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Advanced Communications Technology Satellite High Burst Rate Link Evaluation Terminal Experiment Control and Monitor Software User's Guide

Version 1.0

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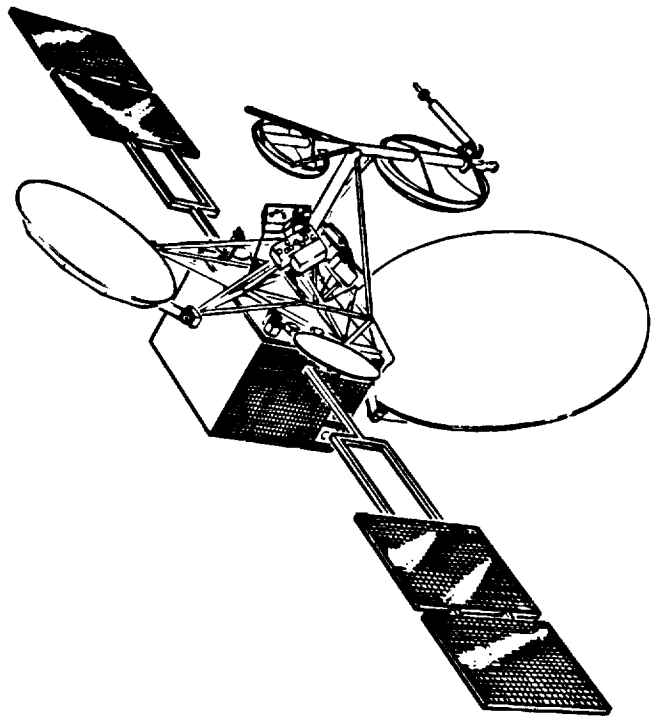

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High Burst Rate Link Evaluation Terminal

LET Experiment Control and Monitor Software User's Guide
Version 1.0, December 1992

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1.0 INTRODUCTION

1.1 Identification of Document

This is the LET-EC&M Software User's Guide for the NASA Advanced Communications Technology Satellite (ACTS) High Burst Rate Link Evaluation Terminal (HBR-LET) Experiment Control and Monitor (EC&M) Software system. This document complies with the NASA Software Management and Assurance Program (SMAP) guidelines in the Information System Life Cycle and Documentation Standards, Release 4.3. This is one component of the Control and Performance Monitor (C&PM) Subsystem document series.

1.2 Scope of Document

The information required to install and execute each component of the LET-EC&M Software is included in this User's Guide. The user should have a working knowledge of the instrumentation used by the HBR-LET project and the various subsystems integration. The user should also be familiar with the system capabilities of the Link Evaluation Terminal.

Each phase of the LET-EC&M Software system is designed to be completely menu driven and user friendly. When catastrophic errors occur, users will be required to use the system console to recover. Although the complete procedure for error recovery is provided, general knowledge of Concurrent's OS/32 operating system is beneficial.

1.3 Purpose of Document

This guide instructs users in the complete operation of each phase of the LET-EC&M Software system. A detailed explanation of the necessary commands to load and execute each component of the system is included. Error conditions and error recovery are also discussed.

Although each component of the LET-EC&M Software system is designed to be independent, each phase has certain requirements that must be followed during development. The reader is advised to become

familiar with each phase of the LET-EC&M system before attempting to use any particular phase. Knowledge of each phase will help the user to develop an instrument and sequence file, which will be used to carry out the desired experiment.

Only operational aspects of the LET-EC&M Software are discussed. If information concerning the development or modifications of the software is needed, consult the LET-EC&M Software Maintenance Manual.

1.4 Document Status and Schedule

Version 1.0 is the first Contractor Report publication of the LET-EC&M Software User's Guide. A preliminary version (not formally published) was released in May, 1991 at which time the HBR-LET was fully integrated and tested. This document includes several enhanced sections and additional information.

The HBR-LET participated in ACTS System test at General Electric's Astro-Space division in July, 1992. Minor modifications were made to the software. However, the changes did not alter user operation and therefore are not discussed in this document. Refer to the EC&M Software Maintenance Manual for additional information on the software modifications.

1.5 Document Organization

This document is divided into ten sections. Sections 1 and 2 introduce this document and describe other related documents. Section 3 summarizes the main capabilities, functions, and limitations of the software system. In Section 4, the procedure for installing and initializing the system is discussed. A detailed explanation of the startup, abnormal operation, and termination of the LET-EC&M Software is provided in Section 5. Section 6 contains a description of each currently available sequence command. Sample menus and command examples are also provided. Section 7 describes both fatal and nonfatal error recovery procedures, while Sections 8 and 9 include a list of abbreviations and acronyms and a glossary of special terms. Section 10 contains several appendices that describe input/output menu functions, possible error messages, and status codes that may be encountered, along with suggested recovery actions. A list of the instrumentation and devices controlled by the software and their subsystem location is also included.

An editor program has been developed to allow users to modify existing Instrument and Sequence files described in this document. The Instrument and Sequence File Editor User's Guide is bound separately and is available, as are other C&PM related documents, from the C&PM Software manager. Users do not need to be familiar with the editor to use the EC&M Software.

2.0 RELATED DOCUMENTS

2.1 Parent Document

None

2.2 Applicable Documents

The following instrument manuals are referenced herein and pertain to this document. Refer to these documents for operating instructions.

1. *EIP 545b Frequency Counter, Users Guide,* EIP Microwave Inc., 1988.

2. *General Microwave 60 dB Attenuator Controller User's Manual,* NASA LeRC, Ivancic, W., 1985.

3. *Hewlett Packard (HP) 11713A Attenuator/Switch Driver, Operating and Service Manual,* Hewlett Packard Company, 1985.

4. *HP 6632A DC Power Supplies Operating Manual,* Hewlett Packard Company, 1987.

5. *HP 437B Power Meter, Operating and Service Manual,* Hewlett Packard Company, 1985.

6. *HP 59306A Relay Actuator, Operating and Service Manual,* Hewlett Packard Company, 1986.

7. *Wavetek 8502A Peak Power Meters, Operating and Maintenance Manual,* Wavetek Microwave, Inc., 1989.

The following document provides additional information on the EC&M Software from a programmers point of view.

8. *HBR-LET Experiment Control and Monitor Software Maintenance Manual,* NASA Contractor Report 189161, NASA Lewis, Reinhart, R.C., October, 1992.

2.3 Information Documents

The following documents provide additional information on other software systems and LET hardware subsystems.

1. *EC&M Instrument and Sequence Editor User's Guide,* NASA Lewis, Reinhart R.C., August 1991.

2. *EC&M Post Processing Software User's Guide*, NASA Lewis, Bandi, R., March, 1991.

3. *HBR-LET Acceptance Test Report, IF Noise Unit*, NASA Lewis, Fujikawa, G., 1991.

4. *Modulation and BER Measurement Subsystem Interface Definition*, NASA Lewis, Andro, M., 1987.

5. *HBR-LET Monitor Subsystem Report*, NASA Lewis, Mohammed, J., 1991.

The following document provides an overview of the HBR-LET C&PM Software system.

6. *A Software Control System for the ACTS High Burst Rate Link Evaluation Terminal*, NASA Technical Memorandum 105707, NASA Lewis, Reinhart, R.C., and Daugherty, E., December, 1991.

The following documents provide additional information on the computer system operation.

7. *OS/32 System Operations I*, Perkin Elmer, 1984.

8. *Multi-Terminal Monitor(MTM) Primer*, Concurrent Computer Corporation, 1986.

9. *FORTRAN VII Language System Reference Manual*, Perkin Elmer Corporation, 1986.

Refer to the appropriate editor reference manual for operating instructions and additional information.

10. *OS/32 EDIT User Guide*, Concurrent Computer Corporation, 1986.

11. *MicroEMACS Reference Manual*, Lawrence, D.M. and Straight, B., 1987.

12. *MEDIT User Guide*, Perkin Elmer Corporation, 1984.

3.0 OVERVIEW OF PURPOSE AND FUNCTIONS

3.1 LET Experiment Control and Monitor

Three independent components comprise the LET-EC&M Software system, and are designed to help create and execute a variety of HBR-LET experiments. Multiple device control, data acquisition, instrument monitoring, and bit error rate (BER) measurement testing are among the available EC&M Software functions.

Software-controlled experiments using the Link Evaluation Terminal are developed in three separate phases. Although each component of the LET-EC&M system is independent of the others, each has initial requirements that must be followed during development. These requirements ensure that all information required for proper execution is provided by the user.

Phase one of the EC&M Software, the Instrument Definition Software (IDS), enables a user to define the instrumentation that is used within an experiment. Each instrument in the experiment has information concerning its initial configuration and control parameters that are required by the EC&M Software.

The sequence of commands that will carry out the desired experiment are defined in phase two, the Sequence Definition Software (SDS). Numerous sequence commands are available to control both the instrumentation used in the experiment and sequence execution.

The Sequence Execution Software (SES) executes the sequence while simultaneously performing data acquisition of all instruments included in the test. Instrument output readings and errors messages are displayed on the user's terminal during sequence execution. Data gathered during the execution of the sequence is stored to a file with individual measurements time stamped for future reference and analysis.

3.1.1 Instrument Definition Software

Instruments used within a sequence are selected from an Instrument Table generated by the Instrument Definition Software. The Instrument Table is created from an ASCII data file that contains a list of the instruments currently available to the LET. It is important that all required instruments be defined during this phase. There is no minimum or maximum number of instruments that must be defined.

The IDS also requires information concerning the initial configuration of each instrument, which is determined by the user and can vary from one experiment to another. The Sequence Execution Software uses this information to initialize each instrument at the beginning of the experiment. Although like instruments have identical default parameters available, each instrument can be individually configured.

The Instrument Definition Software creates a file that consists of information concerning each defined instrument. This information is used by the Sequence Definition Software when creating a sequence, and by the Sequence Execution Software throughout execution of the experiment. Although it is not possible to add instruments once this phase is completed, the user can modify the existing data contained within the instrument file by using the EC&M Instrument and Sequence Editor. Refer to the EC&M Instrument and Sequence Editor documentation for further information on editing the instrument file.

3.1.2 Sequence Definition Software

Commands used to conduct an experiment are specified using the Sequence Definition Software. Upon execution, each command performs the indicated function on the selected instrument. Certain commands can redirect the sequence execution flow. Commands such as **GOTO** or **Check a Parameter** are called control commands. The SDS allows the user to send commands to instruments that have been defined in the Instrument Definition Software. Control commands can be used in a sequence regardless of the instruments defined.

The SDS creates a sequence file used by the Sequence Execution Software in the final phase of the EC&M Software. All required parameters associated with each command are stored in the sequence file. One can add sequence commands and modify existing commands within a sequence file by using the EC&M Instrument and Sequence Editor.

3.1.3 Sequence Execution Software

Sequence execution, data acquisition, real-time data display, and limit monitoring are among the functions performed by the Sequence Execution Software. The SES uses both the instrument and sequence files to carry out the defined experiment. The SES executes each command of the sequence created in the SDS and displays the current output reading of each defined instrument. Errors that occur during sequence execution are also displayed to the user's terminal with an appropriate error message. Refer to Section 7 for a discussion of possible errors and error recovery procedures.

Once a sequence is initialized, the software automatically executes each command. Data acquired from the defined instruments is compiled by the SES and stored to a file for future reference and analysis.

3.2 Restrictions and Limitations

The LET-EC&M Software can control the instrumentation presently used within the HBR-LET. System modification or expansion, including additional instrumentation, could require the development of new software.

Software that controls the instrumentation on the IEEE 488 General Purpose Interface Bus (GPIB) depends on both the IEEE interface bus number and the instrument address. The devices that use the RS-232 interface require a serial port connection to the Concurrent 3205 minicomputer. All instrumentation and computer hardware must be properly configured to satisfy these requirements. Refer to Appendix E for the instrument and address pairs in place at the time of this publication. Instrument addresses and port assignments can be changed by modifying the instrument file discussed in Section 4.3.

An Instrument and Sequence Editor is available that allows the user to modify existing parameters within the respective instrument and sequence files. Although individual parameters can be edited, instruments cannot be added. Refer to the EC&M Instrument and Sequence Editor User's Guide for more information.

4.0 INSTALLATION AND INITIALIZATION

4.1 Initiation Commands

Three terminals are used to initialize, operate and maintain the LET-EC&M Software; a user's terminal, a programmer's terminal and the system console. The user's terminal serves as the primary user interface to the EC&M Software and other C&PM Software applications. All EC&M Software functions including instrument definition, sequence definition, and sequence execution are controlled from the user's terminal by making the appropriate menu selections from the C&PM main menu. The user's terminal does not provide access to the computer system other than for specific C&PM Software applications.

The programmer's terminal provides access to the computer system via a user's account under MTM. Use the programmers terminal to sign-on to the computer system and view data files after sequence execution is complete.

The system console provides the user with greater control of the computer system. Use the system console to recover from catastrophic errors when they occur. Refer to Section 7 for information on error messages and error recovery.

Execute the EC&M Software from the user's terminal using the C&PM Main Menu. Appendix A describes the C&PM menu commands used throughout the EC&M Software. The procedures for selecting a menu item, inputting data to a menu and navigating through the menu system are described. The menu commands are the same for all menus and will not be repeated each time they occur in this document.

The user terminal serial communication port connection on the computer is defined in the first line of the EC&M Software menu program. Although a dedicated port has been reserved, the port designation can be changed if necessary. Appendix F contains a list of the EC&M Software menu programs and a procedure for redefining the user's terminal. Use the programmer's terminal to modify the EC&M menu programs.

4.2 Equipment Requirements and Set-up

The LET-EC&M Software system resides on a Concurrent Corporation 3205 minicomputer utilizing Concurrent's OS/32 operating system. In addition to the operating system, the Concurrent computer has a Multi-Terminal Monitor (MTM) that oversees the communication and sharing of system resources between individual users on the system. Tasks (programs) are not required to run under the control of MTM. Each phase of the LET-EC&M Software system runs independent of MTM.

Communication ports of the Concurrent 3205 minicomputer have been assigned dedicated devices. The Digital Ground Terminal (DGT), Data Generator, Data Checker (DG/DC), and General Microwave (GM) attenuators must be connected to the correct port for the system to function properly. Failure to do so may result in the inability to install or execute certain phases of the LET-EC&M Software. Refer to the HBR-LET EC&M Software Maintenance Manual for a list of the communication port assignments and a general description of the hardware set-up.

The menu driver used by the LET-EC&M Software requires a WYSE 50 or compatible terminal for best operation. The type of terminal used for menu display is indicated in the first record of the menu software. Refer to Appendix F for a description of the user terminal definition and a list of the menu software associated with the LET-EC&M Software.

> **Note:** Be certain that the CAPS lock key is on during all phases for proper menu operation.

