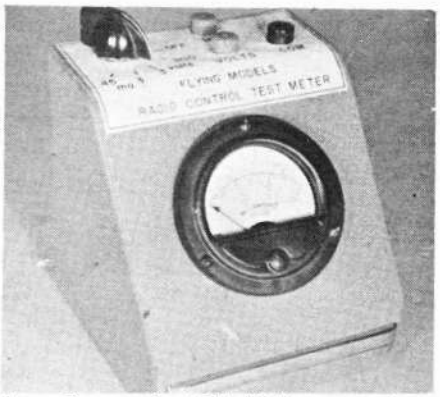
Phil Greenberg's Jasco R/C Master uses an E.C.C. receiver and a Super Aerotrol escapement. The sponge-mounted nose section effectively eliminates vibration effects of the engine.

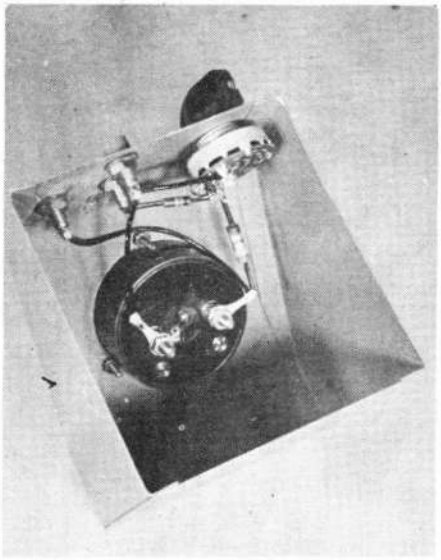


Above: The completed FM Multimeter, used to check all components of your R/C equipment.

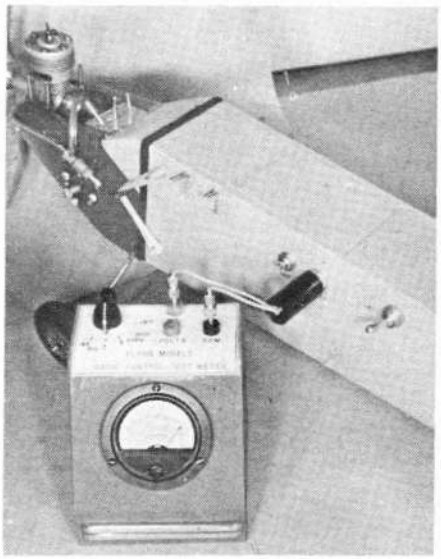
GETTING STARTED IN
RADIO-CONTROL

by Phil Greenberg

Complete details for building the FLYING MODELS R/C Multimeter



Above: An inside view of the case, showing the ultra-simple wiring of this inexpensive meter.



Above: Using the meter to check receiver plate current. Note short wires on test lead set.

● As you become more involved in radio-control activities, you will find the subject of meters and test equipment of steadily increasing importance, as well as an endless source for experimentation. We have owned, used, seen, and heard of many different types of meters, and we've studied each one to determine its value in radio-control work.

The combination FM Test Meter presented herewith is one which we feel fulfills almost all the needs of the radio-control modeller. It is inexpensive, easy to build, and a pleasure to use. But before we start to build it, let's have a closer look at this business about meters:

As we discussed in earlier issues, the primary need in R/C flying is for an 0-3 ma. meter (D.C.) for checking receiver operation. Another meter you should have is an 0-50 ma. meter for checking transmitter operation. In order to keep an accurate check on the batteries, you need two additional meters: a low-range voltmeter for the "A" (filament) and escapement batteries; and a high-range voltmeter to check both receiver and transmitter "B" (plate) batteries.

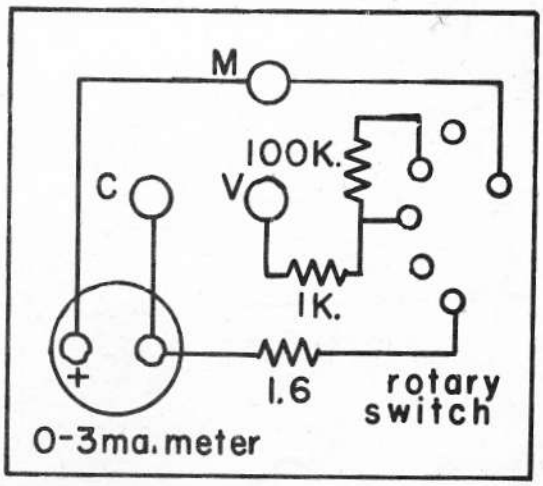
The FM Test Meter takes care of all four jobs—with it you can check all of the radio components. It uses an 0-3 ma. basic meter, plus a "shunt" resistor and two "multiplier" resistors to adjust the range of the meter, according to the unit being tested.

