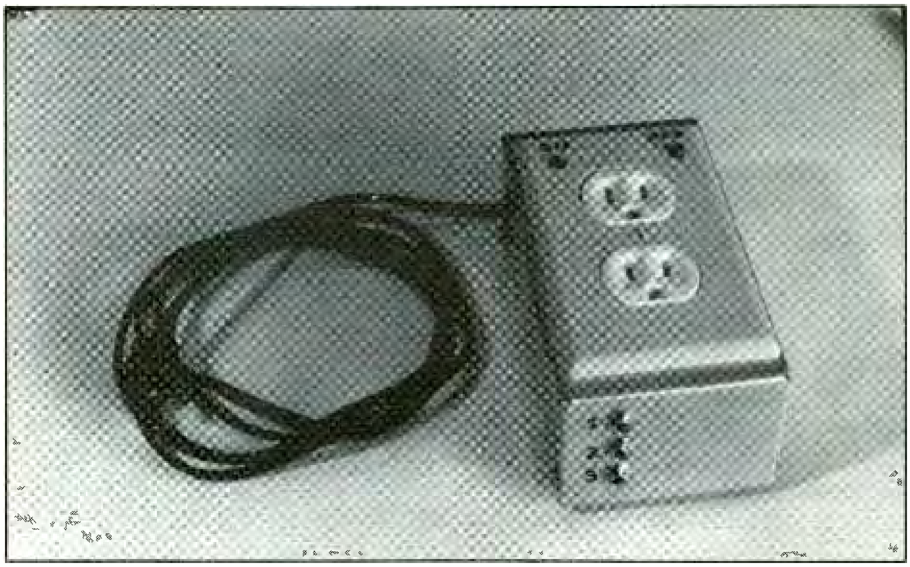
An Automatic Printer Power Controller

Switches on a printer and external printer buffer automatically when you power up any computer sharing them in a multi-computer setup

By Ralph Tenny



When you have one computer and one printer, life is easy. Add a printer buffer so the printer doesn't hog the computer during printing, and life gets better. Add another computer and a way of switching the printer buffer between computers, and things are still okay. However, if you're like most people, each computer you have is controlled by its own power strip, with the printer plugged into the one that's most frequently used. So if you want to use your printer and buffer (if you have one) with computer number two, you have to unplug them from number one's power strip and plug them into number two's if you want automatic power-up when the computer is turned on. Or you can plug the printer and buffer into their own separate wall outlets and manually switch them on and off whenever you need them.

What you need, especially if you have more than two computers that are to be used with the same printer, is a device that will automatically power up/down the printer and buffer whenever *any* computer in your system is turned on. This is what the automatic printer power controller described here does. With this power controller, life with a multiplicity of computers that share the same printer and buffer suddenly becomes almost as easy as it was when you had only one computer.

Our automatic printer power controller connects to each computer with which it is to be used via a cable that taps off the computers' +5-volt and ground lines. Turning on any computer sends 5 volts to the controller, which then powers up the printer and buffer plugged into it. Turning off the computer cuts off the 5 volts and causes the controller to power-down the printer and buffer. The whole operation is automatic. Your only extra step is to switch the printer or buffer to the computer you want to use. Interfacing between the computers and controller is through optical isolators, any number of which can be added as needed for the computers you have.

About the Circuit

Shown in Fig. 1 is the complete schematic diagram of the automatic printer power controller. Power transformer *T1* and rectifier/filter *BR1/C1* power relay *RLY1* to switch power to the printer and printer buffer plugged into the ac power sockets. The same dc voltage used to power the relay circuit is stabilized by zener diode *Z1* to power quad CMOS Schmitt trigger *IC1* to drive the relay via buffer transistor *Q1*.

Since I also have a Tandy Model

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100 laptop computer, momentary-action the ON pushbutton switch allows me to activate the printer on rare occasions when I print from this computer. A separate OFF pushbutton switch allows me to turn off the printer when I'm finished working. I could have included another IC to sense when the computers are turned off. However, I didn't feel this was worth the effort or expense.

