

Atari XL/XE Power Supplies: A Hardware Mystery Solved

Exploring similarities and differences of the four major types of XL/XE supplies and how you can repair them

By Benjamin Poehland

If you're a serious Atari XL hardware enthusiast, you probably keep a copy of the 800XL Field Service Manual close by your machine. Perhaps you've even purchased a copy of the recently released Sams *Computerfacts* for the 800XL. As good as these references are for troubleshooting and repairing a malfunctioning 800XL, neither contains information concerning the power supply, which is very prone to failure. Replacement of a defective power supply will cost you 30% or more of the price of a new 800XL at today's discount prices. Of course, you can return an out-of-warranty power supply to Atari directly for repair. However, you'll pay for this and you won't have the use of your computer during the turnaround. Given that the power supply is a major component of the computer and is absolutely essential to its operation, it's doubly mysterious that the available hardware manuals virtually ignore it. The reason may be that there are at least four different types of power supplies shipped with the 800XL! This being the case, let's examine each and determine what, if anything, can be done if it fails.

A Plethora of Supplies

Figure 1 shows the four major types



Fig. 1. Pictured here are the four major configurations of power supplies supplied with Atari XL computers arranged from Type I through Type IV left to right.

of power supplies that have been shipped with 800XLs. (Considering the many changes Atari has undergone since the introduction of the XL machines, there may be still others not covered in article.) The units are arranged and numbered roughly in the order of their appearance. Type I on the left was shipped with early production 800XLs until about the winter of 1984. It is the prettiest of the power supply boxes and is the only one made in Hong Kong (all the

others are made in Taiwan). Type II supply appeared in 1984 prior to the Tramiel takeover. It seems to be the most frequently encountered. It's also the heaviest, hottest and ugliest. Type III was encountered by chance in a shipment of 800XLs containing the most recent (Type IV) power supplies. Although black in color like the Type II it has the stylish appearance of the Type I and is the only one of the group specified for use with both the 600XL and 800XL. The newest

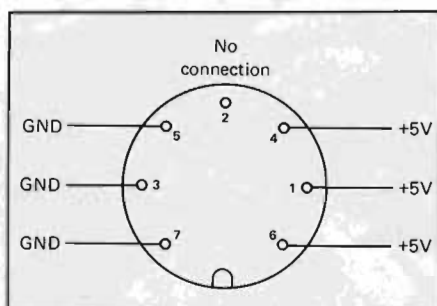


Fig. 2. Pinout descriptions for XL/XE connector on cable that goes to the computer.

Type IV supply has been shipping with some 800XLs since the spring of 1985. It's the smallest, lightest, coolest and most sophisticated (electronically) of the XL supplies. The Type IV is also the standard supply that has been shipping with the new 130XE since the appearance of that machine in mid-1985. The design of the Type IV represents a radical departure from all the previous designs, as we shall see.

Despite the multiplicity of differences, all four of these power supplies perform the same function. They convert the 117 volts from the ac line to the +5 volts required by the computer. All have the same type of power connection for an XL or XE machine (see connector pinout in

Fig. 2). Any of the four power supplies described in this article (and *only* these four!) should provide sufficient current to operate a 600XL, 800XL or 130XE computer and associated peripherals without difficulty.

Type I: The Beauty Queen

If your computer was furnished with this type of supply, count yourself lucky. Not only is it the most powerful and aesthetically pleasing, it is also *repairable*. Access to the circuit-

ry is accomplished by first removing the four rubber feet from the bottom (they may be held in place by soft glue, so pull hard). Under each foot is a screw that can be removed with a Phillips screwdriver. You can then remove the top cover.

Figure 3 is an interior view of this supply, while Fig. 4 is its schematic diagram. The component most likely to fail in this circuit is the miniature 3-amp fuse. (You can get it inexpensively from Radio Shack as an "in-

