CHAPTER 24

Modem Applications in Liquid Scintillation Counting

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New counters today are all controlled by sophisticated software which means that new liquid scintillation counters are now married to computers. Therefore, it seemed appropriate about two years ago to explore the applications of a modem to liquid scintillation counting technology. The person who aroused my interest in this study was Stan De Filippis, senior marketing applications specialist, who was then at the Packard Instrument Company. He envisioned that the modem could provide both the instrument manufacturer and the user with a very powerful tool. The major concern with this idea was reliability because of the well known problems associated with early attempts at data transmission with modems and personal computers.

To explore this concept, a modem was placed into my counter, a Packard Model 2200CA, located at the Worcester Foundation for Experimental Biology in Shrewsbury, MA. The Packard 2200CA is controlled by an IBM model PS/2-30 computer equiped with a 20 MB hard disk. The modem was a Leading Edge Model "L" set to run at 2400 baud/sec. An identical modem was used in a computer at the Packard Instrument Company located in Downers Grove, IL. Later in this study a Hayes Smartmodem 2400B modem was installed in my home computer in Wellesley, MA, about 25 miles from Shrewsbury.

Once the modems were in place, we needed to choose a communications package to make the system work. After trying a few commercial software packages, we settled on one called CLOSE-UP from Norton-Lambert Corporation. The CLOSE-UP system consists of two separate software packages: one called Support, which was used at the remote receiving stations located in Downers Grove and Wellesley and another called Customer, which was installed in the counter. At the Worcester Foundation all telephone calls are routed through a switchboard. Although the communication software is designed to operate under these conditions, we decided to install an outside line directly to the modem in the counter to avoid this high potential source of problems.

Table 1. Modem Applications in Liquid Scintillation Counting from a Remote Site Investigated in this Study

1. Monitor counter
2. Control/Operate counter
3. Trouble-shooting aid
4. Update software
5. Transfer data
6. Automatic data transfer

When the counter is called from Downers Grove, IL and contact is established, the screen of the counter appears on the computer screen in Illinois. From that moment, the counter can be controlled from the computer keyboard in Illinois just as if the operator were standing at the counter in Massachusetts. We have found the system to be very reliable and useful. In Table 1, all the applications successfully executed during this study are listed.

This system allows you to monitor the counter from a remote site. For example, if you wanted to check on the state of your counter from home, you can call your counter and examine the Status Page. The Status Page in a Packard 2200 counter tells you what program is being used and which sample is currently being counted. On the other hand, if you were scanning a group of samples to see the distribution of counts among them and wanted to change the counting time from, say, one minute to ten minutes, you can also do that from home without going to the laboratory. This has proven to be a convenient option.

Perhaps the most intriguing potential application of the modem is its use as a trouble shooting aid. This aspect of the modem, however, was not really tested because the counter did not have any serious problems during the study. In the case of the Packard 2000 series counters, the potential usefulness of the modem is there because of the diagnostic software contained within the counting system software. An engineer in Illinois can actually look at all the operating parameters of the counter in Massachusetts, such as the history of the high voltage applied to the photomultiplier tubes for the last 10 instrument normalizations. He can also check the performance history in terms of the check source counting efficiency for the last 90 normalization cycles; all of this is stored in memory. In terms of diagnosing problems, the only occasion in which the modem was used for this purpose was to send the puzzling data for a particular spectrum to the engineers in Illinois for analysis.

During the course of this evaluation, a software update for the Packard 2200 counter was released. The installation of the new software was done using the modem. This meant erasing the old software and installing the revised version. The entire process went without any problems. This demonstrated one operation which could save both the instrument manufacturer and the user a lot of time. In the case of the manufacturer, the need to schedule a service call for the installation of the new software is eliminated, and, in the case of the user, the entire software update can be scheduled after working hours when the instrument is not in use.

