PC8800

ISC 8001 and Intecolor 3800/8800
Terminal Emulator

User's Manual

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Copyright Notice

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Preface
About PC8800

PC8800 is a software emulator of ISC 8001 and Intecolor 8800 and 3800 series color graphics terminals that runs on PCs. PC8800 supports all the functions found in the standard versions of the original 8001, 3800 and 8800 series terminals.

Intecolor supplied a number of custom versions of these terminals to OEMs for use in their control systems. In some cases, the terminals were merely fitted with custom character sets. In other cases, the terminals were fitted with custom kernel firmware to provide special functions required by OEMs.

PC8800 is designed to handle custom character sets quite easily. Several custom character sets are distributed with the emulator, and can be used as replacements for or additions to the standard character sets. Other custom character sets can be created by the user as needed with a font editing utility that is distributed with PC8800.

Custom versions of PC8800 are available to replace original terminals that were fitted with certain custom kernel firmware versions. These versions are listed below. If you have a terminal with custom firmware that is not on the list, you can contact Mirador Software to discuss having Mirador create a custom version of the emulator for you.

Features of PC8800

Support for host communications:

- Serial port is selectable (COM1 through COM4)
- Baud rates to 38,400
- Selectable hardware (DTR/CTS) or software (^S/^Q or ^F/^G) flow control
- Data analysis (Line Monitor) mode

Support for text and character graphics displays:

- 80 column x 48 line displays rendered on monitor with 640x480 resolution
- Each character is rendered in an 8x10 pixel matrix
- Four text mode display pages, stored independently of graphics pages
- Double height and blink attributes
- Block, underscore and box cursors
- Lower Case, Process, Forms and Custom character sets
- Protected Fields
- 8001G plot graphics (160x192 addressable pixels)

Support for dot-addressable graphics displays:

- Complete 8001R command set
- Fill patterns and super-pixels
- Terminal coordinate space (480x384 pixels) scaled to VGA resolution

- Four graphics pages, stored independently of text pages

Support for 8001 and 8800 V1 Fastscreen functions:

- Text mode screens can be saved locally for fast recall
- INI, DEV, SAV, LOA, DEL commands
- Local storage devices RX0 and RX1 are implemented in RAMDISK or hard disk

Support for keyboards:

- AT keyboard keys mapped to 8001 keyboard codes
- Multi-level programmable function keys (up to 40 characters per level per key)

Support for locator devices:

- Follows 8800 terminal locator system conventions
- Arrow keys
- Microsoft compatible mouse or trackball at auxiliary serial port
- IR touch screen at auxiliary serial port

Support for printers

- Follows 8800 terminal print system conventions
- Parallel or serial printer at selectable port
- Print buffering is built-in (no need for an external buffer box)
- Support for Epson FX-86 compatible dot matrix B/W printer, landscape or portrait mode
- Support for Hewlett-Packard Paintjet and Deskjet color ink jet printers, landscape or portrait mode

Support for 8800 style Setup Menus

- Host communications menu
- Operator preferences menu
- Printer menu
- Keyboard menu
- Locator menu

Terminal Models that are Replaceable by PC8800

Basic 48 Line Terminal	48 Line Terminal with Character Graphics	48 Line Terminal with Dot Addressable Graphics	Package Style
B08001, B84819	B8001G	B8001R	20" Benchtop (1st Generation)
E08001	E8001G	E8001R	20" Benchtop (2nd Generation)
F08001	F8001G	F8001R	20" Benchtop (3rd Generation)
	R08810	R08820	20" Benchtop (4th Generation)
	R08814	R08824	20" Open Chassis (5th Generation)
	R08815	R08825	20" Desktop (5th Generation)
	R08816	R08826	20" Benchtop (5th Generation)
	R08865	R08875	20" Rackmount (5th Generation)
	T03810	T03820	14" Desktop (4th Generation)
	T03815	T03825	14" Desktop (5th Generation)
	T03860		14" Rackmount (4th Generation)
	T03865	T03875	14" Rackmount (5th Generation)

Custom Versions of PC8800 Currently Available

Custom versions of PC8800 are available that provide replacement solutions for terminals equipped with the following Intecolor custom firmware releases:

Firmware Version	OEM
CSR 978000-228	MCC Powers
CSR 978000-276E	Dow Chemical
CSR 978000-361A	Dow Chemical
CSR 978000-334B	Mannesman Demag
(no number)	Florida Power and Light
(no number)	Carolina Power and Light

If you need one of these custom versions, or a version that does not appear on this list, please contact Mirador Software.

Chapter 1
Installation and Startup

System Requirements

Operating System

The emulator was developed to run on any x86 based PC running DOS V3.3 or above. It has been tested on DOS 3.3, 4.01, 5.0, 6.0, and 6.2, on OS/2 Release 1.3 & 2.0, on DOS based operating environments such as Quarterdeck's DESQview 386 and Microsoft Windows 3.1, and on Microsoft Windows 95 and Windows 98 DOS compatibility modes. PC8800 currently does not run on Windows NT, Windows 2000, Windows XP or Unix platforms.

Hardware

CPU	80386 or above
RAM	Consistent with operating system requirements. 512KB is enough when running DOS. (When it loads, the emulator allocates of all available memory below the 640KB boundary as Pixel Graphics data buffers.
Serial Port(s)	One serial port for host communications, additional serial ports as required for locator device or serial printer
Parallel Port	One parallel port must be available for attachment of a software protection key. The key does not prevent the port from being used for a printer.
Video Card	IBM VGA compatible. The emulator uses VGA 640x480 graphics mode.
Floppy drive	One 1.44MB 3.5-inch floppy drive is needed for loading the software.
Hard drive	The emulator files occupy about 1MB of disk space. If a printer is to be used, an additional 2-5MB of space should be available for print spooling to temporary files. If the emulator's Fastscreen mode is to be used, additional space should be available for local storage of screen data.
Keyboard	AT Style 101-key keyboard

About The Distribution Disk and License Key

The contents of the distribution diskette are not encrypted or otherwise copy protected, and they may be copied to other media for archive purposes. However, copying for other than archive purposes, or transmission over a public network is prohibited under the license agreement.

The emulator uses a hardware key for license control. The hardware key must be installed on the PC's parallel port to enable the emulation software to function. The key does not interfere with the use of a printer or other parallel device attached to the same port.

Installing the Emulator

An installation script (INSTALL.BAT) is provided on the emulator distribution disk. This program copies all necessary files to a designated directory on one of the target machine's hard disks and optionally performs configuration for a typical hardware setup.

The installation script places the files that are required to run the emulator, along with certain other files, including demonstration screens and extra fonts, in their own directory tree at the place you designate. Since the installation script gives you the flexibility to locate the emulator's directory tree where you want it, and since all the files it installs take up only about 1MB of disk space, it is recommended for use in all but the most extreme cases.

Copying individual files from the distribution diskette to the target medium is, of course, possible, but this method is indicated only when the target medium is a RAM disk, flash drive, or the like, with very limited capacity. The files that must be installed include:

```
pc8800.exe
comdrvr.bin
lpt1drvr.bin
```

Configuration involves making some changes to the DOS startup files CONFIG.SYS and AUTOEXEC.BAT. Lines must be added to the CONFIG.SYS file to tell the operating system to load device drivers for the serial and parallel ports. (These drivers are included among the emulator files on the distribution diskette.) Lines must be added to the AUTOEXEC.BAT file to set certain environment variables that the emulator uses to find fonts, setup data, and the like, and to add the directory in which the emulator's executable file resides to the system path.

It is recommended that you let the installation script do the initial modification of these system files for you. You can then examine these files to determine if any changes or additions need to be made to accommodate your particular hardware setup. In most cases, the configuration performed by the installation script will provide a basic working installation.

Using INSTALL.BAT To Install The Emulator

1) Boot the target machine and place the emulator distribution diskette into the target computer's floppy disk drive.

2) At the DOS prompt, run INSTALL.BAT by typing the following command:

```
>source_drive:\install target_drive: <CR>
```

where *source_drive* is the letter for the drive in which the installation diskette is installed, and *target_drive* is the hard disk drive on which the emulator is to be installed. For example:

```
>a:\install c: <CR>
```

3) You will be given the option to review the license agreement. Make the desired selection.

4) You will be prompted to specify a directory on the target drive for the installation of the emulator files. If no directory is specified, the install will default to the root directory of the target driver. Make the desired selection.

5) After the emulator files have been copied to the target drive and directory, you will be prompted to specify whether the install program should modify your system configuration files CONFIG.SYS and AUTOEXEC.BAT. If you are installing on a system that is running Windows 95 or Windows 98, you can say "no" here and perform configuration for these platforms following the instructions given below.

6) If you selected "yes" in the previous step, you will be prompted to specify whether you want to review the changes made to the system configuration files. Note that when INSTALL.BAT makes changes it saves backups of the original files. You will be prompted to accept the changes or have the original files restored.

If you selected "no" in the previous step, you will be prompted to specify whether you want to review the README.TXT file, which contains updates to the information in this manual. If you selected "no", see the next sections of this chapter about modifying these files.

Modifying the AUTOEXEC.BAT File (DOS and Windows 3.x)

The install script can make the changes in AUTOEXEC.BAT that are necessary to add the path to the PC8800 executable to the system path and set environment variables needed by the executable to find auxiliary files, including the setup data file and font files.

If the install script is not used to make these changes, or if the default settings it provides are not appropriate for your system, you can use the DOS EDIT program or any other text editor of your choosing to add the following statements to AUTOEXEC.BAT:

```
SET PATH=path_to_pc8800_exe;%PATH%
SET PC8800=path_to_pc8800_exe
```

The following additional statements must be added to AUTOEXEC.BAT if you are planning to use the emulator's Fastscreen capabilities:

```
SET RX0:=path_to_first_fastscreen_store
SET RX1:=path_to_second_fastscreen_store
```

Modifying the CONFIG.SYS File (DOS and Windows 3.x)

The install script can configure your system to allow the emulator to use serial ports COM1 (at I/O address 03F8h, with IRQ4) and COM2 (at I/O address 02F8h, with IRQ3), and parallel port LPT1 (at an I/O address determined by the system BIOS). If you want the emulator to use additional serial ports or parallel ports, or if the ports on your machine are at non-standard I/O addresses, or use non-standard IRQ lines, you will have to make changes to your CONFIG.SYS file using DOS EDIT or another text editor.

An instance of the emulator's serial port device driver COMDRVR.BIN, must be loaded at boot time for each serial port that is to be accessed by the emulator. A DEVICE statement in the CONFIG.SYS file that references COMDRVR.BIN tells the system to load an instance of the driver.

COMDRVR.BIN takes command line arguments that tell it how to attach itself to a given port at load time.

The syntax of the DEVICE statement is:

```
DEVICE[HIGH]=path_to_driver\COMDRVR.BIN/COM=com/ADDR=addr/IRQ
=irq/RXQ=rxq_len/TXQ=txq_len/RTC=rtc_flag
```

Where:

path_to_driver	A string representing the drive and directory where COMDRVR.BIN resides.
com	a numeric character representing the COM port number, in decimal.
addr	four alphanumeric characters representing the COM port base address, in hexadecimal. (Pad to four characters using leading '0's when necessary.)
irq	one or two numeric characters representing the number of the IRQ line (hardware interrupt) associated with the COM port, in decimal.

rxq_len	four numeric characters representing the desired number of bytes for the receive buffer to be associated with the COM port, in decimal. (Pad to four characters with leading '0's as necessary. '4096' is usually a good value.)
txq_len	four numeric characters representing the desired number of bytes for the transmit buffer to be associated with the COM port, in decimal. (Pad to four characters with leading '0's as necessary. '0256' is usually a good value.)
rtc_flag	(Use only with V3.0 driver.) One numeric character, either '1' indicating that the driver should hook to the real time clock, or '0' indicating that the driver should not hook to the real time clock. Use '0' unless there is a specific requirement for paced transmit capability. When the driver is hooked to the RTC, paced transmit can be selected by setting 'Function Key Rate' in the Keyboard Setup Menu to 'Slow'.