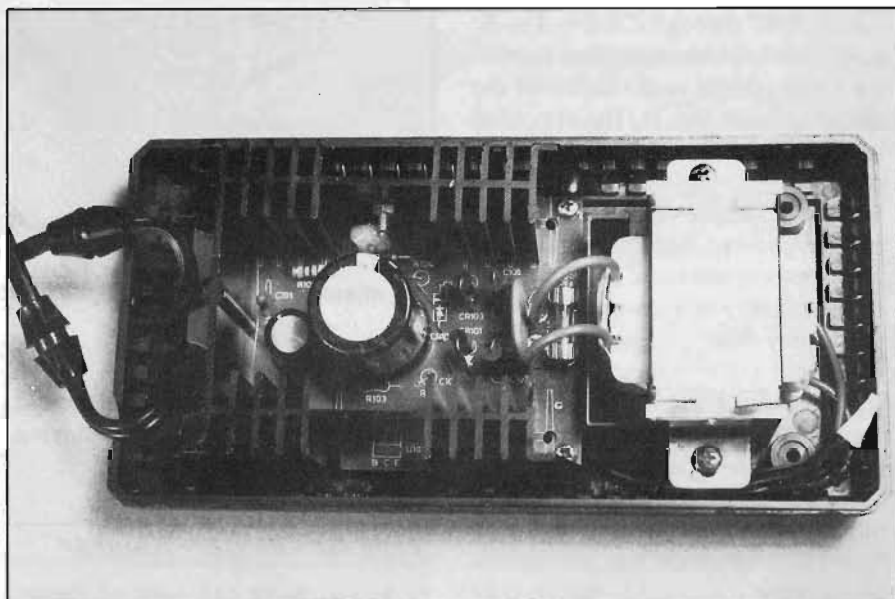
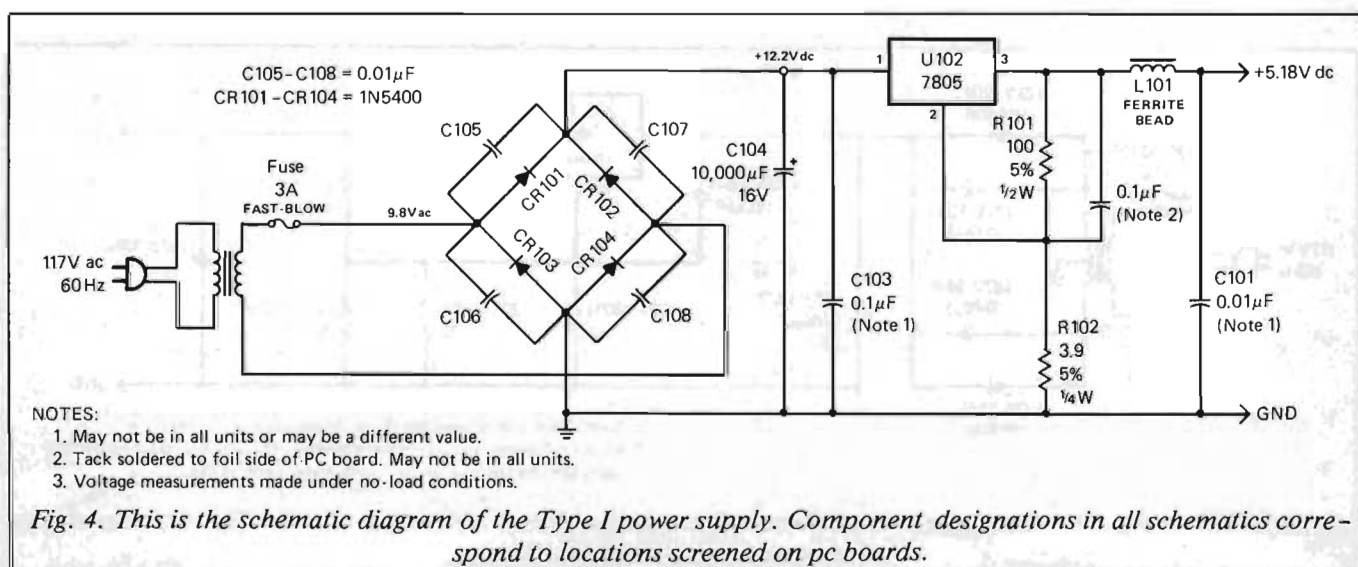


Fig. 3. This is the interior view of the Type I power supply, slightly modified.



strument fuse.”) The critical component in this supply is the *U102* 7805 voltage-regulator chip with built-in thermal overload protection. If the chip gets too hot, it shuts down until it cools off, then pops back on again. The large heat sink visible in Fig. 3 cools the chip and prevents the thermal protection from activating prematurely.

