two outer bails in their original positions. Make sure rear stick ends mate with the bails. Verify correct operation before replacing stick covers.
6. Check servo action on the transposed elevator and motor channels. It is possible that a minute repositioning of the two bail adjustment levers may be necessary to obtain correct servo centering and throw.

7. An alternate method of changing modes is to unsolder all stick wires, transpose positions of the two stick assemblies in the case, then rewire the sticks. This necessitates recalibration of the controls and rearranges the channel functions. When blocks are involved, a change in logic output is required to insure correct servo usage.

#### WARNING

Operation of any car, boat, airplane or other vehicle can be hazardous to property or persons if every precaution is not taken. NEVER operate a radio controlled device in an area where failure, accidental or inadvertent loss of control could permit the vehicle to cause property damage or personal injury. Before attempting unrestrained operation BE ABSOLUTELY CERTAIN that all equipment is functioning properly, that batteries are fully charged, and that the selected operating area is free of persons or property. Neither the Factory nor its Representatives assumes liability for loss, damage or injury incurred or inflicted during operation of R/C equipment or related devices.

## BATTERIES

### DRY BATTERIES

Use only ALKALINE BATTERIES where dry pencils are specified. As batteries are used and output voltage decreases, battery internal resistance increases. This can result in improper equipment operation. Fresh ALKALINE cells normally provide many hours of satisfactory operation, but replace cells at the first sign of unusual system operation.

Recommended replacement voltage for transmitter batteries is 7 volts, under load (Tx ON). Receiver cells should be replaced when voltage under load drops to 4.5 volts.

Nicads may be installed instead of dry cells in both Tx and Rx. Four 1.2 volt 500 mah sintered nicad "AA" pencils are needed for the Rx, eight for the Tx. Factory installation of Tx nicads plus charging jack is available for \$27.50 (Kit \$24.00). Charger, shipping and handling are extra.

### INSTALLING TRANSMITTER CHARGE RECEPTACLE

When using nicads in 810 transmitter, an external charge receptacle is desirable. A Dual Charger with matching plug will be needed. Install receptacle as follows:

1. Remove transmitter rear cover.
2. With an Xacto knife, very carefully cut out the rectangular recess just below meter. When open, this hole is exact size of receptacle body.
3. Drill two 3/32" holes at indentions, one on each side of receptacle hole.
4. Slide two spacers over front of charge receptacle, mount unit in transmitter case from rear and secure with two No. 2 x 5/16" screws from front side. Note correct position of receptacle keyway.
5. Solder 2-1/2" black and red wires to connections on charge receptacle and switch, as shown. Install shrink tubing over all connections during assembly.

### NICAD BATTERY CHARACTERISTICS

Batteries are the source of most equipment problems and should receive the most attention. In case of malfunction, ALWAYS check batteries first.

Battery voltage should be measured with a voltmeter under load, that is, with transmitter turned ON and receiver and servos connected, and Rx battery switch ON. Tx batteries should indicate a minimum of 9.6V, Rx batteries 4.8V. If voltage is lower, charge system completely, then recheck. If low voltage condition persists, check voltage of each individual cell UNDER LOAD. Any cells reading less than 1.2V should be replaced.

More accurate condition of nicads can be ascertained by charging batteries fully, then discharging over a period of time into a fixed load which provides a specified discharge rate, such as 270, 350 or 500 ma. Battery condition is rated on discharge time (minutes) required for the battery to reach a critical voltage level, nominally 4.4V. Battery testers on the market such as Power Pacer and Super Cycle are designed to

perform this function. The longer the discharge time, the better the condition of the battery. Comparison of this discharge time against a known standard provides an approximate indication of battery condition. Don't interpret results too literally.

After charge, receiver battery voltage may "top out" as high as 5.5 volts under load. Within a few minutes use this will drop to 4.8 - 5 volts, where it remains virtually constant until charge is depleted. Upon depletion to a critical level (approx. 4.4V) nickel-cadmium battery voltages drop very rapidly, practically to zero. Under no condition should battery be used beyond depletion; over-discharge may cause cell reversal and permanent damage.