4.3 Modifying the HBR-LET Instrument Table

An ASCII data file named **INSTRMTS.LET**, located in the Control and Performance Monitor Software Account (CPMSA), is utilized by the IDS. This file contains a list of the instruments currently available to the HBR-LET. Associated with each instrument is information required for proper execution of the LET-EC&M Software. Refer to Appendix D for information regarding the correct record entry and position for each item listed in the data file. A description of each item in the file is also provided.

Modifications to the Instrument File are permitted if the current format of the file and column positions remain the same. Programs in the first phase of the LET-EC&M Software (IDS) require this format to remain unchanged.

The user can easily modify the Instrument File anytime. Possible modifications include, but are not limited to, the following:

1. Changes in an instrument address or IEEE interface bus number

2. New instruments added to the HBR-LET

3. Instruments in need of repair and are temporarily unavailable to the LET. These instruments can be returned to the Instrument Table when they become available.

Any standard text editor or word processor with the ability to read and write an ASCII text file can be used to alter the **INSTRMTS.LET** file. Three text editors, EDIT32, EMACS, and MEDIT, are currently installed on the Concurrent computer system. Please refer to the appropriate user's manual for operating instructions on the various editors.

4.4 Instrument Parameter Default File

A second ASCII data file in the CPMSA called **DEFAULT.LET** is also used by the Instrument Definition Software. This data file contains default parameters for each type of instrument currently listed in the Instrument File. The default values are displayed in the instrument initialization menu during the initialization process. Identical instruments have the same default parameters.

Default file parameters are either initial values of selected parameters or those that will remain constant throughout the experiment. These values can be changed for different experiments once the instrument data file has been created by using the EC&M Instrument and Sequence Editor. Parameters within the default file can also be modified, if required, before executing the Instrument Definition Software. Programs within the IDS require the format of the default file **DEFAULT.LET** to remain unchanged. Refer to Appendix E for a description of each entry in the file as well as information regarding the correct record entry and position for each item listed in the default value data file.

The user can easily modify the Default Parameter File anytime. Any standard text editor or word processor with the ability to read and write an ASCII text file can be used to alter the **DEFAULT.LET** file. Three text editors, EDIT32, EMACS, and MEDIT, are currently installed on the Concurrent computer system. Please refer to the appropriate user's manual for operating instructions on the various editors.

4.5 EC&M Software Filenames

Filenames on the Concurrent computer consist of a volume, filename, extension, and account number and comply with the following format:

VOLUME:NAME.EXTENSION/ACCOUNT NUMBER

Two different volumes on the Concurrent 3205 computer are used by the OS/32 operating system and individual user applications, respectively. All user data files associated with the LET-EC&M Software system are located on the user volume, which has the name M1. For information on the operating system volume, refer to the OS/32 System Operation I manual.

All filenames on the Concurrent 3205 computer consist of one to eight alphanumeric characters. The first character must be a letter. The user can select any name for the instrument definition file. Sequence Definition filenames must match that of the instrument file. This design feature correlates the instrument file with its particular sequence file to ensure execution of the sequence with the proper instrumentation. A second sequence file can be created from the same instrument file by making a copy of the instrument file and giving it a different name. Refer to Appendix H for a summary of the OS/32 operating system commands that are used to perform this function.

The filename extension consists of a three-character name specified by the LET-EC&M system. Files created by the software including the instrument file, sequence file, subsequence file, and data files must have the default extensions as shown in Table 4-1 for the system to function properly.

File Type	Extension
Instrument	TDF
Sequence	SDA
Subsequence	SUB
Data	DAT

Table 4-1 Required Filename Extensions

Subsequences as well as main sequences can be created using the Sequence Definition Software. When initially developed,

subsequences must use the same name that is used by the instrument file. This ensures that all sequence commands within the subsequence refer to instruments defined in the instrument definition file. Once the subsequence is developed, its name can be changed and assigned the appropriate extension from Table 4-1 which distinguishes it from main sequences. Multiple subsequences can be created this way. The subsequence can then be used in the SDS when the **Call Subsequence** command is executed.

Data files created by the Sequence Execution Software are given the same name as the instrument file and sequence file being executed, but with the appropriate extension. The data files created by the sequence software are used in post-processing applications. Instructions on using the post-processing software can be found in the *EC&M Post-processing Software User's Guide*.

4.6 Loading System Programs and System Requirements

Each phase of the LET-EC&M Software system is individually loaded from the user's terminal. The Concurrent 3205 should be on-line, and the user should have access to an account on the computer system. All user files are stored in the user's private account.

Certain requirements must be observed to successfully operate each phase of the LET-EC&M Software. Failure to meet these requirements may result in the inability to install the software component.

Executing the IDS requires both the instrument and default value files to be properly configured. Programs within the IDS require a specified format for both files as described in Appendix D and Appendix E, respectively. In addition, an existing instrument file with the same name as the instrument file being created cannot reside on the user's account when executing the IDS.

An instrument file with the same name as the sequence file being created must exist in the user's account before executing the SDS. This assures that the proper instruments have been defined for the sequence to be created. As with the IDS, a sequence data file with the same name as the sequence file being created cannot reside on the user's account when executing the SDS. This protects the user from writing over an existing sequence data file.

Both an instrument file and sequence file must exist in order to execute the Sequence Execution Software. Data files are created from the execution of a sequence. Multiple executions of an existing sequence is permitted, provided the date files created by the software are removed from the account or renamed before running additional tests.

5.0 STARTUP AND TERMINATION

5.1 Preinitialization Procedures

If both the LET-EC&M Software and MTM are executing simultaneously, the user must remove the communication ports connected to the DGT, the DG/DC, the GM attenuator controller boards, and the user's terminal from under the MTM. This is accomplished by typing the following command at the system console:

> REMMTMLET <cr>

Note: This command will automatically remove the communication ports connected to the DGT, DG/DC, GM attenuator controller board, and the user's terminal respectively.

Communication between the DGT, DG/DC, and the GM attenuator controller boards with the Concurrent 3205 is established through RS-232 communication links. These connections must be made before installing and executing the Sequence Execution Software. Both the IDS and the SDS can be used without the computer being connected to the various devices or instruments contained within the LET.

Since the phases of the LET-EC&M operate independently of one other, the software can be executed in any order if the initial requirements are met for each system. Initialization requirements are discussed in Section 4.6.

The aforementioned commands are performed when the system is set up and the computer is brought on-line. The user should verify the information in this section in case initialization errors occur.

5.2 Startup Commands

Each segment of the LET-EC&M Software is initialized in the same way. To initialize a particular system, select the correct menu option listed in Table 5-1, from the C&PM main menu, followed by a carriage return.

Software System
Instrument Definition
Sequence Definition
Sequence Execution

Table 5-1 LET-EC&M Startup Commands

After the software has been properly installed, the initialization menu is displayed to the user terminal requiring the user to enter the name and account number of the file to be created or executed. Refer to Section 6 for detailed operating instructions of each software component. Display of the initialization menu indicates that the software has been properly loaded and executed by the computer.

5.3 Normal Termination Procedure

With error-free operation, the IDS will terminate normally after defining the final instrument. All instruments must be initialized once they are selected from the Instrument Table.

The test sequence defined by the user can consist of any number of sequence commands. Selecting the **END SEQUENCE** command will automatically terminate the Sequence Definition Software. Subsequences are terminated by selecting the **RETURN TO MAIN SEQUENCE** command.

The Sequence Execution Software will terminate after the execution of the final sequence command. Errors encountered during execution are not necessarily fatal, and recovery is possible by following the instructions provided in Section 7. A message is displayed to the user terminal indicating that the sequence has been completed successfully.

5.4 Abnormal Termination Procedure

The IDS and SDS exhibit fatal errors most often caused by format errors input by the user at the menu. To avoid this error, verify each input before pressing the RETURN key. When this type of error occurs, recovery may be possible as described in Section 7. When fatal errors occur during sequence execution one must terminate the sequence before all commands have been executed. The data file created by the SES will contain the data acquired during the sequence before the fatal error occurred. The sequence can be terminated from either the user terminal or the system console depending on the particular error.

If the error recovery procedure fails, terminate the failed software from the system console by typing the appropriate command from Table 5-1 at the system console, depending on which software component failed.

Software Component	System Console Command
Instrument Definition	> ECMABORT INSTDEF
Sequence Definition	> ECMABORT SEQDEF
Sequence Execution	> ECMABORT SEQEXEC

Table 5-2 Abnormal Termination Procedures

Fatal errors that occur within the sequence execution software because of an instrument error can generally be terminated from the user terminal by using the abort command when prompted from the software. System errors that occur from improper formats, or system function failures are terminated from the system console.

Executing sequences can also be abnormally terminated by "interrupting" the sequence. Pressing the return key while the sequence is executing will stop the sequence and allow the user to terminate the sequence. A prompt from the EC&M Software allows the user to either abort or continue the sequence. Normal sequence execution will occur if continue is selected. Aborting the sequence will terminate its execution at the current command. All data compiled during its execution will be available in the data file created by the SES.

5.5 Abnormal Restart Procedure

To re-execute the IDS or SDS, follow the normal startup procedure. The current instrument or sequence file being created will be lost when either the IDS or SDS is abnormally terminated, respectively. If the recovery procedure was successful, verify the integrity of the file using the EC&M Instrument and Sequence Editor. Note the command where the error occurred in the appropriate file to verify the integrity of the command.

Sequences abnormally terminated can be re-executed, once the error condition has been resolved. Verify that instrument connections have all been properly made and the required files exist in the proper accounts on the computer system. Modify the sequence in error, if necessary, using the EC&M Instrument and Sequence Editor.

Existing data files should be renamed or removed from the user's account before attempting to execute the SES. Failure to do so will result in the inability to successfully execute the SES.

Follow the normal startup procedure for executing sequences described in Section 5. If errors persist, complete the upper half of the C&PM Software Problem Report (CPMPR) provided in Appendix G, and submit it to the C&PM Software manager.

6.0 FUNCTIONS AND THEIR OPERATION

6.1 Instrument Definition Software

The Instrument Definition Software enables a user to select the instrumentation that will be used for an experiment. Both the initial configuration of each instrument and various control parameters are required in this phase. Once the installation command has been executed from the system console as described in Section 5.2, the IDS opening menu will appear on the user's terminal requiring several inputs from the user.

Identifying the name of the file and the account number of where the file will reside are the first two required inputs. The filename can be from one to eight alphanumeric characters. The first character must be a letter. Although the syntax of the filename will be verified by the system, a correct filename is the responsibility of the user. To enter a filename, place the cursor in the appropriate field using the arrow keys and type the name of the file.

Account numbers can be any integer from 1 to 254. The system assumes that the user has been given access to a private account to store their personal files. If the user does not have access to an account on the Concurrent 3205, contact the system administrator.

The final input permits the user to describe the instrumentation contained within the file. This input is not required by the system and is only provided to assist the user in identifying the file when hard copies are produced.

Use the arrow keys or tab key to move from one field to another until all fields have been defined. Press the ENTER key to direct the computer to accept the input information. The system will prevent the user from overwriting an existing file in the user's account and will issue an error message to the user's terminal indicating that the file already exists. If the user no longer needs the existing file, it should be deleted from the private account. The user can enter a new name for the file if this occurs. This error will appear only after all inputs have been made and the ENTER key is pressed.

6.1.1 Instrument Selection

Once a filename and an account number for the instrument file have been entered, a table of the available instruments is displayed to the user's terminal. The Instrument Table is constructed from the **INSTRMTS.LET** data file as described in Section 4.3. The Instrument Table displayed to the user's terminal will be similar to that shown in Figure 6-1.

The Instrument Table consists of the available instruments identified by a number (NUM), label, NASA tag number (TAG), and a mnemonic identifing the instrument type (ID). The instrument type corresponding to the mnemonics are provided in Section 8 of this document.

HBR-LET EC&M Software System Instrument Table

X	NUM	LABEL	TAG	ID	X	NUM	LABEL	TAG	ID	X	NUM	LABEL	TAG	ID
X	01	PM1	G88833	WTPM		02	B37	G50340	HPSD	X	03	N20	071649	HPPM
X	04	L16	071646	HPPM	X	05	PIN	071580	HPPS		06	U13	068276	HPAT
X	07	R12	068275	HPAT	X	08	C7	071535	HPRA	X	09	C9	071557	EIPF
	10	SA1		SABR		11	A1	183198	GMAT	X	12	B2	183196	GMAT
X	13	L6	068274	HPAT	X	14	PM2	TBD	WTPM		15	C26	003612	HPPM
X	16	U12	068279	HPSD		17	U4	068278	HPSD		18	R11	071645	HPPM
X	19	DG1		DG	X	20	DC1		DC	X	21	DGT		DGT

Figure 6-1 HBR-LET Instrument Table

To select an instrument, place an **X** in the first column next to the desired instrument under the column header labeled "X". This process is repeated until all instruments used in the sequence are selected. An initialization menu for each instrument allows the user to specify the configuration of the instrument at the beginning of the sequence. Initializing the instrument can be thought of as the initial sequence command. Each instrument's initial values can be independent of other instruments defined for that sequence. The instrument initialization menus will appear only after all instruments have been selected and the ENTER key is pressed.

6.1.2 Instrument Initialization Menu

After the instrumentation for the experiment has been defined, initialization menus for individual instruments are displayed to the user terminal. The user must enter the initial configuration of each instrument along with several control parameters.

Figure 6-2 is an example of an instrument initialization menu. The instrument type, instrument label, interface type, and NASA tag number are displayed on all the instrument initialization menus and are provided for description only. These parameters come from the Instrument File and cannot be altered at this time. These parameters can only be altered inside the instrument data file INSTRMTS.LET, prior to executing the IDS. Refer to Section 4.3 for information on editing the Instrument File.

