Super Serial Imager
Operator's Manual

APRICORN
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Introduction

Apricorn's Super Serial Imager ([tm]) is a multipurpose I/O connection for the Apple II series of computers including the Apple II, the Apple II+ and the Apple IIe. The Imager provides a hardware interface and a set of complex programs which make communication with a wide variety of devices relatively simple.

The Imager provides a wide variety of options that allow it to easily communicate with printers, plotters, modems, other Apple, other computers or any device which uses the RS-232C serial communications format. It is fully compatible with Apple's Super Serial Card while also providing a very powerful graphics printer interface program for support of printers such as Apple's Imagewriter II, Epson's FX-80.

The Imager contains special smart handshaking circuitry to permanently and RS-232C "hookup hassle". This smart circuit will automatically find the correct bus line so that no buffer overflow can result. This means an end to special cables and wasted time.

In the Super Serial Card Emulation Mode the Imager supports all of Apple's Super Serial Card commands, allowing programs written for the Super Serial Card to be completely compatible with the Imager. The emulation program supports three basic modes of operation: Communications Mode, which allows you to connect your Apple to modem, or directly to other computers; Terminal Mode, which allows you to use your Apple as a terminal for use with other computers or time sharing networks; and Printer Mode, which allows you to use the standard Apple Printer Card commands.

The Imager GPI (Graphics Printer Interface) Mode provides a full featured graphics printer interface for use with the Apple Imagewriter II, Epson FX-80 and any of the compatibles such as Citizen and Panasonic. Any Apple screen can be transferred to paper with a single Imager command. These screens include 48 column text, Apple's B&W graphics, high resolution graphics and Apple's double resolution graphics screen. More commands are also available for formatting output of printed text.

The Imager is compatible with all Apple operating systems, such as DOS 3.3, ProDOS, Integer and Apple's BASIC, Apple Pascal, Apple FORTRAN, Apple PILOT, Apple LOGO and CP/M. Compatibility is also maintained with all word processing systems, spreadsheet programs, communications packages, and graphics programs. Among the programs with which the Super Serial Imager has been thoroughly tested are Mousepaint, Imagewriter Toolkit, Apple Access, and AppleWorks.

Installation

Installation of the Super Serial Imager into your Apple II, Apple II+, or Apple IIe involves two tasks. The first is to configure the Imager to suit your particular needs, the second is to physically install the unit.

Connecting the Cable Assembly

There are two different methods of RS-232C communications and two devices must each be of the opposite type to hook up to each other correctly. This has been simplified by the Imager's two cable connections available on the circuit board. If you are connecting the Imager to a modem then connect the cable assembly to the header labeled "MODEM". If you are connecting the Imager to a printer, plotter, terminal or other similar output device connect the cable assembly to the header labeled "PRINTER".

WARNING

Be sure to install the cable assembly with the colored wire positioned nearest the top part of the card. In this position the cable assembly should not lay over the card, but should extend past the right side of the card. Failure to position the cable assembly correctly could result in damage to your computer equipment.

Setting the DIP Switches

The Imager has two banks of "DIP switches" which it uses for hardware options and to set certain configuration options. Many of these options can be changed through software, but it is very convenient to have the unit start off in the configuration you want to use.

If you are using the Super Serial Card Emulation Mode of the Imager, then you will need to set the DIP switches as indicated below under "Super Serial Card Emulation DIP Switch Settings". If you are using the Imager as a graphics printer interface then you will need to set the DIP switches as indicated under "Imager GPI Mode DIP Switch Settings" later in this chapter.

Super Serial Card Emulation DIP Switch Settings

To select the Super Serial Card Emulation Mode SW1-8 must be set to the ON position. In this mode the Imager acts exactly like a Super Serial Card right down to the DIP switch settings. The Super Serial Card has two banks of seven position DIP switches of which only the first six are of concern (SW1-7 and SW2-7). On the Super Serial Card select one of two lines to use for Clear-To-Send, which is automatically taken care of in the Imager's smart serial circuit). These six DIP switches are set up exactly the same as on the Imager so that any recommendations or chart settings concerning the Super Serial
Card can be used as such with the Imager. Remember to use only the first six DIP switch settings for these cases.

**Super Serial Card Emulation: SW1-3/ON**

The Imager's DIP switches as used under Super Serial Card Emulation Mode are described below:

**Baud Rate Control**

The Imager's baud rate is controlled by SW1-1 through SW1-4. These four switches are used to select the baud rate which the Imager will use for transmission and reception of data. The following table describes how to set the switches for the baud rate you desire, which must match the baud rate of the device with which the Imager is communicating.

| Baud Rate | DIP Switch SW1
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>ON ON ON ON</td>
</tr>
<tr>
<td>110</td>
<td>ON ON OFF ON</td>
</tr>
<tr>
<td>150</td>
<td>ON OFF ON OFF</td>
</tr>
<tr>
<td>300</td>
<td>ON OFF OFF OFF</td>
</tr>
<tr>
<td>600</td>
<td>OFF ON OFF OFF</td>
</tr>
<tr>
<td>1200</td>
<td>OFF OFF ON ON</td>
</tr>
<tr>
<td>2400</td>
<td>OFF OFF OFF ON</td>
</tr>
<tr>
<td>4800</td>
<td>OFF OFF OFF OFF</td>
</tr>
<tr>
<td>9600</td>
<td>OFF OFF OFF OFF</td>
</tr>
<tr>
<td>19200</td>
<td>OFF OFF ON ON</td>
</tr>
</tbody>
</table>

*(Note: actual baud at 110 baud is 109.92 and at 135 baud is 134.58)*

**Generate <LF> on <CR>**

When using a printer it is usually desirable to have the printer execute a linefeed <LF> along with carriage return <CR>. Some printers do this automatically, and most can be told to do so by setting DIP switches on the printer. You can tell the Imager to generate <LF> with <CR> by setting SW2-5 ON. The Imager will not generate <LF> with <CR> if SW2-5 is turned OFF.

You will be able to tell if you need to turn this switch on or off by sending several lines of text to your printer. If your printer is generating <LF> when it receives <CR> or you have this switch on your printout will be double spaced. If neither your printer or the Imager are generating <LF> on <CR> then your printout will write over the same line again and again.

Some programs need to be able to write on the same line more than once, and send the <LF> character when it is necessary to advance the paper. In these cases, and whenever you are using the Imager in Communications or Terminal Mode, SW2-5 should be OFF.

**<LF> After <CR> SW2-5**

Send <LF> ON
Don't send <LF> OFF

**Interrupts**

The Imager has the capability to generate interrupts on the Apple bus. This capability is not used by most applications. Unless an application program specifically indicates that interrupts must be on, set SW2-6 to OFF. If your application needs interrupts supported then set SW2-6 to ON. An example of an application that will usually support or require interrupts are telecommunication programs such as ASCII Express Professional.

**Interrupt Status SW2-6**

Interrupts On ON
Interrupts Off OFF

**Data Carrier Detect**

The Data Carrier Detect (DCD) signal can be disconnected via SW1-7. This is useful for certain intelligent modems that do not have the capability to produce a false DCD signal. The Imager's Terminal Mode and most terminal programs will not let you send data out the serial port unless the DCD line is asserted. However, certain intelligent modems don't assert the DCD line until after they have dialed a host and established a connection. The problem is that characters have to be sent to the modem to dial the host! If your modem works in this way then turn SW1-7 ON. For all other applications turn SW1-7 OFF.