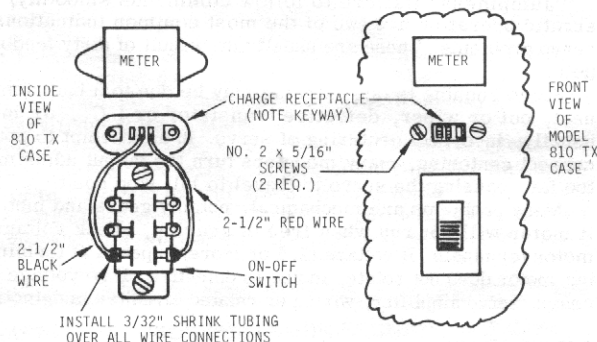
If battery voltage after charge is below 4.8 volts, cell(s) are either defective or worn out, charger may be defective, battery may have been reverse-charged, or a short may exist in the equipment. A wiring or equipment short usually will be indicated by overheating of wires to battery pack.

Transmitter battery voltage may top-out as high as 11 volts under load, but will drop to 9.6 volts with use. If voltage after charge is less than 9.6 volts, check individual cells or charger for fault.

Other than voltage measurements taken at each individual cell under load, no positive means is available to determine when either a charged or discharged state exists. For this reason, batteries must be charged at recommended rate for sufficient time to insure a full charge.

### CHARGING OF NICAD BATTERIES

Nicad cells supplied with this equipment have a C/3 rating, making it possible to charge at 1/3 normal cell capacity, if desired. However, except for field fast-charge on 100 mah or smaller cells, we recommend using an overnight charge rate of about 50 milliamps (100 mah packs require a Charge Limiter when charging with standard charger, but Limiter is not used with Auto-Charger). Maximum battery life and highest efficiency are obtained in this manner.



INSTALLING TRANSMITTER CHARGE RECEPTACLE



Our standard chargers supply 45-50 milliamps output, and can be used for 12-14 hour charge of all standard cell sizes, without damage.

#### NICAD CHARGING PROCEDURE

A single-output charger is supplied for receiver (Flite Pack) nicad charging. To use, connect 3-pin male Dean's plug to connector on receiver battery. Turn battery switch ON or unit will not charge. Then plug charger into 110V AC receptacle. There is no visual charge indicator.

DELUXE Systems employ a Dual Charger with separate outputs and charge indicator lights for both transmitter and receiver batteries. Plug appropriate matching charger plugs into transmitter and/or receiver sockets, then plug charger into AC. Turn transmitter switch OFF, and place receiver switch in correct position so both charge indicator lights are ON. Note: When specified, 220V Dual Chargers are supplied for use on foreign Mains.

Charge batteries 12-14 hours to insure full charge. Units can be left ON charge indefinitely without harm to batteries.

Transmitter and receiver batteries can be charged simultaneously or independently, without damage. Unplug charger from AC receptacle when charging is complete.

The Auto-Charger provides a means of fast-charging ONLY 100 mah batteries at the field from the car cigarette lighter or other 12 volt source to permit continued flight operation. We recommend the following charge procedure:

1. Charge batteries 12-14 hours with the AC charger and Charge Limiter before flying. Do not give a boost charge with Auto-Charger. After flying, and between subsequent flights, charge 100 mah packs as follows; using Auto-Charger (no Charge Limiter).

Channels	Max. Flite Time	Max. Recharge Time
2	40 Min.	15 Min.
3	30 Min.	15 Min.
4	20 Min.	15 Min.

If lesser flight times are used and recharge is desired, reduce charge time by percentage difference between chart and actual flight time.

#### WARNING

UNDER NO CIRCUMSTANCES SHOULD THE ABOVE CHARGE RECOMMENDATIONS BE EXCEEDED!! We assume no responsibility or liability for equipment damage or personal injury resulting from improper handling of batteries.

#### NICAD BATTERY LIFE

Proper battery selection will assure best operating results. Primary rule - always use the largest Rx battery your vehicle can carry (for maximum operating time). Battery drain is directly related to number of servos and frequency of use. Select the nicad battery which best meets your weight and operating time requirements from the following chart.

Average Duration, Rx Nicads (Minutes)				
Battery	Weight	2 CH.	3 CH.	4 CH.
*100 mah	1.4 oz	40	30	20
250 mah	2.25 oz	90-120	60-90	45-60
450 mah	3.04 oz	150-180	120-150	90-120
500 mah	3.96 oz	200-240	180-200	150-180

\*May be fast-charged at field with Auto-Charger.

## MAINTENANCE PROCEDURES

#### GENERAL

A rigidly-followed inspection and maintenance program by the user will increase equipment reliability ten-fold. Preventative maintenance is simple and easy to perform, and will guarantee continued system operation. Suggestions following will significantly reduce equipment visits to the repair shop.

