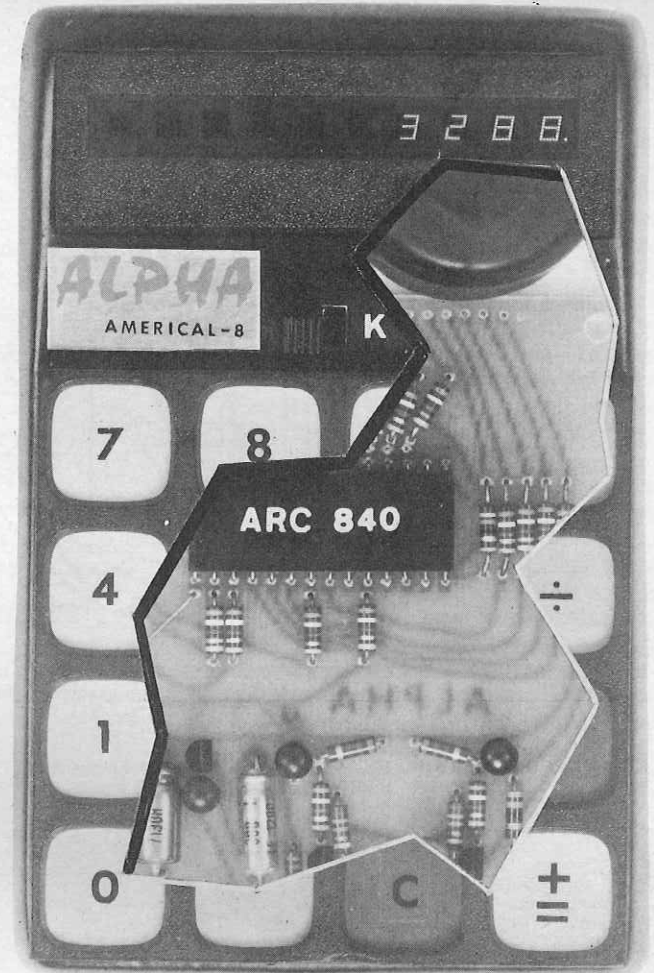


# IC Pocketcalculator

One giant IC wired between keyboard and an LED 8-digit readout; is the heart of battery-powered pocket-sized calculator that adds, subtracts, multiplies and divides

by W. L. GREEN  
President, Alpha Research Corp.



Actual size photo of calculator

ALMOST DAILY WE READ ABOUT A NEW Mini or Midi electronic calculator, selling for \$169, \$179 or \$199, and for about 6 months now many news releases about the elusive under \$100 pocket-size full-function calculator. If you've been waiting for the right mini or have a desk-size calculator and need the handy battery operated convenience of a mini, this is the story you've been waiting for.

The under \$100 calculator is here! It adds, subtracts, multiplies and di-

vides, either straight or mixed; holds a constant for multiplication and division; has a full floating decimal point; bright 8-digit display; is battery operated (measures a mere 3/4 x 5 x 1 1/2 inches).

If you or your wife buy groceries at the supermarket, have a checking account, try to balance a budget, are a businessman, salesman, pilot, engineer, technician, accountant or deal with figures simple or complex, the Americal-8 is for you. The calculator takes less than

2 hours to build, and is simple enough for a beginner to assemble.

**How it works**

The heart of the unit is a single MOS-LSI (Metal Oxide Silicon-Large Scale Integration) integrated circuit. It contains the equivalent of more than 6000 transistors and other parts which encode the keyboard, store and manipulate the entered data and decode the results for display. The only external parts required are a keyboard, clock

generator, power source and display.

**Construction is fast and easy**

Using a PC board is mandatory, as the LSI chip has 28 pins and though it has input protecting diodes it should be handled as little as possible to prevent static discharge damage. *DO NOT USE A SOLDERING GUN* and *DO NOT WEAR WOOL* or nylon clothing during assembly.

Assemble the complete PC board, except for the LSI chip first. Full-size

patterns for the board and the parts layout are shown. Observe polarities of the diodes and capacitors and make sure the transistors are properly positioned. Then solder all connections before installing the LSI chip.

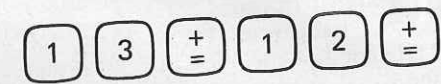
Solder carefully, and avoid forming any solder bridges on the board. Next, mount the keyboard and display in the case and wire them to the PC board. Double check all components and solder joints before applying power.

