

HP-94 Handheld Industrial Computer

Software Development System Getting Started Guide



Edition 1 December 1986

**Reorder Number
82520-90007**

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1000 N.E. Circle Blvd.
Corvallis, OR 97330 U.S.A.

Printing History

Edition 1

December 1986

Mfg. No. 82520-90008

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

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Introduction

Application programs for the HP-94 are created and compiled on a development computer. Program files thus created, as well as any data files, must then be converted into suitable form before being transferred to the HP-94 or to an EPROM programmer. The HP 82520A Software Development System (SDS) provides you with the software needed to perform these tasks.

This guide will help you get started using the SDS. It is organized as follows:

- Introduction
- A guide to the documentation available for the SDS. This is in tabular format and shows the relationship between various functions of the system and the documentation associated with them.
- A list of required equipment.
- Diagrams showing equipment connections.
- A step-by-step description of the development process, including the development of two sample programs and the transfer of the programs to the HP-94.
- A section covering what to do in case of difficulty.

There are more detailed manuals in the software development system, but if you read this manual thoroughly first you will have a good insight into the software development process for the HP-94.

NOTE

Be sure that the memory backup batteries have been installed in your HP-94. Also, be sure that the main battery pack on the HP-94 is fully charged. Refer to the *User's Documentation Kit* for complete information on these tasks.

Creating an SDS Work Disc

Before proceeding further, make a work copy of your SDS master disc. Refer to your development system computer documentation for information on making a work copy. Place the SDS master disc in a safe place, and use your work copy for all SDS work.

Documentation Guide

Use the table below to find the proper document for the specific task you have in mind.

If You Are Interested In	And You Want To Do This	Read This
Software Development	Get a brief description Find detailed information	This guide <i>Utilities Reference Manual</i>
HXBASIC Program Development Utility	Learn file management, debugging, and program editing commands	<i>Utilities Reference Manual</i> , chapter 2
HXC File Conversion Utility	Get a brief description Find detailed information	This guide <i>Utilities Reference Manual</i> , chapter 3
HXCOPY File Copy Utility	Get a brief description Find detailed information	This guide <i>Utilities Reference Manual</i> , chapter 5
HXMODE Handshaking Utility	Get a brief description Find detailed information	This guide <i>Utilities Reference Manual</i> , chapter 6
HP-94 BASIC Language	Find detailed information Interpret error messages	<i>BASIC Reference Manual</i> <i>BASIC Reference Manual</i> , appendix B
Assembly language programming	Find detailed information	<i>HP 82521A Technical Reference Manual*</i>
HP-94 Operating System	Find detailed information Learn the Commands Interpret error messages	<i>HP 82521A Technical Reference Manual*</i> <i>Utilities Reference Manual</i> , chapter 7 <i>Utilities Reference Manual</i> , appendix A
Setting up the HP-94	Install memory backup batteries Charge main battery	<i>User's Documentation Kit</i> <i>User's Documentation Kit</i>

*Available from your HP representative.

Equipment Required

In order to develop software to be used on the HP-94, you must have access to one of the following personal computers:

- Hewlett-Packard Vectra.
- IBM PC.
- IBM PC/XT.
- IBM PC/AT.

An RS-232-C Level Converter (HP 82470A) may be required between the development computer and the HP-94, depending on which personal computer is used. The following table shows when a level converter must be used for a given type of computer and serial interface, and the cables necessary to connect the equipment.

Development Computer	Interface Used	Level Converter Required?	Cables		
			Computer to Level Converter	Level Converter to HP-94	Computer to HP-94
HP Vectra	HP 24540A Serial/Parallel (9-pin male)	No	—	—	HP 82436A
HP Vectra	HP 24541A Dual Serial (9-pin male)	No	—	—	HP 82436A
HP Vectra	HP 24541A Dual Serial (25-pin female)	No	—	—	No Cable
IBM PC	Serial (25-pin male)	Yes	HP 17255D*	HP 82435A	—
IBM PC/XT	Serial (25-pin male)	Yes	HP 17255D*	HP 82435A	—
IBM PC/AT	Serial (9-pin male)	Yes	HP 24542G	HP 82435A	—

*The HP 17255D is a 1 meter cable. Also available are 2 and 5 meter cables, HP 82974D and HP 13242H, respectively.

From the table above, determine which cables you will need to connect your equipment. If you are using an HP Vectra, note that there are two interface cards available, the HP 24540A Serial/Parallel and the HP 24541A Dual Serial. Be sure to use the cables for the type of interface you have.

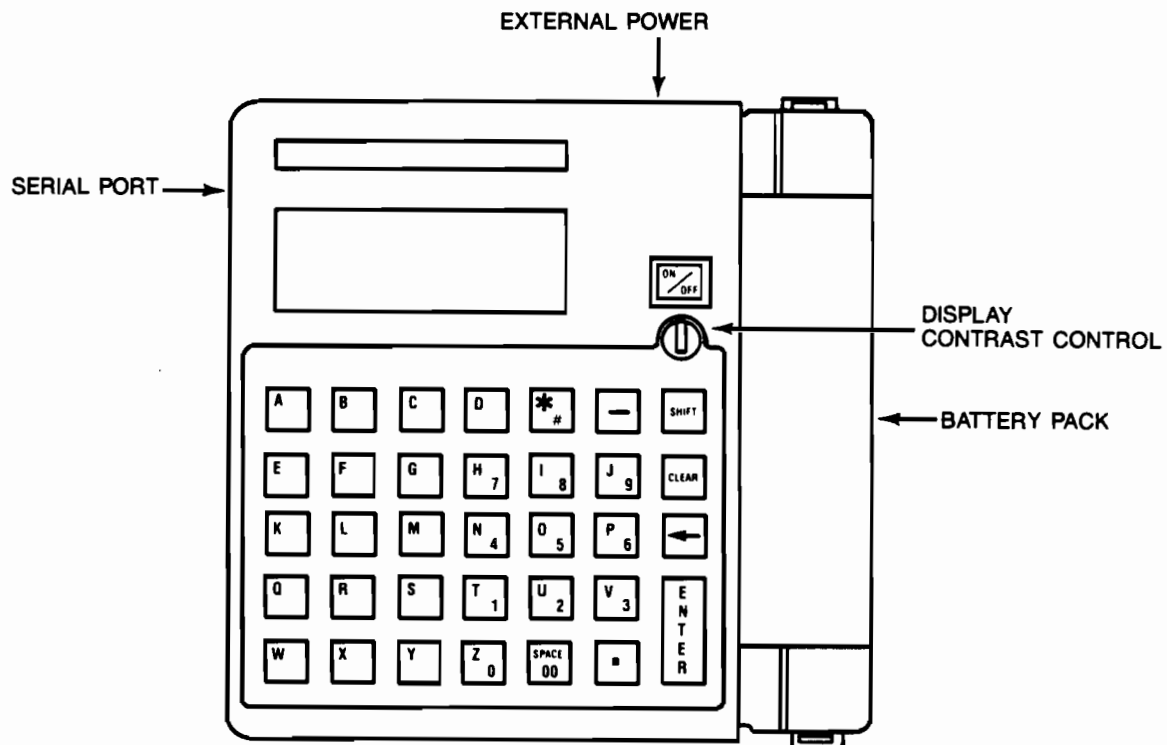
If you wish to build your own cables, use the connector wiring diagrams on the following pages. In all cases, the connector housings should be wired together using the braid or shield in the cable. Note that if you wish to use the HP Vectra 25-pin serial port on the HP 24541A Dual/Serial interface, you must build your own cable as there is none available.

