DOLCH
LOGIC INSTRUMENTS

OPERATOR'S MANUAL FOR

GPIB, RS-232-C, & Extended RS-232-C

ANALYZER INTERFACES

FOR

LAM 4850A, 64300, & 64300S

PUBLICATION NUMBER: 028433N3

DOLCH
LOGIC INSTRUMENTS

FOREWORD

This manual combines descriptions for all interfaces available (GPIB, RS-232-C, and Extended RS-232-C) for Dolch logic analyzer products into one document. Because many of the commands are applicable to all interfaces, specific differences between them are called out in the text where necessary.

Although this manual is a stand-alone document, it can best be used by an operator who is thoroughly experienced with Dolch logic analyzers. It is therefore recommended that less experienced operators should use this manual in conjunction with the Operator's Manual for the host analyzer, which describes the theory and operation of all control and display parameters available for the various menus and displays.

Detailed figures, showing the protocol and command structures for all menus and displays (as well as options), are provided in this publication to assist the user in efficient programming techniques. See especially Section 4 - Interface Programming, where the following general format used is:

- A fold-out sheet that illustrates the protocol and command structure for each menu or display.
- Text that describes special considerations and/or comments about the menu or display.
- Programming examples.

This manual is divided into the following sections:

- General Description
- Installation
- Functional Description
- Interface Programming
- Analyzer Menu And Display Printing
- Transmission
- Special Features

Note that the last part of this publication, Section 8, is presented as a series of reference fold-out sheets that contain a functional index of command prefixes. These fold-outs also direct the user to the page in text that describes the command, the figure, and examples of command usage. These are on 8 1/2 inch aprons to allow them to be viewed along with other text.

CHANGES TO THIS MANUAL

This manual will be changed periodically to keep it current with improvements as we make them. Changes start with Service Notes that alert field service technicians to critical problem areas and changes in maintenance procedures. After a series of these notes are issued or a critical one is issued, we will publish change pages, which are the remove-the-old and insert-the-new type. When the company prepares a change package, it sends announcements to its users. The change packages are available upon request and without charge.

Record of Changes

The record of Changed Pages lists all the pages in this book, that are deleted, changed pages, added pages, and foldout pages.

Reader Comment Form

We have supplied the reader comment form (at the back of this manual) to get feedback from our customers. If you are dissatisfied with this publication, we want to hear from you. Tell us about inaccurate information. typographical errors, or missing information. If you know a way to improve a procedure, please let us know about that, too, When filling out the form. please be specific and give the page number, line reference, and the paragraph number, if possible.

RECORD OF CHANGES

CHANGE NUMBER	DATE	TITLE OR BRIEF DESCRIPTION	ENTERED BY (NAME, DEPT.)

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As with any electronic equipment, precautions consistent with all standard industrial safety practices must be observed while servicing this equipment since it contains potentially lethal voltages. Any servicing that requires removing cabinet covers should be performed by qualified service personnel. Always disconnect power prior to inspection or servicing.

Admonishments are included throughout this manual to alert the reader to problem areas or situations that could cause loss of data, hardware damage, or personal injury.

A WARNING statement precedes the text of procedures that, if not strictly observed, could result in fatal injury to the service technician. A CAUTION statement precedes the text of a procedure that, if not strictly observed, could result in damage or destruction of equipment (hardware or software). A NOTE statement highlights essential operating or maintenance procedures, conditions, or clarifying facts. NOTEs also provide information that, though not necessary, is helpful to the understanding of a concept or the completion of a procedure.

NOTE:

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This manual applies to software revisions as follows:

4850A - Rev 0 or later
64300 - Rev D or Later
64300S - Rev D or Later

SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The logic analyzer is a complex instrument with which a user can record information of many different types. Timing relationships between signals, digital logic performance, and microprocessor activity are just a few of the types of recordings that can be provided by a logic analyzer. Each recording situation may require a uniquely different setup of recording parameters. To save time-consuming reprogramming, the GPIB or RS-232-C interfaces can be used to provide off line programmability and/or memory.

The GPIB (General Purpose Interface Bus) and RS-232-C interfaces provide the universally accepted communications interface between the 64300 and LAM 4850A and a wide range of computers and peripherals. A computer system can be used to program the logic analyzer for a given System Under Test, take a recording, and then provide viewing or a hard copy printout of certain conditions or results. By allowing the computer or other peripheral to do the tedious work, users can spend their time much more efficiently.

In addition to the Standard RS-232-C Interface, and the GPIB, an Extended RS-232-C Interface is also available as an option.

This manual provides information concerning the theory and operation of programming and monitoring aspects of the Dolch logic analyzers using their interface capabilities. It is recommended that the Operator's Manuals for the equipment desired for remote control are read and thoroughly understood before attempting the operations described. Of course, it is possible to also begin programming right away, but results of interactions may be confusing without the knowledge gained from experience with the equipment.

1.2 GPIB INTERFACE

The GPIB Interface allows the user to control most functions of the analyzer remotely from the IEEE 488 instrumentation bus. Furthermore, it provides for the transfer of data recordings to other GPIB-compatible devices. The electrical interface uses standard IEEE 488 open collector drivers with passive terminations.

The GPIB Interface provides full remote control, supporting talk/listen addressed mode for the control of the instrument in a test system environment with a separate controller. Figure 1-1 shows the GPIB Interface hardware. Table 1-1 is a listing of IEEE 488 control messages.

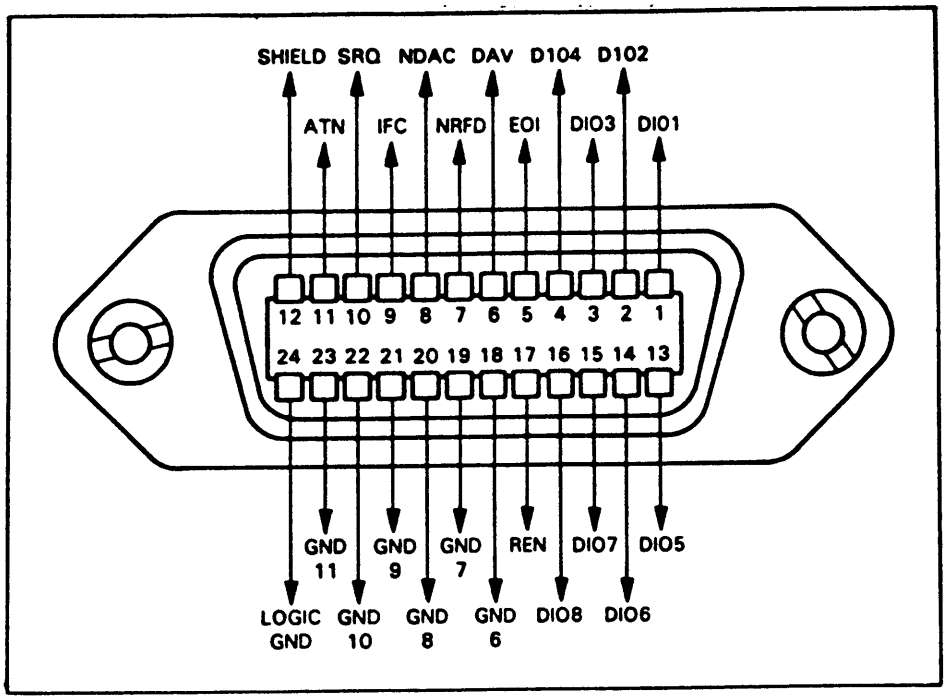


Figure 1-1. GPIB Interface Hardware

IEEE-488 CONTROL MESSAGES

B_{7} B_{6} B_{5}	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
B_4 B_3 B_2 B_1	0	1	2	3	4	5	6	7
0 0 0 0	0 NUL	DLE	SP	0	@	P		p
0 0 0 1	1 SOH GTL	DC1 LLO	!	1	A	Q	a	q
0 0 1 0	2 STX	DC2	"	2	B	R	b	r
0 0 1 1	3 ETX	DC3	#	3	C	S	c	s
0 1 0 0	4 EOT SDC	DC4 DCL	$	4	D	T	d	t
0 1 0 1	5 ENQ PPC	NAK PPU	%	5	E	U	e	u
0 1 1 0	6 ACK	SYN	&	6	F	V	f	v
0 1 1 1	7 BEL	ETB	'	7	G	W	g	w
1 0 0 0	8 BS GET	CAN SPE	(	8	H	X	h	x
1 0 0 1	9 HT TCT	EM SPD	)	9	I	Y	i	y
1 0 1 0	10 LF	SUB	*	:	J	Z	j	z
1 0 1 1	11 VT	ESC	+	;	K	[	k	{
1 1 0 0	12 FF	FS	,	<	L	\	l	|
1 1 0 1	13 CR	GS	-	=	M	]	m	}
1 1 1 0	14 SO	RS	.	>	N	^	n	~
1 1 1 1	15 SI	US	/	?	O	_	o	DEL

UNL

UNT

MLA ASSIGNED TO DEVICE

MLA ASSIGNED TO DEVICE

MTA ASSIGNED TO DEVICE

MTA ASSIGNED TO DEVICE

MEANING DEFINED BY PCG CODE

MEANING DEFINED BY PCG CODE

ADDRESSED COMMAND GROUP (ACG)

UNIVERSAL COMMAND GROUP (UCG)

LISTEN ADDRESS GROUP (LAG)

TALK ADDRESS GROUP (TAG)

PRIMARY COMMAND GROUP (PCG)

SECONDARY COMMAND GROUP (SCG)

Table 1-1. IEEE-488 Control Messages

1.3 STANDARD REMOTE CONTROL INTERFACE DESCRIPTION

The RS-232-C and GPIB Interfaces of the 64300 and LAM 4850A provide remote control of the analyzers, allowing menu setup, option programming, data and menu printout and upload/download capability. It is easily implemented with the coded commands described in this document.

The 64300 and LAM 4850A are delivered with the GPIB IEEE-488 Interface and the Standard RS-232-C Interface Installed.

The Standard RS-232-C Interface also provides full remote control with a simple link to a terminal or computer. Only transmit and receive signals are supported (pins 2 and 3) with this Interface at baud rates from 110 to 4800. It can be controlled partially through the GPIB Interface.

1.4 EXTENDED CONTROL INTERFACE DESCRIPTION

As an option, the GPIB/RS-232-C can be replaced with option CEB 232, which is the Extended RS-232-C (or Extended Serial Interface). The Extended RS-232-C Interface provides full remote control by an Intelligent terminal or computer with modem capability. All handshake signals are supported at baud rates from 50 to 9600. It is comprised of a different Interface board and firmware, and is generally factory Installed.

The Extended RS-232-C provides key features, such as Characters/Block and Pause, Modem Control Lines, Data Communications Monitor, and Full/Half Duplex Mode, in addition to those offered by the Standard RS-232-C.

1.4.1 Characters/Block And Pause

These parameters are used when it is necessary to control the amount and the timing of information transmitted by the analyzer, and it is inconvenient to use the modem control lines. By setting the block count to a suitable number of characters and choosing an appropriate delay between the blocks in the PAUSE field (of the INTERFACE MENU), the information flow can be tailored to the application.

1.4.2 Modem Control Lines

These fields allow the user to set up the Interface control to match the terminal or computer being used with the serial Interface.

1.4.3 Data Communication Monitor

This monitor provides a way to check on the communication by displaying all received/transmitted characters and the modem control line status at any given moment. Received and transmitted characters are displayed separately (RX/TX), except the echoed characters in full duplex mode, which appear in the receive (RX) position.

The monitor can be activated only in the INTERFACE MENU to avoid its accidental use. This is necessary because the monitor activity slows down the Interface throughput.

1.4.4 Full/Half Duplex

A character will always be echoed in full duplex mode, and never echoed in the half duplex mode. In half duplex mode, the analyzer will assume the receive status except when transmitting information, so that no special care needs to be taken to switch the communication lines.

1.5 SYSTEM CONFIGURATION

The logic analyzers can be configured in many different ways, depending on the applications desired. Essentially, an external computer, or other "controller" is used to monitor and control the analyzer through the various interfaces available. In this document, "GPIB" refers to GPIB-equipped controller devices, while "Serial" generally refers to Serial Interface-equipped terminals or other computers. Each interface offers certain advantages over others in terms of compatibility and programming power. Typical configurations for the three types of interfaces, GPIB, Standard RS-232-C, and Extended RS-232-C, are shown in Figures 1-2, 1-3, and 1-4.

1.6 STANDARD RS-232-C SPECIFICATION

The pin configuration for the Standard RS-232-C is as follows:

PIN	SIGNAL
1	PROTECTIVE GROUND
2	TRANSMIT DATA
3	RECEIVE DATA
7	SIGNAL GROUND

Figure 1-5 shows an illustration of the Standard RS-232-C Pin configuration.

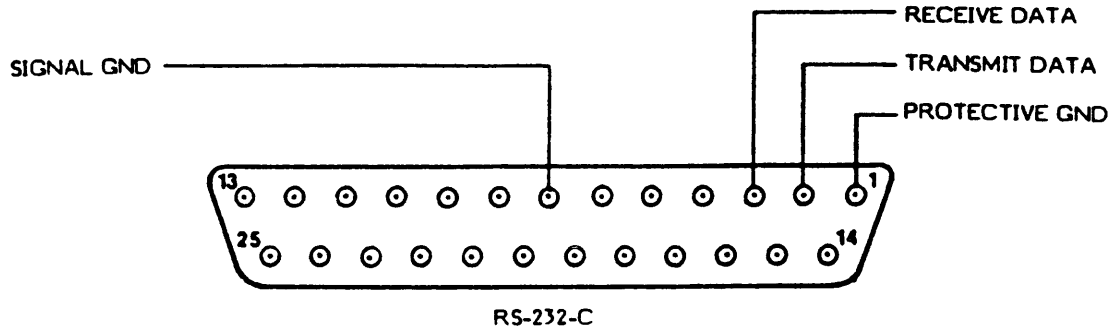


Figure 1-5. Standard RS-232-C Configuration

Table 1-2 shows the specifications for the Dolch logic analyzer Standard RS-232-C.

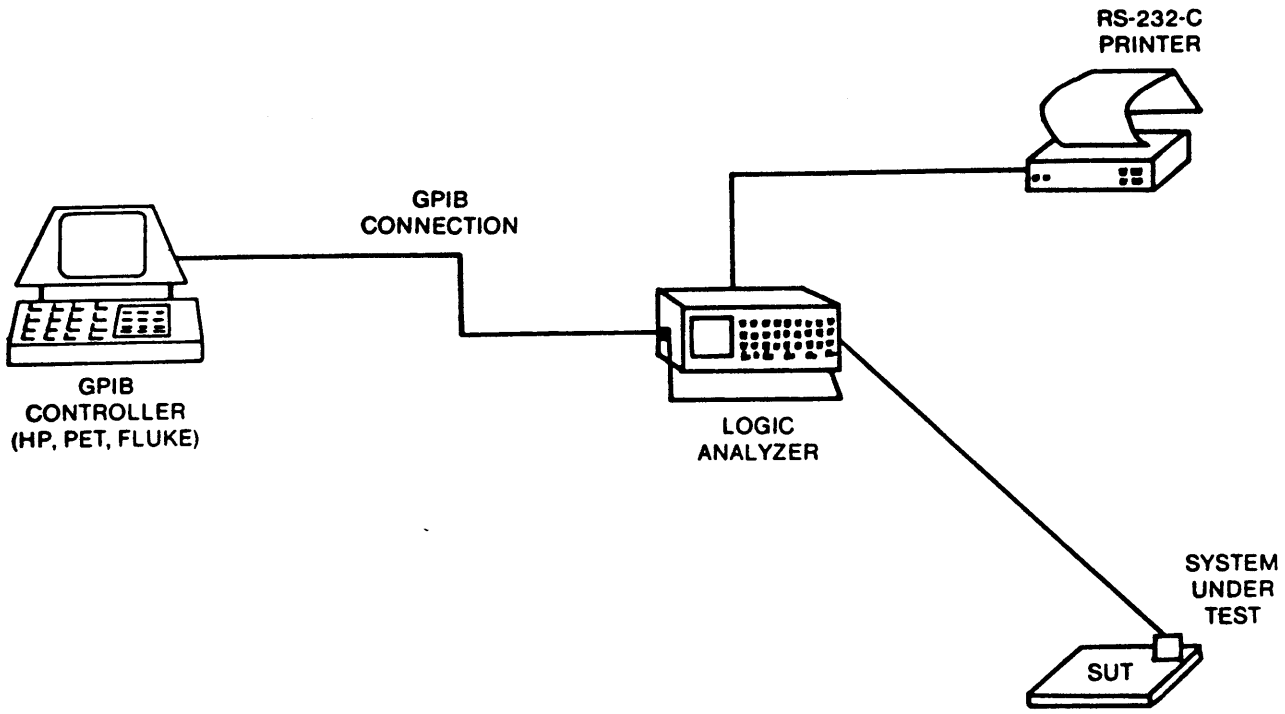


Figure 1-2. Standard GPIB Configuration

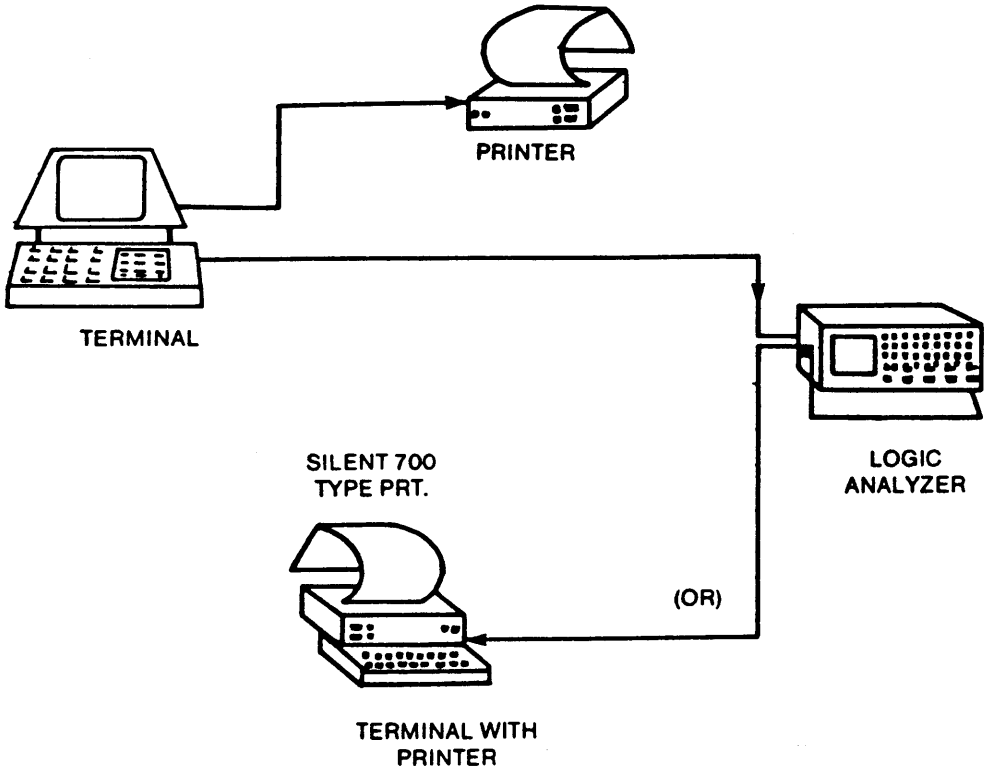


Figure 1-3. Standard RS-232-C Configuration

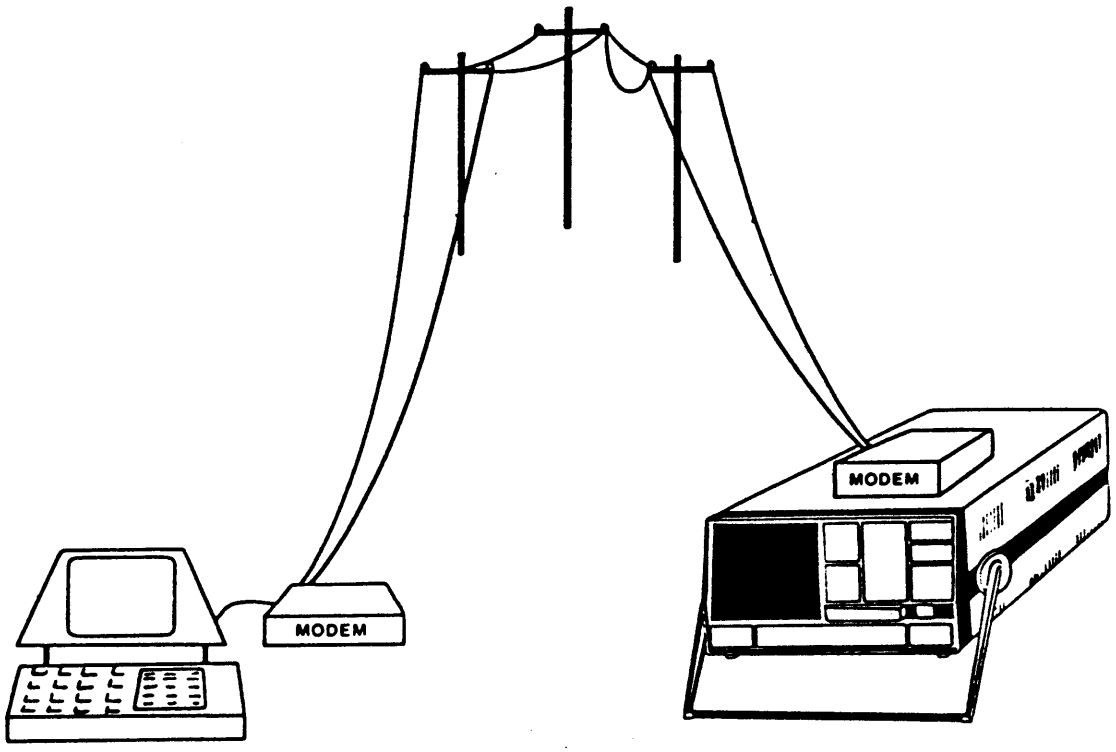


Figure 1-4. Extended RS-232-C Configuration

Table 1-2. Standard RS-232-C Specifications	
Data Rate	110, 300, 600, 1200, 2400, 4800 baud rates, auto detected
Data Bits	8 including parity
Start Bits	1
Stop Bits	2
Parity	No (bit 7 low)
Logic "1"	+3V to +12V
Logic "0"	-3V to -12V
Mode	Full Duplex

1.7 EXTENDED RS-232-C SPECIFICATIONS

The following list highlights features of the Extended RS-232-C Interface that are additional to the specifications listed in Table 1-2 for the Standard RS-232-C Interface.