After double checking the wiring, install the batteries being especially careful to check polarity. Now turn on the power switch and depress the red C key. A zero and decimal point will appear in the right corner of the display.

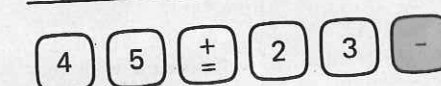
**Using the calculator**

The white number keys (see keyboard top left) when depressed enter the corresponding number into the machine's memories. At the same time this number appears on the display entering

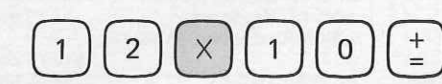
**ADDITION:** 13 + 12 = 25



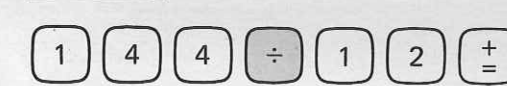
**SUBTRACTION:** 45 - 23 = 22



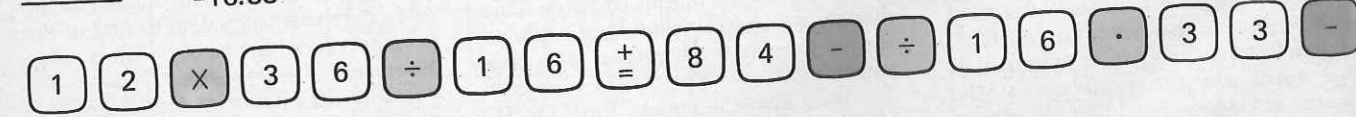
**MULTIPLICATION:** 12 x 10 = 120



**DIVISION:** 144 ÷ 12 = 12

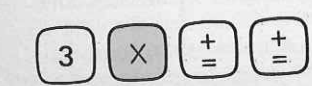


**MIXED:**  $\frac{12 \times 36}{16} - 84 - 16.33 = 3.4905082$

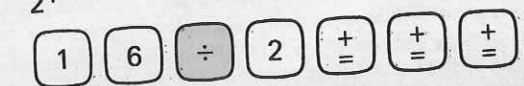


**K OPERATION: (CONSTANT) K SWITCH ON IN ALL STEPS**

$3^3 = 27$



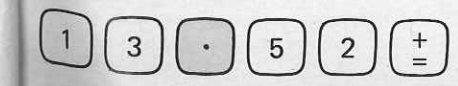
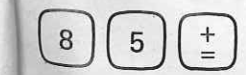
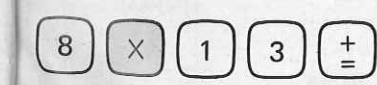
$\frac{16}{2^4} = 1$



$8 \times 13 = 104$

$8 \times 85 = 680$

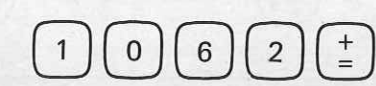
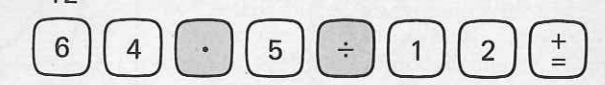
$8 \times 13.52 = 108.16$