**DCD Status SW1-7**

Connect ON
Disconnect OFF

The rest of the DIP switch settings depend on whether you are using the Communications Mode or Printer Mode. If you are using the Imager with a modem or external terminal then Communications Mode is best suited for your device. If you are using the Imager with a printer, plotter or other output device then Printer Mode is for you.
Communication Mode DIP Switch Settings

Under Super Serial Card Emulation, SW1-5 and SW2-6 control the mode. Communications Mode is selected by setting both of these switches ON. The remainder of the DIP switches applicable to Communications Mode will be explained below.

Communciations Mode: SW1-5/ON SW1-6/ON

Data Format

When transmitting data, it is very important that both the transmitter and the receiver use the same data format. The Imager always sends its data one character at a time, as a string of ones and zeros, but the interpretation of the data is by convention. There you must tell the Imager which data format it is to use. Transmission always begins with a "start bit", followed by 7 or 8 "data bits", an optional "parity bit" followed by one or two "stop bits".

Data Bits

The number of data bits sent or received is controlled by SW2-2. If this switch is ON then 8 data bits will be transmitted. If it is OFF then 7 data bits will be transmitted.

Data bits

7 Data bits ON 8 Data bits OFF

Parity

Parity is a method of confirming correct data transmission. The details of this method are explained under the "Data Parity" command in the chapter "Sending Commands to Imager". SW2-3 SW2-4 are used to control the parity used by the Imager, as follows:

Parity

Odd ON OFF
Even OFF OFF
None --- ON

Stop Bits

The number of stop bits used by the Imager is controlled by SW2-1. If this switch is ON then one stop bit will be used, if this switch is OFF then two stop bits will be used.

Stop bits

1 stop bit ON
2 stop bits OFF

Printer Mode DIP Switch Settings

Under Super Serial Card Emulation SW1-5 and SW1-6 control the mode. To select Printer Mode set SW1-5 to OFF and SW1-6 to ON. The remainder of the DIP switch settings applicable to Printer Mode will be explained below.

Printer Mode: SW1-5/OFF SW1-6/ON

Data Format

Data format DIP switch settings under Printer Mode are limited to controlling the stop bits. The Imager defaults to 1 start bit, 8 data bits and no parity. The stop bits can be set using SW2-1. To select 1 stop bit turn SW2-1 ON. To select 2 stop bits turn SW2-1 OFF. For baud rates of 110 and under, 2 stop bits is best. For baud rates over 110, 1 stop bit is preferred.

Stop bits

1 stop bit ON
2 stop bits OFF

Carriage Return Delay

Many printers need extra time to move the printhead when executing a carriage return. Printers which do not support handshaking with the Imager may lose characters after receiving a CR. If this occurs you can tell the Imager to wait 32 ms after sending a <CR> to allow the printhead time to position itself by turning SW2-2 ON.

<CR> Delay SW2-2

NONE OFF
32 ms ON

The Imager can also be told to wait by using the NC command described in the chapter "Sending Commands to Imager", which will allow delay times of 0 ms, 32 ms, 250 ms (1/4 second) or 2 seconds.

Line Width and Video Echo

You can control the line width and turn on or off video echo with SW2-3 and SW2-4. The following table lists the possible settings:

<table>
<thead>
<tr>
<th>Line Width</th>
<th>Video Echo</th>
<th>SW2-3</th>
<th>SW2-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 Characters</td>
<td>Enabled</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>72 Characters</td>
<td>Disabled</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>80 Characters</td>
<td>Disabled</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>132 Characters</td>
<td>Disabled</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>
If you intend to use the Imager with a printer then set the switches for the number of characters per line that you want on your printer. If you are using the Imager with a terminal then set the switches for the number of characters per line that the terminal can accommodate on one line.

Imager GPI Mode DIP Switch Settings

If you are using the Imager to interface to an Apple ImageWriter, Epson, Star Micronics, C. Itoh Prowriter, Okidata or Epson compatible printer, the Imager's graphics printer interface mode is the one to use. To configure the Imager as a Graphics Printer Interface (GPI) set SW1-8 to the OFF position. The Imager's use of the DIP switches under GPI Mode will be explained below.

Imager GPI Mode: SW1-8/OFF

Baud Rate Control

The Imager's baud rate is controlled by SW1-1 through SW1-4. These four switches are used to select the baud rate which the Imager will use for transmission of data. The following table describes how to set the switches for the baud rate you desire, which must match the baud rate of the printer with which the Imager is communicating. The highest common baud rate of the Imager and printer is best.

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>SW1-1</th>
<th>SW1-2</th>
<th>SW1-3</th>
<th>SW1-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undef.</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>50</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>75</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>110</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>135</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>150</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>180</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>2400</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>3600</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>4800</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>7200</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>9600</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>19200</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

(note: actual baud at 110 baud is 109.92 and at 135 baud is 134.58)

Printer Selection

In order for the Imager GPI to print bit image data it needs to know exactly what printer it is being used with. SW2-1 through SW2-4 are set to indicate this. Use the chart below to set these switches.

<table>
<thead>
<tr>
<th>Printer Type</th>
<th>SW2-1</th>
<th>SW2-2</th>
<th>SW2-3</th>
<th>SW2-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ImageWriter</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Epson</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Star Micronics</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Okidata</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>C. Itoh</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Epson compatibles such as Panasonic should use the Epson setting.

Most Significant Bit Control

The Most Significant Bit (MSB) can be controlled using SW2-5. If this switch is set to the ON position, the Imager will pass the 8th bit of output data to the printer. In the OFF position the 8th bit of output data will be cleared before being sent to the printer. This setting is valid even if SW2-8, which controls transparent mode, is ON.

MSB Control: SW2-5

Clear it: OFF
Pass it: ON

Generate <LF> on <CR>

When using a printer it is usually desirable to have the printer execute a linefeed (<LF>) along with carriage returns (<CR>). Some printers do this automatically, and most can be told to do so by setting DIP switches on the printer. You can tell the Imager to generate <LF>s with <CR>s by setting SW1-6 ON.

You will be able to tell if you need to turn this switch on or off by sending several lines of text to your printer. If your printer is generating <LF>s when it receives <CR>s and you have this switch on your printout will be double spaced. If neither your printer or the Imager is generating <LF>s on <CR>s then your printout will write over the same line again and again.

Some programs need to be able to write on the same line more than once, and send a <LF> character when it is necessary to advance the paper. In these cases SW1-6 should be OFF.

<LF> after <CR>: SW1-6

Send <LF>: ON
No <LF>: OFF
Video Echo Control

If you want the Imager to echo all of its output to the video screen, then turn SW2-7 ON. For a silent screen turn SW2-7 OFF. The video echo will work correctly with the 80 column screen of the Apple //e.

Video Echo SW2-7
Echo on ON
Echo off OFF

XON/XOFF Control

The Imager supports XON/XOFF software handshaking. This can be enabled by turning SW1-5 ON and disabled by turning SW1-5 OFF.

XON/XOFF SW1-5
Enabled ON
Disabled OFF

Transparent Mode

The Imager can be transformed into a fully transparent serial output port. This can be enabled by turning SW2-8 ON. In this mode no printer control commands will be acted upon by the Imager and they will be sent directly out the serial port. The NSB control is still active under transparent mode to allow selection of a 7 bit or 8 bit transparent port.

Transparent Mode SW2-8
Enabled ON
Disabled OFF

Interrupts

Interrupts are rarely used for printing and unless interrupts are specifically required turn SW2-6 OFF.

Data Carrier Detect

The Data Carrier Detect (DCD) line is controlled by SW1-7. The DCD line is normally left connected for printing so turn SW1-7 ON.

Physical Installation

The Imager can be installed in any of the Apple's internal slots except the auxiliary slot on the Apple //e. On the Apple II[[ or Apple II]+ there are 8 internal slots, numbered 0 to 7 from left to right. On the Apple //e there are 7 slots, numbered 1 to 7.

