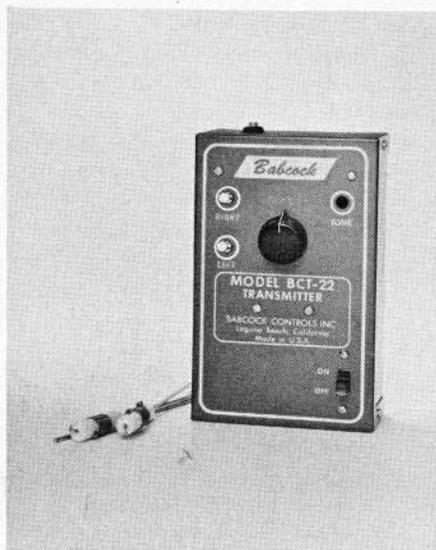


PRODUCT REPORT

BABCOCK BC-22



THE AGE OF PROPORTIONAL

. . . . THE FIRST STEP

In the October 1964 issue of RCM, we reviewed the Babcock BC-21 sport single channel system, designed expressly for the newcomer to radio control, and for the sport flyer demanding maximum reliability at a budget price. Included in this system were several unique design considerations, including an interference-free relayless superregenerative receiver operating at an audio frequency of 6000 cycles per second, and an almost completely pre-wired airborne installation, including the BCR-21 receiver, Mark VII 9-volt escapement, switch and test panel, and battery connection. As reported, and based on our test evaluations, the extreme range, interference immunity, and simplicity of installation, combined with a price tag of under \$50, made the BC-21 an ideal single channel package for the consumer market for which it was intended.

Following closely behind the BC-21 escapement system is the newly released BC-22 pulse-proportional single channel system from Babcock Controls. Unlike many new releases in the R/C field, the BC-22 is not intended to obsolete, nor replace, the BC-21. Rather, it incorporates all of the outstanding features of the "21" while eliminating the rubber-band driven escapement and providing, instead, a magnetic actuator

for rudder-only pulse-proportional flying. Designed for use in small aircraft up to, and including .049 size, the beginner or sport flyer can experience simple proportional flying with complete reliability and without straining the family budget.

As received by our Consumer Research Department, the new BC-22 system was completely installed in an .020 size airplane with 32" span — the D.Q.A. 704, presented in this issue. Subsequent flight tests by RCM's testing staff supported the manufacturer's claims — the system was no more difficult to fly than an ordinary escapement installation, while providing a smoothness of flight unobtainable with the more conventional escapement. The addition of the magnetic actuator presented no maintenance or installation problems. An additional BC-22 system was obtained, packaged as it would be for the consumer, and was installed in another D.Q.A. 704 prototype in less than fifteen minutes.

Transmitter

Insofar as physical differences are concerned, the BCT-22 differs from the "21" only to the extent of a rudder control knob instead of the usual tone key, or button, and the addition of two buttons for "full left" and "full right" rudder control. As with the

10 REASONS WHY YOU* SHOULD JOIN A.M.A.

*RADIO CONTROLLERS!

If you read anything about the Nationals at Dallas this year, you know that the R/C event was a tremendous success. This was due to a very special effort by the Academy of Model Aeronautics, U.S. governing body for model aviation and responsible for the conduct of our annual National Championship Meet. The Academy, in addition to serving modelers in general, is similarly providing special services for radio control.

FCC FUND

An AMA project to support legislation for more R/C frequencies and interference relief.

WORLD RECORDS

Three new world records—Altitude, Speed, Duration have come about from AMA's current efforts assisting record attempts (only AMA members are eligible for records in the U.S.).

NATIONAL RECORDS

FAI R/C TEAMS—Only AMA members may represent the U.S. at world championships. The 1965 team—Weirick, Ritchie, Brooke—won team places at the 1964 Nationals.

SUPERB R/C EQUIPMENT

Present performance and reliability is the direct result of developments from AMA competition. Sport flyers would not have such fine equipment today without the accelerated competition developments.

NATIONAL RECORDS

AMA R/C Pylon flying is an established U.S. national record event. All AMA members eligible.

INSURANCE BENEFITS

AMA members are protected from injury and property damage claims both by fellow members and Sunday flyers, whether at contests or sport flying. Special third party liability available for AMA clubs.

CONTEST CALENDAR

Details of all AMA sanctioned contests in U.S., including local R/C meets, fun-fly sessions and record trials, are sent monthly to AMA members.

R/C JUDGES GUIDE

Every AMA member gets this special section covering maneuvers, interpretations, flying advice for higher scores.