Table 2. Example of a Task File used in CLOSE-UP for Automatic Data Acquisition using a Modem

File Name: DATAOUT.TSK
1. CONFIG DIAL REDIAL = 3 WAIT = 3
2. WAIT UNTIL 23:45
3. BAUD 2400
4. PRINT LOG ON
5. DIAL 15558425555[a]
6. FETCH C:SDATA10.DAT TO A:
7. HANGUP
8. PRINT LOG OFF

[a]Fictitious telephone number.

The most useful feature of a modem-equipped counter is its ability to transfer data to a remote site. In the Packard 2200CA, it is possible to store any counting data onto the hard disk. This data can then be transferred to any remote site via modem. During this study, this was achieved as a routine option. The convenience of this option is that the researcher can now transfer his counting data to his home computer and analyze the data without going to the laboratory.

Perhaps the most unique feature of the communication software package, CLOSE-UP, is its ability to transfer counting data automatically. For example, the computer at home can be programmed to call the counter, say at midnight when the phone rates are low, and transfer counting data while I sleep. This is accomplished by using a simple routine called a task file. An example of a task file is shown in Table 2.

This simple, eight line test program was written using EDLIN which is a resident DOS text editor. This task file was called DATAOUT and all task files are designated by the extension, TSK. DATAOUT is stored in the subdirectory which contains CLOSE-UP. The first line instructs CLOSE-UP to make a total of three attempts to connect with the counter. If the first try is unsuccessful, it will wait three minutes before trying again. The next line instructs the program to make the first call at 11:45 PM; military time is used here. The next line sets the baud rate. The next line turns on the printer to type a log of all activities. The next line gives the phone number (the phone number listed is a fictitious number). After contact is made with the counter, the next line instructs the computer operating the counter to fetch a file from the C drive called sdata10.dat and copy it to the A drive of the home computer. When the task is completed, the program hangs up the phone and turns off the printer.

Table 3 shows the log generated by the task file. The program was initiated on September 14th and the name of the task file in control was DATAOUT-.TSK. The program was activated at 11:45:07 PM; connection was made on the first try at 11:46:32. The data file, sdata10.dat, was located on the C drive and copied to the A drive of the home computer. The counting data for 28 samples were counted under low-level conditions. The transferred data received and stored in the home computer is shown in Table 4. The log shows

Table 3. Example of a Log for Task File, DATAOUT.TSK

—Sept. 14 1989 DATAOUT.TSK	
23:45:07	5—dial 15558425555[a]
	Connect: 1 attempt
23:46:32	6—fetch c:sdata10.dat to a:
	Complete – 00:00:06
23:46:47	7—hangup
23:46:51	8—print log off

[a]Fictitious telephone number.

that the call was terminated at 11:46:47 for a total connect time of only 15 seconds and 4 seconds later, the printer was turned off. All of this was done without anyone being present. This sample test file was run to check out the system. Also, in actual practice, the file transfer system can be protected by requiring a password to allow only authorized access to the counter computer system.

In setting up this automated data collection system, it was reasoned that the counting data should be collected in the A drive of the computer controlling the counter rather than in the C drive. The removable diskette would be a backup system for the automated data processing system; should any problem occur with data transfer, the original data will always be saved on a removable

Table 4. Data File, SDATA10.DAT, Transferred by Modem from a Packard 2200CA Counter. Data Transferred, in Sequence, are: Sample Number, Time in Min.: Region A cpm, Region B cpm, Region C cpm, SIS and tSIE.