If you intend to use your Imager as a printer interface you should install it in slot number 1. If you intend to use it with a modem or as a general purpose I/O port it should be installed in slot 2. For use with an external terminal it should be installed in slot 3. To be used, the slot in which the Imager resides must be known, and these are the standard slot usages compatible with most Apple operating systems and commercial software.

The following steps should result in the correct installation of your Imager:

WARNING

Make sure the power to your Apple is off while physically installing the Imager into one of the Apple's internal slots. Failure to do so will result in damage to both your computer and the Imager.

1) Turn off the power to your Apple computer. Failure to do so will result in damage to both the Imager and your Apple. The POWER light located in the lower left hand corner of the keyboard should not be illuminated.

2) Remove the cover from your Apple II[[ by pulling up on the rear of the cover until it just pops loose, and then slide it rearward until it is completely free of the rest of the Apple case.

3) Insert the Imager into the desired slot. Press firmly with a slight forward and backwards rocking motion (along the length of the card).

4) On the Apple II[[ and Apple II[[+ the Imager cable assembly hangs out the rear of the case. The Apple //e has cutouts in the rear panel designed to accept DB-25 connectors. Using the enclosed screw-lock kit, attach the Imager's DB-25 connector to the rear panel in the desired location.

5) Replace the cover to your Apple by reversing step 2.

6) Connect your peripheral device using an appropriate cable with a male termination.

7) Recheck the installation of the Imager and cable assembly. You may want to reread the installation instructions.
In order to check the installation of your Super Serial Imager, turn on your Apple and peripheral device. To check a printer, type the command:

PR$1 <RETURN> (This selects Slot 1)

This should turn the printer on, hitting the return key a few times should cause the BASIC prompt character to be printed on the printer.

To check installation with an intelligent modem, first type:

IN$2 <RETURN> (This selects slot 2)
CTRL-A> T <RETURN> (This commands Imager into Terminal Mode)
AT <RETURN> (This is the Attention command for the modem)

If everything is correct the modem should respond to the AT command with the characters "OK". If your modem does not accept commands then you will have to dial a test host and try to get on-line.

Selecting the Imager for I/O

Before you can use the Imager you must tell the Apple to communicate with the Imager. DOS 3.3 and ProDOS support eight different I/O devices. These are the standard Apple 48 column screen/built-in keyboard and up to seven different I/O devices that are present in the peripheral slots. The PR$ (a = slot) command is used for selecting output and the IN$ (a = slot) command is used to select input. To turn the printer on in slot 1 we would type:

PR$1 <RETURN>

This channels output to the printer attached to the Imager in slot 1. To turn the printer off type:

PR$0 <RETURN>

To select the Imager in slot 3 for input and output so that we could use an external terminal instead of the standard Apple screen and built-in keyboard we would type:

PR$3 <RETURN>
IN$3 <RETURN>

The external terminal's screen and keyboard can be used as if they were the Apple's own.

To use the Imager in slot 2 to emulate a terminal with an external modem to communicate with a remote host we would type:

IN$2 <RETURN>
CTRL-A> T <RETURN>

The <CTRL-A> was a "Control Command" issued to the Imager to put it into Terminal Mode. This will be explained in the next chapter.

In deferred execution mode (or program mode) all "PR$" and "IN$" commands must actually be printed in PRINT statements and preceded by the DOS character <CTRL-D>. The following BASIC program will turn the printer on, print a short message and then turn the printer off.

100 DB = CHR$(4); REM DOS CHARACTER <CTRL-D>
110 PRINT DB; "PR$1"
120 PRINT "HELLO FROM THE SUPER SERIAL IMAGER"
130 PRINT DB; "PR$0"
140 END

If you are using the Imager under an operating system other than DOS 3.3 or ProDOS consult your instruction manual for details on how to select I/O devices.
Sending Commands to Imager

The format of the commands used with the Imager will depend upon the language you use. However, your goal will always be the same: you must send specific codes to the slot in which the Imager resides.

When you are using DOS 3.3 or ProDOS, codes can be sent simply by pressing the correct sequence of keys or sending codes via simple PRINT statements. Imager commands usually start with a "control code" which is sent by first holding down the control key (like a shift key) and then pressing another key. When the Imager receives this code, it knows that a command is coming. When a complete command sequence has been recognized the Imager will execute the specified command.

For example, the key sequence:

```
<CTRL-I><G>
```

would tell the Imager to perform a test screen dump to the printer, assuming the Imager is in Printer Mode configuration and output has been redirected to the Imager. In BASIC the statement:

```
100 PRINT CHR$(9); "5"
```

would do the same thing. Notice that `<CTRL-I>` has an ASCII code value of 9.

Super Serial Imager Commands

The Imager supports three different sets of commands. There are two sets of commands under Super Serial Card Emulation (Communications Mode and Printer Mode) and another set for the QPI mode. These three sets of commands will be explained in this chapter.

Commands in the Communications Mode

Before any of the commands in this section can be used the Imager must be configured and initialized as follows:

The Imager must be installed with the cable header connected to the MODEM port on the Imager circuit board, and the Dip Switches set for Communications Mode, under Super Serial Card Emulation, as described in the installation chapter of this manual.

The Imager must be initialized for input or output using the IN1s or IN2s commands, where $S$ is the slot containing the Imager, as described in the section "Selecting the Imager for I/O" earlier in this manual.

>>> Note: all commands listed must be preceded by the "control" character, which will always start as `<CTRL-A>` in Communications Mode.

The control character can be changed by first typing the current control character, and then the desired control character. For example:

```
<CTRL-A> <CTRL-W>
```

would change the control character from `<CTRL-A>` to `<CTRL-W>`.

Apple Super Serial Card Emulation

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB &lt;CR&gt;</td>
<td>Set Baud Rate</td>
<td>0 - 15</td>
</tr>
<tr>
<td>NC &lt;CR&gt;</td>
<td>Carriage Return Delay</td>
<td>0 - 3</td>
</tr>
<tr>
<td>ND &lt;CR&gt;</td>
<td>Data Format</td>
<td>0 - 7</td>
</tr>
<tr>
<td>NF &lt;CR&gt;</td>
<td>Form Feed Delay</td>
<td>0 - 3</td>
</tr>
<tr>
<td>NL &lt;CR&gt;</td>
<td>Line Feed Delay</td>
<td>0 - 3</td>
</tr>
<tr>
<td>NP &lt;CR&gt;</td>
<td>Parity</td>
<td>0 - 7</td>
</tr>
<tr>
<td>NS &lt;CR&gt;</td>
<td>Specify Screen Slot</td>
<td>0 - 7</td>
</tr>
<tr>
<td>NT &lt;CR&gt;</td>
<td>Translate Lowercase</td>
<td>0 - 3</td>
</tr>
<tr>
<td>NB &lt;CR&gt;</td>
<td>Transmit 233ms Break Signal</td>
<td></td>
</tr>
<tr>
<td>R &lt;CR&gt;</td>
<td>Reset Super Serial Imager</td>
<td></td>
</tr>
<tr>
<td>T &lt;CR&gt;</td>
<td>Enter TERMINAL MODE</td>
<td></td>
</tr>
<tr>
<td>Z &lt;CR&gt;</td>
<td>Transparent Mode</td>
<td></td>
</tr>
<tr>
<td>EM &lt;CR&gt;</td>
<td>Echo keyboard input on screen</td>
<td>E/D</td>
</tr>
<tr>
<td>FN &lt;CR&gt;</td>
<td>Find Keyboard</td>
<td>E/D</td>
</tr>
<tr>
<td>EN &lt;CR&gt;</td>
<td>Send &lt;LF&gt; with &lt;CR&gt;</td>
<td>E/D</td>
</tr>
<tr>
<td>MN &lt;CR&gt;</td>
<td>Mask incoming &lt;LF&gt; w/ &lt;CR&gt;</td>
<td>E/D</td>
</tr>
<tr>
<td>XN &lt;CR&gt;</td>
<td>XOFF detect</td>
<td>E/D</td>
</tr>
<tr>
<td>HR &lt;CR&gt;</td>
<td>High bit</td>
<td>E/D</td>
</tr>
</tbody>
</table>