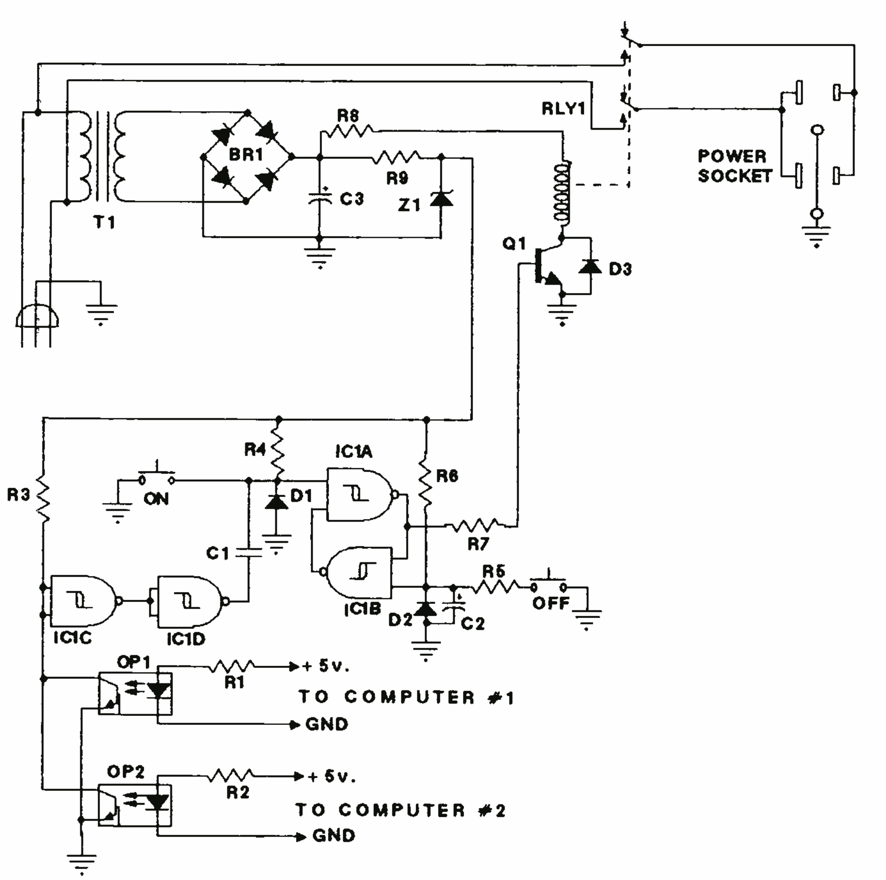
Sections *IC1A* and *IC1B* for this application are connected as a latch that drives *Q1* when the output of *IC1A* goes high. This condition occurs when the ON switch is closed or when either *OP1* or *OP2* detects a computer has been turned on. Note that these optical couplers are powered by the +5-volt supplies in their respective computers only when the computers themselves are turned on. Resistors *R1* and *R2* limit the current from the computer power supplies to a level suitable to turn on *OP1* and *OP2*, respectively.

When either (or both) optocouplers are turned on, current through *R3* pulls *IC1C*'s inputs low. This causes *IC1D* to pulse *IC1A* on via *C1*, which is exactly what occurs when the ON switch is pressed. Resistor *R4* holds the latch input high except when the ON switch or *C1* pulses the input low to set the latch. Diode *D1* protects the input of the latch from negative swings that could be generated when the power supply turns on.

On the other side of the latch, the OFF switch resets the latch by discharging *C2* through *R5*, while *R6* and *D2* protect the input of the latch from negative inputs. Also, *R6* and *C2* hold the input of *IC1B* low when power is applied. This forces the latch to power up in the off state.

Resistor *R7* provides base current for *Q1* whenever the latch is in the ON state. Diode *D3* protects transistor *Q1* from the inductive kickback generated when the relay turns off.