- Asynchronous data transmission
- Voltage or current loop input/output
- All standard transmission rates from 50 to 9600 baud
- All standard modem control lines available: DTR, RTS, DSR, CTS
- Selectable logic levels of outputs on modem control lines (DTR, RTS) for transmit/receive
- Selectable reaction to logic level on DSR
- Selectable parity, bits/character, and number of stop bits
- Selectable full/half duplex communication mode
- Selectable number of characters/line
- Block transmission mode with programmable block length and pause between blocks
- Modem control line status and data monitor
- Three methods of setting up parameters:
    - DIP switches for power-on setup
    - Serial COMMUNICATION INTERFACE MENU for application-dependent setup changes
    - Full remote control by using macro-like instruction sets

SECTION 2

INSTALLATION

2.1 GENERAL

The GPIB/IEEE 488, Standard RS-232-C, and Extended RS-232-C consist of hardware and software that are to be installed and tested at the factory.

2.2 INITIAL TURN-ON/CHECK-OUT

Initial Turn-On and Check-Out is presented for the GPIB, Standard RS-232-C, and Extended RS-232-C respectively.

2.2.1 GPIB Set-Up

Refer to Figure 2-1 for an illustration of the GPIB interface and the address select switches located on the rear panel of the analyzer. The connector is completely defined in the ANSI/IEE STD 488-1978.

An eight pole address switch, located below the GPIB connector, controls the talk and listen address of the analyzer. It is labeled one through eight. The ON position specifies a "one" in the binary bit weighted position as shown in Table 2-1.

Table 2-1. GPIB Switch Weighted Positions.

S1	value 2 [0]
S2	value 2 [1]
S3	value 2 [2]
S4	value 2 [3]
S5	value 2 [4]
S6	reserved for future use
S7	reserved for future use
S8	reserved for future use

Note that the switch settings shown in the table above actually select an address pair, one for talk, and one for listen. For instance, if 16 decimal (0010000 Binary) were selected, the controller would send an ASCII Zero (48 decimal, 0110000 Binary) for an analyzer listen address command and an ASCII "P" (80 decimal, 1010000 Binary) for an analyzer talk address. Also, address 31 decimal may not be used because this address pair is reserved for untalk and unlisten control. See Appendix A for a chart of IEEE-488 the ASCII character set.

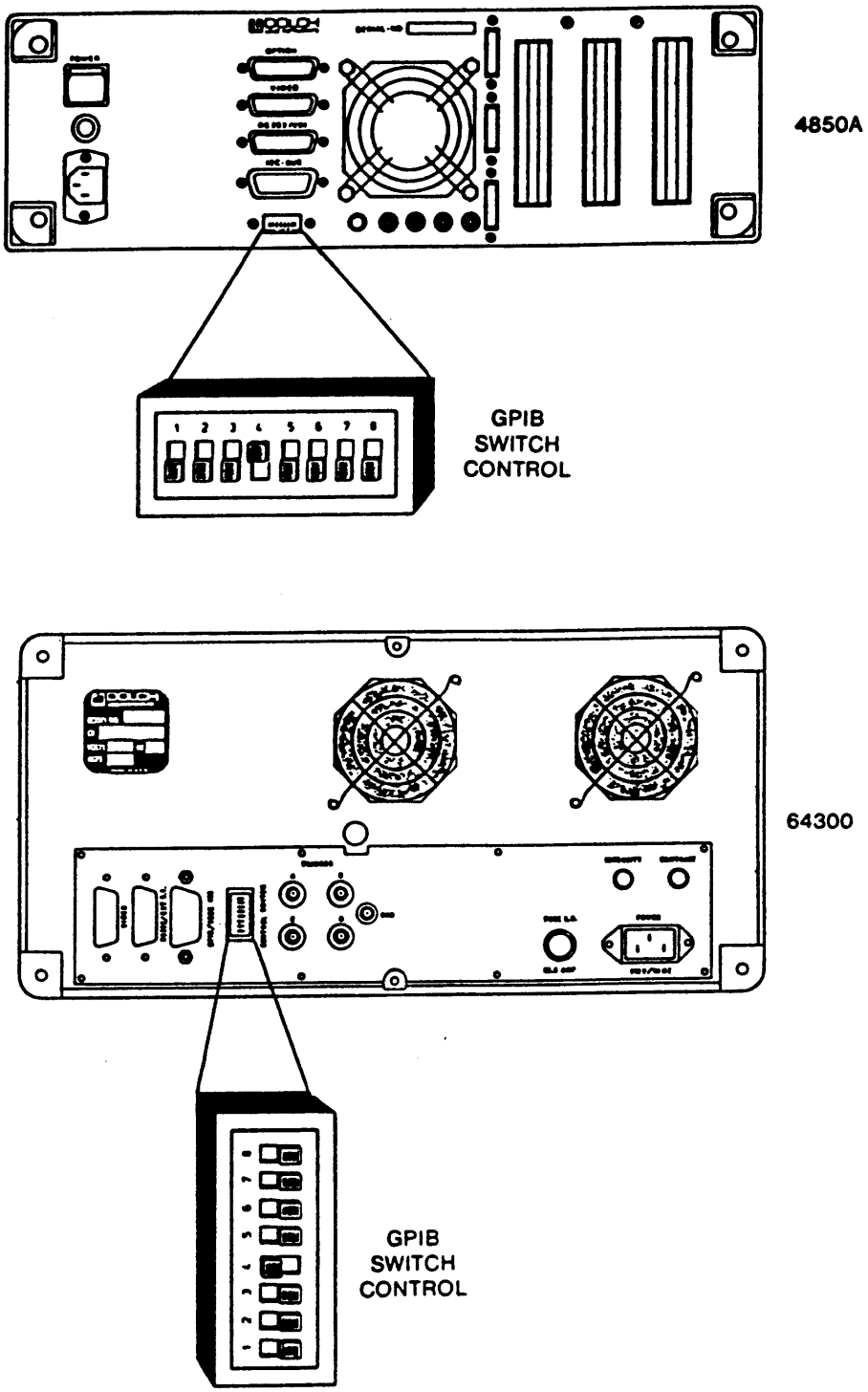


Figure 2-1. Interface Switches

2.2.2 Standard RS-232-C Set-Up

To configure the analyzer for Standard RS-232-C communications, perform the following steps:

1. Set the RS-232-C interface (terminal or computer) to:
   - Baud rate desired (110, 300, 600, 1200, 4800)
   - 8 characters
   - 2 stop bits
   - No parity (bit 7 constant low)
   - Full duplex

2. Connect the analyzer and the terminal together using the RS-232-C ports. Because the analyzer can act as a DTE (Data Terminal Equipment), pin 2 of the analyzer must be connected to Pin 3 of the terminal. Pin 3 of the analyzer must be connected to pin 2. See Figure 2-2 below for connections.

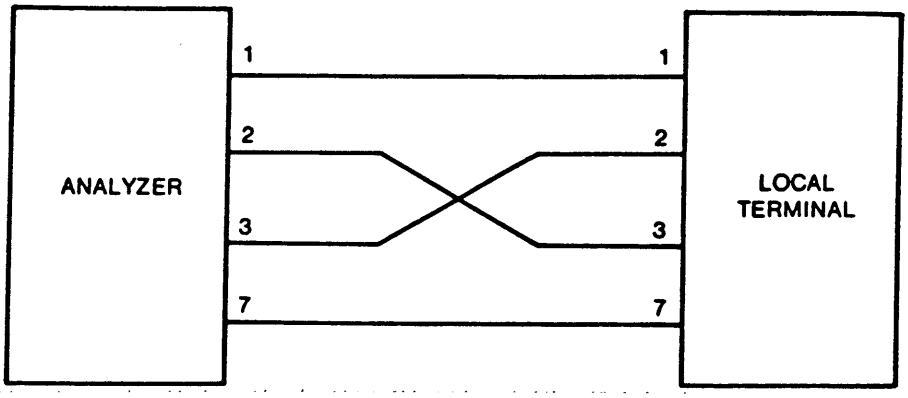


Figure 2-2. Analyzer/RS-232-C Connection

3. Apply power to the terminal first, and then apply power to the analyzer. After 30 seconds, the analyzer will have completed the power up tests and will display the "POWER UP SELF TEST COMPLETE!" message. Do not send characters to the analyzer during this power up phase.

4. Press the CARRIAGE RETURN key on the terminal once. The analyzer reponds with a "period" that will appear on the terminal. The analyzer will automatically detect the selected baud rate.

5. Type into the terminal:
   $MP•BS (Return)

NOTE

In these examples, a • symbol means a "space".

6. Verify that the terminal responds with the following type of message:
   T=0;C=0;O=07;08;03;
This message is explained in the System Configuration Checkout section.

2.2.3 Extended RS-232-C Set-Up

Only the Extended RS-232-C option uses a Communication Board which contains four DIP switches used to set up the default, or power-up conditions. Switch one (1) is located on the back panel of the analyzer, and is connected to the Communication Board by a cable. See Figure 2-3 for an illustration of these switches. Some jumpers, which are located on the Communications Board, must be set for different configurations. Appendix E describes settings for the DIP switches. Positions of jumpers is also described in Appendix E.

To configure the analyzer for the Extended RS-232-C communications, perform the following steps:

1. Set the POWER switch to ON.

2. After the "POWER UP SELF TEST COMPLETE!" display is present on the CRT, press the MENU pushbutton until the SERIAL COMMUNICATION INTERFACE MENU is displayed. See Figure 2-4 for an illustration of the menu. After power-up this menu will be programmed according to the DIP switches on the Communications Board.

3. Verify proper setting of parameters displayed. Parameters may be changed by using the EDIT group cursor keys to move the cursor to the desired field and then using the ROLL pushbutton (or ENTER if necessary) to select parameters.

NOTE

The Serial Interface is active at all times, whether or not the menu is displayed. Note that the Standard RS-232-C Interface may not be used when the Communications Board is installed.

4. Set the POWER switch OFF.

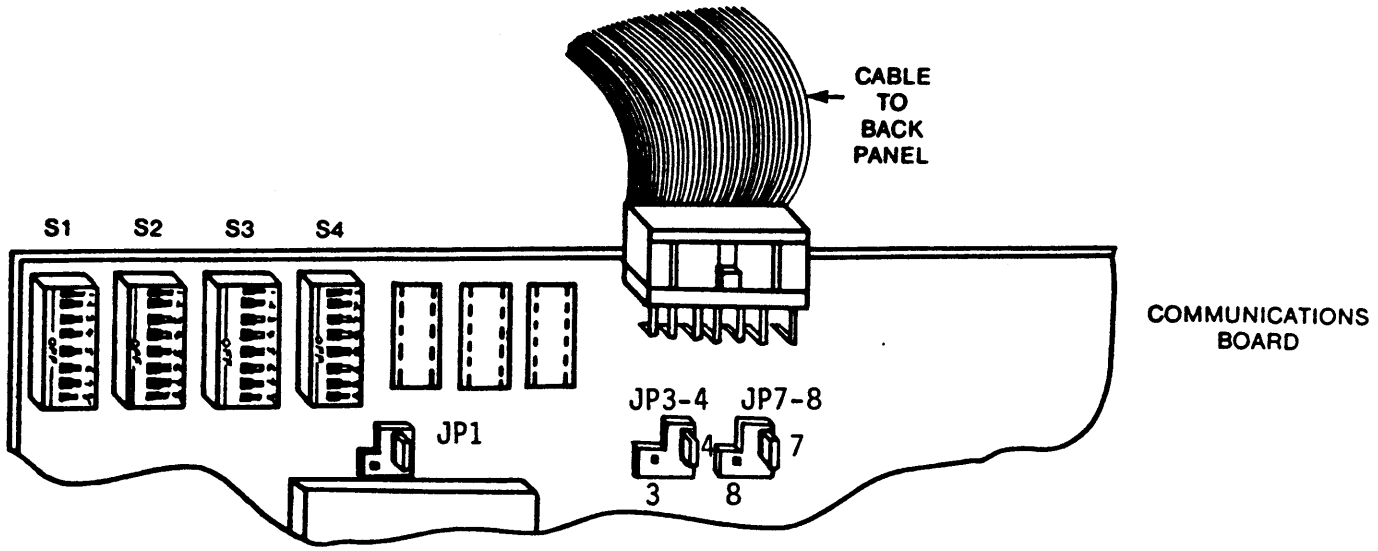
5. Connect the monitor or computer to the OPTION connector on the LAM 4850A or the RS-232-C connector on the 64300. Note that the position of the jumpers on the Communication Board will determine if the transmit and receive lines need to be crossed.

6. Repeat steps 1 and 2 above. Verify that the parameters are set properly.

7. Activate the DATA COMMUNICATION MONITOR and send the following command string from the monitor or computer:

"$MP@BS,"

8. Verify that the modem control lines are correct on the monitor or computer display. Levels should match the parameters displayed on the analyzer. If the set-up is correct, the analyzer should send back, to the computer or monitor, the Power-Up status.



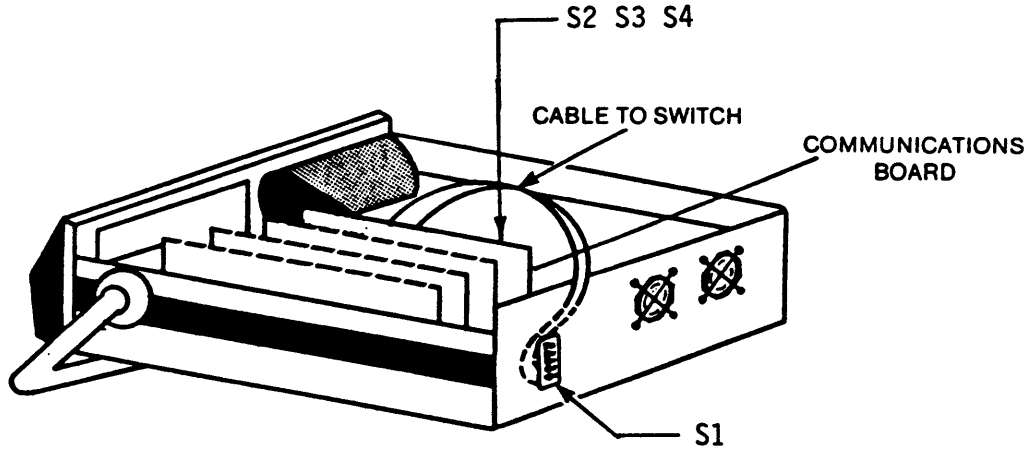


Figure 2-3. Extended RS-232-C Switches

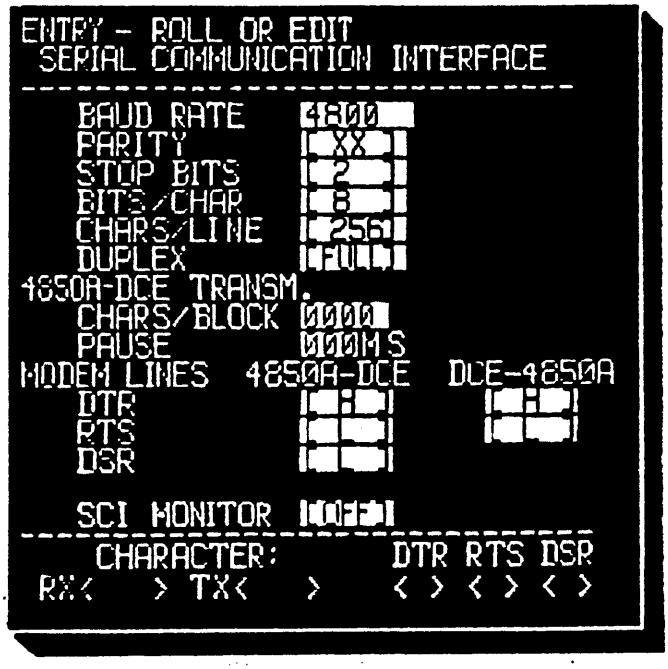


Figure 2-4. Serial Communications Interface Menu

2.3 SYSTEM CONFIGURATION CHECK-OUT

After Power-Up is complete, the system configuration and power-up test results may be read from the Transmit Buffer. If a GPIB controller is used, an input or enter command should be used. If a serial terminal is used, the command "$MP^BS," will cause the terminal to read the contents of the Transmit Buffer. The message received from the analyzer should be similar to the one shown below:

T=n;C=n;O=X1;X2;X3...X;

Table 2-2 shows the decimal equivalents of messages received.

Table 2-2. Configuration Messages

LETTER	DESCRIPTION	CODE
T	Memory Test Results (Error Codes)	0 - no error 1 - RAM 2 - CMOS 3 - CMOS,RAM 4 - EPROM 5 - EPROM,RAM 6 - CMOS,EPROM 7 - CMOS,EPROM&RAM
C	Hardware Configuration	0 - all SBLA's (DAB's) are ON 1 - A&B are N/A 2 - C&D are N/A 3 - A&B,C&D are N/A 4 - E&F are N/A 5 - A&B,E&F are N/A 6 - C&D,E&F are N/A 7 - A&B,C&D,E&F are N/A
O	Options Available	See POWER-UP Menu for details

SECTION 3

FUNCTIONAL DESCRIPTION

3.1 GENERAL

The remote control operation is supported internally by a multiple information exchange buffer structure:

- Command Buffer
- Transmit Buffer
- Batch Buffer

3.2 COMMAND BUFFER

The Command Buffer holds all received commands with the exception of two types:

- Immediate Commands - Acted upon immediately upon reception (hence, they are always one character long).

- Command Strings - Stored temporarily in the Command Buffer until their syntax is checked. When syntax is correct, they are "uploaded" in the selected batch file.

The "normal" command strings are kept in the Command Buffer until the "Buffer Clear" ($) immediate command is received. This feature allows command strings to be repeatedly executed. Additional command strings can be appended to these - as long as the buffer size (800 characters) is not exceeded.

Every "Execute" command (,), which is recognized as an "Immediate Command" type, causes the immediate execution of all commands contained in the command buffer.

3.3 TRANSMIT BUFFER

The Transmit Buffer is used to request information from the logic analyzer. It holds two types of information:

- Information received from the controller - This can be data with destination Source /Reference Memory as well as messages to be displayed upon request using the CRT of the Analyzer.

- Information prepared for the controller as a result of a remote command - These include formatted data, reloadable setup strings, status and error messages, and documentary information such as the LIST DISPLAY, TIMING DIAGRAM, etc.

During Transmit operations, all information is stored from the beginning of the buffer. "Older" information is thus overwritten. Therefore, a recommended practice is to read out information from the Transmit Buffer before executing a command.

With the GPIB interface, this can be done by separating the commands with a "Halt" (#), and asking for a "Service Request" (SRQ). The information contained can then be read. For continued viewing, issue the "Continue" (=) command.

When using both the Standard RS-232-C and Extended RS-232-C interfaces, the transmit commands must be accompanied by the "Transmit" (MP^BS) command.

NOTE

When messages are downloaded to the Analyzer, any information being prepared for transmission may partially overwrite the Transmit Buffer.

3.4 BATCH BUFFER

The Batch Buffer is a storage area reserved for the nine batch command strings. These strings can be executed or read back as long as the logic analyzer is not active.

SECTION 4

INTERFACE PROGRAMMING

4.1 GENERAL

This section describes programming rules, interface commands, programming structure, and detailed operating procedures for the following modes of interface operation:

- Analyzer Menu And Display Programming
- Analyzer Options Programming

Note that in this section the • is used as a symbol for a space.

