

# RCM PRODUCT REPORT



## CITIZEN-SHIP DP-5 PROPORTIONAL SYSTEM

**T**HE Citizenship digital proportional system is one of the most recent entries to the growing list of digital systems being offered for sale. It is offered by one of the oldest manufacturers of radio control equipment in this country. As usual, for Citizenship, the price is highly competitive and "frills" have been omitted toward this end. I saw one of the early prototypes of this system at the 1965 Garden Grove Trade show and discussed the system with Citizenship's representative, Bill Welker, who has since won or placed in several contests with the system during its flight evaluation tests.

The system submitted for this evaluation was selected at random from Citizenship stock to insure "average" characteristics. The equipment arrived with the transmitter battery clamps broken and the transmitter crystal apparently "jarred" loose from its socket and rattling inside the case. The transmitter battery clamp is made of plastic and the crystal has no retaining device, so the results are not surprising after a game of "Post Office Football." No damage to the transmitter was caused, and after replacement of the clamps and

crystal, the transmitter worked perfectly.

### GENERAL

The Citizenship system is a five channel digital type using a "spiked" off carrier for intelligence transfer between the transmitter and receiving equipment. The transmitted pulses have a period of 200  $\mu$ s and the duration between pulses is nominally 1.5 MS for servo centering. Extreme movement of servos occur at 1 and 2 MS duration, respectively, between transmitted pulses. The transmitted pulse train consists of six pulses, which are independently controllable at the various control sticks, plus a sync pause to insure proper commutation at the decoder. The composite pulse train is repeated every 16 MS. The receiver/decoder processes the transmitted pulses and sorts them into five independent channels. Each channel is applied to its separate servo where pulse duration is compared and proportional positioning of the servo output arm is accomplished.

Operating instructions supplied with the system are complete and include schematics.

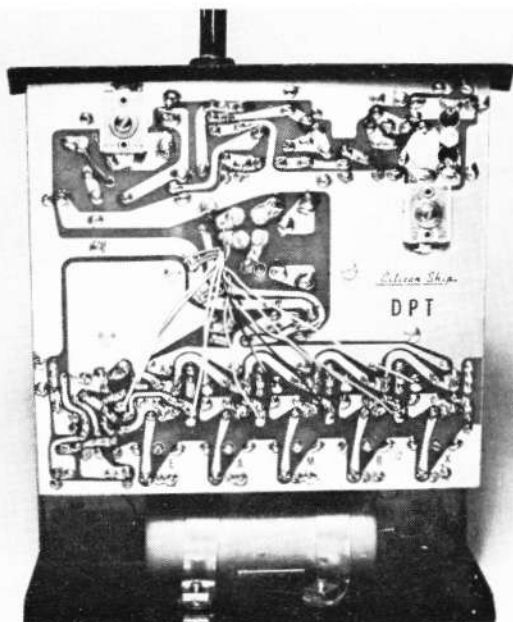
### TRANSMITTER

Overall external appearance of the transmitter is one of economy with prime consideration given to grouping of the controls. In short it was designed to be strictly functional.

The most notable omission on the front panel is the meter. Meters can be useful for monitoring transmitter operation, however, they are expensive, and its omission is one of the methods used to keep the system cost down.

Internally, the transmitter is well engineered with production considerations evident throughout. It was engineered for ease of duplication, fast assembly and uniform results. This is to the modeler's benefit. Generally speaking, the less time a system spends in buildup and quality control the lower the cost to the modeler. This is one area where Citizenship can take advantage of their lengthy experience in the RC manufacturing business and pass on savings to the modeler. Also on the plus side is the use of quality components throughout the transmitter. This doesn't save the modeler money but might save him several airplanes!

Electronically, the transmitter is well



Good electronic circuitry characterizes the Citizen-Ship DP-5 transmitter.

designed and uses tried and proven circuits throughout. The power output of the transmitter is average for digital systems and should prove to be adequate. The control sticks, while not exceptional in design, are nevertheless ingenious and their action can also be termed adequate. Although not mentioned in the instruction manual, there are trim pots along the bottom of the PC board which allow servo centering adjustment should this become necessary.