The large power transformer reduces the 117 volts from the ac line to about 10 volts ac, which is then converted to pulsating dc by rectifier diodes *CR101* through *CR104*. The dc pulses are smoothed by filter capacitor *C104* (visible in the center of the circuit board in Fig. 3). The smoothed unregulated dc is regulated down to a constant +5 volts by 7805 regulator *U102*. The output voltage to the computer is boosted slightly by the *R101/R102* resistor network to help counteract delivery of a lower voltage under heavy load. Capacitors *C101*, *C103* and *C105* through *C108*, and ferrite bead *L101* filter out high-frequency noise that could interfere with computer operation.

In addition to the usual Atari part number, the Type I's printed-circuit board also has markings and spaces for additional parts that may or may not be present in your unit (several different versions are probably in existence). Those empty spaces give the

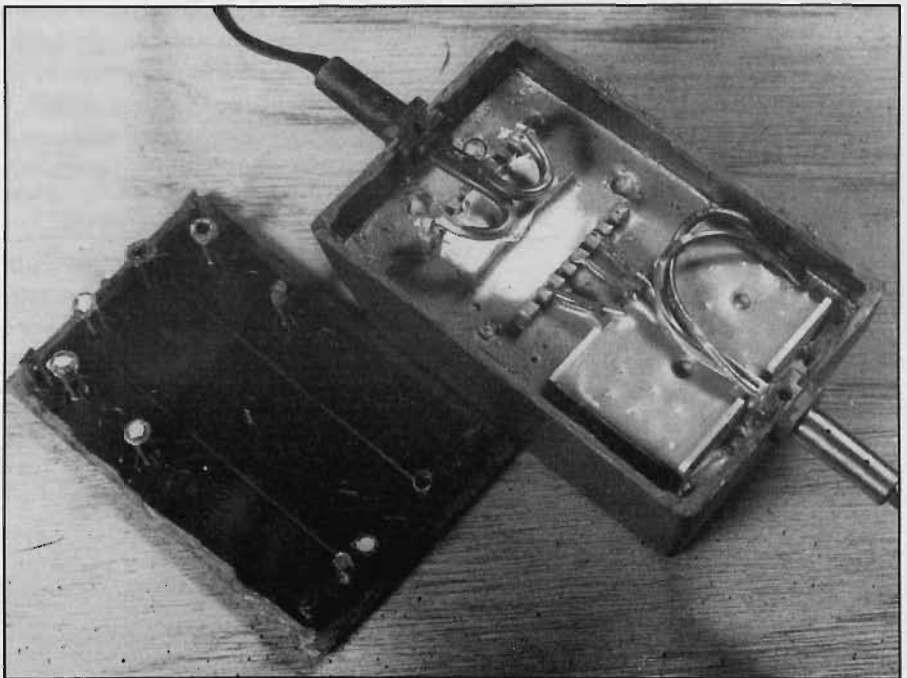


Fig. 5. Note in this photo of the Type II power supply that the entire unit is permanently sealed in plastic potting compound, eliminating repairability.

appearance that someone at the old Atari tried to save money by shaving the number of parts.

Type II: The Ugly Klunker

If you're using this type of power supply and it poops out, you can't fix it. Atari can't fix it, either! Figure 5 shows why. The entire circuit, trans-

former and all, is permanently sealed in potting compound. The outer plastic case is permanently sealed, too. I had to use special tools to cut open the one shown to get this photo. After several hours of operation, the Type II supply gets uncomfortably warm, which probably means that its circuitry is similar to the Types I and III circuits. It's very discouraging to

