

How to Build a Word Processor

This 6800-based system was assembled from available hardware and software products.

Many articles in the hobby press have described various components of word-processing systems. However, to my knowledge, none has de-

scribed an integrated system, complete with hardware, software, all system interfaces and a high-quality impact printer at the lowest possible cost and

the least possible fuss.

This article describes a 6800-based system, complete with all hardware and software interfaces, using a Selectric-based I/O printer. Most of the components used here have been described before, but not as an integrated system. So I will only discuss those aspects of each component as it relates to the system as a word processor.

The System

If you need a high-quality word-processing system at low cost, or if you already own an SWTP 6800 computer and would like to integrate it into a quality word processor, this article is for you. If you own an 8080-based system and would like to do quality word processing, then this article can help.

I knew two years ago, when I bought my SWTP 6800 system, that I wanted to use it for word processing. And I wanted high-quality hard-copy output from an impact printer, preferably based on the Selectric mechanism. So, on the same day that I bought the SWTP computer at The Micro Store in Richardson (Dallas), I bought a COPE-1030 Selectric I/O terminal at the Rondure Company, also in Dallas.

I expected interfacing to pose some problems, but it turned out to be absolutely

painless. And the nice part is that everything is off-the-shelf. There is absolutely *no* haywiring required. And here's an added bonus: In a pinch, you can use the Selectric for input. The software driver described here provides full handshaking between the Selectric terminal and the computer (more on this later).

Here are the main system components:

1. SWTP 6800 computer system with AC-30 interface and 20K of programmable memory.
2. Lear Siegler ADM-3A Dumb Terminal.
3. COPE-1030 I/O Terminal (IBM heavy-duty mechanics).
4. Computerware software driver for Selectric in EPROM.
5. Percom Data Co. LFD-400 single floppy-disk system.
6. Percom TOUCHUP software, used in conjunction with Technical Systems Consultants' Text Editor/Processor package.

The COPE-1030 I/O Terminal

Since the characteristics of the COPE-1030 place constraints on the rest of the system, I will describe it first.

The first important characteristic of the COPE-1030 is its price. It is inexpensive, that is to say, it is low-cost, but decidedly *not* cheap. In shopping around for Selectric-based terminals, you will find them ad-



As a schoolteacher, my wife, Mary Ellen, frequently uses the home word-processing center for classroom planning. In the left foreground is the COPE-1030 printer, with paper coming off the tractor feed. Mary Ellen's right hand is at the keyboard of the ADM-3A terminal. Between her right hand the bookcase is the SWTP 6800 computer. The entire word-processing system takes up less room than many stereo systems.

vertised for anywhere from \$895 (used, modified or reconditioned) to \$2600. The COPE-1030 costs between \$295 and \$695 at current prices.

Usually, the 1030 is advertised in one of three conditions: (1) "as-is" (you take your chances); (2) used, but working; (3) refurbished. The price increases about \$100-\$200 as you move from one version to the next. Mine was "used, but working." At the then-prevailing price, I saved \$200. And I haven't regretted it, although the refurbished models did look a lot better than mine.

Since the COPE-1030 was originally a computer terminal, it comes with all of the electronics built in to provide RS-232 serial interface with the outside world, on the one hand, and to drive the Selectric magnets, on the other. It comes complete with an RS-232 connector built in. Mine even came with an acoustic coupler and modem for use over telephone circuits. You can even get a tractor feed for \$50 (they cost \$176 new).

Having all of the electronics built in does save a lot of trouble. I've seen articles on how to interface the Selectric with microcomputers, including how to build and interface the magnet drivers. None of that with the 1030—you just run three wires from the RS-232 connector of the 1030 to the RS-232 connector of your micro. There is one small hitch, however: The 1030 and the 6800 don't speak the same language.

The 6800 speaks and understands ASCII, while the 1030 speaks in one of the IBM codes (either Correspondence or EBCDIC). As near as I can tell, there is no reason to prefer one code over the other. It was only by chance, therefore, that I got the Correspondence version, and I can't tell that it makes any difference. They are the same price. In any event, since the 6800 and the 1030 don't speak the same language, there must be some means of translating. And that's where Paul Searby of Computerware comes in.

The Software Driver

Two years ago, when I bought

the major components of my system, the usual method of translating was to obtain a used terminal of some kind, strip it down and add the necessary relays, electronics, etc., and then write a software driver to make it go. I thought I would have to do the same. But I got away from developing the system for one reason or another. And then when I did get back to it, I found that all of the hard work had been done for me by Paul Searby of Computerware, in Encinitas, California.

Paul has developed two versions of the software driver for the COPE-1030. Which version you need depends on which version of the SWTP 6800 system you have. If your system has the older MP/A microprocessor board, then you will need the RC-68 version of Paul's software driver, which comes in an EPROM and requires some minor modifications to the CPU board.