Set Baud Rate: `<CTRL-A>` (n) (B)

100 PRINT CHR$(1); "BB"

This command provides software control of the baud rate used by the Imager when communicating with external devices. The following table lists the baud rate settings assigned to different values of n:

<table>
<thead>
<tr>
<th>n</th>
<th>Use Dip Switches (p.8)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>use Dip Switches (p.8)</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>75</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>110 (199.92)</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>135 (134.50)</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>150</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>160</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>168</td>
<td>15</td>
</tr>
</tbody>
</table>

12000
Set Time Delays: nC, nP, & nL.

These commands cause the Imager to wait after telling a printer to reposition the printhead so that data will not be lost while the printhead is in transit. For almost all communications mode applications these commands will not be necessary. See the Printer Mode section of this chapter for specifics regarding these commands.

0    None
1    32 milliseconds
2    250 milliseconds (=1/4 sec)
3    2 seconds

Data Parity: <CTRL-A> (n) (P) <CR>

This command is used to specify the type of parity used by the Imager when sending or receiving data. The following table lists possible parity selections:

<table>
<thead>
<tr>
<th>n</th>
<th>Parity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None (send bit 8 as is)</td>
</tr>
<tr>
<td>1</td>
<td>ODD Parity</td>
</tr>
<tr>
<td>3</td>
<td>EVEN Parity</td>
</tr>
<tr>
<td>5</td>
<td>MARK Parity (bit 8 always 1)</td>
</tr>
<tr>
<td>7</td>
<td>SPACE Parity (bit 8 always 0)</td>
</tr>
</tbody>
</table>

Parity is a method of confirming correct data transition. In "odd parity" the low 7 bits of each byte sent or received are checked, and if an "odd" number of them are set (1's) then the high bit of the byte (bit 8) is transmitted as a 0, otherwise it is sent as a 1. Thus when examining incoming data, all bytes must contain an odd number of bits or a transmission error has been detected.

Even parity is the same as odd parity except the total number of set bits in each byte is defined as even rather than odd.

Translate Lowercase Characters: <CTRL-A> (n) (T) <CR>

This command converts lowercase characters to uppercase before passing them to the screen or a BASIC program. Lowercase characters coming into the Imager can be converted as you desire with this command. Conversion options are as follows:

0    Convert lowercase characters to uppercase. Default.
1    Do not convert incoming lowercase character. Pass them along unchanged.
2    Show lowercase characters as reversed uppercase characters.
3    Send lowercase characters to programs unchanged. Send them to the screen as uppercase characters, and display uppercase characters as reversed.

Reset Imager: <CTRL-A> (R) <CR>

This command will reset the Imager, having the same effect as pressing the "Reset" key on the Apple 1 (but only effecting the Imager). The difference between this command and issuing a PIB and IIB is that reset will re-establish the default configuration indicated by the DIP switches. This means that any changes in the configuration which have been made (such as the location of the left margin) will be lost after a system reset or reset command, but not when PIB and IIB, are used.

Transparent Mode: <CTRL-A> (T) <CR>

This command tells the Imager to ignore all subsequent control characters, and pass them along unaltered. Thus no further commands will be recognized by the Imager. This command is useful if the data being transmitted may contain desired control characters, which would normally be filtered out by the Imager.

Note: Once you issue this command the only way to turn this option off is to clear bit 8 at location $57B8 + (s = slot).

Find Keyboard: <CTRL-A> (F) <SPACE> (E/D) <CR>

This command is used to disable the Apple Keyboard in order to prevent possible keystrokes from disrupting incoming data. This command would be used in a program immediately preceding the inflow of data to disable (D) the keyboard, and again after the data has been received to enable (E) the keyboard.

Generate <LF> with <CR>: <CTRL-A> (L) <SPACE> (E/D) <CR>

This command tells the Imager to send or not send a linefeed character after transmitting a carriage return. This command overrides the setting of SW-5.
Mask Incoming Linefeeds: <CTRL-A> (M) <SPACE> (E/D) <CR>

This command enables/disables the removal of linefeed characters which are immediately preceded by carriage return characters in an incoming data stream.

Terminal Mode

Terminal Mode is really a subset of Communications Mode. This mode allows your Apple to act as a terminal for use with other computers, or network timesharing services.

To use Terminal Mode you simply issue the command:

<CTRL-A> T <RETURN>

from Communications Mode. The following commands relate specifically to Terminal Mode:

>>> Note: All commands listed must be preceded by the "control" character, which will always start as <CTRL-A> in Terminal Mode. The control character can be changed by first entering the current control character, followed by the desired control character. For example, typing:

<CTRL-A> <CTRL-W>

would change the control character from <CTRL-A> to <CTRL-W>.

Apple Super Serial Card Emulation

Terminal Mode

Command Description Range

T <CR> Enter TERMINAL MODE
B <CR> Transmit 233ms Break signal
T <CR> Translate Lowercase 0 - 3
E <CR> Echo keyboard input on screen E/D
S <CR> Special Characters E/D
Xn <CR> XOFF detect E/D
Q <CR> Quit TERMINAL MODE

Enter Terminal Mode: <CTRL-A> T <CR>

This command is used to enter Terminal Mode from Communications Mode. Execution of this command allows your Apple to function as a full-duplex terminal with an external modem. By enabling screen echoing with "Echo keyboard input on screen" you can cause the Apple to function as a half-duplex terminal.

>>> Note: Unless you have enabled screen echoing with the command "<CTRL-A> E <SPACE> E <CR>", the Apple will not send characters to the screen. If you have done this and characters are still not being sent to the screen, the Imager has probably not yet established communications with your modes.

Transmit Break Signal: <CTRL-A> B <CR>

This command sends a 233 millisecond break signal, which is recognized by most timesharing systems as a system signal.

Translate Lowercase Characters: <CTRL-A> n (T) <CR>

When receiving data the Apple converts lowercase characters to uppercase before passing them to the screen or a BASIC program. Lowercase characters coming into the Imager can be converted as you desire with this command. Conversion options are as follows:

0 Convert lowercase characters to uppercase. Default.
1 Do not convert incoming lowercase character. Pass them along unchanged.
2 Show lowercase characters as reversed uppercase characters.
3 Send lowercase characters to programs unchanged. Send them to the screen as uppercase characters, and display uppercase characters as reversed.

Echo Keyboard Input to Screen: <CTRL-A> E <SPACE> E <CR>

Once a character is received from the keyboard it can be "echoed" to the screen. This command will tell the Imager to echo (E) or not to echo (D) keyboard input to the screen.