The power supply consists of



PARTS LIST

Semiconductors
BR1—50-PIV, 1-ampere bridge-rectifier assembly or individual 1N4001 rectifier diodes
D1,D2—1N4148 switching diode
D3—1N4001 rectifier diode
IC1—CD4093 CMOS Schmitt trigger
OP1,OP2 . . . OPn—General-purpose TTL-level optical isolator (4N25 or similar)—see text
Q1—MPS3904 npn transistor (Radio Shack Cat. No. 276-2016)
Capacitors
C1—0.01-µF, 50-volt film
C2—1-µF, 35-volt tantalum
Resistors (10% tolerance)
R1,R2—1,000 ohms, ¼ watt
R3—22,000 ohms, ¼ watt
R4—100,000 ohms, ¼ watt
R5—1,000 ohms, ¼ watt
R6—220,000 ohms, ¼ watt
R7—4,700 ohms, ¼ watt
R8—82 ohms, ½ watt
R9—330 ohms, ½ watt
Miscellaneous
RLY1—12-volt dc dpdt relay with 5-ampere contacts
T1—12-volt, 300-mA power transformer
Two momentary-action spst pushbutton switches; dual 3-contact ac receptacle assembly; miniature phone jacks for inputs (see text); printed-circuit board or perforated board with holes on 0.1" centers and suitable Wire Wrap or soldering hardware (see text); three-conductor ac line cord with plug; suitable enclosure and wall plate (see text); rubber grommet (to line ac line cord entry hole); lettering kit; spacers; machine hardware; hookup wire; solder; etc.

Fig. 1. Complete schematic diagram of automatic printer power controller.

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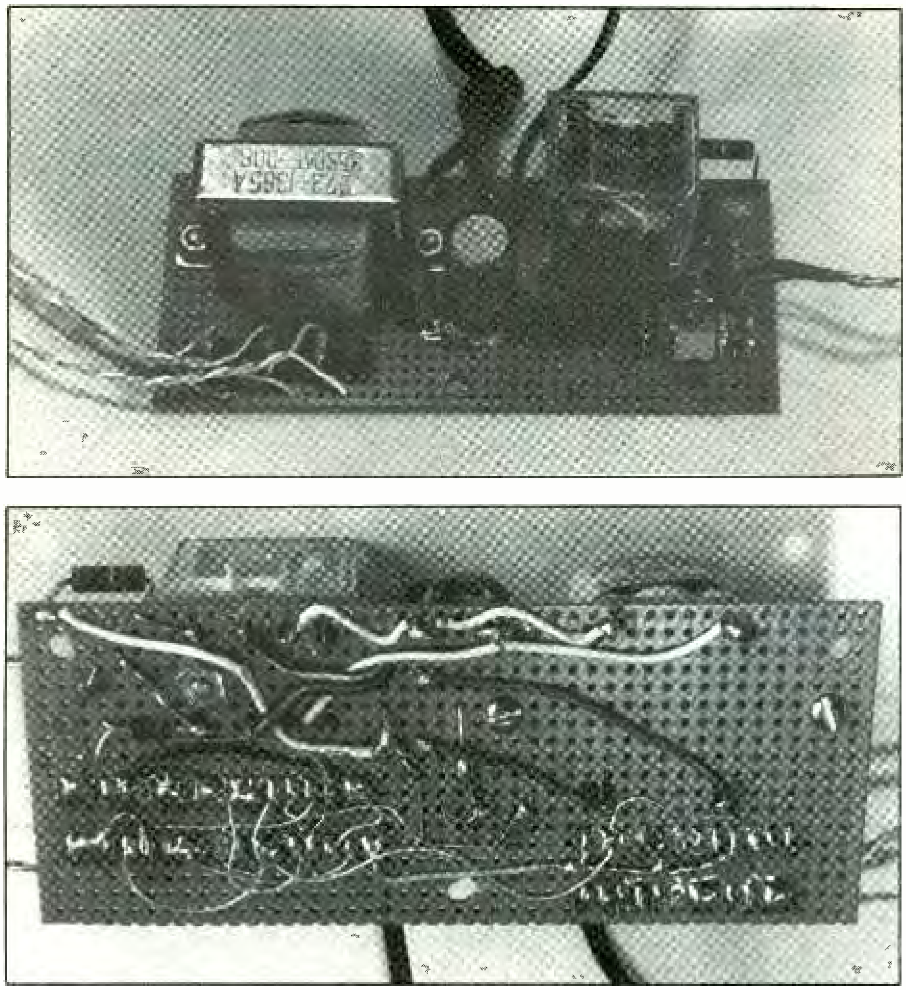