An instance of the emulator's parallel port device driver LPTxDRVR.BIN, must be loaded at boot time for each parallel port that is to be accessed by the emulator. A DEVICE statement in the CONFIG.SYS file that references LPTxDRVR.BIN tells the system to load an instance of the driver.

The syntax of the DEVICE statement is:

```
DEVICE[HIGH]=path_to_driver\LPTxDRVR.BIN
```

where x is 1 for parallel port LPT1, 2 for LPT2, or 3 for LPT3.

Some additional statements in CONFIG.SYS might have to be added or changed according to the following recommendations.

STACKS should be set to 10,128 or greater. Some operating systems such as Quarterdeck's DESQview 386 ask that stacks be set to 0,0 since they allocate stack space within the operating system. We recommend setting stacks if these types of operating systems are not being used.

BUFFERS may be omitted if using the SMARTDRV.SYS device driver for caching hard disks. Buffers are only required to buffer data from the hard disk when other caching drivers are not being used.

FILES should be at least 10, but most other PC applications require higher values (especially database programs).

Configuration for Windows 95 or Windows 98 Systems

PC8800 is a DOS program and runs best on DOS (V3.3 or later). However, if properly installed, it can be run successfully on Windows 95 or Windows 98, since these operating systems still have DOS mode support. (Currently, PC8800 will not work on Windows NT, 2000 or XP.)

To install on a Windows 95/98 machine, do the following.

1. Run the install script on the PC8800 installation disk in the normal manner. This will set up a PC8800 directory tree on the target drive and copy the necessary files to the correct directories.

2. Use Windows Explorer to locate the file "pc8800.exe" (normally found in the c:\pc8800\bin directory). Using the mouse, right click on the file. You will get a menu of options. Choose "Create Shortcut". A Windows shortcut will be created in the c:\pc8800\bin directory.

3. Use Windows Explorer to move the shortcut to the c:\Windows\Desktop directory (or wherever you want it.)

4. When the shortcut has been placed in the proper directory, right click on it and select "Properties". You will get a "Properties" window that contains several dialog boxes, each with a labeled tab.

5. Click on the "Program" tab to get the Program dialog box. The top dialog line should contain "PC8800" or whatever you want to call the shortcut. The "Cmd line" should read

```
"c:\pc8800\bin\pc8800.exe [switches]"
```

where [switches] are any optional command line switches you want to use. (See the section of this chapter on starting the emulator.)

The "Working" line should read:

```
"c:\pc8800\bin"
```

6. After setting up these fields, click the "Advanced" button. You will get another dialog box.

7. Click the box next to "MS-DOS mode" to select this mode for running the program.

8. Click the box next to "Specify a new MS-DOS configuration".

9. Enter the following lines in the CONFIG.SYS for MS-DOS mode box:

```
DOS=HIGH, UMB
Device=c:\windows\himem.sys
Device=c:\pc8800\bin\comdrvr.bin/com=1/addr=03f8/irq=4
     /rxq=8192/txq=0256
Device=c:\pc8800\bin\comdrvr.bin ...(as required)
Device=c:\pc8800\bin\lpt1drvr.bin
```

10. Next, enter the following lines in the AUTOEXEC.BAT for MS-DOS mode box:

```
set tmp=c:\windows\tmp (or whatever)
set winbootdir=c:\windows
set path=c:\pc8800\bin;%path%
set PC8800=c:\pc8800\bin
set RX0:=c:\pc8800\rx0
set RX1:=c:\pc8800\rx1
```

11. Click OK and save the configuration for the program.

12. If you wish, click the "Close on exit" box in the "Program" dialog to cause DOS mode to exit after the PC8800 exits from DOS mode.

13. Click OK again to save all the shortcut properties settings.

14. Now you are ready to test the setup by clicking on the newly configured shortcut to invoke PC8800. Note that the system will restart in DOS mode. Likewise, the system will restart after the PC8800 session, so that Windows 95/98 can be re-entered. (This is an unavoidable requirement for running a DOS program like this on Windows 95/98.)

Installing the APPLICATION/licensing key

Install the licensing key provided on the **LPT1** parallel printer port.

If a parallel printer is to be used at LPT1, install the key on the LPT1 port first, then attach the printer cable to the key. The key is a "pass-through" device and will not interfere with printing operations.

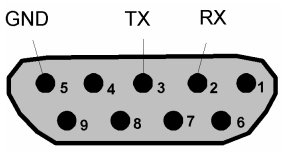
Note: The male end of the licensing key (marked COMPUTER) must be connected to the LPT1 port. The key will not operate correctly if connected backwards through a gender changer.

Connecting to the Host

To complete installation, it is necessary to connect the host computer to the PC that will be running the emulator. The connection will be made by way of a cable between one of the host's serial ports and one of the PC's COM ports. Normally, RS-232 signaling will be used; however, current loops are used sometimes instead of RS-232.

The cable to the host will often be pre-existent and will terminate at an old style DB-25 connector. Since most PCs are nowadays equipped only with DB-9 connectors, it will be necessary in such cases either to use a DB-25 to DB-9 adapter, or to replace the existing DB-25 connector with a DB-9 that will mate with the PC's COM connector.

A typical wiring arrangement for RS-232 signaling, using DTR/CTS hardware flow control, is shown in the following table. Note that if DTR/CTS flow control is not going to be used, it is not necessary to connect the DTR and CTS lines. In that case, only TXD, RXD and SG must be connected.



PC COM Port DB-9 Pins		**Host Serial Port DB-25 Pins**	**Host Serial Port DB-9 Pins**
(DCD) 1			
(RXD) 2	←	2 (TXD)	3 (TXD)
(TXD) 3	→	3 (RXD)	2 (RXD)
(DTR) 4	→	5 (CTS)	8 (CTS)
(SG) 5	—	7 (SG)	5 (SG)
(DSR) 6			
(RTS) 7			
(CTS) 8	←	20 (DTR)	4 (DTR)
(RI) 9			

If current loop signaling is being used, it will be necessary to obtain a serial port to current loop adapter for the PC. Such adapters are readily available off-the-shelf. Follow the manufacturer's instructions for connection.

On many PC/AT computers the physical spacing and orientation of I/O ports can lead to a problem when connecting data cables and software keys. Most of these systems have port connectors situated in very close proximity to each other. If a DB-9 to DB-25 adapter is used on a COM port, it can easily interfere with the installation of the software key on the LPT1 port.

In these cases, you may choose to use a DB-9 pin cable to your host COM port (not requiring the DB-9 to DB-25 adapter) or use a short male to female DB-25 pin cable on the LPT1 port. This cable may be up to 10 feet long but must have all wires required for parallel printer communications. These cables are available at most computer stores. When using the extender cable, connect the DB-25 male cable-end into the LPT1 port, and connect the DB-25 female-end of the cable to the male-end of the software key. This will leave the female-end of the key available to connect standard parallel printer cables.

Starting the Emulator

After installing the emulator, reboot the computer by pressing **Ctrl + Alt + Del** on the keyboard or pressing the computer's reset button.

As the computer boots, you should see messages relating to the loading of the serial and parallel port device drivers. If a message such as the one given here appears, you will need to recheck CONFIG.SYS and make any changes necessary.

```
COMx device driver not installed -- no hardware.
```

Assuming that the directory containing the emulator's executable file has been added to the system PATH, you can invoke the emulator by issuing the following command at the DOS prompt:

```
>PC8800 <CR>
```

If the licensing key is missing when the emulator is started, an error message will appear on the display:

```
Unable to start emulator. Missing or faulty hardware key.
```

Note that if the key is removed while the emulator is running, the emulator will not be able to operate properly.

User Specified RUN-TIME Switches

The emulator may be invoked without any command line switches, as described above:

```
>PC8800
```

However, several optional command line switches are available for use in special circumstances. These switches may be added to the command line in any order. They are not case sensitive. Each switch must be preceded by the DOS switch character (normally '/').

```
>PC8800 /switch ...
```

Switch	Usage
/NOBLINK	Use the /NOBLINK switch to disable the blinking of characters and cursors. /NOBLINK may be useful with third-party screen capture programs.
/INT9KEYS	Use the /INT9KEYS switch to enable the installation of a special keyboard handler (INT 9) for use with the emulator in place of the standard BIOS handler. This special keyboard handler allows the PC keyboard to reproduce the functionality of the original terminal keyboard with greater precision than is possible using the standard BIOS handler. However, successful use of this switch is dependent on individual BIOSs and is not possible in all cases.
/STRICTG	Use /STRICTG to force the emulator to interpret the data stream from the host computer exactly like an ISC 8001 terminal would interpret it. When this switch is not used, the emulator behaves like an Intecolor 8800 series terminal. The difference is the way control sequences beginning with the <ESC> character are handled. The 8001 ignores the three highest order bits of the character immediately following an <ESC> in the data stream. Thus, it interprets a the string "<ESC>[" as equivalent to the string "<ESC><ESC>", to use an especially significant example. The 8800 series terminals behave somewhat differently. They do not ignore the high order bits of the character immediately following an <ESC>. Thus, they can distinguish the string "<ESC><ESC>", which is used, for example to exit blind cursor mode, from the string "<ESC>[", which, in the 8800 series units is the introducer of a command set extension in accordance with ANSI X3.64. /STRICTG should always be used when the emulator is installed in a Jagenberg system.
/NOBELL	Use /NOBELL to disable the sounding of a tone in response to the ASCII <BEL> code. This switch is useful in case the host software uses <BEL> codes instead of <NUL>s as padding characters in the data stream, and the update of the display is slowed to an unacceptable rate on that account. There is a 100 millisecond processing delay associated with the sounding of a tone in response to a single <BEL> code. If many <BEL> codes are encountered, the associated delays can become quite long.
/65550	Use the /65550 switch to enable a workaround for a bug in the 65550 video controller chip. This chip has a bug in its attribute mode controller that results in the loss of color information in certain circumstances. If the emulator's display appears to be faulty (colors missing at the left edges of characters), check your video card documentation to determine if the 65550 chip is being used on the card. If it is, use of this switch should solve the problem.

Switch	Usage
/DEMO	This switch enables the emulator to respond to a command to display of a series of demonstration screens. When the emulator has been started using this switch, and the emulator is placed in Local Mode, it will respond to the command '<ESC>[D', entered at the keyboard, by displaying a series of demo screens. Note the demo makes use of Fastscreen Mode and utilizes Fastscreen files stored in the directory \pc8800\rx0 following a normal install. Note also that this switch has no effect when the /STRICTG switch is used.
/H	This switch causes the emulator to print a command line help message and then exit.

The Initialized State

At start-up, the emulator checks the path associated with the PC8800 environment variable (usually the BIN directory, where the executable is located) for any font files it needs to load. (See the section of the manual for details.)

The emulator also checks the path associated with the PC8800 environment variable for a file named 88SETUP.DAT. If the file exists, the emulator will use its contents to initialize itself and will then present a header message on the display.

If 88SETUP.DAT does not exist, a setup menu will appear allowing the user to set operating parameters. Once setup menu parameters have been set and saved, the file 88SETUP.DAT will be created, and settings will be available for subsequent use. When the operator then exits the setup menu system, the emulator will initialize itself normally.

