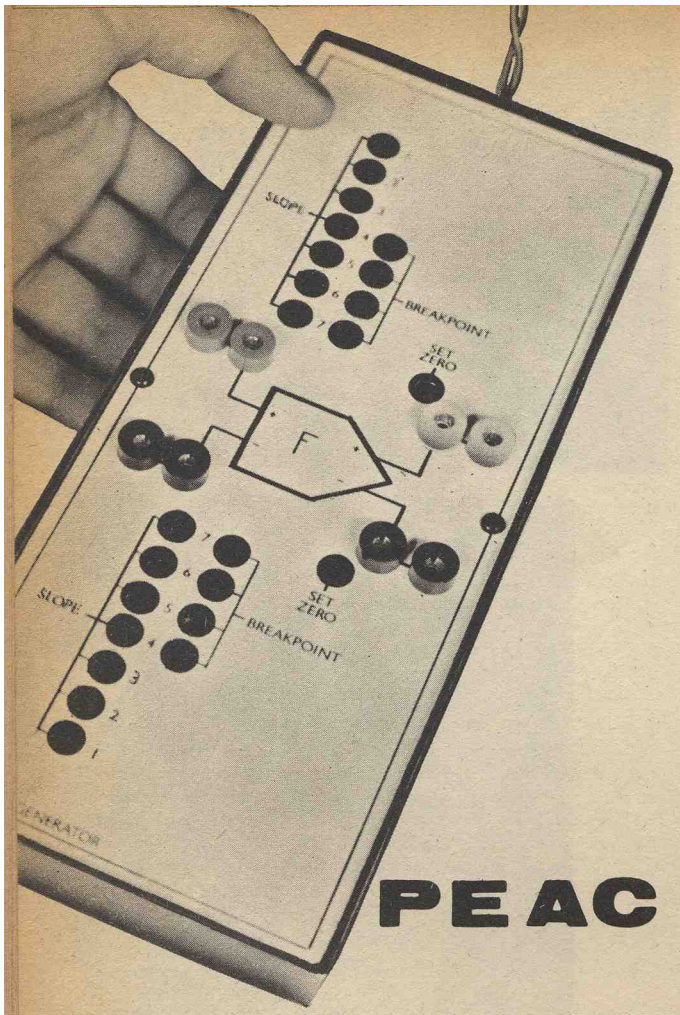

ANALOGUE COMPUTER

By D. BOLLEN

LAST month the Function Generator UNIT "C" was introduced. The principle of operation and some of the uses of the function generator were explained. We are continuing with a description of the practical circuit, constructional details, and application information.

FUNCTION GENERATOR CIRCUIT

The function generator circuit of Fig. 8.1 is designed to display a nominal resistance of 100 kilohm when the input voltage is ± 1V. A typical resistance variation with applied voltage is from 500 kilohms at 0·2V to 10 kilohms at 10V. In the Fig. 8.1 circuit, components forming the positive branch are identified by the letter A after a component number, and the letter B is appended to negative branch numbering. As both branches are identical, except for diode and bias polarities, it is not necessary to describe them separately.

D1 is a gold-bonded diode, for a low voltage drop with small input voltages. All other diodes (D2–D7) are of silicon construction to keep reverse leakage low. The natural forward voltage drop of D1 and D2 furnishes self-bias, and bias conditions for D3 are satisfied by a fixed resistor R1. The values of slope adjusters VR1, VR2, VR3, VR4, VR6, VR8 and VR10 were selected to give a parabolic function approximating to $E_0 = E_{in}^2$ when all sliders are at mid-track, and appropriate bias values for that function are provided by mid-track settings of breakpoint adjusters VR5, VR7, VR9 and VR11. The combination VR12 and R3 serves to eliminate offset voltages resulting from diode leakage currents, and VR12 is therefore used for zero-setting.

With so many possible adjustments, including amplifier closed-loop gains determined by R_f or R_{in} computing resistors, it is obviously impossible to catalogue the coverage of the Fig. 8.1 circuit. As a rough indication though, powers of E_{in} ranging from about $E_{in}^{1.1}$ to beyond E_{in}^3 are available. If both branches are cascaded in series with operational amplifiers, the upper limit will extend beyond E_{in}^6. Corresponding root functions $\sqrt[1.1]{E_{in}}$ to $\sqrt[6]{E_{in}}$ may also be generated. It is sometimes possible to use the UNIT "C" function generator for certain trigonometrical functions, and logs to the base 10 or e.

UNIT "C" BOX

A wood and plastics laminate box, of small dimensions compared with other PEAC units, will serve to house the two function generator circuit panels. The suggested form of construction is shown in Fig. 8.2. Softwood blocks are glued to a 9½in × 4in × ¼in plywood frame, which has its centre cut out, and white plastics laminate side pieces are then glued to the blocks. The front panel sits on the wooden blocks and is recessed.

UNIT "C" FRONT PANEL

The only items to be mounted on the 9½in × 4in plastics laminate front panel are eight coloured sockets; the layout is given in Fig. 8.3. A series of ¼in holes are drilled in the front panel to allow screwdriver access to slope, breakpoint, and set-zero controls. Panel markings are similar to previous PEAC units.

FUNCTION GENERATOR CONSTRUCTION

Two 3¾in × 3¾in s.r.b.p. panels are drilled and shaped according to the Fig. 8.4a diagram. Before inserting turret tags, lay the prepared panels out as shown in Fig. 8.5, so that one panel is turned over in relation to the other, and components are clearly seen to be mounted on opposite sides. The underside wiring of the positive branch panel is shown in Fig. 8.4b, and the wiring of the negative branch is in Fig. 8.4c.

All diodes are mounted on turret tags to allow them to be disconnected for special purposes, where for