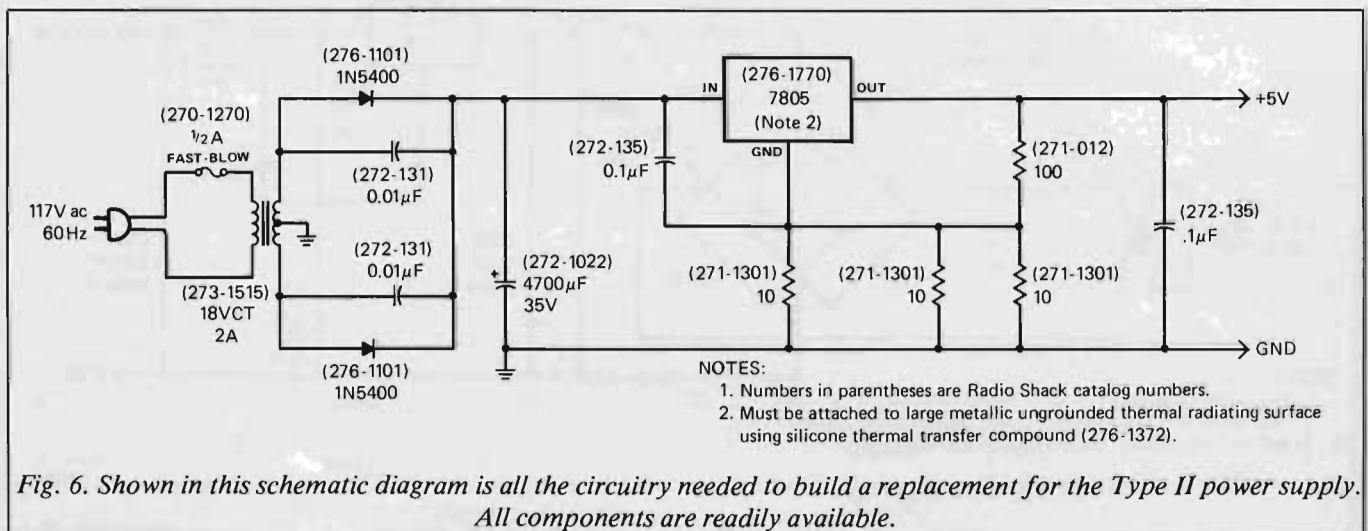


Fig. 6. Shown in this schematic diagram is all the circuitry needed to build a replacement for the Type II power supply. All components are readily available.

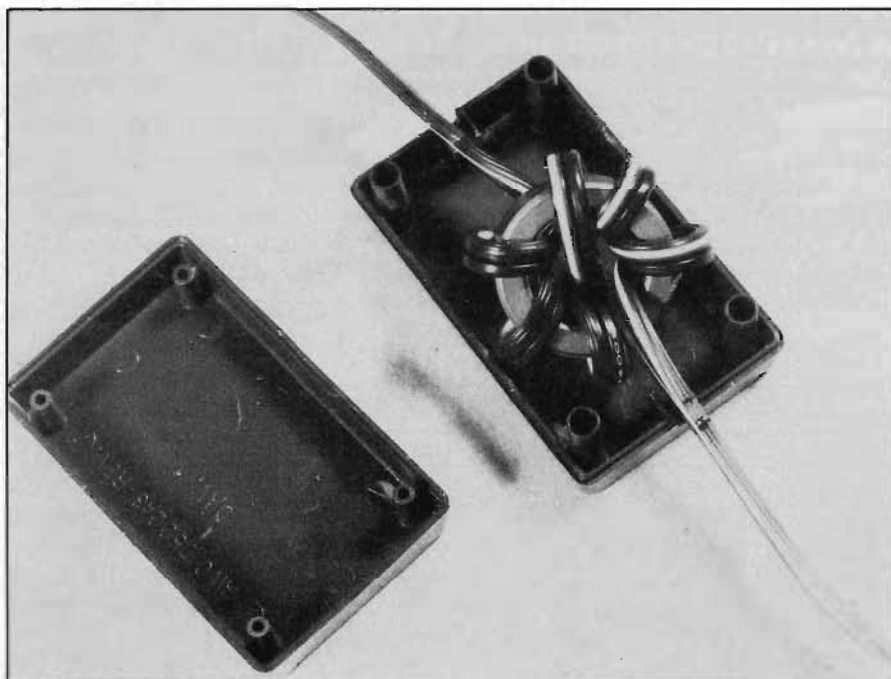


Fig. 7. A radio-frequency interference suppressor for the Type II power cord is inside a plastic box near the end of the cable that goes to the computer.

consider that inaccessibly buried in that chunk of plastic may be a 25-cent fuse whose failure will require replacement of the *entire* unit.

If this supply goes dead and your computer is out of warranty, you have only three options. You can return your defective Klunker to Atari accompanied by a suitable payment (\$24.95 including the handling fee), which is costly if you live on the East Coast and wait up to four weeks for a replacement to arrive. You can purchase a new power supply outright from any of several mailorder houses for \$25 to \$35 plus shipping. Your best alternative, however, may be to build a new supply from the schematic in Fig. 6.

