Babcock Controls inc.

INSTALLATION AND OPERATING INSTRUCTIONS FOR BCT-18 "DIGITRAN" TRANSMITTER AND BCR-18 SUPERHETERODYNE RECEIVER.

GENERAL INFORMATION

The BCT-18 "Digitran" Transmitter and the BCR-18 Superheterodyne Receiver are the products of a comprehensive survey to determine the best universal radio control system for model aircraft. The system gives right, left, up, down and motor control by means of digital codes from the BCT-18 transmitter. The receiver is a selective Superheterodyne which, with the Mark VI Hyper Compound Escapement and MMH Motor Control Escapement, fulfill these functions. The system is "fail safe" and all control surfaces neutralize in the event of lack of control. We urge you to follow these instructions to the letter in order to insure the satisfactory operation of this equipment. It is designed to control small to medium size model aircraft with wing spans of 35" to 60" and engines displacing from .02 to .15 cubic inches. The escapements do not have sufficient power for large control surfaces of larger or faster model aircraft except with very limited deflection. Both receiver and transmitter must be on the same frequency (marked and color coded). (See specifications.)

PART I: BCT-18 "DIGITRAN" TRANSMITTER INSTRUCTIONS:

A. **Specifications:**

1. Circuit; Circuit is R. F. oscillator with series type High Level Class A modulator, audio multi-vibrator, coding multi-vibrator, stick controlled time base, and "quick blip" discharge circuit for motor control.
2. Size; Height: 7¼"
   Width: 4½"
   Depth: 2 1/8"
3. Weight: 20 ounces
4. Antenna: Center loaded whip, 40 inches long.
5. Power input to R. F. stage; 100 MW.
6. Frequency Tolerance; .005%
7. Audio Frequency, 3,500 cycles per second.
8. Voltage; 18
9. Current Drain; 18MA idling—22MA command.
10. Batteries; 2 Eveready No. 216 or 2 Burgess 2U6 or equivalent.
11. Standard Frequencies Furnished:

27.045 — Red
27.095 — Orange
27.145 — Yellow
27.195 — Green

B. **General Description:** The BCT - 18 "Digitran" Transmitter contains a crystal oscillator series modulated by a Class A modulator for a high percentage of upward amplitude modulation. Input to the R. F. stage is less than 100 M.W. which brings the BCT - 18 transmitter under Part 15 of the Rules and Regulations of the Federal Communications Commission making licensing unnecessary. The coder consists of a 3,500 cycle multi-vibrator audio oscillator which is keyed by a low frequency multi-vibrator. The number of pulses of this latter multi-vibrator are in turn automatically controlled by a time base. The "TIMING" control on the panel of the transmitter adjusts the time base to the speed of the pulsing multi-vibrator. Commands (automatically generated by the position of the control stick) are as follows: Right; hold long pulse, Left; 2 pulses and hold the third, Up; one pulse and hold the second, Down; 3 pulses and hold the fourth. Motor control is by the "quick blip" method. This involves an extremely short pulse of the audio oscillator generated by a discharge circuit. The block diagram of the BCT-18 transmitter illustrates these various functions.

The transmitter employs 18 volts which is furnished by two 9 volt batteries connected in series. These may be either Eveready type 216 or Burgess type 2U6 or equivalent and may be purchased in almost any drugstore, market or radio shop. They are installed behind the clasp at the bottom of the transmitter.

C. **Assembly Instructions:** The antenna is a center loaded whip packed with each transmitter and should be assembled as follows: Screw the large diameter rod into one end of the loading coil; screw the threaded end of one of the smaller diameter rods into the other end of the loading coil; slip a brass ferrule on to the end of this rod: insert another small diameter section into the other end of this ferrule following this with another ferrule and antenna section. When assembled, the antenna will be composed of 4 sections and a loading coil which can then be screwed into the antenna fitting through the grommet at the top of the transmitter. Using an ohmmeter, check across the loading coil for continuity to assure that the ends of the adjacent antenna sections are contacting the coil.

The transmitter tuning adjustment is made at the factory and no further adjustments other than the "TIMING" control will be made by the user. Operation of the transmitter will be covered under the check out instructions for the receiver.

D. **BATTERIES:**

It should be noted that although the nominal value of the batteries is 18 volts, the transmitter will actually operate down to about 5 volts. It is suggested that batteries be discarded after they have reached 15 volts under load. This may be measured by removing the case of the transmitter and with the switch turned on, measure between the switch contact and one of the printed circuit board mounting stud bolts with any voltmeter.

