CMT HPIL RAM Disc

and

HPIL/RS232 Interface

Owner's Manual

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CMT

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ABOUT THIS MANUAL

The first section of this manual gives a general description of the CMT HPIL RAM Disc and CMT HPIL/RS232 Interface and their basic operation. It also points out some differences between the RAM Disc and other mass storage devices, such as the HP 82161A Digital Cassette Drive and the HP 9114B Disc Drive.

Since the specific information you need to communicate with the RAM Disc is contained on the HP-IL Owner's Manual for your particular controller, we refer you to that text as the primary source of detailed information. However, we have placed a command summary for each of the standard HP controllers in the Appendix of this manual for your reference.

Sections Two and Three cover the technical aspects of the RAM Disc and HPIL/RS232 Interfaces, respectively.

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INTRODUCTION

Congratulations on the purchase of your CMT HPIL RAM Disc. The RAM Disc is a totally solid state device used as a mass storage medium on most HP-IL computer systems. The RAM Disc was designed to be used in outdoor, rugged, and dirty environments where a tape or hard disc drive will not operate effectively. The RAM Disc acts similar to a "hard" disc on a personal computer in that the media cannot be exchanged freely. Files can be transferred to/from other forms of mass storage via HP-IL. The design of the RAM Disc is such that very little power is required for the interface. The RAM Disc is powered by a 9 Volt Alkaline battery, the same as that used in a pocket transistor radio.

The CMT HPIL RAM Disc was designed to be fully compatible as possible with the "Extended Filbert Protocol" mass storage devices and the HP 82164A HP-IL/RS-232 Interface. Where HP devices are now being used, the CMT HPIL RAM Disc should be able to be inserted in the loop in place of the other devices and operate without changes to the software. (Watch for loop addresses on some controllers.)

In order to prevent the accidental loss of data in the media on the RAM Disc, the design has several built-in features. There is a lithium backup battery cell which can retain the contents of the memory for up to two years with no other battery installed. The device has a low battery indicator LED to let the user know when the battery power is running low. If the battery decays below a threshold value, the RAM Disc will shut down automatically and will not power back up until a new battery is inserted, or until the unit is connected to another power source.

The small size and low power consumption of the CMT HPIL RAM Disc makes it a truly portable mass storage device that will be much appreciated, especially in extended outdoor applications.

The RAM Disc comes in the following models:

CMT-RD128	128K Byte HPIL RAM Disc
CMT-RD256	256K Byte HPIL RAM Disc
CMT-RD512	512K Byte HPIL RAM Disc
CMT-RD128-01	128K Byte HPIL/RS232 RAM Disc
CMT-RD256-01	256K Byte HPIL/RS232 RAM Disc
CMT-RD512-01	512K Byte HPIL/RS232 RAM Disc
CMT-IL/RS	Battery Powered HPIL/RS232 Interface

The CMT Portable HPIL/RS232 Interface is a battery powered unit that is compatible with the HP 82164A HP-IL/RS-232 Interface. Like the RAM Disc, the product has been engineered for long battery life. Specific references to this product are made in Section One, with the technical information detailed in Section Three.

Section 1

CMT HPIL RAM Disc and HPIL/RS232 Interface User's Manual

INSTALLATION

POWER

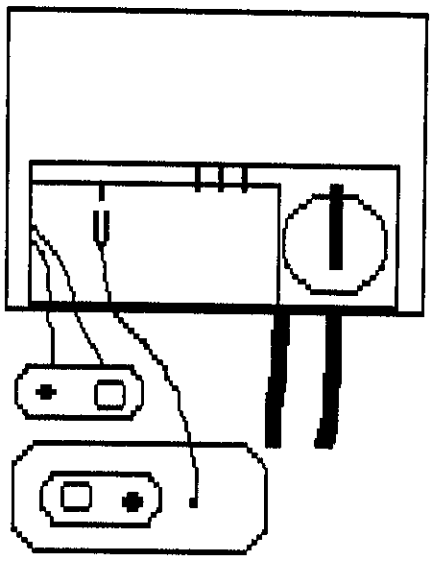
CMT reccommends the use of a 9 Volt Alkaline battery or 9 Volt Mercury battery for your RAM Disc. Carbon Zinc batteries will work, however, they will provide significantly less battery life. For a rechargable battery, CMT reccommends our 9 Volt NiCad battery. This battery is made exclusively for our RAM Disc and HPIL/RS232 Interface products. Other Nicad batteries are available, but these will most likely have a much shorter life and may not be able to be recharged by our recharger.

Alkaline Battery - This battery is inserted by removing the battery door on the bottom of the RAM Disc. The door is removed by sliding it away from the center of the case. Attach the battery clip wires onto the 9 Volt battery and insert the battery into the RAM Disc battery compartment. Re-attach the battery door by sliding it toward the center of the RAM Disc case. The door should latch when closed.

NiCad Battery - This battery is an option with the CMT HPIL RAM Disc, but **is included with every CMT HPIL/RS232 Interface.** The battery is inserted just like the Alkaline battery except the recharging wire must be connected in order to recharge the battery(see diagram below). Re-attach the battery door by sliding it toward the center of the RAM Disc case. The door should latch when closed.

To recharge the NiCad battery, plug the recharger into the wall and connect the recharger receptacle to the RAM Disc D.C. Jack. It will take 6 hrs. to fully recharge the battery.

In the diagram to the right, the pin to place the recharging connector on is located on the bottom board of the unit. **DO NOT** hook the connector onto one of the three pins which are located on the top board of the unit. This may damage the RAM Disc. Securely fasten the connector over the pin and then attach the 9V battery clips. If you find that the unit is not recharging properly, check that this connection has not come loose. When you put the battery back in to the unit, place it in so the connector is in the foam pad. Doing this will make it easier to get the battery door on.



Lithium Battery - This battery is used to retain the contents of the RAM Disc whenever power is removed. Under normal use, this battery will not need to be replaced for about two years. In order to ensure data integrity, replacement of this battery once a year is encouraged. To replace this battery, remove the battery door and pry the old battery from the socket. Insert a new battery in the socket, observing the proper polarity. When replacing this battery, data will not be lost if power is applied to the RAM Disc from the 9V battery or the DC jack.

CAUTION: Back up your data on another medium before replacing the lithium battery if no other power supply will be available. Or else your data may be lost.

DC Jack - An external power jack has been provided to allow the user to supply power to the RAM Disc from other sources. This may be a wall transformer or a 6-12V DC battery. See the figure below for more details. CMT supplies an optional 120VAC wall adapter and an external battery pack which can be worn as a belt. When the 120V wall adapter is connected to the RAM Disc, the unit can be operated even if the 9V battery is dead (unlike previous HP-IL drives). The 120V wall adapter acts as an AC/DC converter for the 9V alkaline and as a recharger for the 9V NiCad battery.

If using your own power source, the D.C. Jack accepts a 2.1 mm DC power plug. The external power supply should be able to supply up to 200 ma of current. To recharge the CMT NiCad battery pack properly, the external DC supply should be 12V. To prevent the internal battery from draining while using an external 6V battery for the main power source, remove the internal 9V NiCad or 9V Alkaline batery from the RAM Disc.

If you choose to supply your own power source for the DC Jack, the connector plug **must** be like the diagram to the left. The inner sleeve must be POSITIVE and the outside must be NEGATIVE.

INTERFACE CONNECTIONS

HP-IL - Connection to your HP-IL loop is provided by the two sets of wires which are near the DC Jack. Familiarity with HP-IL is assumed. If you are not familiar with HP-IL, consult the owners manual of your HP-IL controller. The large connector is "IN" and the small connector is "OUT".

RS-232 - If you have the optional RS-232 interface, there are two types of cables available for your use. They are DTE(Data Terminal Equipment) and DCE(Data Communication Equipment) cables. The DTE cable is typically used for connection to printers, plotters, modems, etc.. The DCE cable is typically used for connection to an IBM PC.

Please refer to the appendix for pinouts of the DTE and DCE cables.

CMT supplies optional cables to convert the 9 pin connector to the 25 pin DTE and 25 pin DCE receptacles. They are also commercially available at most computer store outlets. The CMT 9 pin signal arrangement is same as that used by the IBM-AT serial interface. Part numbers of the cables are listed in the Accessory section of this manual.

FRONT PANEL OPERATION

ON/1 Switch - Pressing this button switch will turn the RAM Disc on. The yellow LED will light up. The RAM Disc will also turn on automatically when an HP-IL frame is received from the controller.

OFF/0 Switch - Pressing this button switch will turn the RAM Disc off. The yellow and red LEDs will both be off. The RAM Disc will also turn off if a "Loop Power Down" HP-IL sequence is received from the controller. (Some controllers do not have this function. Please consult your controller manual.) The RAM Disc may also power down if it determines that the battery level is too low to operate properly. This is to prevent any possible alteration of the media.

RED LED - This LED will light up whenever the battery level is too low. This means the 9V battery should be replaced. If a NiCad battery is being used, it should be recharged. In addition to the RED LED being lit, the low battery condition can be determined by looking at the controller's "Device ID". If the battery level is good the last character before CR/LF will be a 'G'; if the level is bad the last character will be a 'L'. This feature can be used with some controllers to prevent writing to the RAM Disc if the battery is low.

YELLOW LED - This LED lights up any time the HP-IL IC is active. When the RAM Disc is first turned on, it is drawing maximum power; if there is no loop traffic (i.e. the RAM Disc has nothing to do), the RAM Disc will go to a low power state with only the HP-IL IC active. This prolongs the life of the battery. The yellow LED remains lit so you are aware the unit is not completely off and that it is still draining power from the battery. If you have the RS232 option, the RAM Disc can be prevented from timing out to the low power state by using the new remote command, TO0.

OPERATION OVERVIEW

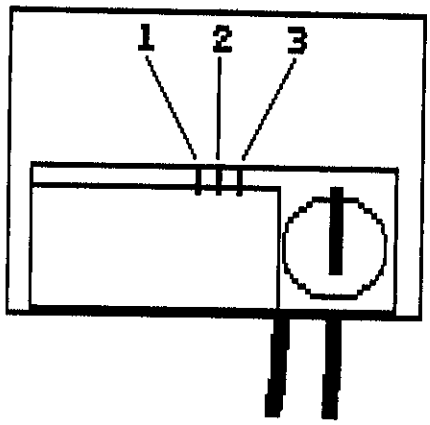
The CMT HPIL RAM Disc can be operated in either single or multiple drive mode. These modes determine the number of virtual devices on the loop and the data size of each device. This partitioning is done to allow as much flexibility over the use of the memory by different HP-IL controllers. Not all HP-IL controllers can handle over 128K of memory per mass storage device. See the appendix for mass storage commands for use with your HP-IL controller.

RAM Disc Single Drive Mode - The RAM Disc appears as one device on the HP-IL loop with a total address space equal to the amount of memory installed in the RAM Disc.

RAM Disc Multiple Drive Mode - The RAM Disc appears as multiple 128K bytes mass storage devices on the HP-IL loop. A 256K version would appear as two 128K devices, a 512K version would appear as four 128K devices.

The selection between the two modes is made by the jumper in the battery compartment. The position of the jumper is ascertained every time the unit is powered on. After the jumper has been changed, the media must be re-initialized (reformatted) to correct all the directory tables. Failure to do so will cause undetermined behavior.

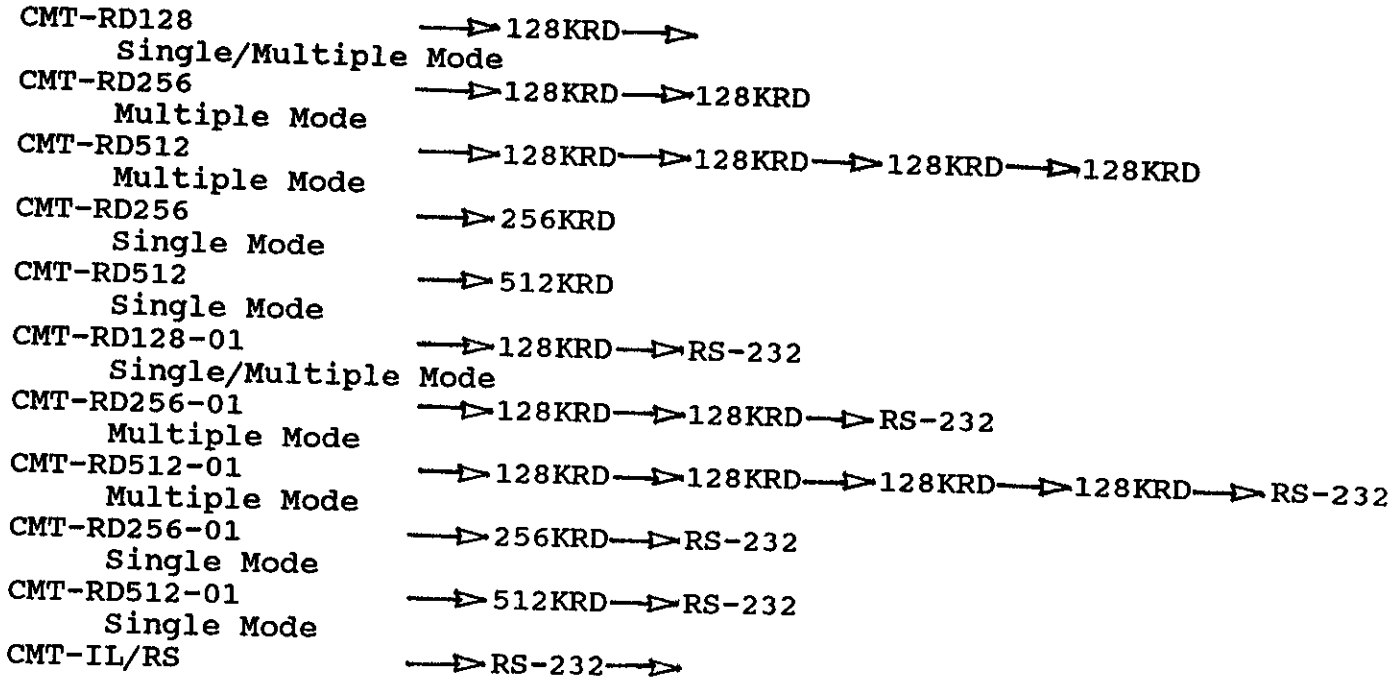
CAUTION: Before changing the jumper, be sure to back up any files that you wish to restore to the RAM Disc later. Failure to do so will result in the loss of all data!