Special Characters: <CTRL-A> S <SPACE> E/D <CR>

Unfortunately the Apple II keyboard does not support all the ASCII codes sometimes needed when using your Apple as a terminal. Normally, Apple programs simply do not use these codes, thereby avoiding any problem. To generate these special codes you must first enable special characters with this command. From then on, pressing the (ESC) key followed by another key will send one of the unsupported codes. The following table lists the keys, characters, and ASCII codes enabled by this command:
Entering <ESC> (n) will generate

<table>
<thead>
<tr>
<th>Code Sent</th>
<th>Dec</th>
<th>Hex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FS</td>
<td>156</td>
</tr>
<tr>
<td>2</td>
<td>US</td>
<td>159</td>
</tr>
<tr>
<td>3</td>
<td>/</td>
<td>219</td>
</tr>
<tr>
<td>4</td>
<td>\</td>
<td>218</td>
</tr>
<tr>
<td>5</td>
<td>&lt;</td>
<td>222</td>
</tr>
<tr>
<td>6</td>
<td>&gt;</td>
<td>223</td>
</tr>
<tr>
<td>7</td>
<td>&lt;ESC &gt;</td>
<td>251</td>
</tr>
<tr>
<td>8</td>
<td>&lt;EOL&gt;</td>
<td>252</td>
</tr>
<tr>
<td>9</td>
<td>&lt;</td>
<td>253</td>
</tr>
<tr>
<td>0</td>
<td>RUB</td>
<td>254</td>
</tr>
<tr>
<td></td>
<td></td>
<td>155</td>
</tr>
<tr>
<td></td>
<td></td>
<td>255</td>
</tr>
</tbody>
</table>

XON/OFF Detect: <CTRL-A> (X) <SPACE> (E/D) <CR>

180 PRINT CHR$(1); "X D"

Many devices use the decimal code "19" to tell other devices to wait. In this way, when the peripheral device (say a modem) is about to run out of buffer space for incoming characters, it can tell the receiver to halt transmission. When the peripheral device has finished buffering the data, it can resume transmitting by sending the code "19". The receiver will recognize the XOFF and XON characters, (CHR$(19) and CHR$(17) respectively). You can tell the receiver not to recognize these codes by disabling ("D") XOFF recognition with this command.

High Bit Enable/disabled: <CTRL-A> (H) <SPACE> (E/D) <CR>

180 PRINT CHR$(1); "H E"

This command allows you to have a full 8 bit serial data port yet still control the "8th" or "high" bit of the transmitted byte. Enabling the 8th bit allows the sender to pass along the full 8 bit byte it receives for transmission out the serial port. Disabling the 8th bit forces this bit to always be cleared before transmission out the serial port.

Uppercase/Lowercase on the Apple II and II+

Because the Apple II and II+ keyboards do not support lowercase characters, the <ESC> key is used to switch between upper and lowercase output for the Imageer. Here's how it works:

Assuming that you start off with uppercase output, to switch to lowercase output press the <ESC> once. To switch back to uppercase output, press the <ESC> twice in a row. To capitalize just one character while in lowercase mode press <ESC> once followed by the character you want capitalized. This will work also work on the Apple IIe, but since they support upper/lowercase characters it is unnecessary.

Commands in the Printer Mode

Before any of the commands in this section can be used the Imager must be configured and initialized as follows:

- The Imager must be installed with the cable header connected to the PRINTER port on the Imager circuit board, and the DIP switches set for Serial Card Emulation and Printer Mode as described in the installation chapter of this manual.

- The Imager must be initialized for output by sending a return character to the slot containing the Imager using PRTS, as described in the chapter "Selecting the Imager for I/O" earlier in this manual.

Note: All commands listed must be preceded by the "control" character, which will always start as <CTRL-I> in Printer Mode. The control character can be changed by first typing the current control character, and then the desired control character.

For example:

<CTRL-T> <CTRL-W>

changes the control character to from <CTRL-I> to <CTRL-W>.

Apple Super Serial Card Emulation

Printer Mode

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB &lt;CR&gt;</td>
<td>Set Baud Rate</td>
</tr>
<tr>
<td>NC &lt;CR&gt;</td>
<td>Carriage Return Delay</td>
</tr>
<tr>
<td>NF &lt;CR&gt;</td>
<td>Form Feed Delay</td>
</tr>
<tr>
<td>NL &lt;CR&gt;</td>
<td>Line Feed Delay</td>
</tr>
<tr>
<td>ND &lt;CR&gt;</td>
<td>Data Format</td>
</tr>
<tr>
<td>NP &lt;CR&gt;</td>
<td>parity</td>
</tr>
<tr>
<td>NT &lt;CR&gt;</td>
<td>Translate Lowercase</td>
</tr>
<tr>
<td>C &lt;CR&gt;</td>
<td>Column Overflow</td>
</tr>
<tr>
<td>R &lt;CR&gt;</td>
<td>Reset Super Serial Imager</td>
</tr>
<tr>
<td>Z &lt;CR&gt;</td>
<td>Transparent Mode</td>
</tr>
<tr>
<td>Fn &lt;CR&gt;</td>
<td>Find Keyboard</td>
</tr>
<tr>
<td>Ln &lt;CR&gt;</td>
<td>Send &lt;LF&gt; with &lt;CR&gt;</td>
</tr>
<tr>
<td>Mn &lt;CR&gt;</td>
<td>Mask &lt;LF&gt; preceded by &lt;CR&gt;</td>
</tr>
<tr>
<td>Tn &lt;CR&gt;</td>
<td>Tab in BASIC</td>
</tr>
<tr>
<td>Xn &lt;CR&gt;</td>
<td>XOFF detect</td>
</tr>
<tr>
<td>Hn &lt;CR&gt;</td>
<td>High Bit</td>
</tr>
<tr>
<td>ON</td>
<td>Video Echo Off &amp; Set Line length</td>
</tr>
<tr>
<td>I</td>
<td>Video Echo On &amp; Set Line length</td>
</tr>
<tr>
<td>K</td>
<td>Do not generate &lt;LF&gt; with &lt;CR&gt;</td>
</tr>
<tr>
<td>S &lt;CR&gt;</td>
<td>Text Screen Dump</td>
</tr>
</tbody>
</table>
Set Baud Rate: <CTRL-I> (n) (B) <CR>

100 PRINT CHR$(9); "15a"

This command provides software control of the baud rate used by the Imager when transmitting data to the printer. The following table lists the baud rate settings assigned to different values of n:

<table>
<thead>
<tr>
<th>n</th>
<th>Baud Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1200</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>110 (189,92)</td>
</tr>
<tr>
<td>4</td>
<td>135 (134,58)</td>
</tr>
<tr>
<td>5</td>
<td>150</td>
</tr>
<tr>
<td>6</td>
<td>300</td>
</tr>
<tr>
<td>7</td>
<td>600</td>
</tr>
</tbody>
</table>

Set Carriage Return Delay <CTRL-I> (n) (C) <CR>

100 PRINT CHR$(9); "2C"

This command is used to tell the Imager to wait after sending a <CR> to the printer. This is necessary with some printers to allow the print head adequate time to position itself. The delay time is specified by the value of n, as follows:

<table>
<thead>
<tr>
<th>n</th>
<th>Delay Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>32 milliseconds</td>
</tr>
<tr>
<td>2</td>
<td>250 milliseconds (1/4 sec)</td>
</tr>
<tr>
<td>3</td>
<td>2 seconds</td>
</tr>
</tbody>
</table>

Set Form Feed Delay: <CTRL-I> (n) (F) <CR>

100 PRINT CHR$(9); "2F"

This command is the same as "Set Carriage Return Delay" above except delay is executed after transmission of a Form Feed character.

Set Line Feed Delay: <CTRL-I> (n) (L) <CR>

100 PRINT CHR$(9); "2L"

This command is the same as "Set Carriage Return Delay" above except delay is executed after transmission of a Form Feed character.

These commands are not necessary with printers capable of sending a printer busy signal to the Imager. If your printer does not do so you will have to look through its manual and find the needed delay time after carriage returns, line feeds, and form feeds.

