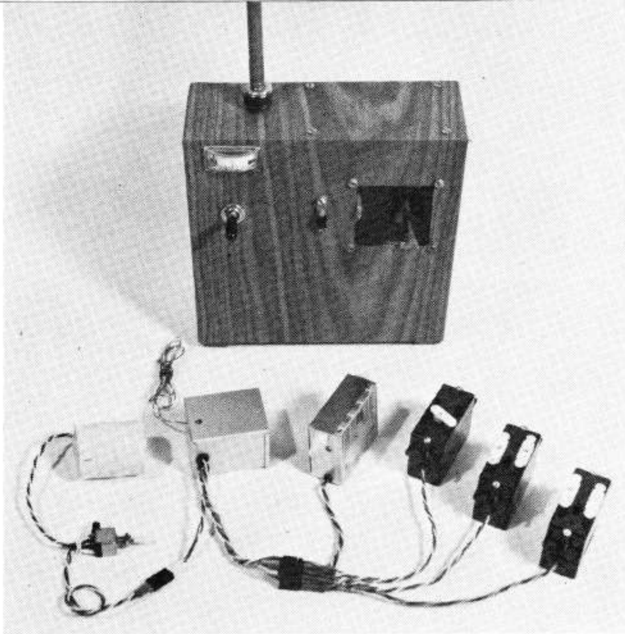
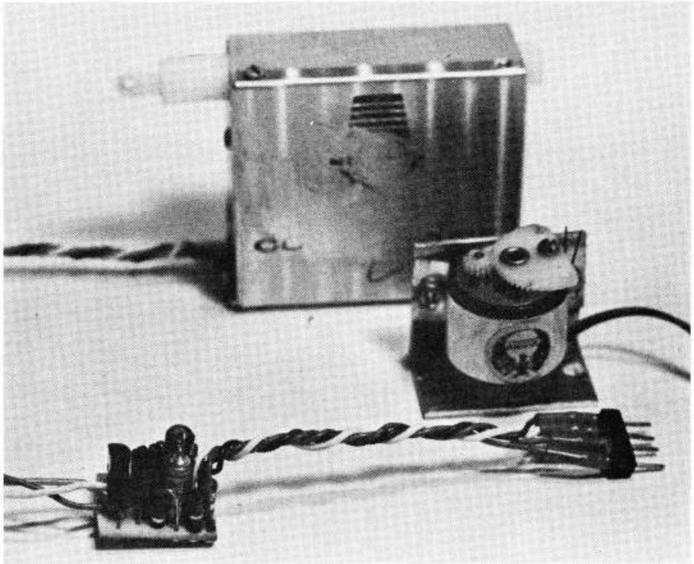


Maximum use of single-channel gear with Versapro components is four-servo system suitable for 60-powered stunt planes. Weight, size, and power are comparable with modern digitals.



Trimmable throttle operation is easily achieved with mechanically or electrically limited trim servos using Versapro dual POD. It fits easily inside ANNCO, Controlaire, and Bonner reed servos.

VERSAPRO SS-3

VERSAPRO SERIES SYSTEM — CONCLUSION

Throttle servo POD driver construction, elevator retention during engine speed changes, use with most receivers, and the SS-4 configuration.

FRED M. MARKS

THE Versapro SS-3 is the full-house version, or the Mode-4 configuration of the Versapro system described in the May '69 issue. The decoder described contained the pulse-width driver and filter, the pulse-rate decoder and filter, and the analog signal lock-out to permit independent control of two analog channels plus full on and off for throttle control or, alternatively, extreme pulse width for throttle with elevator control retained.

The basic units for all Versapro systems are the same for all modes: The decoder, the conversion for the Rand servo, and the POD throttle drive. All modes are obtainable simply by the combinations of servos chosen.

The pulse omission detector: Those who fly the current Galloping Ghost or decoded pulse systems are aware that just four throttle positions are available from the go-around servos. The pulse-omission detector (POD) and throttle servo drive are combined in one unit designed to permit trimmable throttle from either a reed-type servo or from a very simple lightweight positionable servo. The objective was to provide the third function which completes the SS-3 system. Upon completion of the POD and the decoder, we now have proportional rudder and coupled aileron, proportional elevator, and trimmable throttle.

The throttle unit is also quite attractive for use with any pulse system to provide infinitely trimmable throttle via an auxiliary trim servo, instead of the usual four positions. More thrust, easier mounting, and instant response are also achieved.

The proportional servos may be existing feedback servos (listed in the previous article) or they may be converted Rand servos as described in the March issue.