In the diagram on the left, the jumper pins are numbered 1, 2, and 3. The RAM Disc is in Multiple Drive Mode when pins 1 & 2 are covered by the shorting plug and in Single Drive Mode when pins 2 & 3 are covered.

RS-232 Option - If your RAM Disc has the RS-232 option, there will appear to be another virtual device on the HP-IL loop. This device emulates the HP 82164A HP-IL/RS-232 Interface. It is programmed with the same remote commands and/or device dependent commands as the HP device. This device will always appear after the RAM Disc mass storage devices on the HP-IL loop. If you are using the CMT HPIL/RS232 Interface then it will appear as a single device on the HP-IL loop.

The following table shows all the possible HP-IL "virtual" loop devices for all RAM Disc sizes and options. While the RAM Disc is itself one physical device, depending on the operation mode it is in it may look like more than one device on the HP-IL. Therefore, it is called a virtual device.



RS-232 STARTUP CONDITIONS

The following are the RS-232 startup and HP-IL "device clear" default conditions. The startup conditions only occur when power is applied after a power drained state (i.e. all batteries and power have been removed and about 1 minute has elapsed)or an HP-IL "device clear" or "selected device clear" and the device was a listener. They do not change when the device is simply powered on and off.

By using these defaults as much as possible you will minimize the amount of programming of the RS-232 interface and avoid ambiguities when a device clear statement is sent on the HP-IL loop.

The defaults are:

Number of STOP bits - 1 bit
Number of DATA bits - 8 bits
Show Parity Error - OFF
Baud Rate - 9600
Parity Select - none
Software Handshakes - XON/XOFF enabled
ENK/ACK - terminal enabled
ECHO - OFF
Data Terminal Ready - Enabled and TRUE
Request to Send- Enabled and TRUE
Service Request Conditions - OFF
Delete Special Characters - OFF

COMPATIBILITY WITH HP DEVICES

The CMT HPIL RAM Disc supports the functions of the HP 82161A Digital Cassette Drive. The RAM Disc also has the following extensions:

Send Device ID - CMTDSK<size><bat level><CR><LF>
size= 1, 2, or 4 (128K Byte Segments)
bat level = 'G' - good or 'L' - low battery
Extended Filbert Protocol
AUTO ADDRESS UNCONFIGURE - Removes Listener and Talker Status.

If your RAM Disc has the RS-232 interface, it will support the functions of the HP 82164A HP-IL/RS-232 Interface with the following extensions or deletions:

CMT device has no service request switch
CMT device has no manual service request switch or bit
CMT device has no DCE/DTE jumper (action is performed by changing cable)
CMT device register R13 bit 3 is timeout bit
if 1 - light sleep enabled (default)
if 0 - light sleep not allowed
CMT device does not support remote commands P2 and P3, Zero and One parity
CMT device has three new remote commands - TO0, TO1, SB0
TO0 - no timeout
TO1 - time out enabled
SB0 - turn off RS-232
AUTO ADDRESS UNCONFIGURE - Removes Listener and Talker Status

Section 2

CMT HPIL RAM Disc
TECHNICAL DESCRIPTION

The User's Manual has covered the basic information about using the CMT HPIL RAM Disc mass storage device. This section covers some of the more technical aspects of the the product. For most applications you will not need to use the following information. However, it is included here for those situations that require such detail.

SINGLE AND MULTIPLE MODE OPERATION

The CMT HPIL RAM Disc can operate in one of two modes: Single or Multiple mode. When operating in Single mode, the RAM Disc appears as one device on the HP-IL loop which has all of the available memory accessible as one unit (i.e. one 512K or 256K block). In Multiple mode, the RAM Disc appears as multiple devices on the HP-IL loop, each device able to access 128K bytes of the memory in individual sections. A 512K RAM Disc would appear as four devices on the HP-IL loop, each emulating an HP 82161A Digital Cassette Drive.

The following technical description applies to each section that is a device on the HP-IL loop. That is, each device has its own buffers and status registers. Only one device can be active on the loop at a time. This requirement means that you can not make one device a talker and another a listener at the same time. Normally this will not affect normal operation, but it may cause some difficulty with tape cloning programs such as MCOPY. (MCOPY is a routine provided in the HP-41 and HP-75 I/O modules.)

You can MCOPY from an HP 82161A Digital Cassette Drive to a 128K configured RAM Disc (single or multiple mode), but you can not MCOPY from one 128K RAM Disc to another 128K RAM Disc in multiple mode in the same unit. You can MCOPY from a 128K RAM Disc to another physically different 128K RAM Disc.

You can of course copy a file from one 128K section into another 128K section in the same physical unit using your controller's standard copy routines.

INTERNAL DESIGN

The RAM Disc has three internal features that are important for understanding the drive's operation: buffer 0, buffer 1, and the byte pointer.

BUFFER 0. This buffer consists of 256 cells, with each cell capable of holding one byte (eight bits). Buffer 0 is used for holding information that is being transferred between the internal memory (medium) and the interface loop.

BUFFER 1. This buffer also consists of 256 cells, with each cell capable of holding one byte. Buffer 1 is used for holding information being sent to or received from the interface loop.

BYTE POINTER. The byte pointer is essentially an indicator that directs the transfer of information into and out of buffers 0 and 1. It specifies a certain cell (or byte) in the buffer-from 0 to 255. The transfer normally follows the pointer, which advances from one cell to the next. The one pointer applies to both buffers.

The RAM Disc has two primary modes for recording on the medium: continuous recording and partial recording. Continuous recording is selected by the Write (Device Dependent Listener 2) command. Partial recording is selected by the Partial Write (Device Dependent Listener 6) command.

For continuous recording, the contents of buffer 0 are defined by data received in the interface loop. Each time buffer 0 is filled, its contents are replaced on the medium. This recording mode is useful for storing entire records.

For partial recording, the current record on the medium is first copied into buffer 0, then part (or all) of this copy is replaced by data from the interface loop. Whenever the buffer is filled, the revised contents replace the original record on the medium and the next record is copied into buffer 0. This recording mode is useful for changing part of a record without affecting the rest of the record.

Multiple tracks of information are available on the RAM Disc, with each track consisting of 256 records. (Each record contains 256 bytes.) It is possible for one file to span from the end of one track to the beginning of the next track.

CONTROLLING THE DRIVE

STARTUP CONDITIONS

Whenever the RAM Disc turns on (including recovery from a low-power condition), it sets the medium to the start of the first record, clears the recording mode, and sets its HP-IL address to an undefined state. An undefined address prevents the drive from performing any operation until it is assigned a valid address.

HP-IL MESSAGES

When the drive receives an HP-IL message on the interface loop, the drive responds according to the following list. Except where noted, the drive automatically sends each HP-IL message to the next device in the loop.

HP-IL MESSAGE	RAM Disc Response
COMMAND GROUP	
Interface Clear	Talker or listener status removed and pending command cleared (unless Device Clear command).
Device Clear	Record position set to start of first record, recording mode cleared, and sending of data terminated.
Selected Device Clear	If listener, device cleared as with Device Cleared command.
Go to Local	No response.
Local Lockout	No response.
Remote Enable	No response.
Not Remote Enable	No response.
Parallel Poll Enable 0-5	No response.
Parallel Poll Disable	No response.
Parallel Poll Unconfigure	No response.
Group Execute Trigger	No response.
Loop Power Down	Devices turns off and device clear is executed.
Enable Asynchronous Request	No response.
Auto Address Unconfigure	Device Removed from Listener and Talker Status. Same as Unlisten and Untalk.
Listen Address 0-31	If address matches, device removed from talker status and becomes a listener. If address is 31, device removed from listener status.
Unlisten	Device removed from listener status.
Device Dependent Listener 0-31	If listener, responds as described under Device Dependent Commands.

Talk Address 0-31	If address matches, device removed from listener status and becomes a talker. If address doesn't match, device removed from talker status.
Untalk	Device removed from talker status.
Device Dependent Talker 0-31	If talker, responds as described under Device Dependent Commands.
Secondary Address 0-31	No response.
Null	No response.

READY GROUP

Take Control	No response.
Ready for Command	Executes previous command.
Send Data*	If talker, begins sending data as previously selected.
Send Status*	If talker, sends one byte of status (Refer to the table following this list).
Send Device ID*	If talker, the device sends eight bytes of ASCII data plus <CR><LF>. The ID sent is: CMTDSK<size> <battery flag> <CR><LF> where <size> is memory size in bytes divided by 131,072. <battery flag> is "G"(good) or "L"(low battery).
Send Accessory ID*	If talker, sends one byte with the value 16.
Not Ready for Data	If talker, makes previous data byte the last byte sent.
End of Transmission-OK	If talker, sent at end of data or for read error.
End of Transmission-ERROR	If talker, sent immediately for bad HP-IL error check.
Auto Address 0-31	If device has earlier auto address, no response. If address is 31, no response. If message address less than 31 and device address to message address, increments message address by one and passes revised message.

Auto Extended Primary 0-31	No response.
Auto Extended Sec. 0-31	No response.
Auto Multiple Primary 0-31	No response.

IDENTIFY GROUP

Identify (no service request)	No response.
Identify (service request)	No response.

DATA GROUP

Data Byte(no service request)	*If talker, performs HP-IL error check and sends next data byte.
Data Byte(service request)	If listener, accepts data byte and passes to next device.
End Byte(no service request)	If listener, accepts data byte, records contents of buffer 0 onto tape, and passes the byte to next device.

*Indicates that the received message is not passed to the next device in the loop.

STATUS VALUE	MODE	DEFINITION
0	Idle condition	No error and not executing a previous command.
18	Stall error	Failure of internal RAM.
26	Checksum error	Computed checksum differs from expected.
28	Size Error	Specified track number that was too large.
32	Busy condition	Device is executing a previous command. (This is not an error.)

DEVICE DEPENDENT COMMANDS

Device Dependent Listener commands and Device Dependent Talker commands are special HP-IL messages whose meanings depend upon the device receiving them, the listener or the talker. When these commands are sent to the RAM Disc drive, they are referred to by names that correspond to the specific actions they cause. Device-dependent command numbers, names, and responses are listed below.

DEVICE DEPENDENT LISTENER COMMANDS

NUMBER	NAME	DESCRIPTION
0	Writes Buffer 0	Subsequent Data Bytes are treated as data. That is, they are stored in buffer 0 starting at the byte pointer location and, when the buffer fills, are recorded onto the medium according to the current mode. Additional data bytes fill the buffer starting at its first cell and are recorded onto the medium. A subsequent End Byte is stored as a data byte.
1	Write Buffer 1	Subsequent Data Bytes are stored in buffer 1 starting at the byte pointer location. When the buffer fills, additional data bytes replace those already in the buffer starting at the first cell. A subsequent End Byte is stored the same way. (This command also clears the partial recording mode set up by the Partial Write command-Device Dependent Listener 6 command).
2	Write	The device is set for continuous recording of information onto the medium. The byte pointer is set to the first cell in buffer 0. As subsequent Data Bytes fill buffer 0, its contents will be recorded into sequential records on the medium(leaving the medium positioned at the next record). The contents of buffer 0 will be recorded onto the medium when a Close Record (Device Dependent Listener 8) command or End Byte is received.
3	Set Byte Pointer	Subsequent Data Bytes redefine the byte pointer, from 0 to 255. Only the last byte received is used.

