APPENDIX A. ASCII COMMANDS TO THE MODULE

This appendix describes the ASCII command format used by the 994 module.

NOTE: When controlling the module from a terminal, lower case letters typed at the terminal are converted to upper case by the module before echoing the characters to the terminal and evaluating the command.

A.1. COMMAND WORDS

A command consists of words separated by underscores. The first word of the command is a verb. The second and third words are not always used and are called nouns and modifiers, respectively. The following is a typical command:

SHOW_COUNT_PRESET

In the preceding command, SHOW is the verb, COUNT is the noun, and PRESET is the modifier. Only enough letters of a word to make it unique (four letters is always sufficient) need be used in a command. The preceding command could thus be abbreviated to SH_COU_PRE.

A.2. DATA VALUES

Some commands need to include data values. Such values must be separated from the keywords by one or more spaces. The data is also sent as ASCII characters, and if more than one parameter is included in the value, the parameter values must be separated by commas. The following is a command with data values:

SET_COUNT_PRESET 75,3

In the preceding command, the module is told to set the preset value to 75 x 10^3. This represents a preset value of 75,000.

In the command descriptions given in this appendix, the following notation is important:

< . . . > encloses a required value
[. . .] encloses an optional value

A.3. CHECKSUMS

A checksum may optionally be included at the end of a command record. It is used by the module upon reception of the command to verify that the record was transmitted without error. The actual checksum is a byte obtained by adding all of the bytes of the record together, as if they were 8-bit, unsigned, binary integers. Unless otherwise stated, the checksum is to be transmitted as three ASCII characters representing the decimal equivalent of the binary integer (decimal values range from 000 to 255 for 8-bit integers) rather than a single binary byte. The three checksum characters, if present, must be the last characters of the command record before the delimiter and must be separated from any data values by a comma. If a data value is optional or not used, a comma must precede the checksum for clarity.

A.4. RESPONSE FROM THE MODULE

After a command has been transmitted from the computer or terminal to the module, no other command should be issued until a response record has been received from the module. The response record indicates how the module responded to the previous command and that the module is ready to receive another command. Appendix B explains how the computer or terminal operator should interpret the response records.

A.5. TIME UNITS USED IN COMMANDS

"Delay" is the time the module will wait before processing or responding to a command from the operator or computer. Delay values must be given in special time units of 0.25 ms. The computer operator must remember to enter the values for Delay properly.

A.6. CATALOG OF COMMANDS FOR THE 994

The commands on the following pages are arranged in alphabetical order. Be sure to read the introductory material in this appendix before proceeding to the command descriptions.

CATALOG OF COMMANDS

Command	Minimum Letters	Description
CLEAR_ALL	CL_ALL	Clears counters, count preset, event counter, and event preset.
CLEAR_COUNTERS	CL_COU	Clears all counters in the 994 module.
CLEAR_COUNT_PRESET	CL_COU_PR	Clears the M, N, and P values in the 994.
CLEAR_EVENT_PRESET	CL_EV_PR	Resets the event preset register to zero.
COMPUTER	COMP	Sets the 994 to the computer mode, where it does not echo any characters. This is the complement to the TERMINAL command.

CATALOG OF COMMANDS (cont'd)

Command	Minimum Letters	Description
DISABLE_ALARM	DIS_ALA	Disables the alarm function. When the alarm is disabled, the 994 does not automatically send the contents of the counters to the host computer when the preset count value is reached. The front-panel Dwell control is enabled, and the 994 operates in the stand-alone mode.
DISABLE_EVENT	DIS_EV	Disables the event counter in the 994.
DISABLE_EVENT_PRESET	DIS_EV_PR	Disables the event preset function.
DISABLE_TRIGGER_START	DIS_TRI_START	(IEEE-488 operation only.) Disables the group execute trigger command from starting the counting cycle in the 994.
DISABLE_TRIGGER_STOP	DIS_TRI_STOP	(IEEE-488 operation only.) Disables the group execute trigger command from stopping the counting cycle in the 994.
ENABLE_ALARM	EN_ALA	Causes the 994 to transfer the contents of the counters to the host at the end of a preset interval without a direct command.
ENABLE_EVENT_AUTO	EN_EV_AU	Causes the event counter to be advanced, by one count, each time the preset value is reached in the 994.
ENABLE_EVENT_PRESET	EN_EV_PR	Enables the event counter to stop after a preset number of counting cycles have occurred.
ENABLE_LOCAL	EN_LOC	Places the 994 under local control (i.e., the front-panel controls). The 994 will still respond to the communications interfaces and to commands from a host.
ENABLE_REMOTE	EN_REM	Places the 994 totally under the control of a host computer. All front-panel controls except the display select are disabled.
ENABLE_TRIGGER_START	EN_TRI_STA	Enables the 994 to start a counting cycle on a "group execute trigger" command from the IEEE-488 bus. This enables a number of counters to start simultaneously from a single trigger command.
ENABLE_TRIGGER_STOP	EN_TRI_STO	Enables the 994 to stop a counting cycle on receiving a "group execute trigger" command from the IEEE-488 bus. This is the complement to the ENABLE_ TRIGGER_START command.
INIT	INIT	Causes the 994 to restart or initialize. Same as a reset or power up.
SET_COUNT_PRESET <MN,P>	SET_COU_PR	Sets the preset value in the 994 to the value of the MN,P parameter of the command. MN can be any value from 01 to 99, and N can be any value from 0 to 6.