Fig 1 presents the schematic for the POD servo drive. The signal lead connects to the rudder servo driver output, thus sees a pulsing alternately positive and negative signal. The 1N34 diodes steer the proper polarity to Q1 and Q2 and their respective holding circuits formed by C1 and C2 and the 2.2K resistors. Q1 and Q2 are biased on by the two 2.2K resistors. However, as long as the pulsing signal is present, both C1 and C2 are charged and can only discharge through the 2.2K resistor and Q1 and Q2. The charge on C1 and C2 is opposite the polarity provided by the 2.2K resistors, thus both Q1 and Q2 are held off as long as the pulsing signal is present.

The 100 ohm resistors serve as collector load for Q1 and Q2 and also bias Q3 and Q4 solidly off.

Application of full on, or high throttle,

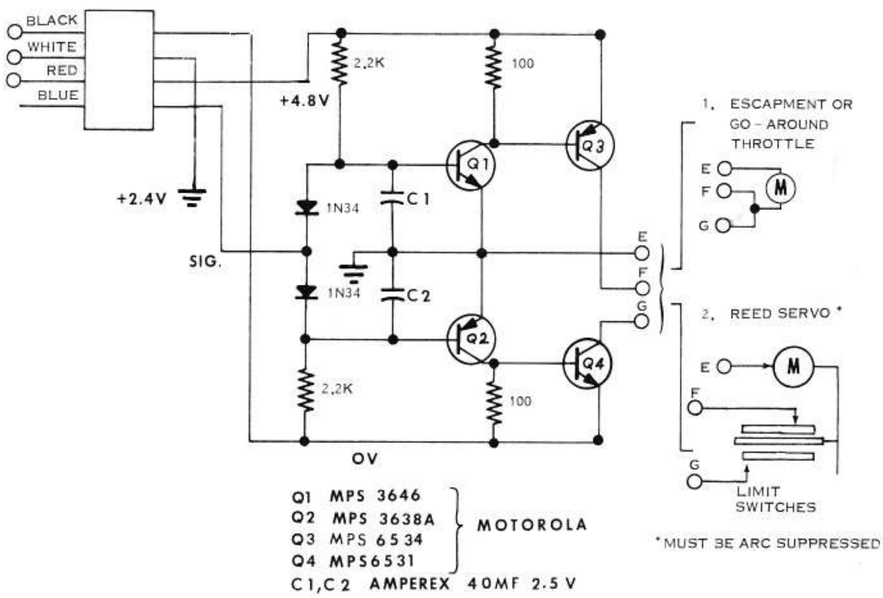
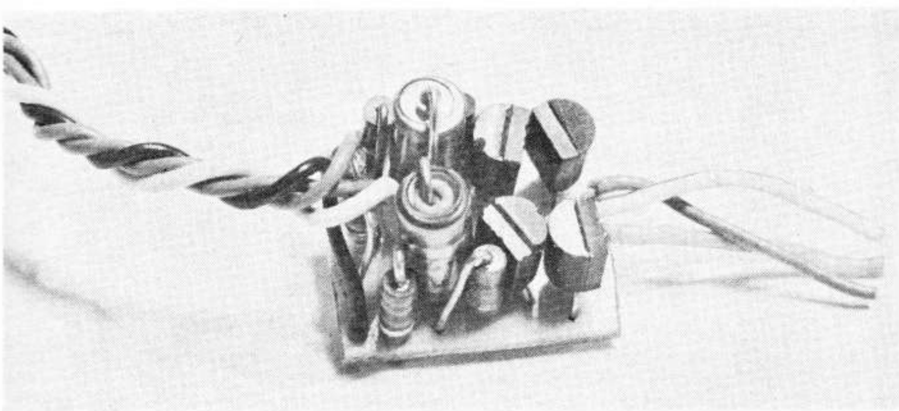
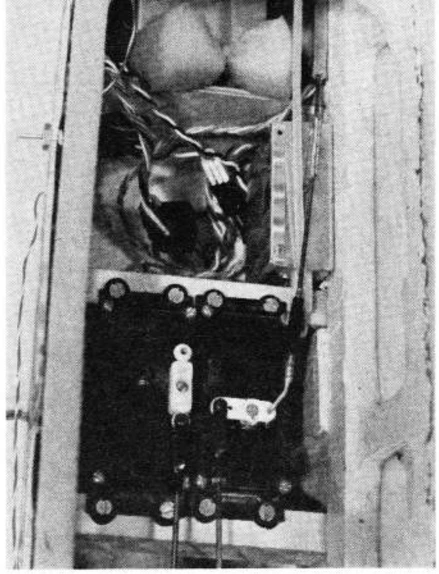


Fig. 1 Circuit is deceptively simple. Two pulse-ommission detectors hold off the drive transistors during pulsing and one, or the other, drives with on-or-off signal of length greater than 1/10th second. Parts substitution not encouraged.