4.2 PROGRAMMING RULES

Valid alphanumeric characters are all upper case letters and numbers 0 through 9. Valid symbols are %,*,),(,comma,backslash,=,$,],[,>,<,',&,!, ?,#,>,<,CTRL-E,CTRL-F and carriage return (CR).

A programming statement consists of a maximum of 800 alphanumerics and symbols followed by an execution character. All programming specifications must be separated by one character space.

Following selection of a programming group by M(X) where (X) is a menu setup specification, the analyzer remains in the selected menu until a further menu specification M(X) is executed or in the event that programming errors occur. This does not apply to transmit (MX) or printout (MP) commands.

The symbols are always in effect (menu independent) unless otherwise specified. This is an especially important point to remember. There is no default to a neutral parameter.

NOTE

A "$" (Dollar sign) before any command clears the entire previous command buffer.

4.2.1 Overview Of Programming Strategy

The following summary of remote control interface operating principles should help in programming the logic analyzer.

- Communication can only be established after the "Self Test" power up sequence is complete.

- Command strings are accepted only if the analyzer is idle (not recording). The only exception is during a formatted data upload operation, during which, commands are accepted, but not executed until the upload is completed.

• Commands are executed only upon reception of the "Execute" (,) command. Exceptions to this are "Immediate" type commands. Data and batch command string terminators - ")" and "]" - are considered as immediate commands that start the check and upload process.

CAUTION

Do NOT send several batch strings in one "Go". Be sure to clear the buffer(s) before every batch string.

• Execution is preceded by syntax (checksum in the case of data) test. If syntax errors were found, the erroneous terms are loaded into the Transmit Buffer accompanied by the corresponding error code. Error is signaled in the status byte and execution is inhibited. The syntax check always covers the entire string, but does not include the ability to analyze setups. During data upload operations, the incorrect data blocks are not loaded. Their start addresses are loaded into the Transmit Buffer and an error status is signaled. This feature makes it possible to only reload the effected data blocks, headed by the setup block.

• The activity of the analyzer can, and should be fully monitored by the controller through status inquiry - serial poll for GPIB, and "ENQ" character for RS-232-C. However, by making extensive use of the "HALT" (#), and "SRQ/ACK" (') commands, it is possible to free the controller from the monitoring mode, thus eliminating wait loops and continuous polling.

• All setup and data obtained from the analyzer can be reloaded without any modifications, except the terminator character(s), which is only needed by the controller. If work is done with setup strings, this can be replaced by the "Execute" (,) command.

• After executing a command string, the analyzer display is "refreshed" to make remote and local command interlacing possible. Nevertheless, it is recommended to lock the built-in keyboard while remote control is used to avoid accidental setup/display changes. The display is not refreshed if the command string is terminated by a "Display Message" (MW°B) command.

• Remote messages can be displayed on the built-in CRT by using the Transmit Buffer as a CRT Buffer to prestore one, or several lines (32 characters) up to the display capacity of 21 lines. By using the message formatting command sequence, the controller can select which line(s) are to be displayed. This makes possible the "insertion" of a message into a standard display (e.g. a menu) without effecting it. The fact that the Transmit Buffer is used to hold the remote messages means that they are available only as long as no information is required from the analyzer irrespective of whether error or status (during recording) information is generated.

- When developing a remote control program, it is a good idea to take advantage of the "Check" (/) immediate command. This permits the syntax check of a command string without execution. If there is any doubt about syntax, it is recommended to program the required setup using the built-in keyboard, "Read" it out, and then check the syntax of the respective command term(s).

4.3 INTERFACE COMMANDS

Interface commands are non-alphanumeric character commands which are used in conjunction with the programming commands. They are divided into three groups of commands; Immediate, Supervisor and Special Interface commands. Immediate commands are executed immediately by the analyzer. Supervisor commands require an immediate type command to accompany it (immediately following the Supervisor Command) before being executed. These are sometimes found in command strings. The last group is the Special Interface, consisting of two symbols. Table 4-1 shows immediate commands and their meanings, Table 4-2 shows Supervisor Commands and their meanings, and Table 4-3 shows the Special Extended Interface Commands and their meanings.

Table 4-1. Immediate Commands

SYMBOL	COMMAND	DESCRIPTION
ß	HALT RECORDING	Stops a recording or compare process in progress, whether initiated manually or through programming.
*	RESET	Resets the analyzer to default conditions, but not through power up self tests.
(,)	RECEIVE DATA	The character "(" followed by formatted data indicate that the following characters are data to be sent to the buffer. The character ")" terminates the string, indicating the end of transmission of data. Also used to send text to the analyzer screen when string is pre-fixed with a "T".
[,]	BATCH FILES	Stores the Command String in a Batch File for later execution. Brackets define the Command String contained within.
/	STRING BUFFER CHECK	Checks the command string buffer up to this command for any errors.
=	CONTINUE EXECUTION	Continues execution of a command string that has been previously halted by the supervisor command "ß".

Table 4-1. Continued

$	CLEAR STRING BUFFER	Clears the command string buffer of all previously entered commands. Generally it is a good idea to initiate every command string with a "$", otherwise all previous commands will be executed followed by the current command string.
^	BACKUP DISPLAY	Selects and displays the previous location of a data list for the "MP*C" command. Standard RS-232-C command only.
CTRL-E	ENQUIRY	Used to determine the current status of the analyzer (busy, idle, error), with a Serial Interface.

Table 4-2. Supervisor Commands

SYMBOL	COMMAND	DESCRIPTION
&(N)	MEMORY SELECT	This command selects either the Source or Reference Memory for the data transfer or selected display. It can also transfer data from Source to Reference Memory and display highlighted memory differences.
	N = S	Source Memory selected.
	= R	Reference Memory selected.
	= T	Transfer Source to Reference Memory.
	= X	Displays highlighted differences (S+R or R+S), depending on whether Source or Reference was last selected. Default value is source data.
I(N1,N2)		This command selects how data will be transmitted and the final termination character for transmission.
	N1 = 1	: Block transmission mode
	N1 = 2	: Special Commodore PET Mode
	N1 = 3	: Standard GPIB mode
	N1 = 4	: HP (Hewlett-Packard) transmission mode
	N2 = 1	: ETX will be final termination
	N2 = 2	: CR LF will be final termination
	N2 = 3	: "END" will be final termination
	N2 = 4	: NUL will be final termination
	N2 = 5	: EOT will be final termination
		Once a transmission mode command is sent, the transmission and final termination character will remain in effect until changed or a power-up reset occurs. Default value is setup 31. See Appendix B for detailed information on block format.

Table 4-2. Continued

	GPIB/SERIAL Service Request. If the apostrophe is reached during execution of the command string, the analyzer will acknowledge completion of the respective section. In GPIB, the SRQ is set active. In Serial, the acknowledge character (06), is sent.
	This command selects the recording process and starts it.
	Data recording. (Do not use "?S" or "?D" in the COMPARE MENU).
	Data recording and prepare data per transmission mode command and MX command. (Do not use "?S" or "?D" in the COMPARE MENU).
	Start compare process.
	This command halts execution of a command string. It remains in halt mode until a continue command is received.

Special Interface Commands (Extended RS-232-C Only)

	DESCRIPTION
	This command unlocks the front panel keyboard of the analyzer. This is the default condition upon power up.
	Locks the front panel keyboard of the analyzer and all operation is done through the interface.

AND DISPLAY PROGRAMMING

rogramming follows the modes of analyzer operation defined Manuals under Section 5, Operating Procedures. These are

rd Programming
alysis
nipulation

utor's Manual for the specific device affected for details of ay operation. The description of programming structure and nu and display in this section is presented in three notes (including examples of menu programs), a figure of ay with keys to programming commands, and a programming

Menus and displays are always available for programming, regardless of whether they are on the CRT or not. They can also be displayed at any time using the "MW" command, which is immediately followed by a space and then the letter that corresponds to the menu or display desired. This is true for all but the EXTENDED TRIGGER MENU, which must be accessed with the "MO°A07°A" command, which is immediately followed by a letter or number which corresponds to the menu or definition page desired. Table 4-4 shows the letters used to select menus and displays in conjunction with the "MW" command. Table 4-5 shows the letters used to select the EXTENDED TRIGGER MENU and its associated pages.

Table 4-4. MW°(N) Command

N=	SELECT
R	Format (Trace) Menu
C	Compare Menu
L	List Display
D	Timing Diagram
I	Interface Menu (Extended RS-232-C only)
B	Display Buffer Contents
V	Set-Up Monitor Display

Table 4-5. MO°A07°A(N) Command

N=	SELECT
S	Extended Trigger Sequence Menu
1	Word Definition Page 1
2	Word Definition Page 2

4.4.1 Pre-Record Programming Mode

In the Pre-Record Programming Mode, the recording parameters of the analyzer are given, before the actual recording, as a set of instructions on Menus. The analyzer uses a tiered structure for programming these parameters. This structure is duplicated in the command strings used for each Menu associated with the Pre-Record Programming Mode. The hierarchy of command structure is also shown in the Programming Charts.

NOTE

The order of commands must be maintained, as shown in the Programming Charts. A command can be skipped if not used, but remember that if it was used before, the parameters previously set will apply to the current command string, unless changed.

In the figures within sections covering the programming of each menu, the circle letters correspond to the command used to effect the field(s) pointed to. In examples accompanying each menu section, a ␣ symbol represents a "space".

The Pre-Record Programming Mode consists of the following Menus:

- Trace
- Trigger
- Compare
- Set-Up Monitors

4.4.1.1 TRACE MENU Programming (MR). Refer to Figure 4-1 for an illustration of the TRACE MENU and the command protocol for programming the TRACE MENU.

Some examples of TRACE MENU programs follow.

1. A) Clock at 20 ns
   B) Latch Mode

INPUT:

$MR°S0°OEF°PA°IL°F00,

2. A) 32 Bit
   B) Pod Skew = 500
   C) Delay = 1300
   D) Pod A to Sample Mode
   E) Assume starting program after example 1 above is successful

INPUT:

$MR°S0°D1300°B0500°OEN°PA°F10,

3. A) Assume starting immediately after power up
   B) 48 Bit Mode
   C) C1 on all Pod Groups
   D) Delay = 899
   E) Note that this example can be used for setting up the analyzer for Personality Probe use.

INPUT:

$MR°D0899°PA°C2°PC°C2°PE°C2,

BEGIN COMMAND STRING WITH	END WITH
$MR ␣	,(COMMA)

TRACE MENU PROTOCOL

$MR␣S␣G␣R␣F␣D␣B␣O␣P␣L␣I␣C␣Q␣E␣T␣,

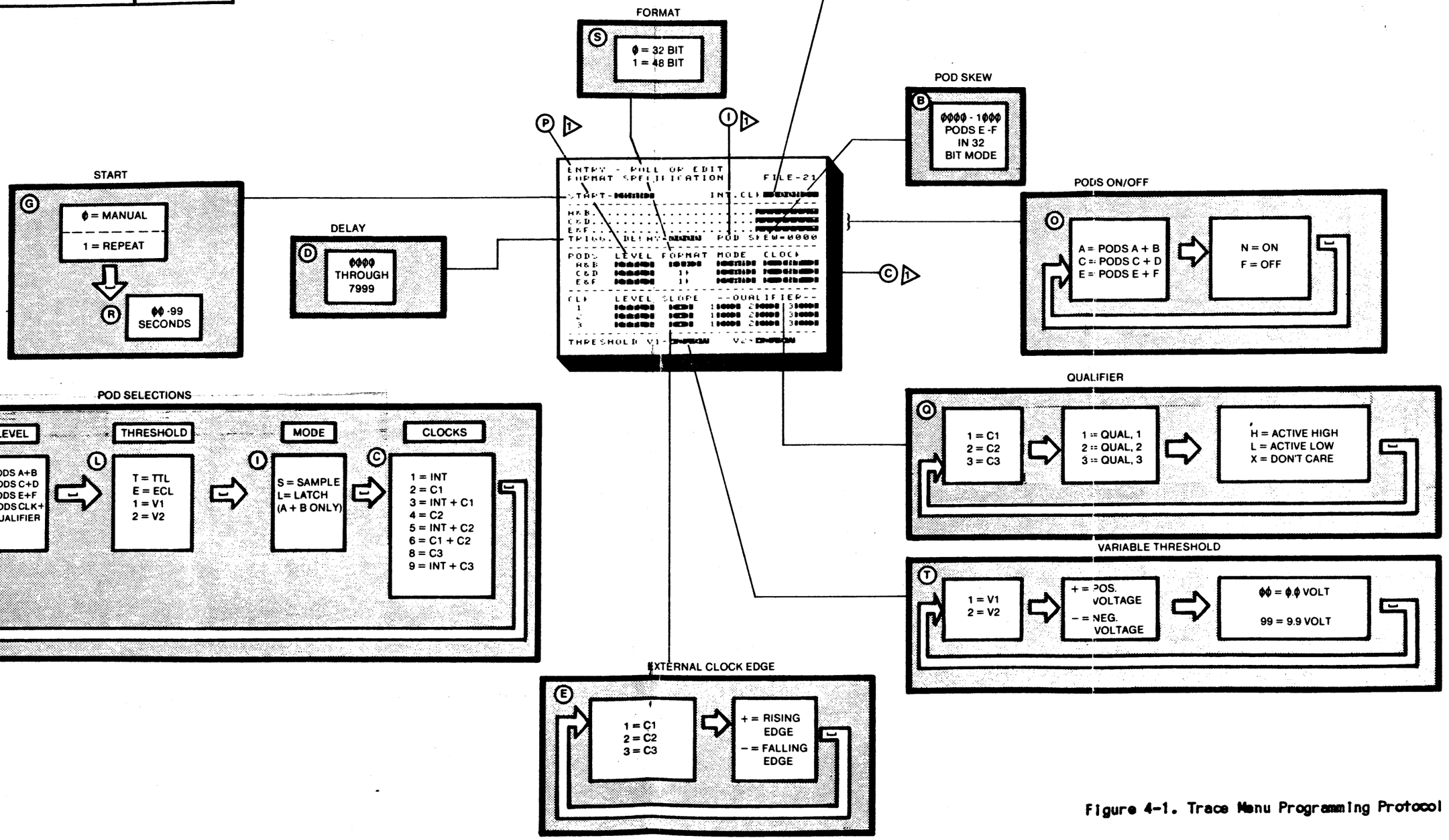


Figure 4-1. Trace Menu Programming Protocol

4.4.1.2 EXTENDED TRIGGER MENU Programming (M0°A07). Figure 4-2 shows an illustration of the EXTENDED TRIGGER MENU, the WORD DEFINITION PAGE 1 (The format of this page is the same as that for Page 2), and the command protocol for the EXTENDED AREA TRACE MENU programming. These commands allow full programmability, with the exception of the Trigger Word polarity (which is always positive).

An example of programming for the EXTENDED TRIGGER MENU and the WORD DEFINITION PAGE follows.

TRIGGER MENU:

SEQUENCE 1: Advance after 123 events of Word 00
OR 001 event of word 01
SEQUENCE 2: Advance if next word is 02
SEQUENCE 3: Advance if next word not 03
SEQUENCE 4: Advance after 001 event of word 04
And trace data if word 05

Sample Clock CLK 1

WORD DEFINITIONS:

00: Pod A = 4F (16)
01: Pod A = 8B (16) Pod B = XX11XX00 (2)
02: Pod A = 00 (16)
03: Pod A = 04 (16)
04: Pod A = NONE Pod B = 0001XXXX (2)
05: Pod A = 4B (16)

INPUT:

$M0°A07°L1°F110°W000100°E123°L2°F200°W020000°L3°F300°W030000°L4°F170°W040500°E001°BHBBBBB°N00°PA4F°N01°PA8B°PBXX11XX00°N02°PA00°N03°PA04°N04°PB0001XXXX°N05°PA4B°C2

4.4.1.3 COMPARE MENU Programming (MC). Figure 4-3 is an illustration of the COMPARE MENU and the command protocol for this menu.

Two additional commands (not shown in Figure 4-3) used in conjunction with the COMPARE MENU are associated with the Cyclic Redundancy Check (CRC). The CRC compares the total data in a Pod Group and calculates a checksum (a 4 digit number) for the value. Be aware that CRC checksums are returned only for active pods within the COMPARE and TRACE menus. Also note that the validity of Reference CRCs cannot be guaranteed after a SCRATCH TABLE (for analyzer models previous to the 64300) or the DATAPAK TABLE (64300 Model). The validity of Reference CRCs also cannot be guaranteed after a data transfer from Source to Reference Memory.

Some examples of programs for the COMPARE MENU follow.

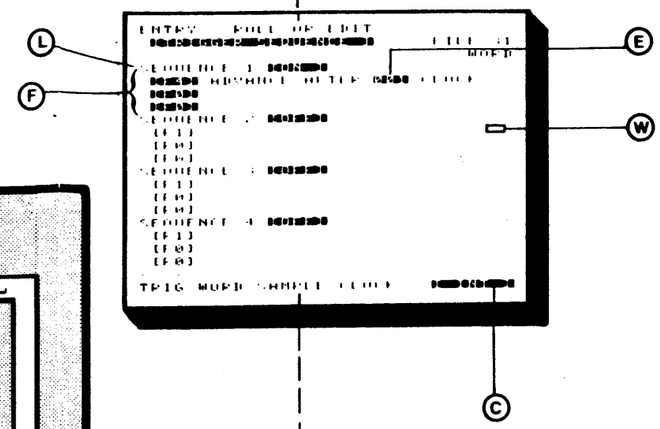
EXTENDED TRIGGER MENU PROTOCOL

$MO ␣ Aϕ7 ␣ L ␣ F ␣ W ␣ E ␣ B ␣ N ␣ P ␣ C ␣ ,

BEGIN COMMAND STRING WITH	END WITH
$MO ␣ Aϕ7 ␣	, (COMMA)

Ⓒ TRIGGER WORD SAMPLE CLOCK

1 = INT	5 = INT + C2
2 = C1	6 = C1 + C2
3 = INT + C1	8 = C3
4 = C2	9 = INT + C3



TRIGGER MENU PROGRAMMING

Ⓛ SEQUENCE

1 = SEQUENCE 1
2 = SEQUENCE 2
3 = SEQUENCE 3
4 = SEQUENCE 4

Ⓕ LEVEL

LEVEL 1 ⇨ LEVEL 2 ⇨ LEVEL 3

SELECT ONLY 1 PER LEVEL

FUNCTION

ϕ = OFF
1 = ADVANCE AFTER XXX EVENTS
2 = ADVANCE IF NEXT (WORD)
3 = ADVANCE IF NEXT NOT (WORD)
4 = ADVANCE AFTER XXX CLOCKS
5 = OR TRIGGER IF (WORD)
6 = OR GO TO SEQUENCE 1 IF (WORD)
7 = AND TRACE DATA IF (WORD)

(ALWAYS PROGRAM 3 NUMBERS)

Ⓦ WORD ASSIGNMENT

LEVEL 1 ⇨ LEVEL 2 ⇨ LEVEL 3

ϕϕ THROUGH 11

(ALWAYS PROGRAM 3 WORDS
2 DIGITS EACH I.E.
ϕ1, ϕ2, 1ϕ)

Ⓔ EVENT OR CLOCK COUNTER

ϕϕ1 THROUGH 255

THERE CAN ONLY
BE ONE EVENT
OR CLOCK COUNTER
PER SEQUENCE

TRIGGER WORD DEFINITIONS

Ⓑ TRIGGER BASES

POD A | POD B | POD C | POD D | POD E | POD F

SELECT 1 FOR EACH

B = BINARY
H = HEXADECIMAL
O = OCTAL

ALWAYS PROGRAM ALL 6 PODS, I.E.
B B B O B H
(A) (B) (C) (D) (E) (F)

Ⓝ WORD #

ϕϕ
↓
11

Ⓟ POD & WORD DEFINITION

A = POD A
B = POD B
C = POD C
D = POD D
E = POD E
F = POD F

THEN

BINARY
ϕϕϕϕϕϕϕϕ
11111111
XXXXXXXX

OR HEX
ϕϕ → FF

OR OCTAL
ϕϕϕ → 255

MUST MATCH FORMAT SPECIFIED IN TRIGGER BASE COMMAND Ⓑ CAN ONLY BE IN POSITIVE LOGIC.

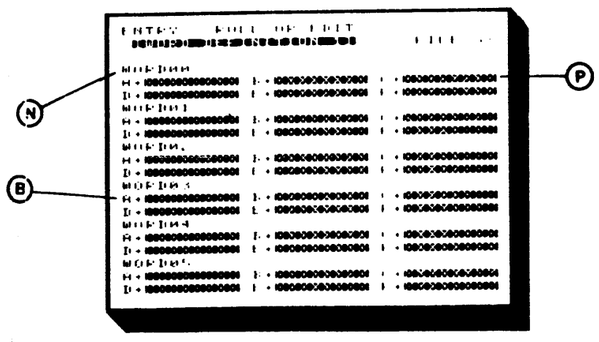


Figure 4-2. Trigger/Word Definition Menu Programming Protocol

1. A) Start Address = 120
   B) End Address = 500
   C) Compare Skew = +/- 5 Samples
   D) Channel Groups - A,B,C
   E) Compare Mode - Bit/Bit
   F) Count If R=S

INPUT:

$MC°S0120°E0500°K05°PABC°B0°F2

2. A) Start Address = 200
   B) End Address = 700
   C) Compare Skew = +/- 20 Samples
   D) Channel Groups - D,E,F
   E) Compare Mode - Byte/Byte
   F) Halt If R=S

INPUT:

$MC°S0200°E0700°K20°PDEF°B1°F3

Checksum programming is presented in the following example. This example assumes that the COMPARE MENU has been programmed.