Fig. 2. Prototype of circuit-board assembly wired on perforated board. Upper photo shows top side of board, lower photo shows bottom of board.

transformer *T1*, bridge rectifier *BR1*, filter capacitor *C3*, resistors *R8* and *R9* and zener diode *Z1*. Current limiting for *RLY1* is provided by *R8*. Both *R9* and *Z1* stabilize the voltage for *IC1*. The contacts of *RLY1* switch 117-volt ac line power to both contacts of a standard three-conductor wall outlet. In operation, the printer power cord would be plugged into one socket, while the printer buffer cord would be plugged into the other socket.

Construction

There is nothing critical about circuit layout. Therefore, you can use any traditional wiring technique that suits you, including a printed-circuit board of your own design and a perforated board (with holes on 0.1″ centers) and suitable Wire Wrap or soldering hardware. In either case, it's a good idea to use DIP integrated-circuit sockets for *IC1, OP1* and *OP2*. The prototype shown in Fig. 2 was wired on perforated board. The upper photo shows a top-of-the-board view, while the lower shows the solder side. In this particular case, neither sockets nor other hardware were used.

The only important point to keep foremost in mind with regard to construction is electrical safety. As noted in Fig. 1 and the Parts List, you *must* use a grounded three-conductor line cord and ac sockets, with the green ground wire going to the metal chassis to complete the ground circuit for the printer and buffer.

A common aluminum utility box was used for the prototype of this project (see lead photo), though it did require a respectable amount of chassis work to make the cutout for the power sockets. If you go this route, make sure the project box you choose has enough depth to permit mounting the circuit-board assembly on the floor and the power sockets above, with enough room between the two to prevent interference with each other.

If you prefer, you can use a standard four-outlet electrical box, with the circuit-board assembly mounted in one half of the box and the two sockets in the other half. This will eliminate extensive chassis work, and the box can be covered with a standard two-socket, one-switch wall plate, with the switch slot covered over with electrical tape or a glued-on metal or plastic plate. This type of box lets you avoid any interference whatsoever between the circuit-board assembly and power sockets, though at the expense of a larger enclosure. On the other hand, if you need more room for the additional optical-coupler computer inputs, the double electrical box provides ample room to stack another board on which the extra circuitry can be mounted below the first.

Whichever type of enclosure you choose, drill holes for the ac line cord, the switches and the jacks for the various inputs from the computers to the optical isolators, as well as for mounting the circuit-board assembly (and for mounting the ac receptacles if you use the aluminum utility box). Once you've drilled these holes, deburr all cut and drilled holes to remove sharp edges. Then line the line-cord hole with a rubber

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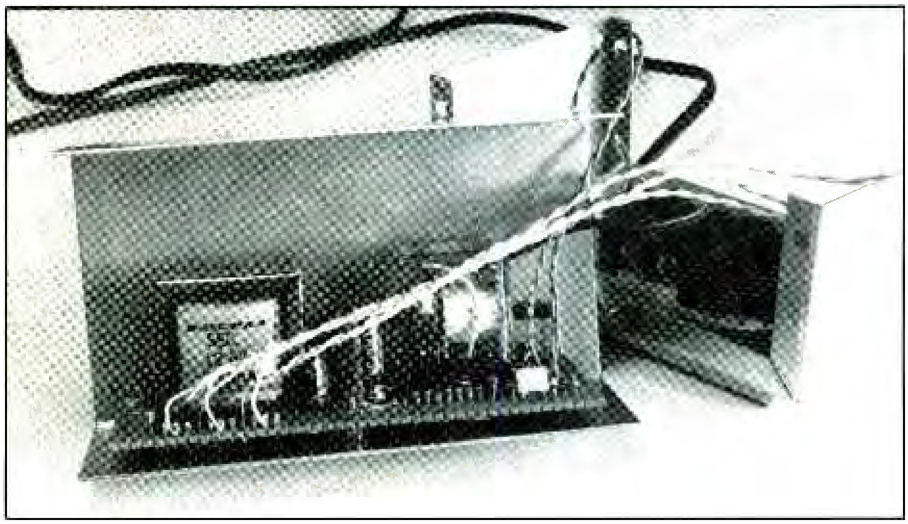