Data Parity: <CTRL-I> (n) (P) <CR>

100 PRINT CHR$(9); "2P"

This command is used to specify the type of parity used by the Imager when sending or receive data. The following table lists possible parity selections for different values of n:

<table>
<thead>
<tr>
<th>n</th>
<th>Parity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,2,4,6</td>
<td>None (send bit 8 as is)</td>
</tr>
<tr>
<td>1</td>
<td>ODD Parity</td>
</tr>
<tr>
<td>3</td>
<td>EVEN Parity</td>
</tr>
<tr>
<td>5</td>
<td>MARK Parity (bit 8 always 1)</td>
</tr>
<tr>
<td>7</td>
<td>SPACE Parity (bit 8 always 0)</td>
</tr>
</tbody>
</table>

Parity is a method of confirming correct data transmission. In "Odd Parity" the low 7 bits of each byte sent or received are checked, and if an "odd" number of them are set (1's) then the high bit of the byte (bit 8) is transmitted as a 0, otherwise it is sent as 1. Thus when examining incoming data, all bytes must contain an odd number of bits or a transmission error has been detected.

Even Parity is the same as odd parity except the total number of set bits in each byte is defined as even rather than odd.

Translate Lowercase Characters: <CTRL-I> (n) (T) <CR>

100 PRINT CHR$(9); "1T"

When receiving data the Apple converts lower case characters to upper case before passing them to the screen or a BASIC program. Characters coming into the Imager can be converted as you desire with this command. Conversion options are as follows:

<table>
<thead>
<tr>
<th>n</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Convert lowercase characters to uppercase. Default.</td>
</tr>
<tr>
<td>1</td>
<td>Do not convert incoming lowercase characters. Pass them along unchanged.</td>
</tr>
<tr>
<td>2</td>
<td>Show lowercase characters as reversed uppercase characters.</td>
</tr>
<tr>
<td>3</td>
<td>Send lowercase characters to programs unchanged. Send them to the screen as uppercase characters, and display uppercase characters as reversed.</td>
</tr>
</tbody>
</table>

Column Overflow Handling: <CTRL-I> (C) <CR>

100 PRINT CHR$(9); "C"

This command causes the Imager to send a <CR> character to the printer when the column count exceeds the printer line width.

>>>Note: Once this command is issued, the only way to turn it off is by clearing the 8th bit at location 8578 and $8 = slot.
Reset Imager: <CTRL-I> (R) <CR>

100 PRINT CHR$(9); "R"

This command will reset the Imager, having the same effect as pressing the RES/ED key on the Apple (but only effecting the Imager). The difference between this command and issuing a PRT0 and IN10 is that reset will re-establish the default configuration indicated by the DIP switches. This means that any changes in the configuration which have been made (such as the location of the left margin) will be lost when a system reset or reset command occurs, but not when PRT0 and IN10 are used.

Transparent Mode: <CTRL-I> (E) <CR>

100 PRINT CHR$(9); "E"

This command tells the Imager to ignore all subsequent control characters, and pass them along unaltered. Thus no further commands will be recognized by the Imager. This command is useful if the data being transmitted may contain desired control characters, which would normally be filtered out by the Imager.

NOTE: once you issue this command the only way to turn this option off is to clear the 8th bit at location $5F85.

Find Keyboard: <CTRL-I> (F) <SPACE> (E/D) <CR>

100 PRINT CHR$(9); "F"

This command is used to disable the Apple Keyboard in order to prevent possible keystrokes from disrupting incoming data. This command would be used in a program immediately preceding the inflow of data to disable (E) the keyboard, and again after the data has been received to enable (E) the keyboard.

Generate Linefeed with <CR>: <CTRL-I> (L) <SPACE> (E/D) <CR>

100 PRINT CHR$(9); "L D"

This command tells the Imager to send or not send a linefeed character after sending a carriage return to the printer. This command overrides the setting of SW2-5.

Mask Incoming Linefeeds: <CTRL-I> (M) <SPACE> (E/D) <CR>

100 PRINT CHR$(9); "M E"

This command enables/disables the removal of linefeed characters which are immediately preceded by carriage return characters in an incoming data stream.

Tab in BASIC: <CTRL-I> (T) <SPACE> (E/D) <CR>

100 PRINT CHR$(9); "T E"

This command enables/disables the use of the various tabbing and horizontal spacing functions used in BASIC. All tabs beyond column 40 still require a POKE to location 36.

Text Screen Dump: <CTRL-I> (S) <CR>

100 PRINT CHR$(9); "S"

This command will transfer a copy of the current text screen to the printer. On the Apple IIe the screen dump will be 40 or 80 columns wide, depending upon which mode the computer is in. If the left margin is set, 40 column screen dumps will be left justified at that position. 80 column screen dumps will start at the left edge of the paper.

XON/OFF detect: <CTRL-A> (X) <SPACE> (E/D) <CR>

100 PRINT CHR$(11); "X D"

Many devices use the decimal code "13" to tell other devices to wait. In this way, when the peripheral device (say a modem) is about to run out of buffer space for incoming characters, it can tell the Imager to halt transmission. When the peripheral device has processed the data, freeing buffer memory, it can tell the Imager to resume transmitting characters by sending it the code "17". Normally the Imager will recognize the XOFF and XON characters, (CHR$(19) and CHR$(17) respectively). You can tell the Imager not to recognize these codes by disabling ("D") XOFF recognition with this command.

High Bit Enable/Disable: <CTRL-A> (H) <SPACE> (E/D) <CR>

100 PRINT CHR$(11); "H E"

This command allows you to have a full 8 bit serial data port yet still control the "8th" or "high" bit of the transmitted byte. Enabling the 8th bit allows the Imager to pass along the full 8 bit byte it receives for transmission out the serial port. Disabling the 8th bit forces this bit to always be cleared before transmission out the serial port.

Apple Parallel Card Commands

In order to support compatibility with the Apple Parallel Card the next three commands have been included.

Video Echo Off & Set Line Length: <CTRL-I> (n) (N)

100 PRINT CHR$(9); "nN"
This command turns off output to the Apple video screen and sets the line length to 48. The line length will be used for automatic (CR) generation if enabled by the "Column Overflow" command listed above. The value for n must be between 40 and 255.

Video Echo On & Set Line Length to 48: <CTRL-I> (2)

100 PRINT CHR$(9); "I"

This command will turn on video echo to the Apple video screen and sets the line length value to 48.

Do not Generate Line Feed with <CR>: <CTRL-I> (K)

100 PRINT CHR$(9); "K"

This command turns off the generation of linefeed characters after carriage returns.

Imager GPI Mode Commands

The GPI (Graphics Printer Interface) Mode of the Imager is a special mode. Setting SW7-8 to the GPI position will cause the Imager to operate in this mode, and will make all other modes unavailable.

In the GPI Mode you will be able to transfer both text and graphics to your printer. Of course, printers not capable of bit image will not be able to print bi-res images.

The following table lists the commands available while in the GPI Mode, and a description of the commands is presented thereafter.

>>>Note: All commands listed must be preceded with the control character, which will always start as <CTRL-I> in the GPI Mode. The control character can be changed by first typing the current control character, and then the desired control character. For example:

<CTRL-I> <CTRL-W>

would change the control character from <CTRL-I> to <CTRL-W>.

Imager GPI Mode Commands

A Send <LF> with <CR>
K No <LF> with <CR>
F Print firmware version
H Pass MSB to printer
X Clear MSB from print stream
I Video Echo on
nN Video Echo off & set line length 40 - 255
nL Set left margin 0 - 255
nP Set page length 1 - 255
nS 48 column Text Screen Dump
2S Side by Side 48 column Text Screen Dump
3S Text VideoFormat #8 column Screen Dump
8S Apple //e 80 column Text Screen Dump
SV Chain Output to slot s 0 - 7
2 Transparent Mode
Q Quit 80 column Video

G options <CR> Graphics Dump

GI<CR> Inverse Image
GBCR<CR> Emphasize Image
GDCR<CR> Magnify Image x2
2<CR> Rotate Image
2S<CR> Select Page 2 Image
S<CR> Select Both Pages
M<CR> Mix Graphics & Text
L<CR> Left margin
L<CR> Low Resolution Graphics Dump
e<CR> Double Resolution Graphics Dump
C<CR> Overlay Screens
n2<CR> Zoom Graphics Size 2 - 3
n<CR> Horizontal Aspect Ratio n = 1 - 16
nV<CR> Vertical Aspect Ratio n = 1 - 8
nP<CR> Set Print Mode

Send <LF> with <CR>: <CTRL-I> (A)

100 PRINT CHR$(9); "A"

Append a linefeed to all carriage returns, i.e. whenever the Apple sends a <CR> character to the Imager, it will also send a <LF> character. This tells the printer to move the print head to the beginning of the line and to advance the paper 1 line.