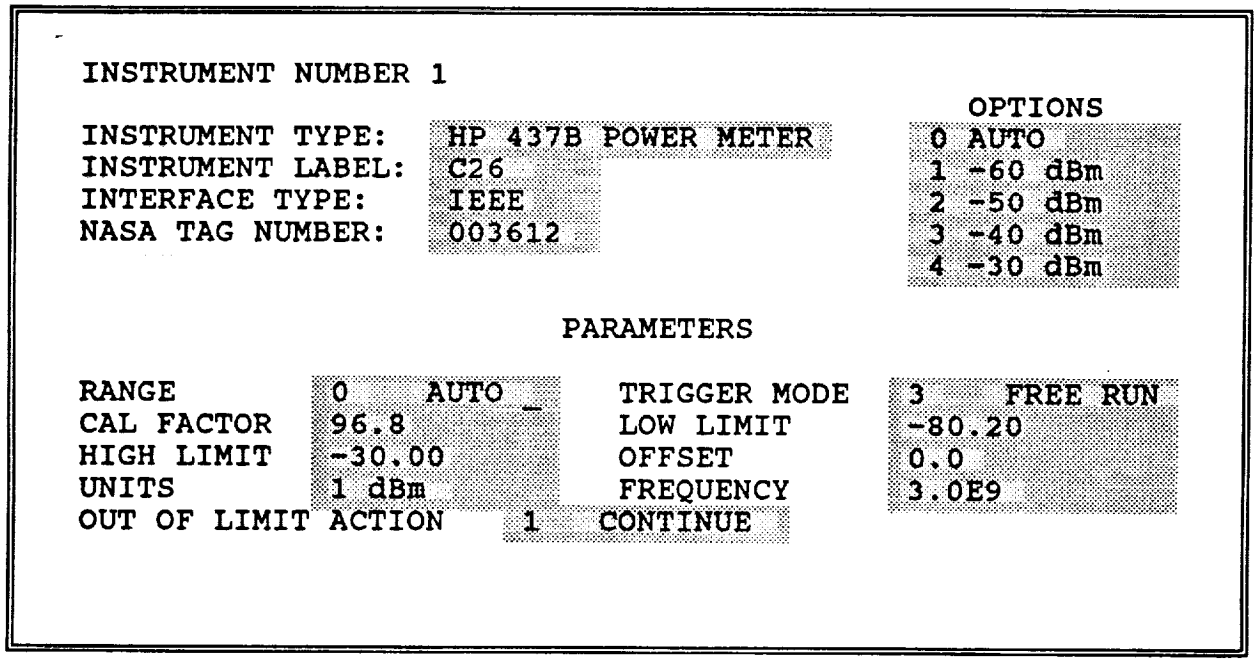

Figure 6-2 HP Power Meter 437B Instrument Definition Menu

The parameters in the initialization menus have default values stored in the DEFAULT.LET data file, described in Section 4.4. The options for each parameter are displayed in the option field when the cursor is placed at the input field. In Figure 6-2 the cursor (represented as an underscore), is located in the RANGE parameter input field, thus the options displayed correspond to the various ranges available.

Each instrument must be initialized once it has been defined in the Instrument Table. Initialization commands for the Data Checker and the Digital Ground Terminal are incorporated into the Data Generator Initialization Menu.

6.1.3 Instrument Control Parameters

This manual assumes the user is familiar with the instrumentation used by the LET and does not discuss each instrument function in detail. However, the control parameters used by the SES to ensure proper execution of the software merit some discussion. Refer to the appropriate instrument user's guide for an explanation of instrument-specific parameters.

6.1.3.1 Limit Monitoring

Several of the available instruments have control parameters that are common to each instrument initialization menu. The control functions available include low limit, high limit, and out of limit action. These commands are used by the LET-EC&M Software to monitor the instrumentation and control the execution of sequence commands during an experiment or test.

High and low limits allow the software to monitor output levels of the instruments and show when an instrument is outside its limits. The LET-EC&M Software issues warnings or errors appropriately, when a problem arises because of an out of limit condition.

The system responds to an out-of-limit condition depending on the action selected by the user for that particular instrument. Out-of-limit actions for a particular instrument are independent of other instrument actions. Available actions include continuing the sequence or halting the sequence if an out of limit condition is detected.

Potential out-of-limit conditions are also detected by the software system for certain instruments such as attenuators and power supplies. Whatever the out-of-limit action selected, the software stops the sequence and displays a warning message to the user terminal for the first potential out-of-limit condition. This occurs for each instrument that exhibits the potential out-of-limit feature. If the "continue sequence" action was selected for that instrument, only the first potential out-of-limit error is flagged by the system. Future potential errors will not be displayed to the user's terminal. If the "halt sequence" action was selected, the potential errors are displayed to the user terminal, suspending sequence execution each time they occur.

Section 7 describes in detail the system's actions taken during an out-of-limit condition. An illustration of the messages for the out-of-limit errors and potential error warning messages are given.

6.1.3.2 Wavetek Peak Power Meter Channel Definition

There are two channels (A and B) and three modes of operation (CW, PEAK, and GRAPH) available on the Wavetek Peak Power Meter. Within the Wavetek initialization process, the user must indicate which channels are going to be used and which of the CW or PEAK mode output should be read by the Sequence Execution Software.
Failure to accurately indicate which channels are to be used during an experiment may result in sequence command errors.

6.2 Sequence Definition Software

Creating a sequence consists of selecting certain commands in a specified order to carry out a desired experiment. There are numerous sequence commands available to the user. Commands can be either directed toward a particular instrument that has been previously defined in the Instrument Definition Software, or used to alter the flow of sequence execution.

Two types of sequences can be created using the Sequence Definition Software: Main Sequences, which are the primary sequences, and subsequences which can be called from within a main sequence. Subsequences can be thought of as subroutines in a computer program.

When the Sequence Definition command has been executed from the user terminal, an opening menu appears and requires three inputs. The first is the name of the sequence file to be created. The filename must be identical to the instrument filename that is to be used with that sequence. If a file with the same name currently exist on the account, the system will prevent the user from overwriting the existing file by issuing an error to the user's terminal. The user can then re-enter the filename.

The second input, the account number, must correspond to the location of the instrument file. If the system fails to locate the appropriate instrument file, it will issue an error message to the user's terminal and query the user for another account number. An instrument file with the same name must exist before executing the SDS.

Finally, the type of sequence to be created must be specified. There are two ways to enter this information. The user can enter the type of sequence by typing the sequence type using the same

format as that given in the option field, or select the type of sequence from the option field by following the procedure given in Appendix A. Subsequences can be called from within a main sequence, by issuing the **Call Sub-Sequence** command, explained in the next sections.

6.2.1 Sequence Definition Main Menu

The Sequence Definition opening menu requires valid input for each entry. Press the ENTER key to go to the main menu of the SDS. The main menu contains a list of available commands for either the main sequence or subsequence.

The SDS main menu is illustrated in Figure 6-3. The sequence number is incremented automatically by the SDS each time a sequence command is defined. The sequence action and label are user defined for each command. The sequence action (required by the software), instructs the Sequence Execution Software as to which type of command to execute. Sequence labels are similar to statement label numbers within a computer program and are required only when that particular label number is the argument of a **GOTO** or **Check a Parameter** sequence command.

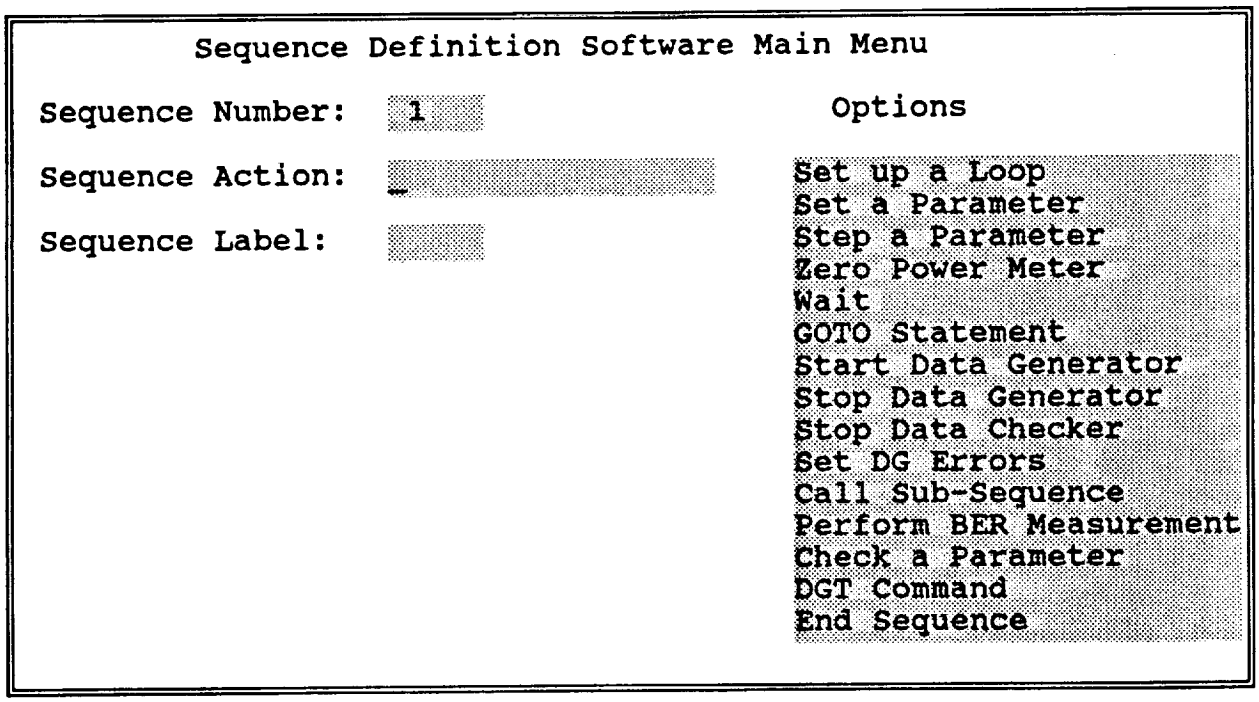

Figure 6-3 Sequence Definition Software Main Menu

Sequence label numbers must be positive integers that increase from one sequence command to the next. Label numbers cannot be repeated within the same sequence. Due to the independence of the main sequence and subsequences, it is permitted for them to share common label numbers.

Because of software design features, **End Loop**, **Return to Main Sequence**, and **End Sequence** commands cannot have a label number. These commands are given specific labels by the software system for control purposes.

6.2.2 Sequence Command Definition

Sequence commands that are available to the user to carry out an experiment were defined at the time of this publication. The software has been written in a modular fashion so that the system could expand to include additional commands if necessary. If additional commands are required, submit a CPMPR form, provided in Appendix G, to the C&PM Software manager.

The sequence commands are accompanied by various menus that require additional information with respect to the instrument, specific parameter, and value associated with a particular command. Each command and its requirements are discussed in detail in the following sections.

> Note: Menu selection of any command or parameter is discussed in Appendix A. All menu commands follow the same format and are menu independent. Individual menu commands will not be discussed for each sequence command.

Most sequence commands require that a particular instrument be identified to receive the command. If there are no instruments available to meet the requirements of the particular command, the option field will contain NONE AVAILABLE. If this occurs, the only recovery is to create a new instrument and sequence file including the required instrumentation. The Sequence Execution Software cannot execute a sequence without the proper instrumentation. If this error occurs inadvertently, recovery is possible by "backing out" of the menu by pressing Ctrl-C until the main menu appears. At that point, sequence development can continue.

6.2.2.1 Set up a Loop

Loops within a sequence are used to repeatedly execute a group of commands. To initiate a loop the user must first enter the number of times to execute the loop. This must be a positive integer greater than zero. The menu shown in Figure 6-4 will then be displayed to the user's terminal showing the available commands that can be executed within a loop. The user selects the commands for the loop the same way as selecting commands from the main menu. Nested loops are not permitted within the sequence, therefore the **Set up a Loop** command is not displayed in the loop menu. However, the sequence command **End Loop** is displayed and is used to terminate the loop and return to the main menu.

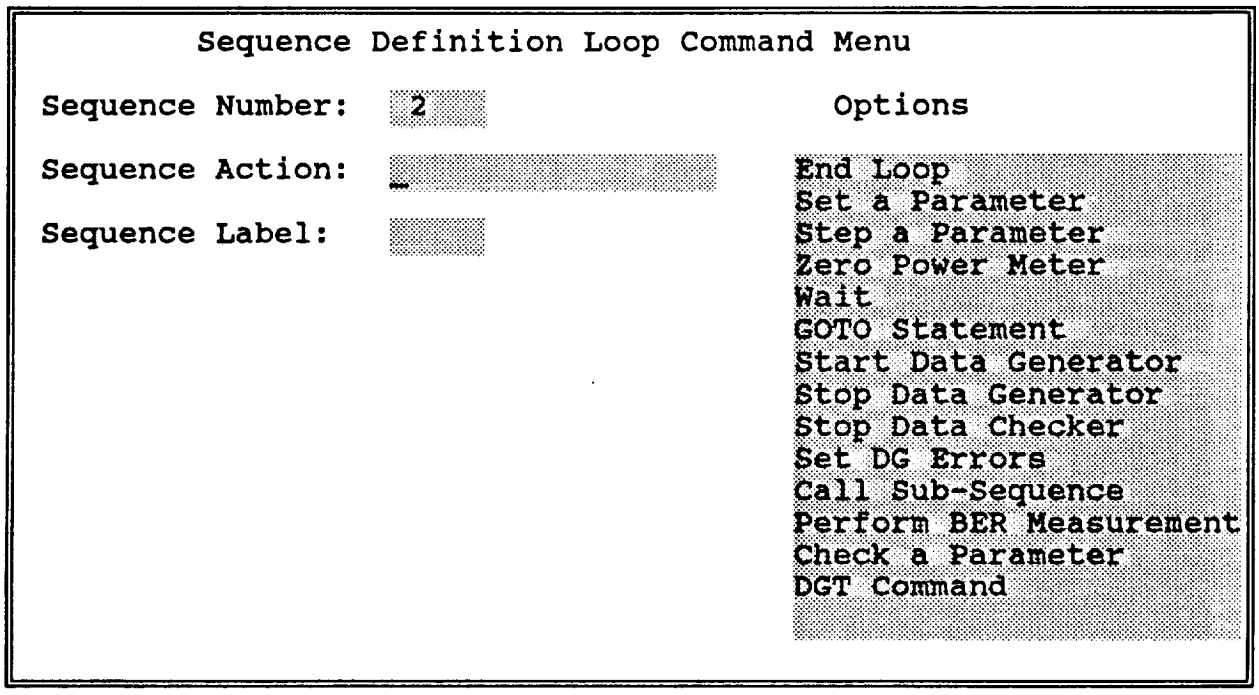

Figure 6-4 Loop Command Menu

Sequence commands within a loop are called the body of the loop. Transfer of control to a command within the body of the loop is not permitted. Transfer of control can only go to the **Set up a Loop** sequence command, which prohibits a sequence from accessing the middle of a loop. Leaving the loop by other than normal termination is permitted by using either the **GOTO** or **Check a Parameter** command.

6.2.2.2 Set a Parameter

There are several types of parameters that can be "set" on the various instruments. The options listed in Figure 6-5 have additional menus that enable the user to enter the instrument and other required information. The Beacon Receiver and Wavetek parameters have a subparameter menu with available parameters for each specific instrument. Other "set parameter" options refer to different instruments that have that particular function available.