Longer life batteries may be easily made by the user in this manner. Connect a stack of twelve size "A" pencells in series. This stack may be three batteries by four and should be taped. It will fit nicely into the transmitter. The bracket for the two 9 volt batteries of course should be removed. Transmitter battery life will be more than doubled. If desired, dress snap connectors may be used.

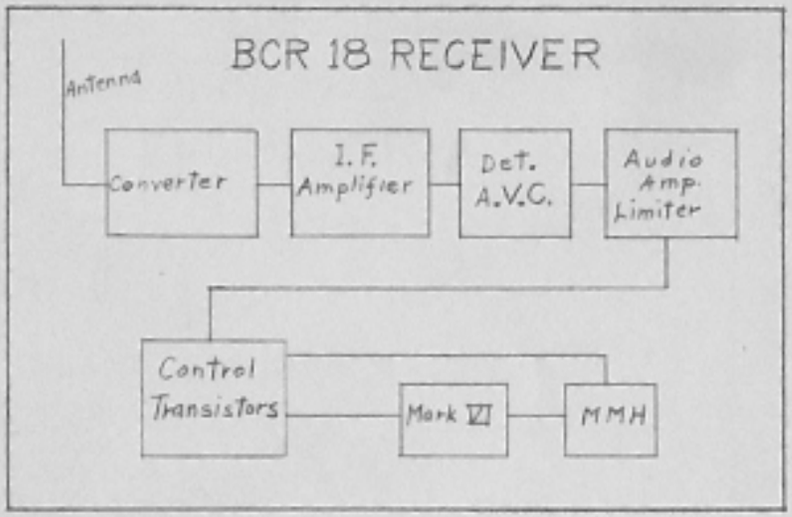
PART II: BCR-18 SUPERHETERODYNE RECEIVER INSTRUCTIONS:

A. **Specifications:**

1. Circuit; Circuit is a crystal controlled superheterodyne with direct transistor control of escapements.
2. Size: Length: 3"
   Width: 1 5/8"
   Depth: 7/8"
3. Weight; 2¼ ounces
4. Sensitivity; Better than two microvolts.
5. Crystal Frequency; Operating frequency minus I. F. frequency.
6. I. F. Frequency; 455 K. C.
7. Audio Operating Frequency; 3,500 cycles per second.
8. Voltage; 9 volts
9. Current Drain; 5MA idling, 95MA on command.
10. Battery; Eveready No. 216, Burgess 2U6 or equivalent.
11. Standard Frequencies Furnished;
    27.045 — Red
    27.095 — Orange
    27.145 — Yellow
    27.195 — Green
12. Escapements; must be of the high resistance type (100 ohms). These are the types Mark VI compound and MMH motor control.

B. **General Description:** The BCR - 18 Superheterodyne Receiver is a crystal controlled superheterodyne. It is mandatory that the receiver be installed exactly in accordance with the installation diagram and the following instructions.

The receiver contains both I. F. and audio limiting. The audio channel is the high pass type and will not respond to modulation frequencies of less than 2,000 cycles per second. In this way interference from Citizens Band equipment is eliminated.



C. **Installation Instructions:**

1. The receiver is installed by glueing two pieces of plastic foam about ½" x 1¼" to the bottom of the receiver case and in turn to the airplane (use the material in shipping box).
2. The antenna for the receiver is an 18" length of piano wire installed vertically, preferably at the forward end of the receiver compartment.
3. Route this wire so as to be as far as possible from the receiver tuning controls to eliminate hand capacity, which would be detrimental to tuning the antenna.
4. The ground plane against which the tuned circuit of the receiver works is a wire from the engine to the tail.
5. Install four bolts and on-off switch in fuselage side.
6. Mark these A, B, C, D, as shown on the installation drawing.
7. Connect wires per installation drawing. NOTE: Bolt "D" is the common ground. All bonding is done to either bolt "D" or the ground plane.

   Notice the pair of bonding wires from Pin 2 of the Mark VI escapement to the two control torque rods.

The purpose of bonding is not only to increase the pick up and range of the receiver but also to eliminate electrostatic noise which might trigger the very sensitive BCR-18 receiver. In connection with the numbering of the pins of the Mark VI escapement, refer to the escapement instruction sheet.

CAUTION: It is essential that the Mark VI and MMH escapements be used because these are 100 ohm, 9 volt escapements. The use of escapements of less than 100 ohms will not only run the battery down very quickly, but will almost surely damage the control transistors in the receiver.