If you are using a personal computer other than those shown above, you may need to use a level converter if the device you are using has an input low-to-high transition threshold greater than 4.2 volts, a high-to-low transition threshold less than 0.2 volts, and the input impedance is greater than 3000 ohms. Refer to your owner's documentation or ask the manufacturer for this information.

NOTE The maximum cable length recommended for use without a level converter is three meters. If you use a longer cable you must use a level converter regardless of which PC you are using for development. If you must use a level converter with a Vectra because of cable length, the 9-pin serial ports should use the AT-to-level converter cable (HP 24542G). The 25-pin port (dual serial) does not have a cable available. You will have to build a cable using the wiring diagram shown on page 6.

The HP-94

The HP-94 is a handheld, battery operated computer suitable for use in many applications. The figure below shows the HP-94 keyboard and external connections. Refer to the section entitled "Getting Acquainted With Your HP-94" in the *User's Documentation Kit* for more detailed information. The section entitled "Setting Up the HP-94" on page 22 of this guide will show you how to operate the HP-94.



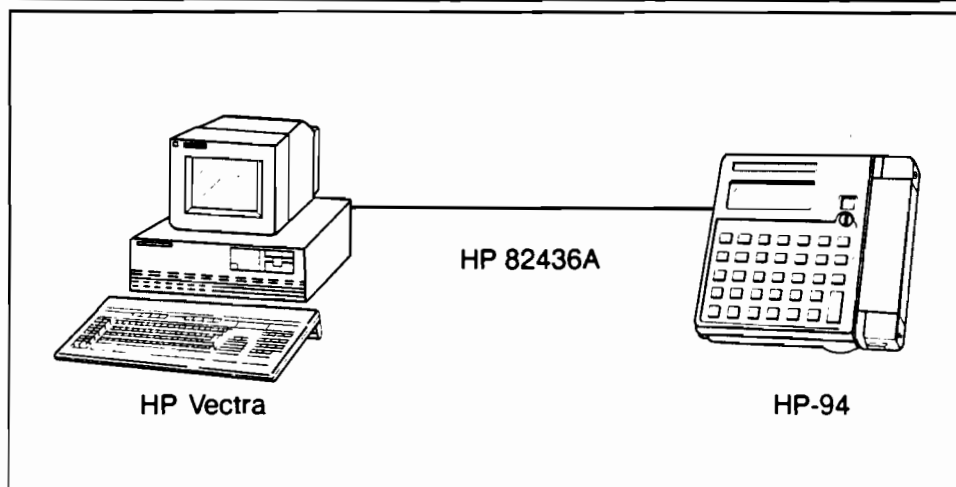
Connecting the Equipment

You will need the proper cables to connect the various pieces of equipment. The type of cable to use depends on the computer you are using as a development computer, and whether or not a level converter is needed. The following information is intended as a guide in case you want to build your own cables. The pin assignments are shown for each end of the cable, and all of the possible system configurations are covered. Connect the equipment as shown in the diagram which most nearly represents your system.

HP Vectra to HP-94 Cable (HP 82436A) 9-Pin Serial/Parallel or Dual Serial Interface*

HP Vectra 9-Pin Female Connector			HP-94 15-Pin Male Connector		
Signal Name	Symbol	Pin Number	Pin Number	Symbol	Signal Name
Receive Data	BB	2	2	TXD	Transmit Data
Transmit Data	BA	3	3	RXD	Receive Data
Data Terminal Ready	CD	4	5	CTS	Clear to Send*
Data Terminal Ready	CD	4	6	DSR	Data Set Ready*
Signal Ground	AB	5	7	SG	Signal Ground
Data Set Ready*	CC	6	15	DTR	Data Terminal Ready
Clear to Send*	CB	8	15	DTR	Data Terminal Ready

*Pins 6 and 8 on the Vectra side are tied together and connected to pin 15 on the HP-94 side. Pins 5 and 6 on the HP-94 side are tied together and connected to pin 4 on the HP Vectra side.



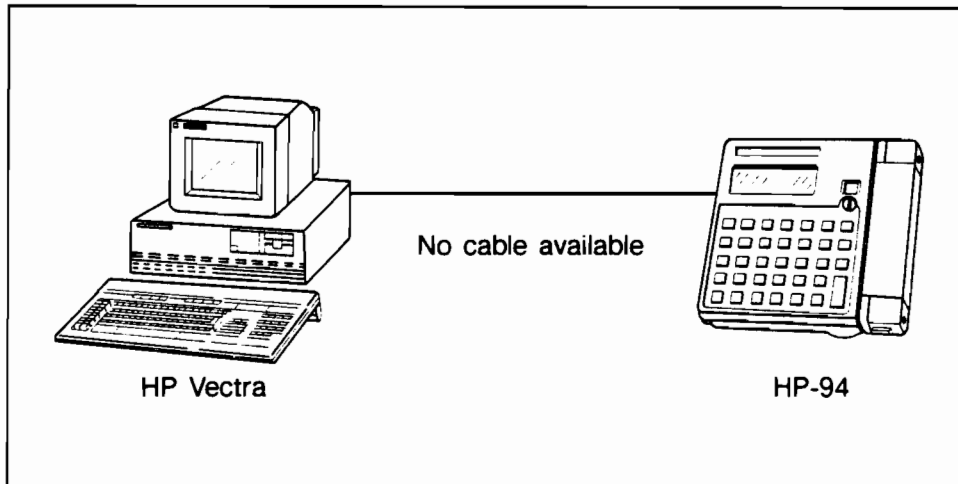
HP Vectra (9-Pin Connector) to HP-94

* This is the recommended method of connecting the HP Vectra to the HP-94 when the cable length is less than three meters.