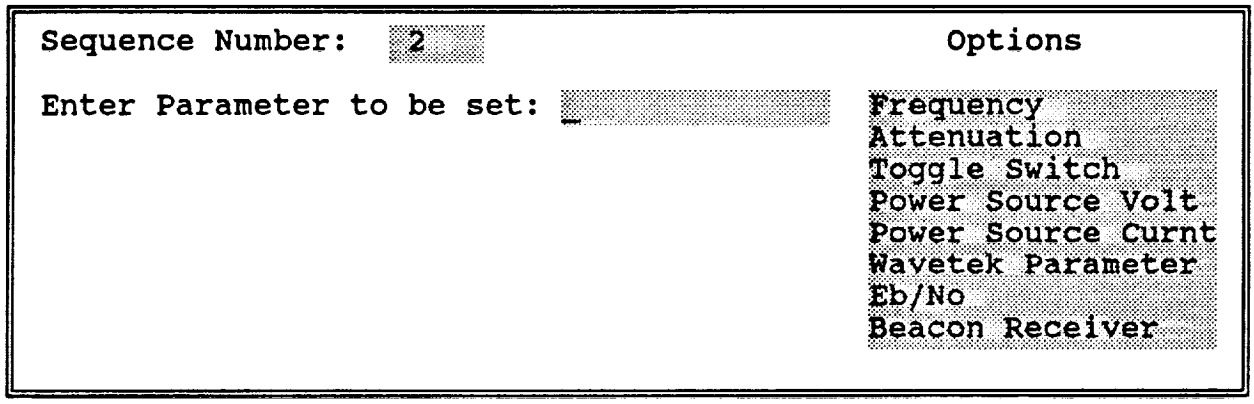

Figure 6-5 Set Parameter Command Menu

6.2.2.2.1 Frequency

When the frequency parameter is selected, a menu similar to the one shown in Figure 6-6 is displayed to the user's terminal. The instruments displayed in the option field depends on two factors: the instruments must be selected in the IDS and they must have the frequency function available.

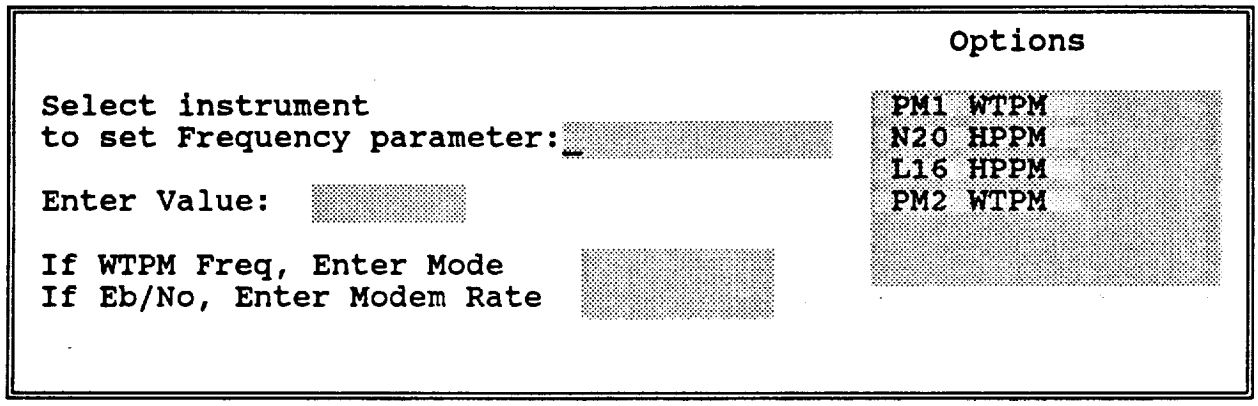

Figure 6-6 Set Frequency Parameter Menu

Enter the desired frequency value as any positive integer or real number. Scientific notation is permitted for the value. The need for the remaining inputs are instrument or parameter dependent. If the Wavetek Peak Power Meter is selected from the available instruments, both the channel and mode of the instrument must be selected. Although all modes and channels are affected by the frequency, the selected mode and channel are output to the instrument's front panel. Refer to the Wavetek Peak Power Meter User's Manual for a description of the available modes and channels.

For the frequency parameter, the final input can be disregarded. This menu is also used by the Eb/No command, which will be discussed in the following section.

6.2.2.2.2 Eb/No

The Eb/No parameter menu is similar to the one shown in Figure 6-7. Only the data generators accessible to the LET will appear in the option field. Currently, the LET uses a single data generator; thus, only one will appear. Note that the data generator will appear as an option only if it was selected during the instrument initialization process. Select the data generator as the instrument for this command.

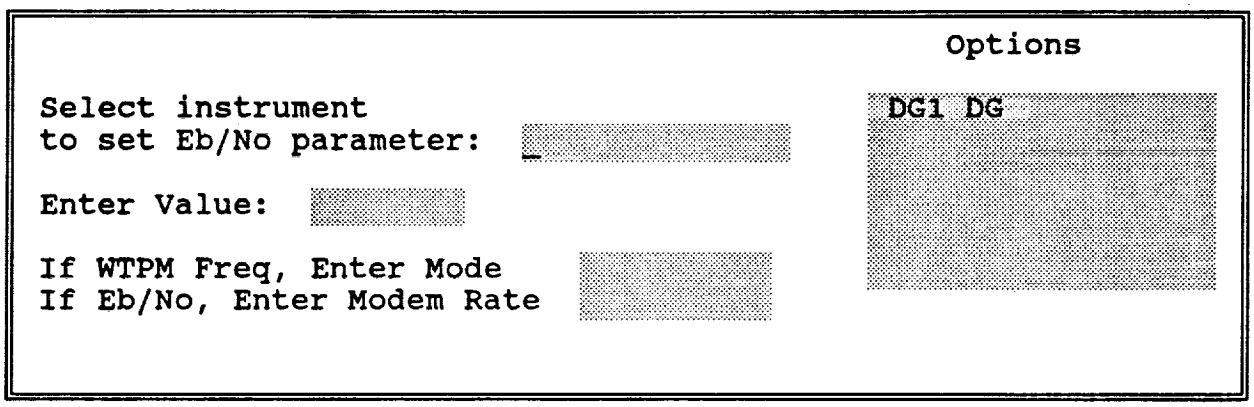

Figure 6-7 Set Eb/No Parameter Menu

Next, enter the desired value of Eb/No as any positive integer or real number. The Eb/No parameter command sets the noise attenuator of the IF Noise Unit specified in the IDS to the value of attenuation necessary to achieve the desired Eb/No. The approximate value of attenuation corresponding to a given Eb/No are provided in the IF Noise Unit Documentation. The system will attempt to match the desired Eb/No within +/- .55 dB by incrementing or decrementing the noise attenuator appropriately. The signal attenuator is not affected during the Eb/No calculation.

The remaining inputs are instrument or parameter dependent. Since the frequency parameter was not selected, the first conditional input can be disregarded. The second input requires the user to define the burst rate of the modem at which the Eb/No is measured. Available burst rates include 221.184 Megabits per second (Mbps) and 110.592 Mbps. Refer to the *Modulation and BER Measurement Subsystem* documentation for further information on the available burst rates.

The signal power used in the Eb/No calculation is measured once for each Eb/No at a specified modem rate. The EC&M Software measures the power of the power meter selected in the IDS for this measurement. A new power level is read each time the modem burst rate is changed from 220 to 110 Mbps or from 110 to 220 Mbps.

The formula used to compute the Eb/No is as follows:

$$Eb/No_{calculated} = SP - NP + NBW - Calfac$$

SP = Signal Power
NP = Noise Power
NBW = Noise Bandwidth of Calibration Filter
Calfac = Calibration Factor corresponding to respective modem burst rate

Refer to the *HBR-LET Acceptance Test Report, IF Noise Unit* for additional information on the Eb/No calculations and related definitions.

6.2.2.2.3 Attenuation

The Attenuation parameter menu is similar to the menus for the Frequency and Eb/No parameters. The difference is in the instrumentation available for the particular parameter. Only those instruments selected in the IDS with an attenuation function on the instrument will be displayed.

The desired value of attenuation can be any positive integer or real number. Note that an HP Step Attenuator can accept only integer attenuation values, whereas a GM Attenuator can accept both integer and real values. The remaining inputs can be disregarded for this parameter.

Note: HP Step Attenuators used solely as switch drivers do not appear in the option field of the **Set Parameter** menu because that function is no longer available when used as a switch driver only.

6.2.2.2.4 Toggle Switch

Instruments currently available to the LET capable of toggling a switch include HP Step Attenuators, which function as both attenuators and switch drivers (HPAT); HP Step Attenuators, which function solely as switch drivers (HPSD); and HP Relay Actuators (HPRA).

The same Toggle Switch parameter menu is used for all instruments with the toggle switch function. The menus vary depending on the selected instrument.

The user can set the switch positions for each instrument in one of two ways. In the first method, the switches can be set individually by selecting either "1 ON" or "0 OFF" from the option field. The second method applies only to the HPSD's in the monitor subsystem. Switch positions for these instruments are set by selecting an input monitor location and an output instrument. The input and output selections refer to the path used for monitoring a desired reference point in the system. For further information on input and output paths, refer to the monitor subsystem documentation. When the user selects the input/output feature of the HPSD, the software will set the switches on the switch driver to the necessary position to provide the desired path. The menu is updated to reflect the corresponding switch positions.

Figure 6-8 shows a sample menu of the HP Relay Actuator. The menu displays the current position of the valid switches for the respective instrument. Other switch positions are labeled DO NOT USE, indicating that the particular switch does not exist for the instrument shown. The option field displays the available settings for a particular switch.

Since this instrument does not exhibit the input/output feature, the user must individually set the position of each switch. There are no additional options available for the input and output selections.

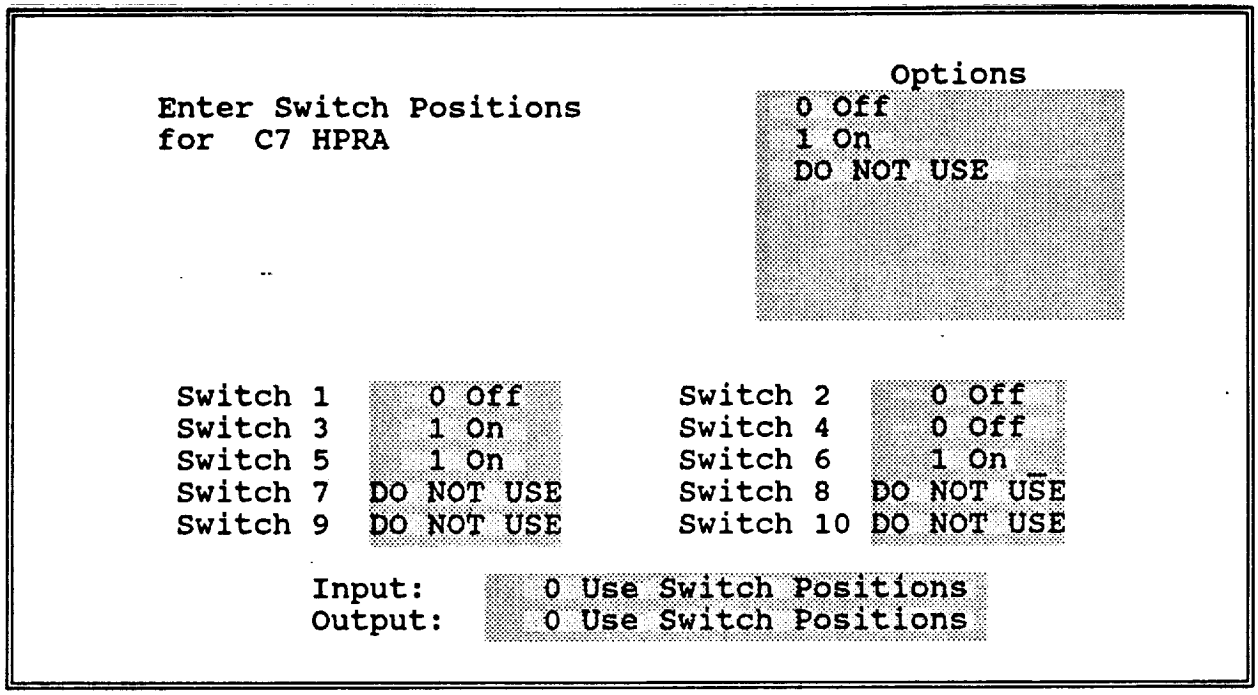

Figure 6-8 Set Toggle Switch Parameter Menu for the HP Relay Actuator

HPSD's are capable of defining an input device and an output instrument. The software will set the switches to the necessary position to yield the desired configuration. Figure 6-9 illustrates an example of an HPSD with the input and output labels specified. The switch positions reflect the positions necessary for the given input and output combination. The options displayed are those available for other inputs.

Additional options also exist for the output that are displayed when the cursor is in the same line as the output selection field.

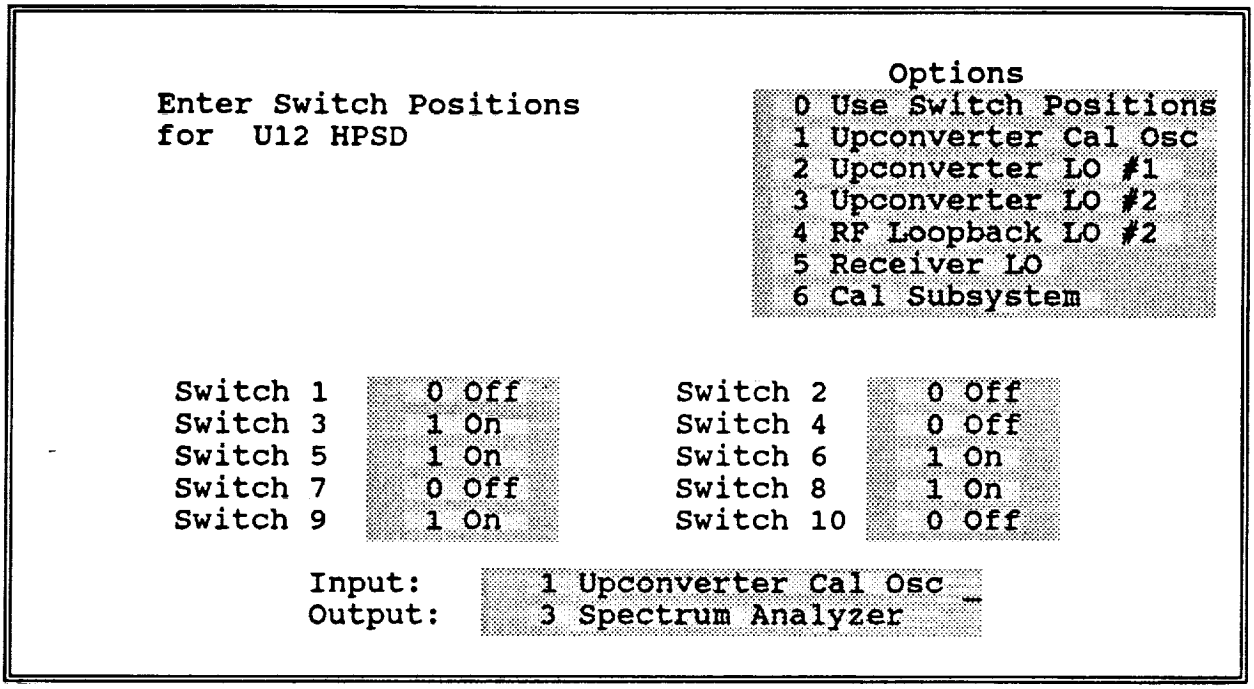

Figure 6-9 Set Toggle Switch Parameter Menu for the HP Attenuator Switch Driver

The operation of the Toggle Switch parameter menu differs slightly from other menus. The benefit of this enhancement is noticed most when using the toggle switch parameter for an HPSD with an input/output combination. When the user has selected an input and an output combination and presses the ENTER key one time, the menu updates the switch position fields with the positions necessary to provide the selected path from input to output. Pressing ENTER a second time directs the computer to accept the input. The user can change either entry before pressing ENTER the second time by pressing CTRl-C. When CTRL-C is pressed, the user can change any or all entries in the menu. If either the input or the output is changed, and ENTER pressed once, the new switch positions are displayed to the menu. Pressing ENTER a second time directs the computer to accept the new input/output combination.