CATALOG OF COMMANDS (cont'd)

Command	Minimum Letters	Description
SET_EVENT_PRESET <VALUE>	SET_EV_PR	Loads the value (a number between 1 and 99,999,999) to the event preset register. Counting will be stopped when the event counter reaches that value.
SET_MODE_EXTERNAL	SET_MOD_EXT	Selects the external input to the preset counter in the 994.
SET_MODE_MINUTES	SET_MOD_MIN	Selects the minutes time base as the input to the preset counter.
SET_MODE_SECONDS	SET_MOD_SEC	Selects the seconds time base as the input to the preset counter.
SET_DISPLAY_ <VALUE>	SET_DISP	Selects the counter whose contents will be displayed on the 994 front-panel, 7-segment LEDs. The value will be either 0 or 1 for Counters A and B respectively.
SHOW_ALARM	SH_ALA	Returns a $I response record showing the status of the alarm. The answer is in the form of a "T" for true and "F" for false. Example: $IF.
SHOW_COUNTS	SH_COU	Shows the contents of Counters A and B of the 994. 00000000;00000000; %000000069
SHOW_COUNT_PRESET	SH_COU_PRE	Causes the 994 to transmit a $D response record which includes the MN and P values presently selected. $D015004146 %000000069
SHOW_DISPLAY	SH_DISP	Causes the 994 to send a response record showing the number of the counter whose contents are being displayed in the digits on the front panel. 0 = Counter A, 1 = Counter B. $A000245 %000000069
SHOW_EVENT	SH_EV	Causes the 994 to send the contents of the event counter. This is an 8-digit number. $G00000000235 %000000069
SHOW_EVENT_PRESET	SH_EV_PRE	Causes the 994 to send the contents of the event preset register. This will be an 8-digit number. $G00000000235 %000000069
SHOW_MODE	SH_MOD	Causes the 994 to send a record showing which input is selected for the preset counter. 0 = seconds, 1 = minutes, 2 = external. $A000245 %000000069

CATALOG OF COMMANDS (cont'd)

Command	Minimum Letters	Description
SHOW_VERSION	SH_VER	Causes the 994 to send a record which shows the firmware version included in the 994. $F0994-001 %000000069
START	STA	Causes the 994 to start a counting cycle.
STOP	STO	Stops the 994 from counting.
TERMINAL	TER	Places the 994 in the terminal mode so that every character received is echoed to and displayed on the terminal.
TEST <NUMBER>	TEST	Causes the 994 to perform certain self-test routines. Only the ROM and RAM self-tests are implemented.

APPENDIX B. RESPONSE RECORDS FROM THE 994 MODULE

The 994 Dual Counter/Timer sends various types of information to the controlling terminal or computer. This appendix describes the types of responses the module makes to the various commands. The operator must be familiar with the concept of a record; that is, a continuous stream of characters with a special character such as the ASCII carriage return or line feed marking its end.

B.1. DELIMITING CHARACTERS

The end of a record transmitted between two devices must be marked by a special delimiting character. The record delimiter for communications with the 994 module is either a carriage return or a line feed character, or both, as follows:

INPUT from either RS-232-C or IEEE-488:
Either a carriage return or a line feed character will be accepted.

OUTPUT to IEEE-488:
A line feed character is always used.

OUTPUT to RS-232-C:
Either a carriage return or the two-character combination of a carriage return and a line feed may be appended to a record transmitted over the RS-232-C interface.

B.2. PERCENT RESPONSE RECORDS

This type of record is called a "percent" record because it always begins with the ASCII percent (%) character. A percent record is always transmitted after the execution of a command by the module; it tells whether the command execution was successful and, if not, what type of error may have occurred. Execution of a subsequent command cannot begin until the module has transmitted the percent response record, terminating the current command. Percent response records are fixed in length and have the following format (the spaces are for readability and are not part of the record):

% xxx yyy ccc <DL>

where % is the ASCII percent character, the next three bytes (xxx) are a code for the general type of error, the second three bytes (yyy) are the specific type of error, and the final three bytes (ccc) are the checksum bytes (Appendix A). <DL> is an appropriate delimiting character (Appendix B).