At start-up, the emulator assumes the states specified by the operator's setup and also the following states:

- Visible Cursor set to Home position (top-left corner of screen).
- Visible Cursor foreground color set to White.
- Visible Cursor background color set to Black.
- Visible Cursor set to single height (1X) characters.
- Character Plot Mode set Off).
- Visible cursor writes left to right.
- Blind Cursor foreground color set to Red.
- Blind Cursor background color set to Black.
- Blind Cursor set to single-height (1X) characters.
- Blind Cursor Character Plot Mode set Off.
- Blind Cursor set to Home position (top-left corner of screen).

- Character Graphics page set to 1st page.
- Pixel Graphics page set to 1st page.

The initial display, in normal height characters, is:

```
PC8800 EMULATOR Vx.xx            PRESS ALT + ESC FOR SETUP MENU
```

where " Vx.xx" will vary depending on the version of the emulator software.

The emulator is now ready to accept commands from the keyboard and/or from a host computer connected to a serial port (COM1, COM2, etc.). It takes input from one or both of these sources, depending on selections made in Setup, which is described in a following chapter.

Chapter 2
Using the Keyboard

The PC/AT 101-key keyboard that is typically used with the emulator differs in physical appearance and key layout from the original terminal keyboard. (See Appendix B for layouts.) However, most of the keys on the original terminal keyboard have direct equivalents on the PC keyboard, and where direct equivalents are not available, indirect equivalents are. Thus, all the functions of the original keyboard can be reproduced using the PC keyboard.

Modifier Keys

The Shift, Ctrl and Alt modifier keys on the PC keyboard are set up to emulate the SHIFT, CONTROL and COMMAND keys of the 8001/8800 keyboard.

When the emulator accesses the PC keyboard through the standard BIOS interface (the default situation), the BIOS controls the way the modifier keys affect other keys. For most keys, including main keypad keys, there are four possible states, depending on the use of the modifier keys with those keys. However, other keys are not allowed to have four states. The situation is different respecting the original terminal, which provides four states for every key on the keyboard. Thus, the PC BIOS imposes a something of a limitation on the emulator.

To get around this limitation, the emulator is provided with a command line switch (/INT9KEYS), which tells it to load its own keyboard interface when it starts. This interface provides four levels of mapping for all keys. (See the chapter on Configuration and Startup for details.)

Note: When the /INT9KEYS switch is not used with the emulator, it is still possible to generate all codes necessary from the PC keyboard.

The four key states determined by the modifier keys are: NORM, SHIFT, CONTROL, and CONTROL+SHIFT or ALT, which corresponds to COMMAND on the 8001/8800 keyboard. CAPS LOCK works like ALPHA LOCK on the 8800.

Shift	There are two Shift keys. One of these must be held down while the selected alphanumeric key is operated to produced a shifted state.
Caps Lock	This key affects only the alpha keys A through Z. When invoked (LED On) operation of the alpha keys results in upper case characters. When Off, operation of the alpha keys results in special characters or in lower case ASCII characters, depending upon the character set selected. Using the Shift key with the Caps Lock key invoked negates the effect of the Caps Lock key. Operation of the Shift key does not

	change the status of the Caps Lock key.
Ctrl	This key must be held down while operating the selected alpha, symbol or numeric key to generate a desired control code.
Alt	This key generates codes requiring the operation of both the Ctrl key and Shift key in combination with another key. Pressing the Alt key yields the same result as pressing both the Ctrl and Shift keys at the same time.

Main Keypad

Note that positions differ on the PC and on the 8001/8800 keyboards for the following characters:

" 2 & 6 ' 7 (8) 9 0 = - _ ^ ~ ` @ ; + : *

However, the codes generated by the keys are the same for corresponding legends, observing differences in modifier states. This is true for all four levels.

There is no main pad DEL on the PC. The PC has a backspace key not found on the 8800. PC SHFT-BS = DEL.

There is no repeat key on the PC. The PC has an auto-repeat capability which makes this key unnecessary.

The following 8800 main pad keys are not represented on the PC keyboard. The codes may be generated using the PC numeric pad digit keys with ALT or with controls:

8001/8800	**PC Numeric Pad**	**PC Main Pad**
AUTO		Esc I
FG ON	Alt '29'	Ctrl]
BG ON	Alt '30'	Ctrl ^
BLINK ON	Alt '31'	Ctrl _
2X / BLINK OFF	Alt '15'	Ctrl O
2X CHAR ON	Alt '14'	Ctrl N

In general, where there is no PC key for an 8800 key, the numeric pad may be used with ALT to generate any code in the range 0-255. NUM LOCK must be set for this.

Numeric Pad

The numeric keypad on the PC keyboard has three different modes of operation. Num Lock and Scroll Lock control these modes.

When unmodified by Num Lock or Scroll Lock, the numeric pad keys generate codes that are strict equivalents of the codes generated by corresponding 8001/8800 numeric pad keys. Note that legends differ in two cases. The PC's '*' is equivalent to the terminal's 'x', and the PC's 'Enter' is equivalent to the terminal's '='.

When Num Lock is on, an Alt key, together with the number keys, may be used to generate any character code in the range 0 to 255 decimal. Otherwise strict 8001/8800 numeric pad emulation is maintained.

The method for generating characters from their numeric codes is to hold down the Alt key and press, in sequence, the numeric keys that correspond to the decimal code of the character to be generated. For example, to generate a character with code 240 decimal, hold down the Alt key and press 2, 4, and 0 keys in succession, then release the Alt key.

When Scroll Lock is on, the Home, Arrow, Ins, Del, PgUp and PgDn keys are operative for the generation of 8001/8800 style cursor and control sequences. Other keys are disabled.

Note that Scroll Lock takes precedence over Num Lock.

PC Legend	**Scroll Lock On**
0 Ins	Ins Char
1 End	(disabled)
2 ↓	↓
3 Pg Dn	Erase Line
4 ←	←
5	(disabled)
6 →	→
7 Home	Home
8 ↑	↑
9 Pg Up	Erase Page
/	(disabled)
*	x
-	(disabled)
+	(disabled)
Enter	=
. Del	Del Char

Auxiliary Cursor Pad

When present (extended keyboards) the Auxiliary Cursor and Function keys work like corresponding 8001/8800 keys. Note the differences in legending.

PC	**8800**
Ins	Ins Char
Del	Del Char
Home	Home
UpAr	UpAr
DnAr	DnAr
RtAr	RtAr
LfAr	LfAr
End	(not used)
PgUp	Erase Page
PgDn	Erase Line

8001/8800 Color Pad

The PC keyboard has no equivalents for the eight Color Pad keys on the 8800 117 key keyboard. The color pad codes are generated as follows:

8001/8800	**PC Numeric Pad**	**PC Main Pad**
BLACK	Alt '16'	Ctrl P
RED	Alt '17'	Ctrl Q
GREEN	Alt '18'	Ctrl R
YELLOW	Alt '19'	Ctrl S
BLUE	Alt '20'	Ctrl T
MAG	Alt '21'	Ctrl U
CYAN	Alt '22'	Ctrl V
WHITE	Alt '23'	Ctrl W

Function keys

F1-F10, or F1-F12 (when present on extended keyboards), are mapped to emulate F1-F10 (and F11,F12) on the 8800. There are four modifier levels. Note that F0,F13-F15 are not present on the PC keyboard. The codes for these keys may be generated using ALT and the numeric pad keys, when NUM LOCK is set.

To support the generation of terminal function keys not present on the PC/AT keyboard, there is a simple solution that works in most instances. Since all function keys are "User-Definable", the use of Shift along with F1 can be programmed to generate the F0 function code. The same applies to programming Shift F2 as F13, Shift F3 as F14, and Shift F4 as F15. The use of Alt or Control may be used instead of Shift, the choice is yours.

Special Keys and Keystroke Sequences

CTL-ALT-DEL still works to reset the PC. But note that a hard reset is performed.

PC print screen key generates an interrupt 5, which is remapped to trigger the print flag.

Setup mode entry is by ALT ESC. This corresponds to SHIFT SETUP on the 8800.

The PC Pause/Break key generates the 8800 break code, '#'.

Chapter 3
Using the Setup Menu System

The emulator provides a Setup Menu system to allow the operator to select and save such things as host communications settings, printer settings, locator device settings.

The menus are similar in appearance and operation to those of the Intecolor 3800 and 8800 series terminals. (ISC 8000 series terminals do not have Setup Menu systems.)

Entering Setup

The **Alt + Esc** keyboard sequence gives entry to the Setup Menu system. The first menu to appear will be the HOST MENU. You can switch to other menus by holding down the Alt key and pressing the Up or Down Arrow.

Note: When the terminal is switched from an on-line state to Setup mode, input from the host computer is gathered in a receive buffer associated with the host COM port for processing later. If host flow control is set, a "stop sending" code is sent to the host before the buffer can overflow.

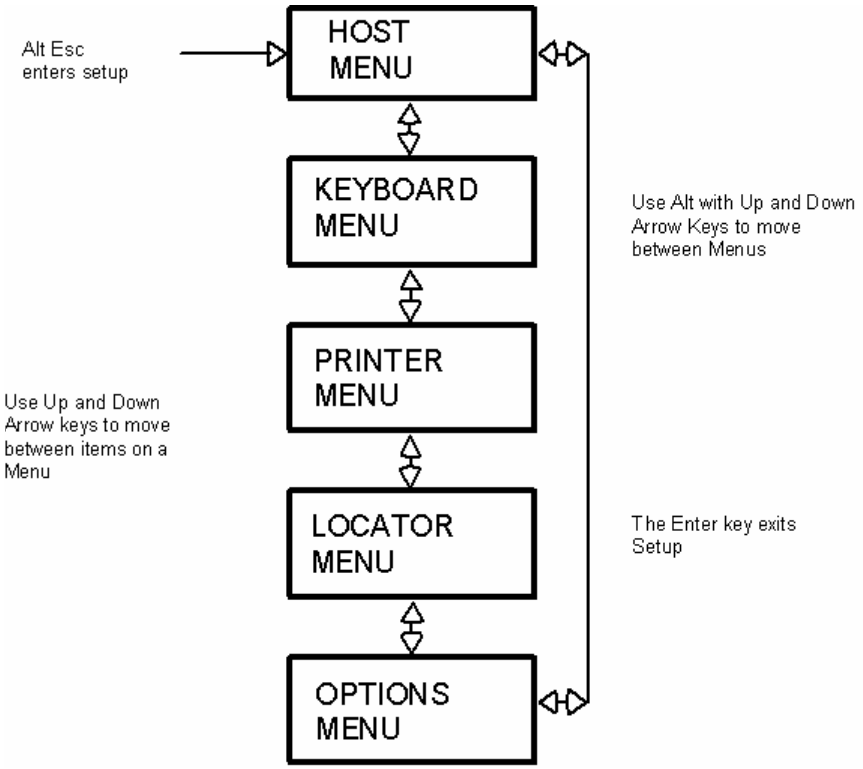


Figure 3-1. *Menu System Flow Diagram.*

Host Menu

The Host Menu allows changes to parameters dealing with host communications. The serial port, data rate, echo mode, and related parameters may be changed to meet user preference and saved.