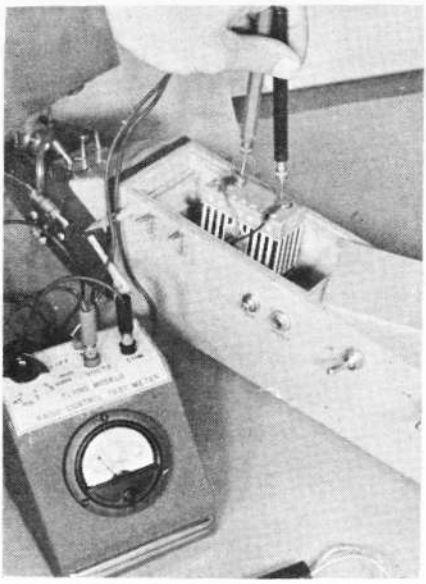
The rotary switch selects the appropriate resistor for the desired testing range. When checking receiver or transmitter plate currents, use the pin jacks marked "COM" and "MA", with the selector switch pointing to 3 ma. for receivers, and to 45 ma. for transmitters.

(*Please turn to Page* 26)

FULL-SIZE PATTERN OF TEST METER PANEL

FIG. 1—SCHEMATIC OF METER





Checking the B-battery voltage, using standard test leads. Note switch position. Receiver is turned on while batteries are checked. Meter reads 67 volts, indicating a fresh battery.

GETTING STARTED

(Continued from Page 18)

When checking battery voltages, use the jacks marked "COM" and "VOLTS," with the selector switch pointing to 3 volts for checking "A" or escapement batteries rated up to 3 volts, and to 300 volts for "B" batteries.

After obtaining the necessary parts (see Bill of Materials), begin construction of your meter by cutting out the full-size panel pattern and cementing it in place on the meter case, as shown. When this is dry, brush on a few coats of dope, and then fuel-proof the entire case, including the paper pattern. Next, drill one ⅜" hole as indicated and three 5/16" holes in the locations shown.

Mount the rotary switch in the ⅜" hole with the five terminals facing towards the center of the case. Mount the pin jacks in the other three holes, using the black one in the hole marked "COM", and the red jacks in the remaining holes. Be sure to include the insulating washers which are supplied with the jacks, to prevent the jacks from shorting to the case. Add soldering lugs to the meter terminals and install the meter.

The schematic diagram and photo show the arrangement of the wires and resistors inside the case. Insert them in the locations shown and solder all connections, using rosin core solder. Use spaghetti tubing over the exposed leads of the resistors.

Rotate the switch to either extreme position. Set the knob in place on the shaft, lined up with the pattern line at that position, and tighten the set screw. Your FM Test Meter is now ready for operation.

For checking batteries, use a standard set of test leads. For receiver checks, make up a pair of test leads using two pieces of No. 20 stranded wire, about 8" long, with two pin plugs on one end and a PL-55 type plug on the other end of the wires.

The same lead set can be used for the transmitter checks, if you use an open circuit jack on the transmitter to accept the keying lead. The keying lead has to be fitted with a PL-55 type plug. Similar test leads can be made up to match whatever type of jack you have in your plane or transmitter.

Which Meter To Buy?

When purchasing a meter for use in radio-control work, keep these facts in mind:

(1) Buy the best meter you can afford.

(2) Make sure that the resistance of the meter itself is as low as possible.

The surplus market still offers many excellent buys in meters, but you must know what you are doing or you may be throwing your money away. Have somebody who knows about radio-control help you whenever you buy surplus supplies.

A safe way to shop is to deal with a regular retailer who sells brand new equipment, or one of the mail-order houses who specialize in R/C gear. When you deal this way, you can use the price as an index of quality.

A low-resistance meter is a very important item in your tool kit, so choose yours carefully. When using the meter, it must be inserted in series with the "B" batteries and the radio set. Any resistance of the meter will be added to that in the circuit, and the meter will indicate the plate current under this condition.

When you remove the meter from

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The three types of meters described in this article. Up front, the 0.3 ma. meter with a plug extending from rear; left, the FM Test Meter; and in rear a commercial multimeter.

THE X-DW1

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stability, longitudinal trim must not be overlooked. It is almost certain that the ship will climb at an alarmingly steep angle immediately after take-off, settling down to a more gradual climb after about 20 feet of altitude has been attained. This is due to the excess speed during the take-off run, when the wings are at a relatively low angle of attack.