I had the older board, but after reading a review of the newer, MP/A/2 board in *Kilobaud*, I decided to buy the new board. The bare board cost me \$14.50 from The Micro Store. After spending about another \$20 for new integrated circuits, I was ready to go. So I bought the 2716 EPROM version of the Selectric driver. Here's how it works.

When you order your Selectric driver from Paul, you have to tell him which version of the SWTP computer you have, whether your keyboard is Correspondence or EBCDIC and which typeface and monitor you prefer. As for typeface, the ASCII is a good choice. But in any event, you can get the one you want from IBM for \$18.

When he burns the EPROM, Paul will burn it co-resident with the monitor that you specify. Then you no longer need your old monitor plugged into the CPU board. For example, the RC-68 version plugs into the socket that you had MIKBUG plugged into when you bought it. In my case, I ordered the 2716 EPROM version with MIKBUG, since I was used to it and didn't want to try two new things at the same time. I have another



COPE-1030 in action. Although the tractor-feed mechanism looks formidable, it actually goes on or off in less than five minutes. Cost is about \$50 (used). Ribbons for the COPE-1030 are readily available at most office-supply houses for about \$2 (Marathon Selectric #72 black standard fabric in throwaway cartridge). Tractor-feed paper is inexpensive—about \$19 for 3000 sheets (8 1/2 x 11 inches). The COPE-1030 uses standard IBM Selectric typefaces. Author uses the ASCII style (part no. 01167168), which costs about \$19 each from IBM. Incidentally, if you don't like the case style, you can purchase a stylish office case at nominal cost.

on order now, with SMARTBUG and output to port 7. Unless you specify otherwise, Paul will configure the Selectric driver with output to an MP-S serial interface card on port 3 (more about this later).

When you buy the Selectric driver, Paul includes the complete source listing. I feel that this is one practice that should be encouraged to the limit, since it is nearly impossible to work on a system without full software documentation. The Selectric driver is copyrighted, and Paul asked that the source listing not be printed. So I have not included it here.

Using the Selectric driver is the essence of simplicity. Just plug it into socket 23, set DIP switch number 7 on, and you're ready. Incidentally, do not place DIP switch number 5 in the on position. I followed what I thought was a pretty reliable source (not Computerware) and put number 5 on. Three weeks later, after lengthy trouble-

shooting procedures, I found that switch 5 should be off.

If your main interest in the Selectric is word processing, then it will probably be a rare occasion when you will want to use it for input. But in a pinch it does come in quite handy, if you have that capability. That's what makes the Computerware driver so nice. As an extra, you get I/O capability with full hand-shaking.

I mentioned earlier that the characteristics of the COPE-1030 determine what you have to do to the rest of the system to make it functional. One of its characteristics that must be considered is its 134.5 baud rate. Now don't panic... this doesn't complicate things at all. The MC14411 baud rate generator in the SWTP 6800 system already has the 134.5 baud rate as an output; they just don't tell you. Here's how you get to it.

Pin 14 of the MC14411 is the output for the 134.5 baud rate. Pin 8 outputs the 150 baud rate.



The SWTP 6800 computer in the extreme right foreground, with the LFD-400 single floppy disk drive between it and the ADM-3A video terminal. In the background at left center is the COPE-1030 printer. Note that if you have an 8080-based computer instead of the 6800, you can still use the COPE-1030 and the TSC editor/processor and your own disk drive. The Rondure Company sells an assembled and commented software driver program for the 8080. You can have it stored in either EPROM or disk, since it only takes a few hundred bytes.

As sent from the factory, pin 14 is not used. The pad is there, but the signal isn't routed anywhere. You probably aren't using the 150 baud rate anyhow, so cut the land from pin 8 and run a jumper from pin 14 to the land that you just separated from pin 8. You now have 134.5 baud being sent out over the lines marked 150b. It takes about three minutes if you use an X-acto knife, fine solder and fine wire. That's it.

That's all there is to using Computerware's Selectric driver. Just plug the 2716 EPROM into socket 23, do the jumpering between the pins of the MC 14411, run three wires from the serial RS-232 port on your 6800 to the RS-232 connector of the COPE-1030, and you're in business. All you need now is a disk drive and the special software for word processing. That's where Percom Data Co., of Garland (Dallas), Texas, comes in.

LFD-400 and TOUCHUP

If you've ever called a com-

pany and asked to speak with a sales engineer, only to be told that they're all too busy, then you will really appreciate Harold Mauch and the other folks at Percom Data. They have always taken the time to answer my questions and to give any help that they could—both before and after the sale. That was my first reason for choosing Percom.

The second was the location. They were close enough for me to visit and get a first-hand demonstration of the system's capabilities. The third consideration was that I could get a system with only one drive and later expand it to a dual or triple drive system as need and finances permitted. As it turned out, I got the single drive system.

The Percom LFD-400 single drive system is a nice way to get into word processing without being eaten alive by the cost. You have three choices of operating systems. The first is MINIDOS, a primitive system

that requires you to call up files by drive and sector number. In other words, MINIDOS doesn't permit named files.