Fig. 3. Circuit-board assembly mounted on floor of aluminum utility box using spacers and machine hardware.

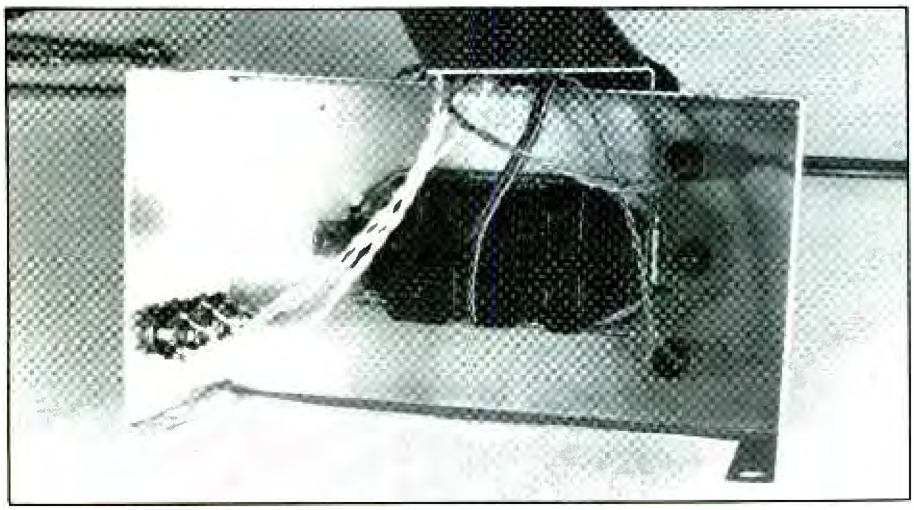
grommet, and mount the switches in their respective locations.

Miniature phone jacks make excellent input connectors for the project. Mount these in their respective holes. Then wire them to the appropriate points in the circuit. Connect and solder heavy-duty hookup wires or at least 18-gauge zip-cord conductors to the contacts of the relay.

Mount the circuit-board assembly in the selected location inside the box, using ½" spacers and 4-40 or 6-32 × ¾" machine screws, nuts and lockwashers (see Fig. 3). Then connect and solder the free ends of the wires last connected to the circuit-board assembly to the ac line cord and power receptacles and wire the switches and jacks into the circuit. Use a voltmeter to trace from the power-cord plug to the socket to make sure you've attached the low side of the line cord to the wide-blade receptacles and the high side to the narrow receptacles of the sockets.

Mount the power sockets, sandwiching the free end of the ac line cord's green (ground) wire between one of the receptacle assembly's mounting tabs and the box to complete the ground circuit. With the project completely assembled, recheck all your wiring against Fig. 1, especially with respect to the integrated circuit and optical isolators. Also, check to make sure the diodes and electrolytic capacitor are properly polarized. Once you're satisfied that your wiring is correct, finish assembling the project.

Plug your printer into one power socket, your printer buffer into the other power socket and the project's line cord into an ac receptacle. You're ready to enjoy the advantages of completely *automatic* printer/buffer switching. **ME**



This interior view shows mounting details for dual ac receptacle and two push-button switches on the front panel and three (you can have as many more as needed) input jacks in one side panel.

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