#### PLUGS AND WIRING

Check occasionally for plug cleanliness and proper pin contact. To clean pins, use electronic tuner cleaner on both male and female contacts, with fine sandpaper as required. Use pointed end of an Xacto knife to close up the female contacts and restore spring tension.

Keep a close eye on condition of wiring throughout the system. With use and vibration wires tend to fray and break at points of connection to receiver and servos, especially at the plugs. Application of silicone rubber to wire connection points is helpful in preventing breakage. Inspect connections regularly, especially at plug solder terminals, motors, servo pots, etc. for signs of fraying or vibration damage. Resolder any questionable connections whenever discovered. Replace any wiring which shows signs of insulation wear.

#### GENERAL SERVO PROBLEMS

"Jumpiness" (failure to follow commands smoothly) and erratic operation are two of the most common indications of servo problems. These are usually the result of dirty feedback pots.

Servo running to one extreme may be due to a bad component, pot or wiper, defective transistor or I.C., or most usually, incorrect centering of servo. In an attempt to obtain correct centering, many modelers turn the output adjustment too far, causing the servo to travel to full stop position.

Many problems are mechanical, notably gears and motors. If motor will not run when free of gearing, check voltage at motor terminals. If voltage (2.5 or more) appears at terminals but motor does not rotate, motor is defective. If no voltage appears, servo amplifier, wiring or related circuitry is defective.

#### SERVO GEARS

Occasionally servo gears will become noisy or damaged due to crashes, hard landings, exposure to fuel, or other "gremlins". In such cases, disassemble servo and inspect each gear carefully under high power magnification to locate

burrs and bent or broken gear teeth which impair operation. Replace imperfect gears when found.

#### SERVO MOTORS

Like all mechanical items, motors are subject to wear and eventually may need replacement. If one servo becomes noticeably slower and less powerful than the others or runs slow one direction, check gears first, then the motor. Often a motor can be rejuvenated for a period of time by applying TV tuner cleaner (lubricant) to the motor bearings. Replacement motor parts are not available; if defective, the entire motor must be replaced.

#### POTS AND WIPERS

These are a major cause of servo problems. A periodic cleaning, adjustment and lubrication of these items can reduce repair costs considerably.

#### CLEANING SERVOS

Amount of servo use will determine the need for cleaning. We suggest that for every five to ten hours of operation the servos be disassembled, cleaned, inspected and lubricated. Proceed as follows:

1. Open servo case to allow access to gears, motor, feedback pot and amplifier.

2. Under magnification, inspect all wiring for signs of fraying or breaks, especially at pot, motor terminals, P.C. board and servo plug. Resolder any bad or frayed connections; replace all wires not in perfect condition.

3. Remove feedback pot. Inspect very carefully for signs of element wear, center contact wear, cracks or wiper element impregnation. Clean pot with a soft cloth, using lacquer thinner or TV tuner contact cleaner. Be certain all foreign matter is completely removed from surface of pot element. Replace element with new unit of correct value if defects are apparent.

4. Check spring wiper contact for cleanliness, wear or deformity. Clean as necessary. Replace wiper if flat spots show at contact points. Be sure spring tension of wiper against pot element is adequate to insure perfect contact, even under vibration.

5. Spread a very thin film of lubricant on all contact surfaces of pot element. This is very important to insure maximum trouble-free pot life. You can use special pot lube, silicone grease or vaseline, as available. When reassembling pot, make sure everything is in correct position and alignment.

6. Slide motor out of retaining boss so that gear operation can be checked by manual rotation of output shaft. While gears are being turned, look, listen and feel for possible gear defects. Hard-to-turn gears may indicate bad teeth or swollen gears, with consequent binding. A clicking noise usually means one or more bad gear teeth exist. Inspect gears thoroughly under magnification for visual signs of damage or other possible trouble causes.

7. Inspect amplifier to make sure no adjacent parts on board are liable to short together. Silicone rubber at wire terminals and potential shorting points is good insurance.

8. Check servo operation, center as necessary and reassemble servo. As needed, install foam tape or plastic pads between amplifier and pot, motor etc. Route wires properly to avoid pinching. Recheck servo operation after assembly is complete.

## REPAIR SERVICE

### WARRANTY REPAIRS

All Warranty Repairs will be performed by the facility whose name appears on this Instruction Manual. This is the address to which you send your warranty card and equipment for repair.

