Behavior Research Methods & Instrumentation
1976, Vol. 8 (4), 419

NOTE

An inexpensive six-digit solid-state counter

FREDERICK RAYFIELD
University of Chicago, Chicago, Illinois 60637

A calculator is basically a counting device. Substituting a switching transistor for the appropriate pushbutton switch, and an electrical pulse for a finger press, an inexpensive calculator becomes a six-digit solid-state counter, capable of better than 50 counts/sec. Essentially any calculator, including a printing unit, that will add one repeatedly by pressing a single key can be so modified. An up-down counter, suitable for subject display, can be constructed using a second transistor in place of the minus key to repeatedly subtract one. If the modification is done carefully, the calculator may be left intact for on-the-rack calculations.

Schematics appropriate for converting the Novus 650 (also sold as Wards P10) and the Commodore Minuteman VI, both retailing for under $10, are shown in Figures 1 and 2, respectively, for a range of supply and input pulse voltages. The 8-V dc supply used by either calculator is easily supplied by an integrated voltage regulator, such as the 7808 or 340T-8 (cost $1.75, Poly-Paks, Lynnfield, Massachusetts), that will accept from 12 to 35 V dc. For input pulses less than 8 V, a 6-V dc supply voltage from a 7806 or 340T-6 (Radio Shack) is usually necessary. Some calculators will operate directly from 5 V dc (there is variance in the circuits of the same models). Using a 2N2222 transistor (cost: eight transistors for $2, Radio Shack), a 33K resistor properly limits the current of a 5-V dc input pulse on the Commodore, and a 330K resistor does so for a 24-V dc pulse. In the Novus/Wards, a 1.5-megohm resistor is suitable for pulses from 5 to 24 V dc. The counter is reset by the "Clear" switch, and it is started by entering "1." The calculator keyboard may be used, or it may be cut away for compactness and other SPST switches substituted, as in Figure 1. Mounting holes may be drilled wherever the printed circuitry permits.

The cost of the four parts (calculator, voltage regulator, transistor, and resistor) is less than $13 for each counter. Several of these counters have operated continuously in our laboratory for over 9 months with no signs of wear.

The author wishes to thank Marvin Segal for his encouragement and Israel Goldiamond, in whose lab the counters were used. Development of these devices was supported in part by a USPHS traineeship to the author, and in part by a grant from the Illinois Department of Mental Health to Dr. Goldiamond. Reprints may be obtained by writing to Frederick Rayfield, c/o I. Goldiamond, University of Chicago, Department of Psychiatry, 950 East 59th Street, Chicago, Illinois 60637.

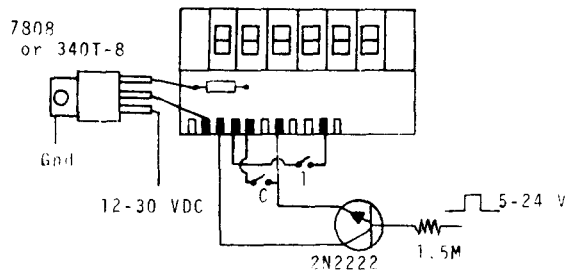

Figure 1. Schematic for converting Novus 650 or Wards P10 calculator to a six-digit counter. Shown with display board removed from case and keyboard cut away for compactness. Two SPST switches added to replace "Clear" and "1" keys for reset and start.

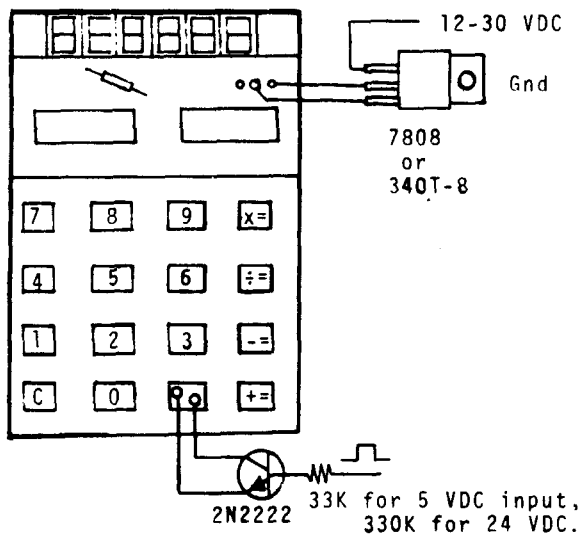

Figure 2. Schematic for converting Commodore Minuteman VI calculator to a six-digit counter. Shown removed from case, and with "Enter" key removed (equivalent to "+=" key). Calculator remains functional.

Two other methods for converting an electronic calculator into a counter are described by Alexandrovich (1975) and Wollach, Roccaforte, and Breuning (1975).

REFERENCES

ALEXANDEROVICH, G., SR. Convert your pocket calculator into a programmable counter. *Electronic Design*, 1975, **23**, 100.

WALLACH, A. H., ROCCAFORTE, P., & BREUNING, S. E. Converting an electronic calculator into a counter. *Behavior Research Methods & Instrumentation*, 1975, **7**, 365-367.

(Received for publication January 26, 1976.)