

# Popular Electronics®

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APRIL 1982/\$1

## Adapt a Turntable to Play 78-rpm Collector Records

## How to Eliminate Data Loss in TRS-80 Personal Computers

### The Wave Saver

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# BUILD A RESISTANCE-CAPACITANCE SUBSTITUTION BOX

Provides resistances from 0.5 ohm to 20 megohms and capacitances from 5000 pF to 2  $\mu$ F

BY CASS LEWART

**T**HE resistance-capacitance substitution box is a simple, yet useful, piece of test equipment. It provides a wide range of resistance and capacitance values that you can select quickly and easily.

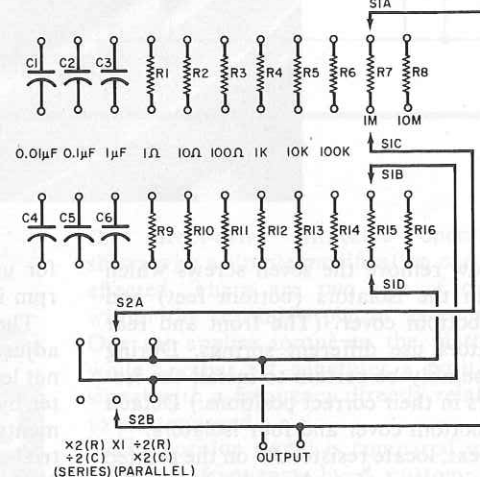
The substitution box described here uses two multi-position rotary switches and 22 resistors and capacitors. It substitutes for a wide range of resistors, from  $\frac{1}{2}$   $\Omega$  to 20 M $\Omega$ , and capacitors, from 5000 pF to 2  $\mu$ F. A 12-position switch selects 1  $\Omega$ , 10  $\Omega$ , 100  $\Omega$ , 1 k $\Omega$ , 10 k $\Omega$ , 100 k $\Omega$ , 1 M $\Omega$ , 10 M $\Omega$ , 0.01  $\mu$ F, 0.1  $\mu$ F, 1.0  $\mu$ F, or an open circuit. A 3-position switch multiplies the reading on the 12-position switch by  $\frac{1}{2}$ , 1 or 2. For finer resolution you can build two of these boxes and connect them together. Also, you can use two boxes to substitute for components in series or parallel RC networks.

**Circuit Operation.** Figure 1 is a schematic of the circuit. One set of eight resistors and three capacitors is connected between sections S1A and S1C of the 12-position switch, S1. A second identical set of components is between S1B and S1D. The 3-position

switch, S2, is used to connect the two sets of resistors/capacitors in series or parallel, or select the first set alone. Depending on the positions of the two switches, you can select thirty-three resistor/capacitor values or an open circuit.

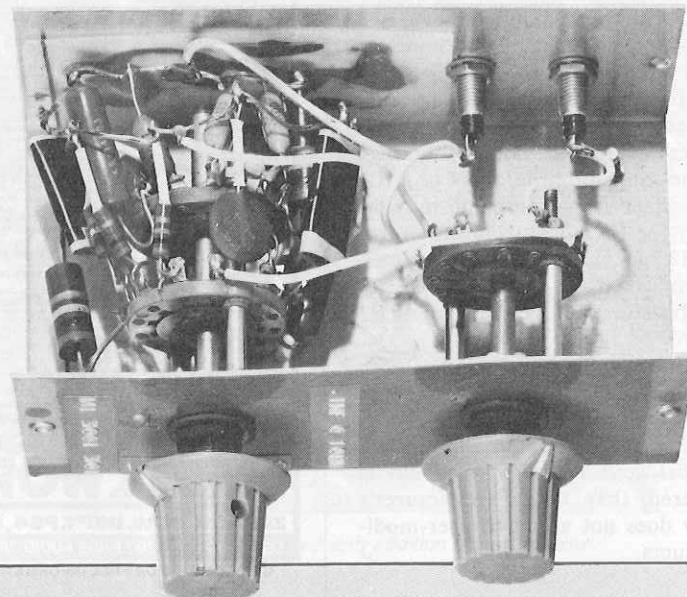
**Construction.** Multiple-section rotary switches are generally available from industrial distributors and many surplus suppliers. Set switch S1 for 12 positions by removing the index pointer. Set the pointer on switch S2 for 3 positions. Mount all components on a small board or directly on S1. To

facilitate mounting of components directly on the switch, disassemble S1 and turn sections S1B and S1D by 180 degrees. By doing this, the two sets of capacitors and resistors can be mounted on opposite sides of the switch providing for a neat layout. Both switches should be wired before being mounted in the cabinet. Select proper wattage and voltage ratings for all components depending on the intended use for the substitution box. Use only nonpolarized capacitors. Use a plastic cabinet or an insulated metal box to protect yourself against shocks from short circuits.  $\diamond$



