MILLENNIUM

Microsystem Analyzer Communications Option Users Manual

Leadership in Microprocessor Instrumentation

87-03-03

WARNING:

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation, it has not been tested for devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

The following procedures may help to alleviate the Radio or Television Interference Problems.

1. Reorient the antenna of the receiver receiving the interference.

2. Relocate the equipment causing the interference with respect to the receiver (move or change relative position).

3. Reconnect the equipment causing the interference into a different outlet so the receiver and the equipment are connected to different branch circuits.

4. Remove the equipment from the power source.

NOTE:

The user may find the following booklet prepared by the FCC helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Printing Office, Washington, D.C. 20402. Stock No. 004-000-00345-4.

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MICROSYSTEM ANALYZER

COMMUNICATIONS OPTION

USERS MANUAL

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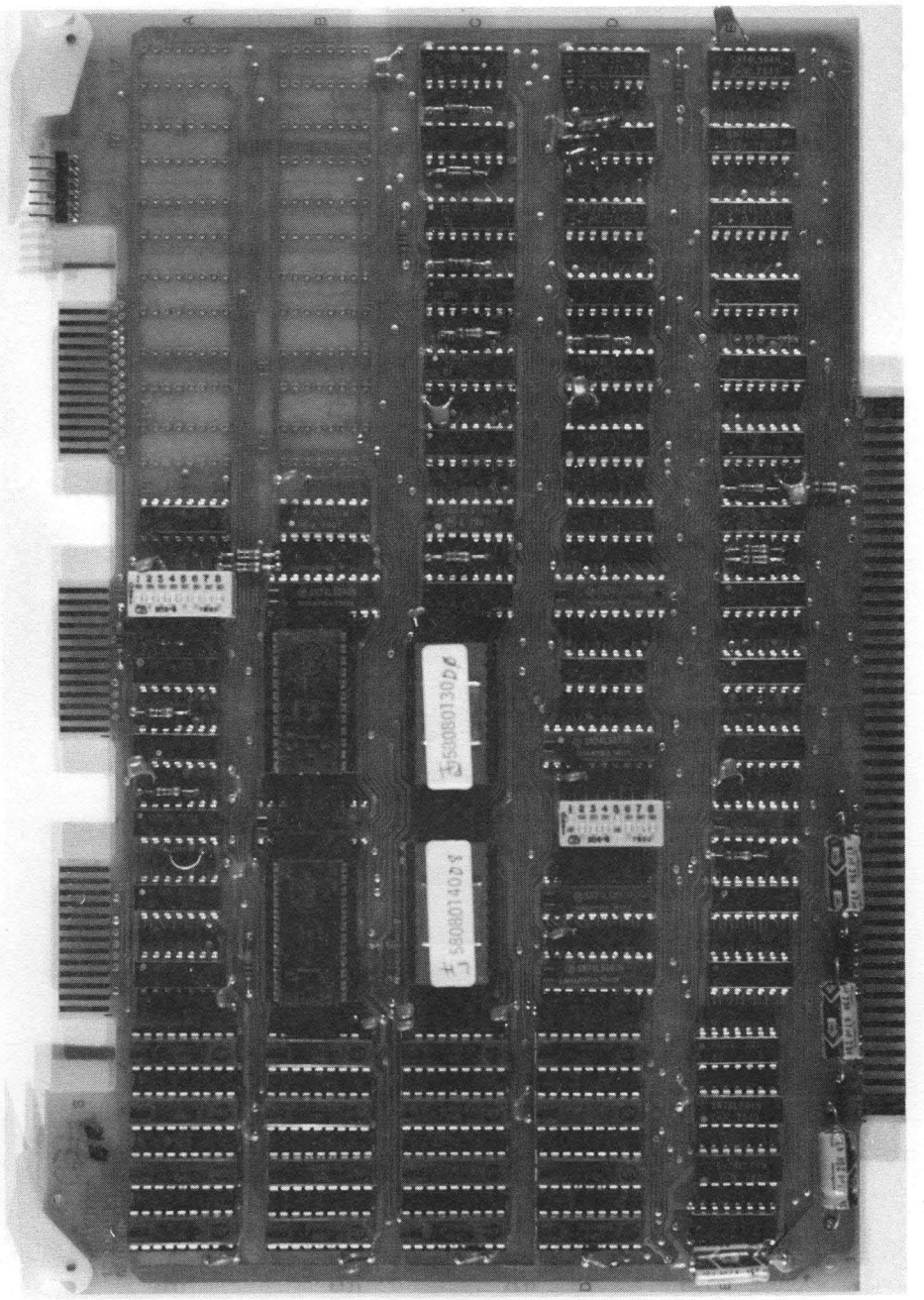


Communications Option

PREFACE

The MicroSystem Analyzer Communications Option Manual provides operational procedures in a tutorial format for both equipment and software.

The material in this publication is subject to change without notice.

Copies of this publication and other Millennium publications may be obtained from the Millennium sales office or distributor servicing in your locality.

MANUAL OVERVIEW

Chapter 1, INTRODUCTION, is an overview of this product.

Chapter 2, INSTALLATION, gives the installation and hardware interface of the option.

Chapter 3, OPERATION, describes the key functions of the Comm Option in detail.

Chapter 4, DATA MESSAGES, is an explanation of the data messages.

Chapter 5, ESTABLISHING uSA TO uSA COMMNUNICATONS, shows some operation examples.

chapter 6, LOGON FUNCTION, gives a detailed explanation of the logon function.

RELATED PUBLICATIONS

- MicroSystem Analyzer Users Manual, Publication Number 87000001
- Application Notes:
  - Programming with uSA Microsystem Analyzer
  - Diagnostic Programming for Microprocessor-Based Systems
  - Guide to Testing Microprocessor-Based Systems and Boards

TECHNICAL ASSISTANCE

If you require any technical assistance on this product, please call Customer Service on the toll-free hot-line numbers listed below:

National	(800) 538-9320/9321
California	(800) 662-9231

CONTENTS

CONTENTS (continued)

TABLES

Chapter 1

INTRODUCTION

1.1 PRODUCT DESCRIPTION

The Communication Option (Comm Option) for the Millennium MicroSystem Analyzer (uSA) provides the capability to perform on-site diagnostic testing from a remote field maintenance station over standard telephone lines, as shown in figure 1-1. This capability reduces the inventory of test PROMs required by the field service personnel.

The Comm Option also provides an additional 8K Bytes of RAM. This feature allows test programs, stored in centrally located stations, to be downloaded to the remote stations.

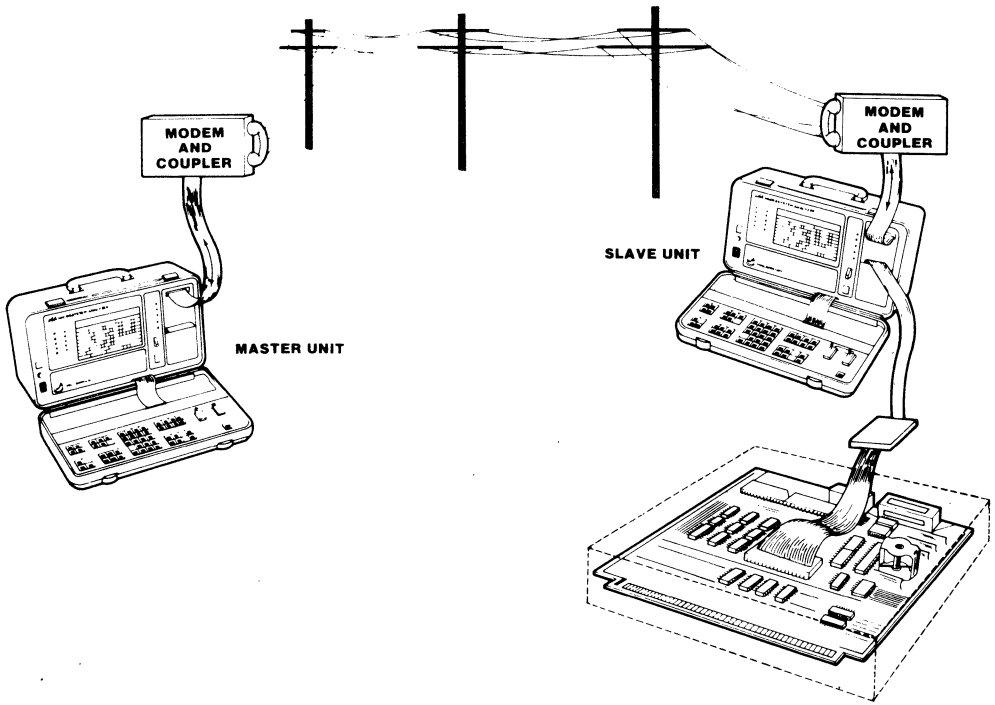


Figure 1-1. uSA Communicating Over Telephone Lines

1.2 FEATURES

The Comm Option provides the software to operate the uSA in one of four modes:

SLAVE
MASTER
DOWNLOAD
GUIDED PROBE

The option also supports the following six function keys:

REMOTE	(Remote)
ATTN	(Attention)
OPT1	(Send)
OPT2	(Move)
OPT/MEM	(Option Memory)
LOGON	(Logon)

The modes and the six function keys are explained in detail in Chapter 5.

1.3 COMM OPTION COMPONENTS

The Comm Option, PN COMM-1, consists of the following parts:

- o Comm/RAM Board (PN 13000015)
- o Internal RS-232 Cable (PN 90010013)

Chapter 2

INSTALLATION

2.1 UNPACKING, INSPECTION, AND SERVICE

Inspect the instrument and accessories for physical damage. If damage is evident do not operate the instrument. Notify the carrier and Millennium Systems at once. Millennium will arrange for repair or replacement without waiting for settlement of the claim against the carrier.

If the instrument is to be returned to Millennium, attach a tag showing: owner, address, part number, and a description of the failure mode. The original shipping carton and packing material should be reused with the Returned Material Authorization (RMA) number prominently displayed on the carton. An RMA number can be obtained by calling Customer Service.

Unless notified to the contrary, any claims for operations assistance and/or service will be provided by Millennium Systems, from its plant in Cupertino, California. Should assistance be required, call the Customer Service Manager at:

National	(800) 538-9320/9321
California	(800) 662-9231

2.2 INSTALLATION

To install the Comm Option, refer to Figure 2-1 and perform the following steps:

1. Turn the uSA off.
2. Remove the four screws from the bottom of the uSA case.
3. Carefully slide the card cage out of the uSA case.
4. Install the Comm/RAM board, into the second from the back slot (J6). Seat the board by pushing down with both hands.
5. Connect the RS-232 cable into the front panel of the uSA with the two nuts provided.
6. Connect the other end of the RS-232 Cable onto P2 of the Comm/RAM board. Route cable as shown in figure 2-1.
7. Slide card cage back into uSA case and reinstall the four screws removed in step 2.

```
* * * * * * * * * * * * * * * * * * * * *
*                                       *
*                CAUTION                *
* Be careful not to damage ribbon cables *
* when reinstalling card cage.           *
*                                       *
* * * * * * * * * * * * * * * * * * * * *
```

Figure 2-1. Installing the Comm Option in the uSA

2.3 HARDWARE INTERFACE

The MicroSystem Analyzer (uSA) is designed to attach to a data set or modem. The physical connection to the uSA is through the RS-232, "D" type, 25 pin connector. All voltage levels are standard RS-232 levels (refer to RS-232 specifications for signals).

Millennium recommends the Anderson Jacobson modem, model AD342.

Figure 2-2 shows the wiring diagram for converting a uSA to a modem.

