SHHH . . .
People Are Sleeping

Maybe noisy and expensive Teletype machines turn you off. This thermal printer from Telpar can serve as a quiet (and economical) replacement.

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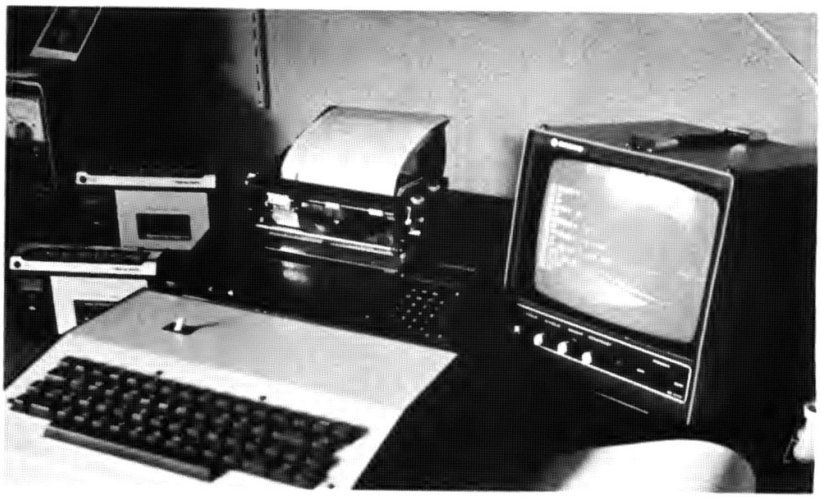

Layout shot of complete system: KIM-1 in redwood enclosure and KIM-2, 4K memory; ACT-1 TTY type TVT with monitor; tape recorders; PS-40 printer; computerist power supply—modified.

Printing the programs I am writing using my KIM-1 has become quite desirable (at least from my viewpoint). Longer programs have resulted as my skills have increased—growing to over 70 lines in Tiny BASIC and even longer in 6502 assembly language.

Checking widely separated timing loops and counting chains is difficult when you're using only a TV display (very handy for writing and editing though—no waste paper). Writing long programs by hand isn't always practical either. I've committed myself to hobby computing and have some longer-range, work-related interests. At this point I was convinced I needed a printer.

I had been checking printer ads in all the hobby magazines for some time, but the information I found was either conflicting, confusing or otherwise uninformative. I could not tell whether the various printers would work with my KIM-1. The ads either contained nothing about the interface connections or addressed themselves to RS-232C and parallel connections. KIM-1 has a serial, Teletype-oriented interface, and I had no desire to build something that *might* make a printer usable in my system.

Mid June brought the National Computer Conference (and me) to nearby Dallas. While checking out the personal computing exhibits, a display by Telpar, Inc., caught my eye. The Telpar PS-40 printer was being demonstrated, and it was printing with only a keyboard connected to it. (The significance of this did not occur to me until later.)

I picked up the data sheet and went on my way. When I looked at the sheet, I saw that the basic printing speed was 110 baud—Teletype speed. The data also indicated serial input. It seemed to be just what I wanted; now I was at least interested enough to learn more. A couple of days later I called the company and I talked to Rick Ables, vice-president of

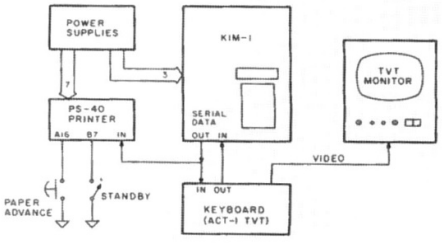

Fig. 1. Serial receive-only block diagram.

Function	Pinnumber To	From
Serial input (active low)	B-6	*KIM-1 (A-U)
Serial ground	B-20	KIM-1 (A-1)
Standby switch	B-7	B-5
Paper advance (momentary)	A-16	B-5
Jumper	A-5	A-7
Jumper	A-6	A-15
Jumper	A-15	B-15
Jumper	A-8	A-13
+18 V	B-12	Supply
Gnd	B-5	↑
+16 V	B-23	↕
Gnd	A-23	↕
+12 V	A-28	↕
+5 V	A-21	↕
Gnd	B-20	Supply

*1k pull-up resistor required from KIM-1 pins (A-U) to (A-S)
Note: Transpose numbers from the numbered pins to the adjacent pins on the lettered side.

Table 1.

engineering. Here's what I learned.

