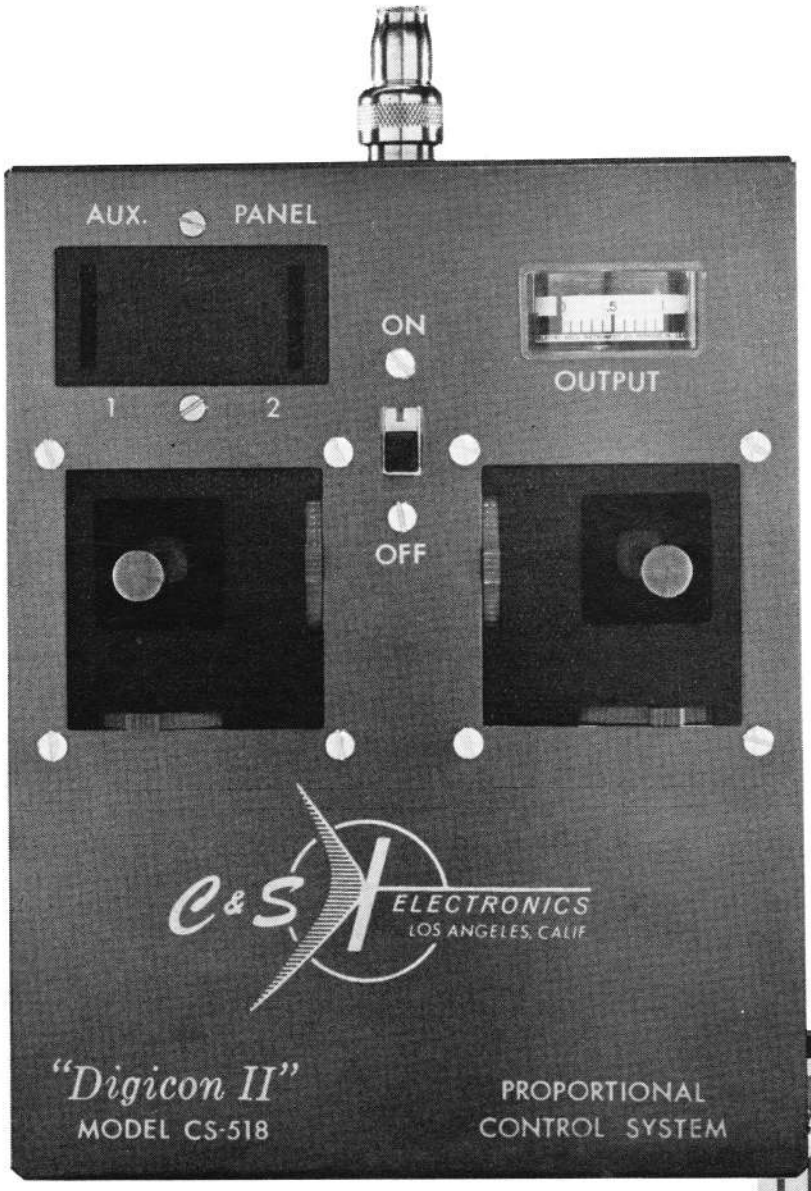
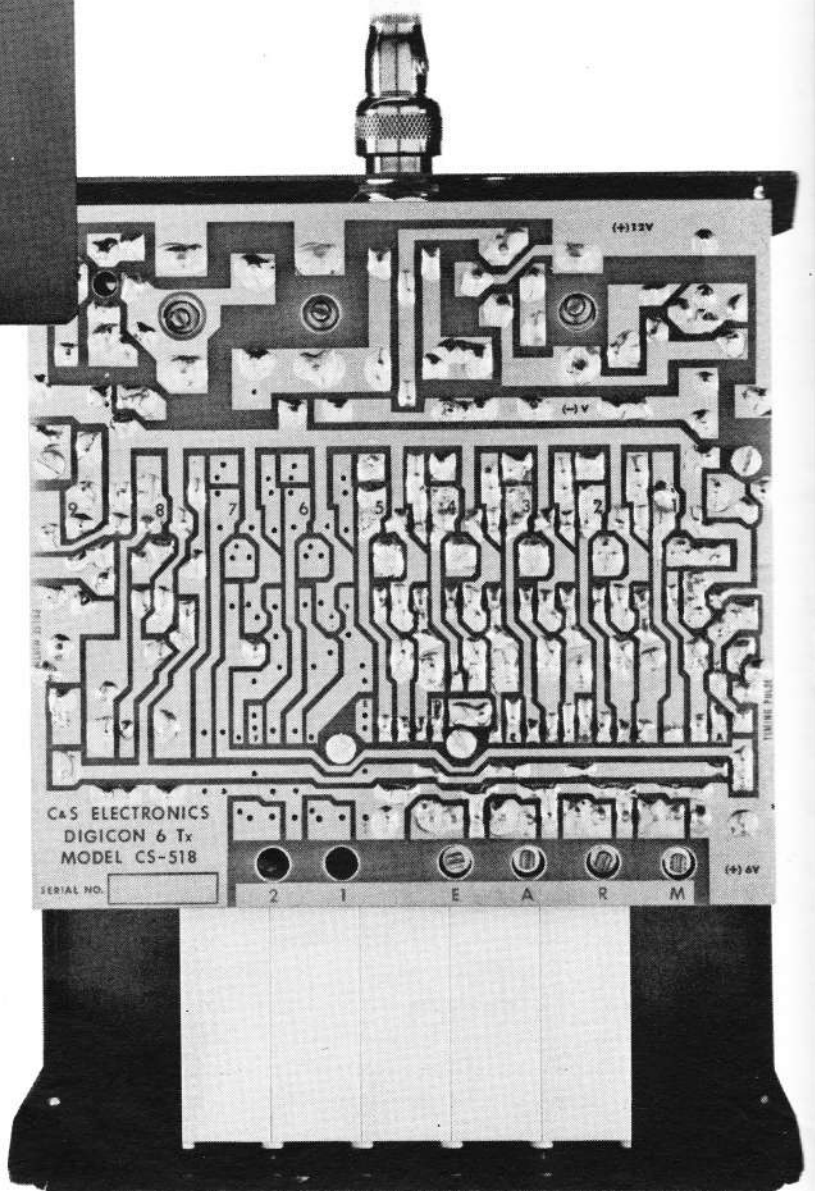
RCM PRODUCT REPORT:

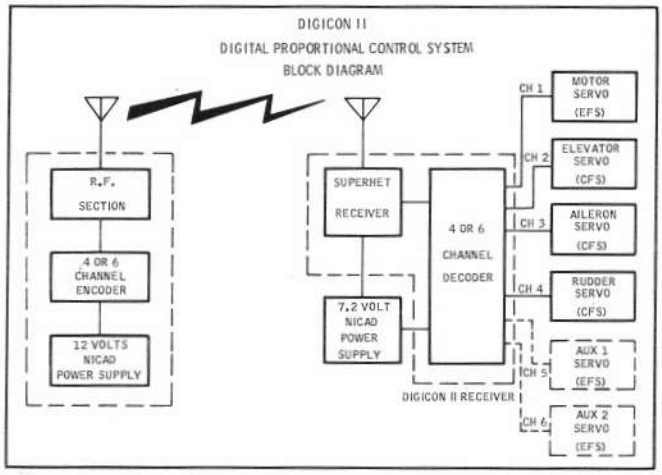
C&S DIGICON II

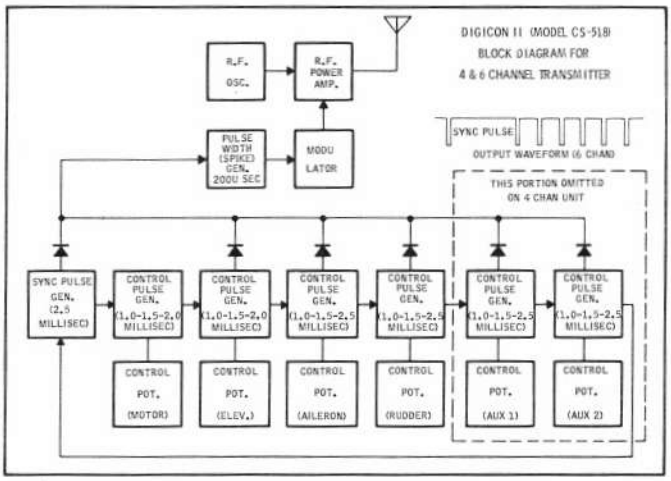
Proportional System

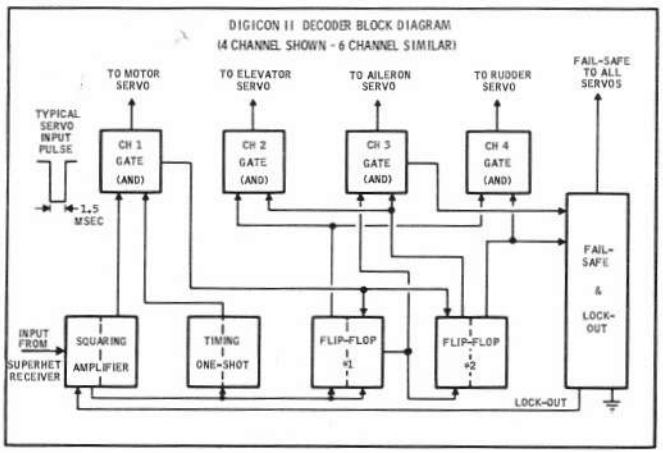


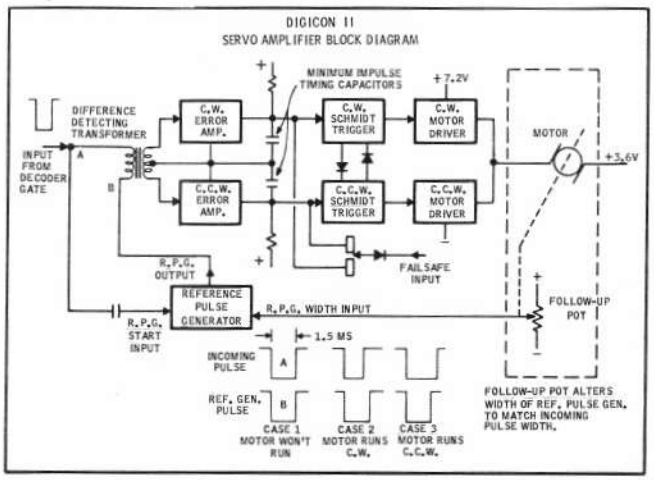


By Chuck Waas









THE Digicon II Proportional Control System, manufactured by C&S Electronics, 13400-12, Saticoy Street, North Hollywood, California, is available in a four channel and a six channel version. The former includes controls for motor, rudder, elevator, and aileron, plus flight trims for the last three functions. Total controls available would be the equivalent of a fourteen channel reed system. The six channel version provides two auxiliary proportional channels to operate optional accessories such as retracting gear, flaps, dive brakes, etc.

In order to provide maximum flexibility for the consumer, the Digicon II transmitter can be purchased as a four channel unit, and can, at the owner's request, be converted by the factory to a six channel configuration at a later date. The same is true of the receiver-decoder unit – the four can be factory converted to a six channel unit at the owner's request. All channels are independent, simultaneous, fully proportional control channels.

The Digicon II, as received at Radio Control Modeler Magazine, consisted of a fully tuned and factory tested transmitter (four channel), receiver, four servos, switch harness and plugs, batteries and charger. Total airborne weight of the system is 23 ounces. This is a digital type system utilizing solid state circuitry throughout. A separate battery charger serves to recharge the 12 volt transmitter battery and 7.2 volt receiver battery simultaneously. Both nickel cadmium units are of 600 mah capacity.

Digicon II Transmitter

The Digicon II transmitter is an all-transistorized unit delivering one of the highest power outputs of the many proportional systems we have tested at RCM – approximately one watt out! This output is monitored by an RF meter on the front of the transmitter, giving an indication of the relative battery condition.

The C&S Digicon II transmitter is well packaged, and employs the familiar overall green C&S color with yellow overprinting. Standard Bonner control sticks are used, with the elevator and aileron on the right, and rudder and engine on the left. Both sticks are self centering with the exception, of course, of the motor control function which remains in the preset position. All of the flight control surfaces are trimmed via a trim lever adjacent to each stick control axis. Basically, this is a single stick system, since most of your flying is done with the right hand stick – elevator and aileron. The left hand stick is primarily used for ground control.

The block diagrams accompanying this article will give a visual description of the theory of operation of the Digicon II system. Simply, the circuitry is basically a crystal controlled silicon transistor oscillator feeding two parallel connected silicon planar output transistors. Connection to the non-center-loaded antenna is made through a combination matching and loading coil.