4	Seek	The next two Data Bytes are interpreted as a track number and record number (0 thru 255), and the medium is positioned to that track and record. If the track number is greater than the maximum, the record pointer is not moved and a Size Error is generated. (Refer to the Status Byte Definition table above). (This command also clears the partial recording mode set up by the Partial Write command-Device Dependent Listener 6 command.)
5	Format	The value 255 is recorded in each byte in all records on the medium. This sets up on the medium the physical positions of the records. When finished, the record pointer is positioned to the first cell of record 0, track 1. (This command also clears the partial recording mode set up by the Partial Write command-device Dependent Listener 6 command.)
6	Partial Write	The device is set for partial recording of information onto the medium. That is, the current record is read from the medium into buffer 0 and the record pointer is positioned back to the start of the same record. Subsequent Data Bytes will replace the contents of buffer 0 starting at the byte pointer location. When the buffer is filled, its contents will be read into buffer 0, and the record pointer will be positioned back to the start of the record just read. The byte pointer is not changed when the buffer is recorded. This continues until a Close Record (Device Dependent Listener 8) command or End Byte is received. A Close Record command will cause the contents of buffer 0 to be recorded and the record pointer to be positioned back to the start of the same record. An End Byte will be stored in buffer 0 and will cause the contents to be recorded and the record pointer to be positioned back to the start of the same record-unless the End Byte fills the buffer, for which the buffer contents will be recorded, the next record will be read into the

		buffer, and the record pointer positioned back to the start of the record just read.
7	Rewind	The record pointer is set to zero. The storage memory can't be used until a Device Clear command or a Seek (Device Dependent Listener 4) command is issued.
8	Close Record	The contents of buffer 0 are recorded in the current record on the medium. Following a Write (Device Dependent Listener 2) command, a Close Record command leaves the record pointer positioned at the next record. Following a Partial Write (Device Dependent 6) command leaves the record pointer positioned at the start of the record just recorded.
9	Transfer Buffer	The contents of buffer 0 are copied into buffer 1. The byte pointer is reset to 0.
10	Exchange Buffers	The contents of buffer 0 and buffer 1 are exchanged. The byte pointer is reset to 0.
11	Verify Records	The next two bytes are interpreted as the number of records to verify starting from the present record. The first byte received is the most significant byte. Verification starts at the present record and continues until an error is detected or the end of storage. If an error is detected, the Status Byte will be set to its CHECKSUM ERROR value. If the two bytes were both of value 99 then a diagnostic test is initiated which checks all storage RAM and ROM without changing the storage memory data. If the ROM test fails, a CHECKSUM ERROR will be reported; if the RAM fails, a TAPE STALL error will be reported by the Status Byte.
12-31		The device is set to ignore Data Bytes and End Bytes until directed by subsequent Device Dependent Listener commands. This prevents improper use. These commands also clear the partial recording mode set up by the Partial Write command (Device Dependent Listener 6 command).

DEVICE DEPENDENT TALKER COMMANDS

NUMBER	NAME	DESCRIPTION
0	Send Buffer 0	A subsequent Send Data message causes the contents of buffer 0 to be sent on the interface loop. Data starts with the byte indicated by the byte pointer. When the end of the buffer is reached, the next record is read from the medium into the buffer and sent on the interface loop. This continues until the end of medium is reached, a Not Ready for Data message is received, or any error condition occurs. This command also clears the partial recording mode set up by the Partial Write command (Device Dependent Listener 6 command).
1	Send Buffer 1	A subsequent Send Data message causes the contents of buffer 1 to be sent on the interface loop. Data starts with the byte indicated by byte pointer. It continues until the end of the buffer is reached or Not Ready for Data message is received.
2	Read	The next record is read from the medium into buffer 0. A subsequent Send Data message causes the contents of buffer 0 to be sent on the interface loop starting with the first byte on the buffer. When the end of the buffer is reached, the next record is read into the buffer and sent. This continues until the end of medium is reached, a Not Ready for Data message is received or any error condition occurs. This command also clears the partial recording mode set up by the Partial Write command (Device Dependent Listener 6 command).
3	Send Position	Three bytes indicating the current medium position are sent on the interface loop. The first byte represents the track number. The second number represents the record number, 0 through 255. The third number represents the byte number, 0 through 255.

4	Exchange Buffers	The contents of buffer 0 and buffer 1 are exchanged. The byte pointer is reset to 0.
5	Transfer Buffer	The contents of buffer 0 are copied into buffer 1. The byte pointer is reset to zero.
6	Send Attributes	A subsequent Send Data message causes 12 bytes to be sent onto the interface loop. The 12 bytes are grouped into three 4 byte numbers (sent most significant first). The first number sent is the number of tracks (2 through 8). The second number is the number of sides(1). The third number is 256 records per track.
7	Send Max Address	A subsequent Send Data message causes 2 bytes to be sent onto the interface loop (most significant first) which indicate the last record number in the storage memory.
8-31		The device is set to not send data unless directed by subsequent Device Dependent Talker commands. This prevents improper use.

Section 3

CMT HPIL/RS232 Technical Description

RS-232 INTERFACE OPERATION OVERVIEW

Your CMT HPIL/RS232 interface has many programmable features which allow you to customize the interface's characteristics to adapt to the RS-232 peripheral and HP-IL controller you are using. The interface was designed to be software compatible with the HP 82164A HP-IL/RS-232 Interface. This allows you to use your CMT interface where the HP interface is expected with little or no software modifications. The CMT interface is fully battery operated and designed to be used in outdoor environments. Some of the CMT interfaces features are listed below:

* Low power battery operation
* Retention of programmable settings when powered off
* Programmable baud rates
* Programmable stop bits
* Programmable word length
* Programmable parity
* XON/XOFF protocol
* ENQ/ACK protocol
* AUTO/MANUAL hardware handshake line control
* Transmit and Receive buffers
* Programmable insertion of nulls at end of line
* Programmable auto-disconnect on error conditions
* Programmable break send
* Programmable echo mode
* Programmable insert/delete characters
* Programmable END-OF-LINE options
* Programmable protocol control characters
* Programmable HP-IL service request conditions
* Programmable power consumption states
* Male 9 pin DB connector (Same as IBM AT serial port)

The descriptions of the features that follows assumes that the user has knowledge of HP-IL and RS-232. For more information on HP-IL consult your controller manual and the following:

* The HP-IL SYSTEM by KANE/HARPER/USHIJIMA
* HP-41/HP-IL SYSTEM DICTIONARY by Carl Reinstein
* HP 82164A Owner's Handbook
* HP Technical Service at (503)757-2000

For more information on RS-232, consult your owners manual for the peripheral or computer and the following:

* RS-232 Made Easy by Martin Seyer
* The RS-232 Solution by Joe Campbell

HP-41C/CV/CX Users

Most operations on the RS-232 interface will not be usable on the HP-41C/CV/CX with out the purchase of the HP 82183 Extended I/O Module. The Extended IL ROM by Skwid Ink is also useful for HP-41C/CV/CX use. The HP user's library has many helpful programs also.

HP-75C/D Users

Most operations on the RS-232 interface will not be usable without the purchase of the HP-75 I/O Module. The use of the HP-75 Data Comm Pac makes use of the interface much more easy. The I/O Utilities solution book also is available if you do not want to purchase the I/O Module.

HP-71B Users

All features on the RS-232 interface are accessible in crude form with the HP71 HP-IL Module. The HP-71 DATACOMM Module makes use of the interface much more easy. The appendix includes a program listing which allows you to set up and examine the RS-232 setting with REMOTE mode commands.

HP Portable/IBM PC/Compatible Users

As of the date of this manual, there is no software available that allows you to use the HP-IL/RS232 interface with the HP HP-IL CARD or HP Link software. HP portable users can select the device HP 82164A in the configuration menus.

EduCALC

All of the above books, modules, solution books are available through EduCALC. Most items are usually in stock. EduCALC is a discount mail order catalog dealer. Their phone number is (714) 582-2637. Their address is:

EduCALC Mail Store
27953 Cabot Road
Laguna Niguel, CA 92677 U.S.A.

DEFAULT CONDITIONS

Initial Power On - The following conditions apply whenever the CMT RS232 interface is powered on for the first time or an HP-IL "device clear" command is received:

* Baud Rate - 9600
* Stop Bits - 1 bit
* Word Length - 8 bits
* Parity - none
* Show parity error - off
* Software handshakes - XON/XOFF enabled
  ENQ/ACK terminal enabled

* ECHO - off
* Date Terminal Ready - enabled and true
* Request to Send - enabled and true
* Service Request Conditions - off
* Delete Special Characters - off
* Auto-disconnect cleared
* Remove HP-IL listener status
* Remove HP-IL talker status
* Remove pending service request
* Reset asynchronous service request
* Reset software handshakes
* Clear transmit buffer
* Clear receive buffer

Power ON/OFF conditions - The following conditions apply whenever the CMT RS-232 interface is powered off and on. This may occur by use of the front panel buttons or HP-IL loop messages. They are listed below:

* Auto-disconnect cleared
* Remove HP-IL listener status
* Remove HP-IL talker status
* Remove pending service request
* Reset asynchronous service request
* Reset software handshakes
* Clear transmit buffer
* Clear receive buffer

By remembering and using these defaults as much as possible, you will minimize the amount of programming of the RS-232 interface and avoid ambiguities when a device clear statement is sent on the HP-IL loop.

When the 9V battery is replaced, the lithium cell will retain the memory contents. The unit will power back up using the power ON/OFF conditions.

INTERFACE FEATURE SUMMARY

TRANSMIT AND RECEIVE BUFFERS

Your HPIL/RS232 interface has two buffers for controlling the exchange of data between HP-IL and RS-232. The are the transmit and receive buffers. The transmit buffer accepts data from HP-IL and sends it to RS-232. The transmit buffer can accept up to 84 bytes. The receive buffer accepts data from the RS-232 port and sends it to HP-IL. The receive buffer can accept up to 109 bytes. Both buffers are implemented as first-in/first-out.

PROGRAMMING THE INTERFACE

Remote Mode - The interface's options can be programmed through the use of HP-IL remote commands. First the interface must be set into remote mode by having the controller issue a remote enable HP-IL command and then making the interface a listener on the loop. The

remote mode by having the controller issue a remote enable HP-IL command and then making the interface a listener on the loop. The remote commands are ASCII characters followed by a terminating sequence. The terminating sequence can be either a semicolon (;) or a line feed character (LF). Only the commands listed in the appendix will be accepted. All others will be ignored and a syntax error will be generated. Spaces and carriage returns are ignored by the interface. See the appendix for more detail.

Device Dependent Messages - The interfaces options may also be changed by using HP-IL device dependent commands which allow you to read and write to the interfaces control registers. See appendix for more detail.

BAUD RATES - DEFAULT IS 9600

The baud rate determines the rate of data transfer over the RS-232 channel. Your HPIL/RS232 interface supports the following baud rates:

19200, 9600, 7200, 4800, 3600, 2400, 1200, 600, 300, 150, 135, 110, 75, 50, OFF

REMOTE COMMANDS: SB0 through SBF
CONTROL REGISTER: seven (7)

STOP BITS - DEFAULT IS 1

The number of stop bits are used by the RS-232 devices to determine when a character is thru being transmitted. Your HPIL/RS232 interface supports the use of one or two stop bits.

REMOTE COMMANDS: SS0, SS1
CONTROL REGISTER: six (6)

WORD LENGTH - DEFAULT IS 8

The word length is the number of bits that are sent in the data stream on RS-232. Your HPIL/RS232 interface can transmit in 8 bit, 7 bit, 6 bit and 5 bit word lengths.

REMOTE COMMANDS: SW0 thru SW3
CONTROL REGISTER: six (6)

PARITY - DEFAULT IS NONE

The parity bit is used to allow RS-232 devices to determine errors in transmission or reception. Your HPIL/RS232 interface can transmit even, odd or no parity. It can detect even, odd, ones, zeros, and no parity.

REMOTE COMMANDS: P0, P1, P4
CONTROL REGISTER: eight (8)

XON/XOFF PROTOCOL - DEFAULT IS ACTIVE (XON=17, XOFF=19)

XON/XOFF is a standard software handshake protocol used to control the flow of data between different RS-232 devices. You can control whether the interface uses XON/XOFF or not. You can also control which characters are used for XON/XOFF control.

REMOTE COMMANDS: C0, C2, PCwxyz
CONTROL REGISTER: eleven (11)
CHARACTER REGISTER: four(4) - ready char, five (5) - not ready char

ENQ/ACK PROTOCOL - DEFAULT IS ACTIVE TERMINAL (ENQ=5, ACK=6)

ENQ/ACK is a standard software handshake protocol used to control the flow of data between different RS-232 devices. You can control whether the interface uses ENQ/ACK or not, whether it operates as a host or terminal and which characters are used for ENQ/ACK control. You can also determine which prompt character to recognize before sending data, and transmitter and receiver block sizes.

REMOTE COMMANDS: C0, C1, C3, C4, PCwxyz
CONTROL REGISTER: eleven (11)
CHARACTER REGISTER: six (6) - request char, seven (7) - answer char
eight (8) - xmit block size, nine (9) - prompt
ten (10) - recv block size

HARDWARE HANDSHAKE LINE CONTROL - DEFAULT OFF

In its default condition the interface does not use the hardware handshake lines. It ignores the input signals and sets the output lines true. You can read the input lines through the control registers and set the output lines with the remote commands or control registers. You can set the box to observe the hardware handshakes by programming the control registers. You can set the interface to observe each line individually.

REMOTE COMMANDS: SL0 thru SL7
CONTROL REGISTER: nine (9)

INSERTION OF NULLS AT END OF LINE - DEFAULT IS TO SEND NONE

Some RS-232 devices are very slow (i.e. old teletype terminals) and need time from an end-of-line sequence before they can accept more data. By inserting nulls after the end-of-line, no data will be lost. You can program up to eight nulls to be sent after an end-of-line sequence is sent on RS-232.

REMOTE COMMANDS: NE0 thru NE8
CONTROL REGISTER: twelve (12)

AUTO-DISCONNECT ON ERROR - DEFAULT IS TO NOT DETECT AND SHUT DOWN

An Auto-Disconnect event stops communication on the RS-232 port. It will remain until a power off/on cycle or device clear is sent on HP-

IL. When this condition occurs the handshake lines are set to a false state. You can determine when a disconnect condition will occur. This condition occurs on receive buffer overrun errors and when you enable it for any of the input handshake lines.

REMOTE COMMANDS: AE0 thru AE7
CONTROL REGISTER: thirteen (13)

SEND BREAK - DEFAULT IS NOT TO SEND BREAK

You can set the interface to send a continuous break to the external RS-232 device thereby suspending RS-232 data transmissions.