INPUT:

$MC°XS°MP°BS,

ANALYZER RESPONDS:

MC°CA1EF0°CBF3FF°CCF3FF°CDF3FF°CEF3FF°CFF3FF

(Digits returned are in Intel Hexadecimal format.)

4.4.2 Data Analysis Mode

In the Data Analysis Mode, the full range of comparison and analysis functions are available after a recording has been made. This mode is primarily accessed through the use of the TIMING DIAGRAM and the LIST DISPLAY. Functions that allow for the automatic search of data are key features of the TIMING DIAGRAM and the DATA LIST. For the sake of clarity, search functions are described separately from the basic programming and format manipulation commands of the two displays.

In the figures within this section covering the programming of the TIMING DIAGRAM, the DATA LIST, and their respective search functions, the circle letters correspond to the command used to effect the field(s) pointed to. In examples accompanying each section, a ␣ symbol represents a "space".

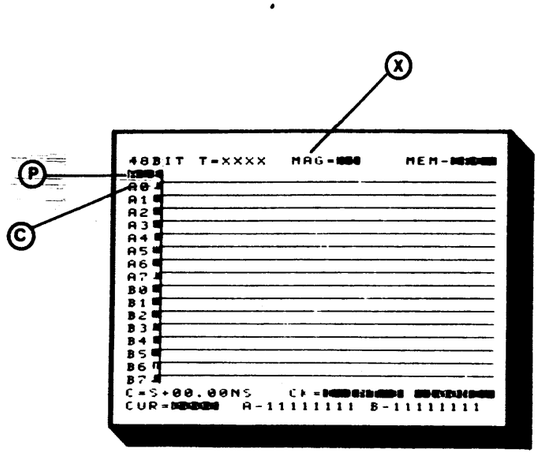
4.4.2.1 TIMING DIAGRAM Programming (MD). Figure 4-4 shows an illustration of the TIMING DIAGRAM and command protocol used for it.

BEGIN COMMAND STRING WITH	END WITH
$ M D ␣	, (COMMA)

POD GROUP SELECT

Ⓟ

A = PODS A + B
C = PODS C + D
(NOT AVAILABLE IN 32 BIT MODE
E = PODS E + F



MAGNIFICATION

Ⓧ

1 = X 1
2 = X 5 (X10 IN 32 BIT MODE)
3 = X 10 (X20 IN 32 BIT MODE)

TIMING DIAGRAM PROTOCOL
$ M D ␣ X ␣ P ␣ C ␣ ,

Ⓒ CHANNEL ARRANGEMENT

DELETE

WANT TO DELETE A CHANNEL?

YES

IS CHANNEL IN POD GROUP SELECTED?

NO

GO BACK AND INPUT POD GROUP CHANNEL IS IN. SEE Ⓟ

YES

INPUT

$ M D ␣ C

INPUT POSITION OF LINE ON SCREEN IN HEX, THEN FOLLOW IMMEDIATELY WITH "O" AND ","

EXAMPLE

$ M D ␣ CO 0,

EXAMPLE

0 = LINE 0
1 = LINE 1
2 = LINE 2
3 = LINE 3

A0
A1
A2
A3

D = LINE 14
E = LINE 15
F = LINE 16

B5
B6
B7

CHANGE DISPLAY

WANT TO CHANGE A CHANNEL NAME?

YES

IS CHANNEL IN POD GROUP SELECTED?

NO

GO BACK AND INPUT POD GROUP CHANNEL IS IN. SEE Ⓟ

YES

INPUT

$ M D ␣ C

INPUT POSITION OF LINE WHERE NEW CHANNEL IS DESIRED IN HEX

EXAMPLE

$ M D ␣ CF A 7,

INPUT POD AND CHANNEL NUMBER DESIRED

PODS	CHANNEL
A → F	0 → 7

THEN FOLLOW WITH ","

NO

WHAT'S WRONG WITH YOU?

Figure 4-4. Timing Diagram Programming Protocol

NOTE

Program only for the displayed Pod Group.
Use the Pod Group Select Command to
call other displays in the TIMING DIAGRAM.

4.4.2.2 LIST DISPLAY Programming (ML). Figure 4-5 shows an illustration of the LIST DISPLAY and command protocol for the LIST DISPLAY. Note that the "ML" command adds to the existing display, but will not remove any columns in the display until the screen is full.

4.4.2.3 Search function commands are initiated by the "$MF" command, and are followed by the commands presented in Figure 4-6, which shows the command protocol. These commands allow full programmability of all search functions except for WORD SEARCH (this can be accomplished with the SEQUENCE SEARCH using only one sequence).

The search results are prepared and put into the transmit buffer after each execution with the following format:

E = XXXX = Search Event Counter
T = XXXX = Search Total Counter
C = XXXX = Actual Cursor Position

The results can be read out to a Serial terminal with the "$MP°BS," command. The command "$MF°D(N)," will execute a search using previously loaded word definitions. See Figure 4-6, D, for search codes.

4.4.3 File Manipulation Mode

The File Manipulation Mode allows for the storage and recall of menu set-ups or reference data. This is accessed through the SCRATCH TABLE, and is only available for programming on the LAM 4850A model.

4.4.3.1 SCRATCH TABLE (MS) [LAM 4850A Only]. Figure 4-7 shows the SCRATCH TABLE and an illustration of the command protocol used for it.

4.5 ANALYZER OPTIONS PROGRAMMING

This section contains the command set for Analyzer options, with the exception of the Time Stamp Option. Refer to the Operator's Manual that accompanies the specific option for details of operation, and its interaction with the Analyzer.

Options programming described in this section are as follows:

- Disassemblers
- Area Trace
- Extended Area Trace
- High Speed Memory
- 4K Memory
- Extended RS-232-C Interface

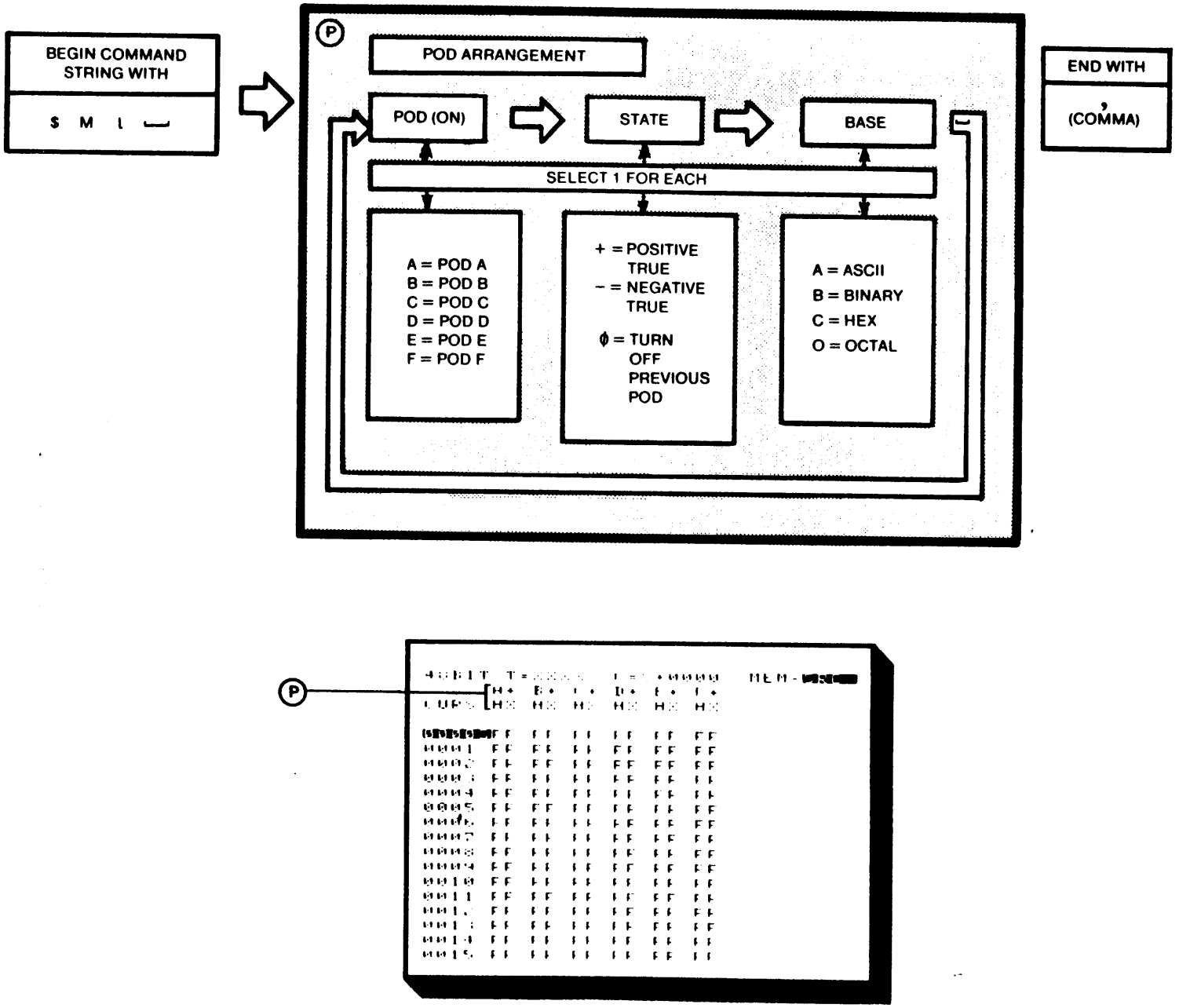
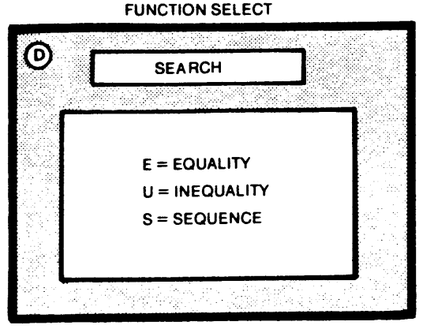
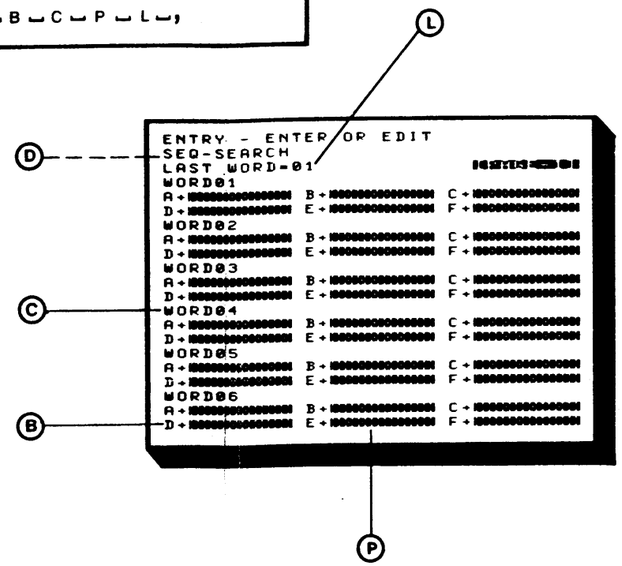


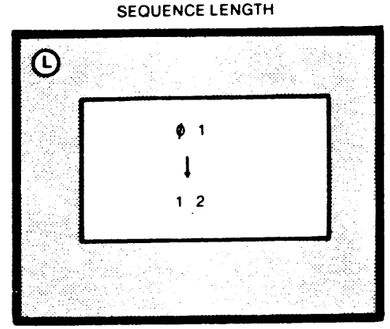
Figure 4-5. List Display Programming Protocol

BEGIN COMMAND STRING WITH	END WITH
$MF␣	, (COMMA)

SEARCH COMMAND PROTOCOL
$MF␣D␣B␣C␣P␣L␣,







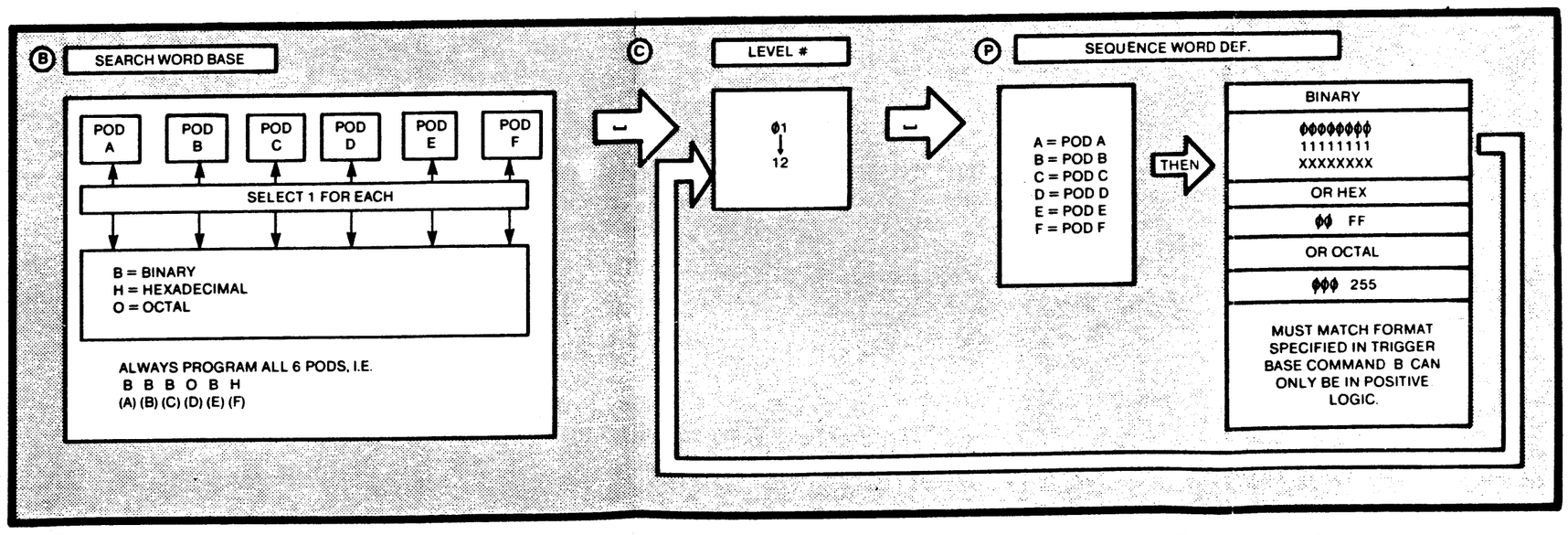
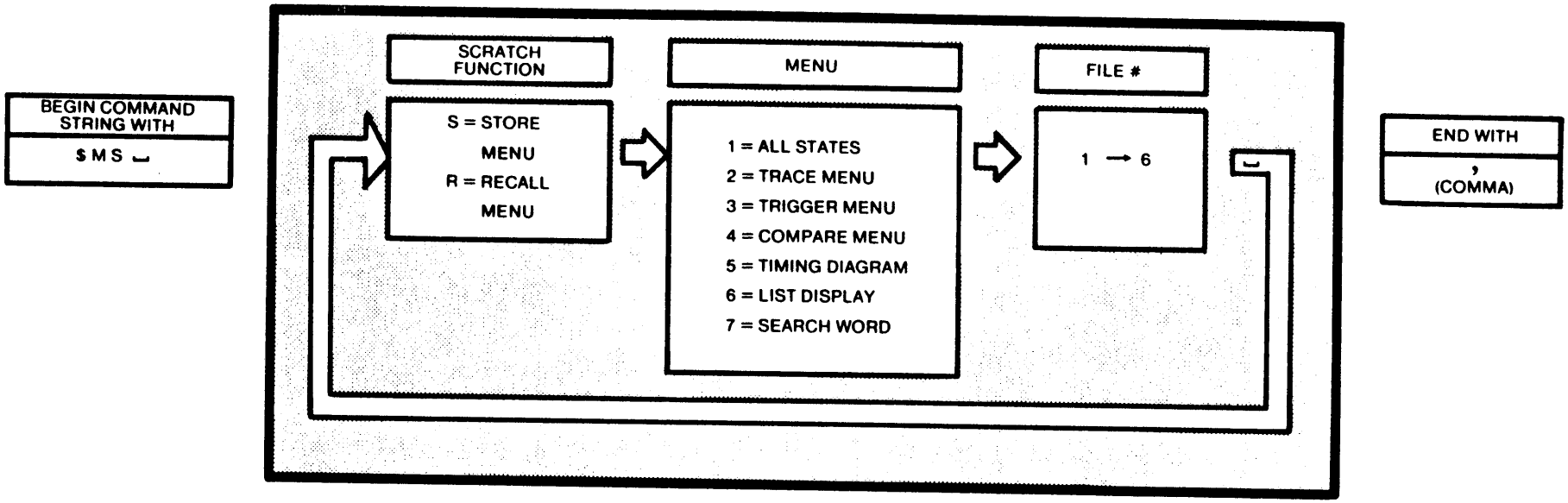


Figure 4-6. Search Function Programming Protocol




```
ENTRY:-FILE NR(1-6),EDIT,EXECUTE

          SCRATCH TABLE

                      STORE  RECALL
ALL STATES             1##    1##
FORMAT SPEC            2##    2##
TRIGGER SPEC           3##    3##
COMPARE SPEC           4##    4##
TIMING SET UP          5##    5##
LIST SET UP            6##    6##
SEARCH WORD            7##    7##
```

Figure 4-7. Scratch Table Programming Protocol

4.5.1 Disassemblers ($MO°A(N))

Disassemblers are always initiated by the "$MO°A(N)" command, where "N" is the part number of the option. This number can be easily identified by viewing the analyzer configuration in the initial "Power Up" message. The command is followed by a sequence of characters separated by single space characters. The command is executed by one of the execute control characters following the last element of the command sequence.

Figure 4-8 illustrates the command protocol for all Disassembler options. Start and End Addresses refer to the Analyzer's memory address - not the addresses of the recorded instructions. The proper addresses can only be determined by relating the microprocessor addresses to the memory locations of the Analyzer. Note that the "Power-Up" display shows the proper disassembler options installed.

Some examples of the Disassembler Option programming follow.

1. Call the Z80 Disassembler to the CRT.

INPUT:

$MO°A04°W°,

2. Print over the Serial Interface, the 8080 disassembly between address 0000 and 0200.

INPUT:

$MO°A10°S0000°E0200°P°,

4.5.2 Area Trace/Extended Area Trace ($MO°A08)

The AREA TRACE and EXTENDED AREA TRACE menu programming are combined in this description because they are displayed on the same menu. Figure 4-9 shows the AREA TRACE/EXTENDED AREA TRACE MENU. All AREA TRACE programming command strings are initiated by a "$MO°A08" command, and are followed by the commands shown in Figure 4-9, which also illustrates the command protocol.

NOTE

Trace History and Trace Future are only used with the EXTENDED AREA TRACE Option.

Some examples of the AREA TRACE programming follow.