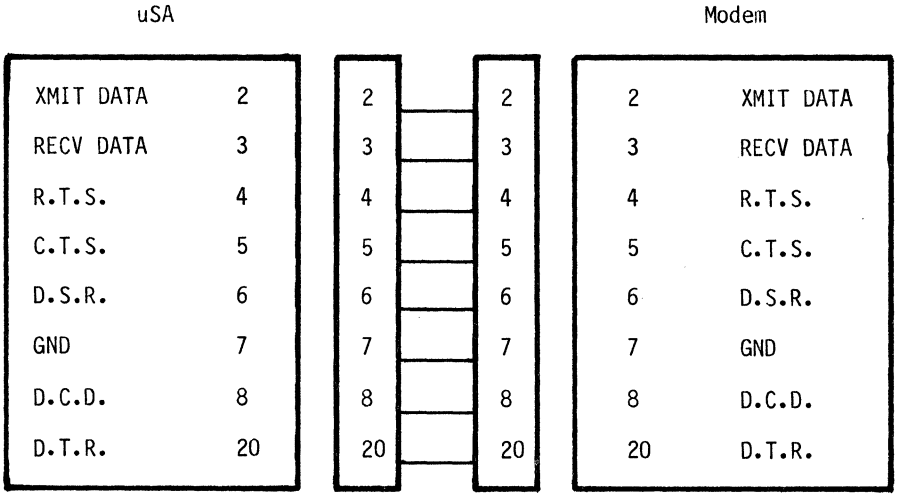


Figure 2-2. uSA to Modem

Figure 2-3, shows the wiring diagrams for connection one uSA to another uSA.

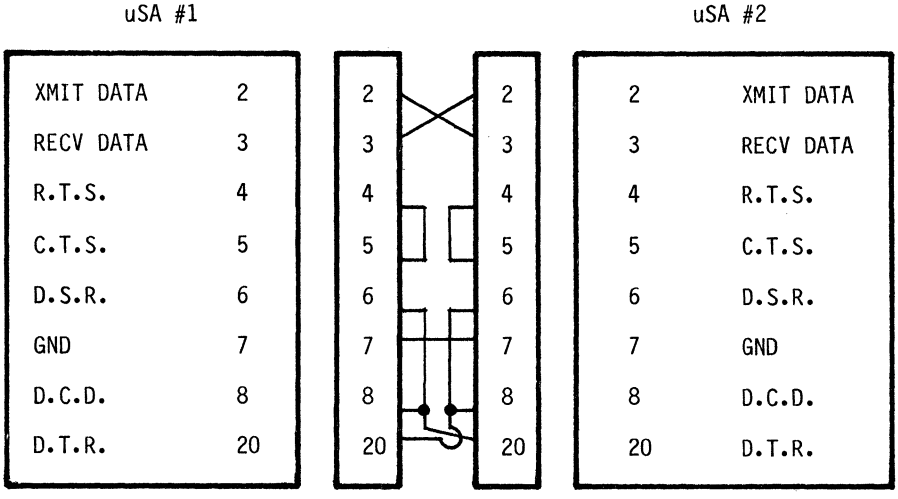


Figure 2-3. uSA to uSA (null modem cable)

Figure 2-4 shows the uSA connected to a development system.

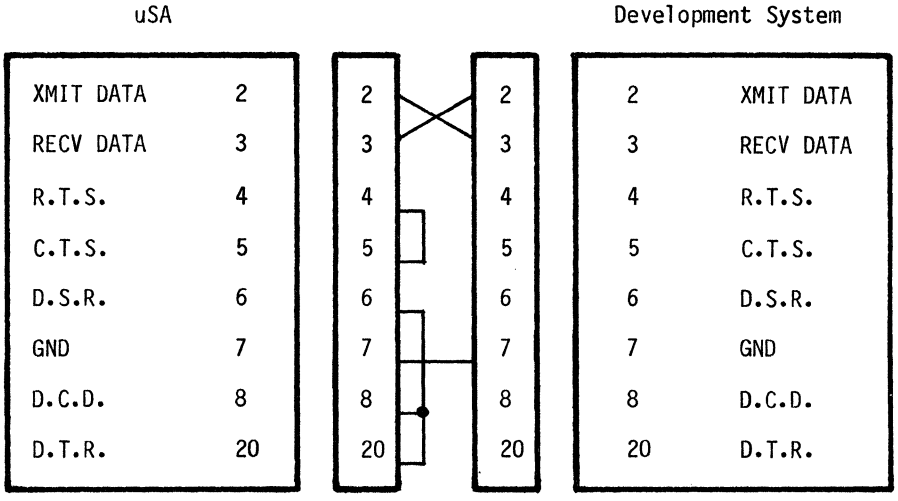


Figure 2-4. uSA to Development System

Chapter 3

OPERATION

3.1 REMOTE LINK

The remote link capability of the Comm Option allows two uSA's to be linked together via a modem or data set. When the Remote Link is used, the on-site slave uSA will emulate the Unit Under Test (UUT) and perform all normal functions, but the operator of the master uSA controls the slave uSA from his keyboard. The results are displayed on both master and slave uSA's. The remote link can operate in these four modes:

SLAVE
MASTER
DOWN LOAD
GUIDED PROBE

3.1.1 Slave Mode

When operating in the slave mode, the slave uSA is totally under the control of the master uSA. The keyboard of the slave uSA is locked out. All operations are initiated by keystroke messages received from the master uSA via the RS-232 link. Results are displayed on the slave uSA and transmitted back to the master uSA as display messages and LED messages.

3.2.2 Master Mode

When operating in the master mode, the master uSA is totally in control of the slave uSA. The master uSA does not perform any functions locally. All keystrokes are transmitted via the RS-232 link and all display messages and LED messages are received from the slave uSA and displayed on the master uSA.

3.2.3 Download Mode

When in the download mode, the uSA is connected to a host computer system. The operator can download a program from the host computer into the 8K RAM memory of the Comm Option. The program can then be executed by the uSA.

3.2.4 Guided Probe Mode

The guided probe mode is used when the uSA is linked to a host computer. Keystrokes from the uSA are not executed, but are transmitted to the host computer. Keystroke messages received from the host computer are executed. All normal displays are transmitted as display messages, but are not displayed on the uSA. Messages received from the host computer are displayed on the uSA to allow the operator to perform fault isolation under the control of the host computer system.

3.2 KEY FUNCTIONS

The Comm Option supports the following six function keys:

REMOTE	(Remote)
ATTN	(Attention)
OPT 1	(Send)
OPT 2	(Move)
OPT/MEM	(Option Memory)
LOGON	(Logon)

3.2.1 REMOTE Key

The REMOTE key is used to set up the communications link. It sets the baud rate, parity, and selects the mode of operation. The format of the remote option byte is shown in figure 3-1. Defaults are taken from the switch setting on the Comm/RAM board. The switch is located on the Comm/RAM board at location D7. See figure 3-2 for the default switch settings.

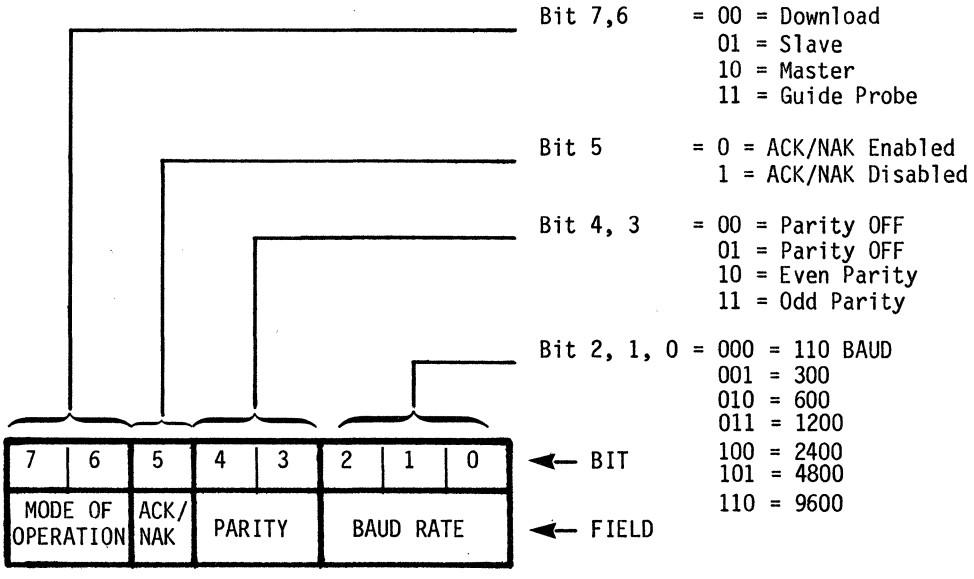


Figure 3-1. Remote Option Byte

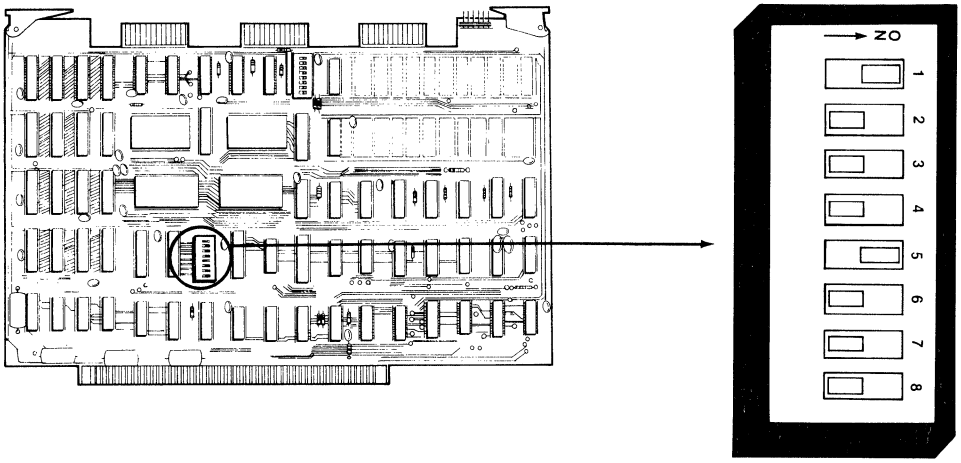


Figure 3-2. Comm/RAM Board Default Switch Settings

During initialization of the uSA, the default options for the remote function are read from the switches at location D-7 on the Comm/RAM board and stored for display when the REMOTE key is pressed. If the operator changes the options via the hexpad and ENTER key, then the new data is displayed the next time the REMOTE key is pressed. In addition, the most significant bit of the switches at location A-10 on the Comm/RAM board is sampled to determine if all messages transmitted are to be suffixed with a line feed ("ON" implies a line feed).

During initialization, the affirmative acknowledge sequence "0<CR>" (30H, 0DH) and the negative acknowledge sequence "7<CR>" (37H, 0DH) are stored in the data base to be used while ACK/NAK is being enabled. ACK/NAK is disabled by setting bit 5 of the Comm/RAM board switches at location D-7. Note that the ACK/NAK sequence may be altered prior to enabling the remote options and that the operator may specify up to seven characters in either or both sequence(s).

There are eight bytes reserved in the data base for each of the ACK/NAK sequences. ACK/NAK sequences must be terminated with FFH. If the operator wants to enter a seven character ACK or NAK sequence (the maximum number of characters that may be entered from the keyboard into the displayed ACK or NAK sequence), then the eighth location in the data base will contain an FFH so that the integrity of the ACK or NAK sequence's termination is maintained.

If the operator changes the remote options displayed with the hexpad keys and enters the new option selections, then the newly selected options will be displayed the next time the REMOTE key is pressed (not the options implied by the Comm/RAM board switches at location D-7).

If the remote option has been enabled, and the operator has selected local mode; then, to reenable the remote option (master, slave, download, guided probe), press the REMOTE key. This will display the current remote options last entered. If the remote options displayed are not correct, change the options then press the ENABLE key. If the options are correct, then just press the ENABLE key.

Remote Subfunctions

MODIFY - Using the hexpad, the operator can modify the remote options.

BINARY - Using the binary keypad, the operator can modify the options in binary.

INCR - Increments the display.

Remote Displays

Display	Explanation
REM OPTS = xx	
REM OPTS = bbbbbbb	The operator may select desired options in either hex or binary.
ACK = 300DFFFFFFFFFF	Default ACK sequence by initialization.
NAK = 370DFFFFFFFFFF	Default NAK sequence by initialization.

When changing the ACK/NAK sequence, any sequence less than seven characters long must be followed by a character of all ones (FFH).