**HP Vectra to HP-94 Cable (No cable available)
25-Pin Dual Serial Interface***

HP Vectra 25-Pin Male Connector			HP-94 15-Pin Male Connector		
Signal Name	Symbol	Pin Number	Pin Number	Symbol	Signal Name
Transmit Data	BA	2	3	RXD	Receive Data
Receive Data	BB	3	2	TXD	Transmit Data
Clear to Send	CB	5	15	DTR	Data Terminal Ready*
Data Set Ready	CC	6	15	DTR	Data Terminal Ready*
Signal Ground	AB	7	7	SG	Signal Ground
Data Terminal Ready*	CD	20	5	CTS	Clear to Send
Data Terminal Ready*	CD	20	6	DSR	Data Set Ready

*Pins 5 and 6 on the HP Vectra side are tied together and connected to pin 15 on the HP-94 side. Pins 5 and 6 on the HP-94 side are tied together and connected to pin 20 on the HP Vectra side.



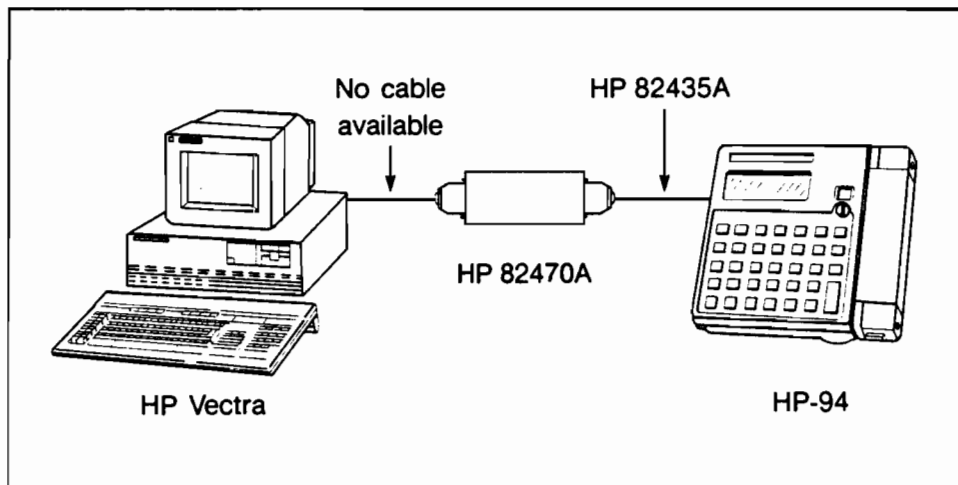
HP Vectra (25-Pin Connector) to HP-94

* This is the recommended method of connecting the HP Vectra to the HP-94 when the cable length is less than three meters and the 9-pin serial connector on the Vectra is in use.

**HP Vectra to HP-82470A Level Converter Cable
25-Pin Dual Serial Interface***

HP Vectra 25-Pin Male Connector			Level Converter 25-Pin Male Connector		
Signal Name	Symbol	Pin Number	Pin Number	Symbol	Signal Name
Frame Ground	FG	1	1	FG	Frame Ground
Transmit Data	TXD	2	3	RXD	Receive Data
Receive Data	RXD	3	2	TXD	Transmit Data
Clear to Send	CTS	5	20	DTR	Data Terminal Ready*
Data Set Ready	DSR	6	20	DTR	Data Terminal Ready*
Signal Ground	SG	7	7	SG	Signal Ground
Data Terminal Ready*	DTR	20	5	CTS	Clear to Send
Data Terminal Ready*	DTR	20	6	DSR	Data Set Ready

*Pins 5 and 6 on the HP Vectra side are tied together and connected to pin 20 on the level converter side.
Pins 5 and 6 on the level converter side are tied together and connected to pin 20 on the HP Vectra side.



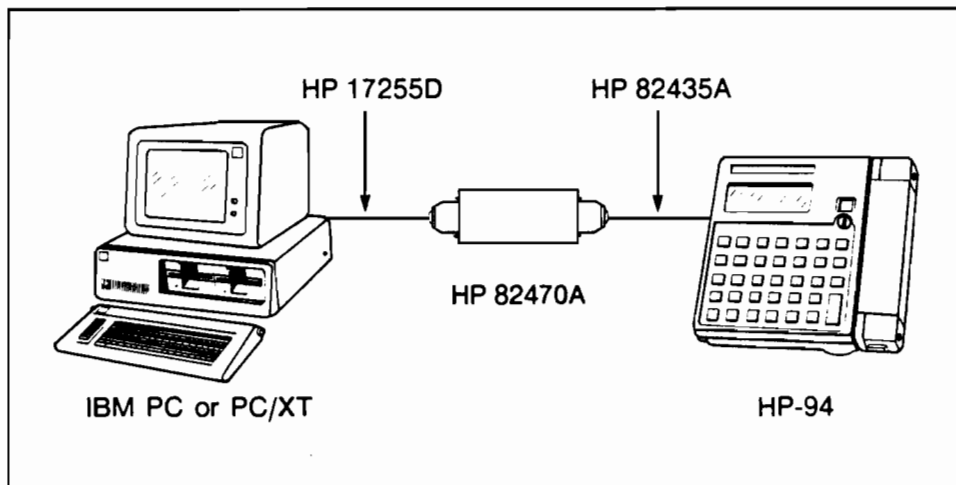
HP Vectra (25-Pin Connector) to Level Converter

* This is the required method of connecting the HP Vectra to the HP-94 when the cable length is greater than three meters and the 9-pin serial connector is in use.