REMOTE COMMANDS: B0, B1
CONTROL REGISTER: nine (9)

ECHO - DEFAULT IS NO ECHO

You can enable the interface to send back (echo) the characters it receives.

REMOTE COMMANDS: EE0, EE1
CONTROL REGISTER: eight (8)

DELETE CHARACTERS - DEFAULT IS TO NOT DELETE CHARACTERS

You can set the interface to delete certain characters received from RS-232 before the interface sends them on HP-IL. You can set the interface to delete nuls, rubouts (DELS) or a character that is specified in character register eleven.

REMOTE COMMANDS: DE0 thru DE7
CONTROL REGISTER: three (3)
CHARACTER REGISTER: eleven (11)

END-OF-LINE OPTIONS - DEFAULT IS TO NOT INSERT OR DELETE ON EOL

You can set the interface to detect and delete EOL characters on RS-232. The characters for EOL are in character registers zero and one. You can also insert characters onto RS-232 after receiving an END byte from HP-IL. The character inserted are in character registers two and three. You can also insert characters on HP-IL after detecting and deleting characters on RS-232. The character inserted are in character registers two and three.

REMOTE COMMANDS: LE0 thru LE4
CONTROL REGISTER: ten (10)
CHARACTER REGISTERS: zero (0), one (1), two (2), three(3)

HP-IL SERVICE REQUEST CONDITIONS - DEFAULT IS NONE ENABLED

You can set the interface to signal your controller that the RS-232 status has changed by send a service request message. You can enable the interface to send a service request when the buffers are full or

empty or not full, on data errors, buffer overflows, receiving a break, and/or auto-disconnect condition.

REMOTE COMMANDS: SE0 thru SE8
CONTROL REGISTERS: zero (0), one (1), two (2)

TIME-OUT TO LOW POWER CONSUMPTION STATE - DEFAULT IS YES

You can set the interface to time-out to a low power state when there is no HP-IL or RS-232 traffic. This will reduce the power consumption from the batteries by more than ten times the full on power draw. The interface will return to the full power state any time an HP-IL frame is sent to the interface. It can not be set to the full power state from RS-232. If this power up/down sequence causes a problem for your application, it can be disabled with the TO0 command. The interface will then always remain in a full power state unless turned off by the front panel controls or a loop power down sequence. When in the low-power state only the HP-IL IC is active, thus allowing the device to continue receiving HP-IL frames.

REMOTE COMMANDS: TO0, TO1
CONTROL REGISTERS: thirteen (13)

RS-232 SIGNAL LINES

The RS-232 signal lines supported in the HP-IL/RS-232 interface are listed in the table below. Also listed are the pin assignments for the interface in its standard configuration as a Data Terminal Equipment. Note that this is the same pinout as the IBM AT serial port.

Please refer to the appendix for cable connections to standard 25 pin DTE and DCE cables.

All signal lines are defined from the view of the Data Terminal Equipment. For example, the Data Terminal Equipment sends data on the Transmitted Data line and receives data on the Received Data line. However, the Data Communication Equipment receives data on the Transmitted Data line and sends data on the Received Data line. Your RS-232-C Interface in its standard configuration is a DTE.

	SIGNAL NAME	DEFINITION
1	Received Line Signal Detect	Notifies DTE that DCE is receiving carrier signal.
2	Received Data	DTE input data line and DCE output data line.
3	Transmitted Data	DTE output data line and DCE input data line.
4	Data Terminal Ready	Notifies DCE that DTE is ready to transfer data. (Inhibits DCE from sending when false.)
5	Signal Ground	Establishes signal reference level between DTE and DCE.
6	Data Set Ready	Notifies DTE that DCE has power on and is not in test or dial mode.
7	Request to Send	Notifies DCE that DTE is ready to send data.
8	Clear to Send	Notifies DTE that DCE is ready to accept data.

WHAT IF IT DOESN'T WORK?

If you have difficulty getting your interface and external device to work together, follow this suggested list of things to check in troubleshooting the connection.

Check the pin configuration and be certain which pin the device sends on and which it receives on.

Check the bit transmission rate (baud rate) on both the interface and the device - make sure they match.

Check the number of bits the device is expecting to send and receive. This includes the start bit, bits in the data word, parity bit (optional), and stop bit(s).

Next, check the handshake option - which signals the device is expecting to see true before it sends and which signals the device is expecting to see true before it receives. Remember that some devices expect to see Received Line Signal Detect (Carrier Detect) true before they will respond.

Some devices require a software handshake. Check the software handshake option to be sure both devices are using the same protocol. Also check the block size and Host/terminal option for transmitter protocol.

ACCESSORIES

Batteries: 9V alkaline.....CMT-9VA
9V NiCad, rechargeable.....CMT-9VR
3V Lithium.....CMT-3VL

Recharger: 120VAC - 9VDC adapter.....CMT-RE2

CMT Battery Belt Pack.....CMT-BELT
Includes: Heavy Duty Belt, two carrying pouches, two 6V rechargeable Lead Acid batteries, and wiring to hook the batteries to the RAM Disc.

CMT HP-IL Cables: .5M 1M 2M 5M 10M

RS-232 Cables: 9 pin to 25 pin DTE.....CMT-DTE
RAM Disc to RS-232 Printers, Plotters, Modems, etc.
9 pin to 25 pin DCE.....CMT-DCE
RAM Disc to PC/Compatibles

Compatibility Software:.....CMT-1010
Converts most HP files on the RAM Disc to IBM PC type ASCII file. Runs on IBM PC or compatible.

SPECIFICATIONS

The following specifications apply to the CMT HPIL RAM Disc.

INTERFACE

Type: HP-IL (Hewlett-Packard Interface Loop).
Default address: undefined.

POWER REQUIREMENTS

Primary source: 9V Alkaline or Nicad battery pack.
Recharging time for pack: 6 hours (drive turned on or off).
Usage: ON .30 watts fully on
STANDBY .015 watts (HP-IL only)
OFF .001 watts (9V battery)
OFF .0002 watts (Lithium cell only)

TEMPERATURE LIMITS

Operating: -20 to 55°C
Charging: 15 to 40°C (59 to 104°F).
Storage: -40 to 75°C (-40 to 167°F).

GENERAL RAM Disc INFORMATION

BASIC RAM Disc CARE

Because the RAM Disc has no moving parts the system does not have to be stationary to operate like a hard disc or floppy disc drive. The RAM Disc can go where you go without concern for damage. Of course, there are still things that you want to avoid, such as:

* Do not allow the RAM Disc to be dropped onto hard surfaces.
* Do not allow water to get inside the case.

Also, care should be taken to see that the RAM Disc remains inside of these operating and storage limits:

* Operating Temperature: -20 to 55°C
* Storage Temperature: -40 to 75°C (-40 to 167°F)
* Charging: 15 to 40°C (59 to 104°F)

VERIFYING PROPER OPERATION

There is one step that you can follow to check for proper operation of the RAM Disc. It is:

* Check that the **ON** light comes on when the **ON** switch is pushed and goes off when the **OFF** switch is pushed.

Verifying proper operation is mainly dependent on your controller. It is recommended that you refer to your controller manuals for more information.

RADIO/TELEVISION INTERFERENCE POTENTIAL

The CMT HPIL RAM Disc generates and uses radiio frequency energy and, if not installed and used properly-that is, in strict accordance with the instructions in this manual-may cause interference with radio and television reception. It has been tested and found to comply with the limits for a class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference in a residentiqal installation. However, there is no guarantee that interference will not occur in a particular installation. In the unlikely event that the RAM Disc does cause interference to radio or television reception (which can be determined by removing all power to the RAM Disc and then reconnecting the power and then turning it on) you are encouraged to try to correct the interference by one or more of the following measures:

* Reorient the receiving antenna.
* Relocate the RAM Disc with respect to the receiver.
* Move the RAM Disc away from the receiver.
* Plug the ac adapter into a different ac outlet so the RAM Disc and receiver arre on different branch circuits.

If necessary, contact CMT or an experienced radio/television technician for additional suggestions. You may find the following booklet, prepared by the Federal Communications Commission, helpful: How to Identify and Resolve Radio-TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock Number 004-000-00345-4.

WARRANTY INFORMATION

CMT provides a limited 90 day warranty on the RAM Disc. The warranty period starts from the time the product is shipped to you from our facility or from an authorized CMT Distributor.

The warranty covers defects in material and workmanship during the warranty period. During this period, Corvallis Microtechnology, Inc. will, at its option, repair or replace, free of charge, any unit which proves to be defective.

The warranty does not cover any damage to the unit caused by batteries, abuse, accident, misuse, buyer-supplied interface equipment or service or modification performed by other than CMT technical personnel.

CMT does not warrant that the operation of this device and the firmware and software installed in it will be error-free.

No other warranty is expressed or implied. Corvallis Microtechnology, Inc. specifically disclaims the implied warranties of fitness for a particular purpose.

SERVICE INFORMATION

Should your RAM Disc require service, please do the following to expedite the process.

1. Verify that the unit is actually not working (i.e. check the batteries, all HP-IL connections, RS-232 connections, etc.).
2. Call CMT for a Return Authorization Number.
3. Write a detailed description of the problem and include your name and address.
4. Ship the product and problem description to CMT, prepaid, in a protective package to avoid damage. (Use the original shipping container and cushioning material.) In-transit damage is not covered by the warranty.

Address all correspondence and packages to:

CMT
895 N.W. Grant Ave.
Corvallis, OR 97330
U.S.A.

Our phone number is: (503)752-5456

CMT does not accept any returns without a Return Authorization Number. For warranty service or repair, return the sales receipt with the unit.

APPENDIX A

RESPONSES TO HP-IL MESSAGES

The interface responds to HP-IL messages as described in the table below. The interface does not respond to any HP-IL messages that are not listed in the table. Except as noted in the table, each HP-IL message the interface receives is automatically sent to the next device in the loop. In general, the interface checks each message it initiates for transmission errors when the message comes back to the interface.

HP-IL MESSAGE	INTERFACE RESPONSE
COMMAND GROUP	
Auto Address Unconfigure	Device removed from Listener and Talker Status. Same as Unlisten and Untalk.
Device Clear	Clears buffers and resets control and character registers to their default values (as at startup).
Device Dependent Listener 0-31	If listener, responds as described in table.
Device Dependent Talker 0-31	If talker, responds as described in table.
Enable Asynchronous Requests	Enables the interface to source an Identify-Service Request message on an idle loop.
Enable Listener Not Ready	Enables the interface to source a Not Ready For Data message if the interface is a listener and its transmit buffer is full.
Go to Local	If listener, the interface responds to subsequent data bytes as data to be passed across the RS-232 lines.
Interface Clear	Talker or listener status removed and pending addressable message cleared (including device dependent message).
Listen Address 0-31	If address matches*, device removed from talker status and device becomes a listener. If Remote mode is enabled, device changes to

	remote mode. If message address is 31, device removed from listener status-same as unlisten message.
Loop Power Down	Device powers off.
No Operation	No Response.
Not Remote Enable	Removes the interface from Remote mode and sets it to Local mode.
Parallel Poll Disable	If listener, set to not modify subsequent identify messages.
Parallel Poll Enable 0-15	If listener, set to modify subsequent Identify messages according to parallel poll conventions.
Parallel Poll Unconfigure	Set to not modify subsequent Identity messages.
Remote Enable	Enables the interface to begin operating in Remote mode whenever it next becomes a listener.
Secondary Address 0-30	Following a Talk Address or Listener Address message, if primary and secondary addresses match device's addresses, becomes a talker or listener.
Selected Device Clear	If listener, clears buffers and resets control and character registers to their default values (as at startup).
Talk Address 0-31	If address matches, device removed from listener status and becomes a talker. If address doesn't match, device removed from talker status. If message address is 31, device is removed from talker status - same as Untalk message.
Unlisten	Device removed from listener status.
Untalk	Device removed from talker status.
READY GROUP	
Auto Address 0-31	If device has earlier assigned address, no response. If message

	address is 31, no response. If message address less than 31 and device doesn't have earlier assigned address, device address is set to message address, increments message address by one, and passes revised message.
Auto Extended Primary 0-31	If device has earlier assigned address, no response. If message address is 31, no response. If not preceded by Auto Extended Secondary 31, no response. If preceded by Auto Extended Secondary 31, no response. If preceded by Auto Extended Secondary < 31, if message address < 31, and if device doesn't have earlier assigned address, then device primary address is set to message address.
Auto Extended Secondary 0-31	If device has earlier assigned address, no response. If message address is 31, no response. If message address < 31 and device doesn't have earlier assigned address, device secondary address set to message address, increments message address by one, and passes revised message. (Must be followed by Auto Extended Primary message to establish valid device address.)
End of Transmission-Error	If talker, sent immediately for bad HP-IL error check.
End of Transmission-OK	If talker, sent after last data byte or as described under "Interrupting Data Transfer".
Not Ready for Data	If talker,makes previous data byte the last byte sent. If listener and enabled to send this message, sent when data byte fills the transmit buffer.
Ready for Command	No response. Not passed to next device until interface is ready for next command message.
Send Accessory	If talker, sends one byte with the value.