## PARTS LIST

C1, C4—0.01- $\mu$ F capacitor  
C2, C5—0.1- $\mu$ F capacitor  
C3, C6—1.0- $\mu$ F capacitor  
R1, R9—1- $\Omega$  resistor  
R2, R10—10- $\Omega$  resistor  
R3, R11—100- $\Omega$  resistor  
R4, R12—1-k $\Omega$  resistor  
R5, R13—10-k $\Omega$  resistor  
R6, R14—100-k $\Omega$  resistor  
R7, R15—1-M $\Omega$  resistor  
R8, R16—10-M $\Omega$  resistor  
S1—1-pole per section, 4-section, 2-12-position rotary switch (OAK G-725550 or equivalent)  
S2—2-pole, 1-section, 2-6-position rotary switch, (OAK G-725551-2 or equivalent).



# ELIMINATE DATA LOSS IN YOUR TRS-80 COMPUTER

A simple circuit addition, usable with any microcomputer, will help prevent outages due to line disturbances

BY ROBERT E. WILSON

**T**HE WORST computer headaches typically involve an unexpected breakdown or random bit errors with no apparent cause. An examination of the hardware may reveal one or more inoperative ICs. It may also show that everything is in good working order; but some (though not all) of the time, data does not flow properly between the system and the cassette or disk.

In most cases, damaged ICs are the result of very high voltage spikes (from air conditioner, refrigerator, or washing machine motors, for example) on the power line. And data flow can be disturbed by electrical "hash" from nearby fluorescent lamps or light dimmers—also coupled through the power line.

If you have had either of these problems or if you want to avoid them, you should add a power line filter/surge arrester to your system. Although designed for the TRS-80, the approach described here can be used with any other microcomputer system.

In the case of the TRS-80, extra outlets are added to the video monitor for the keyboard power supply and cassette player so that only one power cord (the one from the monitor) needs to be plugged into the wall outlet. Triple taps and extension cords aren't needed when this modification is made. The video monitor power switch controls the entire system; the keyboard power switch (beside the cable entrance) will no longer be needed; and there will be no idling currents in either the cassette player or keyboard power transformers.

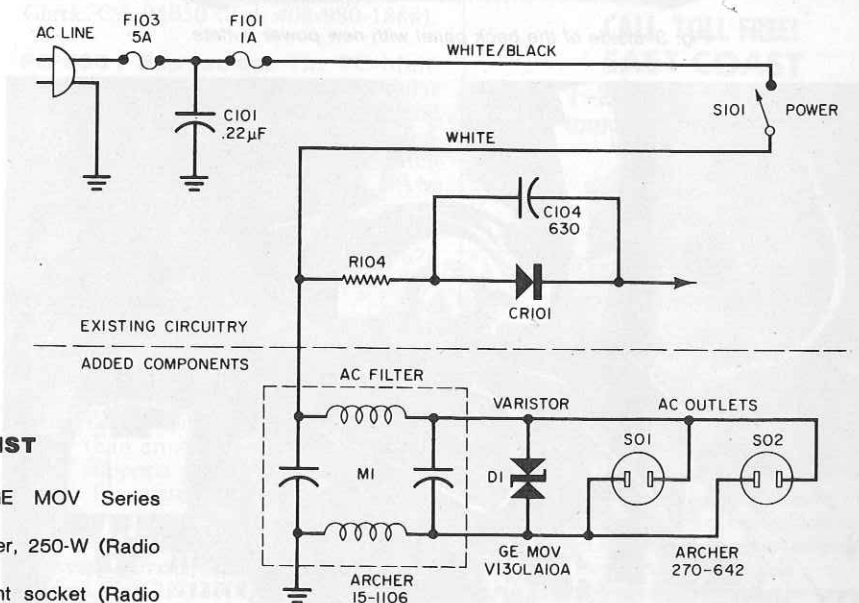
The modification adds an r-f filter,

a varistor surge arrester, and a pair of power outlets to the video monitor for less than \$8. The complete circuit, shown in Fig. 1, complements the fuse and switch already in the video monitor. Power switch S101 is rated at 5 A (600 W), and the fuse F101 is 1 A (120 W).