Remote Example

The following example includes a sequence that will enable the remote option:

Operation	Display	Explanation
RESTART	uSA READY xxxx	xxxx is the microprocessor type.
REMOTE	REM OPTS = 96	The default options are switch selectable.
BINARY	REM OPTS = 10010110	Display the options in binary.
10000110, ENTER	REM OPTS = 10000110	Choose: Master, ACK/NAK, No parity, 9600 Baud.
INCR	ACK=300DFFFFFFFFFF	ASCII "0" followed by a CR is default for Data Message Received without an error.
INCR	NAK=3700FFFFFFFFFF	ASCII "7" followed by a CR is default for Data Message Received with an error.
INCR	REM OPTS = 10000110	Back to remote options.
ENABLE	MASTER MODE	Enable the chosen options. The Remote ENABLE LED is illuminated.

When in the remote mode, the operator can select local mode by pressing the ATTN key. To return to the remote mode (slave, master, download, guided probe), press the REMOTE key. This will display the remote options. If no changes are necessary, press the ENABLE key to enable the remote function.

3.2.2 **ATTN Key**

When the remote mode is enabled (as a master or slave), keystrokes from the front panel are no longer treated as functions. In the slave mode, keystrokes are ignored. In the master mode they are transmitted as keystroke messages for the slave to act upon. The ATTN key is used as a mechanism to temporarily break the remote link and allow functions to be performed locally.

Pressing the ATTN key once allows all keys to be acted upon locally, until the REMOTE and ENABLE keys are pressed. The IND1 LED on the front panel is illuminated when the uSA is in local mode. Pressing the ATTN key twice in succession will cause an Operator Attention Message to be transmitted.

ATTN (Attention) Example

Operation	Display	Explanation
RESTART	uSA READY Z80	
REMOTE	REM OPTS = 96	Default options.
BINARY	REM OPTS = 10010110	Put in binary.
1000001, ENTER	REM OPTS = 10000001	Modify options to MASTER, ACK/NAK on, NO PARITY, 300 BAUD.
ENABLE	MASTER MODE	REMOTE ENABLE LED is illuminated.
ATTN	LOCAL MODE	Put master into local mode. OPT1 LED is illuminated to indicate local mode.
REMOTE	REM OPT = 81	Master ready to return to master mode. Remote link is broken and REMOTE and OPT1 LED's are extinguished.
ENABLE	MASTER MODE	Reestablish remote link. Remote Enable LED illuminated.

3.2.3 OPT1 (Send) Key

The Send function is initiated by the OPT1 Key. This function allows blocks of data from memory to be transmitted over the remote communications link. (The remote link must have been set up first.) Data is sent from either the optional RAM or the front panel PROM.

When the OPT1 key is pressed, the uSA displays:

Display	Explanation
SEND x yyyy zzzz	x = Data source (P=PROM, R=RAM) yyyy = Starting address zzzz = Ending address

OPT1 (Send) Subfunctions

INCR - Changes the data source field, x (P or R).

MODIFY - Using the hexpad, the operator can modify the starting and ending addresses.

ENTER - The ENTER key is used to freeze the starting address and the ending address. When the ending address has been frozen, the ENTER key sends the data (i.e., information contained in the memory between the start and end address), over the remote link in download message format. If the addresses have not been modified, the ENTER key will send the data.

OPT1 (Send) Displays

Display	Explanation
SEND IN PROGRESS	The transmitting uSA displays this message to indicate a transmission is in progress.
LOAD IN PROGRESS	The receiving uSA displays this message to indicate a load is in progress.
SEND COMPLETE	When the transmitting uSA has sent the data, this message is displayed.
LOAD COMPLETE	When the receiving uSA has received the data, this message is displayed.

OPT1 (Send) Example

Send the data from the master uSA front panel PROMs to slave uSA. The PROM data is at address 2000H thru 27FFH. The remote link for the master and slave uSA's has already been established.

	MASTER uSA		SLAVE uSA
Operation	Display	Explanation	Display
ATTN	LOCAL MODE	Master to local mode. IND1 LED is illuminated to indicate local mode.	
OPT1	SEND P 0000 0000	Choose the send function.	
2, ENTER	SEND P 2000 0000	Select starting address 2000H.	
27FF	SEND P 2000 27FF	Select ending address 27FFH.	
ENTER	SEND IN PROGRESS	Start transmission.	LOAD IN PROGRESS
	SEND COMPLETE	All the data has been sent.	LOAD COMPLETE

3.2.4 OPT2 (Move) Key

The Move function is initiated by the OPT2 key. The operator may move blocks of data from the user system to the uSA RAM, from uSA RAM to user RAM, and from front panel PROM to uSA RAM or user RAM.

Four types of moves are allowed by this function:

1. PROM to RAM (PR) - PR enables the operator to move data from the front panel PROM(s) into the option RAM.

2. PROM to User (PU) - PU allows the operator to move data from the front panel PROM(s) to the user RAM.

3. RAM to User (RU) - RU allows the operator to move data from the option RAM to the user RAM.

4. User to RAM (UR) - UR allows the operator to move data from the user memory to the optional RAM.

When the OPT2 key is pressed the uSA displays:

Display	Explanation
MV ww xxxx yyyy zzzz	ww = Source and destination of data (PR, PU, RU, or UR) xxxx = Starting Address (source) yyyy = Ending Address (source) zzzz = Starting Address (Destination)

OPT1 (Move) Subfunctions

INCR - This key increments through the source and destination options (the ww field), allowing the operator to choose one of four options.

MODIFY - Using the hexpad, the operator is able to modify the start and end addresses.

ENTER - The ENTER key is used to freeze the starting source address, ending source address, and starting destination address. When the ENTER key is pressed to freeze the starting destination address, this will initiate the move. If the starting source address has not been modified and the ENTER key is pressed, the move will be initiated with the displayed addresses.

OPT1 (Move) Displays

Display	Explanation
MOVE IN PROGRESS	The message is displayed as the operation is executed.
BOUNDARY ERROR	The operator has tried to cross an illegal boundary. For example, moving to/from option RAM it is illegal to cross an 8K boundary.
WRITE ERROR xxxx	This message is displayed when a memory write error has occurred. xxxx = the address where the error occurred.
MOVE COMPLETE	This message is displayed when the operation is completed.

3.2.5 OPT/MEM Key

The OPT/MEM key enables the optional RAM on the Comm RAM board and maps it into the UUT address space. Programs are initially placed in this memory by a down-load from the remote link, or by a move function. The option memory may be used in diagnostic, or applications mode.

Diagnostic Mode

In the diagnostic mode, the data in the RAM must conform to the standard uSA diagnostic PROM data. This means that the first 256 bytes contain the control information and is overlayed by the Shadow RAM.

Applications Mode

In the applications mode, there is no requirement to conform to the diagnostic format. The Shadow RAM is not used, and no communications to the operator or automatic setup of measurement parameters is provided. This allows direct use of the uSA as a debug tool for user system software. The operator may select 1, 2, 4, or 8K block of RAM memory.

The address entered must be on a boundary corresponding to the amount of RAM enabled, as shown below:

```
1K boundaries = x000, x400, x800, xC00
2K boundaries = x000, x800,
4K boundaries = x000
8K boundaries = y000

              x = 0, 1, 2, ... F
              y = 0, 2, 4, 6, ... E
```

Any other address will cause a boundary error when the RAM is enabled.

OPT/MEM Subfunctions

INCR - Selects either the diagnostic or the applications mode.

HEXPAD - The operator uses the hexpad to modify the address where the diagnostic/application RAM is enabled. If in the application mode, then the size of RAM may be modified. The only valid entries in the size display are 1, 2, 4 and 8.

ENTER - The ENTER key freezes the address data (and size data if displayed). If optional memory was already enabled, then it will be reenabled at the address entered.

ENABLE - Enables the Comm/RAM board RAM.

DISABLE - Disables the Comm/RAM board RAM.

OPT/MEM Examples

Enable the Optional RAM as Diagnostic RAM.

Operation	Display	Explanation
RESTART	uSA READY xxx	xxx is the microprocessor type.
OPT/MEM	DIAG RAM = 0000	
2, ENTER	DIAG RAM = 2000	Select the starting address to be at 2000H.
ENABLE	Initial message	Optional RAM has been enabled as diagnostic RAM. The initial message from the PROM Header is displayed and the OPT/MEM ENABLE LED is illuminated.

Enable the optional RAM as applications RAM for 2K bytes starting at address 0.

Operation	Display	Explanation
RESTART	uSA READY xxx	xxx is the microprocessor type.
OPT/MEM	DIAG RAM = 0000	
INCR	AP RAM=0000 S = 1K	Choose the application mode.
ENTER	AP RAM=0000 S = 1K	Keep starting address of 0.
2, ENTER	AP RAM=0000 S = 2K	Select a block size of 2K bytes.
ENABLE	AP RAM=0000 S = 2K	Enable the RAM. The OPT MEM ENABLE LED is illuminated.

3.2.6 **LOGON Key**

The LOGON key allows the operator to log on to another system through the use of the logon PROMs installed in the front panel PROM sockets. The operator must press the ENABLE key to cause the logon interpreter to access the logon PROM(s). These PROMs define the logon sequence for the particular system. The logon function can only be invoked after remote is enabled. See chapter 6 for details.

3.3 OPERATION EXAMPLES

3.3.1 Move User to RAM

The following example demonstrates a sequence used when moving a block of memory in the user's system, address 0 thru 07FF, to the option RAM at address 0.

Operation	Display	Explanation
RESTART	USA READY Z80	
OPT 2	MV PR 0000 0000 0000	Starts out at move PROM to RAM.
INCR	MV UR 0000 0000 0000	Choose move user to RAM.
0, ENTER	MV UR 0000 0000 0000	Starting address.
07FF, ENTER	MV UR 0000 07FF 0000	Move data in user system from address 0-07FF to Opt/RAM.
ENTER	MOVE IN PROGRESS	Move data to address 0 in Opt/RAM.
	MOVE COMPLETE	(Approximately 1 minute).
OPT/MEM	DIAG RAM ADD = 0000	Envoke OPT/RAM.
INCR	AP RAM ADD=0000 S=1K	Don't want diagnostic mode. Want applications mode.
ENTER	AP RAM=0000 S=1K	Keep address the same.
2, ENTER	AP RAM=0000 S=2K	Set memory size to 2K.
ENABLE	OPT MEM ENABLED LED is illuminated.	The RAM enabled is now ready for use.

3.3.2 **Move PROM to RAM**

To move diagnostics from the front panel PROM to the option RAM for debug, follow the sequence shown below. In the example, the diagnostic PROM starts at address 2000 and extends thru address 27FF.

Operation	Display	Explanation
OPT1	MV PR 0000 0000 0000	Invoke move function.
2000, ENTER	MV PR 2000 0000 0000	Choose starting address at 2000H.
27FF, ENTER	MV PR 2000 27FF 0000	Choose ending address at 27FFH.
2	MV PR 2000 27F 2000	Choose destination starting address at 2000H.
ENTER	MOVE IN PROGRESS	Start move.
	MOVE COMPLETE	
OPT/MEM	DIAG RAM ADR=2000	Choose diagnostic mode for optional RAM.
ENABLE	INITIAL MESSAGE	OPT MEM ENABLE LED is illuminated.
RUN		Run diagnostic.

Chapter 4

DATA MESSAGES

The four types of data messages that can be transmitted and/or received by the uSA are:

LED (front panel indicators)
KEYSTROKE
DISPLAY (front panel 20 character alphanumeric display)
DOWNLOAD (memory load)

All data message characters sent over the serial link are printable ASCII characters, with the exception of carriage return (0DH) and an optional line feed (0AH). These two characters are used to indicate the end of a message. Table 4-1 shows what data can be received and transmitted by each of the remote modes.

Table 4-1. Data Messages

MESSAGE	MODE							
	DOWNLOAD		SLAVE		MASTER		GUIDED PROBE	
TYPE	RCV	XMT	RCV	XMT	RCV	XMT	RC	XMT
Keystroke			X			X	X	X
LED				X	X		X	X
Display				X	X		X	X
Download	X	X	X	X	X	X	X	X

All data can be affirmatively acknowledged (ACK) by the receiver. If an error is found in the message, a negative acknowledge (NAK) is sent. If a NAK is received after a transmission, or no ACK is received, the message is retransmitted. If no ACK is received by the fifth transmission, the task is terminated and the following message is displayed to the operator:

TRANSMISSION ERROR

4.1 LED MESSAGES

The LED message defines a 16-bit integer, bit coded to specify the ON/OFF state for each LED. When in the slave or guide probe mode, the uSA will generate these messages. When in the master or guided probe mode when a LED message is received, the LED lights will be illuminated. Bit values of the LED display lamps are shown in Table 4-2.