Similarly, when using the menu for either the HPAT or the HPRA simply press ENTER once to update the menu and a second time to direct the computer to accept the input. Pressing CTRL-C after pressing ENTER the first time provides an opportunity to change the switch positions or input/output path. Pressing ENTER two consecutive times directs the computer to accept the input.

Warning: When the HP Relay Actuator is returned to local mode, the switch positions are returned to the front panel controls, which may be different from the last command sent to the instrument. Be certain all the switches are manually set to prevent any component damage before returning to local mode.

6.2.2.2.5 HP DC Power Supply

Two individual parameters, current and voltage, can be set independently on the HP DC Power Supply (HPPS). The menus for the power supply current and voltage are similar to those of the frequency and attenuation, Sections 6.2.2.2.1 and 6.2.2.2.3.

One selects a power supply from the option field and enters a numerical value in the same way as the other menus. Refer to Appendix A for a discussion of the menu commands.

6.2.2.2.6 Wavetek Parameter

Three inputs are required to send a command to the Wavetek Peak Power Meter. The specific parameter is first selected from the option field. Currently, there are 15 individual parameters that can be set on the Wavetek Peak Power Meter. Because the user should be familiar with the operation of the power meter, each parameter is not discussed here in detail. Refer to the Wavetek User's Guide for more information on the parameters.

Figure 6-10 shows the available parameters. These options are displayed when the cursor is in the "Select Wavetek Parameter" input field.

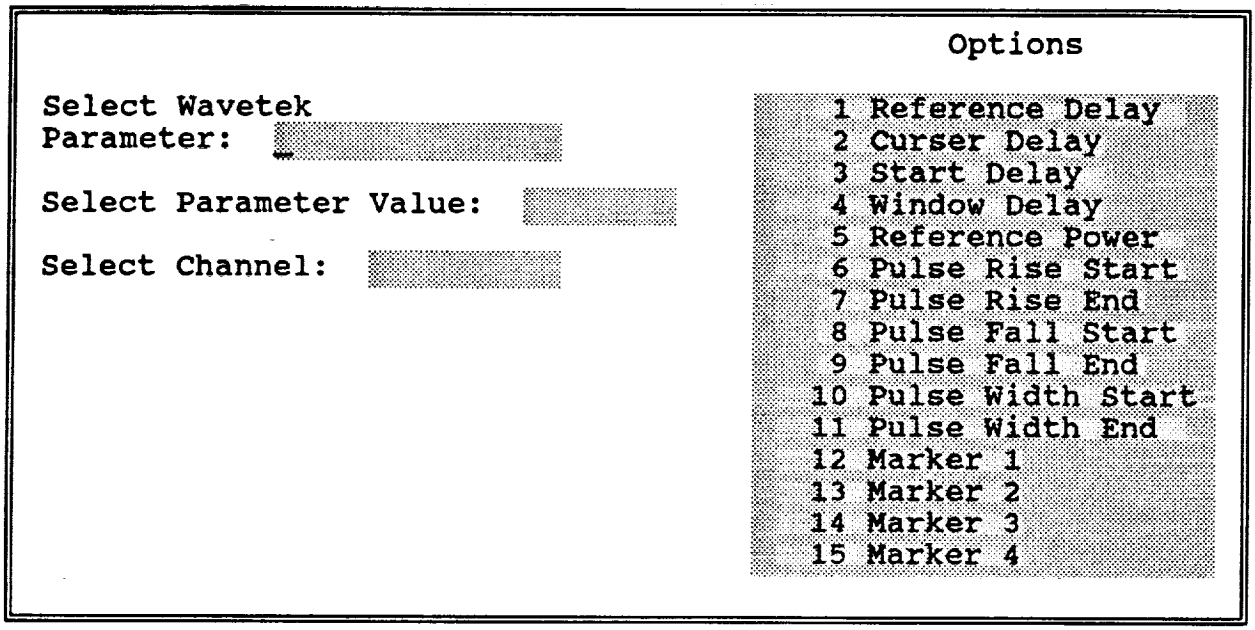

Figure 6-10 Wavetek Parameter Menu

The value corresponding to the selected parameter is required next. Valid ranges for the selected parameter will appear in the option field as shown in Figure 6-11, when the cursor is in the "Select Parameter Value" input field. The valid range of the selected parameter will be in the same line as the parameter selected. For example, if the Reference Delay parameter is selected from the option field, the corresponding range of valid entries is also on the first line of the option field when the cursor is moved to the "Select Parameter Value" input field.

By displaying the valid ranges in this manner, the system can display the ranges of all the parameters and can be expanded to include additional parameters if required.

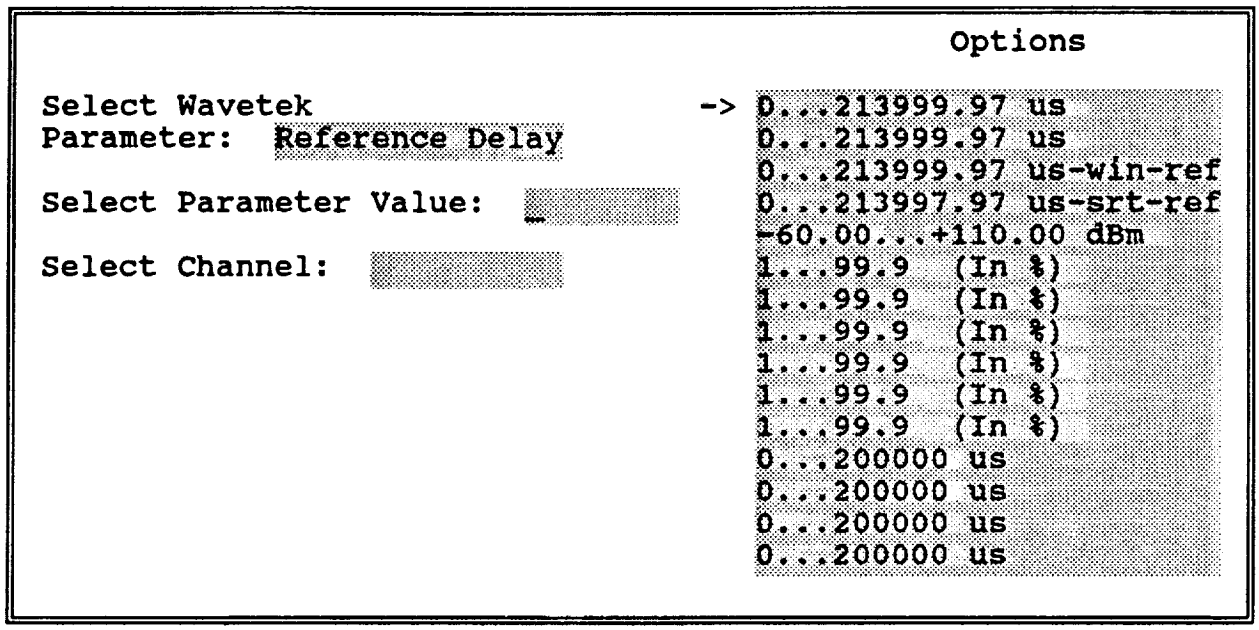

Figure 6-11 Wavetek Parameter Value Menu

The abbreviations used in the Wavetek Parameter Limits Menu are listed in Table 6-1. Refer to the Wavetek User's Manual for a detailed explanation of the limits for each parameter.

Abbreviation	Units
us	microseconds
win	window delay
ref	reference delay
str	start delay

Table 6-1 Wavetek Parameter Unit Abbreviations

Finally, the user must select the mode and channel of the Wavetek Power Meter for the selected command. Table 6-2 lists the option numbers that correspond to the specific channels (A,B) and modes (CW, Peak, Graph).

Option Number	Channel	Mode
1	A+B	CW
2	A	CW
3	A+B	Peak
4	B	CW
5	A	Graph
6	A	Peak
7	B	Graph
8	B	Peak
9	A	Marker
10	B	Marker
11	A	Pulse
12	B	Pulse

Table 6-2 Wavetek Peak Power Meter Channel/Mode Definitions

6.2.2.2.7 Beacon Receiver Parameter

The Scientific Atlantic Beacon Receiver (SABR) parameter menu selection procedure is similar to that of the Wavetek Parameter menu discussed in Section 6.2.2.2.6. Available parameters to set on the SA Beacon Receiver include 2nd LO VFO frequency, video attenuation, signal strength offset, carrier indicator, and signal strength slope. Refer to the Beacon Receiver's User's Guide for a detailed explanation of each parameter and its associated limits.

6.2.2.3 Step a Parameter

The **Step a Parameter** command enables a user to increment or decrement the current value of a parameter on a specified instrument. There are several parameters that can be stepped

depending on the type of instrument selected. The options listed in Figure 6-12 have additional menus that enable the user to enter the instrument and the increment or decrement value for the selected parameter.

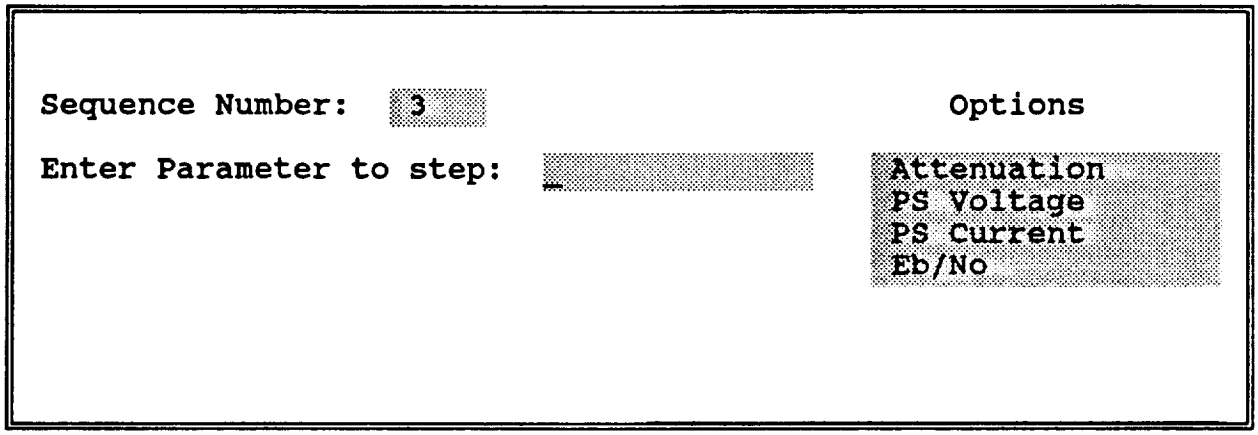

Figure 6-12 Step a Parameter Command Menu

6.2.2.3.1 Attenuation

The HP Attenuator/Switch Drivers and the GM Attenuators can have their attenuation changed using the **Step a Parameter** command. When stepping the attenuation value of one of the HP Attenuators or GM Attenuators, it is assumed that the user knows the current value of attenuation. Although the system will monitor the high and low limit of attenuation as defined by the user, it is best to keep track of the value of attenuation to avoid possible errors during sequence execution.

The step attenuation menu requires the user to enter the instrument and attenuation step value (in dB), which can be any positive or negative integer or real number.

> Note: HP Attenuators can only increment/decrement their value in integer amounts, whereas the GM Attenuators can increment/decrement their value in either integer or real amounts.

The sign of the number indicates whether to increment or decrement the current value (+ increment, - decrement). The instruments that appear in the option field are a subset of those defined in the IDS which have an attenuation function.

Potential out-of-limit conditions are displayed by the Sequence Execution Software if the value of attenuation to be sent to the instrument exceeds the limits set by the user. Out-of-limit conditions are displayed to the user terminal before the attenuation is changed (before the error occurs). Refer to Section 7.0 for a detailed discussion of the out-of-limit errors and the options that are available to continue the sequence.

6.2.2.3.2 Eb/No, Signal-to-Noise Ratio

Stepping the Eb/No is similar to stepping the attenuation except that one additional input is required. In addition to selecting an instrument and a step value, the user must also indicate the burst rate of the digital ground terminal at which the Eb/No is to be calculated. The burst rates include 221.184 Mbps and 110.592 Mbps. The menu software abbreviates the burst rates as 220 Mbps and 110 Mbps, respectively. Refer to the *Modulation and BER Measurement Subsystem* documentation for further discussion on burst rates. The software measures the signal power at the selected modem rate and uses this measurement in its Eb/No calculation. Calculating the Eb/No at one rate and performing a BER at another rate results in an inaccurate BER for the measured Eb/No.

Only the data generators contained in the LET will appear in the option field as available instruments. Currently, the LET has a single data generator available, thus only one will appear. It is important to note that the data generator will appear as an instrument option if it was selected during the instrument initialization process.

The Eb/No value input can be any positive real number. The Eb/No parameter command sets the noise attenuator in the IF Noise Unit to the value of attenuation necessary to achieve the desired Eb/No. The approximate value of attenuation corresponding to a given Eb/No can be found in the *HBR-LET Acceptance Test Report, IF Noise Unit* documentation. The system will attempt to match the desired Eb/No within +/- .55 dB.

6.2.2.3.3 Power Source Output Voltage and Current

Both the power supply voltage and current can be independently stepped using the LET-EC&M Software. The power supply step menu operation is similar to the menu operation for the attenuation and the Eb/No. Refer to Section 6.2.2.3.1 (Step Attenuation) for an explanation of the commands necessary to step the power supply parameters.

6.2.2.4 Zero Power Meter

This command allows a user to zero a defined power meter anytime during a sequence. Only those instruments that have a zeroing function will appear in the option field of the command menu. HP Power Meters, Wavetek Peak Power Meters, and the SA Beacon Receiver are among the instruments with a zeroing function.

Each channel of the Wavetek Peak Power Meter defined by the user in the Instrument Definition Software is zeroed automatically by the Sequence Execution Software whenever the Wavetek Power Meter is selected. Refer to Section 6.2.1.2 for a discussion on defining channels of the peak power meter.

6.2.2.5 Wait Statement

Execution of this statement suspends sequence execution for a user-specified amount of time. The time and units of the wait period and interval time period must be specified. Data acquisition can continue during the wait period by specifying an interval of time for the software to perform its data acquisition function.

The number of readings taken during the wait period is calculated by dividing the total wait time by the interval time. For example, if the user selects to wait eleven seconds, with a two second interval, the SES will take five readings during the wait command.

Data acquisition can also be bypassed to save time by selecting the "No Data Acquisition" command from the WAIT command menu. Sequence execution will continue after the wait has been executed, although it will not be reflected in the data file since no data was taken.