PUBLICATION DISCOUNTS

Grid Leaks, R/C Modeler, American Modeler, Model Airplane News at 15% off to AMA members.

NEW NOVICE/EXPERT BREAKDOWN

For 1965, national standards for AMA contests to permit novices to fly against their own class competition. Up to now, only a local option.

How to Join:

Your license classification is based on your age as of July 1, 1965.

JUNIOR LICENSE (including 15 years)
SENIOR LICENSE (16 through 20 inclusive)
OPEN LICENSE (21 years and over)

Please enter me on the membership roll of the Academy of Model Aeronautics.

I enclose \$.....
Junior \$3.00 R
Senior \$4.50 C
Open \$6.00

Date of Birth

Name

Street

City and State

Mail to: ACADEMY OF MODEL AERONAUTICS
1025 CONNECTICUT AVENUE
WASHINGTON 6, D.C.

BCT-21, the RF section is composed of a drift transistor running in a crystal-controlled oscillator with an input of 18 volts, but using four 9-volt transistor batteries wired in series-parallel instead of the two 9-volt units used in the "21" — the additional power supply required for the pulser section. Again, this is a Part 15 transmitter, using a 6000 cycle modulation frequency. The tone is generated by a variable frequency multivibrator, adjustable at the front panel of the transmitter for peak tuning.

The modulator is the same high level, series type, using no transformer, and with excellent response at 6 Kc. Modulation is approximately 90%. The same simple wire antenna, utilizing twin loading coils, as used on the BCT-21 is used on the newer BCT-22.

The pulser utilized is all-transistorized, running at a 12 cycle per second rate with a duty cycle from 20/80 to 80/20. A separate transistor is used between the pulser and audio oscillator in order to key the latter — a major advantage in that it does not upset the pulser by unsymmetrical loading.

The proportional rudder control knob uses no form of self-centering, a feature that has proven to be completely adequate for simple pulse-proportional flying. The radius of the rudder control knob is 270 degrees, allowing a wide range of control as a safety factor for the beginner. The "full right" and "full left" buttons allow maximum rudder deflection for stunting, or for "bang-bang" rudder action equivalent to that provided by an escapement.

Test Data

Voltage: 18 volts (four small standard transistor batteries wired in series-parallel).

Currents: (Antenna extended) 30 Ma average; (Antenna removed) 28 Ma average.

Waveform: Multivibrator almost sine wave at modulator.

Stability: Excellent.

Temperature Stability: Very slight audio drift but transmitter and receiver stay together with no variance.

BCT-22 Physical Data

Size: 6" high x 3-9/16" wide x 1-15/16" deep. Rudder knob projection 1/2".

Weight: 16 ounces.

Antenna: 34 3/4" extended, including both loading coils. Consists of three sections of 3/32" wire.

Case: Rugged steel construction, blue and white finish, silk-screened Babcock Controls trademark.

Controls: On-off slide switch, rate control knob, tone adjustment, full right, full-left buttons. Back is removable, and secured in place by four sheet metal screws.

Manufacturer: Babcock Controls Inc., 2762 Laguna Canyon Rd., Laguna Beach, Calif.

Price and Availability: Not sold separately. Entire system currently available direct from the manufacturer.



Receiver

Similar to the BCR-21, the BCR-22 receiver contains a superregenerative detector of a highly stable type. This, in turn, is followed by two amplifiers, each of which is composed of a pair of transistors in a circuit similar to the Darlington configuration with an inverse feedback filter. This pair of amplifiers gives an extreme degree of audio selectivity and completely eliminates the great attenuation normally needed to eliminate quench frequency. Unlike the BCR-21, however, the last two transistors radically differ from the ordinary receiver. These are used in a grounded emitter configuration to minimize typical temperature problems associated with relayless receivers. The audio rectification in these two transistors permits a well-defined pulse rate. The **usable** sensitivity of this receiver is again considerably better than 1 microvolt, due to the very narrow audio bandwidth, and shows an increase over the BC-21 system due to the pulsed signal.

Sensitivity is excellent, offering the same interference immunity as its predecessor due to the high audio frequency. (Ref. RCM 10/64)

BCR-22 Test Data

Voltage: 9 volts for entire airborne system (two 9 volt transistor batteries in parallel).

Currents: 35 Ma constant signal.

Tone Frequency: 6000 cycles per second.

Peak: 5600-6400 CPS adjustable at transmitter.

Sensitivity: Better than 1 microvolt (usable).

Interference: With carrier on, the receiver was immune to any form of noise, adjacent channel interference, CB voice interference, or from radiation by another receiver regardless of proximity of adjacent units.