The Host Menu presents the following display:

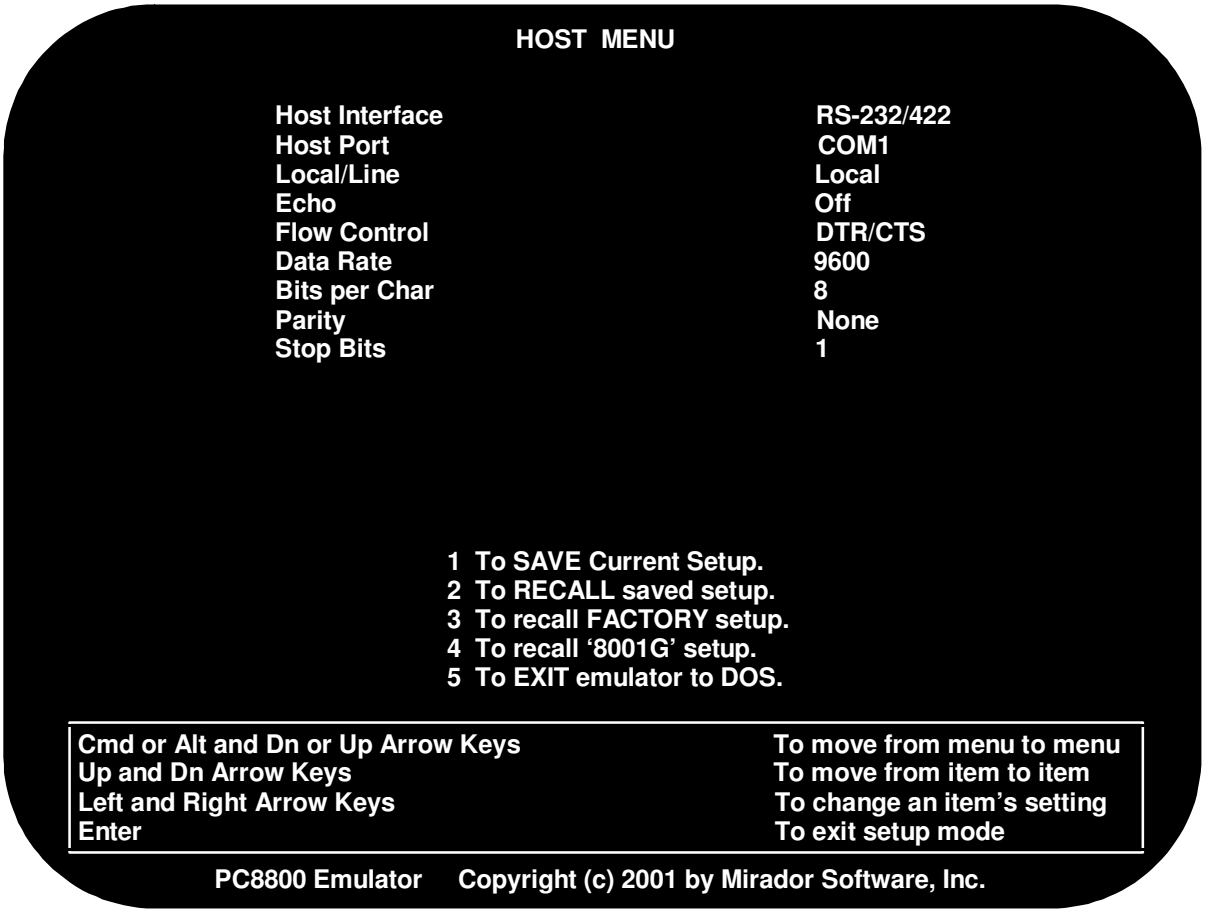


Figure 3-2. *HOST Menu Selections.*

Keyboard Menu

The Keyboard Menu allows changes to parameters dealing with keyboard communications and user-definable function keys. The I/O port, keyboard type, data rate, duplex, function key mode, and related parameters may be changed to meet user preference and saved.

The Keyboard Menu presents the following display:

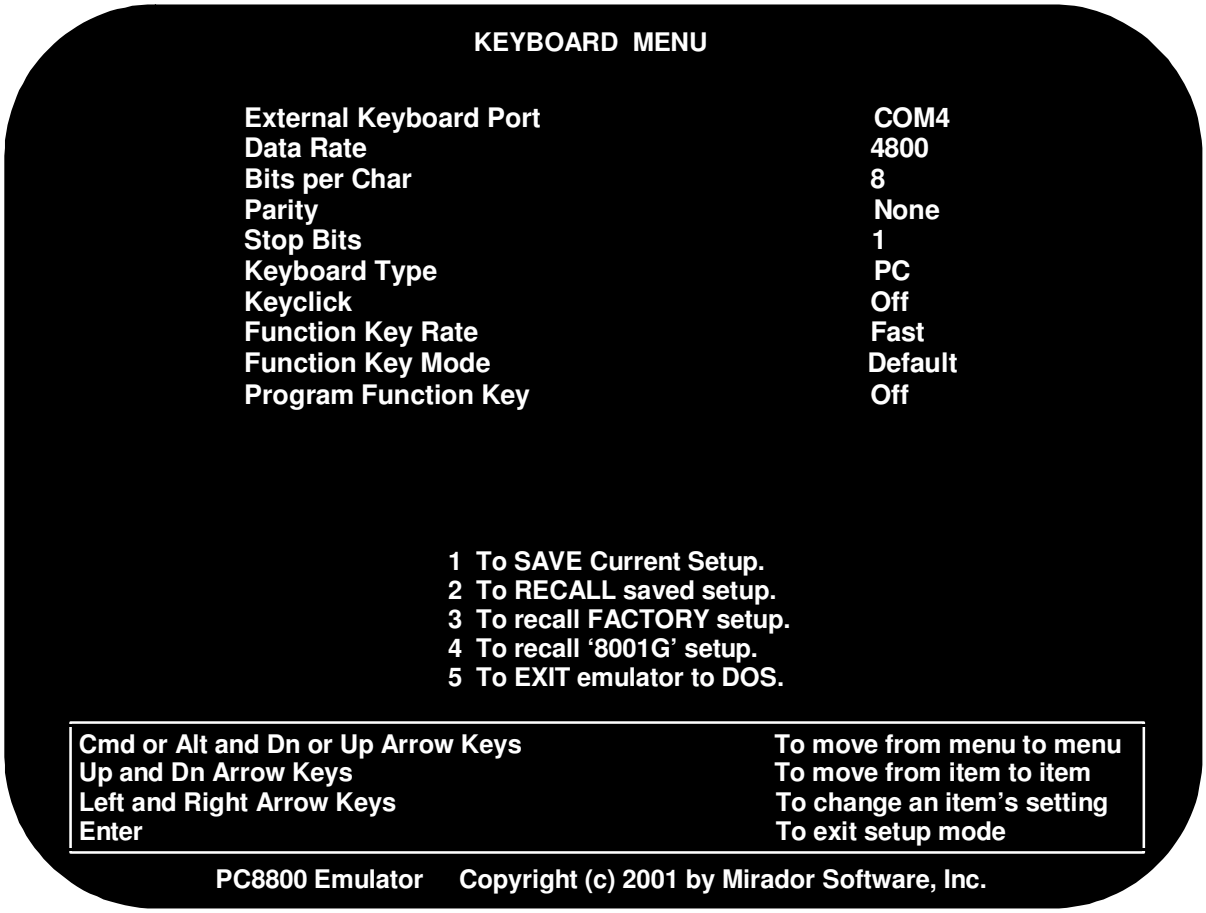


Figure 3-3. *KEYBOARD Menu Selections.*

Printer Menu

The Printer Menu allows changes to parameters dealing with printer communications and printout preferences. The I/O port, printer type, data rate, duplex, orientation, and related parameters may be changed to meet user preference and saved.

The Printer Menu presents the following display:

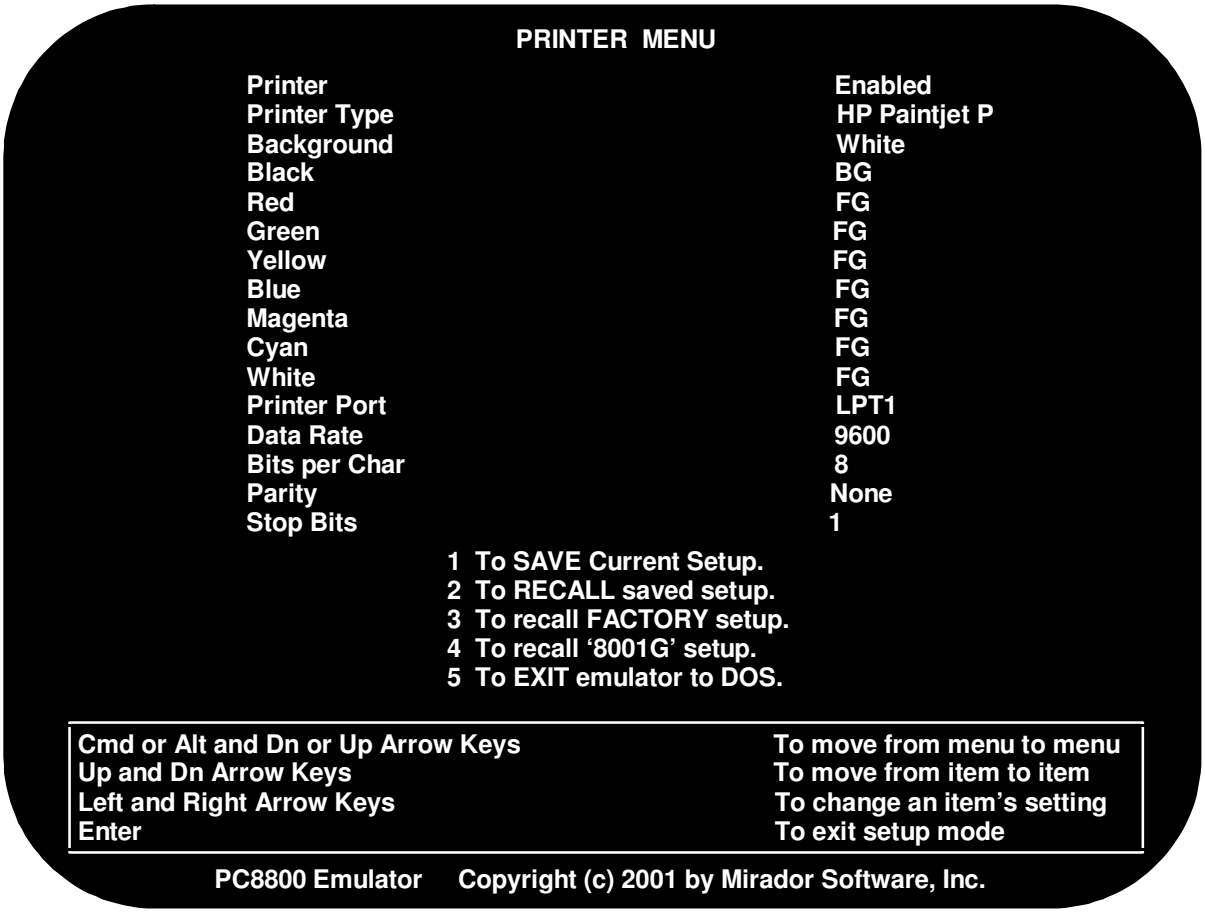


Figure 3-4. *PRINTER Menu Selections.*

Locator Device Menu

The Locator Menu allows changes to parameters dealing with locator device selection, I/O port selection, and host report parameters. The device type, I/O port, data rate, duplex, reporting mode, and related parameters may be changed to meet user preference and saved.