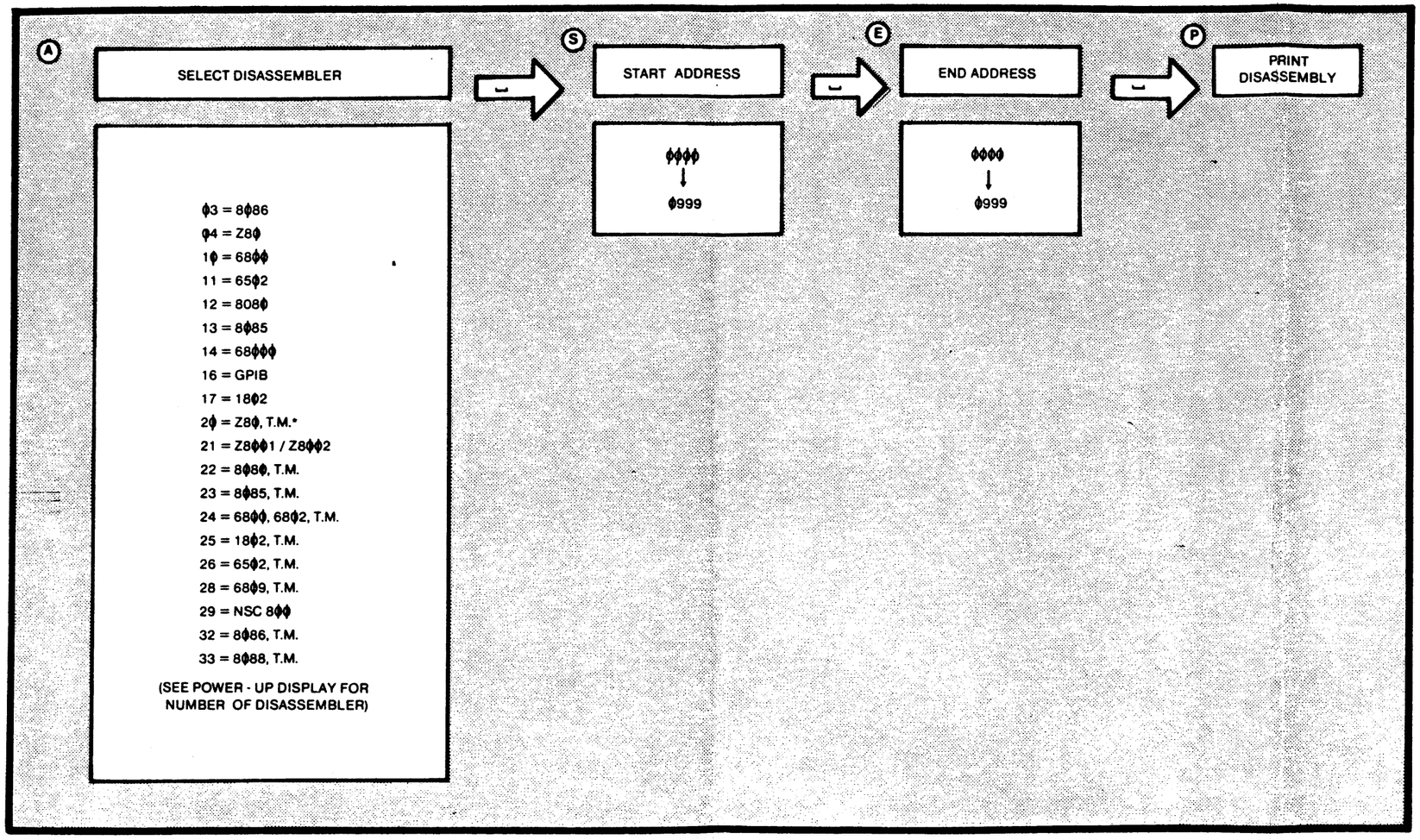
1. A) Area Trace for boundaries:
   0019 - 0022, 00EF - 0100, 02F0 - 02F1
   B) Trace on Lines 1 through 3.

INPUT:

$MO°A08°N01°S0019°E0022°N02°S00EF°E0100°N03°S02F0°E02F1,

BEGIN COMMAND STRING WITH

$ M O ␣



END WITH

, (COMMA)

*T.M. = TRACE MODULE

Figure 4-8. Disassambler Programming Protocol

BEGIN COMMAND STRING WITH	END WITH
$MO␣A∅8	, (COMMA)

AREA TRACE/EXTENDED AREA TRACE PROTOCOL
$MO␣A∅8␣N␣O␣S␣E␣H␣F␣,

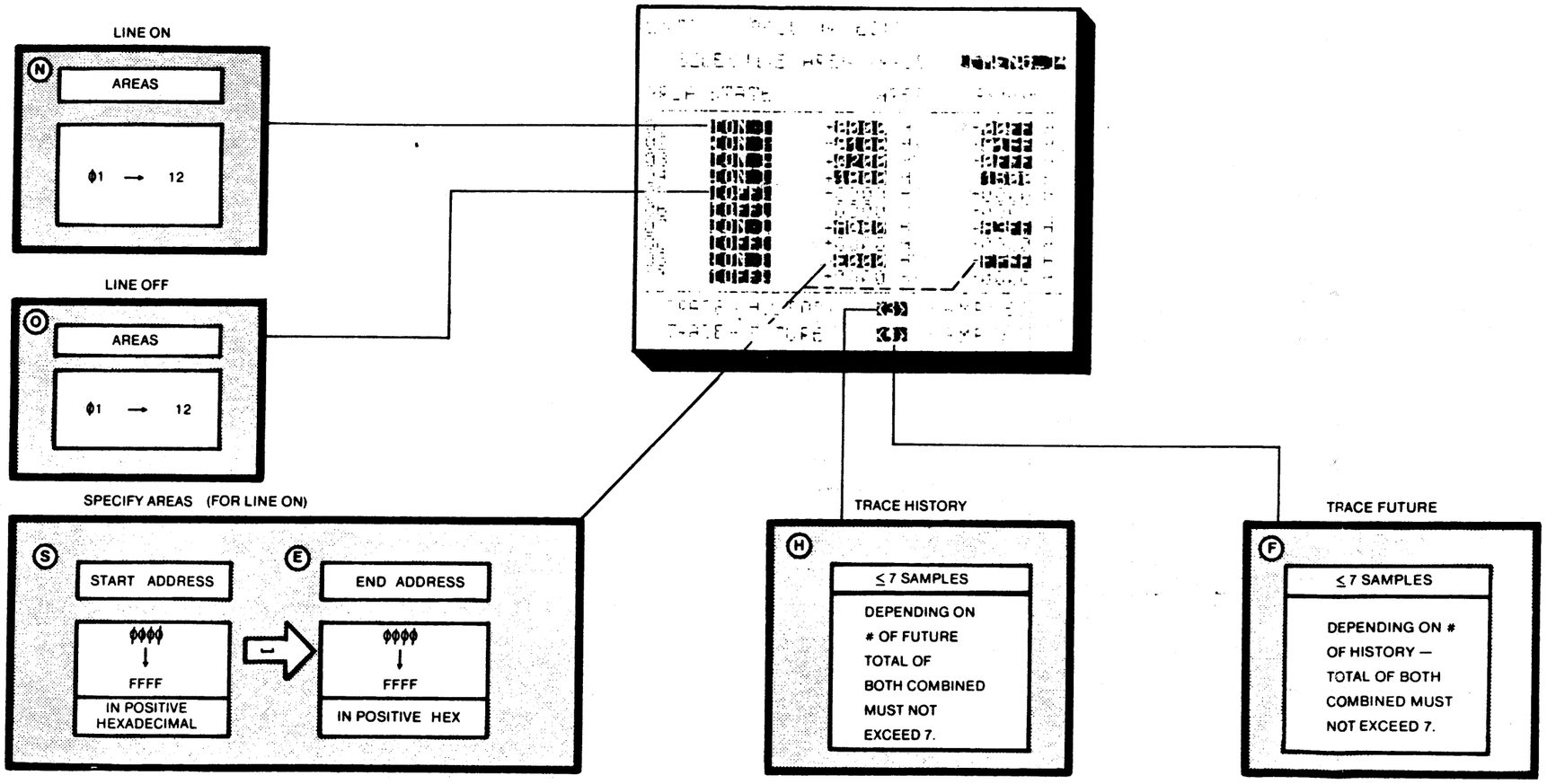


Figure 4-9. Area Trace/Extended Area Trace Programming Protocol

2. A) Turn OFF line 2
   B) Set History samples to 3
   C) Set Future samples to 2

INPUT:

$M0°A08°002°H3°F2°,

The Area Trace Menu setup may be sent to the controller or terminal by using the menu transmit commands shown below. The format it returns can be used to program the Analyzer.

INPUT:

M0°A08°X(N)

N=

A - Transmit all areas, history, and future.
B - Transmit all areas set to ON.
C - Transmit all areas set to OFF.
S - Transmit history and future values.

4.5.3 300 MHz High Speed Memory Option (300MHz HSM)

The 300 MHz HMS command strings are initiated by a "$M0°A05" command. Figure 4-10 shows an illustration of the 300 MHz HSM MENU, and also shows the command protocol for the 300 MHz HSM Option.

Table 4-6 shows the numbers used to change the Clock Speed of the 300MHz HSM Option.

TABLE 4-6. 300 MHZ CLOCK SETTINGS

INPUT #	SETTING	INPUT #	SETTING
00	3.3 ns	11	10 us
01	6.6 ns	12	20 us
02	13.3 ns	13	50 us
03	20 ns	14	100 us
04	50 ns	15	200 us
05	100 ns	16	500 us
06	200 ns	17	1 ms
07	500 ns	18	2 ms
08	1 us	19	5 ms
09	2 us	20	20 ms
10	5 us		

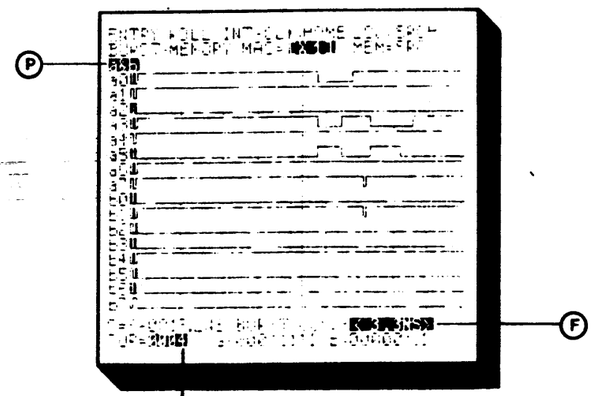
300MHz BURST MEMORY PROTOCOL
$MO␣Aϕ5␣X␣F␣C␣P,

BEGIN COMMAND STRING WITH	END WITH
MO ␣ Aϕ5 ␣	, (COMMA)

CLOCK SELECT

Ⓕ

ϕϕ → 2ϕ
SEE TABLE 4-6 IN TEXT FOR SETTINGS



CURSOR POSITION/ MAGNIFICATION

Ⓒ

ϕϕϕ 5ϕϕ = X1MAG
ϕϕϕ 398 = X5 MAG
ϕϕϕ 449 = X1ϕ MAG

Ⓟ CHANNEL ARRANGEMENT

DELETE

WANT TO DELETE A CHANNEL?

YES

INPUT

$MO␣Aϕ5␣

EXAMPLE

MO␣Aϕ5␣6ϕ,

INPUT POSITION OF LINE ON SCREEN IN HEX. THEN FOLLOW IMMEDIATELY WITH "O" AND ","

NO

EXAMPLE

ϕ = LINE ϕ
1 = LINE 1
2 = LINE 2
3 = LINE 3
D = LINE 14
E = LINE 15
F = LINE 16

aϕ a1 a2 a3 b5 b6 b7

CHANGE DISPLAY

WANT TO CHANGE A CHANNEL NAME?

YES

INPUT

MO␣Aϕ5␣

INPUT POSITION OF LINE WHERE NEW CHANNEL IS DESIRED IN HEX

EXAMPLE

MO␣Aϕ5␣4B3,

INPUT POD AND CHANNEL NUMBER DESIRED

PODS	CHANNEL
A, B	ϕ → 7

THEN FOLLOW WITH "."

NO

WHAT'S WRONG WITH YOU?

Figure 4-10. 300 MHz High Speed Memory Programming Protocol

An example of a possible (albeit complicated) program follows.

1. A) Mag. X5
   B) Select Clock 00
   C) Move Cursor to position 243
   D) Channel 0 to OFF
   E) Change Channel 3 to 7 on Pod B
   F) Select Sequential Search
   G) Select Pod B, in Binary base
   H) Select level 01 for Sequential Search
   I) Program Word A: 00X01111
   J) Program Word B: 11110X00
   K) Search until Word 01
   L) Search for next event
   M) Display HSM 300
   N) Execute the command

INPUT:

$MO°A05°X05°F00°C243°P00°P3B7°DS°BBB°S01°GA00X01111°GB11110X00°L01°AE°W°,

4.5.4 4K Memory

All commands associated with TIMING DIAGRAM and LIST DISPLAY printout are in effect. Some of the key points are:

- Memory locations can be defined between addresses 0000 and 4071.
- Both the MP and the MX commands will work, keeping in mind the new address range. (One pod at a time!)
- Diagram rearrangement is possible.

4.5.5 Extended RS-232-C Interface

The Extended RS-232-C Interface includes a separate menu to display and allow changes of the interface setup. Figure 4-11 shows an illustration of the SERIAL COMMUNICATIONS INTERFACE MENU. Figure 4-11 also illustrates the command protocol used with this option. All parameters shown are programmable through the RS-232-C Interface.

An example of a possible program follows:

$MI°CX028°B4800°DF°L80°S0000°P000°IR9°IT8,

If there is any doubt as to the form of a setup command, one solution is to use the menu to select the desired command, then use the command "$MI°MP°BS", to print the setup to the terminal. The resulting command string will be in exactly the same form as the command used to program the analyzer.

SECTION 5

ANALYZER MENU AND DISPLAY PRINTING

5.1 GENERAL

The various interfaces allow for hardcopy printout of Analyzer menus and displays. With the exception of the EXTENDED TRIGGER MENU, the TIMING DIAGRAM, and the AREA TRACE these are printed out exactly as they appear on the CRT of the Analyzer.

5.2 MENU PRINT (MP)

Menu Print commands are initiated by a "$MP" command followed immediately by a space, and then by the command "T(N);" where N is the desired menu to print. These commands can be sent from the GPIB bus, causing the information to be sent over the RS-232-C interface. Menus are then transferred to the RS-232-C port to a display or printer where hard copies are generated.

Menu Print Commands are divided into three types; those that print the menus, one that prints the EXTENDED TRIGGER MENU set-up information, and those that print displays. Menus printed (excluding the EXTENDED TRIGGER) do not need commands that set up the format for the printout. Displays must be qualified - given which pods, start address, end address, etc. desired for printing. Figure 5-1 shows the Print Command structure.

5.2.1 Print Screen - T(N)

The following commands are added to the "MP°T" command:

N = R Trace (Format) Menu
= C Compare Menu
= I Interface Menu (Extended RS-232-C only)

5.2.2 Print Buffer Contents - B(N)

This command is used to transmit the buffer contents to the RS-232-C port. For example, this command would be used to transmit data after a "MX" (transmit) command was issued.

N = S Send Buffer

5.2.3 EXTENDED TRIGGER MENU Transmit Command (X)

This command allows the EXTENDED TRIGGER set-up information to be printed to a terminal or GPIB controller.

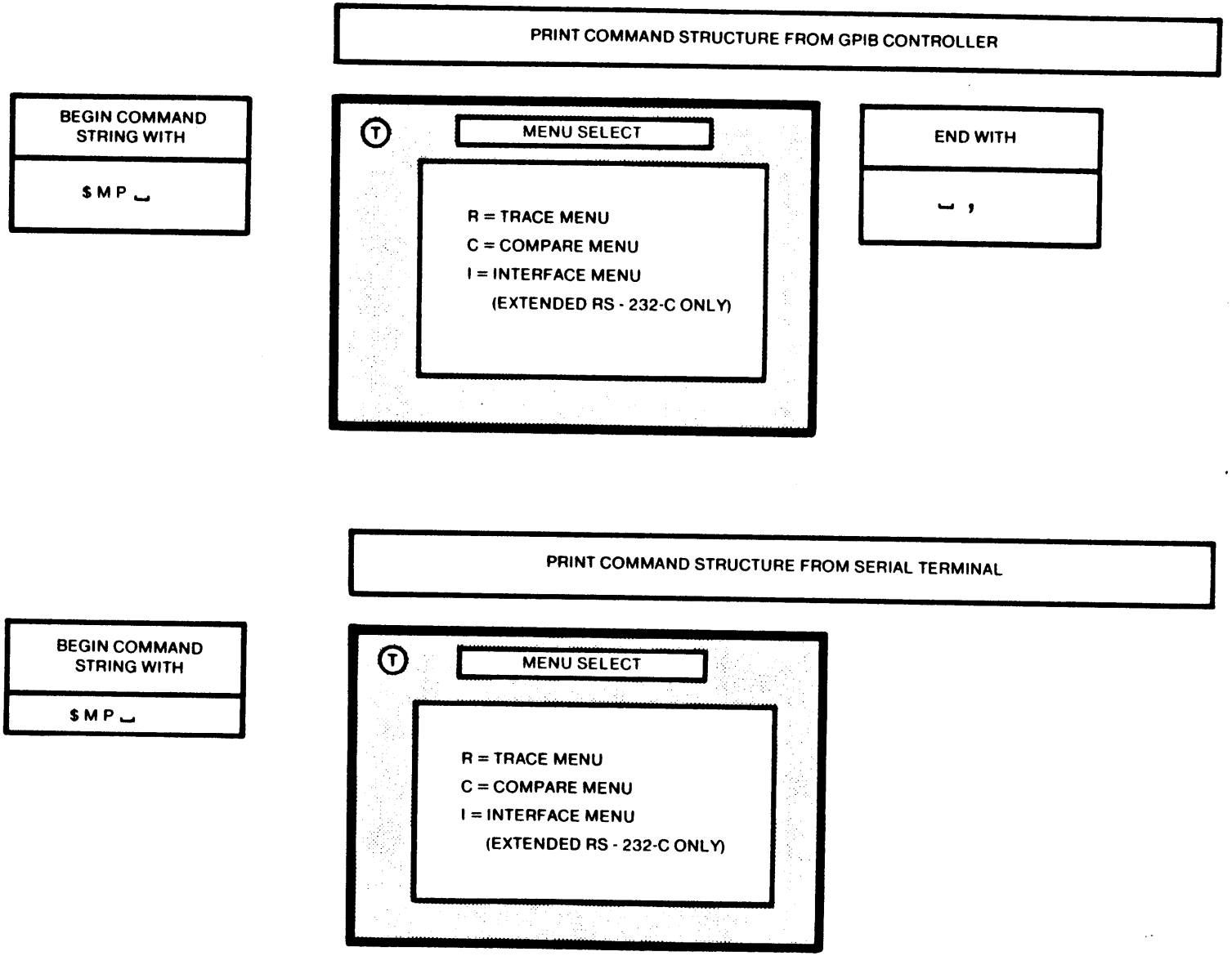


Figure 5-1. Print Command Structure

INPUT:

$MO°A07°X

NOTE

THIS MUST BE FOLLOWED BY "MP°BS" WHEN PRINT-OUT TO A SERIAL TERMINAL IS DESIRED.

There is no command available which will print the EXTENDED TRIGGER set-up in the menu format.

5.3 LIST DISPLAY PRINT COMMAND (MP°L)

The LIST DISPLAY Print Command allows data from specified pods between programmed boundaries to be printed out on the RS-232-C ports. See Figure 5-2 for a Programming Chart.

The Pod Select Command (P(N1, N2, N3)) can be used as many times as necessary to select all the pods needed in a display. Note that this portion of the command structure may be left unprogrammed, in which case, the Analyzer will send back the LIST DISPLAY exactly as it appears, without modification. The Pod Select Command can also exceed the Analyzer's screen size, but is limited by the terminal or printer line size.

Some examples of the LIST DISPLAY Print Command follow.

1. A) Print all six Pod Groups
   B) Positive polarity
   C) From Addresses 0100 to 0107

INPUT:

$MP°L°PA+B°PB+B°PC+B°PD+B°PE+B°PF+B°S0100°E0107,

2. Using same display:
   A) Print from addresses 0200 to 0300

INPUT:

$MP°L°S0200°E0300,

Note that in the example above, the Pod Select Command was ignored, which will cause the Analyzer to respond with the same parameters as before.

5.3.1 LIST DISPLAY Change Command (MP°C)

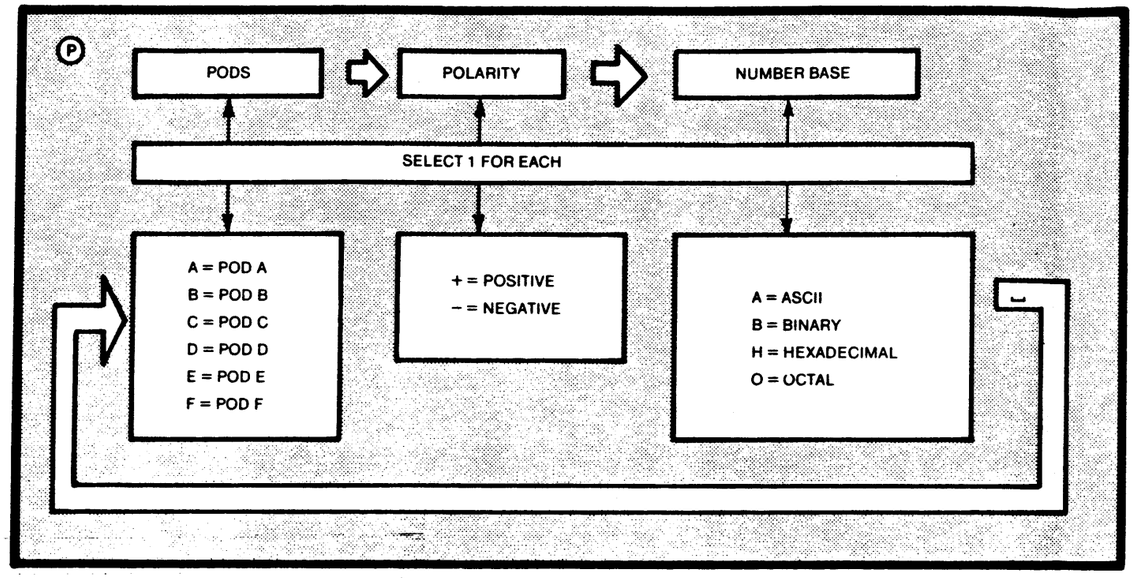
The LIST DISPLAY can be changed only with the Standard RS-232-C option. When the Change List Command is used, the data value of a Pod and its specified address can be changed. Note that this change is only reflected in the DATA LIST and not in the TIMING DIAGRAM.