Send Data	If talker, begins sending contents of buffer control registers, or character registers as previously selected.
Send Device ID	If talker sends the ASCII code characters (bytes).
Send Status	If talker sends four bytes of status.
IDENTIFY GROUP	
Identify Identify-Service Request	If device set to respond by Parallel Poll Enable message, modifies message according to parallel poll setup and service request status. If service is required by interface, message modified to identify - Service Request Message.
DATA/END GROUP	
Data Byte Data-Byte-Service Request	If talker, sends next data byte. If listener accepts data byte and passes to next device. Data is normally sent to transmit buffer. If service is required by interface, message is modified to Data Byte-Service Request message.
End Byte	If talker, sends next data byte. If listener, accepts data byte and passes to next device. Data is normally sent to transmit buffer. (End of Line sequence sent to RS-232 if enabled to so so.) If service is required by interface, message is modified to End Byte-Service Request message.

DEVICE-DEPENDENT MESSAGE

Device Dependent Listener messages and Device Dependent Talker messages (listed on the preceding table) are special HP-IL command messages whose meanings depend upon the device receiving them - the listener or the talker. When these messages are sent to the interface, they are referred to by names that correspond to the specific actions they cause. The device-dependent message numbers, names, and responses of your HPIL/RS232 Interface are listed below.

RESPONSES TO DEVICE-DEPENDENT MESSAGES

MESSAGE	NAME	INTERFACE RESPONSE
DEVICE DEPENDENT LISTENER		
0	Set Control Registers	Up to 14 subsequent Data Bytes from HP-IL are stored in R00 through R13.
1	Clear Transmit Buffer	Transmit buffer is cleared.
2	Set Character Registers	Up to 12 subsequent Data Bytes from HP-IL are stored in C00 through C11.
3	Break On	Clears the transmit buffer and sends a continuous break signal (logical "0") to the external device on the Transmitted Data Line.Continuous until a Break Off instruction is received. (This condition may be recognized by some RS-232 devices.)
5-31		No response.
DEVICE DEPENDENT TALKER		
0	Send Control Registers	Subsequent Data message causes the contents of R00 through R13 to be sent on HP-IL (14 Data Bytes).!
1	Clear Receive Buffer	Receive buffer is cleared.
2	Send Character Registers	Subsequent Send Data message causes the contents of C00 through C11 to be sent on HP-IL (12 Data Bytes).!
3-31		No Response.

*The interface remains set to update the register contents until it has updated all registers or is next made a listener.

!The interface remains set to send the register contents until it sends an End Of Transmission message-as it does after it sends the contents or after it receives a Not Ready For Data message.

STATUS BYTE DEFINITION

The interface maintains a four-byte record of its current condition in the status registers. The definitions of the status bytes are shown in the tables below. Normally, the status conditions in the status register are updated whenever the interface's status changes. Also, bit 6 in status byte 1 (which indicates whether the interface has originated a service request on HP-IL) is cleared whenever a condition causing a service request condition is cleared or when the interface has sent its system status in response to a Send Status message.

Status byte 1 (the system status byte) can show only one condition at a time. The condition indicated is the highest priority condition that exists at the moment. Thus two or more system conditions may occur at the same time, but only one will be indicated. When a higher priority condition is cleared, then the next lower priority condition will be indicated.

STATUS BYTE 1 DEFINITION

Priority	Status Byte Decimal	Status Byte Binary	Condition	Definition
1	132 or 196	1X000101	No Room	Auto-Disconnect occurred.
2	138 or 202	1X001010	Device Condition	Break Signal was received on RS-232 since status last sent.
3	131 or 195	1X000011	Data Error	Received RS-232 data has had a parity error or bit pattern error, or has overflowed the receive buffer(HP-IL--RS-232).
4	162 or 226	1X100010	Ready to Send Data (on HP-IL)	Receive buffer has data in it(HP-IL--RS-232).
5	161 or 225	1X100001	Ready to Receive Data (on HP-IL)	Transmit buffer is not full(HP-IL--RS-232).
6	163 or 227	1X100011	Not Ready To Receive or Send Data (on HP-IL)	Transmit buffer is full (HP-IL--RS-232) and receive buffer is empty (HP-IL--RS-232).

STATUS BYTE 2 DEFINITION

Bit #	Bit Value	Condition	Definition
7	128	RS-232 Parity Error	The interface has detected a parity error on RS-232.+
6	64	RS-232 Frame Error	An RS-232 frame has been received with a bit pattern error. (Such frames are deleted)+
5	32	RS-232 Overrun	RS-232 data has been sent to the interface too fast and has been lost(HP-IL--RS-232). (Causes an auto-disconnect.)
4	16	Receive Buffer Overflow	The receive buffer is full and data has been lost(HP-IL--RS-232).+
3	8	Receive Buffer Full	The receive buffer is full(HP-IL--RS-232).
2	4	Receive Buffer Not Empty	Data is available in the receive buffer(HP-IL--RS-232).
1	2	Transmit Buffer Not Full	The transmit buffer is not full(HP-IL--RS-232).
0	1	Transmit Buffer Not Empty.	The transmit buffer is empty(HP-IL--RS-232).

STATUS BYTE 3 DEFINITION

Bit #	Bit Value	Condition	Definition
7	128	No Clear To Send Response	Request to send is false and Clear To Send is true.
6	-	Not Used	Always 0.
5	32	Auto-Disconnect	The interface has discontinued its RS-232 communication.
4	16	Break Received	The interface has received a break signal since status last sent.+
3	8	Remote Mode	The interface is operating in Remote Mode.
2	4	Remote Mode Syntax Error	An error has been detected in the incoming sequence of Remote mode instructions.+
1	2	No Software Handshake	The software handshake is preventing data transmission.++
0	1	No Hardware Handshake	The hardware handshake is preventing data transmission.++

+ Bit is reset to "0" after the interface has responded to a Send Status message.

++ Bit is reset to "0" when software handshake is redefined.

STATUS BYTE 4 DEFINITION

Bit #	Bit Value	Condition	Definition
7	-		Bit is set equal to "0".
6	-		Bit is set equal to "0".
5	-		Bit is set equal to "0".
4	-		Bit is set equal to "0".
3	-		Bit is set equal to "0".
2	-		Bit is set equal to "0".
1	-		Bit is set equal to "0".
0	-		Bit is set equal to "0".

APPENDIX B

REGISTER DESCRIPTIONS

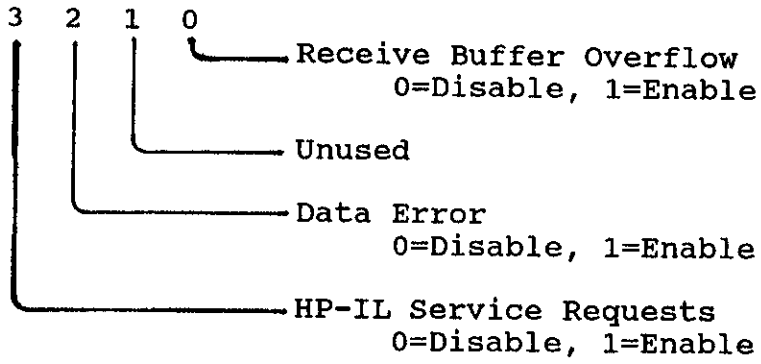
When power is first supplied to the interface, the control registers and character registers are initialized to the default values shown below. The HP-IL controller can change the contents of the registers by using the HP-IL Device Dependent Listener 0 and the Device Dependent Listener 2 messages, or by using Remote mode instructions.

When reading the control registers, the upper four(most significant) bits will be set to '0100'. This action allows the registers to be displayed as readable ASCII characters. When writing to the control registers, the upper four bits are ignored. Only the four lower(least significant) bits will be stored.

CONTROL REGISTERS R00, R01, AND RO2

Control registers R00, R01, and R02 determine the conditions that will cause the interface to send a service request on HP-IL.

R01-Service Request Conditions (Default 0000, Value=0)



BIT 3. Bit 3 enables the interface to modify an appropriate HP-IL message to indicate a service request condition for any status conditions enabled by control registers R00, R01, and R02. If this bit is equal to "0", no service requests will be sent on HP-IL.

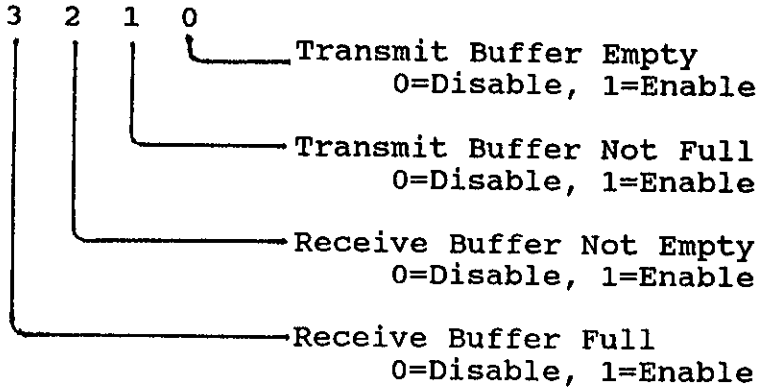
BIT 2. Bit 2 enables the interface to indicate a service request condition whenever any of these conditions occurs on RS-232: a parity error, a frame error, an overrun condition, or a receive buffer overflow condition. Requires that bit 3 be equal to "1" for the service request to be sent on HP-IL. (Refer to bits 7 through 4 of status byte 2.)

BIT 1. Bit 1 isn't used.

BIT 0. Bit 0 enabled the interface to indicate a device request condition whenever the receive buffer is full and additional data has

been received and lost. Requires that bit 3 be equal "1" for the service request to be sent on HP-IL.

R01-Service Request Conditions (Default 0000, Value=0)



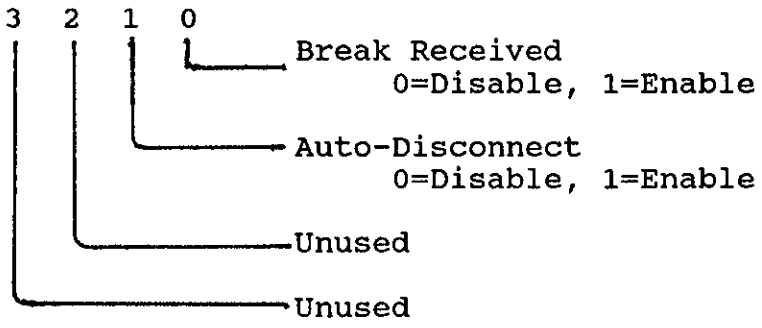
BIT 3. Bit 3 enables the interface to indicate a service request condition whenever the receive buffer is full. Requires that bit R00-3 be equal to "1" for the service to be sent on HP-IL.

BIT 2. Bit 2 enables the interface to indicate a service request condition whenever the receive buffer is not empty. Requires that bit R00-3 be equal to "1" for the service request to be sent on HP-IL.

BIT 1. Bit enables the interface to indicate a service request condition whenever the transmit buffer is not full. Requires that bit R00-3 be equal to "1" for the service request to be sent on HP-IL.

BIT 0. Bit 0 enables the interface to indicate a service request condition whenever the transmit buffer is empty. Requires that bit R00-3 be equal to "1" for the service request to be sent on HP-IL.

R02-Service Request Conditions (Default 0000, Value=0)



BIT 3. Bit 3 isn't used.

BIT 2. Bit 2 isn't used.

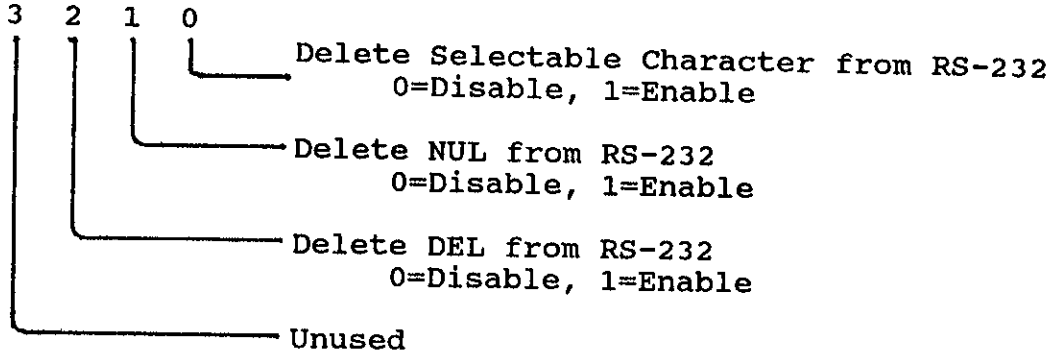
BIT 1. Bit 1 enables the interface to indicate a service request condition whenever it has discontinued all communication on RS-232 (auto-disconnect.) Requires that bit R00-3 be equal to "1" for the service request to be sent on HP-IL.

BIT 0. Bit 0 enables the interface to indicate a service request condition whenever it receives a break signal from the external device. Requires that bit R00-3 be equal to "1" for the service request to be sent on HP-IL.

CONTROL REGISTER R03

Control register R03 specifies the special characters that the interface will delete from data received on RS-232.

R03-Delete Special Characters(Default 0000, Value=0)



BIT 3. Bit 3 isn't used.

BIT 2. Bit 2 enables the interface to detect and delete the DEL (delete, character code 127) character from RS-232 data before passing the data to HP-IL. (DEL is sometimes referred to as "rubout.")