The Locator Menu presents the following display:

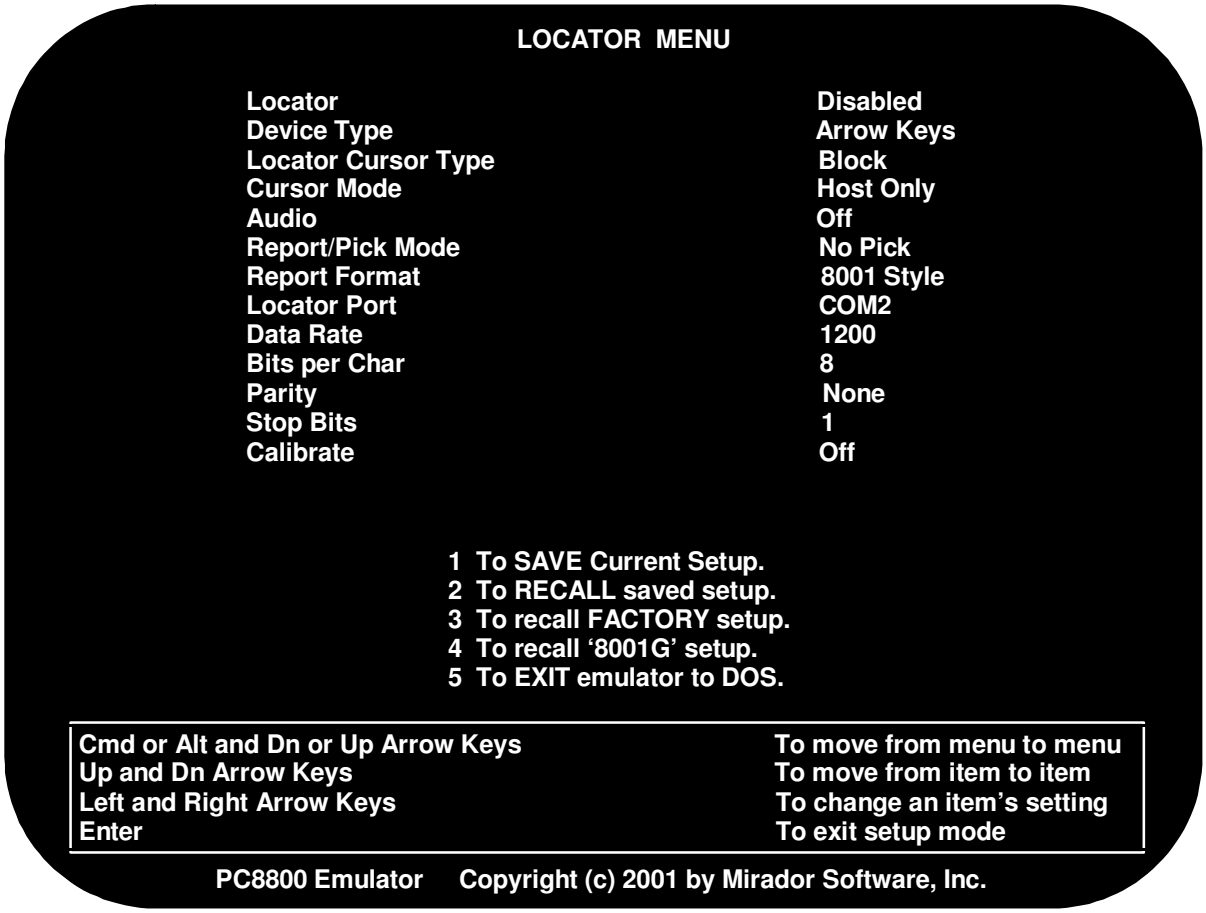


Figure 3-5. *Locator Menu Selections.*

Options Menu

The Options Menu allows changes to parameters dealing with pixel graphics ability, color mapping, Fastscreen, cursor style, character set selection, and CRT saver functions. The items may be changed to meet user preference and saved.

The Options Menu presents the following display:

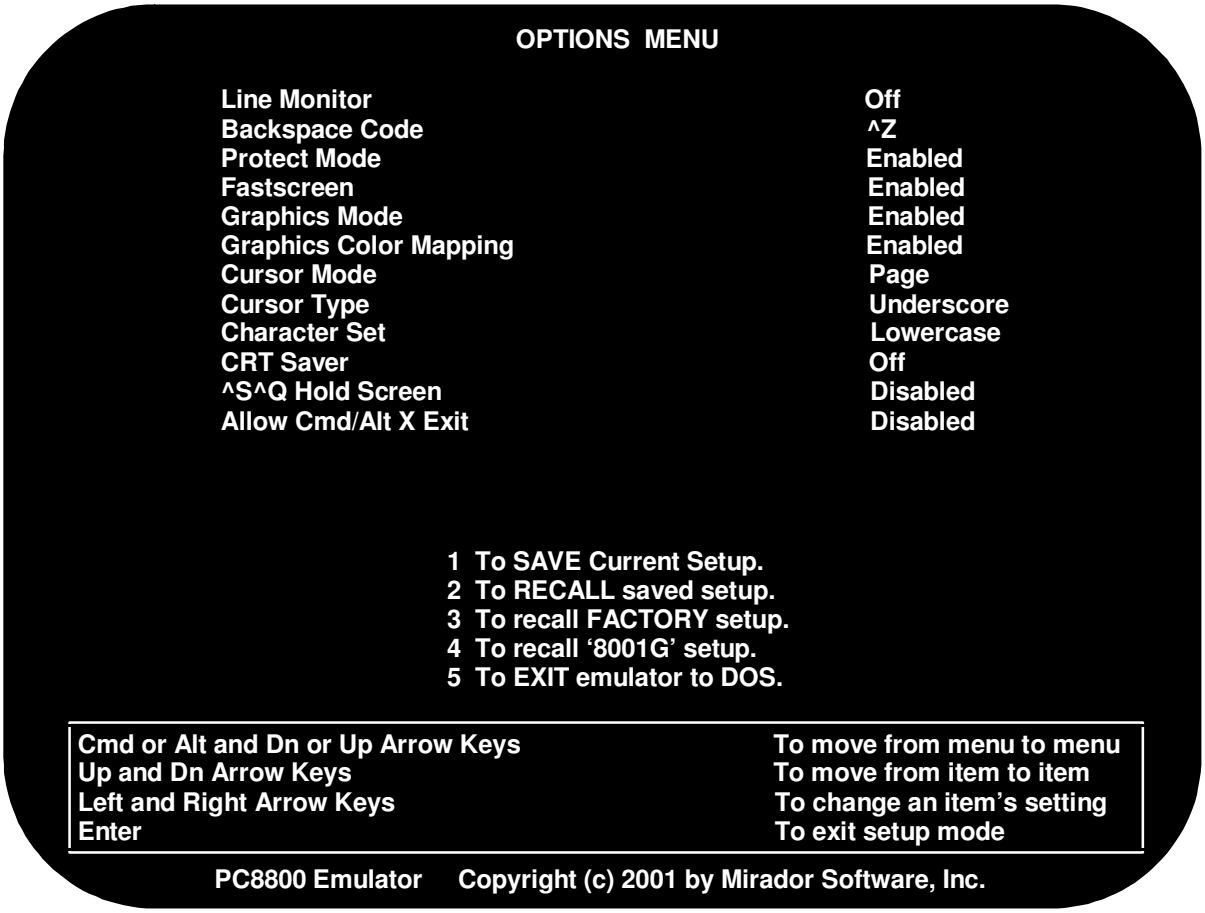


Figure 3-6. *OPTIONS Menu Selections.*

Chapter 4
Using Printers

The emulator supports three printers, the Epson FX-86e dot matrix printer (black and white), and the HP Paintjet and Deskjet color inkjet printers. Printouts may be in portrait or landscape orientation on 8.5 x 11 inch paper.

The drivers for the printers are built into the emulator. No additional software is required. Other printers can be used, provided they use the relevant Epson or HP protocols.

Print operations can be initiated by the operator using the PC keyboard's Print Scrn key. In this case, printing is handled according to settings made from the Printer Setup Menu. Alternatively, print operations can be invoked by a command, issued either from the host or at the keyboard. In this case, a command argument specifies the printer, the print orientation, etc., overriding Setup Menu settings.

Printing the screen can take up to several minutes, depending on the screen's contents and the type of printer being used. Often, it is not acceptable to delay the processing of incoming data from the host for a long period while printing takes place. External print buffers were used with the original terminals to offload the servicing of the printer and free up the terminal to continue processing data. Such external buffers are unnecessary with the emulator, because it incorporates its own print buffering system.

When a print screen operation is initiated, the emulator quickly processes the screen data to form data the printer can use and then stores the printer data in a temporary file on the system hard disk. Periodically, it reads a small amount of print data from the file and sends the data to the printer, until the data have been exhausted. This occurs as a background task, so that the processing of host data can continue. Depending on the type of printer being used and the amount of disk space available, up to ten screens can be queued for printing in this manner. (The temporary files can range in size from 100Kb to over 1MB.)

Printing Using the Print Scrn Key

The Print Scrn key on the PC/AT keyboard can be used to invoke a screen printout. Nothing is sent to the host computer to indicate that printing is occurring, and the emulator "multi-tasks" to maintain communications with the host while printing is under way.

The settings for the printer type, image orientation, color mapping, etc., made previously by the operator in Printer Setup Menu are used to determine how print output is formatted and directed.

If an attached Printer is enabled when the Print Scrn key is pressed, a disk file is created and then immediately sent to the printer.

If the printer is disabled (in Printer Setup), a disk file is created but not printed. The encoded VGA display is stored to the hard disk until the file is erased by the user, or later printed when the printer selection is set to enabled. This is a handy feature that will generate a properly formed print data file on the hard disk that can be printed at a later time.

When using Windows 3.1, the "Print Screen" should be reserved for application use when defining a Program Information File (PIF) or Shortcut.

Printing by Command

The syntax of the print command is

<ESC> M byte_arg

When invoking a print operation by host command, the printer driver is selected with bit patters in the command argument byte, as follows:

Printer Type	**Image Orientation**	**byte_arg b7 b6 b5 b4 b3 b2 b1 b0**
HP Paintjet (color)	portrait	0 x 1 1 1 1 x x
HP Paintjet (color)	landscape	0 x 1 1 1 0 x x
HP Deskjet (color)	portrait	0 x 1 1 0 1 x x
HP Deskjet (color)	landscape	0 x 1 1 0 0 x x
Epson FX-86 (monochrome)	landscape	0 x 1 0 0 0 x x

The 2 low order bits (b1 and b0) in the argument byte select the black and white reverse mode, as follows:

BG/FG Reverse	**b7 b6 b5 b4 b3 b2 b1 b0**
No reverse	0 0
Selective reverse (not supported, maps to full reverse)	0 1
Full reverse	1 0
Printer SW version (not supported, value ignored)	1 1

Bit b6 in the argument byte selects form feed (1) or no form feed (0)

Form Feed	**b7 b6 b5 b4 b3 b2 b1 b0**
Form Feed	1
No Form Feed	0

For example, to select the HP Deskjet with form feed, portrait mode, and background white, the bits of byte_arg would be

0 1 1110 01

which form the code for the ASCII character 'y'. Thus the complete command would be

<ESC> M y

To select the HP Deskjet with form feed, landscape mode, and background white, the bits of byte_arg would be

01 1101 01

which form the code for the ASCII character 'u'. Thus, the complete command would be

<ESC> M u

Chapter 5
Using Locator Devices

Overview

The emulator has built-in support for several locator devices. These devices can be used to speed and facilitate screen cursor positioning or screen area picks by the operator. Locator devices can be selected, enabled, and configured by the operator in Locator Setup, or by host command.

Note: Audible feedback to the operator when a pick or movement is made is not currently implemented.

There are two broad classes of locator devices. The first is referred to as absolute devices, the second class as relative devices.

Absolute Devices

An absolute locator device reports the absolute screen coordinates of a cursor that the operator is moving, or of a screen area that the operator is selecting or picking by means of the device. The devices which fall into this class are light pens, digitizing pads, and touch screens. Generally, absolute locator devices allow the user to move a cursor or make a pick by simply pointing to the desired location on the screen.

Picks can be generated in several ways with absolute locator devices. For example, when a touchscreen is being used, a pick can be generated when the operator's finger first touches the screen or only when it ceases to be in contact with the screen.