FOR GPIB CONTROLLER

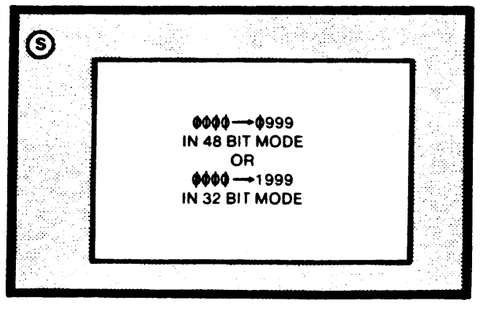
BEGIN COMMAND STRING WITH	END WITH
$MP␣L	, (COMMA)

LIST DISPLAY PRINTOUT PROTOCOL
$MP␣L␣P␣S␣E␣,

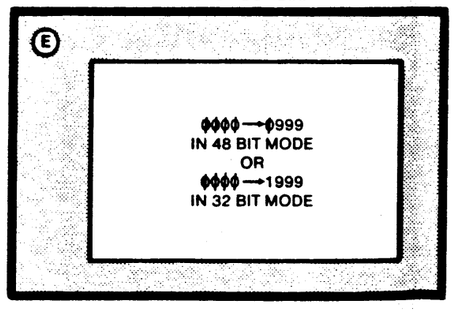
LIST DISPLAY PRINTOUT



START ADDRESS



END ADDRESS



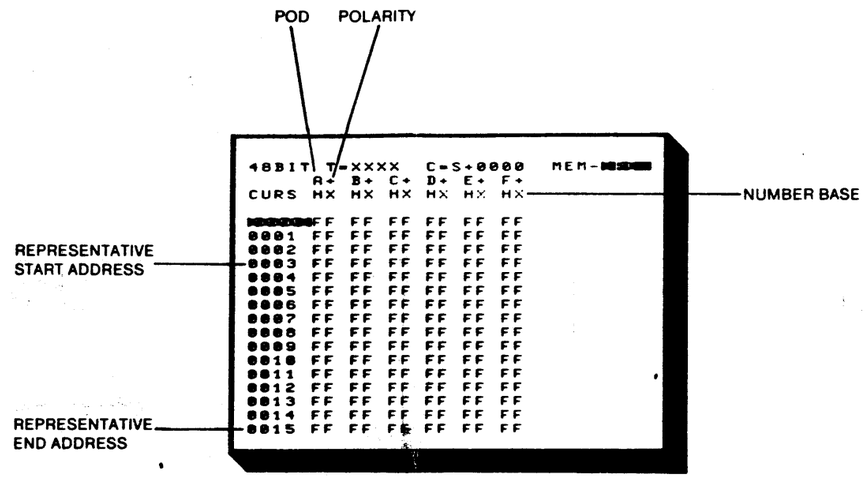


Figure 5-2. List Display Printout Protocol

INPUT:

$MP°C°SXXXX

Where;

XXXX = Start Address; 0000 through 0999 or 1999, depending on the format configuration (48 or 32 bit mode).

ANALYZER RESPONDS:

```
      A    B    C    D    E    F
0000  FF   FF   FF   FF   00   00
```

To change Pod B, for example:

INPUT:
B

ANALYZER RESPONDS:

```
      A    B    C    D    E    F
0000  FF   FF   FF   FF   00   00 B=
```

INPUT HEXADECIMAL VALUE OF THE DATA BYTE FOLLOWED WITH A SPACE:

0000 FF FF FF FF 00 00 B=AA°

To change another Pod assignment on this line, type in the Pod and repeat the procedure above. To exit the Change List Command mode, type a period (.). To review back through the list to check on a result or change a forgotten pod, use the "^" symbol.

5.4 TIMING DIAGRAM PRINT COMMAND (MP°D)

The TIMING DIAGRAM Print Command causes the Analyzer to send a representative printout of the TIMING DIAGRAM to the RS-232-C port. The printout covers 58 memory locations per line and continues to print until the end of the specified end address. Figure 5-3 shows a Programming Chart.

An example of the TIMING DIAGRAM Print Command follows.

1. A) Print timing representation of channel A1
   B) Addresses 0015 through 0030
   C) All four formats (S,R,S+R,R+S)

INPUT:

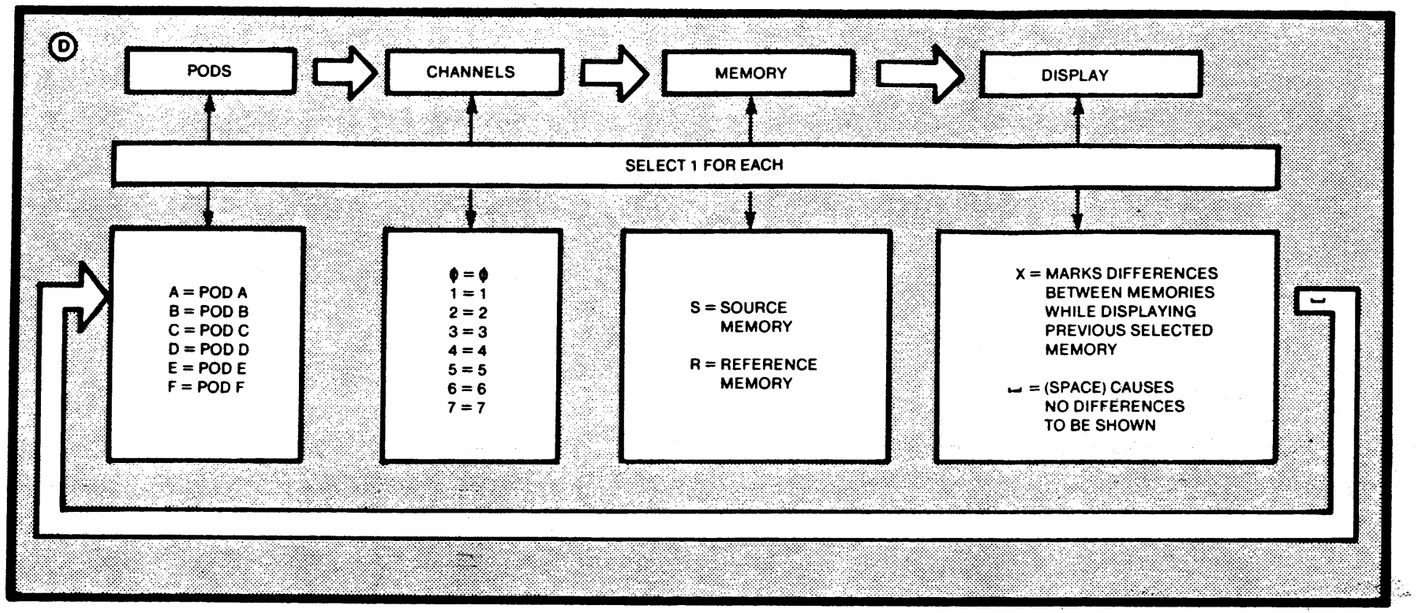
$MP°DA1S°DA1R°DA1SX°DA1RX°S0015°E0030,

See Figure 5-4 for the Analyzer response.

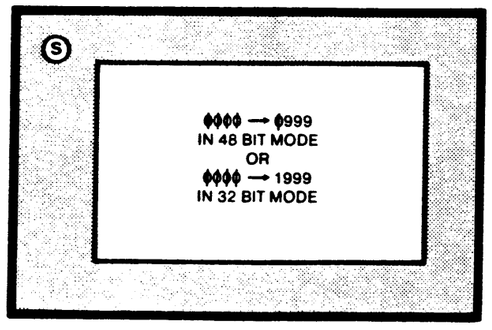
BEGIN COMMAND STRING WITH	END WITH
$MP␣	, (COMMA)

TIMING DIAGRAM PRINTOUT PROTOCOL
$MP␣D␣$␣E,

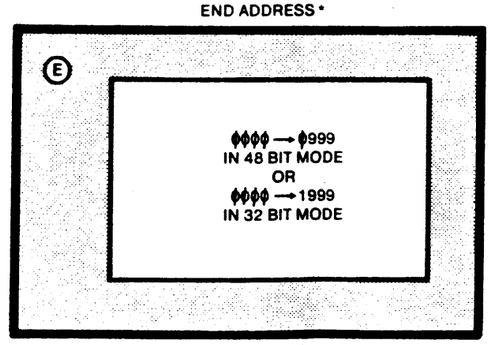
TIMING DIAGRAM PRINTOUT



START ADDRESS *



END ADDRESS *



* LEADING ZEROES ARE REQUIRED

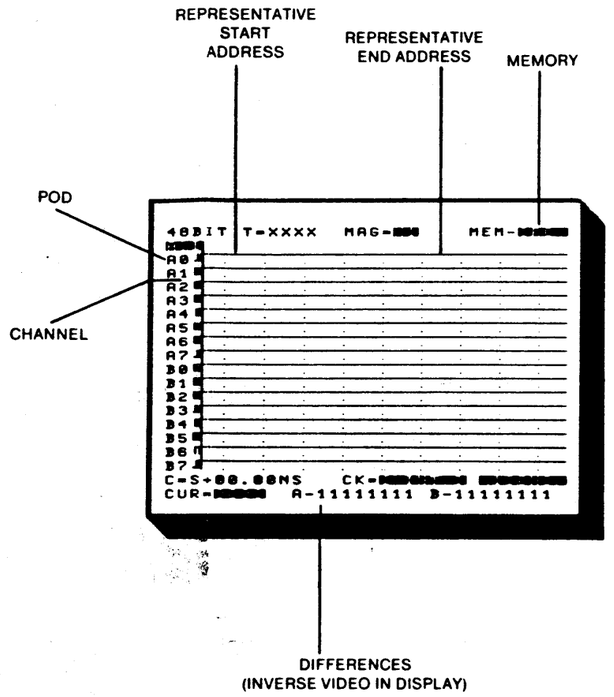


Figure 5-3. Timing Diagram Printout Protocol

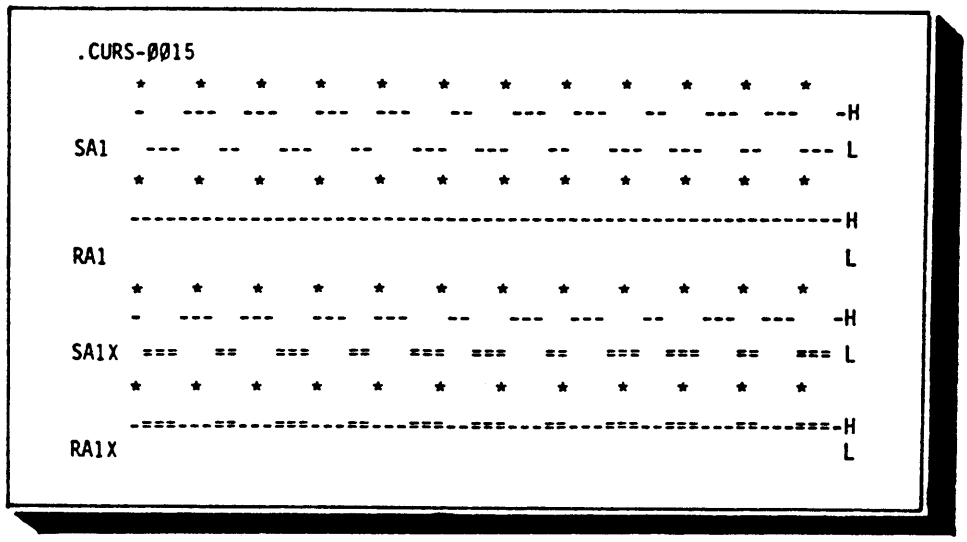


Figure 5-4. Timing Diagram Printout Example

5.5 MENU PRINT BUFFER (MPB)

The Menu Print Buffer Commands are initiated by a "$MPB" command followed by a space, and then the "T(N)" command; where N is the desired menu or display to print. These commands are used to control printing to the GPIB buffer, for reading back to a GPIB controller. This command allows transmission of menus or data list over the GPIB bus, in the same format as displayed on the Analyzer CRT. When the requested information exceeds the Transmit Buffer capacity, the SRQ is activated, and the controller is requested to read out information. Loading then will continue. See the previous sections above for specific command syntax.

NOTE
This function is not available
with the Extended RS-232-C option.

SECTION 6

TRANSMISSION

6.1 GENERAL

The LAM 4850A and the 64300 Analyzers can transmit Menu setup information and recorded data. The analyzers also allow for the "downloading" and "uploading" of data through the GPIB, RS-232-C, and Extended RS-232-C interfaces. This capability allows for storage and retreival of data from an external computer and/or controller.

6.2 TRANSMISSION MODE (MX)

A Transmission Mode command is initiated by a "$MX" followed by additional command characters described below. A "Buffer Send" command "$MP°BS" must follow (RS-232-C only).

6.2.1 Menu Transmission - MX°(N)

This command prepares the analyzer to send back the selected menu setup. The format it returns can be used to program the analyzer.

N =	R	TRACE MENU
=	C	COMPARE MENU
=	F	SEQUENCE SEARCH MENU
=	V	Monitor results in clear text. Either setup results or COMPARE MENU setup are sent back, depending on the menu displayed on the LAM's screen.
=	I	INTERFACE MENU (extended RS-232-C only)
=	B(N)	Batch file; N = 0 to 8 for file selected

6.2.2 EXTENDED TRIGGER MENU Transmission - MO°A07°X

This command prepares the analyzer to send the EXTENDED TRIGGER MENU set-up to an external device. The format it returns can be used to program the analyzer.

6.2.3 TIMING DIAGRAM Setup - MX°D(N)

Prepares the analyzer to send back the TIMING DIAGRAM setup.

N =	A	Pods A&B
=	C	Pods C&D
=	E	Pods E&F

6.2.4 Data Transmission MX

Data Transmission using the MX command is different than the MP command. The MX command sends back the data (in Intel Hexadecimal) from Reference or Source Memories using block transfers, and includes coded information. This is useful with intelligent terminals or computers, whereas the MP command sends back data listings similar to the LIST DISPLAY of the analyzer for hard copy printout.

NOTE

"&S" for Source Memory select, and "&R" for Reference Memory select must precede the "MX" Command.

The command is in the form of:

$MX°P(N1-N6)°SXXXX°EYYYY ,

N1-N6	=	Pods A thru F
XXXX	=	0000 thru 0999 or 1999 depending on format configuration (48 or 32 bit mode)
YYYY	=	0000 THRU 0999 OR 1999 DEPENDing on format configuration (48 or 32 bit mode)

Leading zeroes are not required for this command. The range specified must be equal to or greater than two locations.

Example:

$MX°PA°S0000°E0100 ,

This command prepares the analyzer for data transmission. This should be followed by a "MP°BS", command to start the transfer (RS-232-C only).

6.3 DOWNLOADING SEQUENCE

Both the LAM 4850A and 64300 have the capability for downloading data through the GPIB or RS-232-C interfaces. This allows data to be stored away through a computer/ controller for analysis or temporary storage for uploading later. The sequence to perform downloading is as follows:

1. Program Transmission Format and Memory Select
2. Program menus for recording desired.
3. Take a recording.
4. Request data from analyzer through the Data Transmission command.

5. Send the buffer contents with the command "MP°BS". (RS-232-C only)

Figure 6-1 is an example of a generic program that will download data to a computer for storage. It is not written in a specific language but does show the general procedure.

```
 10  LAM = "LAM4850A"
 20  COMP = "COMPUTER OR CONTROLLER"
 30  DISP = "COMPUTER DISPLAY"
100  PRINT TO LAM,"$113 &S,"
110  PRINT TO LAM,"$MR D0899,"
120  PRINT TO LAM,"$MT BHHHHHH L1 F0 PA00 ?S,"
130  CHECK STATUS
140  PRINT TO LAM,"$MX PAB S0100 E0120 ,"
141  PRINT TO LAM,"$MP BS,"(only on RS-232-C)
150  INPUT TO COMP,DATA$
160  IF FIRST CHARACTER OF DATA$ ="Y" THEN 150
170  IF FIRST CHARACTER OF DATA$ ="N" THEN 210
180  PRINT TO DISP,DATA$
190  IF DATA$ ="END" THEN 220
200  GO TO 150
210  PRINT TO DISP,"ERROR IN PROGRAMMING, ";DATA$
220  END OF PROGRAM
```

TRIGGER COMMAND USE 64300 TYPE CARD

Figure 6-1. Sample Download Program

After completion of the program, the results will be similar to the one shown below:

```
(:05000005000064000080
:15A064000007154F1513F80007154F1513F80007154F1513F892
:15B06400FF8B4500450057FF8B4500450057FF87450045005752
:0000000000)
END
```

Appendix C describes in detail the format of these blocks.

6.4 UPLOADING SEQUENCE

The LAM 4850A and 64300 are able to upload data with the GPIB or RS-232-C interfaces through a computer or controller. Generally data to be uploaded is taken from the analyzer through the download sequence. Either the Source or Reference memory can be uploaded to allow the analyzer to make data comparisons. The sequence used to perform uploading is as follows:

1. Program Transmission Mode and Memory Select.

2. Enter in data to be stored to the analyzer in the form "$(FIRST BLOCK, DATA BLOCK 1, DATA BLOCK 2.. . DATA BLOCK n, LAST BLOCK),".

3. Verify uploading is complete by checking the status. An erroneous block of information can be deleted.

IMPORTANT

DATA UPLOADED INTO THE SOURCE OR REFERENCE MEMORY IS ONLY DISPLAYED IN A STATE LIST OR DISASSEMBLY. TIMING DIAGRAMS DO NOT REFLECT UPDATED INFORMATION OR REFERENCE TIMING OPTION.

Using the data returned from the downloading sequence example, the generic program shown in Figure 6-2 below will upload the data into the analyzer's Reference memory.

```
 10  LAM = "LAM4850A"
 20  B1$ = "(:05000005000640000BC"
 30  B2$ = ":15A06400007154F1513F800071154F1513F0
     007154F1513F892"
 40  B3$ = ":15B06400FF8B4500450057FF8B4500450057
     FF87450045005752"
 50  B4$ = ":0000000000)"
100  PRINT TO LAM,"$113 &R,"
110  PRINT TO LAM,B1$;B2$;B3$;B4$;,
```

Figure 6-2. Sample Upload Program

SECTION 7

SPECIAL FEATURES

7.1 INTRODUCTION

The Dolch logic analyzers offer several special features that enhance the flexibility and power of the interface function. This section covers the following special features:

- Text Writing
- Batch File Handling
- Set-Up Monitor Results
- Cursor And Baud Rate Commands
- Display Status Information

7.2 TEXT WRITING

The LAM 4850A and 64300 CRTs can be used to display any text message desired. This is useful in displaying prompting messages to the operator. There are two methods of displaying text on the screen of the Analyzer:

- Text display on blank screen
- Formatted text on blank screen or menu.

In both cases, the Transmit Buffer is used as the CRT Buffer. To clear all data:

INPUT:

$MW°B°F[number of lines to be filled with "blanks"]°,,

7.2.1 Text Display

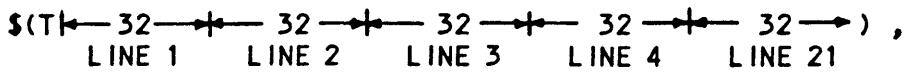
Once the Transmit Buffer is cleared, a text string can be sent in the following format:

INPUT:

$(T"TEXT STRING")

The text string follows immediately after the character "T". It must not contain an "*" (asterisk) - as this will cause a reset to occur. Also, the Analyzer will not recognize control characters such as "CTRL-M" OR "CTRL-J" (CR or LF).

The Text String is formatted as follows:



Where;

32 is the numbers of characters per line (including spaces) and 21 is the number of lines on the screen.

To display the written text string (display buffer):

INPUT:

$MW B ,

7.2.2 Formatted Text

The text format command allows combinations of text and menus or just text with line skip, blink line, invert line and normal writing capabilities. The command is formatted in the following manner:

$MW P(<-------- 21 BYTES -------->) B ,

Each of the 21 bytes must contain one of the following commands:

00	Normal writing
01	Blank skip (no blanks out to CRT)
02	Transmit Buffer
04	Blinking line
20	Transmit Buffer
40	Inverse line
80	Skip line on CRT only

7.2.2.1 An example of a text format command is shown in Figure 7-1 below.

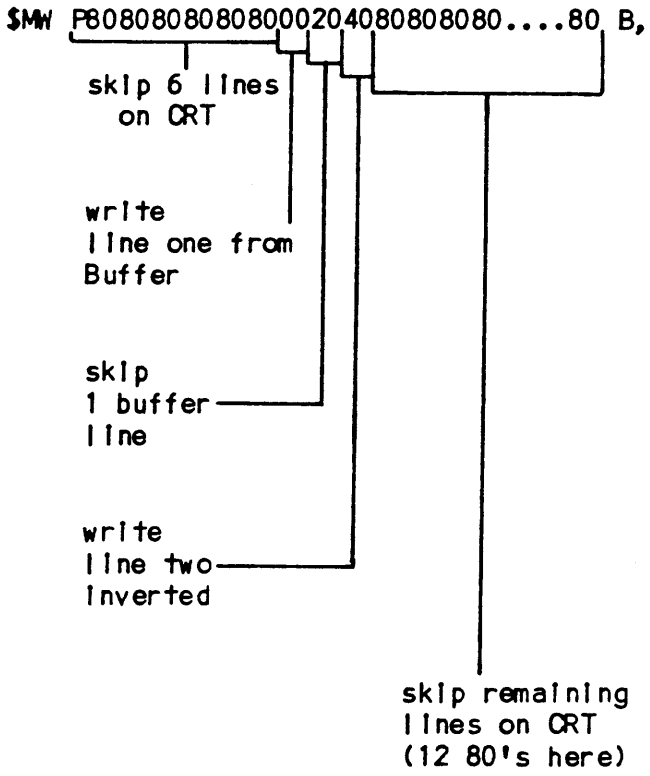


Figure 7-1. Text Format Command Example

7.2.3 Examples of Text Writing Programs.

Figure 7-2 shows how to set up text displays on the Analyzer CRT, Figure 7-3 shows how to set up text within an existing display, and Figure 7-4 illustrates how to set up text display on a blank screen.