D. **TUNING INSTRUCTIONS:**

1. Remove the antenna from the transmitter.
2. Do not turn receiver on. Place a jumper between bolts "C" and "D". Connect a 60MA 2 volt #49 flashlight bulb between bolts "A" and "B". (The jumper and flashlight bulb should have very short leads so that the tuning will not be upset when they are removed).
3. Turn transmitter on. Place the transmitter close enough to the receiver antenna so that the bulb glows dimly.
4. Tune the antenna coil of the receiver for maximum bulb brilliance. The oscillator coil is tuned at the factory and should not be adjusted. During tuning of the antenna coil, the hand and body should be kept as far from the receiver antenna as possible.
5. Remove the bulb and jumper and turn receiver on. A preliminary range check may be made with only the bottom section of the antenna and loading coil on the transmitter. The range should be 75 feet or greater. With the antenna completely assembled, the range will be upward of 800 feet on the ground and will be much greater in the air. Give a "DOWN" command and adjust the "TIMING" control for down elevator.

This command is three pulses and hold the fourth. The setting is quite broad. All other commands will then be correct.

E. **Batteries:** The receiver battery is also Eveready Type 216, Burgess 2U6 or equivalent. Batteries should be discarded when they show less than 7 volts under load (i.e. measured from bolts A to D with a transmitter emitting a command tone).

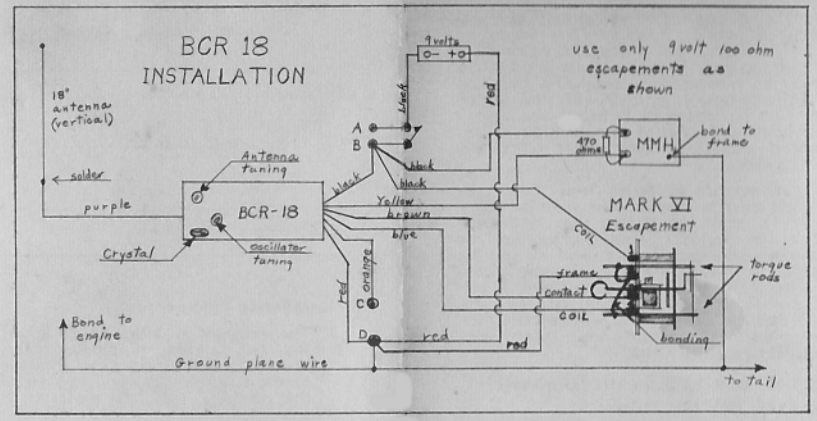
Alternate battery packs may be made by the user as follows: Six type "A" or "AA" pencells may be connected in series for 9 volts. These battery packs will weigh slightly more than the specified 9 volt type. The type 2U6 batteries weigh 1¼ ounces. The battery pack using type "A" pencells will weigh 3 ounces and the "AA" pencells will weigh slightly less than 2 ounces. Either of these home-made battery packs may be carried by a model using a ½A engine. These two battery packs will have longer life.

PART III: OTHER USES:

A. **BCR-18 Superheterodyne Receiver:**

The BCR-18 and its escapements may be used with any transmitter other than the BCT-18 providing it has tone modulation of from 3,000 to 4,000 cycles although the convenience of the automatic coding of the BCT-18 will be sacrificed. The BCR-18 may also be used in small aircraft with a magnetic actuator for proportional control. The blue and yellow wires should go to each coil of the actuator and one of the black wires to the remaining ends of the 2 coils or to the center tap if a single coil type is used.

B. **BCT-18 "Digitran" Transmitter:** The BCT-18 transmitter may also be used with any tone receiver of the relay or relayless type using the Mark V Hyper Compound Escapement and the EM-1 Motor Control and capable of actuating with a tone of 3,500 cycles.



PART IV: SERVICE POLICY:

Your BCT-18 and BCR-18 are good for many years of operation. If you have any reason whatsoever to return your unit to the factory either before or after the policy expires, proceed as follows:

A. Carefully pack the unit and enclose a note with your name, address and serial number of the unit and ship parcel post.

B. Write a letter stating the circumstances as clearly as possible.

C. If the guarantee has expired, we will charge you a base service charge of $3.00 plus parts used to recondition. In all cases, we will make the charges as low as possible. If your receiver has suffered extensive crash or drop damage, we will inform you of the repair estimate before proceeding if you require such estimate.

PART V: GUARANTEE:

The BCR-18 and BCT-18 transmitter are unconditionally guaranteed for a period of 90 days except as follows:

A. Guarantee becomes effective upon receipt of your registration record.

B. Crystals and transistors are not guaranteed.

C. If in the opinion of the factory, crash damage to a receiver is too extensive, we reserve the right to replace to the customer a complete new receiver for $30.00.