An electronic ring counter is used to provide the timing control pulses which modulate the RF carrier, and contain the control information. Width of each of the pulses is varied by the related control stick pot in the transmitter to position the servos as desired. There is no control interaction between the various channels.

The operating voltage of the Digicon II transmitter is 12 volts D.C. The power amplifier input (current) is 100-120 ma and (power) 1.2 to 1.4 watts. Operation time on a single full charge is approximately four hours. The pulse train duration for the four channel system is 8.5 millisecond and 11.5 milliseconds for the six channel version. The frame rate for the four channel is 118 fps and 87 fps for the six. The timing pulse width is 2.5 milliseconds. Channel pulse width is variable from 1 to 2 milliseconds with 1.5 milliseconds neutral. The off time pulse is 200 microseconds. The overall tuning range is 26.995 to 27.255 with a frequency tolerance of .005%. Operating temperature range is 9 degrees F to +140 de-

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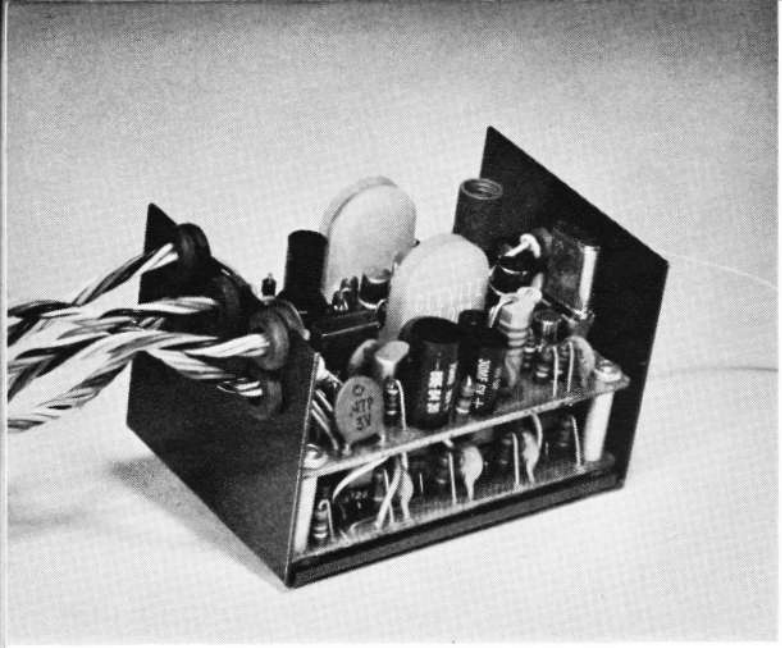

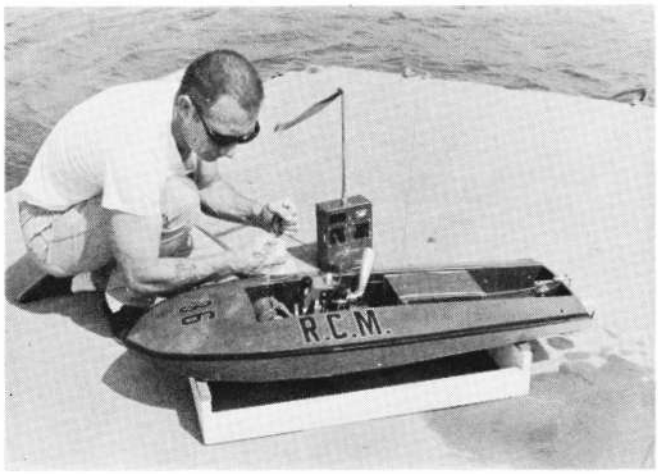

Left: Digicon II receiver-decoder. Above, Bill O'Brien fuels up RCM's White Heat.

grees F. Size of the transmitter is 2¾" deep by 6" wide by 7½" high. Antenna is 54" fully extended. Total weight of the transmitter, complete with battery and antenna, is 45 ounces.

Digicon II Receiver

The Digicon II Receiver is pre-cabled and employs color coded Dean's connector for easy identification of servo function. For example, orange (motor); black (rudder); yellow (elevator); green (aileron); red and white (auxiliary).