When constructing the POD carefully check transistors, capacitors, and diodes to have proper orientation and polarity. Note flat side of transistors and tops of capacitors.



SS-3 is actively flown in Skylane 62 using Controlaire reed servo with POD and older Orbit PS-2A analog servos. Lead pix shows newer, better Orbit PS-3A analog servos.

presents a steady positive signal at the junction of the two IN34 diodes. This biases Q2 solidly off and permits C1 to discharge through its 2.2K resistor and Q1, in about 0.1 seconds at which time Q1 is biased through its 2.2K bias resistor and, in turn, switches Q3 on to drive the throttle servo. Full signal off simply causes the same chain of events through Q2 and Q4 to drive the throttle servo in the opposite direction.

A lightweight trimmable servo is available by modifying an Airtrol pulse servo by opening the centering spring to the point at which the segmented gear still just barely meshes with its pinion at each end. You may also construct a similar simple unit. It is best to have it geared down well over 200 to 1 to avoid an extremely rapid transit time. A Ballamatic or Trimomatic servo can also be used.

If an infinitely trimmable throttle servo is desired with electronic limit switching, then almost any good reed-type servo can be used. The general limit switching arrangement for a trim-type reed servo is depicted in Fig. 1. The exact lands and arrangement for almost all reed servos are different, therefore, you must ascertain the arrangement in the servo used and wire accordingly.

The POD throttle driver is quite small (5/8 x 3/4") and can be mounted with servo mount tape either inside or on the chosen throttle servo.

Construction of the POD throttle drive is a matter of minutes. The full size PC layout is presented in Fig. 2. Fig. 3 presents the layout of components and transistor basing. The decoder presented last issue has the necessary output or you may simply wire the POD into your own G.G., or decoded circuit observing the polarities shown on Fig. 1. The input signal is the pulsing servo drive signal in this arrangement. Diodes have banded end up. The POD driver will be available through ACE R/C in kit form.

Retaining elevator during throttle changes: The primary means for throttle changes for the Versapro system is full signal on or full signal off. However, the desirability of retaining elevator during throttle changes can not be overlooked. The use of electronic decoding, which triggers only on the leading edge of each pulse, permits the rate decoder to continue to function at pulse widths in excess of that needed for rudder control and in fact, sufficient for relatively fast go-around throttle movement with normal pulse servos. When this technique is used with the go-around type feedback conversion of the Rand servo, throttle changes are obtained much more quickly than for the usual Rand servo since there is no centering spring to restrain rotation.

No changes are required to the decoder to permit elevator control to be retained. However, the Versapulse transmitter presented in the April issue must be modified slightly to provide extreme pulse-width changes instead of full on and off.

Fig. 4 and 5 show the changes required. First, remove all wiring from all six lever switch contacts. Remove these wires at their opposite end from points B, C, and J on the pulser/audio board and from the power switch. Don't forget to remove the jumper from contacts 2 and 6. Next, run a jumper between points B and C on the pulser/audio board. Referring to Fig. 4, connect a jumper between contacts 2 and 5 of the lever switch and connect a hook up wire from contact 2 to point Z on pulser/audio board as shown in Fig. 5.

The final step in the modification is selection and installation of R1 and R2 shown in Fig. 4. Install a 2K potentiometer between Lug 1 of the power switch and Lug 1 of the lever switch. Operate the system with both servos centered exactly. Close contacts 1 and 2 of the lever switch and adjust the potentiometer so that the rudder/throttle servo goes around at the maximum rate obtainable without disturbing the elevator. Now check operation at full up and down elevator. If necessary, increase the setting of the potentiometer if a tendency for elevator position drift appears when throttle is changed at full down elevator. In no case should rudder command be given during throttle changes since the pulse widths will be additive and full signal will result in elevator go-around.

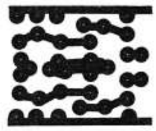


Fig. 2

Full-size copper-side printed-circuit board can be made with X-acto knife cutting lands on PC board material. Photo process is best.