IBM PC or PC/XT to HP 82470A Level Converter Cable (HP 17255D)

IBM PC or PC/XT 25-Pin Female Connector			Level Converter 25-Pin Male Connector		
Signal Name	Symbol	Pin Number	Pin Number	Symbol	Signal Name
Frame Ground	FG	1	1	FG	Frame Ground
Transmit Data	TXD	2	3	RXD	Receive Data
Receive Data	RXD	3	2	TXD	Transmit Data
Clear to Send	CTS	5	20	DTR	Data Terminal Ready*
Data Set Ready	DSR	6	20	DTR	Data Terminal Ready*
Signal Ground	SG	7	7	SG	Signal Ground
Data Terminal Ready*	DTR	20	5	CTS	Clear to Send
Data Terminal Ready*	DTR	20	6	DSR	Data Set Ready

*Pins 5 and 6 on the IBM side are tied together and connected to pin 20 on the level converter side.
Pins 5 and 6 on the level converter side are tied together and connected to pin 20 on the IBM side.

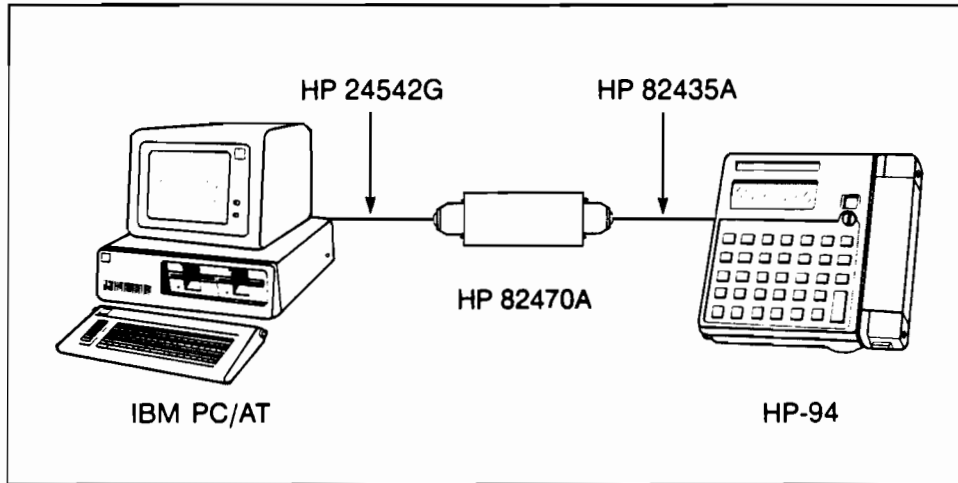


IBM PC or PC/XT to Level Converter

**IBM PC/AT or HP Vectra (9-pin) to
HP 82470A Level Converter Cable (HP 24542G)***

IBM PC/AT 9-Pin Female Connector			Level Converter 25-Pin Male Connector		
Signal Name	Symbol	Pin Number	Pin Number	Symbol	Signal Name
Data Carrier Detect	CF	1	4	RTS	Request to Send
Receive Data	BB	2	2	TXD	Transmit Data
Transmit Data	BA	3	3	RXD	Receive Data
Data Terminal Ready	CD	4	5	CTS	Clear to Send*
Data Terminal Ready	CD	4	6	DSR	Data Set Ready*
Signal Ground	AB	5	7	SG	Signal Ground
Data Set Ready*	CC	6	20	DTR	Data Terminal Ready
Clear to Send*	CB	8	20	DTR	Data Terminal Ready
Request to Send	CA	7	8	DCD	Data Carrier Detect

*Pins 6 and 8 on the IBM side are tied together and connected to pin 20 on the level converter side. Pins 5 and 6 on the level converter side are tied together and connected to pin 20 on the IBM side.



IBM PC/AT to Level Converter

* This is the required method of connecting the IBM PC/AT to the HP-94. It is also the required method of connecting the HP Vectra to the HP-94 when the cable length is greater than three meters.

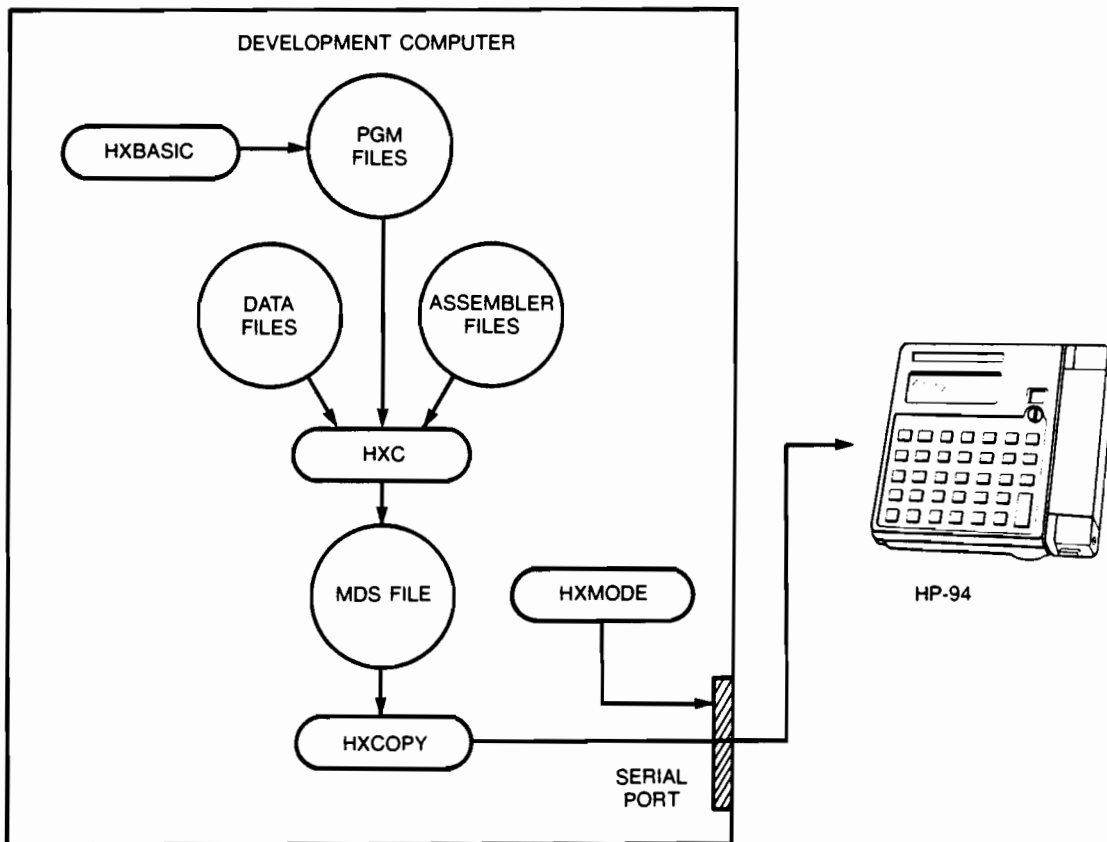
HP 82470A Level Converter to HP-94 Cable (HP 82435A)