A Level II 16K-byte system requires 93 W total, including the cassette player. Replacing fuse F101 with a 2-A type provides up to 240 W, with no change in safety. Adding the filter and varistor provides two stages of protection for the computer.

Although opening the video monitor cabinet will void the warranty, the modification does not affect monitor operation in any way. The filter surge arrester fits into an empty space, well away from any critical signal areas, and produces no heat. The video monitor cabinet back remains completely removable for servicing.

**Modification.** The changes needed are straightforward and are most easily performed in three stages.



## PARTS LIST

D1—Varistor diode (GE MOV Series V130LA10A)  
M1—R-f interference filter, 250-W (Radio Shack 15-1106)  
SO1, SO2—Chassis-mount socket (Radio Shack 270-642)  
Misc.—Twin-lead lamp cord (12"), Styrene cement (modeler's glue)

Fig. 1. Schematic of the circuit to be added to the fuse and switch already in the video monitor.

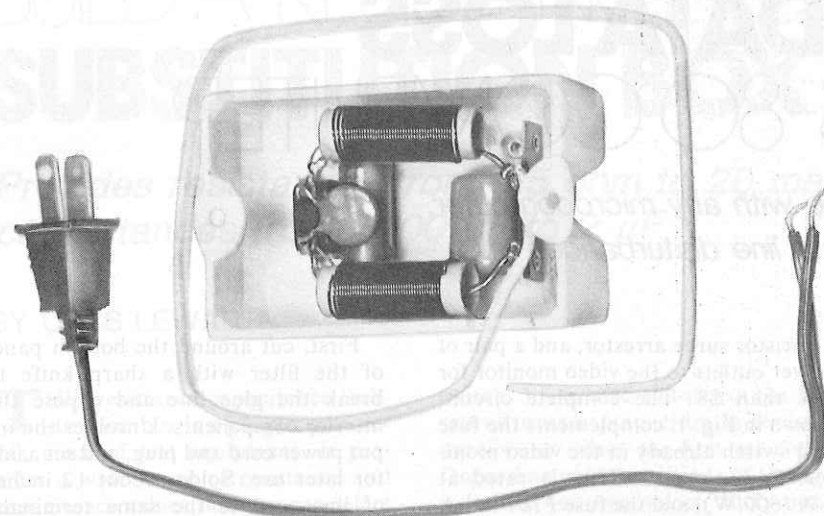


Fig. 2. The opened filter with new line cord attached.

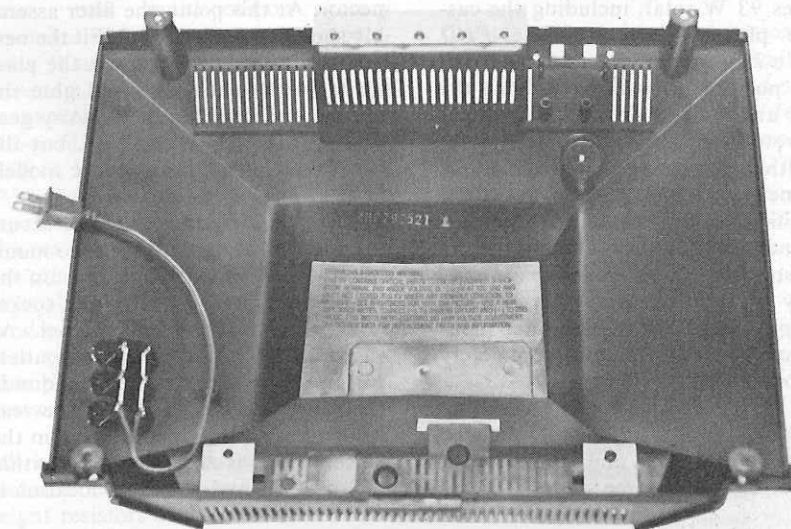


Fig. 3. Inside of the back panel with new power outlets.