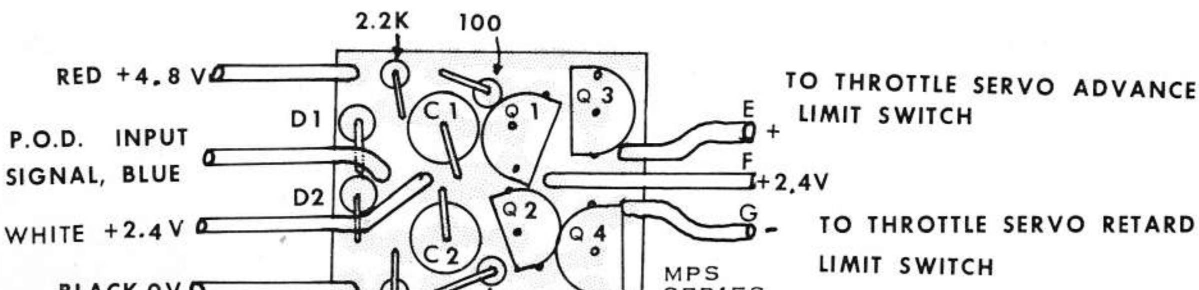


Fig. 3 **Using this parts-location diagram, the POD is easily assembled. Be careful not to mix up transistors; four types are used. Mount POD in servo with double-sided servo-mounting tape.**

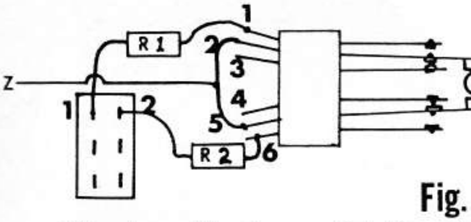


Fig. 4

Wire transmitter lever switch for extra-wide pulse-width throttle operation by tailoring R1 and R2 to suit your own set.

Remove the potentiometer and replace it with the nearest value fixed resistor. Use sleeving over the resistor leads to prevent inadvertant shorts. Repeat the above process for R2, bearing in mind that throttle rotation will be in the opposite direction.

Because the system can be operated at higher rates than for G.G. or most rate-decoded systems, spring centering can be lightened considerably for faster servo go-around.

Compatibility with various receivers: The Versapro decoder was designed for operation with the ACE Commander DE superhet receiver. It has been flown with a number of other receivers both relayless and converted relay types. These include the Controlaire SH-100, and Controlaire (4 regen) Citizen-Ship SSH and SSH-P models, Cannon single-channel superhet, Min-X SH-1, and the C & S Finch.

Most of these require no changes to the decoder but operation can generally be optimized by a) increasing the value of R1 on the decoder to 330 ohms and b) operating with the maximum audio frequency the receiver will accept. The reason for both is the same; to provide the most effective filtering of the audio signal. Any audio signal appearing at the rudder driver output will completely disrupt operation of the rate decoder and must be eliminated.

Relay receivers are readily converted by removing the relay. The relay drive signal then becomes the output signal just as for the relayless receiver. It may be necessary to increase the relay filter capacitor (normally a 10 to 15 microfarad) usually connected across the relay coil input points to filter more effectively.

The only receiver tested which required further change was the C and S Finch, a relayless super-regenerative receiver. Fig. 6 shows the simple modification required to the decoder. This modification may be necessary on most of the relayless regen receivers since it seems most of them have a large capacitance in the output circuitry and the transistor must have a collector load prior to the voltage dropping diode.

Operation and versatility: If you yearn for a brand new radio-control system to fly a full-house acrobatic airplane, this is not the rig for you. However, if you have a quantity of pulse equipment or perhaps some of the elements of the Versapro, then you can expect to have a versatile system for operation of a wide variety of aircraft types. The units described in this series have been flown in gliders, a number of rudder-elevator-throttle planes such as the S-Ray, Skylane 62, Falcon 56, Mambo Special, an American Products full-house, a Beachcomber, and in a low wing version of the Senior Falcon. There is no real performance limit.

In this article series, we have presented Versapro SS-1, SS-2, and SS-3. There also is an SS-4 version. SS stands for Sport System. The suffixed number refers to the number of servos you can use.

SS-4 is simply flying with the rudder and aileron servos coupled. All-out low-wing planes are flown with a coupled servo for the aileron function. With these planes, only two full-time proportional controls are required, aileron and elevator. The throttle and rudder are secondary. To get the most out of the system, the rudder function can be uncoupled at full throttle, although flying with coupled rudder and aileron is no problem in itself (but the rudder throw should be restricted).

With an uncoupling rudder function, normal full rudder travel can be used. For this full-house operation, switch the aileron and rudder signal leads at the decoder PC board. Now the separate plug is the primary directional control. Also bring out a lead from the new rudder signal lead at the PC board and a lead from center tap at the PC board. With the system operating, notice that touching these leads together will neutralize the rudder servo but permit the aileron servo to continue following the control stick.

