

The completed Royal RS-4 and RS-5 servos. Fast, light and powerful, these servos will fit ideally in your system.

### **BUILDING THE**

### BY JERRY SMITH

# **ROYAL RS4 TECH VII SERVO**

● Ever thought about adding a servo to your present system? Then you look at those salty prices and your thought suddenly disolves. Well, it can be done, and for about 1/2 the cost of your present system servo. But, it will take a little more effort on your part than just opening up a box and plugging in a servo. Let me tell you how it can be done.

For many years a company by the name of Royal Electronics Corporation,

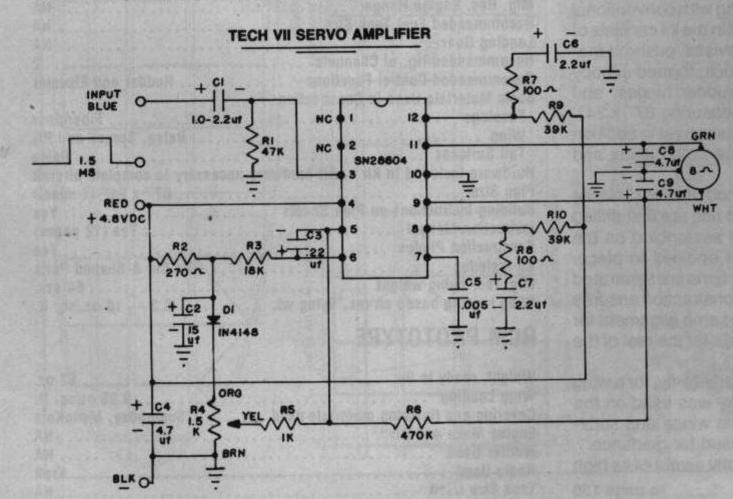
under the management of Mr. Sidney Gates, has been marketing all kinds of R/C electronic kits. I can remember back in the late 60's of having excellent success with the Royal Classic 6 Channel. The radio gear, purchased in kit form, was one of my very first all-out kit building projects. As a matter of fact, the radio is still working great — to this very day.

In those days, the printed circuit boards contained many more compo-

nents and solder joints, increasing the chance of malfunction. I considered the success I had with that old Royal - - - a real feat. As I look back, what stands out most in my mind is the very fact that I built it myself. What remains with me now is a sense of accomplishment and self-satisfaction of having succeeded.

Today, Royal Electronics offers a varied number of servo kits known as the Tech series. The Tech servos are offered in a wide range of configurations depending on your needs. For example, if you own a positive pulse system, you would be interested in a servo amplifier to match. In this case, it would be a Tech VII amp kit. The Tech VII amplifier will operate with Royal, E.K., W.E. Expert, Kraft, Orbit, Unicom, R.S. Systems, MRC, Futaba, and Cannon. (Any positive pulse system with a pulse signal of 1 MS to 2 MS.) If you own Heath 8 channel, Royal has a special servo amplifier board. This is known as the Tech VIII amp. Or, if you own a Proline, which is a negative pulse system, you would simply order the Tech IX servo amp.

The servo mechanics is also a choice and here again, it depends on your needs. Royal offers the RS-4 (D & R Mech.), RS-5 (Dunham Mech.), RS-5D (Double servo brick in the Dunham Mech.), RS-6 (Royal Mech.), KPS-14 and KPS-15 (Kraft Mech.). As you can see, Royal has a wide range to satisfy



your needs - - - a servo kit for whatever system you now own.