Table 4-2. LED Bit Values

Bit	LED	Bit	LED
	(Most significant bit)		
15	BEEP (Audible Alarm)	7	OPT MEM ENABLE
14	Unused (must = 0)	6	RUN
13	Unused (must = 0)	5	HALT
12	Unused (must = 0)	4	PROM MEM
11	Unused (must = 0)	3	BREAK
10	Unused (must = 0)	2	IND2
9	IND1	1	MESSAGE PENDING
8	REMOTE	0	INPUT ERROR (least significant bit)

NOTE: 1 = On, 0 = Off

The message format consists of four parts, the TYPE, VALUE, TEKSUM, and EOL (end of line). An example of a LED message causing the HALT, RUN, IND1 and REMOTE LED's to be illuminated is shown in Table 4-3.

Table 4-3. LED Message

ASCII	HEX	FORMAT	DESCRIPTION
!	21	TYPE	Defines LED message.
0 3 6 0	30 33 36 30	VALUE	Four ASCII hex digits representing the 16-bit value. The LEDs illuminated are: IND1, REMOTE, HALT, and RUN.
0 9	30 39	TEKSUM	Two ASCII hex digits, an 8-bit arithmetic sum of the four hex digits converted to two ASCII hex characters. e.g. value=0123H then TEKSUM=AHEX (0+1+2+3) modulo 256=06H=30 36 in ASCII For this example TEKSUM = 0+3+6+0 = 09
CR	0D	EOL	CR = Message terminator

4.2 KEYSTROKE MESSAGES

The keystrokes are encoded to an unsigned 8-bit integer. When in the master or guided probe modes, the key message will be sent by the uSA each time the operator presses a function key. When in the slave or guided probe mode and a key message is received, the key will be acted upon. Table 4-4 gives actual values of keystrokes.

Table 4-4. Keystroke Functions

Key Type	Hex Value	Key Type	Hex Value	Key Type	Hex Value
SUBFUNCTION CONTROL		PROCESSOR CONTROL		HEX KEYPAD	
OPTSEL	33	RUN	23	<- -	1F
DISABLE	32	STEP	22	-> +	17
ENABLE	31	PROM/MEM	21	ENTER	27
BINARY	2B	SUBSEL	20	"0"	07
DECR	2A	RUN/DISP	1B	"1"	06
INCR	29	RESET	1A	"2"	05
		OPT/MEM	19	"3"	04
FAULT DETECTION		FILL	18	"4"	0E
				"5"	0D
SIG	0B	SPECIAL CONTROL		"6"	0C
FREQ	0A			"7"	16
THRESH	08	TEST	2F	"8"	15
INTRVL	03	OPT 1	46	"9"	14
COUNT	02	OPT 2	45	"A"	1E
FILTER	00	OPT 3	37	"B"	1D
				"C"	1C
DISPLAY SELECT		REMOTE LINK		"D"	26
				"E"	25
I/O	47	ATTN	36	"F"	24
MEMORY	4A	LOGON	2E		
MSG	49	REMOTE	2D		
BREAK	43				
REGISTER	42				

The structure of the keystroke message consists of four parts: TYPE, KEYVALUE, TEKSUM and EOL. An example of the keystroke message sending the register key is shown in Table 4-5.

Table 4-5. Keystroke Message

ASCII	HEX	FORMAT	DESCRIPTION
#	23	TYPE	Defines keystroke message.
4 2	34 32	KEYVALUE	Two ASCII hex digits. Send the register key.
U 6	30 36	TEKSUM	Two ASCII hex digits as defined in the LED message using the sum of the two digit KEY VALUE field. TEKSUM = 4 + 2 = 06
CR	OD	EOL	Terminator

4.3 DISPLAY MESSAGES

In the slave and guided probe mode, the uSA generates display messages when they would normally be displayed to the operator. In the slave mode the messages are displayed and transmitted. In the guided probe mode they are only transmitted. When a display message is received while in the master or guided probe mode, the message will be displayed. The structure of the display message is:

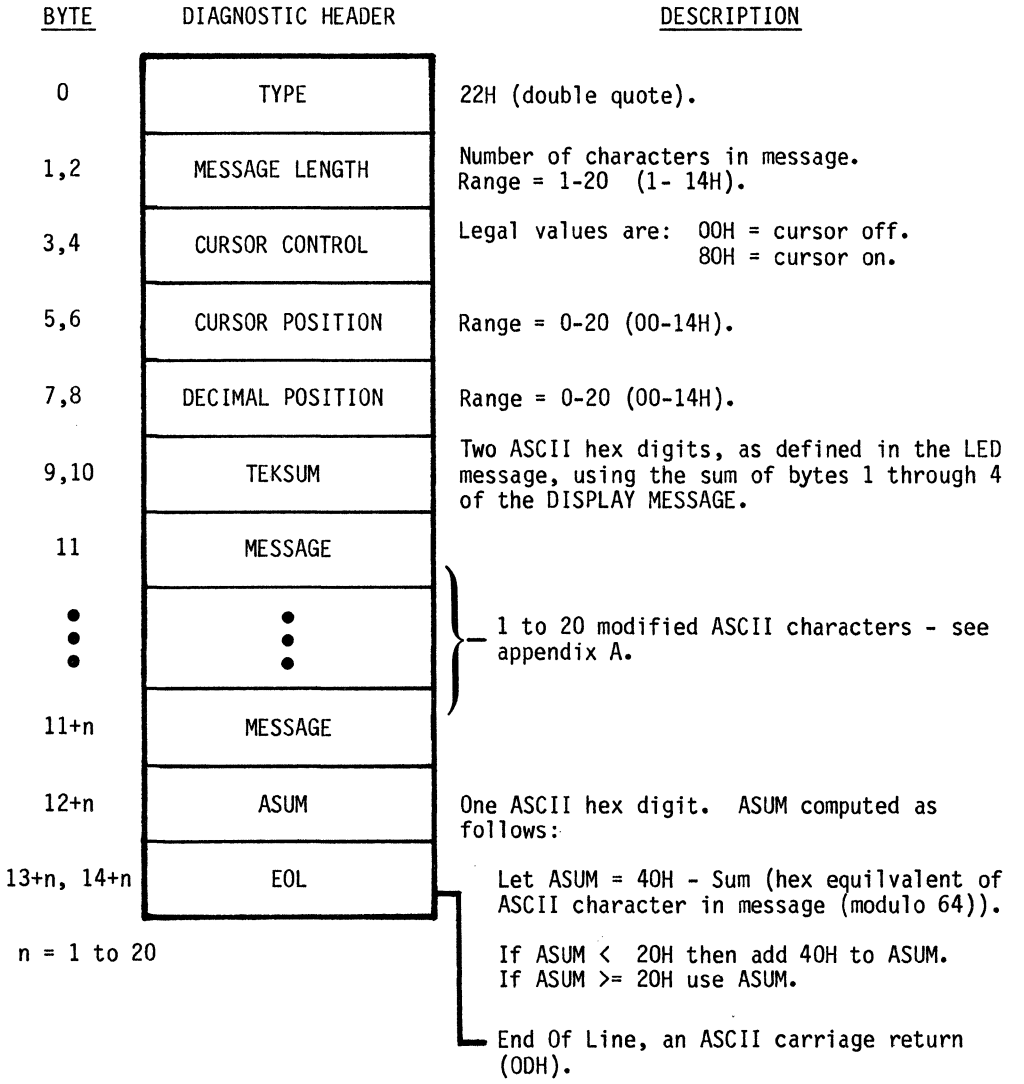


Table 4-6 gives an example of a display message.

Table 4-6. Display Message

ASCII	HEX	FORMAT	DESCRIPTION
"	22	TYPE	Defines display message.
0 F	30 46	MESSAGE LENGTH	Number of characters = 15.
0 0	30 30	CURSOR CONTROL	Cursor off.
0 0	30 30	CURSOR POSITION	No cursor position.
0 0	30 30	DECIMAL POSITION	No decimal position.
0 F	30 46	TEKSUM	Sum of MESSAGE LENGTH, CURSOR CONTROL, CURSOR POSITION and DECIMAL POSITION. TEKSUM = 0 + F + 0 + 0 + 0 + 0 + 0 + 0 = 0F
Z 8 0 A D E M O V 2 . 1	5A 38 30 41 20 44 45 4D 4F 20 56 32 2E 31 20	MESSAGE	ASCII Message is "Z80A DEMO V2.1".
Q	51	ASUM	Sum of MESSAGE = 5A+38+30+41+20+44+45+4D+4F+20+56+32+2E +31+20 = 36F = 2F (modulo 64) ASUM = 40-(2F) = 11, ASUM is < 20, so 40 must be added ASUM = 11+40 = 51
CR	0D	EOL	Terminator.

4.4 DOWNLOAD MESSAGES

The download message moves memory data from one system to another, and can be sent or received in any mode. The structure of the download message function is:

1. TYPE - slash (2FH).

2. LOCATION - Four ASCII hex digits of the starting address range (0 - FFFFH).

3. BYTE COUNT - Two ASCII hex digits of the number of data bytes to transfer range (1 - 20H).

4. TEKSUM 1 - Two ASCII hex digits as defined in the LED message using the sum of the four digits in LOCATION and the two digits in BYTE COUNT.

5. DATA - The ASCII hex digits of data transferred (2 - 40H).

6. TEKSUM 2 - Two ASCII hex digits as defined in the LED message, using the sum of the digits of data transferred.

7. EOL - End-of-Line, an ASCII carriage return (0DH) and, optionally, a line feed (0AH).

Table 4-7 is an example of a seven byte message sent starting at address 0800.

Table 4-7. Download Message

ASCII	HEX	FORMAT	DESCRIPTION
/	2F	TYPE	Defines download message.
0 8 0 0	30 38 30 30	LOCATION	4 ASCII hex digits start loading data at location 0800.
0 7	30 37	BYTE COUNT	2 ASCII hex digits. Transfer 7 bytes of data
0 F	30 46	TEKSUM 1	Checksum of LOCATION and BYTE COUNT fields. TEKSUM 1 = 0 + 8 + 0 + 0 + 0 + 7 = 0F
3 C 3 2 0 9 0 8 C 3 0 0 0 8	33 43 33 32 30 39 30 38 43 33 30 30 30 38	DATA	The ASCII hex digits of memory transfer. When this data is received, the uSA will display "LOAD IN PROGRESS."
3 C	33 43	TEKSUM 2	Checksum of DATA. TEKSUM 2 = 3 + C + 3 + 2 + 0 + 9 + 0 + 8 + C + 3 + 0 + 0 + 0 + 8 = 3C (modulo 256)
CR	0D	EOL	CR = terminator.

A message with a byte count of zero is the file terminator. Memory data and TEKSUM 2 are not part of the termination message. Table 4-8 shows an example.

Table 4-8. File Terminator Message

ASCII	HEX	FORMAT	DESCRIPTION
/	2F	TYPE	Defines download message.
0 8 0 0	30 38 30 30	LOCATION	Starting address is 0800H.
0 0	30 30	BYTE COUNT	No bytes transferred - end record.
0 8	30 38	TEKSUM	TEKSUM = 0 + 8 + 0 + 0 + 0 + 0 = 08
CR	0D	EOL	Terminator.

After the file terminator message is received, the uSA will display:

```
LOAD COMPLETE
```

The data that was received by the download would be in memory as follows:

ADDRESS	DATA
0800	3C
0801	32
0802	09
0803	08
0804	C3
0805	00
0806	08

The starting address is stored in the program counter, and the move and send addresses.