Hook these two leads to a micro-switch mounted on the throttle servo. Set it up so that full throttle closes the switch and uncouples the rudder servo. In flight, or on takeoff, retarding the throttle gives coupled operation. During stunting at full throttle, the rudder is centered.

Readers and users comments on Versapro and its concept are most welcome. Please write author in care of American Aircraft Modeler, 733 15th St. N.W., Washington, D. C. 20005.

CORRECTIONS

In the SS-1 article, in the March issue: a) Fig. F erroneously tied the signal lead to OV (center tap). The center tap should go only to the bottom of the three capacitors and to the servo plug; b) Fig. D, battery C.T. is called out with —2.4V. Battery C.T. should tie to the PC land immediately below, at the junction of the three capacitors.

The remaining articles of the Versapro series will use OV to indicate the most negative side of the battery, +2.4V to indicate the center tap of the battery pack, and +4.8V to indicate the most positive side of the battery. The diagrams of the switcher/filter schematic and parts layout used OV as center tap with —2.4V and +2.4V at the sides of the battery measured from center tap. Switcher/filter diagrams should be corrected to the OV, +2.4V and +4.8V style.

The Versapulse drawings (April 1969) contain two errors: a) Point J on Fig. 4 should be at the junction of the emitter of Q6 and the two 1K resistors, Items 35 and 36. Point J is located properly on Fig. 5, and the lower left lead of transistor Q6 on Fig. 5 should be labeled the emitter, e; b) The color code on the leads going to points E′ and D′ on Fig. 6 are transposed; i.e., the red lead should go to D′ and the black lead to E′. As to the value of CD1 and CD2: these can be any silicone diodes capable of carrying 400 milliamperes with a PIV of at least 100 volts for a reasonable margin.

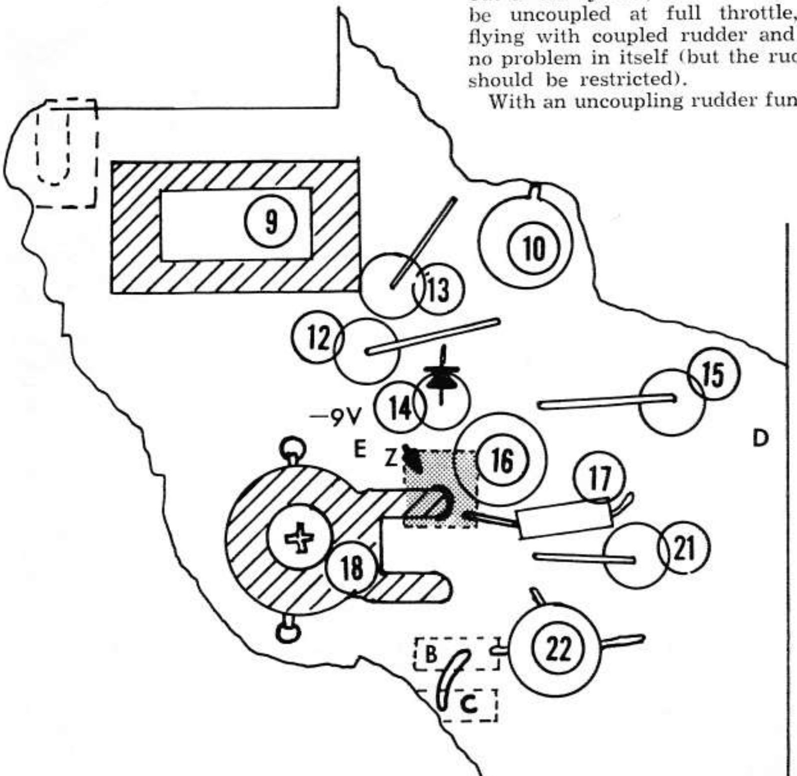


Fig. 5 **Contacts 2 and 5 from lever switch are joined and attached to land Z on encoder. Lands labeled B and C are jumpered. Elevator function is retained to avoid unsightly galloping and go-around servo hang-up.**

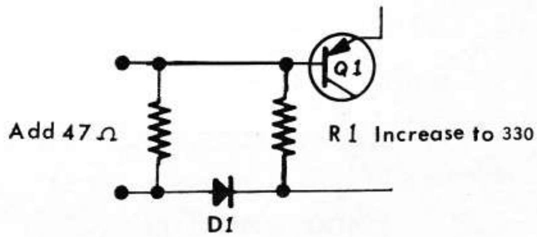


Fig. 6 **A larger tone-filtering capacitor and loading resistor may be needed on some receivers in front of voltage-dropping diode.**