Level Converter 15-Pin Female Connector			HP-94 15-Pin Male Connector		
Signal Name	Symbol	Pin Number	Pin Number	Symbol	Signal Name
Transmit Data	TXD	2	2	TXD	Transmit Data
Receive Data	RXD	3	3	RXD	Receive Data
Request to Send	RTS	4	4	RTS	Request to Send
Clear to Send	CTS	5	5	CTS	Clear to Send
Data Set Ready	DSR	6	6	DSR	Data Set Ready
Signal Ground	SG	7	7	SG	Signal Ground
Data Carrier Detect	DCD	8	8	DCD	Data Carrier Detect
Supply Voltage	Vrs	9	9	Vrs	Supply Voltage
Data Terminal Ready	DTR	15	15	DTR	Data Terminal Ready

The Software Development Process

When you have your equipment connected, you are ready to begin the software development process. This process consists of the following steps:

- Use HXBASIC to create the program.
- Use HXC to convert the BASIC program to a microprocessor development system (MDS) file. This is an executable file which will be transferred to the HP-94.
- Use HXMODE to set up the serial port in the development computer.
- Use HXCOPY to transfer the MDS file from the development computer to the HP-94.



Software Development Process

All the development program utilities are contained on the Software Development System disc. You may execute the programs directly from this disc or you may copy them to a hard disc and execute them from there. In either case, you must start all operation from the MS-DOS prompt.

NOTE

The examples in this guide assume that the development computer has a key with the word "Enter" on it. This key is used to enter data into the computer. If your development computer does not have a key with "Enter" on it, use the key that performs the same function whenever you see [Enter] in this guide. Also, the following descriptions of the utilities you will use contain instructions on how to run the utilities. Do not actually run any utility until you get to the section entitled "Creating A BASIC Program" on page 14.

HXBASIC

HXBASIC is the utility used to create your program. It has three operating modes, each with its own set of commands:

- File management mode.
- File edit mode.
- Program debugging mode.

Refer to chapter 2 of the *Utilities Reference Manual* for detailed information on each of these sets of commands.

When you are ready to execute HXBASIC, simply type:

```
HXBASIC 
```

The file management mode is the default mode, and the prompt is a dollar sign (\$). The EDIT command invokes the file edit mode, the prompt for which is the percent sign (%). Edit mode commands create or modify programs via keyboard entry or by merging existing programs. The program debugging mode is entered when the /D option is used with the RUN command. The program debugging prompt is the at sign (@).

HXC

HXC converts specified BASIC program, assembler, and data files to a single MDS file which can then be transferred to the HP-94. Before running HXC, be sure that your CONFIG.SYS file contains the following:

```
FILES=18  
DEVICE=ANSI.SYS
```

You can use the MS-DOS TYPE command to check your CONFIG.SYS file. If your CONFIG.SYS file does not contain these statements, you must modify that file and then reboot your development computer before running HXC. Refer to your development computer's MS-DOS reference manual for further information.

NOTE The `FILES = 18` statement above specifies the number of files that HXC may have to have open simultaneously. The value 18 is a minimum required by HXC, therefore, if your configuration file has a "FILES =" statement specifying a value greater than 18, you do not need change it. The `DEVICE=ANSI .SYS` statement is necessary to provide the proper displays.

When you are ready to execute HXC, simply type:

```
HXC <filename> 
```

where <filename> is the name of the MDS file to be transferred.

Refer to chapter 3 of the *Utilities Reference Manual* for complete information on HXC.

HXMODE

Before transferring the converted file to the HP-94, you must insure that the handler which controls the RS-232-C port in the development computer is installed. The utility HXMODE performs this function for you. To execute HXMODE, type:

```
HXMODE <COMn> 
```

<COMn> specifies the port where n is the port number in which the RS-232-C interface is installed. The default configurations for the other parameters are:

- The AUTO XON/XOFF handshake is used.
- The baud rate is 9600.
- The bit configuration is seven data bits, even parity, and one stop bit.

These parameters may be changed if needed. Refer to chapter 6 of the *Utilities Reference Manual*.

When HXMODE is executed, the handler is installed, and you use it by executing the HXCOPY utility.

HXCOPY

The HXCOPY utility program transfers data and program files from the development computer to the HP-94. When you are ready to execute HXCOPY, type:

```
HXCOPY <filename> <COMn> 
```

where

- <filename> is the name of the MDS file (including the .MDS extension) to be transferred.
- <COMn> is the name of the port to which the MDS file will be sent.

Refer to chapter 5 of the *Utilities Reference Manual* for complete information on HXCOPY.

Creating A BASIC Program

This section describes how to create a BASIC program using the utility HXBASIC. You will create two BASIC programs which will then be converted and transferred to the HP-94.

The Programs

The two BASIC programs you will create are called MAIN and SUBA. MAIN is the driver program and will call SUBA, a subprogram, and pass it a parameter. Both programs will print a line to identify themselves, and SUBA will print the parameter that was passed. Loops are used as timing devices to allow time to view the messages from the two programs. When control is passed back to MAIN, it will request the user to enter the letter "Q" to terminate the program. When the HP-94 is turned on, it will automatically execute any program named MAIN. Therefore, once you have installed the programs in this example, you only need to turn on the HP-94 to see them run.

To Begin

Begin by booting the system so that you have the MS-DOS prompt on the screen. You should have the disc with the SDS programs installed on your hard disc if you have one, or placed in a flexible drive. Since the proper path name depends on where the SDS disc is installed, the references to SDS programs will assume it is in the current directory. Keep this in mind as you go through the examples that follow, and if your SDS disc is not in the current directory, be sure to preface each command to execute a program with the proper path name.

NOTE Screens shown in the following examples contain program version numbers and available memory amounts which may not agree with your screen. Disregard these differences.