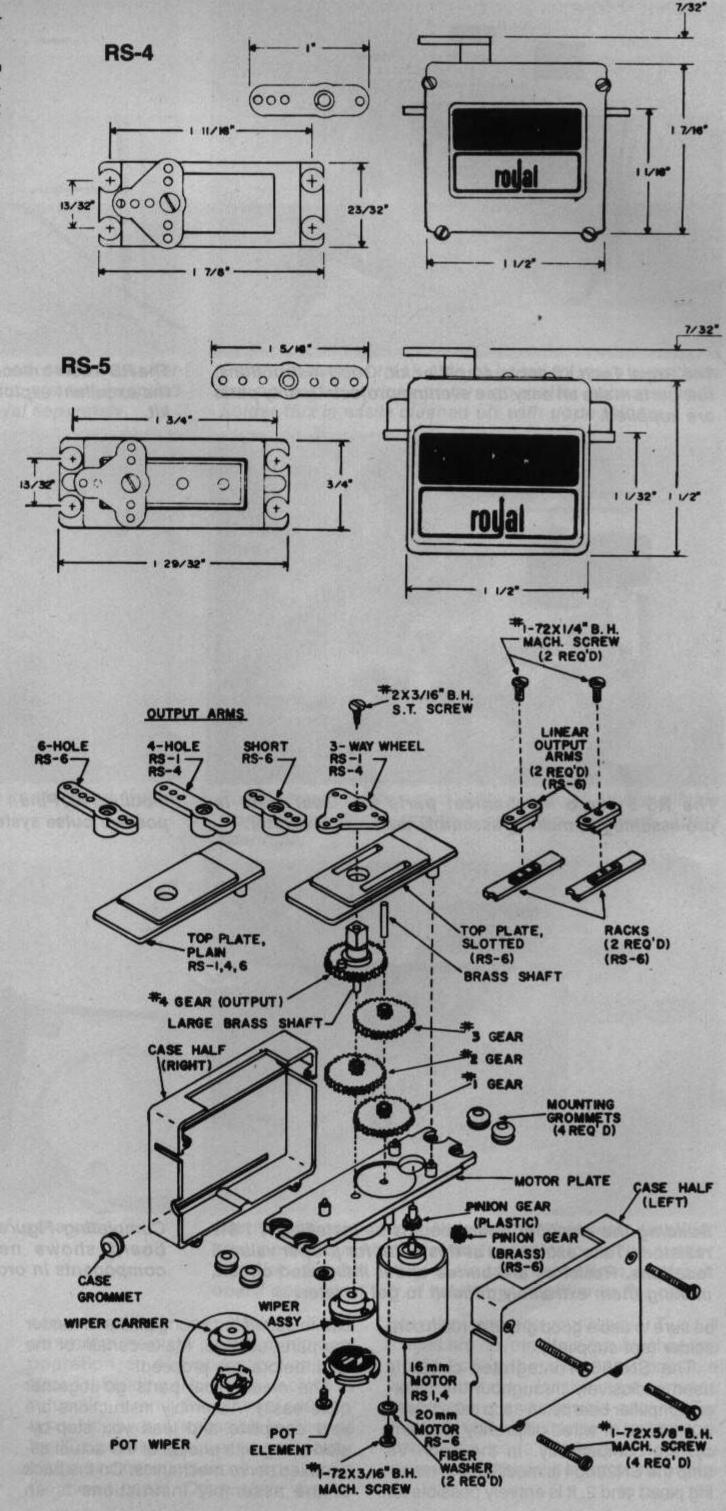
The major reason for buying a servo kit over the pre-built servo is cost. Obviously you don't include your labor as part of that cost, as long as it's for yourself. When it's for the other guy, that's a different story. But, with a little simple reasoning, you will discover that you can buy almost two Royal servo kits for the price of one manufactured servo. And that's a substantial saving in anybody's pocketbook.

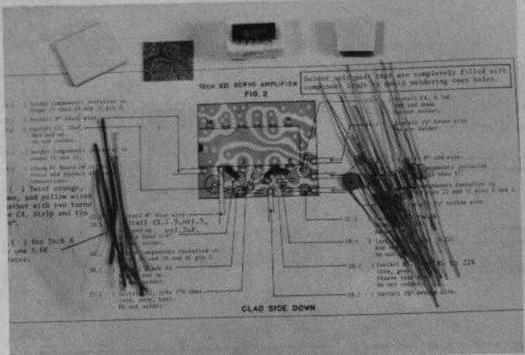
Now, let's talk about the Royal servo kit and what you can expect to encounter. For my system I chose the RS-4 (D & R Mechanics) with the Tech VII servo amplifier (I own a positive pulse system).

Upon examining the contents of the kit you will find about 20 resistors and capacitors, one integrated circuit, a printed circuit board, a few pieces of insulated wire and foam sponge. All these parts are packaged together and make up the servo amplifier kit. The mechanical parts are packaged separately. In the RS-4 kit, the gear train must be assembled, however, good pictorial instructions make this an easy task. The RS-5 servo kit (Dunham Mechanics) has the gear train pre-assembled. You might consider going this route as it does cut down assembly time.