Some absolute devices (touchscreens, in particular) require calibration.

Relative Devices

Relative locator devices are so called because they present the emulator with movement requests in the form of offsets relative to the current locator position. Devices in this category include the Arrow Key cluster, trackball, and mouse.

Picks are generated with buttons on these devices, usually with the leftmost button available on the device. Any other buttons on the device are programmable function keys.

Relative devices do not require calibration as do absolute devices. However, the sensitivity of these devices to physical movement sometimes needs to be adjusted.

Function Key Buttons on Devices

When using various locator devices which have multiple buttons, one button is designated as a pick request button while the others become programmable function keys. The pick button may also be treated as a function key if the Report/Pick Mode is set to "No Pick". The function keys generate default values in the range of 0AFH through 0A0H. Typically the buttons are ordered from left to right with descending associated values.

These buttons are logically attached to the keyboard and will act like keyboard buttons when pressed. The main exception is that modifier keys on the keyboard do not affect the locator device buttons. Modifier keys include Shift, Ctrl, and Alt.

Programming of the buttons as function keys is done in the same fashion as programming the keyboard function keys. Logically, the buttons are treated as function keys F47 - F40 which are not available on the keyboard. The locator device whose button is to be programmed must be correctly attached, enabled, and selected before programming is attempted.

The buttons can be programmed by use of the Function Key Programming facility in Keyboard Setup, or by host command.

Operation

General Considerations

When using locator devices, it is important that they be correctly connected and configured before use. In order for the device to be correctly initialized, the emulator must be able to communicate with the device. The emulator will only attempt to initialize the locator under the following conditions:

- At startup, provided the Locator Type is not set to None, and the Locator is set to Enabled (these settings must have been stored to the hard disk setup file 88SETUP.DAT).
- On exit from Setup, provided the Locator Type is not set to None and Locator is Enabled.
- On host command.

If the device is not connected or is otherwise unable to communicate with the emulator, initialization cannot be completed successfully.

The locator operates in the domain of the character display. There is no facility for the operation of locators as Graphic INput (GIN) devices within the pixel graphic mode. However, the locator device will operate to move its cursor even when submodes such as Pixel Graphics or Fastscreen are in effect.

A locator device cursor position is maintained for each of the four character graphics screens, separately from the normal host cursor position. The locator device cursor on the currently

accessible screen (not necessarily the currently displayed screen) will always be the one moved.

Movement of the cursor is restricted from wrapping at the edge of the screen boundary. For instance, if the cursor is moved all the way to the right edge of the screen by the locator device, continual attempts to move it farther to the right will have no effect.

Double Height character display mode (sometimes referred to as A7 On) affects the movement of the locator cursor. When Double Height mode is on, the cursor (like the host visible cursor) is allowed only on odd numbered screen rows. If the locator device cursor is on an even row at the time Double Height mode is set, the locator device cursor will move down to the next odd row. Turning off Double Height mode will not affect the cursor location.

The setting of the emulator's Private Origin Mode (POM) also affects the movement of the locator cursor. If a scrolling region is defined and active (POM set), the cursor will be restricted to the scrolling region.

Enabling and Disabling the Locator Device

The Locator can be enabled or disabled from Setup or by host command.

Selections: Disabled (default)
Enabled
Disable on Pick

When Disabled is selected, the host can still issue commands to enable the Locator.

When Enabled and a device is selected and configured, normal input operation is in effect until the Locator is specifically Disabled.

When Disable on Pick is selected, the locator device operates normally until a pick action occurs. When the operator makes a pick, the locator device is Disabled following the issuance of the pick report.

Note: If the Report/Pick Mode is set to "No Pick", setting "Disable on Pick" will not have the desired effect.

Note: When a locator device is enabled, exiting the setup mode can take up to an extra 750 milliseconds while the emulator attempts to initialize the locator device currently selected. Assuming flow control is being duly utilized, no data loss will occur should the host be transmitting during device initialization.

Locator Cursor Mode

The Locator can control the host cursor or a separate locator cursor as determined in Setup or by host command.

Selections: Host Only (Standard Defaults)
Locator Only (FACTORY Defaults)
Host and Locator

Normal operation of the terminal has traditionally called for the locator device to control the host `visible' cursor. This is the Host Only cursor display mode for the device when the Standard Defaults are invoked. When the locator is enabled and a device is selected, the host and the device share access to the host cursor. The locator device cursor assumes the current host cursor position and position reports reflect the host cursor position.

Host Only mode permits the host cursor to be moved locally, without host notification, to any position on the screen by the operator. If this occurs during host screen updating data can be scattered haphazardly.

When Host Only mode is in effect, the cursor display style chosen for the locator device has no visible effect since the locator cursor is not displayed separately.

Locator Only allows the locator to move its own cursor which is separate from the host cursor. When this selection is in effect, the host visible cursor will disappear from the screen whenever the Locator is enabled. The Locator cursor will appear and track the operation of the Locator device. When the Locator is subsequently disabled, the Locator cursor will disappear and the host cursor will reappear at its correct current position. Data input to the emulator destined for screen display will be placed at the correct position on the screen and the visible cursor location will be adjusted just as in normal operation even while the host cursor is not being displayed.

Host & Locator allows for the display of both the host and Locator cursors. As described in the previous paragraph, there is no interaction between the host and locator cursors. When this mode is in effect, the Locator cursor will appear only when the Locator is enabled.

Locator Cursor Display

The way in which the Locator Cursor is displayed can be controlled from Setup or by host command.

Selections none
blinking underscore
blinking overscore and underscore
blinking block

If the choice is none, this does not mean that the locator is disabled. It merely means that the cursor is not displayed. Except for the fact that the locator device cursor is not seen, operation is the same as when a visible cursor style is selected.

Report/Pick Modes

A `pick' is an action that can result in the generation of a report to the host computer containing information such as the locator's position. Generation of the pick action is device dependent. This action is caused by pressing a button on some devices; it can be caused by simply activating other devices.

The type of actions signifying picks can be set by Setup selection or by host command.

Tracking with exit pick	The cursor will track the movement of the finger while it is in the active field and a pick will occur when the finger exits the active field. The point at which the finger exits the active field will be reported if that is the action the emulator is set to perform when a pick occurs.
Tracking with movement pick	This mode is the same as mode except picks are generated every time the cursor moves to a new location.
Entry pick	The cursor moves to the point on the screen nearest the entry point of the active field. A pick is generated at that point. No other action occurs until the finger is removed from the active field and then reinserted.
Continuous pick	The cursor tracks the finger and picks are generated continuously while the finger is in the active field.
No pick	The cursor will track locator device actions normally. However, no pick actions can occur. The buttons on external devices which would otherwise be pick buttons will act like function keys.

Note that when 'No pick' mode is in effect, and the locator is set for **Disable on Pick**, the locator will not be disabled by any pick action.

Report Formats

The format of reports transmitted to the host when picks are made can be set in Setup Mode or by host command.

Setting	**Report Syntax**
None	
Standard Style (default)	<ETX> x y <ACK> cci character <CR>
Standard Style (Short)	<ETX> x y <CR>
ANSI-Style	<ESC> [Row ; Column H <ESC> [? cci ; Character m
ANSI-Style (Short)	<ESC> [Row ; Column H
VT100-Style	<ESC> [Row ; Column R
"Pick" Report	<ESC> [? 8 d

None means no report will be generated by a pick operation.

Standard Style means a report has the traditional terminal format. The report is in the form of a seven byte sequence. Coordinates are encoded in binary form.

The first part of the report consists of the leading <ETX> (Code 3) character followed by the x position of the locator cursor and then the y position. The second part of the report begins with <ACK> (Code 6) followed by the Composite Color Information (CCI), or status byte, assigned to the screen position of at the cursor position. The final part of the report is the character code for the character or symbol displayed at that this position. The report is terminated by a Carriage Return character.

Standard Style (Short) means a report in an abbreviated version of the above:

ANSI-Style is a report presenting similar information in a proprietary ANSI style format. The parameters are given as numeric strings representing decimal values. Because the parameters are strings representing values ranging from 0 through 255, the report can vary in length from 13 bytes to 19 bytes.

ANSI-Style (Short) is a report consists only of the first part of the above report.

VT100-Style is identical to the "ANSI-Style (Short)" report with the exception of the terminating character.

"Pick" Report sends no specific information. It merely reports that a `Pick' occurred. The report is a fixed-length ANSI-format string.

Locator Device Sensitivity

The sensitivity of some relative locator devices to physical movements can be controlled from Setup.

Selections: Slow
Normal (default)
Fast

Normal is the default and has been selected as the most comfortable "speed" for each device. For each device, the amount of movement required to move the cursor a certain distance on the screen can be increased or decreased by choosing Slow or Fast.

For example, if a three inch movement of a mouse at "Normal" speed resulted in a certain amount of cursor motion on the screen, it would take more than the three inches of movement to achieve the same results when the sensitivity setting is changed to Slow. The opposite is true when Fast is chosen.

With relative devices, individual speed settings are not maintained for each device. In order to save the relative device sensitivity setting, the user must save the setup menu.

The selection of locator device speed does not affect the operation of the Arrow Key cluster.

Notes on Specific Devices

Microsoft Mouse

The mouse should be held with the buttons away from the user, under the fingertips. When the mouse is moved left, the cursor will move left. When the mouse is moved away from the user, the cursor will move up the screen. Scrolling region and screen boundaries are not crossed.

The Microsoft mouse utilizes its left button for pick generation and the right button as a programmable key. The default value for the right button is 0AEH as function key F46. When the Report/Pick Mode is set to No Pick, the left button becomes function key F47 and generates a default value of 0AFH.

The COMDRVR.BIN device driver must be installed to handle communications at the host serial port selected for use by the device. Installation for this port is similar to installation for the host serial port.

The proper Locator Menu settings for the Microsoft Mouse are: Data Rate = 1200 baud, Data Bits = 8, Stop Bits = 1, Parity = None. The serial COM port MUST be set to match the communication factors of the mouse.

Itac MouseTrak Trackball

The Itac MouseTrak trackball should be the RS-232 compatible version with the female D-Sub 9-pin connector and may be attached to any available COM port. This trackball supports all Microsoft Mouse operational modes and uses the Microsoft mouse selection in the Locator Menu.

The trackball allows positioning of the locator cursor by rolling the ball on the device. The Itac trackball should be oriented so that the ball is at the end farthest from the user. Rolling the ball away will cause the cursor to move up and rolling it toward the user will cause the cursor to move down the screen. Movement left and right is accomplished in a similar fashion.

The cursor will not move across screen boundaries. If the cursor is at the bottom of the screen and an attempt is made to move it down, it will remain at the bottom of the screen. If a scrolling region is in effect, the cursor will not cross region margins once inside the region.

The Itac MouseTrak trackball utilizes its left button for pick generation and the right button as a programmable key. The default value for the right button is 0AEH as function key F46. When the Report/Pick Mode is set to "No Pick", the left button becomes function key F47 and generates a default value of 0AFH. The trackball is set up exactly like a Microsoft Mouse and uses the Microsoft Mouse as the selected locator device type.

The trackball can be ordered from Itac configured to emulate several different protocols and baud rates. For use as a PC8800 locator device, it should be set up to emulate the Microsoft mouse.

The COMDRVR.BIN device driver must be installed to handle communications at the host serial port selected for use by the device. Installation for this port is similar to installation for the host serial port.

The proper Locator Menu settings for the Itac MouseTrak trackball are: Data Rate = 1200 baud, Data Bits = 8, Stop Bits = 1, Parity = None. The serial COM port must be set to match the communication factors of the trackball.