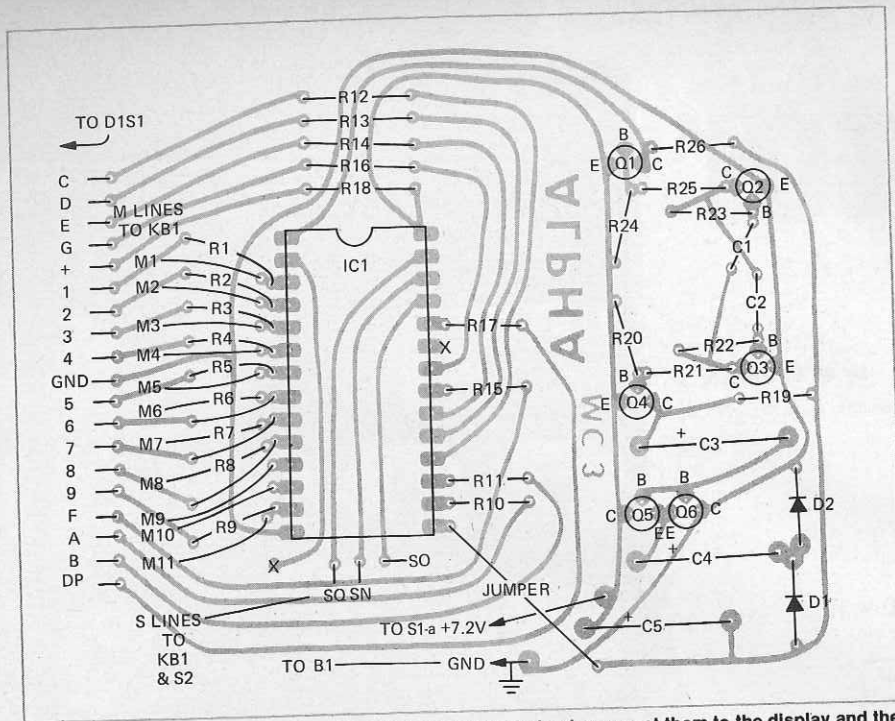


$\frac{64.5}{12} = 5.375$

$\frac{144}{-12} = -12$

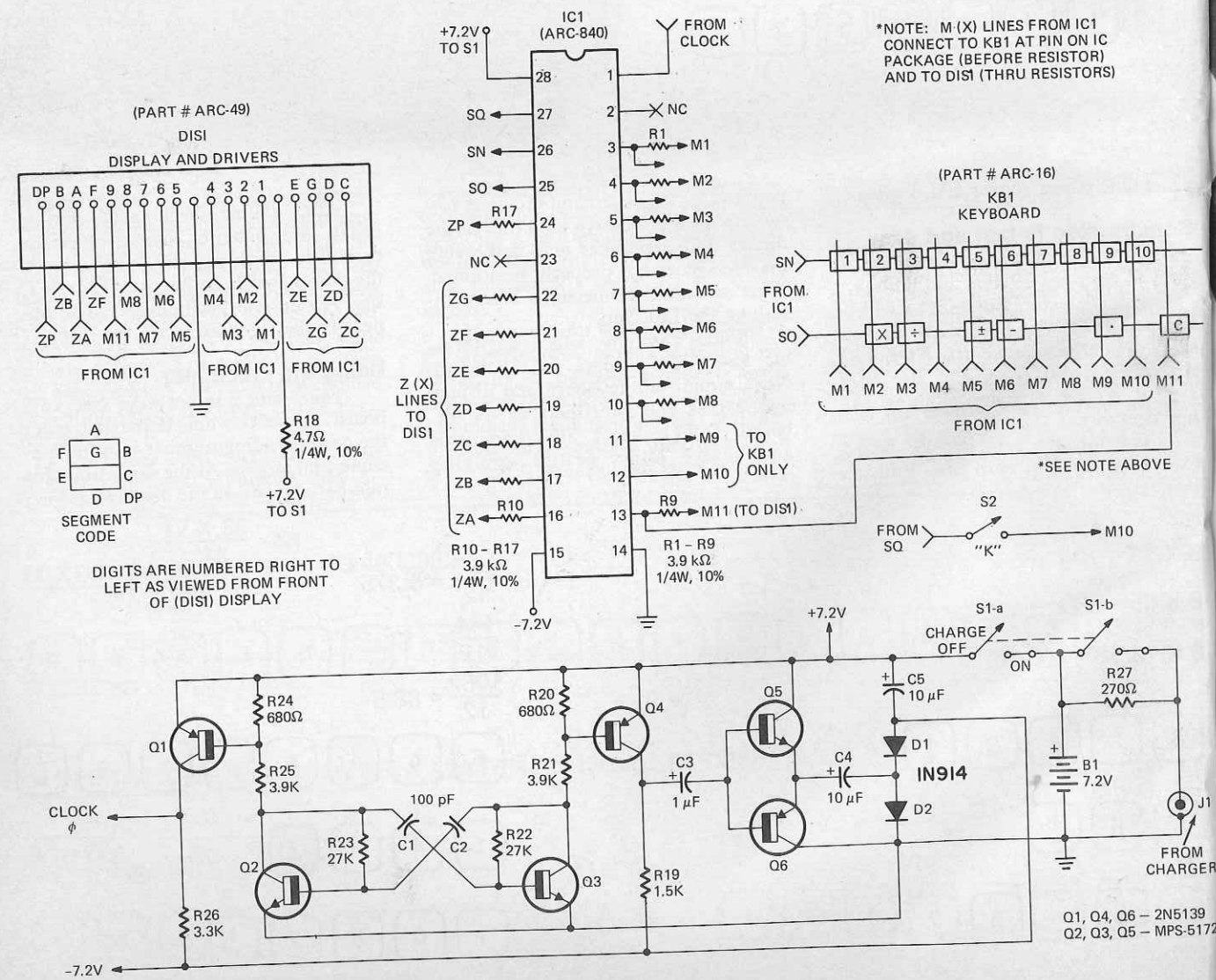
$\frac{1062}{12} = 88.5$





WHERE PARTS ARE MOUNTED on the PC board and how leads connect them to the display and the keyboard. Circuitry has been integrated to the point where assembly takes less than 2 hours.