Building your own power supply should cost you about \$20 in commonly available parts, providing a supply for adequate power for an XL or XE machine. The ac line cord and power cable/connector assembly can be salvaged from your defective Type II for reuse. A pc board isn't required, since the parts can be mount-

ed in a suitable enclosure using 5-lug terminal strips. Be *very* careful if you go this route, because the power supply connects directly to the ac line and a potential electrocution hazard exists if things are not wired properly. When you finish wiring it, measure the supply's output voltage at

each pin of the connector *before* connecting it to your computer.

This is the only power supply that comes with an externally mounted device to suppress radio frequency (r-f) interference. This is the little black plastic box attached to the power cord that goes to the computer. Figure 7 is a photo of the innards of this mysterious little box. Note that it is nothing more than ferrite core around which the power cord has been wound three times in one direction and three more times in the opposite direction. This same device is also used on the video cable that connects the computer to a TV.

Type III: The Black Beauty

This is the simplest and easiest to repair of the XL power supplies. The neat, streamlined appearance of the interior of this unit is shown in Fig. 8. Its schematic diagram (Fig. 9) is very similar to that of the suggested replacement for the Type II supply (Fig. 6). Access to the interior of this unit is obtained in the same manner as for the Type I supply.

Because the power transformer in the Fig. 9 circuit uses a center-tapped secondary, only two rectifiers are required to provide "full-wave" rectification of the ac voltage. With its

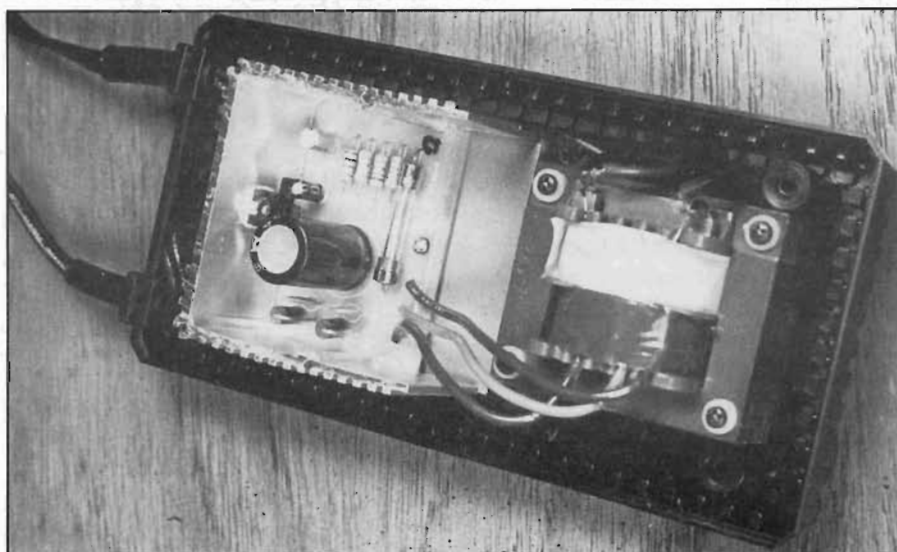


Fig. 8. This is an interior view of the Type III supply.

Power Your Next Project With an ac Adapter

External wall-transformer type ac adapters are now powering home computers and peripherals. The reason for this is that electrical equipment that connects directly to the ac line must be "certified" before it can be approved for consumer use. But certification is costly and time-consuming, which can cut profit margins. To minimize losses, many manufacturers are now obviating the need for certification by eliminating direct connection of their products to the ac line. Using *external* power supplies, puts the responsibility for certification on the manufacturer of the supply. Everyone benefits—even you!

Depending on the power needs of your project, you can use any of a number of plug-in ac adapters instead of building in a transformer. The table lists a number of heavy-duty adapters used with home computers and peripherals and includes input and output specifications. Note that output power ranges from 7.5 to 56 volt-amperes (VA) with these adapters. This should be sufficient for the modest needs of most home-built electronic projects.

All adapters listed are UL or/and CSA approved and are designed to be operated from a 117-to-120-volt, 60-Hz ac line. If you decide you need any of these adapters for a current or your next project, look through the mailorder ads

—many are now available at reasonably low cost.

If your project's power demands aren't in the "heavy-duty" category, you might want to use a less-bulky, general-purpose ac adapter like those sold

by Radio Shack, some local parts stores and many mail-order houses.