Arrow Keys

The Arrow Key cluster can be logically separated from the normal keyboard operation to become an locator device. When selected as the current locator device, the Arrow Keys operate locally to move the locator cursor. The HOME key becomes the pick button for this device.

When the Arrow Key cluster is being used as a locator device, use of modifier keys, Shift, Ctrl, or Alt will cause the keys to act in their normal fashion as keyboard keys. Thus, only the unmodified keys are part of the locator device.

The locator cursor will not move across screen boundaries. If the cursor is at the bottom of the screen and an attempt is made to move it down, it will remain at the bottom of the screen. If a scrolling region is in effect, the cursor will not cross region margins once inside the region.

When the Report/Pick Mode is set to "No Pick", the HOME key no longer generates picks. The key (with no modifiers pressed) will appear to be deactivated.

EloTouch IR Smart Frame

The Setup Mode Locator menu provides a means of selecting and configuring the built-in drivers for a serial IR touch system. (There is also some support for host control via ANSI command.)

Before attempting to use the touch screen as a locator device, ensure that the touch screen is properly installed. The touch screen's serial port must be connected to a spare serial port on the host computer. Cabling is as shown.

Touch Screen DB-9		**Host DB-9**
(+12) 1	→	1 (DCD)
(TXD) 2	→	2 (RXD)
(RXD) 3	←	3 (TXD)
(DSR) 4	←	4 (DTR)
(SG) 5	—	5 (SG)
(DTR) 6	→	6 (DSR)
(CTS) 7	←	7 (RTS)
(RTS) 8	→	8 (CTS)
9 NC		NC 9 (RI)

The COMDRVR.BIN device driver must be installed to handle communications at the host serial port selected for use by the touch screen. Installation for this port is similar to installation for the host serial port.

Finally, the host serial port to which the touch screen is connected must be selected as the locator device port in the Locator Setup Menu under PC8800. It is recommended that the port communications parameters be set initially for 4800 baud, 8 bits, odd parity, 1 stop bit. However, it is possible to use other settings. Most IR touchscreens support auto baud and auto parity detect, and the driver built in to the PC8800 utilizes these features.

After the touch system has been installed and set up for communications, the calibration routine that is built in to the PC8800 and is accessible from the Locator Setup Menu should be run. Once calibration has been performed, calibration data are stored in a file called CTCALIB.DAT on the hard disk. The calibration file is accessed by the device driver

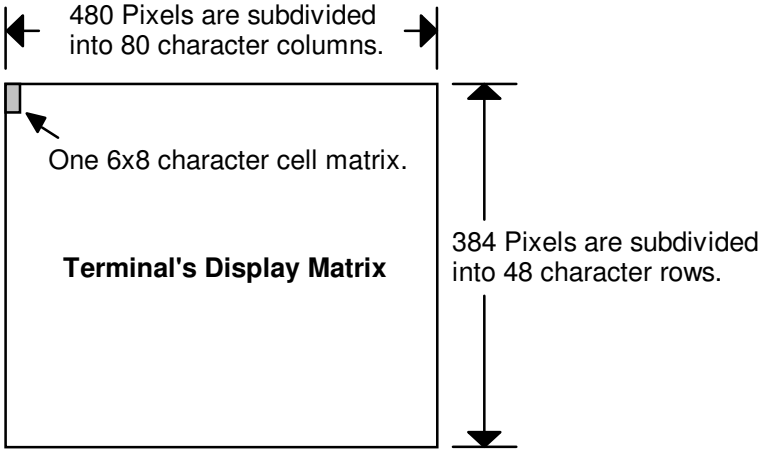
whenever the touch screen is enabled. Therefore, recalibration should not be required at the beginning of every operating session.

Once set up and calibrated, the touch system works like any locator device, subject to the pick mode and report mode settings that are selectable from the Locator Setup Menu.

CHAPTER 6
Display and Character Sets

Organization of the Display

The original terminal's display area resolves to 480 pixels horizontally and 384 pixels vertically. When the terminal is operating in dot-addressable graphics mode, each pixel is addressable independently and may have its own attributes. In this mode, each pixel represents a point in a two-dimensional coordinate system with the origin (0, 0) at the lower left and (479, 383) at upper right.



When the terminal is operating in a text or character graphics mode, the pixels are organized into character cells, and these character cells, rather than individual pixels, are addressable and have attributes. Each character cell is 6 pixels wide and 8 pixels high. Thus, the display represents an array of cells 80 columns wide and 48 rows high. Columns are numbered left to right, beginning with 0. Rows are numbered top to bottom, beginning with 0.

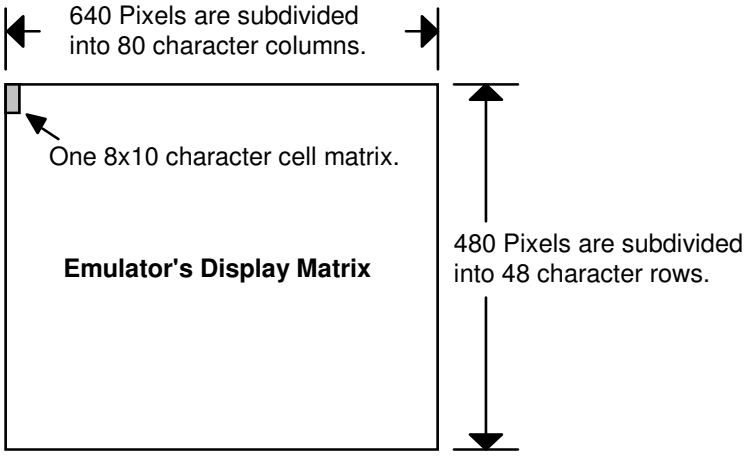
Using this 80 x 48 array of character cells as a basis, the terminal is able to render incoming codes as elements of text or of a character graphic by using these codes to select characters or symbols from one of its character sets and then drawing them in the appropriate character cells.

In addition, the terminal is able respond to certain character plot commands by rendering points and lines with an apparent resolution of 160H x 192V. It does this by using special drawing functions to select characters from a special plot character set, consisting of 256 symbols, and to position these characters on the display so that they form the commanded lines or points.

The emulator faithfully represents the original terminal's display on VGA compatible hardware, which provides a display with a native resolution of 640 pixels horizontally and

480 pixels vertically. It handles dot addressable graphics by scaling terminal pixel coordinates, so that the addressable space is the same as that of the terminal.

It handles text and character graphics by scaling character cells from 6 x 8 to 8 x 10, so that the display still has 80 columns and 48 rows of cells. Since the emulator's character cells have more resolution that those of the original terminal, text and character graphics have better definition.



Character Sets

The emulator, like the original terminal, can render incoming codes as displayable text or character graphics using any of three standard symbol sets: Lowercase ASCII, Process and Forms. It can also use up to four custom sets. Each of these symbol (or character) sets contains 128 symbols, designated G0 to G127. The ASCII uppercase alphabetic characters, numeric characters and punctuation marks (G32 to G95) are common to all sets. Symbol sets are normally selected by host command. They may also be selected by the operator (Options Setup Menu).

When the emulator is in a text or character graphics display mode (but not a character plot mode), the mapping of incoming codes is determined by the currently selected character set and the state of the internal FLAG, as follows:

Code	Lowercase (ASCII)	Process	Forms
0 to 31 (0x00 to 0x1F) FLAG on or off	These codes are normally interpreted as controls and are not mapped to any character set. If Control Representation Mode is set, these codes are mapped to G0 to G31 of whatever character set is currently selected.		
32 to 95 (0x20 to 0x5F) FLAG on or off	G32 to G95 (ASCII numeric, punctuation and upper case characters), common to all three standard character sets		
96 to 127 (0x60 to 0x7F) FLAG off	G96 to G127 of the Lowercase (ASCII) set, the lowercase ASCII characters	G96 to G127 of the Process set	G96 to G127 of the Forms set
96 to 127 (0x60 to 0x7F FLAG on	G0 to G31 of the Lowercase (ASCII) set, the control representation characters	G0 to G31 of the Process set	G0 to G31 of the Forms set
128 to 255 (0x80 to 0xFF)	These codes are normally interpreted as equivalent to codes 0 to 127 and are mapped to displayable characters accordingly. If Control Representation Mode is set, these codes are distinguished from codes 0 to 127 by being rendered in red, rather than green.		

Note that the internal FLAG affects the rendering of codes 96 to 127 only. The state of the FLAG determines whether these 32 codes will be mapped to symbols G96 to G127 or G0 to G32 of the selected symbol set.

Note also that the setting of Control Representation Mode (Options Setup Menu) affects the rendering of incoming codes independently of the state of the internal FLAG and the symbols set selected. Control Representation Mode is not a normal on-line operating mode; it is intended for trouble-shooting. It is intended to be used with the Lowercase (ASCII) symbol set, which includes the ASCII control representation characters.

When the emulator is in a character plot mode, it interprets incoming codes as commands and command arguments for the display of points, vectors, bar graphs, etc. using a special symbol set consisting of 256 distinct "plot block" combinations. In these modes, there is no one to one mapping of incoming codes to the symbols in this symbol set; rather, the symbols are

selected and placed on the screen at the required positions by the emulator's internal drawing functions.

Standard Font Files

The emulator's standard fonts are stored in files in the BIN directory. These files are:

Font Filename	Description	Setup Menu Name
88ASCII.FNT	32 Lowercase and 32 Control Representation Characters	Lowercase
88PROCES.FNT	64 Process Characters	Process
88FORMS.FNT	32 Line Drawing Characters	Forms
88PLOT.FNT	256 Character Graphics Plot Characters	
CUSTOM1.FNT	64 Customer Specified Characters	Custom 1
CUSTOM2.FNT	64 Customer Specified Characters	Custom 2
CUSTOM3.FNT	64 Customer Specified Characters	Custom 3
CUSTOM4.FNT	64 Customer Specified Characters	Custom 4

When the emulator starts up, it looks for these files and, if it finds them, loads them. If it does not find them, it defaults to built-in fonts. Files with these names can contain other than the standard font definitions associated with these names. If such files are present and are properly formed, they will be loaded at startup, and the font definitions they contain will replace the default definitions.

Custom Font Files

ISC 8001 and Intecolor 8800 and 3800 series terminals were often equipped with custom character sets. These sets were used to facilitate the construction of special graphical displays like process plant schematic diagrams, to enable the use of foreign languages, etc. Intecolor provided many of these custom character sets as options (0B03, 0B1700, 0R1700 and 0T1700). In other cases, Intecolor sold standard units to system suppliers and these suppliers provided custom sets to end users.

The presence of an Intecolor generated custom character set in a terminal is signaled by the appearance of a Custom Software Release number in the terminal's power-up header message (CSR 978000-xxx).

Several Intecolor generated custom character sets have been ported to the emulator. They are made available as additional font files stored in the emulator's FNT directory.

Intecolor Firmware Release	OEM	PC8800 Font File
CSR 978000-088		CSR088PR.FNT
CSR 978000-137	Combustion Engineering Simcon	CSR137PR.FNT
CSR 978000-139	Trane Sentinel	CSR139PR.FNT
CSR 978000-168	MCC Systems	CSR168PR.FNT
CSR 978000-178	Texas Instruments	CSR178C1.FNT
CSR 978000-213	PPG	CSR213C1.FNT and CSR213PR.FNT
CSR 978000-223	DuPont	CSR223C1.FNT
CSR 978000-230	Biles and Associates	CSR230C1.FNT
CSR 978000-246	Combustion Engineering Simcon	CSR246C1.FNT
CSR 978000-275	Modcomp	CSR275C1.FNT
CSR 978000-277		CSR277C1.FNT
	Tano Marine	TAN8X1C1.FNT

The mechanism for loading these custom fonts is to rename the files to the names of corresponding standard font files and then place them into the BIN directory (or the directory associated with the environment variable PC8800) in place of the standard files.