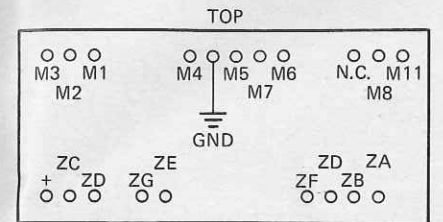
ESSENTIAL CIRCUITRY OF THE CALCULATOR. Heart of the instrument is the large-scale integrated circuit that encodes, stores, manipulates and decodes the results for display on readout.



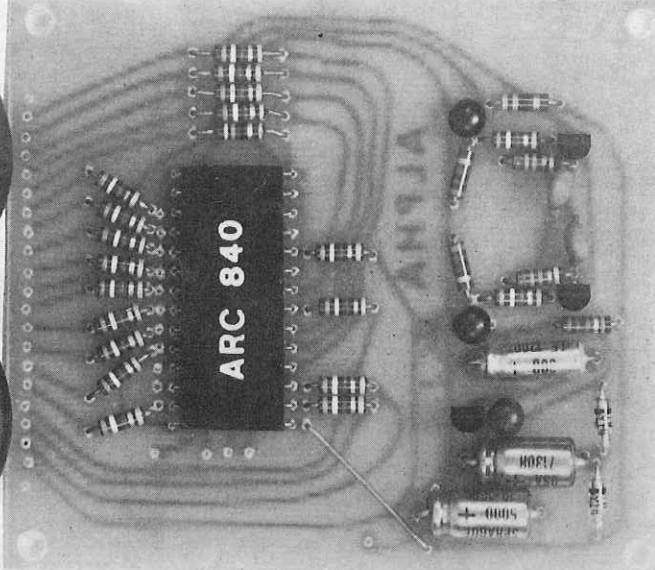
- PARTS LIST**
- All resistors 1/4 watt 10%  
 R1 thru R17—3900 ohms  
 R18—4.7 ohms  
 R19—1500 ohms  
 R20, R24—680 ohms  
 R21, R25—3900 ohms  
 R22, R23—27,000 ohms  
 R26—3300 ohms  
 R27—270 ohms (used with Ni-Cad battery only)  
 C1, C2—100 pF  
 C3—1 μF, 12 V, electrolytic  
 C4, C5—10 μF, 12, electrolytic  
 \*D1, D2—1N914  
 \*IC1—ARC-840  
 \*Q1, Q4, Q6—2N5139  
 \*Q2, Q3, Q5—MPS5172  
 \*DISPLAY—ARC-49  
 \*KEYBOARD—ARC-16  
 S1—dpdt slide switch  
 S2—spst slide switch  
 BATT—7.2V Ni-Cad or 8.4V mercury  
 \*Starred items are available from:  
**ALPHA Research Corp**  
**PO Box 1005**  
**Merritt Island, Fla. 32952**  
 ARC-840—Kit of transistors, diodes, and IC ...\$45.53 postpaid  
 ARC-49—Display module ...\$48.14 postpaid  
 ARC-16—Keyboard ...\$6.93 postpaid  
 7.2V Ni-Cad battery (ARC-72) ...\$10.75 postpaid  
 PC board (MC-3) ...\$4.00 postpaid  
 Complete kit less battery (DC-8) ...\$102.40 postpaid  
 Complete kit w/Ni-Cad battery & charger ...\$112.90 postpaid  
 Prices are for US and Canada only.

from right to left. The blue key is used to enter a decimal point at any desired place during number entry. The blue multiply and divide keys perform their assigned functions and during mixed calculations provide a subtotal. The red key and white ± keys will perform their assigned functions and will also supply a total or sum. The K switch holds the first digits in multiply and the last digits in divide as a constant. If an error in entry is made, merely reverse the operation by re-entering the