PS-40 Capabilities

Telpar's PS-40-3C-1 can do more than just print. For instance:

- PS-40 can be a complete Teletype replacement.
- Connected for serial receive (the way I use it), it will print whatever valid serial data output it receives from my KIM-1.
- Connected to an ASCII keyboard, the PS-40 can be the sole I/O for most of the popular microcomputers.
- Connected to a KIM-1 command generator, it will print assembly-language programs (uses the KIM-1 keyboard mainly, but makes KIM think it's connected to a Teletype).

More about the PS-40 applications—other than serial receive—later. The system, as I have assembled and am using it, is illustrated in Fig. 1.

Making the Connections

Operating the printer requires connection to a power supply: the serial data output from KIM-1 (requires a pull-up resistor) and some jumpers on the 56-pin edge connector supplied with the printer for the PS-40 circuit board. Make all connections on the 56-pin edge connector first (before you connect it to the printer). After these connections are completed, check everything carefully (have someone else check it, too, if possible). Then install the edge connector on the PS-40 circuit board. Make sure the numbered side is up. All this caution will eliminate a return trip to Telpar for repairs. The connections to the 56-pin edge connector for serial receive mode at 110 baud are shown in Table 1. Fig. 2 is a pictorial of the pin connections.

Power supplies for the PS-40 can be obtained locally and modified, if needed, to supply the required voltages. Telpar has a supply available (including −12 V if RS-232C connections are used). Those of you having a more adventurous nature may want to build your own power supply. Schematics (Figs. 3 and 4) of the Telpar power-supply circuits and a suggested power-supply circuit are included for reference.

Be sure your power source can supply peak power for the printer with adequate regulation. During carriage return, the printer motors (18 V) take peak current for more than a second, and during printing, the print head (16 V) hits its peak requirements for each character printed. Power-supply requirements for each output are shown in Table 2.

Print-head voltage is critical and requires close control. It cannot exceed 16 V, but can drop a maximum of 1 V during peak current. Voltages exceeding 16 V are likely to damage the print head. A final word of caution: If the power supply you use won't deliver

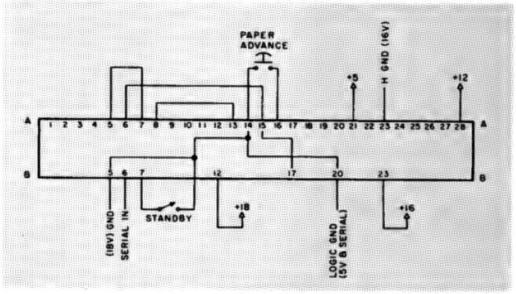

Fig. 2. PS-40 connector, serial receive-input and power connections.

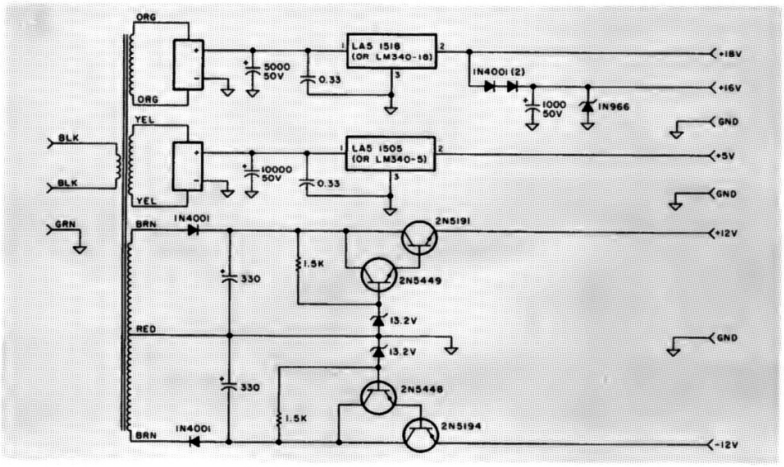

Fig. 3. PS-40 power-supply schematic.

Telpar PS-40 printer and character set.

enough power, the printer probably won't function properly.

Checking Operations

Now that all the connections are made and everything is ready, system and printer operation can be checked. First, turn on your computer and any other system components and verify normal operation. Turn on power to the printer (standby switch at run). A carriage return and line feed are the correct first responses of the printer at power on.