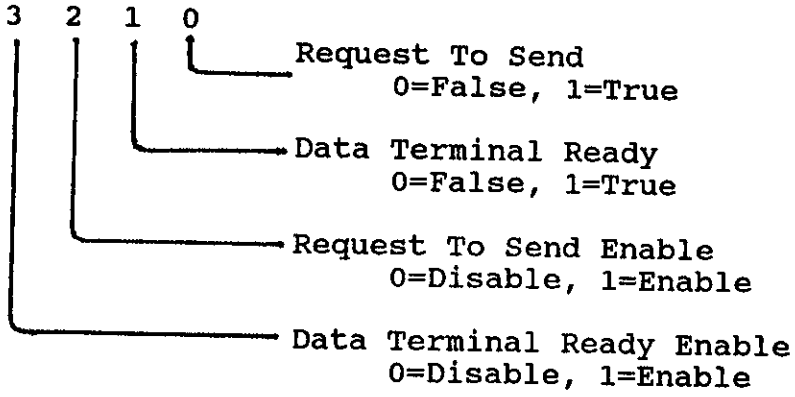
BIT 1. Bit 1 controls the state of the Data Terminal Ready line when bit 3 is equal to "1".

BIT 0. Bit 0 controls the state of the Request to Send line when bit 2 is equal to "1".

CONTROL REGISTER R04

Control register R04 enables the Data Terminal Ready and Request to Send output lines to be individually controlled. Either one or both of these lines may be selected.

R04-Signal Line Control(Default 1111, Value=15)



Bit 3. Bit 3 enables the controller to control the Data Terminal Ready line. If this bit is equal to "0", the Data Terminal Ready line goes false whenever the number of empty bytes in the receive buffer decreases to the number specified by C10, and then goes true when the number of empty bytes exceeds the number specified by C10.

Bit 2. Bit 2 enables the controller to control the Request to Send line. If this bit is equal to "0", the Request to Send line is false when the transmit buffer is empty and is true when the buffer isn't empty.

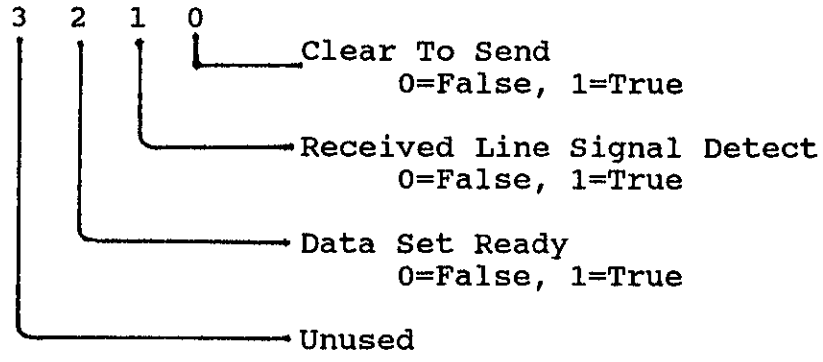
Bit 1. Bit 1 controls the state of the Data Terminal Ready line when bit 3 is equal to "1".

Bit 0. Bit 0 controls the state of the Request to Send line when bit 2 is equal to "1".

CONTROL REGISTER R05

Control register R05 indicates the status of the input lines.

R05-Input Signal Line Status(Default 0000, Value=0)



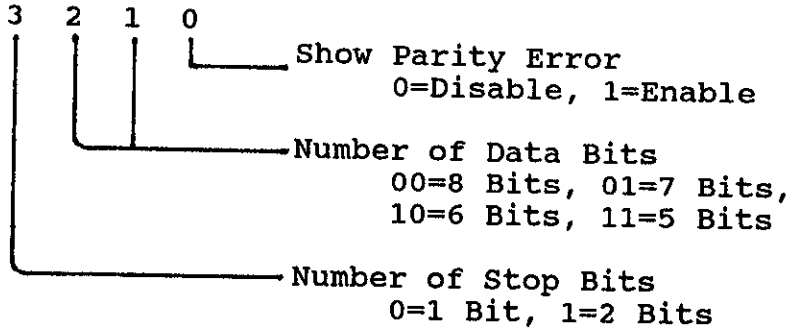
BIT 3. Bit 3 isn't used.

BITS 2 through 0. Bits 2 through 0 indicate the status of particular input signals as shown in the table above. If the respective bit is equal to "1", then the external device is holding the line true. If the bit is "0"., then the line is false. (Any value sent to this register is immediately updated to show the actual status of the lines.)

CONTROL REGISTER R06

Control register R06 determines the number of stop bits and data bits used by the interface and whether it indicates parity errors.

R06-Word Length and Parity (Default 0000, Value=0)



BIT 3. Bit 3 specifies the number of stop bits that are sourced by the interface and that are expected by the interface on received data.

BITS 2 and 1. Bits 2 and 1 specify the number of bits that comprise the data character part of the transmission frame.

BITS 0. Bit 0 enables the interface to indicate HP-IL data bytes that have RS-232 parity errors. This can be shown only when no more than seven bits are actually meaningful in the RS-232 data word. Eight bits may be used on the RS-232 data word, but the eighth bit (bit 7) must be "0", then when Show Parity Error is enables, the interface will set HP-IL bit D7 to "1" whenever a byte with an RS-232 with a parity error. The interface will then send this byte on HP-IL as the Data Byte message 000-11000001 (value 193). This option requires that R08-1 be equal to "1".

CONTROL REGISTER R07

Control register R07 controls the RS-232 bit transmission rate (baud rate) of the interface.

R07-Bit Transmission Rate(default 1110, Value=14)

BITS
3210
|||| Bit Transmission Rate

0000= 0 bps+	1000= 1200 bps
0001= 50 bps	1001= 1800 bps
0010= 75 bps	1010= 2400 bps
0011=110 bps	1011= 3600 bps
0100=135 bps	1100= 4800 bps
0101=150 bps	1101= 7200 bps
0110=300 bps	1110= 9600 bps
0111=600 bps	1111=19200 bps

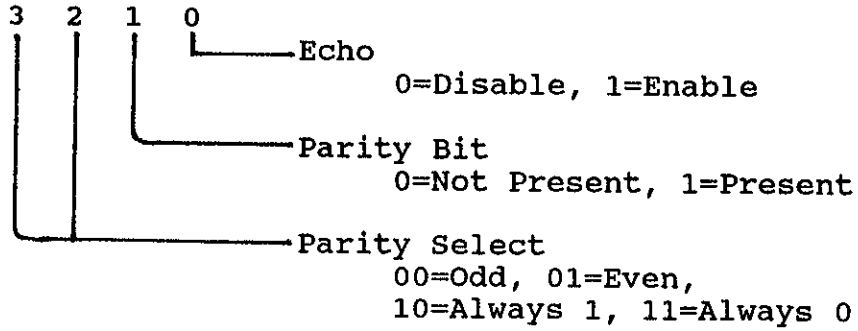
+ The interface will not send or receive RS-232 data.

BITS 3 through 0. Bits 3 through 0 determine the rate at which the interface will send out information and read incoming information.

CONTROL REGISTER R08

Control register R08 determines whether the interface will use a parity bit and whether that bit will be set according to even, or odd as they are received is also set by this register.

R08-Parity and Echo(default 0000, Value=0)



BITS 3 AND 2. Bits 3 and 2 specify which parity option the interface uses.

BIT 1. Bit 1 enables or disables the parity option selected by bits 3 and 2. If bit 1 is equal to "1", the interface inserts a parity bit into its transmission frame and interprets the bit before the stop bit(s) as a parity bit. If bit 1 equals "0", then no extra bit is

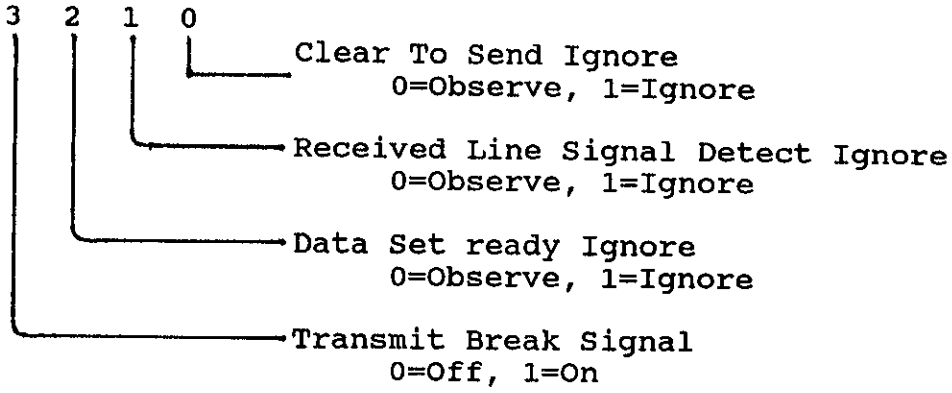
inserted and all bits except for start and stop bits are interpreted as data bits.

BIT 0. Bit 0 enables the interface to immediately send back-echo-the characters as they are received. This provides an additional means for error checking. If the characters that are echoed back are the lines used for displaying the information on the external device, then the display determines whether the interface is properly receiving the data. This option requires a full-duplex device. In addition, when the interface is receiving data on RS-232, the controller should not send any data to the interface from HP-IL because it could temporarily disrupt the echo operation when sent on RS-232.

CONTROL REGISTER R09

Control register R09 controls whether a break signal is sent to the external device and selects signal lines that are used for the hardware handshake.

R09-Break and Hardware(Default 0111, Value=7)



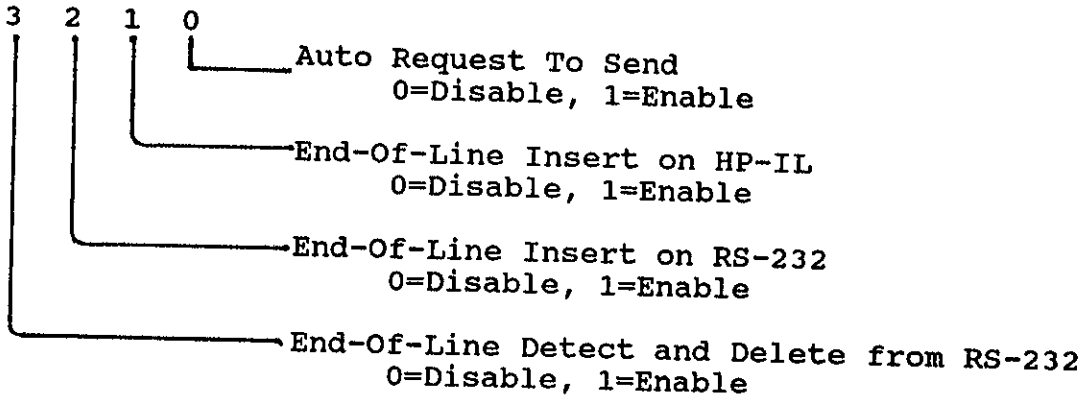
BIT 3. Bit 3 controls the interface's transmitted break signal. While this bit is equal to "1", the interface sends a continuous break signal to the external device, suspending data transmission to that device. While this bit is equal to "0", data can be sent to the external device according to the software and hardware handshakes.

BITS 2 through 0. Bits 2 through 0 select which signal lines will be used by the interface for its hardware handshake. For each bit that is equal to "1", the corresponding signal isn't checked by the interface and doesn't prevent the interface from assuming that the device is ready. For each bit that is equal to "0", the interface required that the signal be true before it will perform the corresponding data transfer on RS-232.

CONTROL REGISTER R10

Control register R10 specifies the end-of-line options that the interface will use.

R10-End-Of-Line Options(Default 0000, Value=0)



BIT 3. Bit 3 enables the interface to look for end-of-line characters on RS-232, to delete them, and to send the preceding byte as an End Byte message on HP-IL. (if an end of line indicator is not preceded by other data, the indicator is deleted and nothing is sent on HP-IL.) The end of line characters are specified in character registers C00 and C01.

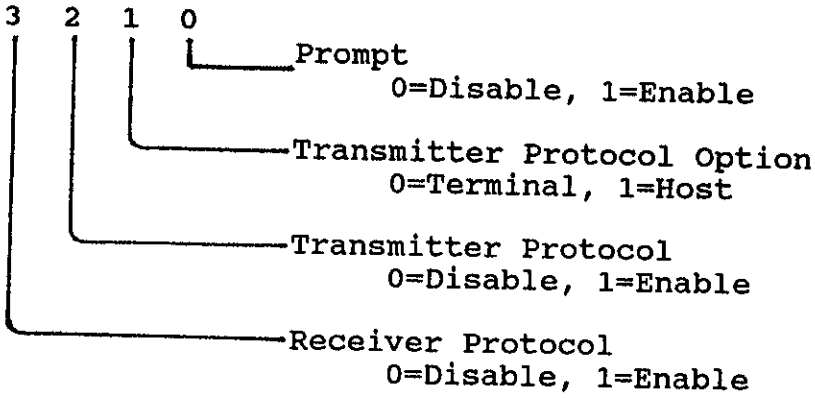
BIT 2. Bit 2 enables the interface to insert end of line characters on RS-232 upon receiving an End Byte message on HP-IL. The characters are inserted after the data from the End Byte is sent. The characters are specified in character registers C02 and C03. Bit 3 must be equal to "1" to enable this capability.

BIT 0. Bit 0 enables the interface to control the Request TO Send line according to half-duplex conventions. If this bit is equal to "1", it caused the Request To Send line to go false whenever an end of line indicator (specified by registers C02 and C03) is sent on RS-232. R04-2 and R09-0 must each be equal to "0" for this option to be available.

CONTROL REGISTER R11

Control register R11 allows you to select the software handshake protocols that the interface will use. The interface is enabled to start sending data on RS-232 without additional software handshake characters whenever this register is redefined.