No <LF> with <CR>: <CTRL-I> (K)

100 PRINT CHR$(9); "K"

This command cancels the automatic linefeed function of the Imager, whether established using the Imager "GPI switches" or GPI Mode command listed above.
Print Firmware Version number: <CTRL-I> (E)
100 PRINT CHR$(9); "F"

Print the version number of the firmware (i.e., ROM program code) contained in your Imager.

Pass MSB to Printer: <CTRL-I> (H)
100 PRINT CHR$(9); "H"

This command is the counterpart of the "Clear MSB from print stream" command, which is used to ensure that the high bit of each byte sent to the printer is clear. The "Pass MSB" command will send the high bit as is to the printer.

Clear MSB from print stream: <CTRL-I> (X)
100 PRINT CHR$(9); "X"

Issuing this command will tell the Imager that when the Apple sends it a byte the high bit is to be cleared before it is transmitted out the RS-232C port. This may occasionally be desirable for printers which use the MSB to indicate special functions. Consult your printer manual to see if the MSB is used for such a purpose (which is usually to change the character set).

Video Echo On: <CTRL-I> (I)
100 PRINT CHR$(9); "I"

The Imager will send a copy of all text it sends to the printer to the screen. This command will work in both 48 and 80 column mode on the Apple //e.

Video Echo Off & Set Line Length: <CTRL-I> (n) (N)
100 PRINT CHR$(9); "BnM"

Set the line length to n characters per line and turn video echo off.

Set Left Margin: <CTRL-I> (n) (L)
100 PRINT CHR$(9); "Lnl"

This command tells the Imager to move the print head to column n after a carriage return. The default left margin is column 0, and issuing this command with n equal to 0 effectively cancels this function.

Set Page Length: <CTRL-I> (n) (P)
100 PRINT CHR$(9); "6np"

This command tells the Imager how many lines of print it is to use on a single page. After the designated number of lines have been printed, the Imager will skip 6 lines. Most printers allow line spacing allows 66 lines on 11 inch tall paper, so using 60 as your value for n will nearly skip over the perforations (this process is called pagination). Issuing this command using 0 as your value for n will cancel pagination.

48 column Text Screen Dump: <CTRL-I> (S)
100 PRINT CHR$(9); "S"

This sends a copy of the current 48 column text screen to the printer. The 48 column dump will be centered if the left margin is disabled, or will start at the left margin if it has been set.

Side By Side 48 Column Text Dump: <CTRL-I> (2) (S)
100 PRINT CHR$(9); "2S"

This command will send a copy of two 48 column text screens to the printer. Text screen 1 is on the left and text screen 2 is on the right.

Videx VidesTerm 80 Column Screen Dump: <CTRL-I> (3) (S)
100 PRINT CHR$(9); "3S"

This command will send a copy of the Videx VideoTerm 80 column display in slot 3 to the printer.

Apple //e 80 Column Text DUMP: <CTRL-I> (8) (S)
100 PRINT CHR$(9); "8S"

This command is the same as the "48 column Text Screen Dump" listed above, except that an 80 column dump will be executed. This command only works with the Apple //e.

Chain Output to Slot 5: <CTRL-I> (4) (V)
100 PRINT CHR$(9); "4V"

This command tells the Imager to send a copy of its output to the peripheral in slot 5. Video echo to an 80 column board in slot 3 can be established with this command. A peripheral must be installed in the specified slot or the system will hang up.
Transparent Mode: <CTRL-I> (2)

100 PRINT CHR$(9); "Z"

This command will turn the Imager into a transparent output port. No commands will be recognised. The only action performed by the Imager once this command has been used will be to send data transfer data out the serial port without modification. The MSB command is still in effect under transparent mode, this allows for a transparent 7 bit or 8 bit serial port.

Quit 80 Column Video: <CTRL-I> (Q)

100 PRINT CHR$(9); "Q"

If an 80 column board was active when the Imager was turned on by a "PR$1" command, then the "Quit 80 column Video" command is used to exit the printing mode. This command is necessary because using the command "PR$0" will cause the Apple not only exit the printing mode but also to turn off the 80 column card in the wrong manner, which will crash the Apple operating system.

Graphics Commands

One of the more powerful features of the Graphics Printer Interface is the ability to transfer low and high resolution images from your Apple's memory to graphics capable printers. To instruct the Imager to perform a "Graphics Dump", the command "G" is issued, optionally followed by any combination of graphics options.

Graphics Dump: <CTRL-I> (G) (options) <CR>

100 PRINT CHR$(9); "G"

Print Apple graphics screen command. When the "G" command is used alone it will send the Apple's high resolution screen, page 1, centered, regular size, black on white (invert-reversed). Sending valid option characters between the "G" and the <CR> will modify the output as described below. Any non-valid character used as an option will terminate the command without action.

Inverse Image: <CTRL-I> (G) (I) <CR>

100 PRINT CHR$(9); "GI"

Normally, the "G" command results in black dots being printed on the screen for corresponding white dots on the screen. This command will tell the Imager to reverse the image, resulting in a white on black printout.

Emphasize Image: <CTRL-I> (G) (E) <CR>

100 PRINT CHR$(9); "GE"

This command will result in denser (darker) image being printed. Some printers do not support this command.

Magnify Image X 2: <CTRL-I> (G) (D) <CR>

100 PRINT CHR$(9); "GD"

This causes the Imager to print an image which is twice as high and twice as wide as normal (渎(trace size). Some printers are not sufficiently wide to perform this function without also rotating the image with the "A" option described below.

Rotate Image: <CTRL-I> (G) (M) <CR>

100 PRINT CHR$(9); "GM"

This command will rotate the image to be printed 90 degrees, turning the printout sideways.

Select Page 2 Image: <CTRL-I> (G) (2) <CR>

100 PRINT CHR$(9); "G2"

This option chooses high resolution page 2 instead of page 1.

Select Both Pages: <CTRL-I> (G) (E) <CR>

100 PRINT CHR$(9); "GE"

This command will print high resolution page 1 and 2, side by side. The "H" option may be needed on some printers to allow sufficient width for both pages.

Mix Graphics and Text: <CTRL-I> (G) (M) <CR>

100 PRINT CHR$(9); "GM"

This option prints the high resolution screen, but leaves 4 lines for text at the bottom of the page. The text characters on the bottom 4 lines of the screen will be printed at the bottom of the printout.

Left Margin: <CTRL-I> (G) (L) <CR>

100 PRINT CHR$(9); "GL"

This option forces the printed image to be left justified against the left margin as set during text mode. If this option is not used the printed image will be centered.
Low Resolution Graphics Dump: 100 PRINT CHR$(9); "GR"
This option will select the Apple low resolution graphics screen for printing.

Double Resolution Graphics: 100 PRINT CHR$(9); "Ge"
This option selects the double resolution graphics mode available on the Apple //e for printing. This capability requires an Apple //e with 128K of system RAM, a revision B motherboard, and a jumper installed on the 80 column board.