Only after the model has climbed about 30 feet or more can a true indication of the glide characteristics be obtained. If these are correctly set, reduce the ballast until the center of gravity moves back ⅛". This alteration may possibly require a slight increase in the angle of down-thrust. Keep in mind that the glide on a delta is naturally steeper than that on a more conventional ship. But, although the sinking speed is higher, due to the greater angle of attack at which it normally flies, the ship's attitude on the glide is still almost parallel with the ground.

A word of warning! If your ship screams along the ground until it either hits something or the fuel runs out, make sure the distance to the ground line at the nose wheel and rear wheels is as quoted on the plan. A reduction in the "sit-down" angle of the ship can keep the model from becoming unstuck, even after a run of 80 yards!!

One other point in conclusion. That golden rule which says never alter your model's flying surfaces once the glide is satisfactory—and trim only by varying the thrust line—most certainly applies to powered deltas!

BILL OF MATERIALS
(Balsa unless otherwise stated)

1—⅛" x 4" x 36" (medium) ... Ribs, dorsal, formers
1—1/16" x 3" x 9" (medium) ... Wing fins
7—⅛" x ⅛" x 24" (hard) ... Fuselage, keel, wing diagonals
2—¼" x ⅛" x 18" (hard) ... Wing leading edge
1—¼" x ⅛" x 9" (medium) ... Center fin trailing edge
2—½" x ⅛" x 12" (medium) ... Wing trailing edge
1—⅛" x 2" x 24" (hard) ... Wing spars

4⅜" x ⅝" x 1/32" hardwood, suitable for left-hand prop; 1/32" plywood for F12 and sheeting between F1 and F2; 18" of .050" piano wire, for undercarriage legs; two 1½" diameter wheels; one 1" diameter wheel; cement; tissue; dope (clear and color as desired); fuel-proofer; pins; McCoy .049 or similar engine.

GETTING STARTED

(*Continued from Page 26*)

the circuit, the circuit is changed by the value of the meter resistance. If the resistance is low, (100 ohms or less), you can be fairly certain that the radio will react the same as when the meter was connected. If the meter resistance is high, it becomes necessary to add another resistor in place of the meter, when the meter is removed. This can be wired into the closed circuit jack in the plane, or substituted for the shorting wire on a shorting jack arrangement.

Other Types Of Meters

Generally speaking, there are two other types of meters in general use for R/C equipment. One is the simple 0-3 ma. meter itself, equipped with a stiff bracket supporting a PL-55 type plug. The main feature of this type is that it is self-supporting. This is a handy feature when you are walking the ship out for a field check, as the plane can be held in one hand, and the other hand is left free for signalling and tuning the receiver. On the other hand, this meter has the disadvantage that, by itself, it cannot be used for anything except checking receiver operation and relay settings.

This meter is the absolute minimum that you can get by with, but you must change batteries at the first sign of erratic operation. Of course, you'll have to check the receiver operation more frequently if you are going to detect any weakening of the batteries.

If you can afford two meters, then this would be the other one to have, in addition to your FM Test Meter.

The other type of meter in use by R/C fans is the commercial Volt-Ohm-Milliameter. This meter has a switch selector or plug-in selectors for checking voltage, resistance, and current. It is very useful to those who build their own R/C equipment, as it can be used to check wiring layouts and resistor values, and for general trouble-shooting.

It can also be used for the other functions of R/C operations, such as receiver, transmitter, and battery checking. Of all the various ranges and utilities of this meter, only the low-range milliameter can be used for flight checks, so if you have one of these meters, or are going to buy one, we recommend that you also obtain a single 0-3 ma. meter for the more common flight checks.

The FLYING MODELS Test Meter, described earlier, is an inexpensive compromise between the two aforementioned types. It is basically an 0-3 ma. meter, yet it includes provisions for transmitter and battery checks as well as the normal receiver functions. It is an ideal meter for the beginner who does not have testing equipment.

BILL OF MATERIALS

1—2" or 3" 0.3 ma. D.C. meter
1—Deluxe meter case (for 2" meter—ICA Type 3995; for 3" meter—ICA Type 3996)
1—1.6 ohm resistor—IRC type BW-½ (code colors: brown, blue, gold)
1—1,000 ohm resistor—IRC type BTS-½ (code colors: brown, black, red)
1—100,000 ohm resistor—IRC type BTS-½ (code colors: brown, black, yellow)
1—Rotary switch—single pole—5 position—Mallory Type 3315J
1—Pointer knob—1¼" long
1—Black pin-jack
2—Red pin-jacks
Soldering lugs, wire, spaghetti tubing

THE NEXT ISSUE OF FLYING MODELS
(The December 1953 Number)
GOES ON SALE ABOUT NOVEMBER 10TH