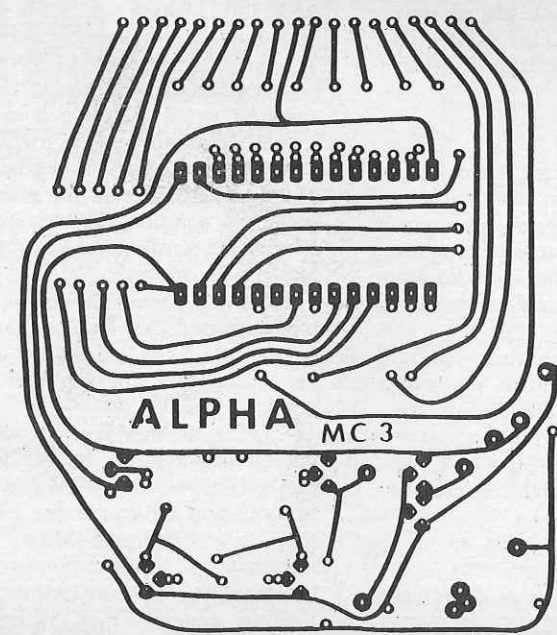
numbers entered in error and depress the complementing key to correct the error. If more than eight digits are entered into the machine, or if the result of calculations exceeds eight whole numbers, the far left overflow and sign digit will light. If an overflow condition causes the indicator to light the machine will automatically latch up, preventing further operations, and the answer will be displayed with the decimal point positioning itself so that the answer may be read by mentally moving the decimal point eight places to the right. A negative answer is noted by the - bar lighting in the left digit. R-E



PIN CONNECTIONS FOR THE LED DISPLAY used in the Americal-8 calculator.

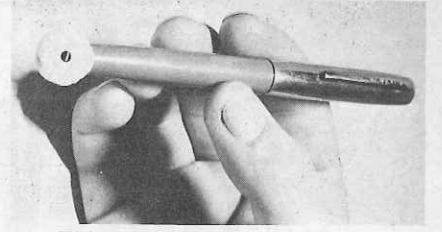


CALCULATOR'S PC BOARD and its associated parts are seen when keyboard and display are removed. Round objects at left are the re-chargable batteries wrapped in heat-shrink plastic tubing.



FULL-SIZE PATTERN OF PC board. You can make your own or order it along with the other parts you'll need to build this electronic calculator.

**TAPE-HEAD TEST STICK**

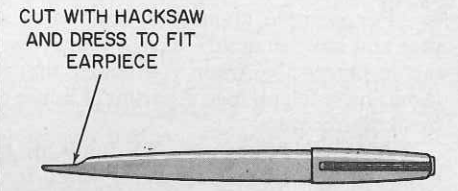


This small tape-head tester is built around the coil assembly of a miniature earphone. Select a magnetic earphone with an internal resistance of thirty ohms or more. The more resistance, the greater sensitivity of the tape recorder checker. Do not use a 6- or 10-ohm impedance earphone.

To remove the small coil assembly, from the miniature earphone, cut three slots around the metal case with a metal hacksaw. Now pull off the metal front piece with a pair of pliers. Remove the small brass ring and metal diaphragm. Next, remove the small round magnet. If the magnet is glued to the coil assembly, use a pocket knife and pry it off.

Leave the coil assembly and hookup cable intact. If the coil assembly is loose within the plastic case, cement with rubber sealer. Now grind or cut off the plastic case so the center metal pole-piece sticks out 1/16 inch.

Pick up a discarded ball point or



ink pen and cut as in the drawing. Push the earphone cable through the pen barrel and cement together with rubber silicone seal. Leave to setup over night.

Now solder the earphone cable to a small earphone jack and cement into the plastic pen. Be sure the pen cap will screw into place. A permanent connection can be made by running the earphone cable through the pen with two alligator clips soldered to the flexible earphone cable.

An audio signal from a pencil-type signal generator or audio signal generator can be connected to these alligator clips. Place the tape-head test stick upon the record/playback head. In the PLAY mode a 1-kHz note can be heard in the tape recorder's output. With this method the record/playhead can be checked for actual reproduction.

To check the tape head of an automatic stereo tape player in the car, mount the earphone piece on the end of the ball-point pen. These tape sticks are cheap to make, so why not construct one for the stereo tape player and another for the tape recorder.—Homer L. Davidson