Overlay Graphics Screens: 100 PRINT CHR$(9); "Go"
This option causes the images contained in the Apple's "page 1" and "page 2" of graphics memory to be printed one on top of the other. Thus a background could be placed on one page, and foreground subjects could be easily printed against that background by using this option.

Zoom Graphics Size: 100 PRINT CHR$(9); "G42"
This option expands the size of the graphics image sent to the printer. The BASIC example listed would cause the printout to be four times as high and four times as wide as normal. Sending a value of "2" would duplicate the function of the "D" option listed above. If the graphics printout is wider than the printer can handle, the right edge of the printout will be chopped off.

Horizontal Aspect Ratio: 100 PRINT CHR$(9); "GM"
This option allows you to control the width of your graphics printout. The BASIC example listed would print an image which is normal height, but 4 times wider than normal.

Vertical Aspect Ratio: 100 PRINT CHR$(9); "GSV"
This option allows you to control the height of your graphics printout. The BASIC example listed would print an image which is normal width, but 5 times taller than normal.

Set Print Mode: 100 PRINT CHR$(9); "G2P"
This option allows you to select different print modes that your printer allows. The range for n depends on how many print modes your printer supports.

Any or all of the above options can be used together, and order is not important. For example, to print an image that is inverse, rotated, double size and emphasized, the following command would be used.

Chart Recorder Mode
In order to emulate a chart recorder a method has been provided to allow several pages of continuous graphics printouts without any intervening spaces or blank lines. This is accomplished by sending more than one graphics command without printing anything else or sending any other commands. For example, let's say your program produces a bar chart which is four graphics pages wide. Your program creates and saves the high resolution screen on the disk drive as SCREEN1, SCREEN2, SCREEN3, and SCREEN4. The following example will produce a continuous printout of these four charts.

10 D8 = CHR$(4): REM DOG COMMAND <CTRL-D>
110 PRINT D8; "BLOAD SCREEN1,A$2000"
115 PRINT D8; "BLOAD SCREEN2,A$4000"
120 PRINT D8; "PR1"
130 PRINT CHR$(9); "GR"
140 PRINT CHR$(9); "GR2"
150 PRINT D8; "BLOAD SCREEN3,A$2000"
160 PRINT D8; "BLOAD SCREEN4,A$4000"
170 PRINT CHR$(9); "GR"
180 PRINT CHR$(9); "GR2"
Technical Information

The information contained in this section is highly technical and is intended for the advanced Apple user. All address values are given in hexadecimal and some technical jargon is used. Proceed at your discretion.

This chapter will describe the Imager's firmware entry points, peripheral card I/O space, and DB-25 pinouts.

Firmware Entry Points

SCn0$: I/O Initialization
SCn06$: Subsequent Input
SCn07$: Subsequent Output

All calls using these vectors should be made using the CSW and KSW zero page vectors. All registers are preserved after these calls except the A register on input, which of course will contain the fetched character from the serial port.

The Imager also supports the Firmware Protocol. The firmware supports the standard generic signature byte, device signature byte and offsets for initialization, read, write and status.

Peripheral Card I/O Space

The Imager contains a 6551 ACIA and two DIP switch registers in the I/O space which is located from SC00H+00 to C00F+00 for each slot. A table below charts this usage.

Address Register

| SC001+00 | DIP Switch 1 |
| SC002+00 | DIP Switch 2 |
| SC004+00 | 6551 ACIA Transmit (Write) |
| SC005+00 | 6551 ACIA Transmit (Read) |
| SC006+00 | 6551 ACIA Status |
| SC007+00 | 6551 ACIA Command |
| SC008+00 | 6551 ACIA Control |

Connector Pinouts

The Imager supports two different connector pinouts dependent upon the internal cable being attached to the PRINTER header or the MODEM header. The tables below will map these pinouts.

MODEM Pinout

<table>
<thead>
<tr>
<th>DB-25$ Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 FG: Frame Ground</td>
</tr>
<tr>
<td>2 TxD: Transmit Data (Output)</td>
</tr>
<tr>
<td>3 RxD: Receive Data (Input)</td>
</tr>
<tr>
<td>4 RTS: Request To Send (Output)</td>
</tr>
<tr>
<td>5 CTS: Clear To Send (Input)</td>
</tr>
<tr>
<td>6 DSR: Data Set Ready (Input)</td>
</tr>
<tr>
<td>7 SG: Signal Ground</td>
</tr>
<tr>
<td>8 DCD: Data Carrier Detect (Input)</td>
</tr>
<tr>
<td>11 SCTS: Secondary Clear To Send (Input)</td>
</tr>
<tr>
<td>12 HLS: High/Low Speed (Input)</td>
</tr>
<tr>
<td>19 JCTS: Jumped Clear To Send (Input)</td>
</tr>
<tr>
<td>20 DTR: Data Terminal Ready (Output)</td>
</tr>
<tr>
<td>22 R1: Ring Indicator (Input)</td>
</tr>
</tbody>
</table>

PRINTER Pinout

<table>
<thead>
<tr>
<th>DB-25$ Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 FG: Frame Ground</td>
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</tr>
<tr>
<td>5 RTS: Request To Send (Output)</td>
</tr>
<tr>
<td>6 DTR: Data Terminal Ready (Output)</td>
</tr>
<tr>
<td>7 SG: Signal Ground</td>
</tr>
<tr>
<td>8 DCD: Data Carrier (Output)</td>
</tr>
<tr>
<td>11 SCTS: Secondary Clear To Send (Input)</td>
</tr>
<tr>
<td>12 A11: Auxiliary Input 1 (Input)</td>
</tr>
<tr>
<td>19 JCTS: Jumped Clear To Send (Input)</td>
</tr>
<tr>
<td>20 DSR: Data Set Ready (Input)</td>
</tr>
<tr>
<td>22 A12: Auxiliary Input 2 (Input)</td>
</tr>
</tbody>
</table>

The Imager will sense a busy signal on any of its main handshaking lines. These lines are CTS (pin 4), DTR (pin 20), SCTS (pin 11) and JCTS (pin 19 default). If your device does not connect to one of these lines the Imager ignores that line. A straight cable will work with the handshaking system of almost any device.

The JCTS (Jumped Clear To Send) line can be moved from its default position of pin 19 and moved to any other unassigned DB-25 pin position. This is done by moving the mini jumper along the strip of lettered positions located at the top right corner of the Imager circuit board. The table below matches the lettered positions with its corresponding DB-25 pin number.

<table>
<thead>
<tr>
<th>Letter</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
</tr>
<tr>
<td>D</td>
<td>14</td>
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<tr>
<td>E</td>
<td>15</td>
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<tr>
<td>F</td>
<td>16</td>
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<tr>
<td>G</td>
<td>17</td>
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<tr>
<td>H</td>
<td>18</td>
</tr>
<tr>
<td>I</td>
<td>19</td>
</tr>
<tr>
<td>J</td>
<td>21</td>
</tr>
<tr>
<td>K</td>
<td>23</td>
</tr>
<tr>
<td>L</td>
<td>24</td>
</tr>
<tr>
<td>M</td>
<td>25</td>
</tr>
</tbody>
</table>
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In the event of failure the remedy will be repair or replacement of the product at no charge to the original purchaser. This warranty does not apply if the product has been damaged by accident, abuse, misuse or misapplication or has been modified in any way. This warranty does not extend to any other products used in conjunction with this product and is limited to the repair or replacement of the product.

To obtain warranty service obtain a return authorization number from the Apricorn Service Department. Securely package the product along with the above number, customer phone number and mailing address, bill of sale as proof of original retail purchase as well as a description of the problem. Return the product postage prepaid and insured to:

APRICORN
10670 TREENA STREET
SUITE 10
SAN DIEGO, CA 92131

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