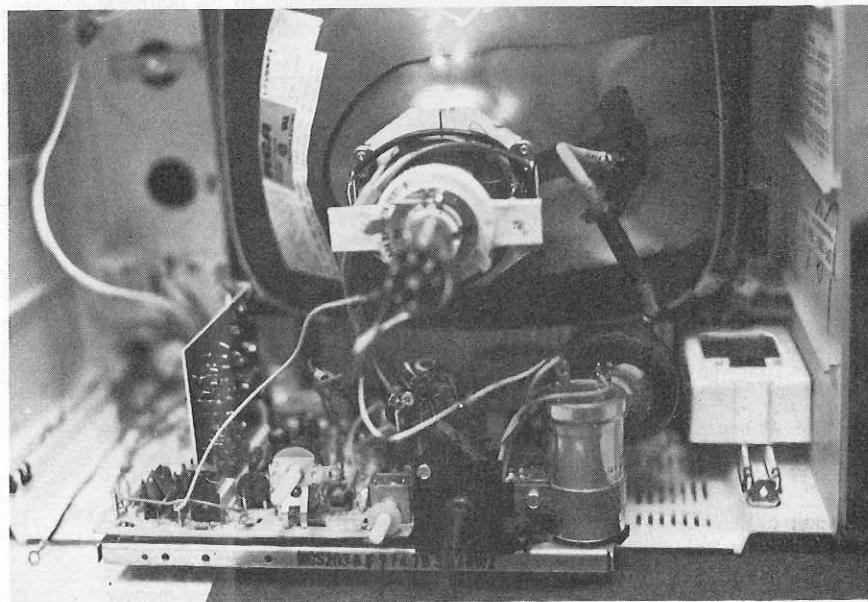


Fig. 4. Glue the filter to the lower inside wall of the cabinet.

not critical. Mark and cut the holes for the outlets. This is most easily done by first drilling a series of small holes around a marked line, then trimming the hole to proper size and shape using a sharp knife. Mount the outlets with suitable hardware, wire them together in parallel, then attach the cord and plug that was salvaged from the original filter. At this point, the back panel assembly should look like Fig. 3. The final step is to type a paper label saying:

SWITCHED POWER  
80 WATTS MAX

and lacquer it onto the outside of the panel near the new outlets.

The last step is to install the modified filter in the video monitor. With the cabinet back off, the main chassis printed circuit board will slide out a few inches to make tracing of the wire easier. Follow along from the power cord through the fuse(s), to a white wire with black stripe, that goes up to the power switch, and finally to a solid white wire that returns from the power switch to a terminal strip at the front of the circuit board.

Solder one of the filter power inlet leads to this terminal, and solder the other lead to the center terminal on the same strip that extends down to the chassis plate. Slide the chassis back into the cabinet. Glue the filter assembly to the side of the monitor cabinet while sliding it down against the bottom of the cabinet for extra support, as shown in Fig. 4.

This mounting position is out of the way, yet sturdy enough to take any abuse that the cabinet as a whole can take. After the glue has set, the new outlet cord from the back panel sockets can be plugged into the filter outlet, and the back panel reinstalled on the monitor cabinet, completing the modification.

Plug the keyboard power supply and the cassette player into the new outlets on the back of the video monitor, and plug the video monitor line cord into a wall outlet. Turn on the keyboard power switch near the cable entrance at the back and forget it—you won't need it again. Now turn on the monitor. After a short warm-up delay, the beginning messages should appear on the monitor, and the system is off and running.

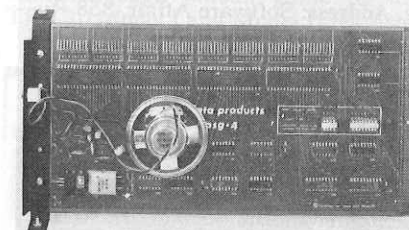
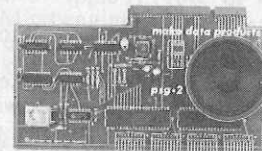
To test the new filter's effectiveness, a particularly noisy fluorescent desk lamp was plugged into the same wall outlet as the computer, and switched on and off repeatedly during a CLOAD. Although flickering appeared all over the monitor screen, the computer never dropped a bit. ♦