6.2.2.6 Goto Statement

This command transfers the sequence execution to a new sequence command with the user-defined sequence label. The sequence label must be defined in the sequence or execution errors will result. If the label is not defined prior to defining the **GOTO** statement in the SDS, the system will remind the user that the label does not yet exist.

If the user exits the sequence definition without defining all required sequence labels, the software will issue a warning that all labels have not been defined. If this occurs, the user is required to edit the sequence using the Instrument and Sequence Editor prior to executing the sequence.

Label numbers must always increase during a sequence so that they are not repeated. Valid label numbers are any integer value from 1 to 99990.

End Loop, **Return to Main Sequence**, and **End Sequence** commands cannot have a sequence label. Labels for these commands are reserved for sequence control. In addition, a sequence command cannot jump into the body of a loop. A loop can only be accessed from the beginning if it has a defined label number.

A **GOTO** statement cannot jump to a label number inside a subsequence, nor can a **GOTO** statement jump from a subsequence to a label number in the main sequence. The main sequence and subsequences can share the same label number.

6.2.2.7 Start Data Generator

This command enables the user to start a data generator. The user must provide additional information such as the user data rate, bursting rate, data type, and destination of data. Currently, there is only one data checker in the LET system; thus, the only valid destination input is data checker number one. The available burst rates are 221.184 Mbps and 110.592 Mbps. These rates are represented in the software menu as 220 Mbps and 110 Mbps respectively.

Table 6-13 shows the data rates currently available from the DGT. The bursting rate selected by the user dictates the maximum user rate allowed.

Data Rate (Mbps)	Data Rate (Mbps)
1.25	27.64889
5.00	50.00
12.50	55.296
13.824	100.00
25.00	110.592
27.648	200.00
27.64809	221.184

Table 6-3 Data Generator Data Rates

The data checker automatically starts after sending the start command to the data generator. There is no independent command to start the data checker.

6.2.2.8 Stop Data Generator

Currently, the LET contains one data generator. The SDS default data generator is number one. There is no need to select a particular device from the option field and no additional input is required to stop the data generator. The SDS will not display additional menus for this command.

6.2.2.9 Stop Data Checker

Currently, the LET contains one data checker. The SDS default data checker is number one. There is no need to select a particular device from the option field and no additional input is required from to stop the data checker. The SDS will not display additional menus for this command.

6.2.2.10 Set Data Generator Errors

This command creates a known number of errors within the user's data. The EC&M Software uses this information to verify that the data generator and data checker are properly communicating with each other. The valid range of errors that can be set is from 1 to 99.

6.2.2.11 Call Subsequence

The **Call Subsequence** command allows a user to execute a subsequence (similar to a subroutine in a computer program) from within a main sequence. The subsequence must exist before it is called. Both the name and the account number of the subsequence are required for this command. The system assumes the file is on the user volume (M1) and has the extension SUB. The proper extension is automatically appended to a file when it is created using the Sequence Definition Software.

A subsequence must reside in a private account before it can be called from within a main sequence. The subsequence name need not match the instrument filename after it has been created. However, subsequence names must match the instrument filename when created, to ensure that the instrumentation corresponds with that being used in the main sequence. Subsequences can be renamed using the RENAME command on the Concurrent 3205. Refer to Appendix H for information on RENAME and other computer commands.

Subsequences cannot be run independent of a main sequence because of control parameters that exist in each file. Attempting to execute a main sequence as a subsequence or a subsequence as a main sequence will result in the inability to execute the Sequence Execution Software.

It is the user's responsibility to ensure that the proper instrumentation exists within in the instrument file for the subsequence commands. Failure to do meet this criterion may result in sequence execution errors within the subsequence.

6.2.2.12 Perform BER Measurement

Perform BER Measurement obtains the current bit error rate and the number of words received by the data checker, and queries the status of the data generator. The user can specify the time between each measurement to ensure a valid BER, the number of measurements, and the particular data checker. Currently, only one data checker exists in the LET system, thus this input must have a value of one.

The software will respond with a cumulative BER for each measurement if multiple readings are selected. The data generator must be started before executing the **Perform BER Measurement** command to obtain a valid BER.

This is the only command that accesses the data checker for the current BER. Because of design requirements the BER is not automatically taken during each data acquisition.

6.2.2.13 Check a Parameter

The **Check a Parameter** command is similar to an if-then computer program statement. The user must select the parameter to be checked from the **Check a Parameter** menu illustrated in Figure 6-13.

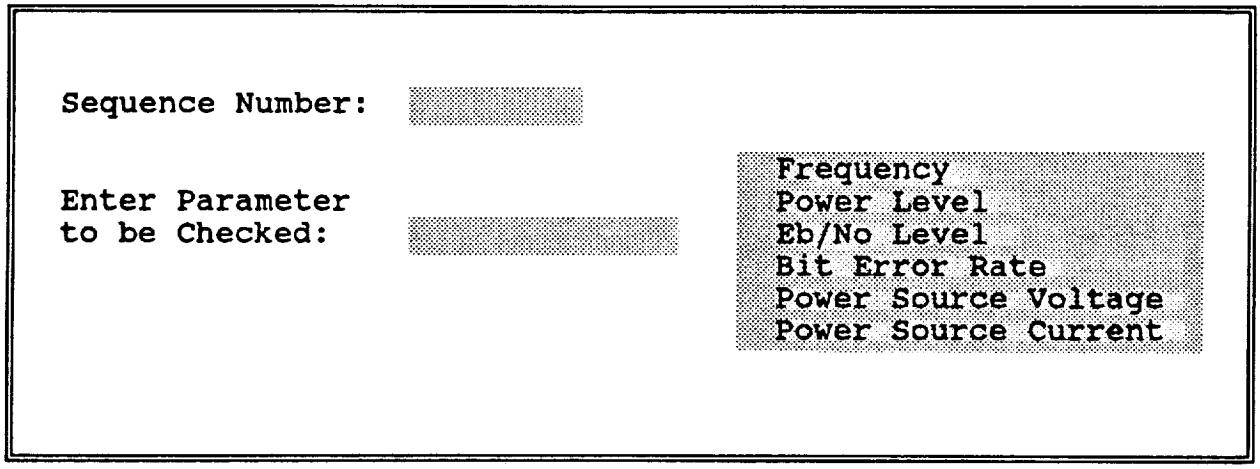

Figure 6-13 Check a Parameter Command Menu

Figure 6-14 shows the **Check a Parameter** command menu for the power level parameter. Instruments in the option field are those that output power which can be read by the computer. Other input options include high and low limits, and the corresponding label numbers to go to if a reading is out of range. Instruments with

power readings the computer can access include HP Power Meters, Wavetek Peak Power Meters, and the SA Beacon Receiver. The instruments in the option field are a subset of those defined in the Instrument Definition Software and are identified using the mnemonic from the instrument table.

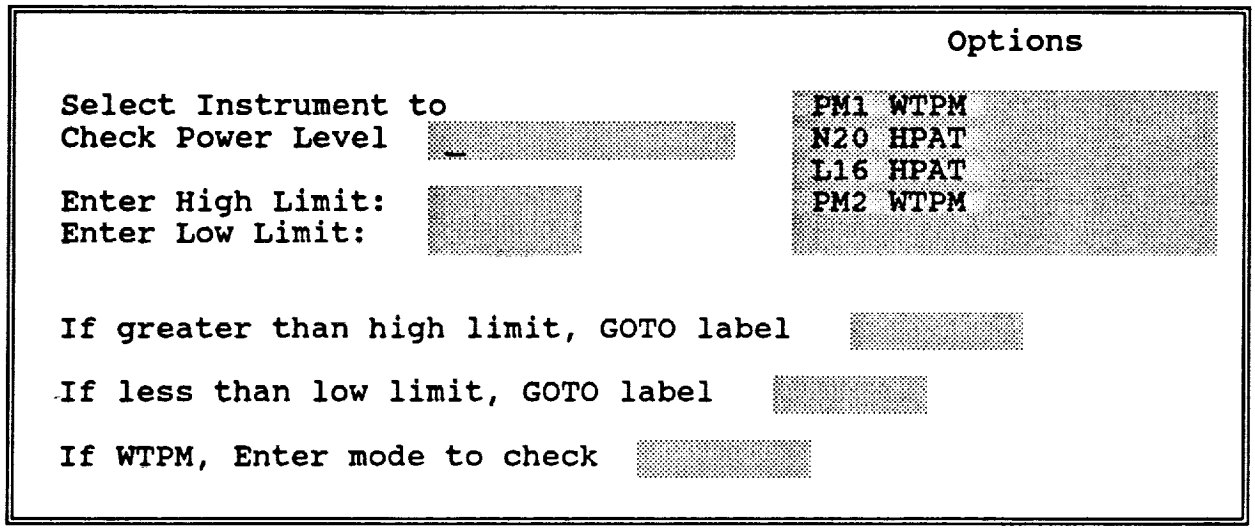

Figure 6-14 Check Power Level Parameter Menu

Any label number entered in this menu must be defined before the Sequence Definition Software is terminated. Failure to do so will result in the inability to execute the sequence. Edit sequences using the EC&M Instrument and Sequence Editor to correct for failing to define all required label numbers.

All parameters require the entry of high and low values that correspond to the selected parameter. Label numbers must be specified in case the current reading is over the defined high limit, or under the defined low limit. Both limits and label numbers can have the same value. If the current parameter is neither over nor under the specified limit, normal execution of the sequence will occur without transferring control to either label number.

Note: As a result of design features, it is not permitted for a **Check a Parameter** command to transfer control back to the executing command. The **Check a Parameter** command label number cannot be the argument for a high or low limit condition.

6.2.2.13.1 Frequency

The frequency parameter refers to the output frequency of an EIP Frequency Counter. This does not refer to the frequency parameter of a power meter. Instrument selection, frequency value, and out-of-limit label numbers are input as described in the previous section.

6.2.2.13.2 Power Level

The Power Level parameter refers to the output power of any power meter defined in the Instrument Definition Software. If the Wavetek Peak Power Meter is selected, the mode to check must also be included. The mode refers to the channel (A or B) and the type of measurement (CW or PEAK) to be checked. Refer to the Peak Power Meters User's Manual for additional information on the different modes.

6.2.2.13.3 Bit Error Rate

This command compares the BER value defined by the user with the last BER measurement taken. Use this command to verify that a BER reading is in an acceptable range before continuing a sequence.

6.2.2.13.4 Power Source Voltage and Current

The power source voltage and current refers to the output voltage or current of the HP DC Power Supply, respectively. Use this command to check either parameter during a sequence to avoid over voltage or over current conditions.

6.2.2.14 Digital Ground Terminal Command

This command enables the user to send commands to the DGT from an external file. The filename, volume, extension, and account number are all required. DGT command files can reside in any private account on the computer system and can have any name and extension.

The software will execute each command of the file sequentially unless an error is encountered. Refer to Section 7.6 for error conditions concerning DGT command files.

DGT command files are created using any standard editor capable of writing an ASCII text file. The user is limited to one command per line with an unlimited number of commands per file. Syntax of the DGT commands is the responsibility of the user. Refer to the *Modulation and BER Measurement Subsystem* documentation for a listing of commands.

7.0 ERROR MESSAGES AND RECOVERY PROCEDURES

7.1 Recoverable Errors

Error messages result from improper input, transmission, instrument, or system input/output failures. The LET-EC&M Software error messages are displayed to the user terminal when they occur. In addition to the error message, the instrument in error is also displayed when appropriate. Refer to Appendix B for an explanation of the LET-EC&M Software error conditions.

The computer system also outputs error messages when they occur. These messages are not displayed to the user's terminal, but appear instead on the system console and suspend operation of software. These error generally result from an invalid format either input to the menu or received from an instrument during transmission and are considered fatal.

7.2 Fatal Error Messages

Errors that occur at the system console and suspend execution of the LET-EC&M Software are considered to be fatal. If a fatal error occurs in the LET-EC&M Software, the user must abort from the software being executed. An abort command terminates the respective software and returns the C&PM main menu to the user terminal.

The program in error is identified at the system console by the name before the colon as shown:

HH:MM:SS NAME: ERROR MESSAGE

A description of the error may also be displayed. Record the error type on a CPMPR form and submit the form to the C&PM Software manager. This information is useful to the software developers to improve the quality of the software and to avoid future errors.

Terminate the failed software from the system console by typing the appropriate command at the system console from Table 7-1, depending on which software component failed.

Software Component	System Console Commands
Instrument Definition	> ECMABORT INSTDEF
Sequence Definition	> ECMABORT SEQDEF
Sequence Execution	> ECMABORT SEQEXEC

Table 7-1 Abnormal Termination Procedures

If a fatal error occurs during the IDS or SDS the instrument or sequence file currently being developed will be corrupted or lost. If the file exists on the specified account, delete the file and re-execute the failed software. If the SES is aborted, the data acquired before executing the ECMABORT SEQEXEC command will be contained in the data file and should be unharmed.

If an error occurs repeatedly, fill out the upper half of the CPMPR and submit it to the C&PM Software manager. Note the exact type of error displayed on the system console, the instrument type, and any other pertinent information. A copy of the CPMPR form appears in Appendix G.

7.3 Out-of-Limit Condition

There are several out-of-limit condition errors associated with particular types of instrument. The action the computer will take in response to an out-of-limit condition is specified by the user for each instrument. Out-of-limit actions available include flagging the error and continuing, or halting the sequence. "Flagging" the error is indicated by displaying the parameter in reverse video mode and logging the condition appropriately in the data file.

The first type of limit error is an out-of-limit instrument reading. This type of error can exist for all instruments. Error conditions and their corresponding abbreviations are listed in Table 7-2.

Unit	Error Condition
OL	Over Limit
UL	Under Limit
OR	Over Range
UR	Under Range

Table 7-2 Out-of-Limit Error Codes

If the user has selected to continue the sequence for that particular instrument, the error is displayed to the user terminal (reverse video) and sequence execution continues. If the halt sequence option is selected, the error is displayed to the terminal (reverse video) along with an error message and the user is prompted to either override the limit and continue the sequence or abort. Overriding the limit will NOT reset the limit defined in the IDS. Each violation of the defined limit will result in suspension of the sequence.