Solid state circuitry is used throughout the Digicon receiver, and includes Clevite Transfilters in the I.F. stages, replacing the more commonly used adjustable transformers, eliminating the possibility of transformer "misalignment" due to drift or vibration. Decoder logic circuits utilize diodes, resistors, and silicon transistors to decode the information from the receiver output. Individual channel outputs are obtained through AND gates and fed to the related servos.

The C&S proportional receiver has a narrow band width, rejecting signals 5 KC or more away from the receiver frequency. Sensitivity is eight microvolts or less. Reverse AGC prevents overloading at close operating ranges.

A "Fail-safe and lockout" circuit is utilized by C&S, providing a neutralizing voltage to center the servos when correctly decoded information is not received. When an extremely strong interference signal is received, a slight servo "dither" around neutral occurs, due to the sampling rate of the lockout circuit.

The nickel cadmium battery supply for the C&S receiver consists of 6 (six) 600 mah cylindrical Gould cells in a hi-impact Cycolac case.

Sensitivity of the Digicon II receiver is less than 8 microvolts for full control. Bandwidth is 4 Kc at 6db. Intermediate frequency is 455 Kc. Operating voltage is 6.0 volts nominal with a current drain of 65 ma for the four channel version and 85 ma for the six channel configuration. AGC operates full control from 8 to 100,000 microvolts. Operating temperature range is from 0 degree F to +140 degrees F. All standard R/C frequencies are available from stock and others on special order. Overall receiver dimensions: 1⅝" high x 1⅞" wide x 2⅝" long (four channel) or 3⅛" long (six channel). All-up receiver weight including plugs and wires is five ounces. The six channel version weighs one ounce additional.

Digicon II Servos

The C&S Digicon system utilizes the new linear mode Bonner-type proportional servos, although the internal circuitry is designed specifically by C&S in order to use these servo mechanisms with the Digicon II. Two types of servos are used – the center-fail-safe and end-fail-safe – the former for flight controls and the latter for motor and auxiliary functions.

Servo components and circuitry are housed in the high impact Cycolac case, the amplifier mounted on a small P.C. board in the case. The feedback pot and wiper lands are on a smaller P.C. board affixed at right angles to the main circuit board. One small poten-

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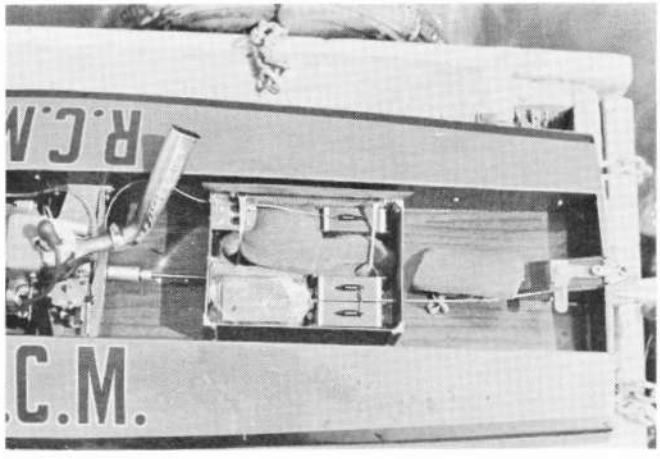
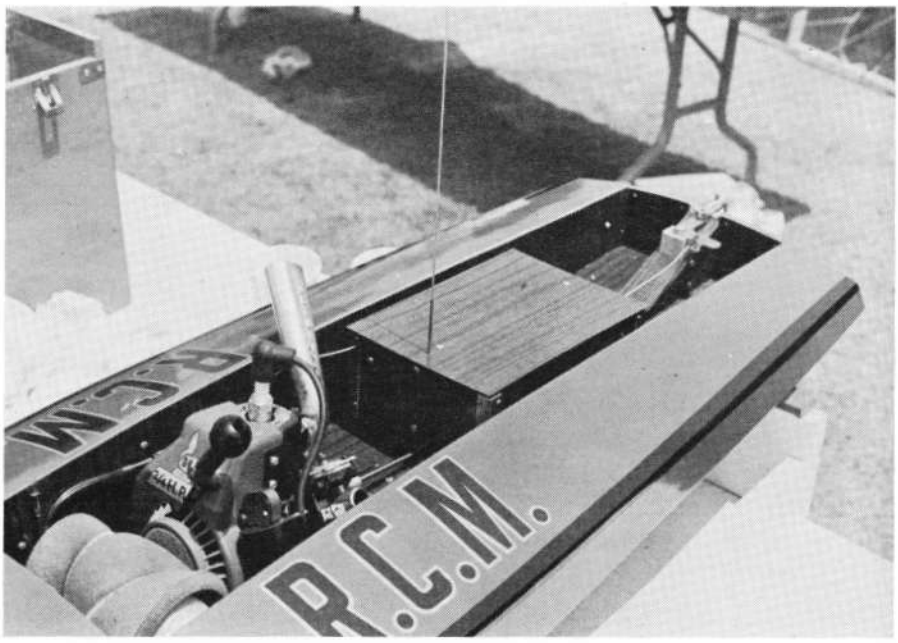
Bill Cannon of C & S looks on as RCM's C & S Proportional controlled White Heat rests between runs