Records beginning with 001, 002, and 004 can be OR-ed together to obtain composite error indications. That is, the indication of power-up and self-test results must all be considered in order to determine what actually happened in the event of an error. For example (see code below), % 005 002 could be derived by OR-ing % 001 with % 004 (power-up just occurred and a self-test failed), with the 002 indicating that the ROM-1 test failed.

The following are percent response code assignments:

Command executed successfully:

% 000 000 CCC

Power-up just occurred:

% 001 000 CCC

Power-up self-test failed:

% 004 002 CCC	ROM test failed
% 004 008 CCC	RAM test failed

Command syntax error:

% 129 001 CCC	invalid verb
% 129 002 CCC	invalid noun
% 129 004 CCC	invalid modifier
% 129 008 CCC	invalid command data
% 129 128 CCC	invalid first data value
% 129 129 CCC	invalid second data value
% 129 130 CCC	invalid third data value
% 129 131 CCC	invalid fourth data value
% 129 132 CCC	invalid command

Communications error:

% 130 001 CCC	UART buffer overrun
% 130 002 CCC	UART parity error
% 130 004 CCC	UART framing error
% 130 008 CCC	IEEE-488 communications error
% 130 128 CCC	input checksum error
% 130 129 CCC	input record too long
% 130 130 CCC	invalid input data record
% 130 133 CCC	aborted due to invalid handshake

Execution error:

% 131 128 CCC	invalid first command parameter
% 131 129 CCC	invalid second command parameter
% 131 130 CCC	invalid third command parameter
% 131 131 CCC	invalid fourth command parameter
% 131 132 CCC	invalid number of parameters
% 131 133 CCC	invalid data (other than command data)
% 131 134 CCC	could not load selected value
% 131 135 CCC	counters must be stopped but were not

B.3. DOLLAR RESPONSE RECORDS

All other response records begin with the ASCII dollar sign character ($) and another character to indicate the particular type of dollar record. The following dollar response records are available:

$A xxx CCC <DL>	A $A record is used to transmit one 8-bit unsigned binary integer. The integer is transmitted as three ASCII character digits (xxx) which are the decimal equivalent of the binary integer. The decimal value will be between 0 and 255. The final three characters (CCC) are three ASCII character digits representing the checksum value for the record as a 3-digit decimal value. <DL> is an appropriate delimiting character. (See SHOW_DISPLAY and SHOW_MODE commands in Appendix A.)
$B xxx yyy CCC <DL>	A $B record is used to transmit two 8-bit binary integers. The integers are expressed as two 3-digit decimal numbers (xxx and yyy). The values will fall between 0 and 255. The command that generates the $B response is SHOW_COUNT_PRESET. The final three digits (CCC) represents the checksum value for the record. <DL> is the appropriate delimiting character.
$F xx <DL>	The $F response record is used to transmit a variable-length string of printable ASCII characters, shown here as "xx". It may consist of one or more characters. No checksum is used, and <DL> is an appropriate delimiter. The command generating a $F record is SHOW_VERSION.
$G xxxxxxxx CCC <DL>	A $G response record is used to transmit an 8-digit decimal value represented here as "xxxxxxxx". The decimal value will be between 0 and 99,999,999. The checksum represented as "CCC" will be a 3-digit number, and <DL> will be an appropriate delimiting character. The commands generating this record are SHOW_EVENT and SHOW_EVENT_ PRESET..
$I x <DL>	A $I response record is used to transmit a single character record, either an ASCII "T" for true or an ASCII "F" for false, represented in the example by "x". <DL> is an appropriate delimiting character. The command generating this record is SHOW_ALARM.

APPENDIX C. OPTIONAL PARTS LIST

C.1. CABLES AND CONNECTORS

A maximum cable length of 50 feet should be used for the RS-232-C interface. The following cables should only be used for data rates of 9600 baud or less; higher rates require shielded cables to minimize RF interference with other devices located in the area.

Module Description	EG&G ORTEC Part No.
495 Power Supply (±6 V)	638630
Cable Description	
25-foot, male-female RS-232-C cable	641810
10-foot, female-female RS-232-C null modem cable	641830
C-75 (3 meter length), female-female RS-232-C null modem cable	641820
Male-male gender changer	641840
3.3-foot, IEEE-488 cable	603620
13.2-foot, IEEE-488 cable	641720
772-C1 print loop cable	462360
918 20 mA cable (C19)	609820

C.2. ORDERING INFORMATION

Information about or orders for parts should be submitted to an EG&G ORTEC sales representative or to the following address:

EG&G ORTEC
Attn: Nuclear Electronics
100 Midland Road
Oak Ridge, TN 37931-0895 U.S.A.