Figure 7-1 illustrates the menu that will be displayed if the HP Power Meter with label N20 was over limit and the "halt sequence" out-of-limit action was selected. Note that the power reading of N20 HPPM (N20 is a specified label of a particular Hewlett Packard Power Meter) is reverse video with the units displayed as "OL" indicating the type of error (over limit). Since halt sequence was selected, an error message is displayed to the user's terminal providing an opportunity to abort the sequence.

```
**************************************************************
Test File: M1:TEST.ECM/123
Time: 12:34:56      Sequence Action: WAIT    Number: 5
**************************************************************
                     Test Instrumentation

 PM1 WTPM  -23.0 dBm  N20 HPPM -56.34 OL   L16 HPPM  -12.43 dBm
 PIN HPPS   3.2  Vlt  R12 HPAT  12.00 dB    C7 HPRA  010001
  C9 EIPF 10.4E9 Hz    B2 GMAT   7.45 dB    L6 HPAT   34.0 dB
 PM2 WTPM  -12.19 dBm U12 HPSD 1101001010  DG1 DG     11.52 dB
 DC1 DC    2.3E-06    DGT     221.184 Mbps


 INSTRUMENT OUT OF LIMIT
 (C)ontinue or (A)bort Sequence?
 >
```

Figure 7-1 Out-of-Limit Error Menu

The second type of limit error is a potential out-of-limit error. This type of error exists if a sequence command to an instrument would result in that instrument going out of range. For this error, the sequence is halted the first time despite the action selected and the user is prompted for an action similar to the message shown in Figure 7-1. The potential error is displayed to the user terminal (blinking mode) for reference. Again, if the "continue" option is selected, the limit defined in the IDS is NOT reset.

If the user has selected the "continue sequence" action in the IDS for that instrument and selected to continue the sequence, the error is flagged, and normal sequence execution continues. Subsequent potential out-of-limit actions do not suspend sequence execution. However, if the user has selected the "halt sequence" action in the IDS and continues the sequence, each out-of-limit condition is detected and sequence execution is halted.

Instruments capable of this type of limit control are the HP Attenuators, the GM Attenuators, the HP Power Supply voltage setting, and the low value of Eb/No for both the 220 Mbps and 110 Mbps burst rate.

7.4 Clearing the IEEE 488 Interface Bus

A type of instrument error encountered frequently is transmitting and receiving ASCII messages to and from the various instruments on the GPIB. Generally, resetting the interface bus is enough to correct this problem if the instrument is functioning correctly and is properly connected to the IEEE 488 bus.

To reset and clear the IEEE 488 GPIB, enter the following command at the system console:

CLEARBUS <cr>

The following message will appear at the system console after executing this command.

ICLEAR: END OF TASK XXX

Repeat the above procedure until a value of 0 is returned in the XXX variable. If a status code of zero is not returned, check the IEEE 488 bus connections from the computer to the instrument and repeat the above procedure.

If the IEEE 488 interface bus cannot be reset, complete the upper half of the CPMPR form and submit it to the C&PM Software manager. A copy of the CPMPR form appears in Appendix G.

7.5 Data Generator and Data Checker Failure

The data generator and data checker may "hang up" on occasion and suspend task execution. This is signaled by an extended time where no action occurs in the sequence. Commands that experience this type of error generally include **Start Data Generator** (STDG), **Stop Data Generator** (SPDG), **Stop Data Checker** (SPDC), and **Perform BER Measurement** (BER). These commands are destined for either the data generator or data checker.

If this type of error is suspected, execute the ECMABORT SEQEXEC command from the system console to abnormally terminate the LET-EC&M Software.

Reset the data generator and data checker computer interfaces before trying to reinitialize the software. If the DG/DC error continues, complete the upper half of the CPMPR form and submit the form to the C&PM Software manager. A copy of the CPMPR form appears in Appendix G.

7.6 Digital Ground Terminal File Errors

Commands are sequentially sent to the Digital Ground Terminal from the DGT data file pending any transmission errors or errors received back from the DGT. If an error is received from the DGT, transmission of DGT commands will cease and an error message is displayed to the user terminal. Any remaining commands will not be sent to the DGT once an error is detected.

To avoid transmission errors, ensure that every record in the file has a valid DGT command and that there are no empty records. A blank record results in an "UNKNOWN COMMAND" error returned from the DGT. Syntax of the commands in the file is the user's responsibility.

8.0 ABBREVIATIONS AND ACRONYMS

A list of the abbreviations and acronyms and their definition is provided for user reference.

ABBREVIATION	DEFINITION
ACTS	Advanced Communications Technology Satellite
ASCII	American Standard Code for Information Interchange
BER	bit error rate
CAL	Calibration Subsystem
C&PM/CPM	Control and Performance Monitor
CPMSA	Control and Performance Monitor Software Account
DG/DC	data generator and data checker
DGT	digital ground terminal
EC&M	Experiment Control and Monitor
EIPF	EIP Frequency Counter
GM	General Microwave
GMAT	General Microwave Attenuator
GPIB	General Purpose Interface Bus
HBR-LET	High Burst Rate Link Evaluation Terminal
HP	Hewlett Packard
HPAT	Hewlett Packard Attenuator/Switch Driver
HPPM	Hewlett Packard Power Meter
HPPS	Hewlett Packard DC Power Supply
HPRA	Hewlett Packard Relay Actuator
HPSD	Hewlett Packard Attenuator/Switch Driver (Used solely as a switch driver)

HPA	High Power Amplifier
IDS	Instrument Definition Software
IEEE	Institute of Electrical and Electronic Engineers
LB	Loopback Subsystem
MTM	Multi-Terminal Monitor
RCV	Receiver Subsystem
RF	radio frequency
SABR	Scientific Atlantic Beacon Receiver
SDS	Sequence Definition Software
SES	Sequence Execution Software
SMAP	Software Management and Assurance Program
SPDC	Stop Data Checker
SPDG	Stop Data Generator
STDG	Start Data Generator
WTPM	Wavetek Peak Power Meter

9.0 GLOSSARY

bit error rate - the number of bit errors divided by the total number of bits received. Bit errors are determined by the data checker after comparing the received bit stream with that produced by the data generator.

calibration - provides either one of two signals to the receiver subsystem (19.914Ghz at-65.5dBm or 20.190 at -117.1 dBm), measures in-place attenuation of signal output cables; and acquires measurements of signal level, frequency, and attenuation.

data generator - produces a pseudorandom data source that simulates a transmitting user.

data checker - outputs the number of bits received and the number of bit errors.

digital ground terminal - transmits and receives bursted 110.592 and 221.184 Mbps serial minimum shift keying signals.

downconverter - accepts a modulated signal from the HPA subsystem, downlinks the signal to the downlink band with a center frequency of 19.914 Ghz.

high power amplifier - provides > 43 dB gain and +45 dBm RF output power to the antenna feed.

Link Evaluation Terminal - ground station to provide LeRC-ACTS-LeRC communication link with transmission rates of 110.592 and 221.184 Mbps. The LET will demonstrate adaptive uplink power control through various experiments.

loopback - provides a path for the signal to bypass the satellite communication link and allows for calibrating the system and troubleshooting the digital and RF systems.

monitor - monitors the frequency, spectrum, and power at various test points within the system.

receiver - accepts a single channel RF downlink signal and downconverts it to the range of 2.659 Ghz to 3.659 Ghz IF band. Other responsibilities include providing two beacon signals at 3.644 and 3.654 Ghz to the Beacon Receiver.

upconverter - accepts a modulated signal, converts the signal to the uplink band with a center frequency of 29.634 Ghz at -25 dBm.

10.0 APPENDICES

Appendix A

Common Menu Functions and Features

There are several functions common to all menus found in the LET-EC&M Software. These functions are presented in detail and later summarized for easy reference. The key stroke and resulting action are both listed in the summary.

Data can be input to a menu using a combination of two ways. The first is to type the desired data in a format identical to that given in the option field for the particular input. Numerical values are generally typed in and do not have any special format. Both decimal and integer values are accepted. It is best to clear the input field before entering any typed input. The input fields can be cleared by either pressing the space bar over each character or by pressing the DELETE key, which will clear the entire field.

The second method of entering data is by selecting an element of the option field. To select an option, first move the cursor into the option field by pressing the HOME key. Placing the cursor on the same line as the desired option and pressing the ENTER key will place a copy of the option and the cursor into the input field. These steps can be repeated until all selections are made. Once inside the input field, press ENTER again to direct the system to accept the input.

If a mistake is detected after the system has accepted it, the user can usually return to the previous menu by pressing CTRL-C. Be certain the current menu has not been altered in any way before pressing CTRL-C. If the menu has been altered, pressing CTRL-C is equivalent to pressing ENTER. CTRL-C can only be used before any change is made in the current menu.

Some menus contain more than one input field. The aforementioned procedures can be followed for each input field. Use the arrow keys or tab key to move from one input field to another, and the arrow keys to move among the various options in the option field.

Summary of Commands

ENTER: Instructs the system to accept the input once the input field contains a selection.

HOME: Toggles the cursor between the input and option fields.

DELETE:	Clears the entire input field where the cursor currently resides.
CTRL-C:	Allows the user to "back out" of the menu system one menu each time it is pressed. Equivalent to pressing ENTER if menu is altered prior to using this function.
ARROW KEYS:	Used to move among the options and input fields.
TAB:	Used to move among the input fields.

Appendix B

Experiment Control and Monitoring Software Status Codes

Error messages encountered while operating the LET-EC&M Software include, when appropriate, a software status and an instrument identifier. The software status codes are listed in Table B-1. Each entry contains an explanation of the error and a suggested action for recovery. If the suggested action does not correct the fault, refer to Section 7 for steps to attempt error recovery. If recovery is not possible or the error persists, complete the upper half of the CPMPR and submit it to the C&PM Software manager.

Table B-1 EC&M Software Error Codes

Status	Error Explanation	Suggested Action
1	System error opening file. Refer to the FORTRAN VII Reference Manual for error code definition.	Check file name, volume, and account number for any errors. Verify that the file exists.
2	EC&M Software menu error	Return to previous menu and retry command.
3	IEEE 488 Interface error	Return to the subsystem or main menu. Check instrument connections. At the system console type CLEARBUS <cr>. Repeat if necessary until end of task code is zero.
4-6	Used by the Check-Out Software	N/A
7	Error initializing the IEEE 488 bus	Return to the subsystem or main menu. Check instrument connections. At the system console type; CLEARBUS <cr>. Repeat if necessary until end of task code is zero.
8	Error transmitting a command to an instrument on the IEEE 488 bus	Return to the subsystem or main menu. Check instrument connections. At the system console type; CLEARBUS <cr>. Repeat if necessary until end of task code is zero.

Table B-1 EC&M Software Error Codes

Status	Error Explanation	Suggested Action
9	Error closing the IEEE 488 bus	Return to the subsystem or main menu. Check instrument connections. At the system console type; CLEARBUS <cr>. Repeat if necessary until end of task code is zero.
10	Error receiving a response from an instrument on the IEEE 488 bus	Return to the subsystem or main menu. Check instrument connections. At the system console type; CLEARBUS <cr>. Repeat if necessary until end of task code is zero.
11	Error zeroing the Wavetek Peak Power Meter	Disconnect all power from the sensor and retry the command.
12	Error calibrating the Wavetek Peak Power Meter	Check the connection of the sensor to the 1GHz port on the front panel of the meter and re-try the command.
13	Error autoscaling the Wavetek Peak Power Meter	Verify that signal present can be autoscaled.
14	Error initializing the Graph mode of the Wavetek Peak Power Meter	Check instrument connections. At the system console type CLEARBUS <cr>. Repeat if necessary until end of task code is zero. Verify that all inputs are valid and retry command.
15-19	GPIB instrument errors	Check instrument connections. At the system console type CLEARBUS <cr>. Repeat if necessary until end of task code is zero. Verify that all inputs are valid and retry command.
20-25	Used by Check-Out Software	N/A

Table B-1 EC&M Software Error Codes

Status	Error Explanation	Suggested Action
26	Attenuation value of HP attenuator out of range	Modify sequence. Enter new attenuation value.
27	Error zeroing the HP Power Meter	Disconnect all power from the sensor and retry command.
28	Wavetek peak Power Meter channel selection error	Modify sequence. Enter valid channel.
28-59	Used by Check-out Software	N/A
60	Error received from DGT	Verify normal operation of the DGT.
61	DGT cannot acquire	Verify normal operation of the DGT.
61-94	Not Used	N/A
95	Data generator not started	Reset DG/DC. Retry command.
96	ACK message expected from DG/DC STOP command, but not received.	Reset DG/DC. Retry command.
97	Illegal DG/DC	Verify DG/DC command, reset DG/DC, and retry command.
98	Invalid response from DG/DC	Verify DG/DC command, reset DG/DC, and retry command.
99	Invalid request	Verify DG/DC command, reset DG/DC, and retry command.
100	Noise attenuation greater than 81 dB	Inspect signal and noise power and re-execute sequence.
101	Label error in Instrument Table	Verify that there are not two identical labels within the INSTRMTS.LET data file.
102	Two identical NASA tag numbers	Correct NASA tag number on instruments in error.

Table B-1 EC&M Software Error Codes

Status	Error Explanation	Suggested Action
103	NASA tag number on incorrect instrument	Compare NASA tag number with list of instruments dedicated to the LET project.
104	Potential out-of-limit error on specified instrument	Check the LET status. Check limit of the instrument in error. Modify sequence if necessary.
105	WTPM channel not defined	Edit Instrument or Sequence file as appropriate.
106	Error setting Wavetek peak power meter parameter	Check IEEE 488 connection to instrument. Retry sequence.
107	Invalid WTPM mode for desired parameter	Edit Instrument or Sequence file as appropriate.
108	Not Used in EC&M Software	N/A
109	Invalid read mode on WTPM	Edit Instrument or Sequence file as appropriate.
110	Command to perform BER measurement with Data generator not running	Edit Sequence file.
111	DGT command error	Verify DGT command file exists in account specified within sequence. Check syntax of each command.
112	Modem rate error in DGT software	Verify operation and status of DGT.
113	No label match for GOTO statement	Edit Sequence file.
114	WAIT command interval time in error	Interval time must be greater than zero. Modify sequence as necessary.
115	Signal attenuator of IF Noise Unit out of limit	Verify and modify sequence if necessary.

Table B-1 EC&M Software Error Codes		
Status	Error Explanation	Suggested Action
116	Number of instruments in Instrument Data File out of range	Remove instruments from data file. (Maximum is 50)
117	No response from DG/DC initialization	Verify operation of DG/DC. Re-execute sequence.
118	Beacon Receiver slope out of range	Inspect instrument. Modify sequence if necessary.
119	Beacon Receiver not locked	Inspect instrument. Modify sequence if necessary.
120	Over voltage error on DC Power Supply	Set voltage below high limit. Reset instrument. Edit Sequence file if necessary.
121	Beacon Receiver not locked and slope out of range	Inspect instrument. Modify sequence if necessary.
122	Beacon Receiver not locked and signal strength below carrier threshold	Inspect instrument. Modify sequence if necessary.
123	Beacon Receiver slope out of range and signal strength below carrier threshold	Inspect instrument. Modify sequence if necessary.
124	Beacon Receiver not locked, slope out of range, and signal strength below carrier threshold	Inspect instrument. Modify sequence if necessary.
125	Over-current error on DC power supply	Set current below high limit. Reset instrument. Edit Sequence file if necessary.
126-128	Not Used in EC&M Software	N/A
129	Over-temperature error on DC power supply	Edit Sequence file if necessary.