Load a roll of special thermal paper (be sure to order some) into the printer before proceeding further. Printing without paper behind the print head can damage it. There are right and wrong sides of the paper, so be sure to start it right. A diagram on the printer shows the paper feeding into the paper-drive mechanism from the bottom of the roll. Start a trimmed edge of paper into the printer and press the paper-feed switch. Continuous paper advance occurs when this connection is made, allowing paper to feed automatically through the printer. Now make some entries from the keyboard and check printer response. All the characters (and back-space arrow) in Example 1 are possible.

If a framing error (a series of vertical lines) occurs, check the polarity of the output signal. The jumpers are wired for an active low (negative-going) signal. This is the output signal polarity from KIM-1. An active high (positive-going) signal should be connected directly to pin A-7.

If the printer does not run, disconnect power and check all connections. If the standby switch is in standby, or pin B-7 is grounded, the printer will not run. Disconnect the edge connector and measure the unloaded voltages. If these are correct, turn off the supply. After the supplies have discharged, reconnect the edge connector and make another voltage measurement. Anything out of order means a short circuit or excessive load. Recheck overall system operation again. More than likely some little thing was inadvertently overlooked.

Some other features of the PS-40 can be examined, now that everything is working OK. My TVT keyboard has a capital-letters-lock key, and when I released it, I found the PS-40 would print small caps in a 5×5 dot matrix. (It prints large caps in a 5×7 dot matrix.) The lowercase output emerges as uppercase on my TVT but prints as small caps on the PS-40. Tiny BASIC, my present interpreter, does not recognize the lowercase outputs as commands or statements, but for REM and PRINT commands, any valid data inside the quotes will print. Example 2 shows what I mean. Typing a line longer than 48 characters is no problem either (see Example 3).

As you can see, a form of text editing and word processing is possible with the PS-40. I have used it as a pseudo-typewriter also. A final note on operating the PS-40: It really is quiet. I worked mostly early mornings and late evenings preparing this article, and was able to do all the testing and printing

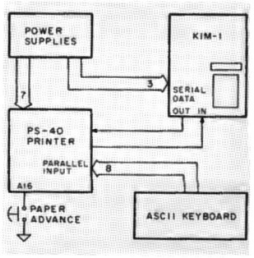

Fig. 5. Teletype replacement block diagram.

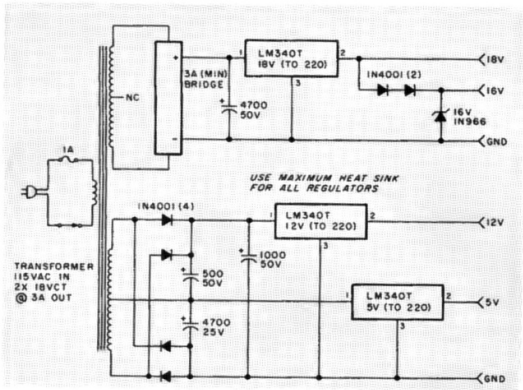

Fig. 4. Suggested power-supply schematic.

+18 V—1.5 Amp max @ less than 50 percent duty cycle.
+16 V—2.5 Amp peak for 2 μs dropping to 1.25 Amp for 6 μs @ 35 percent duty cycle.
+5 V—0.6 Amp continuous.
+12 V—0.1 Amp continuous.
−12 V—0.05 Amp continuous (RS-232C only).

Table 2.

```
Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm
Nn Oo Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz
1 2 3 4 5 6 7 8 9 0 - 1 \ @ ; : [ ] , .
! # $ % & ' ( ) = ~ | + * < > ?
        PS-40 CHARACTER SET
```

Example 1.

```
THE PS-40 WILL PRINT LARGE AND SMALL CAPS.
THIS IS A VERY HANDY FEATURE FOR USE WITH
PRINT AND REM STATEMENTS. HIGHLIGHTING OF
KEY WORDS MAKES PROGRAM PROMPTING LINES
MORE READABLE.
```

Example 2.

```
ANOTHER PS-40 FEATURE - DATA AT THE END OF A LIN
E IS NOT LOST.
```

Example 3.

without disturbing anyone (only a few feet away in adjacent rooms). Teletype-like operation with the PS-40 is also possible. Used in this manner, the PS-40 can be the only I/O needed to communicate with a Teletype, serial-data-oriented microcomputer. An ASCII keyboard with seven data bits and a negative-going strobe are also required. Fig. 5 illustrates a system configuration, and Fig. 6 is a connection diagram for the 56-pin edge connector. You may need to provide an inverter for the strobe to make the polarity correct; a spare 7404 IC will do this job nicely. As before, make all the connections to the edge connector first, then connect it to the printer. When everthing's connected and checked out, use the KIM-1 users' manual as a guide for proper Teletype operation.