R11-Software Handshake(Default 1100, Value=12)



BIT 3. Bit 3 enables the interface to use the receiver protocol to control the passing of information across RS-232. (The receiver protocol characters are defined by character registers C04-C05.)

BIT 2. Bit 2 enables the interface to use transmitter protocol to control the passing of information across RS-232. (The transmitter protocol characters are defined by character registers C06 and C07.)

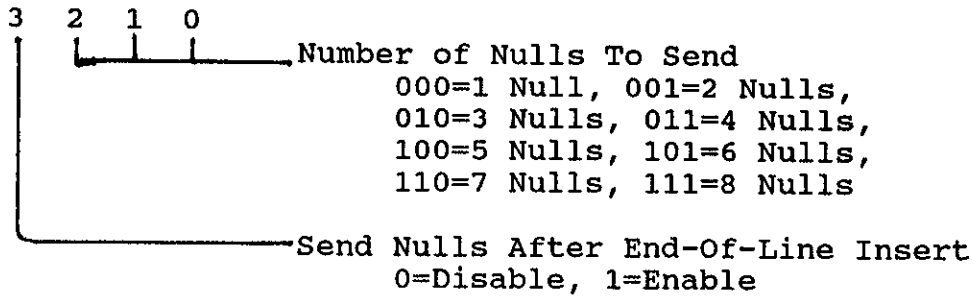
BIT 1. Bit 1 selects which type of transmitter protocol the interface will use, if transmitter protocol is enabled. Bit 2 must be equal to "1" for this option to be valid.

BIT 0. Bit 0 enables the interface to use a prompt character when using transmitter protocol as a terminal. Bit 2 must be equal to "1" and bit 1 must be equal to "0" for this option to be valid. (The prompt character is defined by character register C09.)

CONTROL REGISTER R12

Control register R12 enables the interface to "pause" at each end of line indicator.

R12-End-Of-Line Wait(Default 0000, Value=0)



BIT 3. Bit 3 enables the interface to send out a series of ASCII null characters (NULL, character code 0) after end of line characters

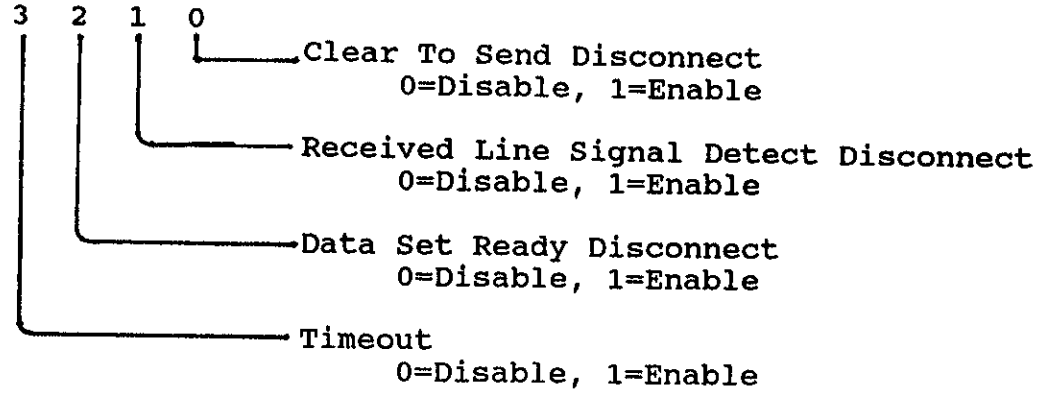
are sent on RS-232. (The end of line characters are specified by character register C02 and C03) This is used mainly by older-style printers that require a "fly back" time for the carriage to return. (The null characters don't take up space in the transmit buffer.)

BITS 2 through 0. Bits 2, 1, and 0 specify the number of nulls to send after the end of line characters.

CONTROL REGISTER R13

Control register R13 specifies which input signal lines the interface will monitor for initiating the auto-disconnect sequence when that line becomes false.

R13 - Auto-Disconnect(Default 1000, Value=8)



BIT 3. Bit 3 - If 0 then Time Out not enabled, if 1 then RAM Disc will power down to conserve battery life. The default is set to '1' for Time Out.

BIT 2. Bit 2 enables the interface to monitor the Data Set Ready line for a false condition and to disconnect the handshake when this lines becomes false.

BIT 1. Bit 1 enables the interface to monitor the Receive Line Signal Detect line for false condition and to disconnect the handshake when this line becomes false.

BIT 0. Bit 0 enables the interface to monitor the Clear To Signal line for a false condition and to disconnect the handshake when this line becomes false.

CHARACTER REGISTERS

CHARACTER REGISTER C00 AND C01

C00-First End Of Line detect/delete character (Default CR, Value=13)
C01-Second End Of Line Detect/delete character (Default LF, Value=10).

Character registers C00 and C01 store the values of the incoming RS-232 end of line characters that are to be detected. If there are two characters, then the first character goes in register C00 and the second goes in register C01. If there is only one character, then that character must go in register C01 and the value 0 must go in register C00. R10-3 must be equal to "1" to delete these characters. (If no characters are to be detected, R10-3 must be equal to "0".)

CHARACTER REGISTER C02 AND C03

C02-First End Of Line insert Character(Default CR, Value=13)
C03-Second End Of Line Insert Character(Default LF, Value=10)

Character register C02 and C03 store the values of the characters that are to be inserted as the end of line indicator. These characters may used on RS-232,HP-IL, or both. If two characters are to be inserted, then the first character goes in register C02 and the second goes into register C03. If only one character is to be inserted, then that character must go on register C03 and the value 0 must go in register C02. R10-3 and R10-1 must equal to "1" to insert these characters on HP-IL:R10-2 must be equal to "1" to insert these characters on RS-232. (If no characters are to be inserted on HP-IL or RS-232,R10-1 or R10-2 must equal to "0", respectively.)

CHARACTER REGISTERS C04 AND C05

C04-Receiver Protocol Ready Character (Default XON, Value=19)
C05-Receiver Protocol Not ready Character (Default XOFF, Value=19)

Character register C04 and C05 determine the characters that the interface used for software handshake using receiver protocol. These characters are usually XON(DC1) and XOFF (DC3). These characters may be changed, but great care should be exercised to ensure that the characters used will be properly recognized by the RS-232 device. R11-3 must be equal to "1" to use receiver protocol.

CHARACTER REGISTERS C06 AND C07

C06-Transmitter Protocol Request Character(Default ENQ, Value=5)
C07-Transmitter Protocol Answer Character(Default ACK, Value=6)

Character registers C06 and C07 determine the characters that the interface used for software handshake using transmitter protocol. These characters are usually ENQ and ACK. These characters may be changed, but great care should be exercised to ensure that the characters used will be properly recognized by the RS-232 device. R11-2 must be equal to "1" to use transmitter protocol.

CHARACTER REGISTER C08

C08-Transmitter Block Size(Default j, Value=106)

This register stores a binary number that is used to determine the size of the transmission blocks used with transmitter protocol (software handshake). The register value specifies the block size-the number of bytes to be passed in one sequence. The interface used the actual value of C08 (except that 0 specifies 256 bytes to be passed in one sequence. The interface uses the actual value of C08 (except that 0 specifies 256 bytes).

If the interface is using transmitter protocol as a host device, it sends a ENQ after it sends the specified number of bytes and then waits for an ACK before sending the next block.

If the interface is using transmitter protocol as a terminal device, it will send an ACK in response to an ENQ only when at least the specified number of bytes are empty in the receive buffer. If the specified number is greater than 109, then the interface will never send an ACK.

NOTE: With some controllers you may need to specify an ASCII character that has a numerical value equivalent to the number of bytes that are needed in a block.

The ENQ and ACK characters mentioned above may be redefined by registers C06 and C07, respectively.

CHARACTER REGISTER C09

C09-Prompt Block Size (Default DC1, Value=17)

This register defines the prompt character used with transmitter protocol when the interface is a terminal. To use this character, control register R11-2,1,0 must be equal to "101".

CHARACTER REGISTER C10

C10 - Receiver Block Size (Default CAN, Value = 24)

This register stores a binary number that is used to determine the number of bytes reserved on the receive buffer for receiver protocol (software handshake). When the number of empty bytes decreases to the number specified by C10, the interface sends an XOFF. It sends an XON when the receive buffer becomes empty. The interface uses the actual value of C10 (except that 0 specifies 256 bytes). If the specified number is 109 or more, then the interface will never send an XOFF or an XON.

NOTE: With some controllers you may need to specify an ASCII character that has a numerical value equivalent to the number of bytes to be reserved.

The XON and XOFF characters mentioned above may be redefined by registers C04 and C05, respectively.

CHARACTER REGISTER C11

C11-Delete Character(Default DC1, Value=17)

This register defines the selectable character that can be detected and deleted from RS-232 and not sent on HP-IL. To delete this character, control register R03-0 must be equal to "1".

APPENDIX C

REMOTE MODE INSTRUCTIONS

SEQUENCE	DEFINITION
	AUTO-DISCONNECT:
AE0...	Disable
AE1...	Enable for Clear to Send false
AE2...	Disable for Clear to Send false
AE3...	Enable for Received Line Signal Detect false
AE4...	Disable for Received Line Signal Detect false
AE5...	Enable for Data Set Ready false
AE6...	Disable for Data Set Ready false
AE7...	Enable for any line false
	BREAK:
B0...	Break off
B1...	Break on
	SOFTWARE PROTOCOL:
C0...	No protocol
C1...	Transmitter protocol terminal
C2...	Receiver protocol
C3...	Transmitter protocol-host
C4...	Prompt enable
	DELETE CHARACTERS:
DE0...	Disable
DE1...	Enable for DEL
DE2...	Disable for DEL
DE3...	Enable for NULL
DE4...	Disable for NULL
DE5...	Enable for selectable character
DE6...	Disable for selectable character
DE7...	Enable for DEL, NULL, selectable character
	ECHO:
EE0...	Disable
EE1...	Enable
	SPECIAL FUNCTION CHARACTERS:
FCwxyz...	w is the first delete character
	....x is the prompt character
	....y specifies the receiver block size
	....z is the delete character
	EOL DELETE AND INSERT CHARACTERS:
LCwxyz...	w is the first delete character
	....x is the second delete character
	....y is the first insert character
	....z is the second insert character

```
      END OF LINE OPTIONS:
LE0...Disable
LE1...Enable insert on RS-232
LE2...Enable detect and delete from RS-232 only
LE3...Enable insert on HP-IL
LE4...Enable auto Request to Send

      SIGNAL LINE CONTROL:
LI0...Disable
LI1...Set Data Terminal Ready true
LI2...Set Data Terminal Ready false
LI3...Set Request to Send true
LI4...Set Request To Send false
LI5...Disable Data Terminal Ready control
LI6...Disable Request to Send control

      SEND NULLS AT EOL:
NE0...Disable
NE1...Send one null
NE2...Send two nulls
NE3...Send three nulls
NE4...Send four nulls
NE5...Send five nulls
NE6...Send six nulls
NE7...Send seven nulls
NE8...Send eight nulls

     PARITY:
P0...Even parity
P1...Odd parity
P4...No parity

     SOFTWARE PROTOCOL CONTROL CHARACTERS:
PCwxyz...w is the ready character
     ....x is the not ready character
     ....y is the request character
     ....z is the answer character

     RESET BUFFER:
R0...Transmit buffer cleared (Device Dependent Listener 1)
R1...Receive buffer cleared (Device Dependent Talker 1)

      BAUD RATE:
SB0...Turn off RS-232
SB1...50 bps
SB2...75 bps
SB3...110 bps
SB4...135 bps
SB5...150 bps
SB6...300 bps
SB7...600 bps
SB8...1200 bps
SB9...1800 bps
SBA...2400 bps
```

```
SBB...3600 bps
SBC...4800 bps
SBD...7200 bps
SBE...9600 bps
SBF...19200 bps

      SERVICE REQUEST:
SE0...Disable all
SE1...Enable for transmit buffer empty
SE2...Enable for transmit buffer not full
SE3...Enable for receive buffer not empty
SE4...Enable for receive buffer full
SE5...Enable for receive buffer overflow
SE6...Enable for data error
SE7...Enable for break received
SE8...Enable for Auto-disconnect

      HARDWARE HANDSHAKE LINES:
SL0...Observe all lines
SL1...Ignore Clear To Send
SL2...Observe Clear To Send
SL3...Ignore Received Line Signal Detect
SL4...Observe Received Line Signal Detect
SL5...Ignore Data Set Ready
SL6...Observe Data Set Ready
SL7...Ignore all lines

      SHOW PARITY ERROR:
SP0...Disable
SP1...Enable

      SEND REGISTERS:
SR0...Send control registers (Device Dependent Talker 0)*
SR2...Send character registers (Device Dependent Talker 2)*

      STOP BITS:
SS0...1 stop bit
SS1...2 stop bits

      TIMEOUT:
TO0...no timeout
TO1...enable timeout

      WORD LENGTH:
SW0...8 bits
SW1...7 bits
SW2...6 bits
SW3...5 bits
```

---

*Causes the interface to sequentially send the contents of the specified registers. After sending the "SR" instruction, you should make the interface a talker and send a Send Data message.

APPENDIX D

The SETUP232 program allows HP-71B users to set and examine the RS-232 interface using the remote mode commands. To execute the program, type 'RUN SETUP232' [END LINE]. The HP-71B will show:

Remote Message?