Table B-1 EC&M Software Error Codes

Appendix C

Instrument Address and Location

Each instrument presently defined in the HBR-LET is listed in Table C-1. The address associated with each instrument has been predefined, but can be changed if desired. The devices that are connected to the Concurrent 3205 via RS-232 links have a dedicated communication port within the computer system. Abbreviations for the subsystem names used within the table can be found in Section 8.

Table C-1 Instrument Identification

Instrument	Tag Number	Name	Subsystem	Addr
WAVETEK 8502 PEAK POWER METER	G88833	PM1	HPA	01
HP 11713A SWITCH DRIVER	G50340	B37	HPA	02
HP 437B POWER METER	071649	N20	Receiver	03
HP 437B POWER METER	071646	L16	Calibration(CAL)	04
HP 11713A ATTEN/SWITCH DRIVER	068280	N6	Receiver	05
HP 11713A ATTEN/SWITCH DRIVER	068281	N12	Receiver	06
HP 11713A ATTEN/SWITCH DRIVER	068275	R12	Receiver	07
WAVETEK 8502 PEAK POWER METER	TDB	PM2	HPA	08
HP 6632A POWER SUPPLY	071580	PIN	HPA	09
HP 59306A RELAY ACTUATOR	071535	C7	Calibration	10
HP 437B POWER METER	003612	C26	Calibration	11
HP 437B POWER METER	G88647	C27	Calibration	12
HP 437B POWER METER	071643	U21	Calibration	13
HP 437B POWER METER	071645	R11	Loopback	14
HP 11713A ATTEN/SWITCH DRIVER	068276	U13	Loopback	15

Table C-1 Instrument Identification				
Instrument	Tag Number	Name	Subsystem	Addr
HP 11713A ATTEN/SWITCH DRIVER	068274	L6	Loopback	16
HP 437B POWER METER	071647	U16	Loopback	17
EIP 545B FREQUENCY COUNTER	071557	C9	Receiver/LB/CAL	18
EIP 545B FREQUENCY COUNTER	071556	R9	Receiver/LB/CAL	19
HP 11713A ATTEN/SWITCH DRIVER	068277	TBD	Monitor	20
HP 11713A SWITCH DRIVER	068278	U4	Monitor	21
HP 11713A SWITCH DRIVER	068279	U12	Monitor	22
SA 930 BEACON RECEIVER	G90028	SA1	Receiver	23
GM ATTENUATOR CONTROLLERS	183198	GA0	Loopback/ Upconverter	A,0
GM ATTENUATOR CONTROLLERS	183192	GA1	Loopback/ Upconverter	A,1
GM ATTENUATOR CONTROLLERS	183191	GB0	Loopback/ Upconverter	B,0
GM ATTENUATOR CONTROLLERS	183196	GB1	Loopback/ Upconverter	B,1
DATA GENERATOR	277172	DG	BER	CRT3
DATA CHECKER	277170	DC	BER	CRT3
DIGITAL GROUND TERMINAL	704905	DGT	DGT/BER	CRT4

Table C-1 Instrument Identification

Appendix D

Instrument Table Definitions and Placement

The Instrument Table contains the following entries; NASA tag number, address or CRT number, interface type, IEEE 488 interface bus number, type number, label, id, and an instrument description.

NASA TAG: NASA tag number affixed to the instrument. Entry must be six characters or less. (Numerical and alphanumeric characters are permitted).

ADDR/CRT: IEEE 488 address. For instruments using an RS-232 interface, this field contains the communication port number. There cannot exist two instruments on the same bus extender, same bus type, with the same address.

BUS: Interface type. Valid inputs are "1" for IEEE 488 or "2" for RS-232.

EXT: IEEE 488 interface bus extender number. Valid bus numbers are "0" or "1". Entry is limited to one character. Currently, only bus "0" is available on the computer system.

LABEL: The label is a three character name of the instrument. The label is taken from the suitable subsystem hardware documentation.

ID: A four-character user-defined name of the instrument. The ID is used to remind the user of the instrument name in the instrument table.

DESCRIPTION: The name of the instrument. This entry can be up to 30 characters in length.

TYPE: Type of instrument as defined in Table D-1. New type numbers can be added as necessary, provided no two different instruments share the same number. Type number can consist of up to four characters.

Type	Instrument
1	HP Power Meter 436A
2	GM Attenuator Controller
3	HP 11713A Atten/Switch Driver
4	Wavetek Peak Power Meter
5	SA 930 Beacon Receiver
6	HP 59306A Relay Actuator
7	EIP 545B Frequency Counter
8	HP 6632A DC Power Supply
9	HP Switch Driver
10	Data Generator
11	Data Checker
19	HP Power Meter 437B
21	Digital Ground Terminal

Table D-1 Instrument Type Definitions

Each entry in the table has been given an assigned location within the file for formatting purposes. Figure D-1 depicts a portion of the Instrument Table used at the time of this publication. At the top of the table is the column number where each entry begins and ends. (Leading zeros are shown as place holders only.) Column numbers are shown for this reference only and are not displayed in the actual data file.

The first entry of the data file contains the number of instruments currently in the file and is limited to four characters. The remainder of the first line contains the name of the file and a short file description. Record two contains column headers of each entry. Instrument descriptions must begin in the third row.

```
         1         2         3         4         5         6         8
12345678901234567890123456789012345678901234567890123456789012345...0

0005  M1:INSTRMTS.LET/111     Instruments available to the HBR-LET
NASA TAG ADDR BUS EXT TYPE  LABEL ID      DESCRIPTION
G88833   0001   1   0   04  PM1   WTPM    Wavetek Peak Power Meter
G50340   0002   1   0   09  B37   HPSD    HP Switch Driver
071649   0003   1   0   19  N20   HPPM    HP Power Meter 437B
183198     10   2   0    2   A1   GMAT    GM Attenuator
183196     21   2   0    2   B2   GMAT    GM Attenuator
```

Figure D-1 Instrument File Definition

The GM Attenuator controllers are controlled using both an address and a channel. A method of encoding the address and channel has been developed. Use the address listed in Table D-2 that corresponds to the correct attenuator address and channel.

ADDR	Channel	Address
10	A	0
11	A	1
20	B	0
21	B	1

Table D-2 GM Attenuator Address Codes

Appendix E

Default Parameter Definition and Placement

Default values are used in the Instrument Definition Software initialization menus for each instrument within the system. The values that appear in the menu come from the default value parameter file and are specified in advance by the user. Instruments of the same type will have identical default parameter values.

The parameters in the default file are either initial values of selected parameters or those that will not change over the execution of the entire sequence. If additional initialization parameters are required for a particular instrument, complete the upper half of the CPMPR and submit it to the C&PM software manager. Indicate the additional parameters that are required.

This manual assumes the user is familiar the instruments used in the LET and will not discuss each one individually . Default parameters used to control sequence execution will be discussed as required. Refer to the proper instrument user's manual for information about the various functions available on each instrument in the system.

The default file is divided among the various instruments and instrument parameters. Each line of the file is called a field or record. Programs within the IDS require that the instrument and parameter **names** and their **locations** remain unchanged within the field and must NOT be altered by the user. Instrument and parameter names are referred to as field descriptors. Figure E-1 illustrates several fields within the default parameter file.

```
This is the default parameter file for the High Burst Rate
Link Evaluation Terminal...

HP POWER METER 437B

RANGE                      1.0    AUTO
TRIGGER MODE               3.0    FREE RUN
LOW LIMIT               -100.0
HIGH LIMIT                10.0
CALIBRATION FACTOR        96.8
UNITS                      1.0     dBm
OUT OF LIMIT ACTION        1.0     CONTINUE TEST

GM ATTENUATOR

INITIAL ATTENUATION       25.0
LOW LIMIT                 10.0
HIGH LIMIT                60.0
UNITS                      1.0     dB
OUT OF LIMIT ACTION        2.0     HALT TEST
```

Figure E-1 Default Parameter File

The user can modify the value of any record in the file. Either a space or comma must appear both before and after the numerical value in order to be interpreted by the software. Control characters (tabs) are not permitted in the file. The numerical value must be the first entry following the field descriptor; however, its location is arbitrary. Comments or any type of user identification can be included in the same field following the parameter value provided there is a space or comma separating the two entries. There can be any number of fields separating the field descriptors. These fields can contain descriptive text or be used to separate existing field descriptors.

Several parameters have default values corresponding to options available for the respective parameter. Table E-1 shows option values for each parameter.

Appendix E - Default Parameter Definition and Placement

Instrument Parameter	0	1	2	3	4	5	6	7	8	9	10
AGC Gain Control	AGC	MGC									
Signal Strength Sync	On	Of									
Anti-Sideband	Enable	Disable									
Over Current Protection	Off	On									
Gain Hold	Normal	Freeze									
Units		dBm	Watt								
Demod Slot		Slot 1	Slot 2								
Search Mode	Auto	Manual	Fast								
Modem Rate		220 Mbps	110 Mbps								
Out of Limit Action		Continue Sequence	Halt Sequence								
Wavetek Peak Power Read Mode		CW	PEAK								
HP Power Meter Trigger Mode		Immediate	Delay	Free Run							
Wavetek Trigger Channel		External	Channel A	Channel B							
2nd LO Mode	Crystal	AFC/APC	External	VFO							
Frequency Band		Band 1	Band 2	Band 3							
Wavetek Peak Power Meter Channel		Channel A	Channel B	Channel A&B							
AGC Time Constant	.1 ms	1 ms	10 ms	100 ms	1 sec						
HP Power Meter Range	Auto	-60 dBm	-50 dBm	-40 dBm	-30 dBm	-20 dBm	-10 dBm				
2nd IF Slot		Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7			
EIP Frequency Counter Resolution		1 Hz	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz	1 MHz	10 MHz	100 MHz	1 GHz

Table E-1 Default File Parameter Options

Appendix F

User Terminal Definition

This section is included if it becomes necessary to change the location of the menu output. The terminal used for menu output is defined in the menu software. The menu software consists of several files used by the menu driver for menu display. It is important when defining a new location not to alter any of the menus within the file. Changes in any menu can cause the software to fail.

The menu software consists of the files TDFLET.MNU, SDALET.MNU, and DSPLET.MNU located in the CPMSA on volume M1. Both the terminal type and the communication port are defined in the first record of each file. The communication port definition begins in column 31, and the terminal type in column 40. Figure F-1 gives an example using the dedicated port assignment. Only the first record of the file is shown.

```
        1         2         3         4         5         6         8
12345678901234567890123456789012345678901234567890123456789012345...0
                                CRT2:     50
```

Figure F-1 Output Terminal Port and Type Definition

In Figure F-1, CRT2: refers to the communication port currently dedicated to menu output, whereas the 50 refers to the WYSE 50 terminal type. In most circumstances, the terminal type will remain 50. For other valid inputs, refer to the MENUP menu driver documentation. The communication port defined for menu output must be removed from MTM (.MTM REM CRT2:) if it is running simultaneously with the EC&M Software.

Appendix G

HBR-LET Control and Performance Monitoring Software Problem Report

Problems or errors may be encountered while executing the LET-EC&M Software that have not been described within this document. The user may be able to correct these errors by following the error recovery procedures discussed in Section 7. If error recovery is not possible, the user should complete the upper half of the CPMPR form and submit it to the C&PM software manager.

Recording new or unusual errors encountered while operating the LET-EC&M Software helps the software developers to improve the operation of the software and to update the LET-EC&M Software User's Guide. A copy of the Control and Performance Monitoring Software Problem Report form is provided in Figure G-1. If more space is needed for the problem description or error messages, additional pages can be submitted.

Return the completed CPMPR form to:

Edward J. Petrik
Mail Stop 54-8
NASA Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135

HBR-LET Control and Performance Monitor Software Problem Report

Name: _____ Date: _____

Address: _____ Organization: _____

_____ Phone: _____

C&PM Software Application Name: _____

Feature / Problem Description:
(Include sequence number and/or instrument)

_____
_____
_____
_____
_____
_____
_____
_____

Error Messages: _____
_____
_____
_____

Target Completion Date: _____
Priority: High _____ Medium _____ Low _____

Cause of Problem / Action: _____
_____
_____
_____
_____

Name: _____ Date Corrected: _____

CPMPR Number: _____

Figure G-1 HBR-LET Control and Performance Monitor Software Problem Report

Appendix H

Concurrent 3205 Command Summary

Appendix H provides a quick reference for users who are not fully knowledgeable of the available commands on the Concurrent 3205 minicomputer. This is only a summary of the frequently used commands. The user is urged to consult the MTM Primer User's Guide for further information on the following commands. Although the full name of the commands are given, only the characters outside the parentheses need to be entered at the user terminal.

SIGNON — Enables a user to access a private account. To sign on to an account, enter the following:

S(IGNON) User ID,Account Number,Password

The user id is a user-defined, one-to eight-character name. The account number and password are previously established by the system administrator for a given account. If this information is required, notify the C&PM software manager.

SIGNOFF — Ends a user session.

SIGNOFF

DISPLAY FILES — Displays the filenames in the user's account to the terminal. Outputs each filename, creation date, file type attributes. Specific files can be displayed by using wildcards (-) when specifying filenames. Several examples are provided:

D(ISPLAY) F(ILES)	Displays all files in account.
D F, -.TDF	Displays all files with extension .TDF.
D F, EXAMPLE.-	Displays all files with the name EXAMPLE regardless of the extension.

COPYA Makes a copy of a file in a private account. Ensure that the name of the file to be created does not currently exist in the account before executing the copy command. The copy command will over-write the existing file.

COPYA NAME.EXTENSION,NEW_NAME.EXTENSION

RENAME Changes the name of an existing file in a user's account.

RENAME NAME.EXTENSION,NEW_NAME.EXTENSION

DELETE Permanently removes a file from a private account. The user is advised to exercise caution when deleting files in the account. Files removed from an account cannot be recovered.

DELETE NAME.EXTENSION

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Mr. Ernie W. Spisz, ACTS Project Office

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13. ABSTRACT (*Maximum 200 words*)

The Experiment Control and Monitor (EC&M) software was developed at NASA Lewis Research Center to support the Advanced Communications Technology Satellite (ACTS) High Burst Rate Link Evaluation Terminal (HBR-LET). The HBR-LET is an experimenter's terminal to communicate with the ACTS for various investigations by government agencies, universities, and industry. The EC&M software is one segment of the Control and Performance Monitoring (C&PM) software system of the HBR-LET. The EC&M software allows users to initialize, control, and monitor the instrumentation within the HBR-LET using a predefined sequence of commands. Besides instrument control, the C&PM software system is also responsible for computer communication between the HBR-LET and the ACTS NASA Ground Station and for uplink power control of the HBR-LET to demonstrate power augmentation during rain fade events. The EC&M Software User's Guide, Version 1.0 (NASA CR–189160) outlines the commands required to install and operate the EC&M software. Input and output file descriptions, operator commands, and error recovery procedures are discussed in the document. The EC&M Software Maintenance Manual, Version 1.0 (NASA CR–189161) is a programmer's guide that describes current implementation of the EC&M software from a technical perspective. An overview of the EC&M software, computer algorithms, format representations, and computer hardware configuration are included in the manual.

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