Low cost and safety make ac adapters the ideal alternative to home-built projects with built-in transformer power supplies.—R.L.L. Hu

AC Adapters Used With Popular Home Computers & Peripherals

Model	Input	Output
Apple IIc	25 W	15 V dc, 1.2 A, 18 W
Atari 130XE	25 W	5 V dc, 1.5 A (7.5 VA)
Atari 400/800 and 1050 disk drive	50 W	9 V ac, 31 VA
Atari 520ST	49 VA	5 V dc, 3 A + 12 V dc, 30 mA - 12 V dc, 30 mA
Atari 600XL/800XL	40 W	5 V dc, 1.5 A
Atari 1027 printer	60 W	9.5 V ac, 40 VA
Colecovision Video Game	250 mA	+ 5 V dc, 900 mA - 5 V dc, 100 mA + 12 V dc, 300 mA
Commodore 16	16 W	9.5 V dc, 1 A
Commodore 64 and VIC-20 (new)	40 VA	5 V dc, 7.5 W 9 V ac, 6.7 VA
Commodore 128	70 VA	5 V dc, 4.3 A 9 V ac, 1 A
Commodore VIC-20 (old)	400 mA	10 V ac, 30 VA
IBM PCjr	70 mA	16.7 V ac, 56 VA
Texas Instruments 99/4A	300 mA	18 V ac, 22 VA 7.5 V ac, 1 VA
Timex/Sinclair TS1000/ZX-81	15 W	9 V dc, 1 A
Timex/Sinclair TS2068	26 W	15 V dc, 1 A

Note: Input is manufacturer's rating at 117 V ac; "dc" Output is pulsating dc; all ratings are nominal.

low parts count and simple layout, this looks like the power supply Atari should have furnished with all XL machines from the beginning. Why they didn't is anybody's guess.

An interesting voltage trimming feature in this supply compensates for slight differences in the output of individual 7805 regulators. The combined value of *R2*, *R3* and *R4* is 1.8 ohms. Together with *R1*, they provide a 1.8% boost in output voltage. It is possible that in some Type III supplies, one or more of these resistors will be missing. This circuit has been cleverly designed so that if the

output voltage is a little low, it can be raised merely by snipping out one or two resistors such that the remaining combination yields the desired voltage within a range of seven values from 1.8% to 8.2%.

Type IV: The Peanut

If the Type III supply caused Atari's power supply designer to sweat a little, the Type IV must have given him a whopping headache! In the Type IV, the elegant simplicity of the Type III has been completely abandoned. As you can see in Fig. 10, the small

circuit board is densely packed with many components. The relative complexity of the circuit is fully revealed in the Fig. 11 schematic.

The "brain" of this supply is the 14-pin 723 low-power voltage regulator. This chip regulates the output voltage very precisely but by itself is not husky enough to deliver the current demanded by a 130XE computer. To overcome this problem the 2SD613 external power transistor is used to pass the heavy current that provides the "muscle." This is really two power supplies in one. Hefty rectifier diodes *D3* and *D4* provide the