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1,10.00,10.9000,4.2000,9.8000,47.29,0.00
2,10.00,8.8000,2.1000,7.7000,54.20,0.00
3,10.00,8.4000,3.9000,7.7000,60.33,0.00
4,10.00,10.4000,4.5000,8.8000,62.50,0.00
5,10.00,10.2000,4.3000,9.2000,66.46,0.00
6,10.00,11.1000,3.5000,9.7000,58.33,0.00
7,10.00,10.8000,3.8000,9.3000,55.33,0.00
8,10.00,14.1000,3.9000,12.2000,49.20,0.00
9,10.00,10.4000,4.7000,9.0000,69.42,0.00
10,10.00,9.3000,3.7000,7.6000,56.67,0.00
13,10.00,12.5000,3.8000,11.7000,54.37,0.00
14,10.00,12.2000,3.6000,9.4000,51.17,0.00
15,10.00,9.6000,3.5000,7.9000,57.22,0.00
16,10.00,9.9000,3.2000,8.9000,53.73,0.00
17,10.00,11.7000,3.7000,9.9000,51.33,0.00
18,10.00,8.8000,3.3000,7.8000,59.44,0.00
19,10.00,9.7000,4.4000,8.2000,61.98,0.00
20,10.00,10.9000,3.8000,9.9000,60.83,0.00
21,10.00,9.3000,3.0000,8.4000,60.77,0.00
22,10.00,12.5000,3.2000,10.0000,44.14,0.00
25,10.00,8.0000,0.7000,6.2000,21.22,0.00
26,10.00,31.7000,12.300,30.2000,46.69,0.00
27,10.00,30.9000,14.1000,29.1000,49.59,0.00
28,10.00,30.5000,15.9000,29.1000,52.94,0.00
30,10.00,76.0000,45.0000,74.2000,56.67,0.00
31,10.00,168.600,89.0000,164.9000,53.49,0.00
32,10.00,77.4000,46.4000,75.6000,57.51,0.00
33,10.00,15.200,0.4000,13.4000,15.63,0.00
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diskette. This means that the Packard 2200 counter will always have a diskette in the A drive. This can be a problem in the event of a power failure, because the counting system is programmed to automatically reboot from the C drive after power is restored. The problem is that, in the IBM PS/2-30 computer used in the counter, the system always first looks at the A drive, for rebooting. This situation can be accommodated by putting all the counting system software on the A drive but this would reduce the data storage capacity of the data diskette. This problem was avoided simply.

First, the A diskette is formatted using the FORMAT A:/S command. The slash S calls for two hidden DOS system files to be copied onto the formatted diskette. Without these two hidden files, the system will not boot up properly from the A drive. Next, using EDLIN, a DOS text editor, write a one-line autoexec.bat file as follows:

C:\KOBY.BAT

All data diskettes used in the A drive must be formatted this way and contain the one line autoexec.bat file. Then, on the C drive, that is, on the hard disk in the DOS directory, write another batch file called KOBY.BAT using EDLIN. This file contains only two instructions:

1. C:
2. autoexec.bat

This little routine ensures that the counter will reboot normally after power failure when there is a data diskette prepared as described in the A drive.

In considering the practical aspects of modems in counting technology, I believe they have limited, but very useful attributes. From an instrument manufacturer's point of view, the possibility of updating software via modem directly from the plant should be an attractive prospect. This system would assure timely distribution of software to all customers and save a service call as well. Also, the ability to inspect a customer's counter performance remotely can be advantageous, especially after a service call was made or a new procedure is being evaluated. I can envision the time when a manufacturer can offer a preventive maintenance program which involves scheduled, invisible inspections of a working counter through a modem. The fact that a log of these invisible inspections can be generated would assure the customer that the service was indeed provided.

For the user, the modem does have limited applications at this time. However, in certain situations I believe the modem can be very useful. For example, any diagnostic laboratory running assays can have the completed results transferred to its various customers via modem automatically every night by using a task file. The customers will then have the results available before the start of the working day. In an industrial plant where the counting is done in a central analytical laboratory, the completed counting data can be sent directly to any laboratory on site provided the remote site, has a modem-equipped computer.

In my limited experience, I have found the modem to be a very convenient and useful option. Even though it has limited applications, the data transfer capability alone justifies its presence in my counter . What is attractive about this technique is that it is a relatively inexpensive option to own. Modems can be purchased for under $100 and good communications software is available in the public domain. For example, a highly regarded public domain software is PROCOMM. This software has been commercialized and is sold as PROCOMM PLUS at nominal cost, especially at software discount houses. However, the original PROCOMM is available and should be more than adequate for this application. The advantage of using a commercially produced software is that these packages are easy to use and well documented.