Chapter 5

ESTABLISHING uSA TO uSA COMMUNICATIONS

To establish communications between the master and slave uSA units, both operators must press the REMOTE key and select the desired options. For the slave operator, bits 7 and 6 of the remote option byte must equal 0,1 respectively. For the master operator the remote option byte, bits 7 and 6 should equal 1,0 respectively. Both master and slave operators must select the same ACK/NAK, parity and BAUD rate. The communications link can be established over wire lines (see RS-232D specifications for distance), or using acoustic couplers (see respective data sets) and the phone lines. Once the options have been selected, both operators press the ENABLE key.

In the following example, the master uSA controls the slave uSA over phone lines. The master will download the program to the slave and then execute the program.

MASTER uSA

Operation	Display	Explanation
RESTART	uSA READY Z80	
REMOTE	REM OPTS = 96	Default options.
BINARY	REM OPTS = 10010110	Put in binary.
1000001, ENTER	REM OPTS = 10000001	Modify options to MASTER, ACK/NAK on, NO PARITY, 300 BAUD.
ENABLE	MASTER MODE	REMOTE ENABLE LED is illuminated.

SLAVE uSA

Operation	Display	Explanation
RESTART	uSA READY Z80	
REMOTE	REM OPTS = 96	Default option.
BINARY	REM OPTS = 10010110	Put in binary.
0100001, ENTER	REM OPTS = 01000001	Modify option to SLAVE, ACK/NAK ON, NO PARITY, 300 BAUD.
ENABLE	SLAVE MODE	REMOTE ENABLE LED is illuminated.

Both units are enabled and are ready to talk to each other.

Operation	MASTER uSA Display	Explanation	SLAVE uSA Display
ATTN	LOCAL MODE	Master into local mode, OPT1 LED is illuminated to indicate local mode.	
OPT1	SEND R 0000 0000	Get ready to send data to the slave.	
INCR	SEND P 0000 0000	Choose SEND PROM data from master to slave.	
2, ENTER	SEND P 2000 0000	SEND PROM data from address 2000 thru 27FF to slave.	
27FF, ENTER	SEND IN PROGRESS		LOAD IN PROGRESS
	SEND COMPLETE		LOAD COMPLETE
REMOTE	REM OPT = 81	Return to master mode. Remote and OPT1 LED's extinguished remote link broken.	
ENABLE	MASTER MODE	Reestablish remote link. Remote Enable LED illuminated.	
OPT/MEM	DIAG RAM = 2000		DIAG RAM = 2000
ENABLE	Z80 DEMO V3.1		Z80A DEMO V3.1
RUN	PROM TEST	The master tested user's system that slave uSA was emulating.	PROM TEST
	RAM TEST		RAM TEST
	END OF ALL TESTS		END OF ALL TESTS

Chapter 6

LOGON FUNCTION

6.1 INTROUCTION

The LOGON function key allows the operator to log on to a computer system. This procedure is designed to be as flexible as possible, and is totally independent of the unit under test.

During a logon procedure, the uSA must be able to perform the following:

1. Send arbitrary ASCII character strings under program control.
2. Display messages to the operator.
3. Search received data for arbitrary character strings.
4. Make program decisions based on received data.
5. Make program decisions based on operator input.

The logon is performed through logon PROM(s) inserted in the PROM sockets on the front of the uSA. The LOGON key enables the PROM(s) after the remote option has been enabled and displays the logon PROM initial message to the operator. The operator must press the ENABLE key to cause the logon interpreter to access the logon PROM(s). These PROMs specify the logon procedure by using a pseudo code that is interpreted by logon firmware. The diagnostic programmer specifies the logon sequence for his system in logon pseudo code. To the programmer, the logon firmware appears to be a pseudo machine with a specialized instruction set. The instruction set includes:

1. SEND - Send a string of ASCII characters to the host.
2. DISPLAY - Displays a messages to the operator.
3. SCANKW - Scans incoming data for the keyword string.
4. JUMP - Modify program counter.
5. MENU - Allows operator to select item from menu.
6. CALLML - Call machine language subroutine.
7. ENDLOG - Terminates logon control.
8. SUSLOG - Temporarily suspends logon.
9. BKPT - For Logon PROM debugging, BKPT allows the operator to change the program counter and/or condition registers.

6.2 LOGON STRUCTURE

Logon PROMs must be started at address 4000H for the convenience of the operating system. The PROM header format consists of two pointers, addresses 4000H and 4002H. The first pointer, 4000H, indicates the location of the initial PROM message list. The second pointer, 4002H, points to the first instruction of executable logon pseudo code. The logon pseudo code must begin at 4100H or greater. At run-time, a Shadow RAM outlays the first 256 locations (4000H-40FFH) of the PROM. The initial message list however, may be located in the Shadow area. Use of the Shadow RAM during run-time is to store operator entered variables.

The logon pseudo machine contains two registers: a Program Counter and a Condition Register. The program counter is a register used as a pointer to the next instruction to be executed. As each instruction is executed, it is incremented to the next sequential instruction (except when modified by a jump instruction).

The Condition Register is a three-bit register that records the results of the extended instructions.

Logon PROM format is shown in figure 6-1. The format consists of an opcode and operand address.

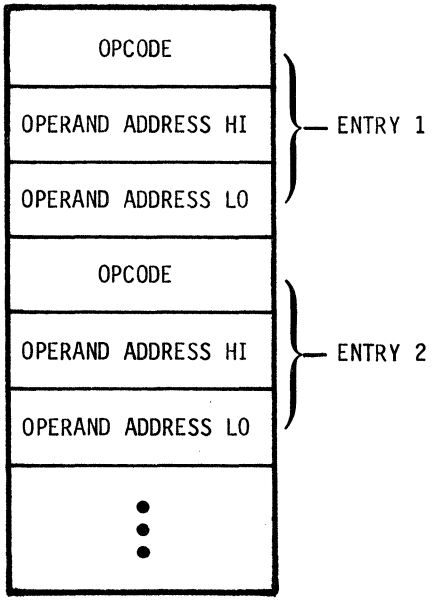


Figure 6-1. Logon Pseudo Code Format

Table 6-1 shows an example of a LOGON PROM.

Table 6-1. Logon PROM Format

ADDRESS	DATA	EXPLANATION
4000	40	Location of the initial message list (4004)
4001	04	
4002	41	Location of start of code (4100)
4003	00	
4004	80	Output only
4005	09	Length
4006	40	Address of initial message (4008)
4007	08	
4008	20	ASCII Message: "Message"
4009	4D	"M"
400A	45	"E"
400B	53	"S"
400C	53	"S"
400D	41	"A"
400E	47	"G"
400F	45	"E"
4010	20	Space
4011		
•		
•		Not used
•		
40FF		
4100		Begin LOGON pseudo instructions

The format of the Opcode byte is shown in Figure 6-2.

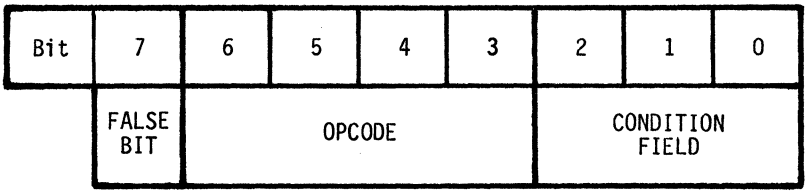


Figure 6-2. Opcode Byte

The condition register (bits 2, 1, and 0) is intially set to an all zero state. Certain instructions can change the condition register, causing it to be set as follows:

1. SCAN - Condition code will reflect which keyword string in the keyword pointer list was received. (1=1st keyword string, 2 = 2nd keyword string, etc. through 7)

2. MENU - Condition code will reflect which item in the MENU list was selected (1 = item 1, etc. through 7)

3. CALLML - Condition code will be placed in the lower three bits of A register, so when the CALLML instruction is executed, the A register will contain the present contents of the condition register. This allows the condition code to be tested, modified, or maintained in its previous state by the subroutine.

4. BKPT - The program counter and/or the condition register can be modified by the operator.

6.3 INSTRUCTION SET

The instructions, listed at the beginning of this chapter, are all conditional and will be executed if the following conditions are met:

1. Condition field of the instruction contains all zeros.

2. Condition field of the instruction matches the present state of the condition register, and the false bit is not set.

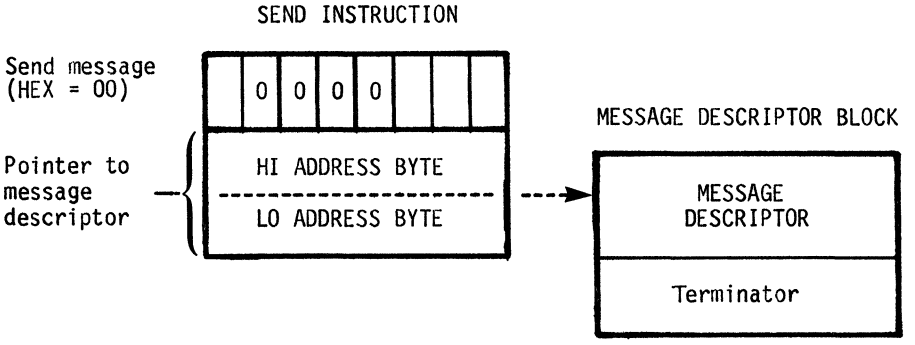
3. Condition field of the instruction does not match the present state of the condition register, and the false bit is set.

If none of these conditions are met, the interpreter will not execute that instruction, but move on to the next instruction.

Listed on the following pages is the logon pseudo code format for each instruction in the set.

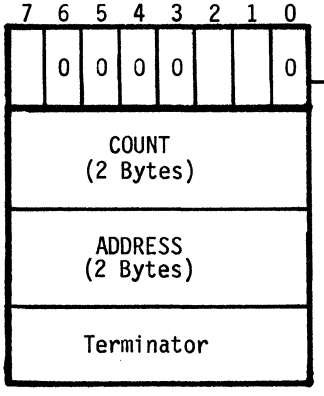
6.3.1 SEND Instruction

The SEND instruction transmits a string of ASCII characters to the host system over the RS-232 data link. The format of the SEND instruction is shown below. The example of a SEND instruction in table 6-2 transmits the three ASCII characters "ABC".



The message descriptor contains a description of the segments of the message to transmitted. The bytes of the message descriptor block are described below:

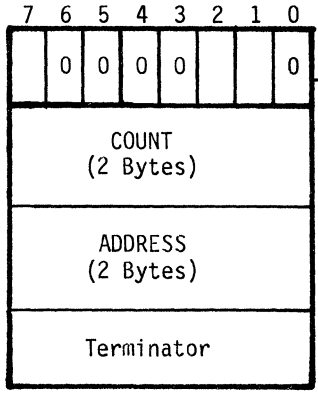
MESSAGE DESCRIPTOR BLOCK



FLAGS - The Flag Byte is defined as follows:

Bits	Meaning
7 = 0	Not the end of the message description block.
7 = 1	Message terminator, previous descriptor block was last segment of message. Rest of the byte is zero.
6 = 0	Special meaning to operating system, must be set to 0.
5 = 0	Special meaning to operating system, must be set to 0.
4 = 0	Special meaning to operating system, must be set to 0.
3 = 0	Special meaning to operating system, must be set to 0.

MESSAGE DESCRIPTOR BLOCK (continued)



FLAGS (continued)

Bits	Meaning
2 = 0	The two-byte address is a pointer to data to be transmitted.
2 = 1	Address is variable. The two-byte address points to an address in the Shadow RAM where the address is stored.
1 = 0	Count is a constant. Lower byte of count used as a byte count, upper byte is set to zero. Counts > 255 are not permitted.
1 = 1	The count is variable. Two-byte count is used as pointer to single byte quantity that is used as actual byte count. (Hi byte, then lo byte.)
0 = 0	Special meaning to operating system, must be set to 0.

Table 6-2. SEND Instruction

ADDRESS	DATA	EXPLANATION
412D	00	Send Opcode
412E	41AB	Address of message descriptor
4130		
.		
.		
.		
41AB	00	Count is a constant
41AC	0003	Value of count is 3
41AE	41B1	Address of message
41B0	80	Message descriptor terminator
41B1	41	Pass word "ABC"
41B2	42	
41B3	43	

6.3.2 DISPLAY Instruction

The DISPLAY instruction displays a message to the operator using the 20 character front panel display. An example of the display instruction is shown in Table 6-3.