#### RECEIVER/DECODER

Here, again, production considerations and quality parts are evident. The overall size is a bit large for the circuitry contained but strong enough to withstand severe crashes. The circuit design of the receiver is good with adequate decoupling and temperature compensation. The sensitivity is not outstanding but, again, should be found adequate. A ceramic filter is used in the first IF stage emitter for better selectivity and dual level AGC is used for

operation over a wide range of input signal level. Three stages of audio amplification/wave shaping is used prior to the decoder. The decoder uses three flip/flop stages of the modulo type in conjunction with five transistor gates to sort the pulse train into five separate outputs for the servos. A two stage hold off and fire type sync generator insures proper decommutation. All waveforms observed throughout the receiver/decoder were clean and the pulse timing was well defined. In short, the receiver/decoder is well designed and should present trouble-free operation.

#### SERVOS

The servo uses a one piece PC board and features electrical limit stops. The electrical limit stops will prevent damage to the motor output transistors and gear train if, for some reason, the servo runs to either extreme, such as failure to turn off the receiver before the transmitter when adjacent channel transmitters are in operation. The servos have smooth action and are capable of +- 1-2% neutral return. Electronically they are well designed with the same high quality parts as used in the rest of the system. Mechanically, however, they fall short of some of the higher priced proportional systems. While this is understandable, due to the lower price of the Citizen-Ship system, the suggested selling price for each servo is as high or higher than that of their higher priced competitors. Of special note is the lack of provision for shock mounting. Also, the output arm slot is directly above the contact fingers and provides a gaping hole for entry of foreign materials and unburned fuel droplets which can cause trouble. The best way to clean or adjust the wiper assembly properly would be to disassemble the entire servo, which could get the average owner into more trouble than he could handle.

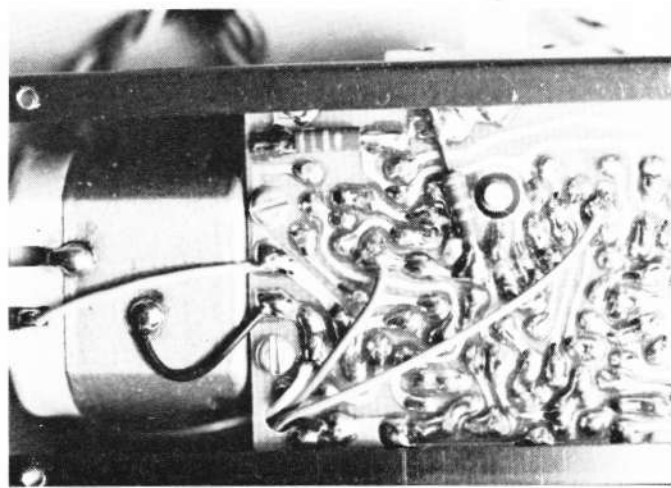
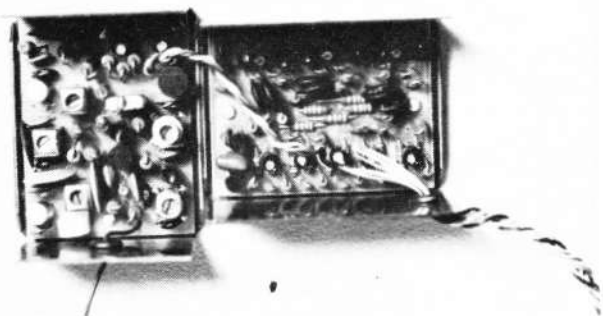
A 3-pole motor is used for power and it uses silver plated wiper brushes. Two brushes are used on each side of the commutator and should provide good reliability. The mechanical construction of the servo motor is of medium quality and should prove adequate.

#### FINDINGS/RECOMMENDATIONS

The only problem encountered during this evaluation was failure of one of the servos during the upper temperature limit check. This servo failed at approximately 140 F when one of the motor driver transistors shorted internally. The equipment was checked quickly up to 155 F without further incident. This failure was apparently due to a defective transistor. The equipment was then checked as low as 20 F with perfect operation. It was obvious that it would go even lower (Citizenship says 0-140 F).

The servos started without hesitation pre-loaded at 4 lbs. with a spring scale. The transit time was measured without load at approximately .8 second (Citizenship says .7 second). Slight servo interaction (jitter) was present continuously during tests, however the movement is so small that it shouldn't be noticeable in flight.