The second possibility is MINIDOS-PLUS. It does permit named files, which is a real convenience. Both MINIDOS and MINIDOS-PLUS are in EPROM. The third possibility is INDEX, a disk-based operating system. I got the MINIDOS-PLUS version. But if you are using the system strictly for word processing, then you really don't need to spend the extra bucks for the MINIDOS-PLUS named-file feature.

When you buy the Percom system, you have the choice of single, dual or triple disk drives. You also have the choice of either Shugart or Pertec drives. As I understand it, the two are almost identical, except for one thing: The Pertec drives permit you to use *both* sides of the diskette simply by turning it over and reinserting it into the drive.

Each side of the diskette has a capacity of about 100K bytes. With an overhead of about 10 percent for supporting the operating system, that leaves a total of about 180K capacity per disk. Although you do not have that much capacity available and on line, it is sufficient.

In order to use the LFD-400 with your SWTP 6800 system, you need to make some minor modifications to the system. First, you need to replace the two-prong ac line cord with one having the third prong for safety reasons.

Next, you need to locate at least 4K of memory starting at address \$A000. If you have the newer A2 board, it means that you only have to modify the memory card. If you have the older MP/A board, you must make a couple of minor jumper mods to it. Percom gives full instructions.

Last, if you have the MPA/2 board, then you really need to replace the RC network for the baud rate generator circuit with a 4 MHz crystal (from Jameco Electronics). That takes care of the hardware considerations for the system, which brings us to the software.

The folks at Percom have developed a set of software overlays to be used with the Technical Systems Consultants' text editor and processor. It's called TOUCHUP. The TSC editor and processor commands make the pair into a versatile word-processing software system. But the additional commands and features of TOUCHUP prove really invaluable. For example, TOUCHUP makes it possible to edit in-line, to add, delete or otherwise modify within the line itself.

Another valuable feature of TOUCHUP is the ROLL command, which makes it possible for you to create and edit files of text many times larger than your available memory. The ROLL command literally creates a software spool so that you can roll the file out of the edit buffer into disk a hundred lines or so at a time. If you happen to have, say, 8K of available memory and a file of text on disk that would occupy, say, 15K, here's what you do.

Suppose that you have the text stored on disk starting at sector 10 and you want to edit it and store the edited copy starting at sector 100. You might give this command:

```
IN 1010:OUT 1100:READ 100
```

This would open the input file at sector 10, open the output file at sector 100 and read 100 lines of text into the editor.

After editing the copy and having it ready for output, you might give this command:

```
T:ROLL 100
```

This would output the first 100 lines to the disk and read in a new 100 lines to be edited. Continue until the entire file is finished.

After the last text has been written to disk, you would finish with an END command to put an end-of-file mark at the end of the text and to close the files. The T indicates that you placed the file in top-to-bottom order before writing to disk. Otherwise, you could end up with the text written to disk backwards.

There are many features of the processing system that you will learn only by frequently using it. But it is amazing how quickly you will learn. The sys-

tem fools you into thinking that you're bright. But the truth is that those folks who originated the editor/processor software were the bright ones. The processor permits even a novice to do versatile formatting after only a couple of sessions. For example, the header and footer macros alone are worth the price of the software. Then when you throw in features such as the editing commands, the other commands from TOUCHUP and the ease of writing made possible with the system, the software is enhanced.

One feature was missing in the original version of TOUCHUP: the back-space command.

Naturally, if you're going to underline a word or section of text, the system needs to be able to respond to a back-space command. Percom's software consultant, Jim Stutsman, fixed it for me by providing a software patch assigning a special character to the back-space function to be recognized by the COPE-1030.

This feature cost me \$25, since it had to be developed from scratch. However, it should be available to future users at a nominal cost. That was the last detail as far as I was concerned. As it now functions, the word-processing system is extremely flexible.

That essentially covers the entire word-processing system. I haven't dwelt on costs since prices on the things I've discussed are usually advertised in *Microcomputing*. Also, the final price that you will end up paying for your system will depend on how you have it configured.

For example, if you use the SWTP CT-64 terminal, your system cost will be different than mine, since I have the ADM-3A. Also, if you already have the SWTP disk system or the one from Smoke Signal Broadcasting, then your costs will be different and your approach to final system hookup will change.

The point is that there is a lot of room for variation. What I've outlined here is a total, integrated system that works superbly to give the best possible performance with the least fuss at the lowest price. I've used it for about six months now and have no complaints. To me, the acid test comes with your answer to this question: "Knowing what you do now, if you had it to do over again, what would you do?" My answer to that question is that I wouldn't change a thing.

So, if word processing is your bag, take some of the ideas outlined here and do it the easy way. ■

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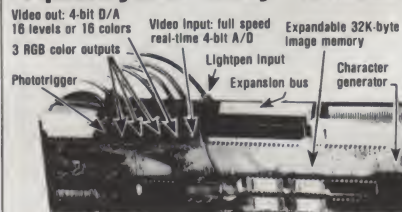
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