The format of the DISPLAY instruction is:

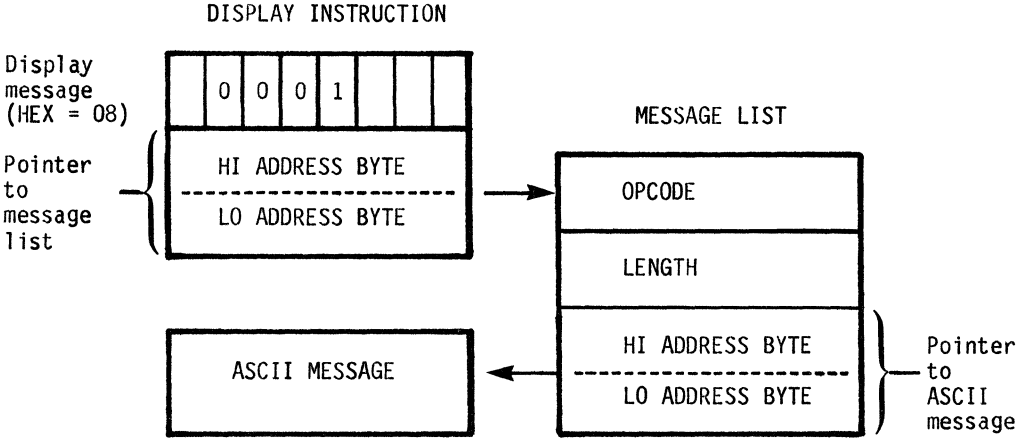


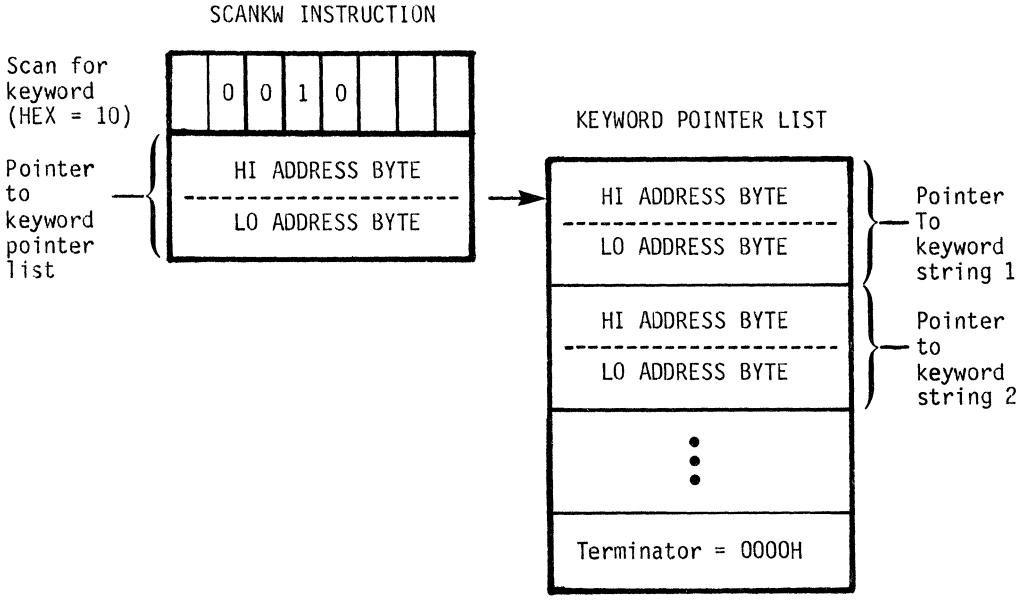
Table 6-3. Display Example

ADDRESS	DATA	EXPLANATION
4142	08	Display OPCODE
4143	424B	Address of message list
•		
•		
•		
424B	80	(Message list) output only
424C	0A	Length of 10 characters
4243	4245	Address of ASCII Message
4245	4C	"L"
4246	4F	"O"
4247	47	"G"
4248	20	" "
4249	4F	"O"
424A	4E	"N"
424B	20	" "
424C	43	"C"
424D	4D	"M"
424E	53	"S"

6.3.3 SCANKW Instruction

The Scan Keyword instruction scans incoming data (up to seven (7) strings of ASCII data). When a string is detected, operation is terminated, and the condition register is updated to show which keyword string was received. There must be a match for one of the keyword strings or the next instruction will not be executed. An example of the SKANKW instruction is shown in Table 6.4.

Format of the SCANKW instruction is shown below:



Condition register will be set to indicate which string was received. One indicates keyword string 1, two indicates keyword string 2, etc. The maximum number of keyword strings is seven.

The keyword string consists of the ASCII characters that are expected. There are two ways of specifying "don't cares":

1. Put a byte of 00 for each ASCII character that is a don't care.

2. If the number of don't care ASCII characters is unknown, but the character to terminate the don't care is known, then use a byte of 00 followed by a byte of FFH, then a byte which is the terminator for the don't care.

KEYWORD STRING

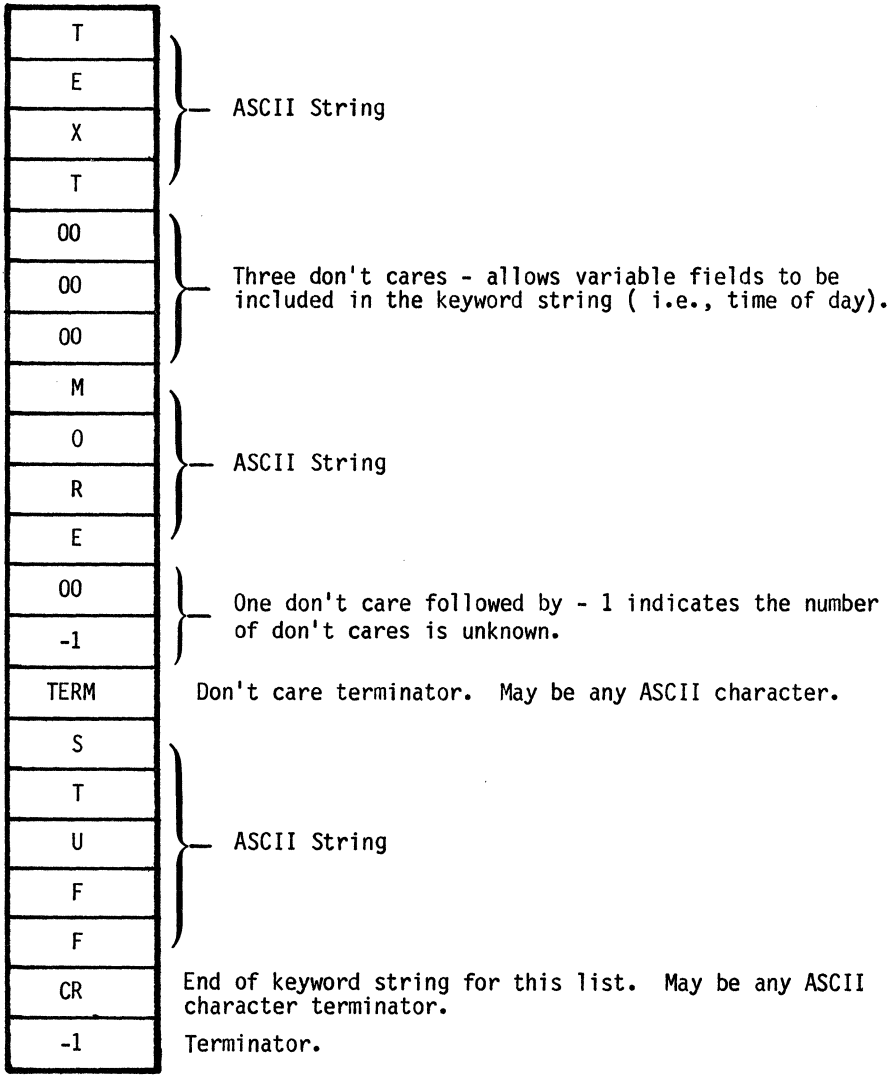


Table 6-4 shows an example of three keyword strings.

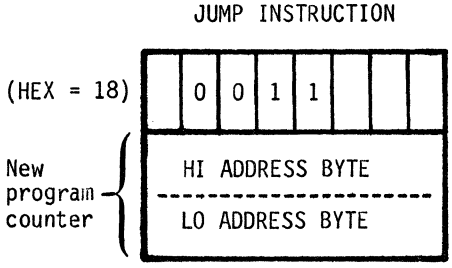
Table 6-4. Scan Keyword Example

ADDRESS	DATA	EXPLANATION	
4130	10	SCANKW OPCODE	
4131	4381	Address of key word list	
.			
.			
.			
4281	428D	Address to keyword string 1	
4283	42B2	Address to keyword string 2	
4285	42C2	Address to keyword string 3	
4287	0000	Terminator	
.			
.			
428D	70	"P"	
428E	61	"A"	
428F	73	"S"	
4290	73	"S"	
4291	77	"W"	Keyword string 1: looking for password
4292	6F	"O"	
4293	72	"R"	
4294	64	"D"	
4295	3A	":"	
4296	20		
4297	FF	Terminator keyword string 1	
42B3	54	"T"	
42B4	49	"I"	
42B5	40	"M"	
42B6	45	"E"	Keyword string 2: looking for time, terminated by a carriage return
42B7	00	Ignore all other characters	
42B8	FF	until	
42B9	0D	a carriage return	
42BA	FF	Terminator for keyword string 2	
.			
.			
42C2	40	"@" Prompt character	Keyword string 3: looking for the prompt character @
42C3	FF	Terminator for a keyword string 3	

6.3.4 **JUMP Instruction**

The JUMP instruction causes the Logon interpreter program counter to be modified. An example of a JUMP instruction is shown in table 6-5.

The format of the JUMP instruction is:



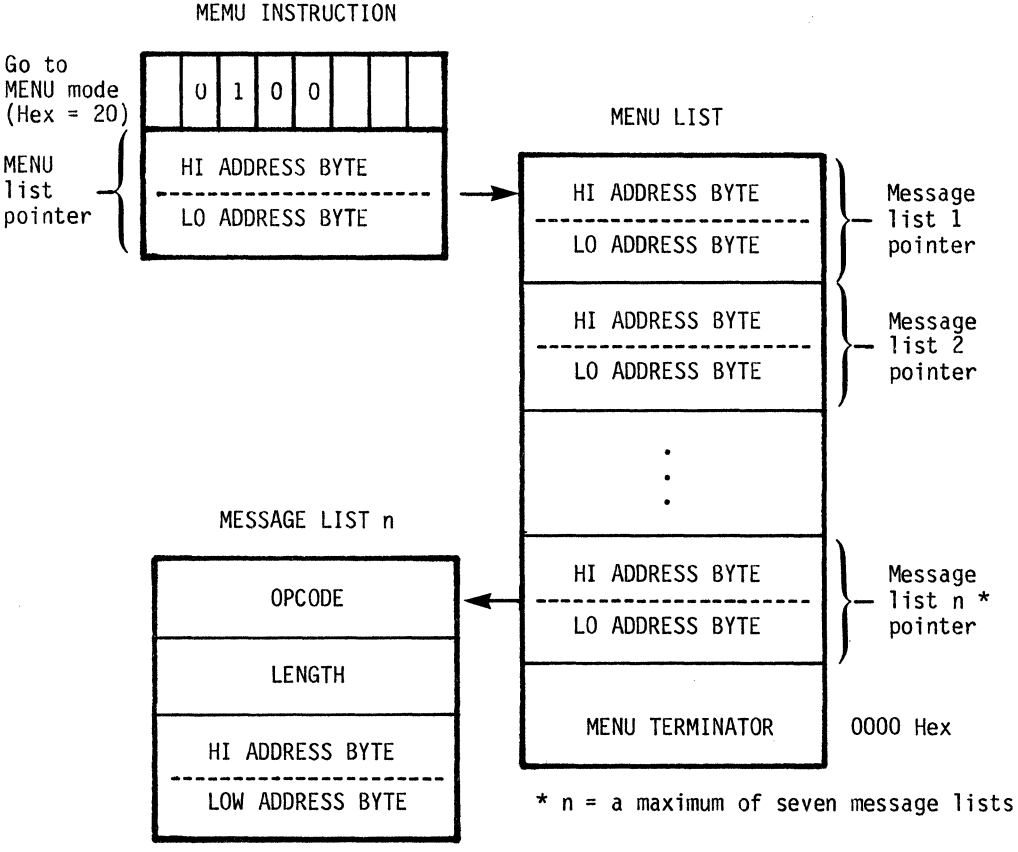
When the Jump instruction is executed, the address becomes the new program counter.