Citizen-Ship receiver-decoder. At right, the Citizen-Ship digital servo with case half removed.



Receiver sensitivity is hard to rate unless the conditions under which it is tested, as well as the results, are specified. Also, I couldn't simulate modulating conditions accurately so I'll bow to Citizenship's integrity on this one. Personally, I didn't find that it was quite as sensitive as other proportional receivers that I have tested, but I do feel that it is entirely adequate.

Selectivity is also hard to rate unless test parameters are specified but I did find it to be more than is needed and within Citizenship's claim at a moderate diode load signal voltage.

#### HERE ARE SOME RECOMMENDATIONS:

The servos should be shock mounted if installed in anything larger than a .19 powered airplane. This can be easily accomplished by shock mounting the entire servo board. A less effective way would be to use strips of resilient material under both ends of the servo (such as rubber weather stripping).

Check the crystal in the transmitter occasionally to insure it has not loosened in its socket due to rough handling.

Periodically (determined by usage) check the wiper assembly in the servo for foreign material and clean with a good electronic contact cleaner and lubricant. This can be done by removing the cover and spraying a small amount of the lubricant directly on the PC board where the wiper fingers ride (use it sparingly). I use Spra-Kleen for this type application, made by G. C. Electronics, and available at almost all Radio/TV Parts outlets. Don't take the servo apart unless you know what you are doing or have the assistance of someone who does.

#### CONCLUSION

The Citizenship digital proportional system should give satisfactory service if afforded reasonable care (especially servos) and servos are shock mounted. Electronically, except for the minor servo interaction, the System is well designed and no marginal circuits were evident. The quality of the electronic components used is equal to, and in some cases, exceeds the higher priced systems. My own opinion based on the other digital offerings is that the system is over priced mechanically and under priced electronically which comes out about even. A list of specifications supplied by Citizenship is included.

#### FLYING EVALUATION\*

The first flight evaluation of the Citizenship Digital System was performed, unknowingly, for us by Leon Schulman during a recent trip to California. Lee brought along Jerry Seiff from New York, and Jerry, in turn, brought along Ken Willard's Top Dawg, complete with Citizenship Digital on rudder, elevator, and motor. Power was supplied by an

O.S. Max 15. All up weight was 3¼ pounds with a wing loading of 23 ounces per square foot. The airborne antenna was a length of music wire which plugged into the aircraft's antenna socket. The plane was flown from an area 75 feet by 75 feet with all landings taking place in that space. Virtually every Class II maneuver that the Top Dawg could perform was performed with ease. At no time was any interference noted nor was there any

"glitches" or interaction noticeable. Range was out of sight and quite capably demonstrated by Lee who put the plane through its paces for us.

Subsequent flight testing of our own proved that the Citizenship would do exactly what was asked of it. No difficulties of any kind were encountered, and we feel that this new Digital system is a major improvement over its predecessor, the Citizenship Analog proportional system.

### GENERAL INFORMATION ON DP-5 SYSTEM

1. Five completely independent simultaneous proportional channels.
2. 500 MAH Nicad Packs supplied for both transmitter and airborne units. Only four cells used for receiver.
3. Wiring board eliminates jungle of wires at receiver and reduces vibration transferred to receiver.
4. All units completely wired and ready to operate.
5. System temperature compensated from 0° to 140° F.

#### DPT TRANSMITTER

1. ½ Watt input.
2. Weighs 2¾ pounds.
3. Built-in charger for receiver and transmitter power supplies with glow light indicator.
4. Simple rugged stick assembly. Positive position stick neutrals with piano key accessibility of trim levers.
5. Two models available: AMR — Aileron and motor on right  
AER — Aileron and Elevator on right.

#### DPR RECEIVER

1. Better than 3uv sensitivity.
2. Cleveite filter for maximum unwanted signal rejection.  
Signal 10kc removed down 22 DB.  
Signal 50kc removed down 70 DB.
3. Size 2½ x 1⅞ x 1¾.
4. Weighs 4 ounces.

#### DPC SERVOS

1. Size 2⅞ x 1⅞ x 1.
2. Weighs 3 ounces.
3. Over 4 pounds thrust.
4. .7 second transit time stop-to-stop.
5. Wire-wound feedback pot.
6. Linear output.
7. Electrical limit switch protection.