HXBASIC

Begin the process by typing:

```
HXBASIC 
```

You will see the following:

```
HXBASIC (A.01.06) HP82520 (c) Copyright Hewlett-Packard Co., 1985
```

```
Available Memory 177712 Bytes
```

```
$
```

The \$ is the prompt for HXBASIC. To create the programs you must enter the EDIT mode of HXBASIC. To do this, type:

```
EDIT MAIN 
```

EDIT will respond with:

Creating Program MAIN

1Ø

You have directed HXBASIC to enter the EDIT mode and create a new file called MAIN. If a file called MAIN.BAS already existed, EDIT would have loaded that program and displayed the first 20 lines. Note that you do not need to specify the .BAS extension when requesting a file.

You are now ready to enter the statements for program MAIN. After you enter a statement, press return and the next line number will appear with the cursor positioned one space to the right of the line number, ready for the next statement. When you have completed entering the program lines and the cursor is one space to the right of the next line number, press without entering anything else. This will cause the automatic line numbering feature to be stopped, and you will see the EDIT prompt (%).

NOTE

If you make a mistake while entering the following lines, you can easily correct it by using the C (change) command from the EDIT mode (% prompt). For example, to correct line number 30, the command is:

C 3Ø

The line you specified will be displayed, and you can make any changes you want to it. Refer to chapter 2 of the *Utilities Reference Manual* for detailed information.

Enter the following lines now (be sure to press after completing each program line):

```
1Ø DIM K$, SPARAM$2Ø
2Ø SPARAM$ = "I came from MAIN!"
3Ø PRINT "In MAIN...."
4Ø FOR I = 1 TO 1ØØØ : NEXT I
5Ø CALL SUBA (SPARAM$)
6Ø PRINT "Press Q to quit."
7Ø PRINT "&ØF" : REM Change keyboard to alpha mode (block cursor)
8Ø K$ = INPUT$(1)
9Ø IF K$ <> "Q" AND K$ <> "q" GOTO 7Ø
1ØØ PRINT "End of MAIN."
11Ø END
12Ø 
```



At this point you should have the program entered and the EDIT mode cursor (%) showing. Refer to the HXBASIC Program Editing Commands in chapter 2 of the *Utilities Reference Manual* for complete information on the EDIT mode commands.

The next step is to save the MAIN program. From the percent (%) prompt type

e

This should put you back to the file management mode of HXBASIC and you should see the \$ prompt. To save the file you just entered, type

save

HXBASIC will respond with the following:

Save to MAIN.BAS (Y/N) ?

Answer Y and press and HXBASIC will save the file on disc and respond with the \$ prompt.

You are now ready to enter the second program. This program is the subprogram called SUBA. Begin by invoking the EDIT mode as you did before:

EDIT SUBA

Now enter the program below (be sure to press after completing each program line):

```
1Ø PARAM INPT$
2Ø PRINT "In program SUBA!"
3Ø PRINT "The parameter is: "
4Ø PRINT INPT$
5Ø FOR I = 1 TO 1ØØØ : NEXT I
6Ø PRINT "Now return to MAIN."
7Ø END
8Ø 
```

Exit from the EDIT mode and save the program exactly as you did before. When you have finished, you are ready to convert the program files to an MDS file. Before doing this however, you may wish to test the programs on your development computer. From HXBASIC (the \$ prompt) type:

RUN MAIN

The programs should execute and display the following:

```
In MAIN....
In program SUBA!
The parameter is:
I came from MAIN!
Now Return to MAIN
Press Q to quit
```

Press Q to terminate the program and you should see

End of MAIN.

\$

If you did not get the expected results, list each program you entered and compare them with the listings shown above. To list a program, enter EDIT with the desired file name. For example:

EDIT MAIN

This should list all the lines of the program on the screen. Refer to the Program Editing Commands section of chapter 2 of the *Utilities Reference Manual* for more information.

To exit HXBASIC, type:

bye

The development computer will return to the MS-DOS prompt.

NOTE You must be in file management mode (\$ prompt) to execute the bye command.

Converting the BASIC Program Files

The next step in the development process is to convert the two BASIC program files into an MDS file which will be executable on the HP-94. This task is performed by the HXC utility. Refer to chapter 3 of the *Utilities Reference Manual* for complete information on HXC.

The Files

The input files to HXC are the two BASIC files, MAIN.BAS and SUBA.BAS, created in the previous section. The output files, all of which have the program name specified when HXC was started, are listed below:

- The CBK file (XXXX.CBK) is a backup file for the CMD file.
- The CMD file (XXXX.CMD) is a command file created by HXC. If you wish to convert the same string of files a second time you can use this file instead of typing in each file name.
- The BMP file (XXXX.BMP) is a special map file created by HXC for each BASIC program it converts.
- The MBK file (XXXX.MBK) is a backup file. If a file with the name of the MDS file already exists, the older file is renamed with the extension MBK.
- The MDS file (XXXX.MDS) is the file ready to be transmitted to the HP-94 or an EPROM programmer.
- The MMP file (XXXX.MMP) is a text file containing the options provided to HXC as well as program size and error information. You can use the MS-DOS command TYPE to examine this file.

Using HXC

Before starting HXC, be sure that your CONFIG.SYS file contains the following:

```
FILES=18  
DEVICE=ANSI.SYS
```

If your CONFIG.SYS file does not contain these statements, you must modify that file to include them, and then reboot your system before running HXC. Refer to your computer owner's documentation for information on how to modify CONFIG.SYS.

To execute HXC, type:

```
HXC MAIN 
```

MAIN is the file which will contain the converted data. It will have the extension .MDS when it is completed.

NOTE

Although not demonstrated in this example, you may specify the name of a command file instead of the MDS file when executing HXC. For example, if you need to execute HXC a second time, you can use:

HXC @MAIN

This will cause HXC to use the command file that was automatically created when you first ran HXC. When you run HXC in this manner, there is no need to type in any file names; the command file has them all. Refer to chapter 3 of the *Utilities Reference Manual* for more information on using a command file.