Figure 7-2. Text Display On Analyzer CRT

```
10 SEND "$MW B F21,"              !CLEAR BUFFER
20 WAIT
30 SEND $(T<--TEXT STRING-->) !ENTER TEXT STRING
```

Figure 7-3.Text Display Within An Existing Display

```
10 SEND "$MW B F21,"              !CLEAR BUFFER
20 WAIT
30 SEND $(T<--TEXT STRING-->)  !ENTER TEXT STRING
```

Figure 7-4. Text Display On A Blank Screen

```
10 SEND "$MW B F21,"                 !CLEAR BUFFER
20 WAIT
30 SEND "$MW B,"                     !DISPLAY EMPTY SCREEN
40 WAIT
50 SEND "$(T<--TEXT STRING-->) ,"    !ENTER TEXT STRING
60 SEND "$MW P(<-21 BYTES->) B,"     !DISPLAY FORMATTED
                                     !BUFFER
```

7.3 BATCH FILE HANDLING (MB)

The LAM 4850A and 64300 provide the user with the ability to store and execute up to nine batch files, each 350 bytes long. Batch files may be used to efficiently manipulate often repeated setups.

7.3.1 Storing Batch Files

The "$[N (Command String)]" Command stores away command strings for future use. Note that each batch file must be indivdually stored. Where;

N = 0 to 8 for each of the 9 files available

And Where;

(Command String) = any string up to 350 bytes long

An example of a Store Batch File is as follows:

$[1°MR°S0°G1°F22°D0500]

7.3.2 Executing Batch Files

The "MB°F(N1,N2)" Command executes batch files that have been previously stored. Where;

N1 = 0 to 8 For first file executed
N2 = 0 to 8 For last file to be executed
Including all files from N1 to N2.

An example of a command that executes files 1 through 3 is as follows:

$MB°F13

NOTE

Nested batch files are not allowed. Also, the batch file area will be cleared at power OFF.

7.4 MONITOR RESULTS (MV)

This command is used to get monitor information back from the LAM 4850A and 64300. The results are prepared and stored into the Transmit Buffer.

The command format is:

MV°(N) Where;

N = S Setup results in coded information
N = C Compare results in coded information

NOTE

This command must be followed by "MP°BS" when a serial terminal is used.

7.4.1 Code Information

Code Information for the SET-UP MONITOR is given in Table 7-1, and for the COMPARE MENU, in Table 7-2.

Table 7-1. SET-UP MONITOR Codes

Bit	Description
2(7)	Compare setup in error
2(6)	Not used
2(5)	" "
2(4)	" "
2(3)	" "
2(2)	Trigger word sample clock has to be assigned to an active pod group
2(1)	Pod skew > trigger delay (negative trigger delay)
2(0)	All pods off
0	Valid Set-Up

Table 7-2. COMPARE MENU Codes

Bit	Description
2(7)	Not used
2(6)	End address & skew> end address
2(5)	Start address- skew< memory start address
2(4)	Start address> end address
2(3)	Data format mismatch
2(2)	All selected pods disabled
2(1)	Not used
2(0)	" "
0	Valid Set-Up

7.5 CURSOR AND BAUD RATE COMMAND (MH)

The "MH" command supports cursor movement and the baud rate for the Standard RS-232-C Interface. It is initiated by the "$MH" command followed by the commands below.

7.5.1 Cursor Move

The "MH°C(N)" command moves the cursor on either the TIMING DIAGRAM or LIST DISPLAY, where;

N = 0000 thru 0999 or 1999, depending on format configuration (48 or 32 bit mode)

7.5.2 Baud Rate Select

The "MH°B(N)" command selects the baud rate for the Standard RS-232-C Interface, where:

N = 0 110 baud
= 1 300 baud
= 2 600 baud
= 3 1200 baud
= 4 2400 baud
= 5 4800 baud

7.6 DISPLAY STATUS INFORMATION

A serial poll routine may be used to read the Analyzer's status byte, thereby allowing a user to determine the actions of the Analyzer at any given moment.

A typical example for the serial poll is the following program example.

NOTE

In this example the "[]" (brackets) are not part of the program, but are used to explain the program element immediatley before it.

```
10 DIM S (500)

20 SENDBUS 7[Device ADD];223[Unt.],191[Unl],152[SPE],196[MTA]

30 WAIT 300

40 S = READBIN (704) [7 = Device Address, and 04 = LA Address]

50 SENDBUS 7;191[Unl],25[SPD]

60 PRINT S[Status Byte]
```

The Status Byte format is shown in Figure 7-5.

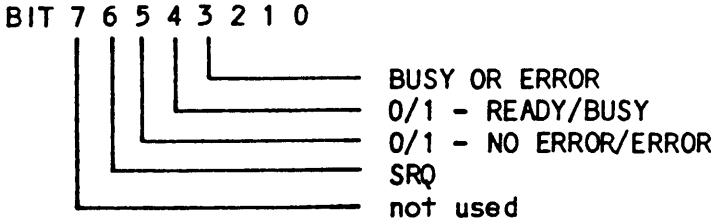


Figure 7-5. Status Byte Format

MENU/DISPLAY COMMAND FUNCTIONAL INDEX

	PROGRAM	DISPLAY	TRANSMIT	PRINT SCREEN SERIAL[1]	PRINT BUFFER GPIB ONLY	
TRACE MENU	**$MP***	**$MP*R**	**$MP*X**	**$MP*TR**	**$MP*TR**	**COMMAND**
	4.4.1.1	4.4	6.2.1	5.2.1	5.5	TEXT (PAR)
		4-4				TABLE (#)
	4-1			5-1		FIGURE (#)
	4.4.1.1					EXAMPLE (PAR)
TRIGGER MENU	**$MP*A07**	**$MP*A07*A(N)**	**$MP*A07*X**			**COMMAND**
	4.4.1.2	4.4	6.2.2			TEXT (PAR)
		4-5				TABLE (#)
	4-2					FIGURE (#)
	4.4.1.2					EXAMPLE (PAR)
COMPARE MENU	**$MC***	**$MP*C**	**$MP*C**	**$MP*TC**	**$MP*TC**	**COMMAND**
	4.4.1.3	4.4	6.2.1	5.2.1	5.5	TEXT (PAR)
		4-4				TABLE (#)
	4-3			5-1		FIGURE (#)
	4.4.1.3					EXAMPLE (PAR)

[1]All commands must end with the "MP*B$" terminator for both GPIB and Serial Controllers/Terminals.

[2]To change the LIST DISPLAY, use the "MP*C" command. See text for details.

MENU/DISPLAY COMMAND FUNCTIONAL INDEX (continued)

	PROGRAM	DISPLAY	TRANSMIT	PRINT SCREEN SERIAL[1]	PRINT BUFFER GPIB ONLY	
TIMING DIAGRAM	**$MD***	**$MP*D**	**$MD*D(N)**	**$MP*D**		**COMMAND**
	4.4.2.1	4.4	6.2.3	5.4		TEXT (PAR)
		4-4				TABLE (#)
	4-4			5-3/5-4		FIGURE (#)
				5.4		EXAMPLE (PAR)
LIST DISPLAY	**$ML***	**$MP*L[2]**	**$MD*P(N)**	**$MP*TL**		**COMMAND**
	4.4.2.2	4.4	6.2.4	5.3	5.5	TEXT (PAR)
		4-4	6.2.4			TABLE (#)
	4-5			5-2		FIGURE (#)
			6.2.4	5.3		EXAMPLE (PAR)
						EXAMPLE (PAR)
SEARCH FUNCTION	**$MF***		**$MD*F**			**COMMAND**
	4.4.2.3		6.2.1			TEXT (PAR)
						TABLE (#)
	4-6					FIGURE (#)
SCRATCH TABLE	**$MS***					**COMMAND**
	4.4.3					TEXT (PAR)
						TABLE (#)
	4-7					FIGURE (#)

MENU/DISPLAY COMMAND FUNCTIONAL INDEX (continued)

	PROGRAM	DISPLAY	TRANSMIT	PRINT SCREEN SERIAL[1]	PRINT BUFFER GPIB ONLY	
SERIAL COMMUNICATIONS	SHI*	SHW*I	SHO*I	SHP*TI	SHPB*TI	COMMAND
	2.2.3/4.5.5	4.4	6.2.1	5.2.1		TEXT (PAR)
		4-4				TABLE (#)
	2-4/4-7			5-1		FIGURE (#)
	2.2.3					EXAMPLE (PAR)
DISASSEMBLER	SHO*A(N)			SHO*A(N)*P		COMMAND
	4.5.1			4.5.1		TEXT (PAR)
						TABLE (#)
	4-8			4-8		FIGURE (#)
	4.5.1			4.5.1		EXAMPLE (PAR)
ATO/EATO	SHO*A08		SHO*A08*X(N)			COMMAND
	4.5.2		4.5.2			TEXT (PAR)
			4.5.2			TABLE (#)
	4-9					FIGURE (#)
	4.5.2		4.5.2			EXAMPLE (PAR)
300 MHz HSM	SHO*A03					COMMAND
	4.5.3					TEXT (PAR)
	4-6					TABLE (#)
	4-10					FIGURE (#)
	4.5.3					EXAMPLE (PAR)
4K MEMORY	SHI*			SHP*I[2]	SHPBI	COMMAND
	4.5.4/4.4.2.2				5.5	TEXT (PAR)
						TABLE (#)
	4-5			5-2		FIGURE (#)
				5.3.1		EXAMPLE (PAR)

[3]COMMENTS: Same functions/commands available as for LIST DISPLAY and TIMING DIAGRAM.

MENU/DISPLAY COMMAND FUNCTIONAL INDEX

	DISPLAY	TRANSMIT	
MONITOR	^Y	^O"V	COMMAND
	4.4	6.2.1	TEXT (PAR)
	4-4	6.2.1	TABLE (#)
			FIGURE (#)
			EXAMPLE (PAR)
BATCH FILE		^O"B(N)	COMMAND
		6.2.1	TEXT (PAR)
		6.2.1	TABLE (#)
			FIGURE (#)
			EXAMPLE (PAR)
DATA		^O"P(N)	COMMAND
		6.2.4	TEXT (PAR)
		6.2.4	TABLE (#)
			FIGURE (#)
			EXAMPLE (PAR)
BUFFER	^B"B		COMMAND
	4.4		TEXT (PAR)
	4-4		TABLE (#)
			FIGURE (#)
			EXAMPLE (PAR)

SPECIAL FEATURES FUNCTIONAL INDEX

TEXT WRITING	CLEAR	DISPLAY	DISPLAY BUFFER	FORMAT TEXT	FUNCTION
	^N"B"F	$(T" ")	^N"B"	^N"P(N)"B	COMMAND
	7.2/7.2.3	7.2.1		7.2.2	TEXT (PAR)
				7.2.2	TABLE (#)
	7-2/7-3/7-4			7-1	FIGURE (#)
	7.2/7.2.3	7.2.1			EXAMPLE (PAR)
BATCH FILE HANDLING	STORE	EXECUTE			FUNCTION
	$[N(X)]	^N"F(N,X)			COMMAND
	7.3.1	7.3.2			TEXT (PAR)
	7.3.1	7.3.2			TABLE (#)
					FIGURE (#)
	7.3.1	7.3.2			EXAMPLE (PAR)
MONITOR RESULTS	SET-UP	COMPARE MENU	SET-UP CODES	COMPARE CODES	FUNCTION
	^N"S	^N"C			COMMAND
	7.4	7.4			TEXT (PAR)
			7-1	7-2	TABLE (#)
					FIGURE (#)
					EXAMPLE (PAR)
CURSOR & BAUD RATE	CURSOR MOVE	BAUD SELECT			FUNCTION
	^N"C(N)	^N"B(N)"			COMMAND
	7.5.1	7.5.2			TEXT (PAR)
	7.5.1	7.5.2			TABLE (#)
					FIGURE (#)
					EXAMPLE
DISPLAY STATUS INFO	7.6				TEXT
	7-5				FIGURE
	7.6				EXAMPLE

ASCII CHARACTER SET

ASCII Char.	EQUIVALENT FORMS			
	Binary	Oct	Hex	Dec
NULL	00000000	000	00	0
SOH	00000001	001	01	1
STX	00000010	002	02	2
ETX	00000011	003	03	3
EOT	00000100	004	04	4
ENQ	00000101	005	05	5
ACK	00000110	006	06	6
BELL	00000111	007	07	7
BS	00001000	010	08	8
HT	00001001	011	09	9
LF	00001010	012	0A	10
VT	00001011	013	0B	11
FF	00001100	014	0C	12
CR	00001101	015	0D	13
SO	00001110	016	0E	14
SI	00001111	017	0F	15
DLE	00010000	020	10	16
DC1	00010001	021	11	17
DC2	00010010	022	12	18
DC3	00010011	023	13	19
DC4	00010100	024	14	20
NAK	00010101	025	15	21
SYNC	00010110	026	16	22
ETB	00010111	027	17	23
CAN	00011000	030	18	24
EM	00011001	031	19	25
SUB	00011010	032	1A	26
ESC	00011011	033	1B	27
FS	00011100	034	1C	28
GS	00011101	035	1D	29
RS	00011110	036	1E	30
US	00011111	037	1F	31

ASCII Char.	EQUIVALENT FORMS			
	Binary	Oct	Hex	Dec
Space	00100000	040	20	32
!	00100001	041	21	33
"	00100010	042	22	34
#	00100011	043	23	35
$	00100100	044	24	36
%	00100101	045	25	37
&	00100110	046	26	38
'	00100111	047	27	39
(	00101000	050	28	40
)	00101001	051	29	41
*	00101010	052	2A	42
+	00101011	053	2B	43
,	00101100	054	2C	44
-	00101101	055	2D	45
.	00101110	056	2E	46
/	00101111	057	2F	47
0	00110000	060	30	48
1	00110001	061	31	49
2	00110010	062	32	50
3	00110011	063	33	51
4	00110100	064	34	52
5	00110101	065	35	53
6	00110110	066	36	54
7	00110111	067	37	55
8	00111000	070	38	56
9	00111001	071	39	57
:	00111010	072	3A	58
;	00111011	073	3B	59
<	00111100	074	3C	60
=	00111101	075	3D	61
>	00111110	076	3E	62
?	00111111	077	3F	63

ASCII Char.	EQUIVALENT FORMS			
	Binary	Oct	Hex	Dec
@	01000000	100	40	64
A	01000001	101	41	65
B	01000010	102	42	66
C	01000011	103	43	67
D	01000100	104	44	68
E	01000101	105	45	69
F	01000110	106	46	70
G	01000111	107	47	71
H	01001000	110	48	72
I	01001001	111	49	73
J	01001010	112	4A	74
K	01001011	113	4B	75
L	01001100	114	4C	76
M	01001101	115	4D	77
N	01001110	116	4E	78
O	01001111	117	4F	79
P	01010000	120	50	80
Q	01010001	121	51	81
R	01010010	122	52	82
S	01010011	123	53	83
T	01010100	124	54	84
U	01010101	125	55	85
V	01010110	126	56	86
W	01010111	127	57	87
X	01011000	130	58	88
Y	01011001	131	59	89
Z	01011010	132	5A	90
[	01011011	133	5B	91
\	01011100	134	5C	92
]	01011101	135	5D	93
^	01011110	136	5E	94
_	01011111	137	5F	95

ASCII Char.	EQUIVALENT FORMS			
	Binary	Oct	Hex	Dec
`	01100000	140	60	96
a	01100001	141	61	97
b	01100010	142	62	98
c	01100011	143	63	99
d	01100100	144	64	100
e	01100101	145	65	101
f	01100110	146	66	102
g	01100111	147	67	103
h	01101000	150	68	104
i	01101001	151	69	105
j	01101010	152	6A	106
k	01101011	153	6B	107
l	01101100	154	6C	108
m	01101101	155	6D	109
n	01101110	156	6E	110
o	01101111	157	6F	111
p	01110000	160	70	112
q	01110001	161	71	113
r	01110010	162	72	114
s	01110011	163	73	115
t	01110100	164	74	116
u	01110101	165	75	117
v	01110110	166	76	118
w	01110111	167	77	119
x	01111000	170	78	120
y	01111001	171	79	121
z	01111010	172	7A	122
{	01111011	173	7B	123
|	01111100	174	7C	124
}	01111101	175	7D	125
~	01111110	176	7E	126
DEL	01111111	177	7F	127

APPENDIX A

APPENDIX B

TRANSMISSION MODE COMMAND DEFINITION

I(N1,N2) -- This command selects how data will be transmitted and the final termination character for that transmission.

N1=1 : Block transmission mode
N1=2 : Special Commodore PET mode
N1=3 : Standard GPIB transmission mode
N1=4 : (HP) Hewlett-Packard transmission mode

N2=1 : ETX will be final termination, and the EOI CR LF will be final termination.
N2=2 : "END" will be final termination
N2=3 : NUL will be final termination
N2=4 : NOT will be final termination

Once a transmission mode command is sent, the transmission mode and final termination character will remain in effect until changed or a power-up reset occurs.

Default setup is I31.

EXAMPLES:

(is a transmitted bracket character; [ ] are delimiters which are not transmitted.