### AUTHORIZED SERVICE CENTERS

A list of Authorized Service Centers is included with your new equipment or repair, or is available upon request (Send S. A. S. E.). Except for Warranty Repairs, please utilize the Center nearest you whenever possible. Since Service Centers are privately owned and operated, the Factory assumes no liability or responsibility for charges or services performed by these Centers.

### PACKING FOR SHIPMENT

Pack all units, securely padded and protected, in a strong cardboard container of adequate size. Enclose a list of items shipped, together with specific, detailed descriptions of equipment problems and/or work required. On outside of package, clearly mark package with both TO and FROM addresses (2 places each). Send equipment directly to the Service establishment. **NOT TO THE DEALER!** Be sure to enclose the Warranty Registration card.

On parcels being returned from outside the U. S. A., please include the following statement in BOLD TYPE on outside of package. "EQUIPMENT OF U. S. MANUFACTURE BEING RETURNED FOR SERVICE". Be certain to indicate package value below \$250.00 U. S. Otherwise duties may be levied, for which you will be charged.

### REPAIR POLICY

Warranty cards on new units, **MUST** be returned within 10 days to activate the Warranty. Cards must be on file in the name of the individual to whom sold. No file cards, no warranty. "Dealer Demonstration Units" are not covered by warranty unless warranty cards are on file.

After completion, repairs will be shipped C. O. D. if charges are below \$25.00. If higher, you will be notified of charges for prepayment prior to shipment. Exception: C. O. D. shipment on repairs will be made when authorized in advance for specific maximums.

### REPAIR SHIPPING COSTS

Repair shipping costs are to be paid by customer, both ways. Return shipping costs should be included with all repairs to save possible C. O. D. return charges.

### ESTIMATES

Repair estimates are usually not economically feasible without wasting excessive time, which must be paid by the customer. Our policy is to keep repair costs as low as possible. Factory rates are \$6.00 minimum repair charge or \$15.00 per hour, plus parts, shipping and handling.

### SYSTEM SCHEMATICS

Available for all Systems at \$3.50 plus \$1.00 S&H (in U.S.A.) or \$3.00 (Foreign). No C. O. D.'s. Specify in detail: Equipment type, year, channels, frequency, Tx & Rx types, servo type, battery type and size, 3 or 4 wires, etc.

### REPAIR WARRANTY

Repairs are warranted for a period of 30 days from date of repair shipment. This warranty applies only to specific parts replaced, not to other related parts. Example: if we replace one specific transistor in a unit, the warranty covers this transistor only, not some other part which might fail later. Also repair warranties do not cover items on which we have not performed a specific repair.

In order to avoid problems, we recommend the following procedure upon receipt of a repair.

1. Charge batteries fully.
  2. Connect entire system and operate all functions.
  3. If a malfunction is discovered, return the component (or system) immediately with a note explaining the problem.
- Remember: Your repair warranty is for 30 days only.

A Class "C" Operator's License issued by the Federal Communications Commission is required before this transmitter can be operated on 27 or 72 MHz. A technician class (or higher Amateur License) is required to operate on the 53 MHz band. License application forms can be obtained from your local FCC office.

### LIMITED WARRANTY

FACTORY-BUILT SYSTEMS AND FLITE PACKS ARE WARRANTED TO THE ORIGINAL PURCHASER TO BE FREE OF DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF 180 DAYS FROM DATE OF PURCHASE (GRAN PRIS SYSTEM IS 1 YEAR).

Warranty is not applicable to Kits, or to damage or defects in Factory-built equipment resulting from abuse, misuse, incorrect battery polarity, abnormal operation or crash damage. Warranty does not cover incidental or consequential damages resulting from or caused by equipment failure or a defect in material or workmanship. This Warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

Liability under this Warranty is limited to repair or replacement, without charge, of the defect or defective part at the Factory or Factory Authorized Warranty Station. Shipping and handling charges are extra, as are other repairs. Any modification, alteration, tampering or attempted unauthorized repair of this System or unit automatically voids the Warranty.

A valid Warranty is contingent upon customer returning the registration card within 10 days of purchase date. Neither the Factory nor its representatives assumes any liability or responsibility for loss or damage incurred or inflicted during operation of R/C equipment or related devices.

ABOVE WARRANTY NOT APPLICABLE TO KITS. KITS ARE WARRANTED ONLY FOR COMPLETENESS OF PARTS.

A Class "C" Operator's License issued by the Federal Communications Commission is required before this transmitter can be operated on 27 or 72 MHz. A technician class (or higher) Amateur License is required to operate on the 53 MHz band. License application forms can be obtained from your local FCC office.