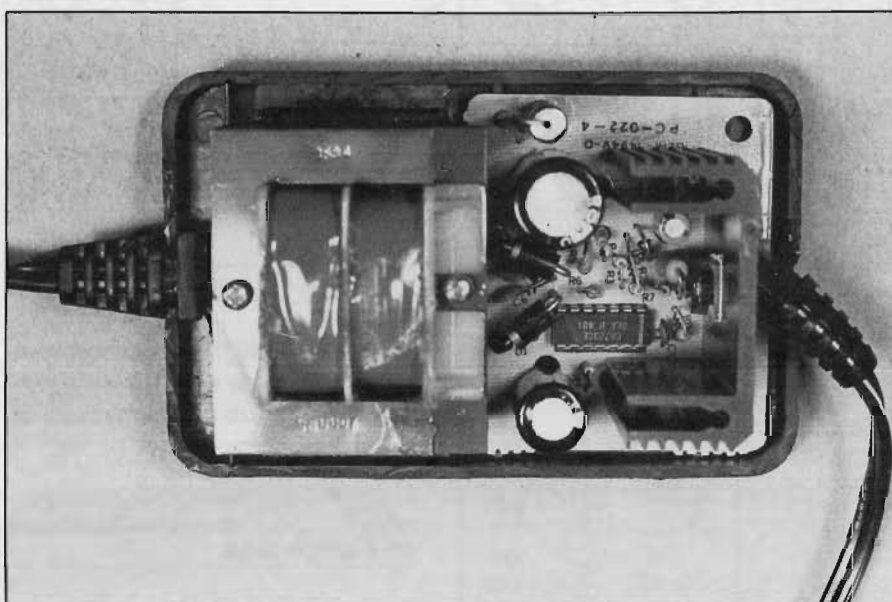
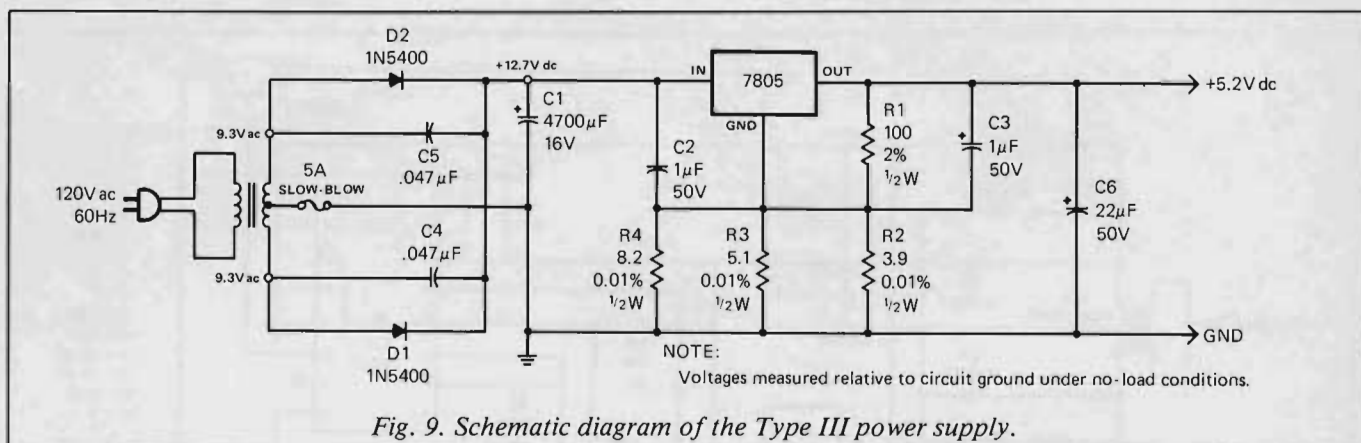


Fig. 10. This is an interior view of the Type IV supply.

primary dc voltage that feeds the pass transistor and powers the computer. The smaller *D1* and *D2* rectifiers provide a secondary supply that's used solely to power the 723 regulator.

Various reference and bias voltages required for proper operation of the regulator are provided by the complicated-looking *R2* through *R7* network. Surge protection for the regulator is provided by *R1*, while *R8* serves a similar function for the pass transistor. Resistor *R9* is a sensing element used by the regulator to limit output current to a safe level.