Table 6-5. Jump Example

ADDRESS	DATA	EXPLANATION
4130	10	SCANKW OPCODE
4131	4281	
4133	01	Send password if match on keyword string 1
4134	41AB	
4136	1A	Jump to address 4395 if match on keyword string 2
4137	4395	
4139	9B	Jump to address 4130 if not keyword string 3
413A	4130	

6.3.5 **MENU Instruction**

The MENU instruction allows the logon interpreter to interogate the operator. The interpreter presents a list of items to the operator who must select one of the items. The logon interpreter then resumes execution with the condition register set to indicate which menu item was chosen by the operator. An example of the MENU instruction is shown in table 6-5. The format of the MENU instruction is shown below:



Condition register will be set to indicate which menu was chosen.

The MENU instruction communicates with the operator through the display and the keyboard. During operation of the MENU instruction, certain keyboard functions are enabled. They are:

1. INCR - This key allows the operator to increment through the menu list, looping back to the beginning.

2. HEX KEYPAD - If menu items have input fields, the hex keypad is used to place information in the Shadow RAM area. This allows the operator to entered data in the Shadow RAM, which can then be transmitted to the Host via a SEND instruction.

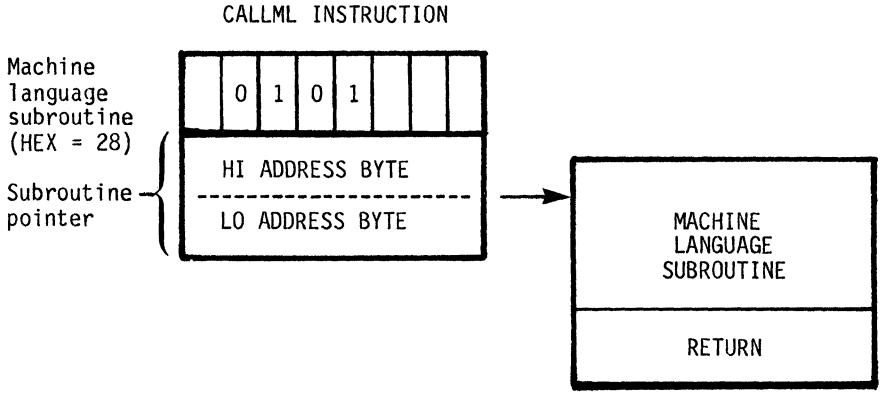
3. ENTER - Allows operator to select an item from the menu list. The condition register is set to indicate which menu item was being viewed by the operator when the ENTER key was pushed. The interpreter resumes execution on the next instruction.

Table 6-5. Menu Example

ADDRESS	DATA	EXPLANATION	
4145	20	MENU Opcode	
4146	42FA	Pointer to MENU list	
•			
•			
•			
42FA	4300	MENU pointer 1	
42FC	4304	MENU pointer 2	
42FE	0000	End of MENU	
4300	08	Output message	
4303	06	Six characters long	MENU List 1
4302	4308	Address ASCII message (LOG-OFF)	
4304	08	Output message	
4305	05	Five characters long	
4306	430E	Address of ASCII message (LOG-ON)	
4308	4C	"L"	
4309	4F	"O"	
430A	47	"G"	
430B	4F	"O"	
430C	46	"F"	MENU List 2
430D	46	"F"	
430E	4C	"L"	
430F	4F	"O"	
4310	47	"G"	
4311	4F	"O"	
4312	4E	"N"	

6.3.6 CALLML Instruction

The CALLML instruction provides a way to call machine language subroutines. THIS INSTRUCTION IS NOT INTENDED FOR THE END USER. It is to provide a way around situations which cannot be handled by the normal logon instruction.

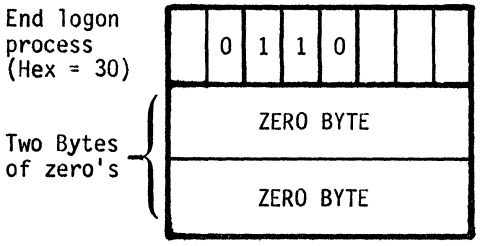


The subroutine is executed by the master processor. Upon entry, the A register contains the present contents of the condition register. Upon return, the condition register will be set to the contents of the lower three bits of A register. This allows the subroutine to preserve or alter the contents of the condition register. The machine language subroutine must be written in 6800 assembly language.

6.3.7 **ENDLOG Instruction**

The ENDLOG instruction terminates the logon control, returning control to normal remote operation.

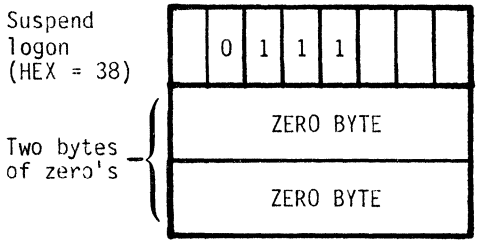
ENDLOG INSTRUCTION



6.3.8 **SUSLOG Instruction**

The SUSLOG instruction temporarily suspends logon control and returns to normal remote operation. The Download, Guide Probe, Master, or Slave Mode will cause the logon execution to resume, upon the completion of a SEND or LOAD operation. Logon control resumes on the next sequential instruction. The condition register is preserved.

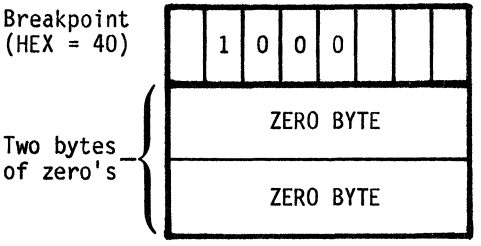
SUSLOG INSTRUCTION



6.3.9 **BKPT Instruction**

The BKPT instruction temporarily suspends execution of the logon instruction. This allows the operator to change the logon program counter and/or the condition register. Logon execution is resumed on either the next sequential instruction, or on the operator specified instruction.

BKPT INSTRUCTION



When the break instruction is encountered, the message pending light is illuminated and the beeper sounded. This allows the current uSA display to be preserved.

Pressing the INCR key will produce the following display:

```
BKPT=xxxx C - REG=y
```

Where: xxxx = the address of the next logon instruction.
y = the current contents of the condition register.

NOTE: xxxx and y can be modified by the operator.

Pressing the INCR key a second time will cause logon execution to resume at the displayed address, with the displayed condition register value.

Appendix A

ASCII CHARACTER SET

Table A-1 contains the 7-bit ASCII hexadecimal code for each character that can be viewed on the uSA front panel display.

Table A-1. ASCII Character Set in Hexadecimal Representation

7-bit Hexadecimal Number	Character	7-bit Hexadecimal Number	Character
20	SPACE	40	@
21	!	41	A
22	RIGHT DOUBLE "	42	B
23	ALL SEGMENTS ON	43	C
24	$	44	D
25	%	45	E
26	u	46	F
27	'	47	G
28	(	48	H
29	)	49	I
2A	*	4A	J
2B	+	4B	K
2C	,	4C	L
2D	-	4D	M
2E	.	4E	N
2F	/	4F	O
30	0	50	P
31	1	51	Q
32	2	52	R
33	3	53	S
34	4	54	T
35	5	55	U
36	6	56	V
37	7	57	W
38	8	58	X
39	9	59	Y
3A	:	5A	Z
3B	;	5B	SIGMA
3C	DEGREE	5C	BACKSLASH
3D	=	5D	]
3E	LEFT DOUBLE "	5E	→
3F	?	5F	←

Appendix B

KEY SUMMARY

KEY	DESCRIPTION	PAGE
ATTN	Allows the operator to suspend remote operations and return to the local mode.	3-6
OPT1	Interpretive logon procedure enables uSA to communicate with a host computer.	6-1
OPT2	Transmitts data in uSA RAM or PROM out the serial RS-232 port.	3-7
OPT/MEM	Moves data from user's system memory to uSA RAM, moves uSA RAM to user memory, moves front panel PROM data to uSA RAM or user RAM.	3-9
LOGON	Enables internal RAM.	3-11
REMOTE	Allows the uSA to establish the communication options.	3-2

Appendix C

MESSAGE INFORMATION

C.1 DATA MESSAGES

Table C-1 shows which of the data can be received and transmitted by each of the remote modes.

Table C-1. Data Messages

MESSAGE	MODE							
	DOWNLOAD		SLAVE		MASTER		GUIDED PROBE	
TYPE	RCV	XMT	RCV	XMT	RCV	XMT	RC	XMT
Keystroke			X			X	X	X
LED				X	X		X	X
Display				X	X		X	X
Download	X	X	X	X	X	X	X	X

C.2 KEYSTROKE FUNCTIONS

Table C-2 gives actual values of keystrokes.

Table C-2. Keystroke Functions

Key Type	Hex Value	Key Type	Hex Value
FILTER	00	SUBSEL	20
COUNT	02	PROM/MEM	21
INTRVL	03	STEP	22
"3"	04	RUN	23
"2"	05	"F"	24
"1"	06	"E"	25
"0"	07	"D"	26
THRESH	08	ENTER	27
FREQ	0A	INCR	29
SIG	0B	DECR	2A
"6"	0C	BINARY	2B
"5"	0D	REMOTE	2D
"4"	0E	LOGON	2E
"9"	14	TEST	2F
"8"	15	ENABLE	31
"7"	16	DISABLE	32
→	17	OPTSEL	33
FILL	18	ATTN	36
OPT/MEM	19	OPT3	37
RESET	1A	REGISTER	42
RUN/DISP	1B	BREAK	43
"C"	1C	OPT2	45
"B"	1D	OPT1	46
"A"	1E	I/O	47
←	1F	MSG	49
		MEMORY	4A

C.3 LED MESSAGES

Bit values of the LED display lights are shown in Table C-3.