Block transmission mode (N1=1):

([:][START BLOCK][:][DATA] . . . [:][LAST BLOCK])

Special Commodore PET transmission mode (N1=2):

([S][START BLOCK][CR][S][DATA][CR] . . . [:][LAST BLOCK][CR])

Standard GPIB transmission mode (N1=3):

([:][START][CR][LF][:][DATA][CR][LF] . . . [:][LAST BLOCK][CR][LF])

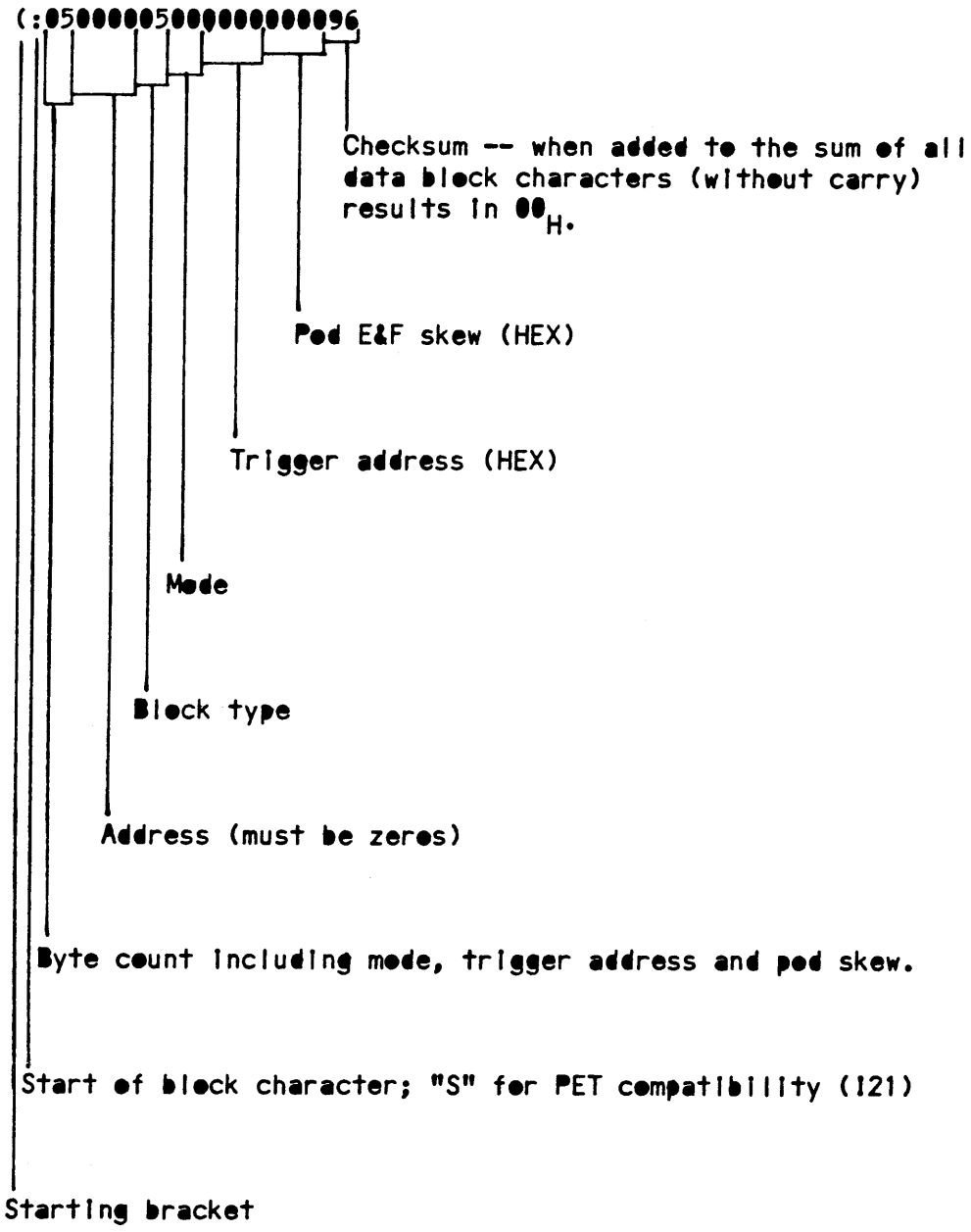
HP (Hewlett-Packard) transmission mode (N1=4):

([:][START][CR][:][DATA][CR][. . . [:][LAST BLOCK][CR])

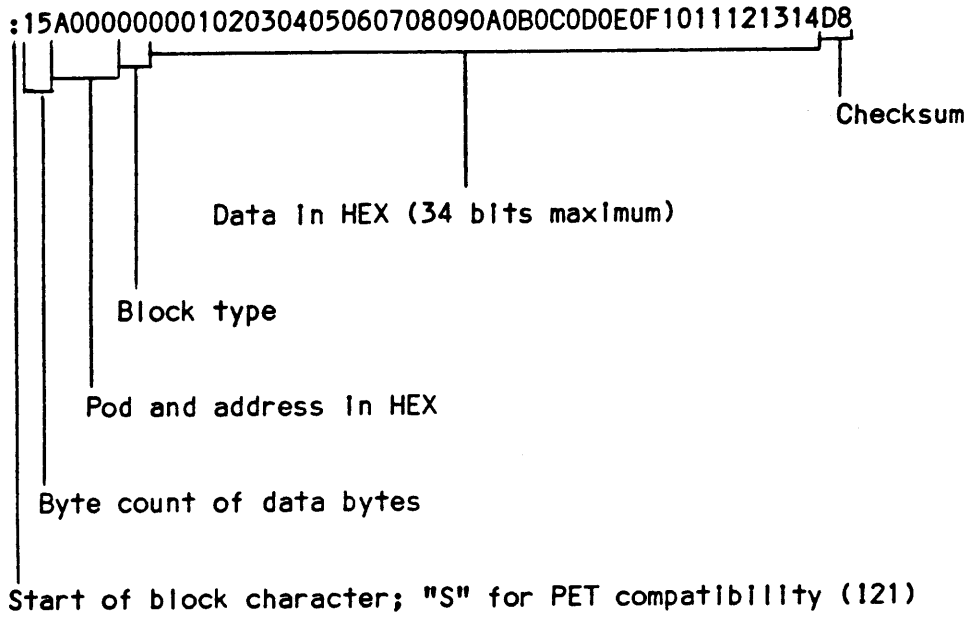
APPENDIX C

Block Definition:

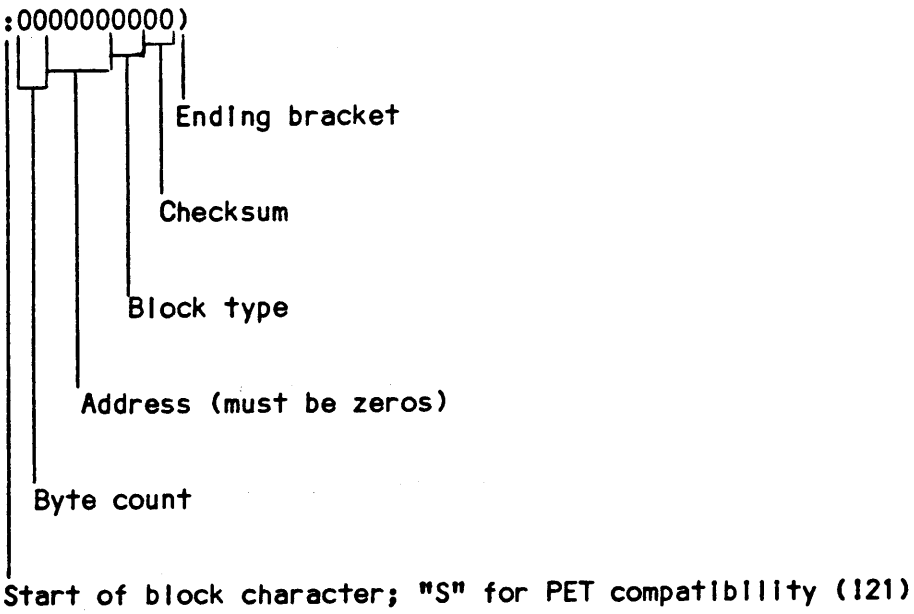
First Block



Data Block

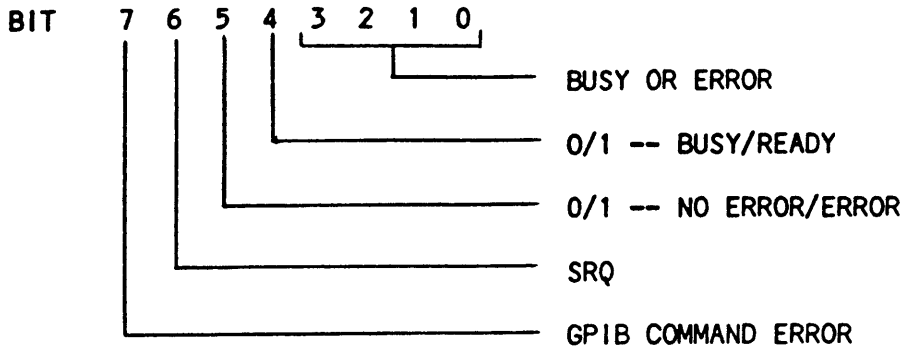


Last Block



APPENDIX D

BUSY AND ERROR CODES



BUSY CODES

BIT 3210

0000 INTERPRETER ACTIVE

0001 DATA BLOCK PREP IN PROGRESS

0010 MENU INFO PREP IN PROCESS

0011 L.A. BUSY EXECUTING KEYBOARD COMMAND

0100 SEARCH ACTIVE

0101 PRINT ACTIVE

0110 COMPARE MENU ACTIVE

1000 SEARCHING FOR TRIGGER

1001 PRETRIGGER DATA SAMPLING

1010 SLOW CLOCK

1011 N.U.

1100 N.U.

1101 N.U.

1110 N.U.

1111 DATA BUFFER FULL (ASCII TRANSMISSION

ERROR CODES

BIT 3210

0000 BATCH FILE OVERFLOW

0001 PARAMETER OUT OF RANGE (RNGERR)

0010 INVALID FUNCTION IN TRIGGER MENU

0011 N.U.

0100 SYNTAX ERROR (SYXER)

0101 GPIB COMMAND ERROR

0110 INVALID PARAMETER (IVPAR)

1000 COMMAND BUFFER FULL

1001 INVALID MENU (IVEN)

1010 N.U.

1011 INVALID TRIGGER DELAY CLOCK

1100 NO OPTION AVAILABLE (NOPTAV)

1101 N.U.

1110 NONVOLATILE MEMORY ERROR (NOVMER)

1111 SETUP IN ERROR (SETER)

APPENDIX E

EXTENDED RS-232-C HARDWARE DESCRIPTION

1. INTERFACE CONNECTOR SIGNALS

1.1 Interface Signal Names and Functions

Pin	Function
1	Signal Ground
2	Transmit Data (EIA)
3	Receive Data Input (EIA)
4	Request to Send (EIA)
5	Clear to Send Input (EIA)
6	Clear Set Ready Input (EIA)
7	Signal Ground
8	N.C.
9	N.C.
10	N.C.
11	N.C.
12	Current Loop Transmit Data (-)
13	Current Loop Receive Data Input (+)
14	Current Loop Receive Data (-)
15	Transmitter Clock Input (EIA)*
16	Current Loop Transmit Data (+)
17	Receiver Clock Input (EIA)
18	+12 Volt
19	N.C.
20	Data Terminal Ready (EIA)

---

*Reserved for future expansion (consult factory).

21	N.C.
22	N.C.
23	N.C.
24	Transmitter Clock Output (EIA)
25	N.C.

All EIA signals are specified as follows:

Transmitter

Marking level:	(Logic "1") -10 V
Spacing level:	(Logic "0") +10 V
Control signals:	"ON" +3 to +12 V
	"OFF" -3 to -12 V

Receiver

Input Impedance:	4000 ohm nominal
Marking level:	-3 to -12 V
Spacing level:	+3 to +12 V

1.2 Interface Handshaking Signals

DATA TERMINAL READY (Pin 20) is "ON" after the LAM 4850A has completed the POWER UP SELFTEST.

REQUEST TO SEND (Pin 4) has two different meanings, depending on duplex (Switch S 3 in "ON" position) or half duplex mode (Switch S 3 in "OFF" position).

- HALF DUPLEX MODE:

  REQUEST TO SEND is "ON" if data is ready to be transmitted from the LAM 4850A. It remains "ON" until the character has had time to clear the LAM 4850A transmit buffer and the modem, if one is used.

- DUPLEX MODE:

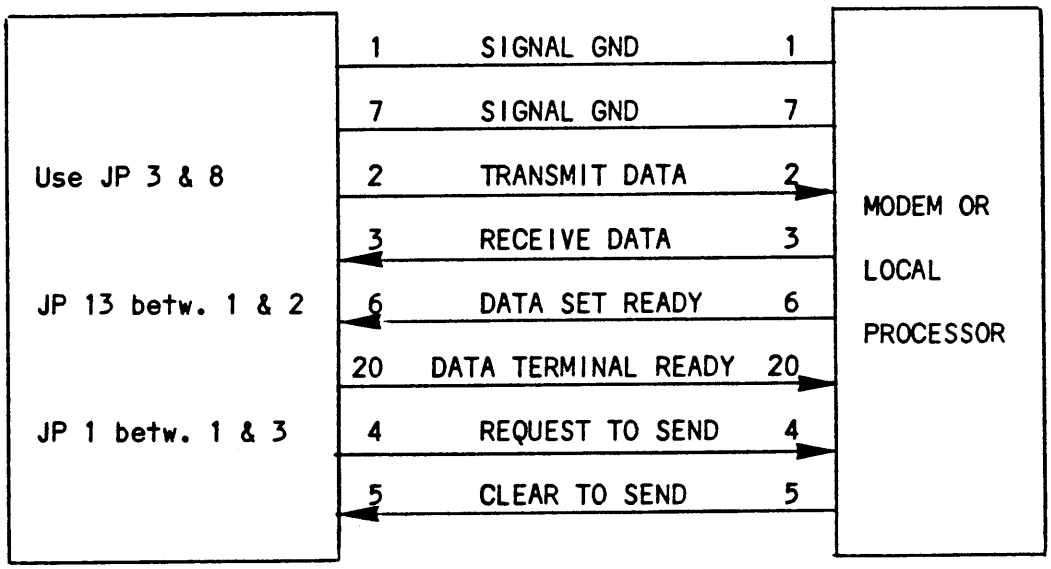
  REQUEST TO SEND is "ON" after the LAM 4850A has completed the "POWER UP SELFTEST" and remains "ON" as long as the unit is powered up.

- CLEAR TO SEND (Pin 5) must be "ON" to transmit data on the communication line. If the external device does not provide CLEAR TO SEND, a connection has to be made between Pins 5 and 4 (REQUEST TO SEND).

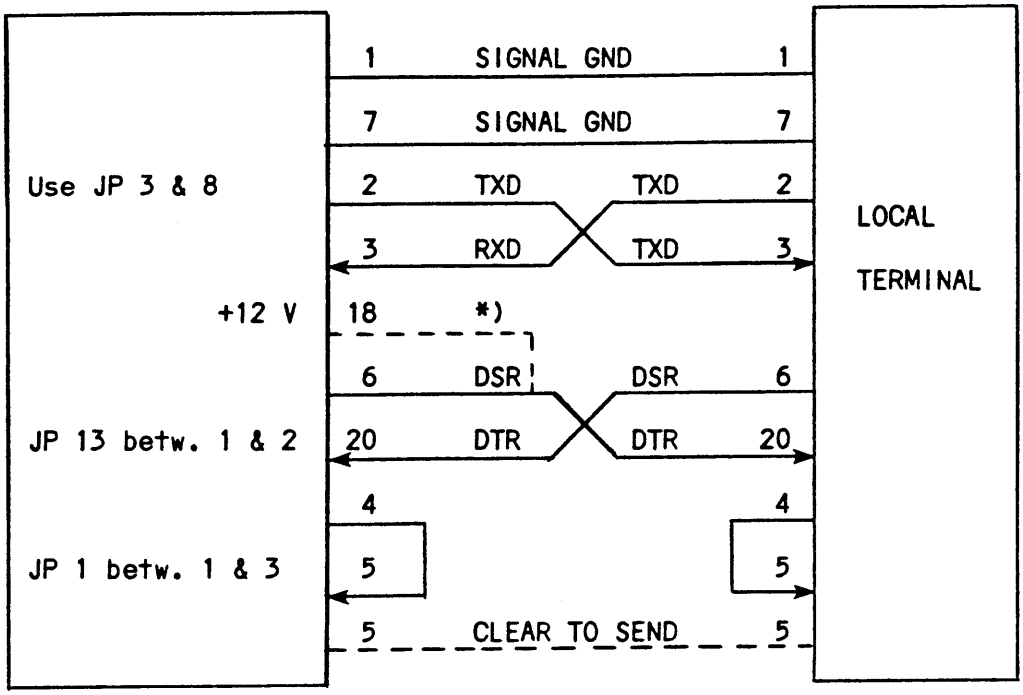
- DATA SET READY (Pin 6). This input must be "ON" to transmit data on the communication line. If the external device does not provide a DATA SET READY signal, connect Pin 6 to Pin 18 (+12 V).

2. CONNECTING EQUIPMENT

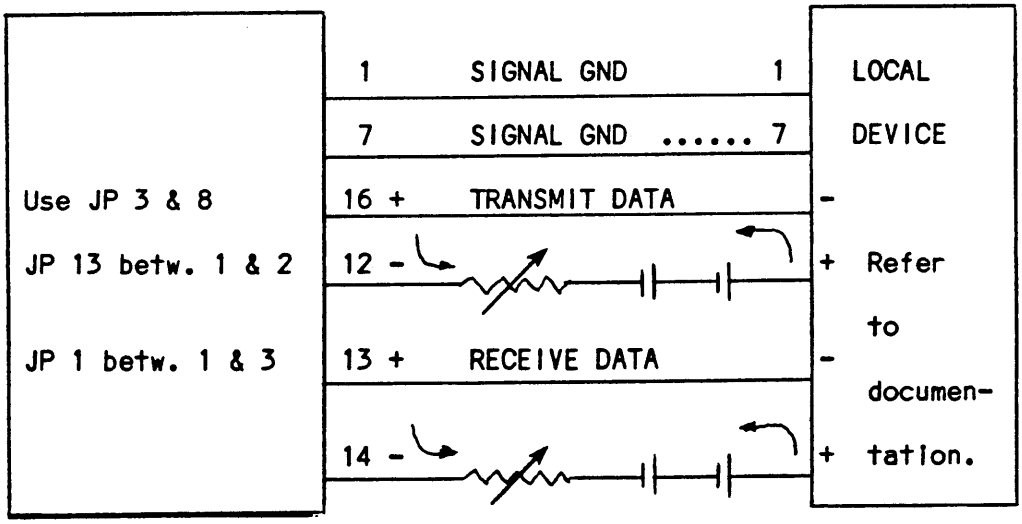
1.1 Connecting to an Asynchronous RS-232-C Modem or Local Processor



2.2 Connection to an Asynchronous RS-232-C Data Terminal



2.3 Current Loop Interface



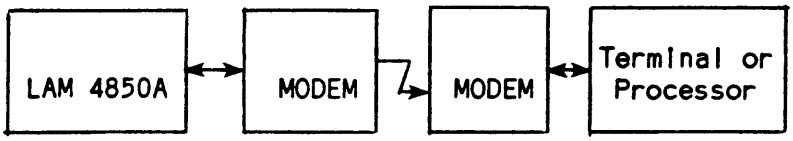
S4-3 = OFF

S4-2 = OFF

2.4 Details on Modem Operation

The LAM 4850A can communicate easily with a remote terminal or computer through an asynchronous modem.

Operation:



Duplex
Half Duplex

The data link can be established after the LAM 4850A or 64300, the remote station and the modems are set up so that all parameters are equal which are necessary to trasmit data. For the LAM 4850A or 64300 this can be done with switches on the communication board and on the rear panel before power up, or from the Serial Interface Menu 20-25 seconds after power-up, the LAM 4850A or 64300 is ready (DTR signal ON). If the remote station is also ready, a connection between the two modes can be made.

3. SWITCHES

3.1 Baud Rate Selection

Switches S1-1 to S1-4 (on the rear panel) are used to select the baud rate, depending on the setting of Switches S2-1 and S2-2.

S1-4	S1-3	S1-2	S1-1	S2-2 ON / S2-1 OFF	S2-2 OFF / S2-1 ON	S2-2 OFF / S2-1 OFF
ON	ON	OFF	ON	0,800	50	22.5
ON	ON	OFF	OFF	1,201	75	18.75
OFF	OFF	OFF	OFF	1,746	110	27
ON	OFF	ON	ON	2,135	134.5	33.6
OFF	OFF	OFF	ON	2,402	150	38.5
ON	OFF	ON	OFF	3,202	200	50
OFF	OFF	ON	OFF	4,803	300	75
ON	OFF	OFF	ON	9,606	600	150
OFF	ON	OFF	OFF	19,212	1200	300
OFF	ON	OFF	ON	* 28,819	1800	450
OFF	OFF	ON	ON	* 38,424	2400	600
OFF	ON	ON	OFF	* 76,848	4800	1200
OFF	ON	ON	ON	* 153,696	9600	2400
ON	ON	ON	OFF	* 307,390	* 19200	4800

This column is preferred for selection (factory setting).

*Not yet released.

3.2 Characters Per Line Selection

For printouts and memory dumps it may be useful to determine how many characters per line should be printed. This can be programmed with Switches S1-5 to S1-8 on the rear panel.

S1-8	S1-7	S1-6	S1-5	CHAR/LINE
ON	ON	ON	ON	32
ON	ON	ON	OFF	16
ON	ON	OFF	ON	20
ON	ON	OFF	OFF	30
ON	OFF	ON	ON	40
ON	OFF	ON	OFF	50
ON	OFF	OFF	ON	60
ON	OFF	OFF	OFF	70
OFF	ON	ON	ON	79
OFF	ON	ON	OFF	80
OFF	ON	OFF	ON	100
OFF	ON	OFF	OFF	110
OFF	OFF	ON	ON	120
OFF	OFF	ON	OFF	128
OFF	OFF	OFF	ON	132
OFF	OFF	OFF	OFF	256

3.3 Transmission Parameter Selection

S2-4	S2-3	CHAR. LENGTH
ON	ON	5 BITS
ON	OFF	6 BITS
OFF	ON	7 BITS
OFF	OFF	8 BITS

S2-5	PARITY
OFF	ENABLE
ON	DISABLE

S2-6	PARITY CHECK
OFF	EVEN
ON	ODD

S2-8	S2-7	STOP BITS
ON	ON	INVALID
ON	OFF	1 STOP BIT
OFF	ON	1-1/2 STOP BITS
OFF	OFF	2 STOP BITS

3.4 Interface Control Signals

S3-1	MODE
ON	FULL DUPLEX
OFF	HALF DUPLEX

S3-2	RTS RECEIVE
ON	HIGH
OFF	LOW

S3-4	DTR RECEIVE
ON	HIGH
OFF	LOW

S3-5	NOT USED

S3-6	DSR TRANSMIT
ON	HIGH
OFF	LOW

S3-7	RTS TRANSMIT
ON	HIGH
OFF	LOW

S3-8	DTR TRANSMIT
ON	HIGH
OFF	LOW

3.5 Interface Signal Polarity

S4-1	$\overline{DTR}$, $\overline{RTS}$
S4-2	TXD
S4-3	RXD
S4-4	$\overline{CTS}$
S4-5	$\overline{DSR}$
S4-6	TXC
S4-7	RXC
S4-8	NOT USED

ON = NORMAL SIGNAL POLARITY

OFF = INVERTED SIGNAL POLARITY

For standard RS-232-C use, all switches should be ON except Switch S40-4, which should be OFF.

For current loop operation, Switches S4-2 and S4-3 should be OFF.

The setting of Switch 4 will not be shown on the INTERFACE MENU. If a switch is set to OFF, the signal polarity will be the complement of the level shown.