A Type IV power supply is repair-

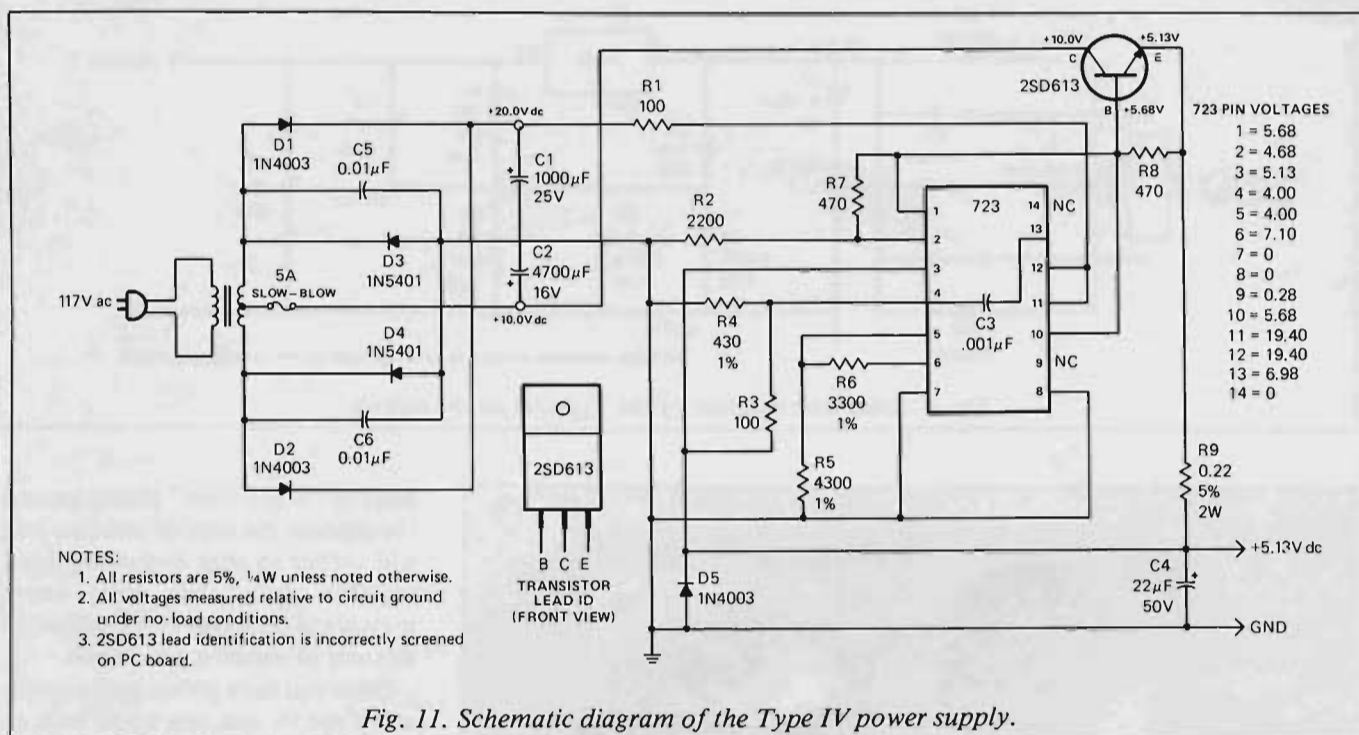
able, but Atari has done a good job of discouraging anyone from attempting repairs by packaging it in a permanently sealed plastic box similar to that used for the Type II supply. It would be very difficult for most Atari owners to open this case without irreparably damaging it. I had to work very carefully with a Moto-Tool fitted with an abrasive wheel to get the photo of the innards shown in Fig. 10. If you get this far and have completed whatever repairs are required, you must then figure out how to re-seal the case. If your incision is relatively clean all around the base, a thin

bead of "Super Glue" placed around the exposed cut edge of one case half will suffice to stick everything back together again. Then apply heavy pressure to both halves for at least 15 minutes to ensure a good bond.

Once you have gotten to the inside of a Type IV unit you could look at the fuse, any of the diodes, the regular chip, and/or the pass transistor as the most likely source of trouble. If you discover a bad transistor, you can replace it with a commonly available TIP 3055 device. If the 723 IC is defective, you'll have to desolder and remove it—without damaging the printed circuit board—before it can be replaced.

Of all the supplies discussed here, the Type IV performs most poorly with regard to meeting its output specifications. The other types all produce in excess of one ampere at their rated voltage under conditions simulating actual use. But the Type IV doesn't produce even one full ampere. While this apparently doesn't hamper operation of the computer, it does suggest a slimmer reliability margin in locations where ac line voltage is subject to fluctuation.

A second point of concern is related to the pass transistor used in the Type IV supply. Any transistor can fail in such a way that it places a short circuit between the collector and emitter terminals. If this should occur and the full 10 volts dc at the collector of the 2SD613 is passed to the



Atari XL/XE Power Supply Characteristics				
Characteristic	I	II	III	IV
Aesthetic appeal	superb	rotten	nice	so-so
Interior accessibility	easy	impossible	easy	difficult
Ease of repair	easy	impossible	easy	tedious
Output Rated Amperes	1.5	1.5	1.5	1.5
Volts	5.0	5.0	5.0	5.0
Measured Amperes	1.44	1.15	1.29	0.93
Volts	4.90	4.90	4.90	4.90

computer, it will "fry" your computer. Though such a disastrous condition is unlikely to occur, the possibility *does* exist.

In Conclusion

By now, you should know what type of power supply your Atari XL or XE computer has, what its circuitry looks like, whether or not it's repairable, and the supply's advantages and disadvantages. In the Table is a summary of the major features of the different power supplies we've discussed and a comparison of output specifications versus actually measured test conditions. Despite the wide variation in ability to meet their full output specifications, all four types of supplies do a good job of delivering the "juice" to your computer. They also appear to be fairly rugged and reliable in normal use. Hopefully, you'll never have occasion to put the material contained in this article to use.

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