Equipment compartment in the White Heat. Two C & S Proportional servos paralleled to give the needed 8 lbs. of thrust for rudder.





C&S Digicon

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tiometer in the servo provides for the centering adjustment of the output arm. This is pre-set at the factory and must not, under any circumstances be changed.

The servo output arm, driven by rack and pinion gearing, moves on upper and lower bearings consisting of 32 small steel balls.

The servo travel is a nominal ⅝" with a centering accuracy of plus or minus 1%. Response time is less than 10 milliseconds. Static thrust is 3½ pounds at any error amplitude. Operating voltage is 7.2 volts with a current drain of 20 ma at the neutral or command position and approximately .8 amp at full stall. Drift is plus or minus 1% in the temperature range of 0-140 deg. F.

Servo dimensions: 1" wide x 1¾" high x 3¼" long. Weight: 3 ounces.

Accessories

The battery charger provided with the Digicon II provides approximately 50 mils to charge the transmitter and receiver batteries simultaneously. The charger plugs into either plug on the bottom of the transmitter and the receiver into the other. A charging indicator lamp provides a charging operation reference.

A wiring harness with two slide action switches is provided so that equipment is ready to install with no wiring necessary for operation.

Price and Availability

The C&S Digicon II 518 is available from C&S Dealers for $495 for the 4 channel version, $500 for the 4 channel-factory convertible to 6 channels, and $550 for the six channel system. 4 channel to 6 conversion cost is $56.00.

Findings

All bench operational checks of the C&S Digicon II Proportional System were completely satisfactory and per the manufacturers specifications. No interaction of any kind was noticed. There was no servo drift through a variety of temperature changes. The aileron channel neutral was, however, quite broad. This was found to be a component defect in this particular unit. Upon spot checking two other C&S proportional systems available in local hobby shops, this particular defect was not apparent. It was brought to the attention of the C&S service department and corrected.

Since every proportional system we have evaluated at RCM has been checked out in a competition type aircraft, we decided to test the next available system in a competition racing hydroplane. Since the C&S Digicon II was "next up," the honors went to this individual system.

The unit chosen was RCM's new Octura White Heat V, equipped with Octura steering accessories and O & R Compact engine. Since proportional control has not yet come into major prominence in the R/C boating field, we were interested to find out its advantages and disadvantages. To begin with, far more power is needed to turn the rudder of a fast moving hydro than is usually necessary for model aircraft. Even when using powerful reed servos, wire spring assist is normally used in conjunction with the servo to aid in rudder control. For this reason, we used two C&S Digicon servos in parallel on the rudder, and one EFS on the throttle of the O&R. This proved to be more than adequate power, and turning

the fast moving hydro was absolutely no problem whatsover. In fact, the complete smoothness and precise control available enabled this author to place fourth in the multiple boat races at a local contest – and this was the first contest I had entered! The major advantage can be attributed simply to the completely precise, and definite incremental control afforded by this system.

Insofar as range is concerned, the C&S transmitter was operated as far as we could see the hydro, and at no time was the antenna fully extended on the transmitter! Range-wise, we sincerely doubt if you'll ever have trouble with this one watt power-house!

Overall, we have experienced no difficulties with the C&S Digicon II as specified. It is a well-constructed, smooth operating digital type system, manufactured and marketed by a well-known and respected manufacturer that should provide the consumer with a flexible proportional control system that will provide him with months and years of dependable, trouble-free service.