Table C-3. LED Bit Values

Bit	LED	Bit	LED
	(Most significant bit)		
15	BEEP (Audible Alarm)	7	OPT MEM ENABLE
14	Unused (must = 0)	6	RUN
13	Unused (must = 0)	5	HALT
12	Unused (must = 0)	4	PROM MEM
11	Unused (must = 0)	3	BREAK
10	Unused (must = 0)	2	IND2
9	IND1	1	MESSAGE PENDING
8	REMOTE	0	INPUT ERROR
			(least significant bit)

NOTE: 1 = On, 0 = Off

Appendix D

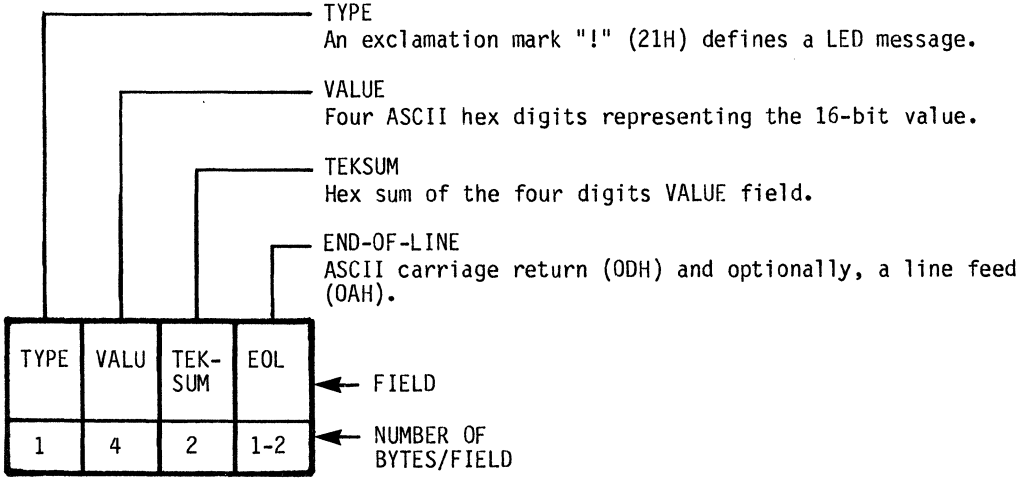
ERROR MESSAGES

MESSAGE	DESCRIPTION
uSA CONDITION 01	Master RAM failure
uSA CONDITION 02	Emulator ROM failure
uSA CONDITION 03	Master ROM failure
uSA CONDITION 04	Emulator not responding
uSA CONDITION 05	Signature ROM failure
uSA CONDITION 06	Shadow RAM failure

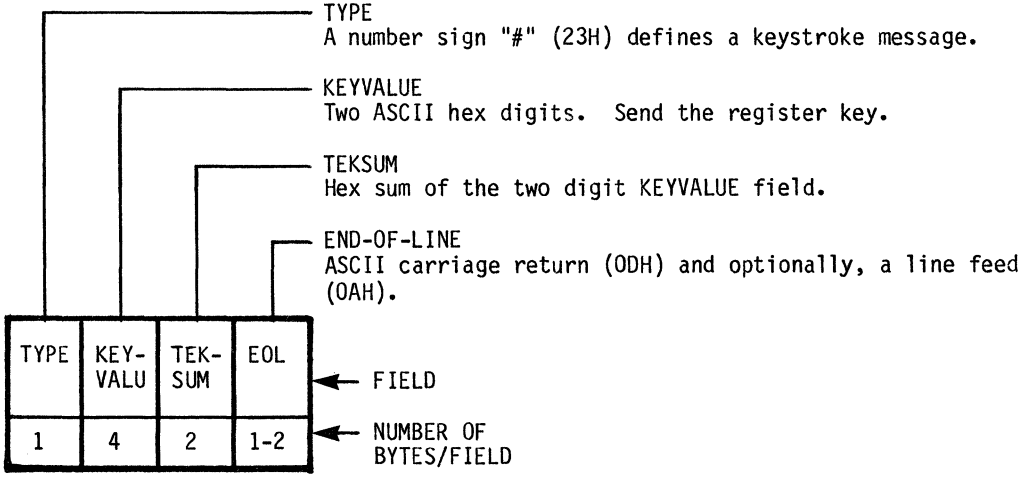
Appendix E

RECORD FORMATS

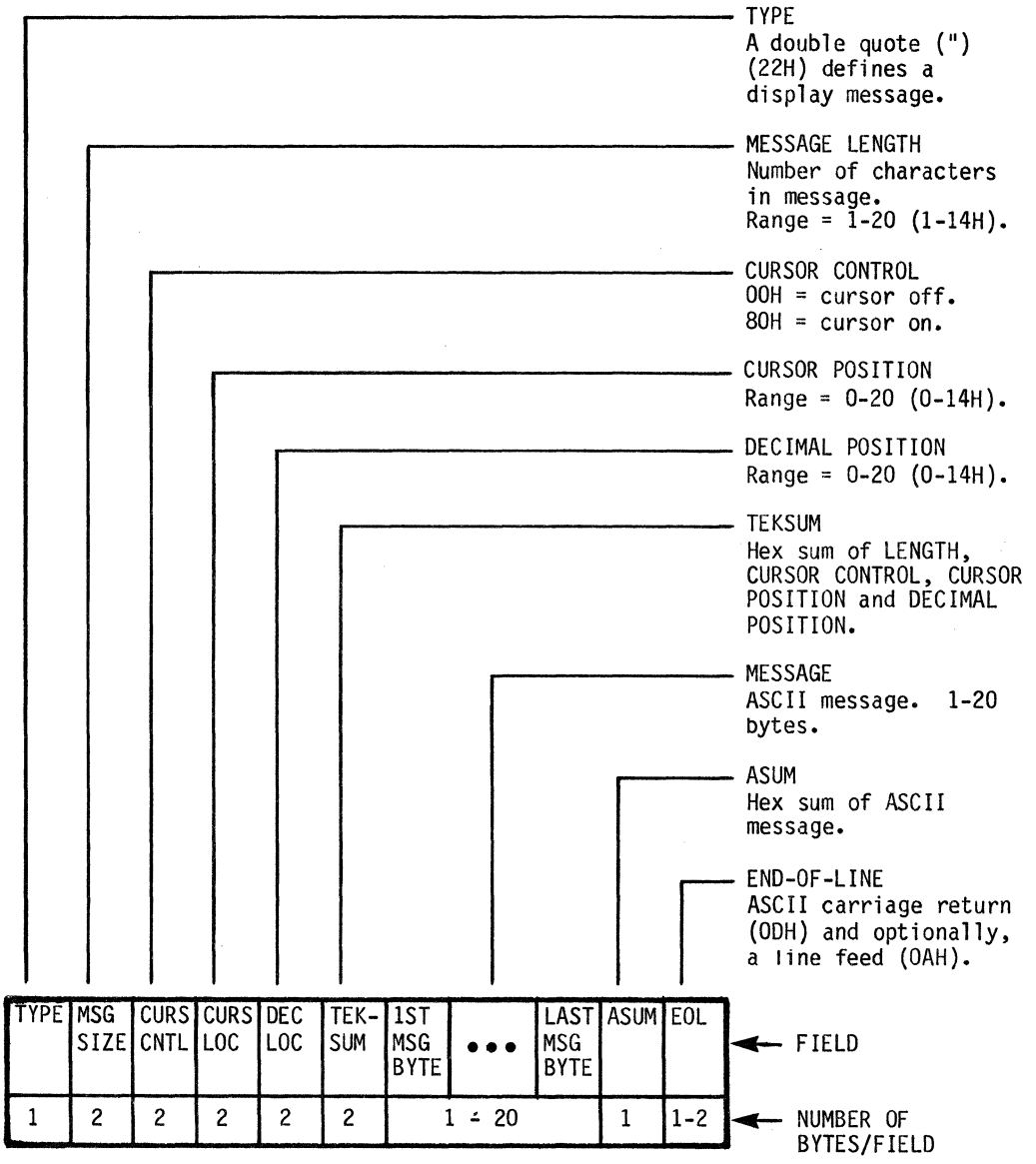
E.1 LED MESSAGE



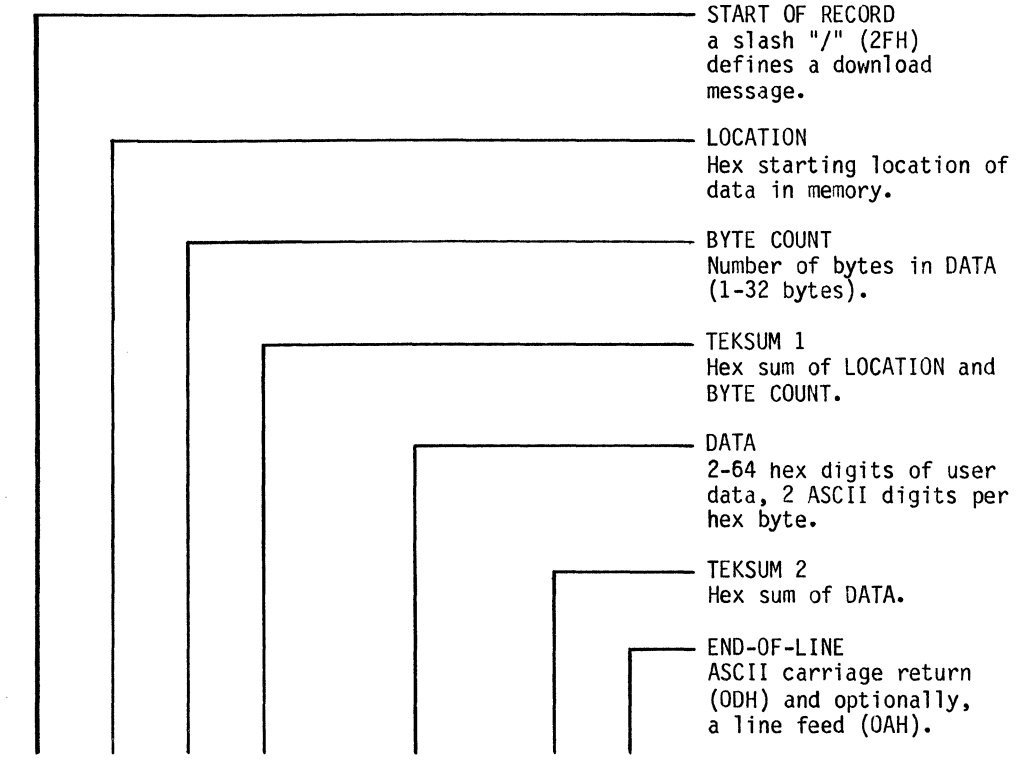
E.2 KEYSTROKE MESSAGE



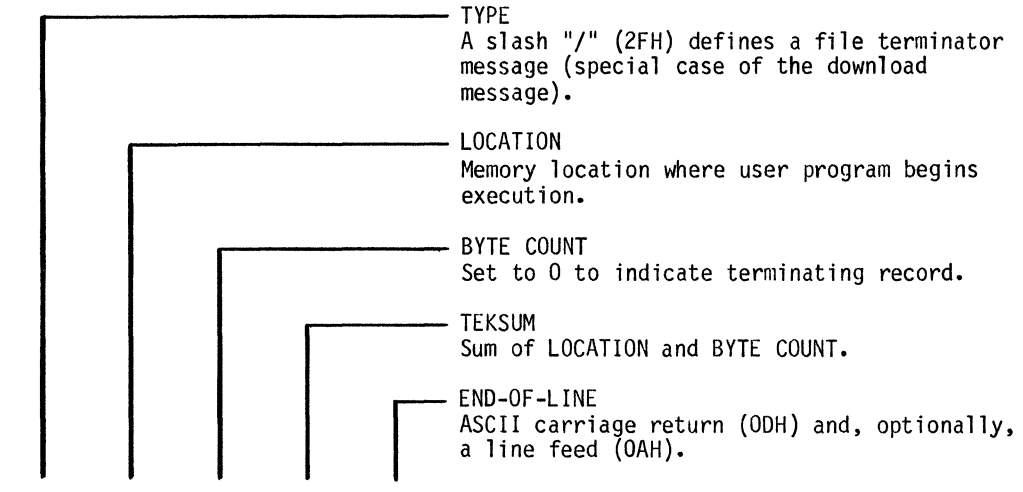
E.3 DISPLAY MESSAGE



E.4 DOWNLOAD MESSAGE



E.5 FILE TERMINATOR MESSAGE



TYPE	TRANS ADDR	BYTE COUNT	TEK SUM	EOL CHARS	← FIELD
1	4	2	2	1-2	← NUMBER OF BYTES/FIELD

Appendix F

LOGON COMMANDS

COMMAND	DESCRIPTION	PAGE
SEND	Send ASCII character string to host.	6-6
DISPLAY	Displays messages to the operator.	6-8
SCANKW	Scans incoming data for the keyword string.	6-9
JUMP	Modify program counter.	6-12
MENU	Allows operator to select item from menu.	6-13
CALLML	Call machine language subroutine.	6-15
ENDLOG	Terminates logon control.	6-16
SUSLOG	Temporarily suspends logon.	6-17
BKPT	For logon PROM debugging, BKPT allows the operator to change the program counter and/or condition registers.	6-18

Appendix G

ORDERING INFORMATION

The Comm Option, P/N COMM-1, can be ordered directly from Millennium or from any Millennium sales office or distributor.

The Comm Option contains all hardware necessary to install this feature in your uSA. The data set or modem is not included.

Millennium recommends the Anderson Jacobson modem model AD342.

INDEX

R

S

U

DOCUMENT REVIEW FORM

MICROSYSTEM ANALYZER
COMMUNICATIONS OPTION
USERS MANUAL

Publication No. 87000033
June 1980
Release 2.0

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SPECIFIC COMMENTS AND CORRECTIONS

Reference	Page

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