Communications and Control of a Remote PC for γ-ray Spectrometry

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Introduction

The determination of thorium and uranium contamination at sub-ppm levels in materials used for Sudbury Neutrino Observatory (SNO) requires the operation of a low background germanium γ-ray detector at a remote location deep underground. Usually, the γ-ray detector is used in conjunction with a personal computer (PC) based multichannel analyzer (MCA) system for data acquisition and storage. The availability of inexpensive high speed modems operating at speeds greater than 9600 baud makes it possible to communicate with the remote PC's over ordinary telephone lines. With the advent of commercial software packages to access the PC's remotely via high speed modems, opportunities come within the reach of many experimentalists which were previously available only to large well established laboratories. Presented below is the information required to get an understanding of a remote control communication system actually used at present by the Guelph and Laurentian Universities radioactivity measurement groups.

Hardware and Software

The hardware and software used at present is indicated in this section. This must not be taken as an endorsement of these products because of the rapid changes taking place in technology. A description of the desirable features is given in the section under discussion and conclusions.

The PC's used are IBM compatible 386/486 machines running at 33 MHz with a minimum of 4 Mb RAM and a 120 Mb hard disk using DOS 5.0 operating system with WINDOWS 3.1 software. The modems used are 14.4 kbps V.32bis series which is the current standard for corporate dial-up modems, many bulletin boards and public access Unix systems. Identical modems made by Boca Research, USA were installed at three locations using similar hardware and software. The particular modem was chosen based on a survey of 69 modems and recommended as best for all round communications[1].

The PC based MCA package is made by APTEC Engineering Ltd., Canada. The remote control software is a package called Carbon Copy Version2.0 (CC) made by Microcom Inc., USA.

changing the local telephone loop, as well as the PC. No difference was observed among the three locations in Guelph in the communication with the remote underground site.

Next, the service from the telephone company to the Guelph SNO office was changed from a voice grade service to a data grade service. The slope in the response specifications for the telephone line changed from 6 db to 1.5 db after the change. Again no difference was found in the communication between the three local sites at Guelph, or between Guelph and the remote site, or between Guelph and the SNO OCB. It was learnt at this stage that at the user end of the phone line the line terminator can be programmable by the modem or preset, and the upgraded modems being used did not have the programmable option. The preset option was chosen though not the best option to be used as far as taking advantage of the data grade service is concerned.

It was also learnt at this stage that the class of telephone exchange through which the connection is made to the remote site, the telephone cable from the exchange to INCO, the internal phone system used by INCO, and the telephone cable from the INCO equipment to the remote site will individually influence the performance of the communications. Attempts were made to investigate the influence of these factors separately. Progress was not made in completing these investigations because of various operational reasons. During these investigations it was also found that the first telephone exchange servicing INCO could be bypassed, if necessary, through a direct connection to the Sudbury telephone exchange. If requested, tests could be done with modem hardware having diagnostic capabilities to identify and evaluate the noise being encountered in communications with the remote site.

An alternative approach to the above was to examine the performance of the remote control software being used. A new software package called Close-Up was chosen which was advertised[2] as being superior to CC. Upon examination the interface of Close-Up to WINDOWS 3.1 was found to be not as elegant as with CC, and for some reason Close-Up did not perform as well as CC in tests conducted locally between the computers at Guelph. Therefore, tests with Close-Up were not carried out on the long distance telephone network, or at the remote site.

At this stage in the investigation of the communication with the remote site we became aware of Version 2.0 of CC. Two copies were purchased immediately. When CC version 2.0 was installed at Guelph dramatic improvement was found in communication with the remote site even though the remote site was still using version 1.0 of CC. For the first time, connection with the remote site could be established from the SNO office at Guelph through the long distance telephone network with the data grade telephone line as well as from the other two locations using regular voice grade telephone lines.

should be 14.4 kbps V.32bis standard. The communications software should be compatible with Windows 3.1 operating system.

Acknowledgments

IBM is a registered trade mark of International Business Machines Corporation. DOS 5.0 and Windows 3.1 are software packages produced by Microsoft Corporation.

References

1. Jim Hurd, Byte Lab Report - V.32 or Better: 69 modems: Byte July 1993, p172.

2. PC Week magazine, October 18, 1993, p 71.