You will then see the following screen:

```
HXC (A.01.04) HP 82520 (c) Copyright Hewlett-Packard 1985
output file(s)                               Status: Entering dev. sys. names
main.MDS                                     Files: 0

Development System Handheld  File      Actual   Allocated   Size
  File Name      File Name  Type    Size(byte) Size(para) Increment(para)
-----
.

Quit  Create RAM MDS  Create ROM MDS  [ ]  [ ]  [ ]  [ ]
```

The cursor will be blinking in the first column, waiting for you to enter the input file names. To enter the files you wish to convert, type:

```
main.bas 
suba.bas 
```

Next press the function key (sometimes referred to as a "soft" key) **f2**. When you press **f2** the cursor moves to the column entitled "Handheld File Name", and you are to enter the file names for the HP-94. If the file names for the HP-94 are to be the same as those on the development computer (remember that the HP-94 file names may not be more than four characters), you only need to press **Enter**. HXC will automatically use the same file name. Also, notice that the information displayed has changed somewhat:


```
HXC (A.01.04) HP 82520 (c) Copyright Hewlett-Packard 1985
```

```
output file(s)          RAM MDS file          Status: Entering handheld names
main.MDS                Files: 2
```

Development System	Handheld	File	Actual	Allocated	Size
File Name	File Name	Type	Size(byte)	Size(para)	Increment(para)
main.bas	-				
suba.bas					

```
Quit
```

Type in the names of the HP-94 files (note that HP-94 file names are limited to a maximum of four characters) or press `Enter`.

```
main Enter suba Enter
```

HXC will then perform the file conversion, write the MDS file to the default disc drive, and automatically terminate, returning control to MS-DOS. The final screen you will see will look like this:

```
HXC (A.01.05) HP 82520 (c) Copyright Hewlett-Packard 1985
```

```
output file(s)          Status: Conversion finished
main.MDS                Files: 2
```

Development System	Handheld	File	Actual	Allocated	Size
File Name	File Name	Type	Size(byte)	Size(para)	Increment(para)
main.bas	MAIN	B	0000E6h	000Fh	
suba.bas	SUBA	B	00008Fh	0009h	

2 component files converted to 1 output file.
Space required in handheld: 0018h paragraphs.

NOTE

If HXC does not display a B in the File Type field, you probably have entered a non-existent file name in the Development System File Name field. If so, press **F1** to terminate HXC and then run HXC again from the beginning. Refer to chapter 3 of the *Utilities Reference Manual* for further information.

You can check to see if the MDS file exists on the default disc by using the MS-DOS DIR command. The file MAIN.MDS should be found. You may or may not see all of the output files listed on page 18, depending on how many times HXC has been run for this conversion. The next step in the process is to transfer this file to the HP-94.

Copying the MDS File to the HP-94

In order to copy the MDS file created by HXC, you must first set up the development computer's serial port using HXMODE, then transfer the file to the HP-94 using HXCOPY. In the examples to follow, the utility programs are assumed to be on the default disc drive, thus no path names are shown. If necessary, add path names to the calls to HXMODE and HXCOPY as appropriate for your installation.

Setting Up the Serial Port

You will use the utility HXMODE to set up the serial port on the development computer. To execute HXMODE, type:

```
HXMODE COM1 
```

This utility installs the handler which controls the serial port on the development computer. If the serial port for your development computer is not in COM1, change the parameter accordingly. The default parameters used by HXMODE are defined as follows:

- /AUTOX...AUTOX signifies that the AUTO XON/XOFF function is used.
- COM1.....The name of the serial port.
- 9600.....The baud rate for transfer.
- 7ES.....The bit configuration is 7 data bits, even parity, and one stop bit.

You may change any of these parameters by adding the new value to the call to HXMODE. Refer to chapter 6 of the *Utilities Reference Manual* for more information.

NOTE You may wish to include the call to HXMODE in an AUTOEXEC.BAT file so that the handler is installed at the time the development computer is booted. Simply place the command as shown above in the AUTOEXEC.BAT file, making sure that the proper path names are present, if necessary. Refer to your computer owner's documentation for more information on the AUTOEXEC.BAT file.

Setting Up the HP-94

NOTE Be sure the main battery pack is fully charged and the lithium battery (some models of the HP-94 require two lithium batteries) has been installed. Refer to the *User's Documentation Kit* for detailed information on these procedures.

Before beginning the actual procedure, take a moment or two to familiarize yourself with the controls of the HP-94. Refer to the diagram on page 4 of this guide, or to the diagrams in the *User's Documentation Kit* for the location of the various controls.

- You turn on the HP-94 by pressing the **ON/OFF** button. The display will appear in a moment. If it does not, check the display contrast control and be sure it is set so that you can view the display. Turn off the HP-94 by pressing the **ON/OFF** button again.
- You can adjust the display contrast control for the display that suits you best. There is a backlight for the display that you can turn on by pressing and holding the **SHIFT** button. Turn off the backlight by pressing and holding the **SHIFT** button again. Note that battery life will be reduced by excessive use of the backlight.
- When you turn on the HP-94 you will see a blinking cursor, either a ■ or a _ . The ■ means the alphabetic characters are active, and the _ means the numeric characters are active. Alphabetic characters are printed in orange on the keys, and numeric characters are printed in white. You switch between the two by pressing the **SHIFT** key. As you do so, you will hear a beep and see the cursor change.
- The **←** key is the backspace key. If you make a mistake, you can correct it by moving the cursor to the left with this key.

Before transferring your files, you should insure that program files named MAIN and SUBA do not already exist on your HP-94. If you find that such files do exist on your HP-94, you will have to remove them before you copy the files you just created. The following steps will show you how to do this.

Turn on your HP-94 by pressing the **ON/OFF** button. The display will appear shortly. Adjust the display contrast control as necessary to obtain the display that suits you. If there is a MAIN program installed, the HP-94 will execute it immediately, and the display you see could be almost anything. The command mode prompt (>) will appear if a MAIN program is not being executed. If you do not see the command mode prompt (>), turn off the HP-94 by pressing the **ON/OFF** key, and then turn it on again in the following manner:

1. Press and hold the **ENTER** and **CLEAR** keys.
2. Press the **ON/OFF** key. You should see the command mode prompt (>) with a blinking cursor immediately to the right of it.
3. To see if there are any files in the HP-94, type:

D **SHIFT** Ø **ENTER**

If your HP-94 contains any files, their names and sizes will be displayed. Refer to chapter 8 of the *Utilities Reference Manual* for more information.

4. If there are no files that you need to erase, skip to step 1 of the next procedure.
5. Press **ENTER** to display the command prompt and cursor (> ■).
6. Type the following on your HP-94:

CAUTION The following steps will erase any files you specify on your HP-94. Be sure you have backup copies of each file on your development computer before proceeding.