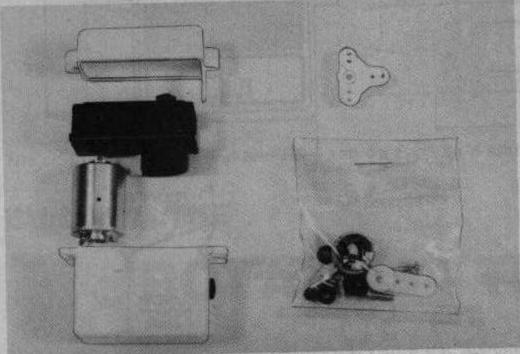
In any kit the instructions are the most important ingredients toward successful construction. You just can't get from here to there without them. I found the instructions supplied most adequate. Royal has done an exceptional job of pulling together all the information required to make kit building less painful. Two overlays in the instructions identify each part, point out exactly where each is located; when to solder; along with the order of assembly. The printed circuit board is quite small but component layout is excellent. Some of the 1/8W resistors are located beneath the integrated circuit, so special care should be taken to see that the right values are properly located. It is difficult to change them later

Although the track and soldering lands are very small, soldering is not difficult. The board is well defined and has good track spacing for its size. I suggest, if you have some doubt about your soldering ability, that you practice a little before starting. A 30 to 50 watt iron with a tip 1/16" or smaller in diameter is required, (i.e., Ungar soldering iron with micro-needle tip No. PL340 3/64"D). Always clean the tip on a damp sponge before each soldering operation. Apply enough heat to allow the solder to flow. then get off it. Do not overheat. And, finally, don't apply too much solder on the joint. It's not necessary to blob it on. Practice with these points in mind and you will encounter little difficulty. When it comes time to assemble the amplifier.

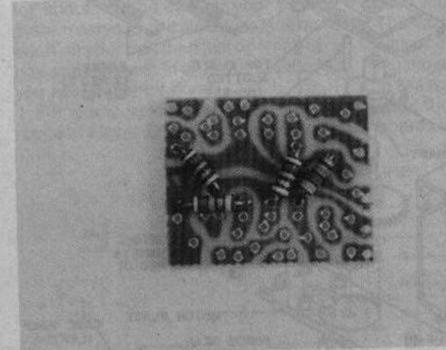




The Royal Tech VII servo amplifier kit. Good instructions, few parts make an easy one evening project. Quality parts are supplied.



The RS-5 servo mechanical parts kit. Gear train is pre-assembled, making assembly time much shorter.



Building the amplifier board begins by installing 4 1/8W resistors. Take extra care at this point for proper value & locations. Resistors are buried under integrated circuit, making them extremely difficult to get to later.

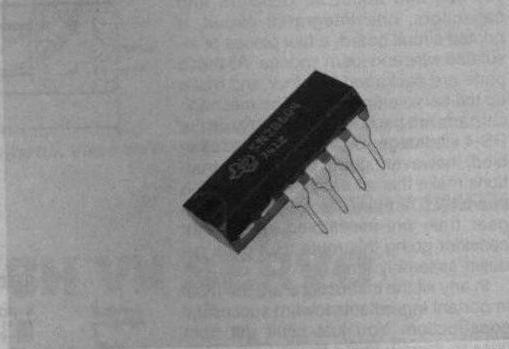
be sure to use a good grade of rosin core solder (not supplied).

The SN28604 integrated circuit is used exclusively throughout the different amplifier boards. In each case this IC is modified or wired differently to satisfy system compatibility. In the Tech VII amp the SN28604 is modified by removing pins 1 and 2. It is entirely possible for

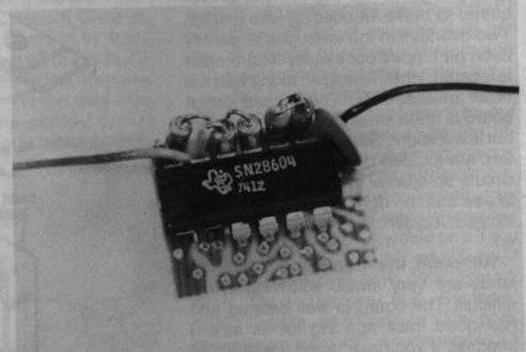
one to cut off the wrong pins and render the parts useless. Make certain of the lead, before you proceed!