Type in the valid remote command string that you wish the interface to be set to and press [END LINE]. The program will then set up the interface and display the interface's programmed condition and status. The amount of status displayed can be reduced by commenting out lines 40, 50, and 60 as required.

EXAMPLE: To set up RS-232 Interface to 7 bits, 2 stop bits, 1200 Baud, NO Timeout:

Remote Message? SW1;SS1;SB8;TO0 [END LINE]

EXAMPLE: To just display conditions of RS-232 without altering the current conditions:

Remote Message? ; [END LINE] (Just type a semi-colon.)

To exit the program, respond to the Remote Message prompt with an [END LINE].

Refer to APPENDIX C for valid Remote Mode commands.

SETUP232

```
0010 'INLOOP': INPUT "Remote message? ";M$
0020 IF NOT LEN(M$) THEN END
0030 REMOTE @ OUTPUT :RS232 ;M$ @ LOCAL
0040 CALL STA1
0050 CALL STA2
0060 CALL STA3
0070 GOTO 'INLOOP'
0080 SUB STA1
0090 S=SPOLL("rs232")
0100 IF BINAND(MOD(S,256),64) THEN DISP "SRQ ";
0110 T=BINAND(MOD(S,256),191)
0120 IF T=132 THEN DISP "auto-disconnect"
0130 IF T=138 THEN DISP "Break"
0140 IF T=131 THEN DISP "Data error"
0150 IF T=162 THEN DISP "received data"
0160 IF T=161 THEN DISP "room in xmit buffer"
0170 IF T=163 THEN DISP "nothing to do"
0180 T=S DIV 256
0190 IF BINAND(T,1) THEN DISP "xmit buffer empty"
0200 IF BINAND(T,2) THEN DISP "xmit buffer not full"
0210 IF BINAND(T,4) THEN DISP "recv buffer not empty"
0220 IF BINAND(T,8) THEN DISP "recv buffer full"
```

```
0230 IF BINAND(T,16) THEN DISP "Overrun"
0240 IF BINAND(T,32) THEN DISP "Frame error"
0250 IF BINAND(T,64) THEN DISP "frame error"
0260 IF BINAND(T,128) THEN DISP "parity error"
0270 IF BINAND(T,256) THEN DISP "no hard handshake"
0280 IF BINAND(T,512) THEN DISP "no soft handshake"
0290 IF BINAND(T,1024) THEN DISP "bad remote syntax"
0300 IF BINAND(T,2048) THEN DISP "remote mode"
0310 IF BINAND(T,4096) THEN DISP "break received"
0320 IF BINAND(T,8192) THEN DISP "Autodisconnect"
0330 IF BINAND(T,16384) THEN DISP "No clear to send response"
0340 END SUB
0350 SUB STA2
0360 A=DEVADDR("rs232")
0370 IF A=-1 THEN BEEP @ DISP "no rs232" @ GOTO 'OVER'
0380 SEND UNL UNT TALK A DDT 0
0390 ENTER :A USING "#,14a";A$
0400 DIM M$[40]
0410 FOR I=0 TO 13
0420 IF I#7 THEN 510
0430 RESTORE 'BAUDS'
0440 FOR J=0 TO MOD(NUM(A$[8]),16)
0450 READ B
0460 NEXT J
0470 DISP "Baud=";B
0480 'BAUDS': DATA
0,50,75,110,135,150,300,600,1200,1800,2400,3600,4800
0490 DATA 7200,9600,19200
0500 GOTO 560
0510 RESTORE "REG"&STR$(I)
0520 FOR J=0 TO 3
0530 READ M$
0540 IF BIT(NUM(A$[I+1]),J) THEN DISP M$
0550 NEXT J
0560 NEXT I
0570 'REG0': DATA sr buffer overflow,"",sr Data error,Sevice req
enabled
0580 'REG1': DATA sr xmit buf empty,sr xmit buf not full,sr rec buf
not empty
0590 DATA sr rec buf full
0600 'REG2': DATA sr Break received,sr Auto disconnect,"",""
0610 'REG3': DATA Delete other,Delete nulls,Delete dels,""
0620 'REG4': DATA RTS,DTR,RTS enable,DTR enable
0630 'REG5': DATA CTS,DCD,DSR,""
0640 'REG6': DATA show parity,data0,data1,stop bits
0650 'REG8': DATA echo,parity enable,parity sel 0,parity sel 1
0660 'REG9': DATA CTS ignore,DCD ignore,DSR ignore,xmit break
0670 'REG10': DATA Auto RTS,EOL ins on hpil,EOL ins on rs232,EOL del
0680 'REG11': DATA ack prompt,ack host,Enq/ack,xon/xoff
0690 'REG12': DATA nulls0,nulls1,nulls2,nulls enable
0700 'REG13': DATA CTS disconnect,DCD disconnect,DSR
disconnect,Timeout
0710 END SUB
0720 SUB STA3
```

```
0730 A=DEVADDR("rs232")
0740 SEND UNL UNT TALK A DDT 2
0750 ENTER :A USING "#,12a";A$
0760 RESTORE 'CHARD'
0770 FOR I=1 TO 12
0780 READ M$
0790 DISP M$;NUM(A$[I])
0800 NEXT I
0810 'CHARD':
0820 DATA EOL delete 1,EOL delete 2,EOL insert 1,EOL insert 2
0830 DATA XON char,XOFF char,ENQ char,ACK char,xmit block size
0840 DATA prompt char,recv block size,delete char
0850 'OVER': END SUB
0860 SUB RBUF
0870 DIM M$[80]
0880 N=0
0890 IF NOT BIT(MOD(SPOLL("RS232"),4096),10) THEN 'OUT'
0900 ENTER :RS232 USING "#,A";A$
0910 M$=M$&A$
0920 N=N+1
0930 IF LEN(M$)>79 THEN DISP M$
0940 GOTO 890
0950 'OUT': DISP M$ @ DISP N
0960 END SUB
```

APPENDIX E

HP-41 COMMAND SUMMARY

Mass Storage Functions:

CREATE	Create a new data file of specific length.
DIR	Display a directory of stored files.
NEWM	Initialize medium for storing files. Not programmable.
PURGE	Erase file from medium.
READA	Read "write-all" file and set calculator accordingly.
READK	Read key-assignment file and reassign keys accordingly.
READP	Copy program file to replace last program in memory.
READR	Copy data from medium to calculator registers.
READX	Copy data to calculator according to x-register.
READS	Read status file and set calculator status accordingly.
READSUB	Copy program file to follow last program in memory.
RENAME	Rename a file.
SEC	Secure a file so it cannot be written over or purged.
SEEKR	Position medium to specified file register.
UNSEC	Remove "secure" status from a previously secured file.
VERIFY	Verify that a stored file can be read.
WRTA	Store "write-all" file onto the medium.
WRTK	Store key assignments onto the medium.
WRTP	Store program onto the medium.
WRTPV	Store program onto medium and make file private.
WRTR	Copy data registers into data file.
WRTX	Copy data from calculator according to x-registers.
WRTS	Store calculator status onto medium.
ZERO	Fill data file registers with zero values.

Control Functions:

AUTOIO	Set interface to auto mode.
FINDID	Find address of specified device type.
INA	Input ALPHA string from primary device.
IND	Input decimal number from primary device.
INSTAT	Input status information from primary device.
LISTEN	Set device as a listener, or remove all listeners.
LOCAL	Set primary device to local mode.
MANIO	Set interface to manual mode.
OUTA	Output ALPHA string to primary device.
PWRDN	Set all devices to low power state.
PWRUP	Set all devices to operating power state.
REMOTE	Set primary device to remote mode.
SELECT	Select device as primary device.
STPIO	Stop I/O communication in loop.
TRIGGER	Trigger all devices set to respond.

HP-41C Examples:

In order to use the CMT RAM Disc with the HP-41C/CV/CX, the HP supplied HP-IL Module must be used. The HP part number is HP 82160A. This module will only access 128K Bytes of mass storage. The RAM Disc must be operated in multiple drive mode to access the entire memory available. This will appear to the HP-41 as multiple drives.

For greater control of the CMT HPIL RAM Disc, you can purchase the HP supplied Extended I/O Module (HP 82183A).

The examples below assume a 512K RAM Disc with the RS-232 Interface option as the only device on the loop.

Selecting the Drive:	MANIO	
	1 SELECT	(First Drive)
	2 SELECT	(Second Drive)
	3 SELECT	(Third Drive)
	4 SELECT	(Fourth Drive)
	5 SELECT	(RS-232 Device)
Formatting the Medium:	(to format the first drive)	
	MANIO	
	1 SELECT	
	NEWM	
Creating a file:	WRTP	(Write Program)
	WRTPV	(Write Program, Mark Private)
	CREATE	(Write Data File)
	WRTA	(Write all contents of HP-41)
Deleting a File:	PURGE	
Renaming a File:	RENAME	
Cataloging Files:	DIR	
Copying Files:	COPYFL	

HP-71 COMMAND SUMMARY

Mass Storage Functions:

ASSIGN #	Associates an I/O channel # with a file and opens the file.
CAT	Gives a catalog of file information.
CAT$	Returns a string containing catalog information.
COPY	Copies a file from one location to another.
CREATE	Creates a data file.
INITIALIZE	Initializes a mass storage medium.
PACK	Packs directory and storage space on a medium.
PACKDIR	Packs only directory space on a medium.
PRIVATE	Permanently prevents a file from being changed or inspected.
PURGE	Deletes a file.
RENAME	Changes the name of the file.
SECURE	Prevents a file from being altered or purged.
UNSECURE	Cancels security for a file.

HP-75 COMMAND SUMMARY

The examples below assume a 512K RAM Disc in single drive mode as the only device on the loop and that the device has been assigned a loop ID of :M1 by the ASSIGNIO command.

Formatting the medium: INITIALIZE ':M1' or INIT ':M1'

Creating a file: COPY 'filename' TO ':M1'

Copying Files:

```
COPY 'file1:M1' TO 'file2:M1'  Interdisc Transfer
COPY 'file1' TO 'file1:M1'     HP-75 to RAM Disc
COPY ':M1' TO 'filename'       RAM Disc to HP-75
```

Cataloging Files: CAT ':M1' (Use up and down arrows to view files.)

Renaming a File: RENAME 'filename:M1' TO 'newname'

Deleting a File: PURGE 'filename:M1'

Packing the medium: PACK ':M1'

IBM PC/COMPATIBLES COMMAND SUMMARY

The RAM Disc will operate with the HP Portable or Portable Plus without additional software; however, it will only work with 128K Byte segments. This means the RAM Disc must operate in multiple drive mode to access all available memory. This will appear to the HP Portable as multiple drives.

To use the RAM Disc with the IBM PC/XT/AT/Compatibles, HP-150, or HP Vectra, the addition of the HP supplied HPIL card is required. The HP part number is HP 82973A HPIL Interface. This interface card is supplied with software which must be installed to operate the RAM Disc.

Install HPIL.SYS as a driver in the CONFIG.SYS file of your PC as:

```
DEVICE=HPIL.SYS /Annnn
     (Where nnnn is the HPIL card's I/O address.)
```

The RAM Disc drives will be given the designators for drives C: to J: if no hard disc is in the PC. If a hard disc is present, the drive names will be from D: to K:. Notice that up to eight drives can be on the HPIL loop.

Before the RAM Disc can accept data, the medium must be formatted correctly. To format the disk drive, type the following (assuming drive D:): (HPILFOR.COM is on the HPIL software disc.)

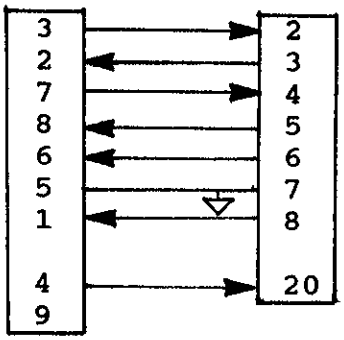
Formatting the Medium:	HPILFOR D:	(For IBM)
	FORMAT D:	(For HP Portable)

Below are other standard commands to use with the RAM Disc.

Creating a Directory:	MKDIR D:dirname
Removing a Directory:	RMDIR D:dirname
Deleting a File:	DEL D:filename
Renaming a File:	REN D:filename D:newfilename
Cataloging Files:	DIR D:
Copying Files:	COPY filename d:filename (Copies from another source onto D:.)

DTE Cable Pinout

Female 9-Pin DB Connector RS-232 Interface			Male 25-Pin DB Connector RS-232 Receptacle	
Transmitted Data	3	2	Transmitted Data	--->
Received Data	2	3	Received Data	<---
Request To Send	7	4	Request To Send	--->
Clear To Send	8	5	Clear To Send	<---
Data Set Ready	6	6	Data Set Ready	<---
	5	7	Ground	
Received Line Signal detect	1	8	Received Line Signal Detect	<---
Data Terminal Ready	4	20	Data Terminal Ready	--->
Unused	9			



** Note that the standard IBM-AT 9 pin-25 pin cable will provide the same pinout as the HP 82164A 25 pin DTE configuration **

DCE Cable Pinout

Female 9-Pin DB Connector RS-232 Interface			Female 25-Pin DB Connector RS-232 Receptacle	
Transmitted Data	3	2	Transmitted Data	<---
Received Data	2	3	Received Data	--->
Request To Send	7	4	Request To Send	<---
Clear To Send	8	5	Clear To Send	--->
Data Set Ready	6	6	Data Set Ready	--->
	5	7	Ground	
Received Line Signal detect	1	8	Received Line Signal Detect	--->
Data Terminal Ready	4	20	Data Terminal Ready	<---