E **SHIFT** Ø **SHIFT** **SPACE** * **ENTER**

The HP-94 will display a : whenever you press **SPACE** while in the command mode. The HP-94

will respond with the name of each file it finds and ask if each is OK to erase. Respond with **ENTER** if you wish to erase the file, or **N** if you do not wish to erase the file.

To set up the HP-94 to receive the MDS file, perform the following steps:

1. With the HP-94 off, simultaneously press and hold the **CLEAR** and **ENTER** keys, then press the **ON/OFF** key. You will see the following display on the HP-94:

```
Copr. HP 1985 V 01.3  
>
```

This indicates that the HP-94 is ready to accept commands.

2. Type the following:

```
C. SHIFT Ø ENTER
```

The HP-94 will respond with the following:

```
Ok?
```

3. Press **ENTER** and the cursor will move to the left of the **Ok**.

The **C** command reads incoming files from the serial port and places them into directory 0, the main directory in the HP-94. The HP-94 is therefore ready to accept the MDS file from the development computer.

NOTE The HP-94 has a default timeout of two minutes. Be sure the following steps are completed within that time. If the HP-94 times out before the next steps are completed, repeat the above process. You can change the default value by using the **SYTO** statement. Refer to chapter 2 of the *BASIC Reference Manual* complete information on this procedure.

Using HXCOPY

The final step in the process is to copy the MDS file to the HP-94 using the HXCOPY utility. For more information on HXCOPY refer to chapter 5 of the *Utilities Reference Manual*.

On your development computer type:

```
HXCOPY MAIN COM1 Enter
```

If all goes well, you will see the following screen:

```
HXCOPY (A.01.07) HP 82520 (c) Copyright Hewlett-Packard Co. 1985  
Copy operation completed
```

HXCOPY will automatically terminate, returning control to MS-DOS. In addition, the following will be displayed on the HP-94:

Copying Ø:MAIN .
Copying Ø:SUBA .
>

Turn off the HP-94, then turn it back on again. You will see the following display (note that since the HP-94 display is limited to a maximum of 4 lines at a time, you will not see the entire display at once):

```
In MAIN....  
In program SUBA!  
The parameter is:  
I came from MAIN!  
Now return to MAIN.  
Press Q to quit.
```

Now press Q and the HP-94 will beep and display

End of MAIN.

And that's all there is to it! You are now ready to develop your own applications for the HP-94.



In Case of Difficulty

There is a table on page 28 that contains an explanation of some HP-94 errors you might encounter during the software development process. The table has a column that lists the error number or condition, a second column that lists the probable causes, and a third column that describes the appropriate action to take.

If you have difficulty during the process, the hints presented here may be helpful. There are also complete error message listings available in other manuals:

- BASIC language error numbers and messages are found in appendix B of the *Basic Language Reference Manual*.
- HP-94 error codes and messages are found in appendix B of the *BASIC Language Reference Manual*.
- HXC error messages are found in chapter 3 of the *Utilities Reference Manual*.
- HXCOPY error messages are found in chapter 5 of the *Utilities Reference Manual*.

HXBASIC

If you have difficulty in HXBASIC, these hints may be of help.

- If a new line number does not appear after pressing from EDIT mode, EDIT has found a syntax error in the line you just entered.
- Don't forget to exit HXBASIC with the `BYE` command. If you try to execute HXC without having exited from HXBASIC, HXBASIC will respond

`Error: HXC.BAS not found`

- Remember that `BYE` is not a valid command in EDIT mode.
- Don't forget to save the program files. You can only save a file from the `$` prompt as the statement `SAVE` is not a valid command from the EDIT mode.

HXC

If you have difficulty in HXC, these hints may be of help.

- Be sure to include the filename when invoking HXC.
- Be sure to include the extension `.BAS` for the Development System File Name field. If this extension is not included, HXC will interpret the file as a datafile, and `D` will appear in the File Type column.
- After entering the development system file names, be sure to press key .

HXMODE

Be sure you have the correct device name for your serial port.

HXCOPY

If you have difficulty in copying the files to the HP-94, these hints may be of help.

- Be sure that all connections are correct and that the cables are firmly seated. If you built your cables from the diagrams in the introduction, check to be sure they are connected correctly for the equipment configuration you are using.
- Be sure to set up the HP-94 to read a file with the `C` command. Remember that the HP-94 `SHIFT` key is a toggle, and to return to the original case the `SHIFT` key must be pressed again.

Refer to the documentation associated with the program in question for more information.

HP-94 Error, Cause, and Correction Table

Error Number or Condition	Probable Cause	Corrective Action
101 or 102	Typing error while typing command.	Retype the command, paying special attention to the use of the SHIFT key.
200	Battery needs recharging.	Press ON/OFF to turn off HP-94, then connect recharger.
201-208	Did not use HXMODE command, or used MS-DOS MODE command instead.	Use HXMODE, not MS-DOS MODE command, to configure development system serial port.
	Specified incorrect serial port configuration.	Specify the correct handshake, baud rate and data format.
	Used MS-DOS COPY command instead of HXCOPY.	Use HXCOPY to transfer the files.
209	Used HXCOPY to transfer a non-MDS file.	Transmit only MDS files using HXCOPY.
210 or 211	Did not install memory backup batteries.	Install the backup batteries.
212 or 214-216	Did not initialize main memory.	Press I SHIFT Ø ENTER ENTER to initialize main memory.
213 or 217	Did not initialize 40K RAM card.	Press I SHIFT 1 ENTER ENTER to initialize the RAM card.
The HP-94 did not turn on.	Battery needs recharging.	Connect recharger.
Copr. HP message did not appear.	Did not press CLEAR and ENTER while turning HP-94 on.	Press ON/OFF to turn the HP-94 off. While pressing CLEAR and ENTER at the same time, press ON/OFF to turn the machine on. When the message appears in the display, release CLEAR and ENTER .
Copying <filename> message did not appear.	Cable not connected.	Connect cable between development system computer and HP-94.
	Used incorrect cable.	Refer to "Connecting the Equipment" to select the proper cable to use.
	Cable connected to wrong serial port, or configured wrong port with HXMODE.	Verify that the port you configured with HXMODE is the one connected to the HP-94. Check which port the cable is connected to, and check the configuration jumpers on the development system computer's serial interface.





Reorder Number
82520-90007

82520-90008
Printed in U.S.A. 12/86