If printing assembly-language listings and memory dumps is your only requirement, a conceptual KIM-1 command generator circuit may be all that's needed. In Figs. 7 and 8, I have included illustrations of this concept: Fig. 7 shows the block diagram of the system, and Fig. 8 is a concept circuit for the character generator. Remember, this is only a concept. I have done similar things using my ACT-1 TVT, and that's where I got the idea. If you try it and it works, I am sure *Kilobaud* would like to tell the rest of the world for you.

As a manufacturing engineer, I found the Telpar PS-40 printer well constructed. There are a couple of problem areas (requires a multiple-output power source; uses special thermal paper), but I consider them minor.

I estimated the cost of building a power supply from Radio Shack parts at $30 to $35. A well-stocked junk box reduces the cost much further. A roll of thermal paper from Telpar is no more expensive than one of TTY paper and lasts a long time (I have printed everything in sight and not yet used half a roll). A 48-column, 5½-inch-wide roll is $3 from Telpar, Inc., 4132A Billy Mitchell Rd, PO Box 796, Addison TX 75001. The PS-40 costs $4.

Incorporating this printer into my system has been a rewarding experience. The people at Telpar are friendly and pleasant to work with. Rick Ables patiently went over (and over) the operation of the printer and explained all my questions; and Mr. Hanschen, the president of Telpar, made it all possible. Without their help and cooperation, this article might not have been written.■

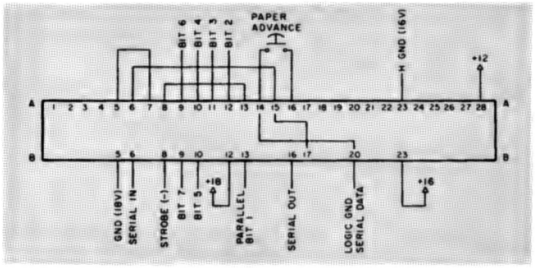

Fig. 6. PS-40 connector, TTY replacement-input and power connections.

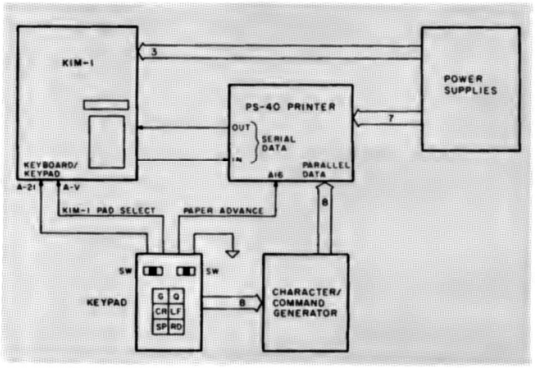

Fig. 7. KIM-1 command generator concept diagram.

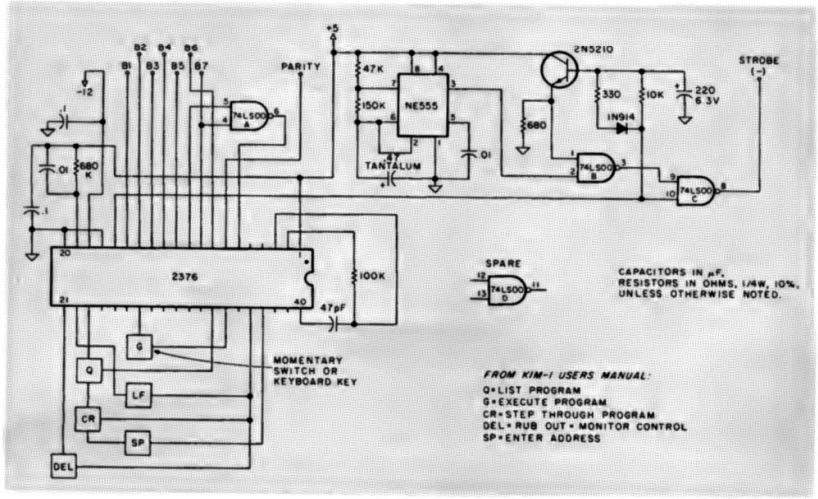

Fig. 8. Command generator schematic.