The mechanical parts go together quite easily. Assembly instructions are very complete and lead you step-by-step along with photos of the actual assembled servo mechanics. On the back of the assembly instructions is an

The RS-4 servo mechanical parts kit. Assembly is easy with the excellent exploded view line drawing supplied in the kit.



Modified IC. Pins 1 and 2 are removed to satisfy wiring for positive pulse system.



Completing Figure 1 of the instructions, partially filled board shows neat and orderly layout. Installing components in order of sequence is a must.

exploded assembly drawing identifying all the parts that make up the servo mechanics. With this excellent drawing it is virtually impossible to become confused. It also makes a handy reference sheet for ordering parts should the occasion arise. Any part of the servo kit can be ordered from Royal. I mean every part! Right down to the #2 x 3/16 screw

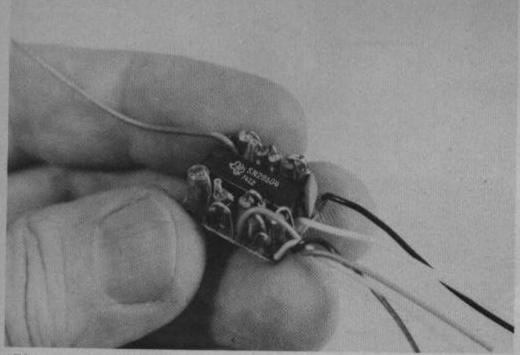
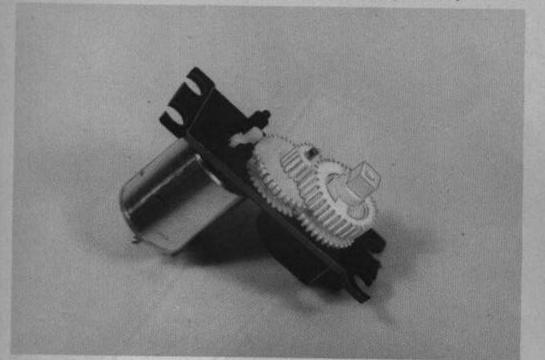
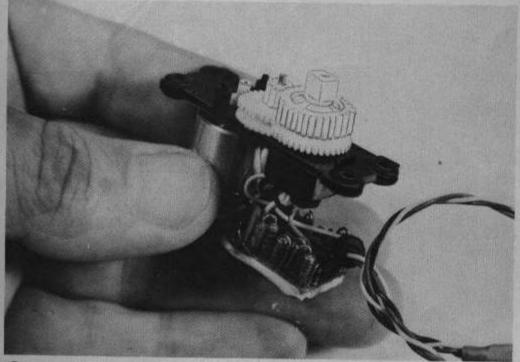


Figure 2 of instructions completed and ready for inspection. Cable wire and connector are not supplied with kit but can be ordered from Royal separately.



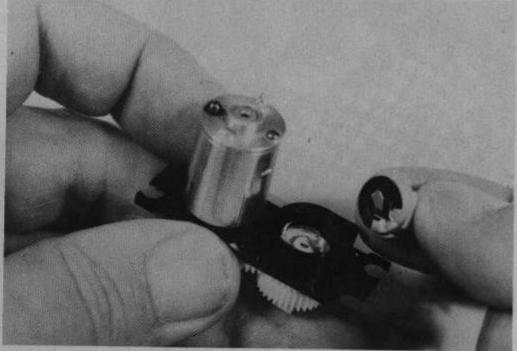
Mechanical section of servo with motor and gears installed.



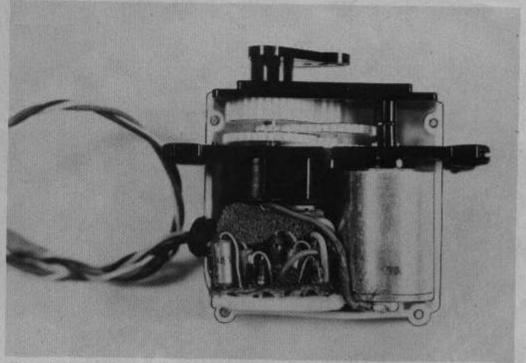
Completed servo ready to be installed in the case.



Carefully inspect track side of board to make sure there are no solder bridges or foreign matter between lands. Solder flux is easily cleaned off with dope thinner.