Combined Range Check: 4700 feet consistent ground range. Manufacturer guarantees 1500 feet minimum.

Swamping: None, regardless of proximity of receiver to transmitter.

Temperature Stability: Response was flat from 30 to 120 degrees F.

BCR-22 Physical Data

Size: 2 1/2" length x 1 5/8" width by 1" depth.

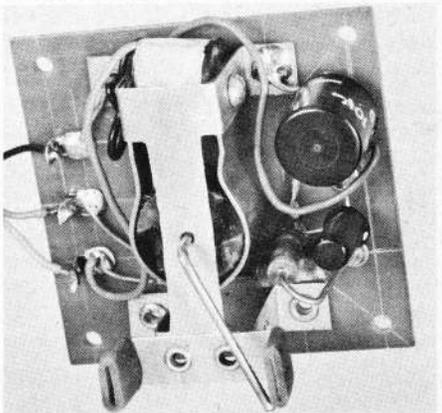
Weight: Entire airborne system, including receiver, PA-9 proportional actuator, two 9 volt batteries, harness, switch, and wiring: 5 ounces.

Antenna: 18" vertical wire whip, or standard hook-up wire equivalent.

Case: None.

Manufacturer: Babcock Controls Inc., 2762 Laguna Canyon Rd., Laguna Beach, Calif.

Price and Availability: Not sold separately. Entire system price, including transmitter, receiver, PA-9 magnetic proportional actuator, and wiring harness \$59.95.



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PA-9 Magnetic Proportional Actuator

The Babcock PA-9 proportional rudder actuator is a permanent magnet in a configuration similar to a two-pole electric motor, therefore extremely efficient for its size and weight, having two points of magnetic attraction and two points of magnetic repulsion. In operation, and when the transmitter control knob is at neutral, the magnetic actuator is pulsing across its entire range, causing the rudder to follow this left and right throw. Although the rudder is "wagging" from side to side, the aircraft is flying in a smooth and straight flight pattern. Turning the control knob either left or right, thereby varying the rate duty cycle, causes the PA-9 to pulse correspondingly more to the left or right, creating an identical deflection at the rudder surface. This, in turn, creates a smooth turn, proportional to the amount of command deflection.

For stunting, the full right or full left buttons are used, creating instantaneous full right or full left rudder.

The PA-9 actuator is identical in size and mounting requirements to the Mark VII escapement provided with the BC-21 system. Also mounted on the 1 $\frac{3}{4}$ " square actuator board is a clever circuit arrangement to complete the off-cycle side of the magnetic actuator. Connection of the PA-9 arm to the rudder surface is by a conventional wire and balsa torque rod.

Findings

Tuning of the Babcock BC-22 system is accomplished by simply removing the antenna from the BCT-22 transmitter, then tuning the receiver slug until you have achieved the maximum range (ten feet or more) at which the rudder will continue pulsing. No long distance range check is necessary, although it is recommended as a final safety check.

Flight testing was conducted with the D.Q.A. 704 model powered by a Cox Pee Wee .020, and carried out by RCM's editor and staff member Bill O'Brien. All flight performance was

smooth, and at no time did the "22" system malfunction or run out of range. Air range was, again, out of sight.

Following the testing of this system, we find that it equals or exceeds the BC-21 system in all respects, and meets the manufacturer's specifications to the letter. This is, in our opinion, an extremely effective introduction to simple proportional control, and an ideal system for the beginner and sport flyer. We particularly commend the pre-wiring of the airborne system, leaving only three wires to connect to three corresponding lugs on the PA-9 actuator. The ability of the BCR-22 receiver to reject spurious emissions and adjacent interference is particularly commendable for metropolitan areas of interference.

As a conclusion, we can only reiterate what we stated about the BC-21—when the performance and price of this system are considered, it becomes an exceptional buy—a well-engineered system of compatible units designed to offer maximum performance and reliability with a minimum expenditure.

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installations is usually a little less, simply because one less servo is required (no elevator trim).

Reliability should be nearly as good as reeds, but not quite. These systems are more complex and have many more parts to potentially fail than do reeds.

Ability to function over wide temperatures should be every bit as good as reeds and perhaps better. Most sets should function from freezing to 140 degrees with little change in characteristics.

The cost of proportional sets will be quite high for some time. Analog sets will tend to cost less than digital. The price tag startles one upon first glance but if time is taken to add up equivalent equipment to operate a reed set, the difference is not as great as was assumed at first glance. The prospective buyer is just not conditioned to see the cost of servos, battery packs, plugs, etc., all in one lump package.

We seem to have turned the corner on the age of proportional control, and I for one have joined the rush to my friendly hobby dealer.