## COMPUTER SOURCES

By Leslie Solomon  
Technical Director

### Hardware

**Heath Sound Effects.** The PSGx2 uses two GI AY3-8910 Programmable Sound Generator chips to produce a wide variety of sound effects when plugged into P504/P505 of the H89



buss. The PSGx4 uses four similar chips and plugs directly into the H8 buss. Each board comes with a speaker, a built-in audio monitor, and uses a crystal time base. PSGx2 is \$125, PSGx4 is \$225. The MICRO-PIANO 2.0 software can play up to 6-note polyphony over an 8-octave range, and features a graphic screen editor. \$24.95. Address: Mako Data Products, 1441-B N. Red Gum, Anaheim, CA 92806 (Tel: 714-632-8583).

**6-MHz CPU Card.** The CP600 Central Processor Card uses a 6-MHz, Z80 CPU and conforms to the IEEE 696 Standard for S-100. Two on-board ports extend memory addressing to 24 bits and I/O addressing to 16 bits. This allows 16 megabytes of RAM and 65K of system I/O. RAM refresh is standard S-100 memory read cycle, and all 8 lower address bits are used for refresh to accommodate 64K RAM devices. A refresh localizer allows intensified parity checking in the area of currently executing programs. All bus cycles are three "T" times long, including refresh cycle. A crystal-controlled clock, jumper-selectable on-board memory and I/O wait states, as well as an on-board EPROM wait are provided. Ready signals are evaluated on rising edge of PHI during BS2, per IEEE 696. \$550. Address: Echo Communications Corp., 1708 Stierlin Rd., Mountain View, CA 94043 (Tel: 415-969-6086).

**Memory Management.** The Memory Master 1.0 for the Apple II with Apple DOS 3.3 provides 44K-bytes of storage within the 48K on the Apple motherboard by relocating the DOS to any of the four 16K banks on the 64KC card. It will also manage Integer/Applesoft firmware, and can be used with any 16K RAM card similar in function to the Apple Language Card. An additional 8.5K of RAM is released on the Apple motherboard, each disk CATALOG displays unused sectors on diskette, machine-language programs can access the DOS RWTS routines through standard DOS page 3 vectors (\$3DO through \$3EC) and no additional page-3 space is used. The .FLIP command allows user to flip between DOS 3.3 and 3.2 without rebooting, the .STAT command displays DOS version in use, and the .BSTAT command displays the hex starting address and length of last binary file either Bloated or BRUN. Address: Great Lakes Digital Resources, POB 32133, Detroit, MI 48232 (Tel: 313-538-7963).

**5M-Byte System.** The LS525 uses a Seagate ST506 5 1/4-inch Winchester drive, LDOS, linear power supply, and an LSI-500 Series controller. All TRS-80 user programs currently running under TRSDOS or NEWDOS will run under LDOS. A separate off-board Host Adapter allows the LS525 to be cross-connected to almost any CPU and bus. Up to three additional Winchesters can be added with no software modifications. Size is 13.5" deep, 12" wide, and 5 1/4" high. \$3750. Address: Laredo Systems Inc., 2264 Calle de Luna, Santa Clara, CA 95050 (Tel: 408-980-1888).

**PC-8001 Expansion.** The PC-Multi Card replaces the PC-8012A Modular Expansion Unit to provide disk I/O and an additional 32K of RAM. While providing 64K of RAM for CP/M, a patch is provided for another 8K of RAM available to NBASIC in ROM. Power is supplied from the PC-8001A. \$375. Address: Astar International Co., 5676 Francis Ave., Chino, CA 91710 (Tel: 714-627-9887).

**128K For Apple.** The 128KDE Soft Disk can be installed in any slot and can be accessed via DOS 3.3 as if it were an actual floppy disk. It is as much as 300% faster than an Apple Disk II. The software supports up to three 128KDE cards. By switching eight 16K banks over the existing ROM space, the Soft Disk triples the RAM capacity. \$750. Address: Great Lakes Digital Resources, Box 32-133, Detroit, MI 48232 (Tel: 313-538-7963).

**VIP Memory.** The GJK 8K RAM card allows expanding the RCA VIP computer to full (32K) capacity. Each 4K block

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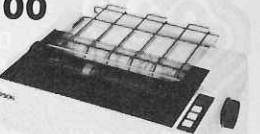
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