Pot element is lubricated with a special lube available from Royal. Pure Vaseline can also be used. Apply sparingly.



Ready for final closing. Note sponge between amplifier and potentiometer. Helps to restrain wires under vibration. Double sticky foam tape on bottom of circuit board does great job of retaining amplifier in the case.

that retains the output arm.

It never ceases to amaze me when, after spending many blurry-eyed hours reading, soldering, assembling and checking, that little blob of electronics does work. After all you expect it to, however, there is that nagging question, will it?

Past experience on hundreds of IC

servo amplifiers sent back to Royal shows that the major causes of improper operation or non-operation can be traced to building errors. Failure of the IC to function is rarely the cause of malfunctions. However, it is possible to damage the IC by applying power when a solder bridge or other short circuit is present in the circuit board. Once again, the in-

structions come to your rescue. Two full pages are devoted to a troubleshooting guide listing the symptom, possible cause, and cure for the most common malfunctions and possible causes. For the technical kit builder with an oscilloscope, one page is devoted to wave shapes at different pin locations on the to page 142



### **ROYAL TECH SERVOS**

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integrated circuit. The troubleshooting guide will come in handy later on should your servo malfunction after operating successfully.

Final assembly of the servo is quite simple. The amplifier board fits in the case easily. A piece of double sticky foam tape is placed on the track side of the amplifier board, allowing about 1/8" of tape to extend over the edge next to the motor. The tape has two functions, in preventing the board from shorting against the motor case, and holding the amplifier board firmly in place. A small piece of sponge tape is placed between

the amplifier and the pot to help retain the wires soldered to the pot.

It is interesting to note that Royal suggests potting the motor wires with Pliobond cement. To further protect against vibration, Pliobond cement is also applied to the wires soldered in the PC board. I particularly liked this idea. It adds that little extra bit of insurance.

The completed servo looks very professional, in fact, from outward appearance you would be hard pressed to tell it was a kit. In operation, the resolution is good. The servo centers very well with no bounce or overshoot. It is fast, responsive, and fits into my system with no operating problems whatsoever.

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My Royal servo has been flying around for sometime now and works simply great. I have it operating the elevator in my .15 powered Top Dawg sport racer. As a side comment, the rest of the radio gear in my racer includes: A WE S10 servo on the rudder, an Ace bantam servo on throttle, an Ace 1-8 Commander receiver, a Kraft 450 ma battery pack and, finally, a Proline transmitter. I have encountered absolutely no trouble with this combination.

Yes, it is possible for you to have that extra servo in your system and at a very reasonable cost. Why not try a Royal kit as I did? It's just not that difficult. Prices to page 146

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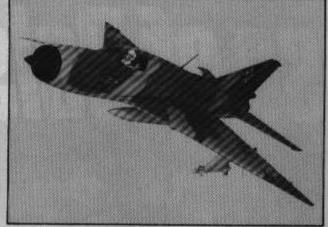
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### ROYAL TECH SERVOS

from page 142/44

start at \$23.50 for the RS-4 and RS-5. You can save even more per servo by taking advantage of Royal's package price, i.e., 2 servos \$44.66, 3 servos \$63.45, and 4 servos at \$79.96. Servos and parts can be ordered from Royal Electronics Corporation, 3535 South Irving Street, Englewood, Colorado 80110. Send for their literature and look 'em over.

### **KESTREL 19**

from page 130/43

of the wood contained in the kit was of good quality, but could have been improved if the strip material had been pre-cut. The Kestrel 19 kit comes with all the material to make a highly detailed cockpit including a headrest and an instrument panel — these items are of a styrene material as is the canopy base. All-in-all, an excellent kit.

With regards to flight performance, the flight characteristics of this model are outstanding. It goes up straight on the hi-start and only requires the slightest movement on the controls for any needed correction. Once off the histart, it has one of the best glide ratios this reviewer has seen. It thermals well on the lightest lift and, if a really good thermal comes along, it will climb at a fantastic rate. It turns well and has no bad tendencies to tip stall at low speeds. Response to the controls is excellent under all conditions and, due to the overall good design of this airplane, it has a wide-speed range. The landings are smooth and extremely scale-like. We would not hesitate to recommend the Windspiel Kestrel 19 to any sailplane enthusiast who wants a high performance machine with scale appearance.



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