Note: Before renaming a custom font file to give it a standard name and moving that file to the BIN directory, save the standard file with the corresponding name somewhere outside the BIN directory.

Note: The names of the custom font files contain information about which standard font files they are meant to replace. For example, custom font file CSR223C1.FNT is meant to replace the file CUSTOM1.FNT in the BIN directory. Custom font file CSR139PR.FNT is meant to replace the 88PROCES.FNT file.

Using FEDIT to Create Custom Fonts

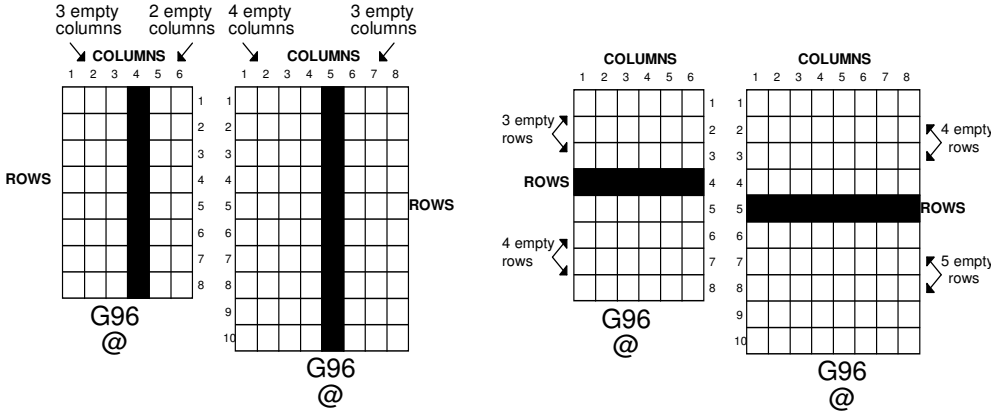
A font editor utility that is distributed with the emulator (FEDIT.EXE) allows users to define their own custom character and symbol sets and store them in appropriately formed .FNT files.

Before attempting to use FEDIT to define a custom character or symbol set, it is important to understand how the emulator's character sets are organized and how characters from these sets are rendered on the display. The beginning sections of this chapter provide the necessary background information.

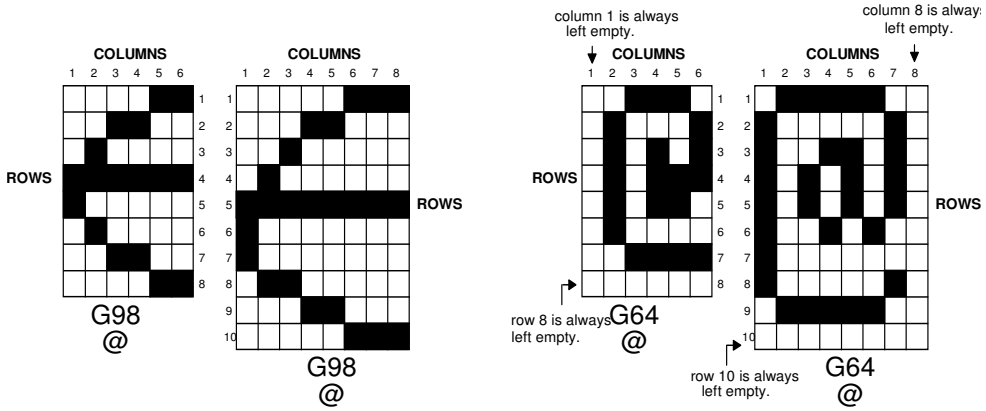
Character Matrix Conversion Examples

When designing custom fonts for the emulator, it is important to take into account the difference in character cell matrix size between the terminal and the emulator. Since the emulator's character matrix has two extra columns and two extra rows, the character definition must be positioned in the matrix differently.

The examples below indicate the differences and provide information should a custom character set need to be created or converted by the end user.



The next example illustrates the differences in defining a "graphics" character and an ASCII upper or lower case character. Graphics characters are defined using the entire matrix, so when characters are placed next to each other, a continuous graphic is displayed. The standard ASCII character set is different from the graphics definitions. On the terminal, the 1st column (1) and last row (8) are left undefined. In essence the ASCII upper and lowercase characters are a 5x7 character definition within the 6x8 matrix.

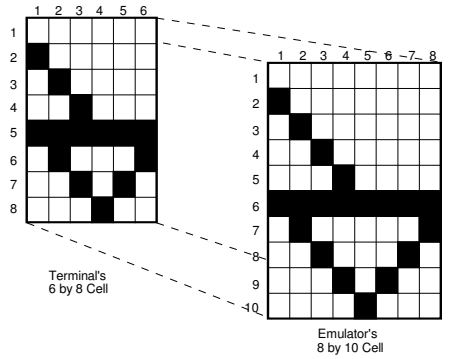


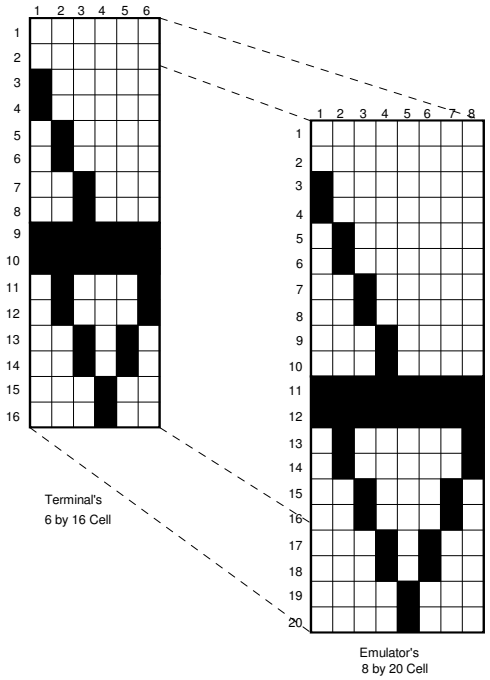
ALL rows and columns may be used to define graphics characters so they may touch each other on the display to create a continous line without spaces between individual character cells.

Only certain rows and columns may be used t define ASCII characters. A column and row is used to allow space between character cells c the display for readability.

The emulator is very much the same, except the last column (8) and last row (10) are left undefined. The character is actually a 7x9 character definition within the 8x10 matrix.

The following examples compare characters displayed in the two matrices in single height and double height modes.





Modifying Existing Font Files.

Modification of an existing character font is relatively easy. If only minor edits are required to change a few characters, the process may take only a few minutes to complete. When FEDIT is used to modify the existing font (such as PROCESS.FNT) a display like that shown on page 51 will be presented.

In general, it is recommended that the user start a new project by editing one of the files CUSTOM1.FNT through CUSTOM4.FNT. These files already contain the middle 64

uppercase ASCII characters common to most fonts. The lower and upper 32 characters are left blank to be filled in as required using the editor.

Running FEDIT

FEDIT.EXE has a command line switches to allow custom character fonts to be created in various matrix sizes. The general syntax for FEDIT is as follows:

>**FEDIT** ***[options] fontfile.fnt]*** *<CR>*

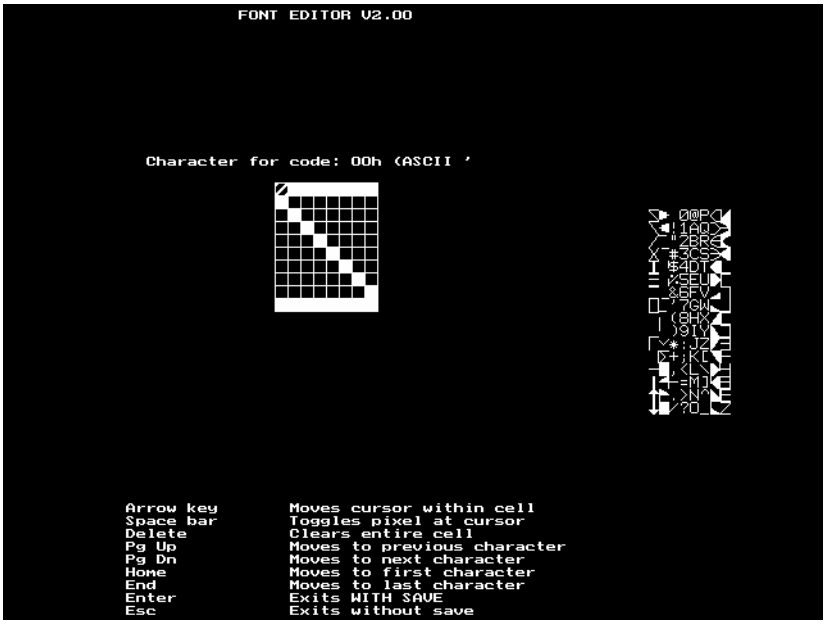
where [***options]*** begin with one or more of the following user-switches:

User Switch	Function
/bNN	set NN bytes per char (6-32, default 16)
/cNNN	set code of first char to NNN ADE (default 0)
/fCCCCCCCC	set font name to CCCCCCCC (defaults to filename)
/hNN	set cell height to NN pixels (6-24, default 10)
/nNNN	set NNN chars in set (default 128)
/wN	set cell width to N pixels (4-8, default 8)
/?	request this help message

To use FEDIT for creating emulator fonts, the defaults are used. Thus, one can start the utility simply by typing:

>FEDIT filename.fnt

The following illustration shows what the FEDIT screen looks like when editing the file 88PROCES.FNT.

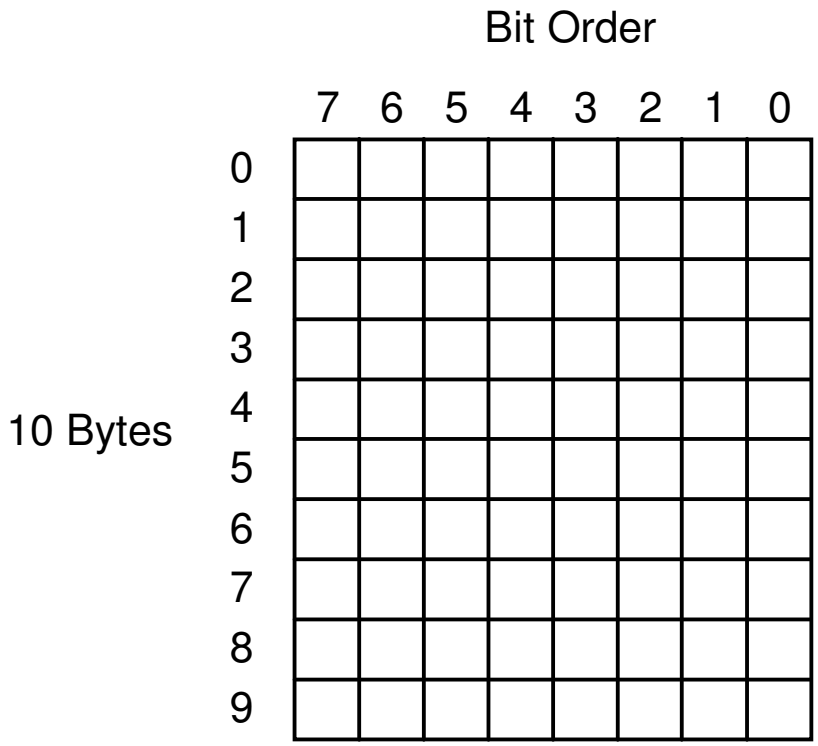


Notice that eight (8) columns of 16 characters each are displayed on the right-hand side of the screen display. Characters are shown in their actual screen matrix size. The arrangement of the characters is shown in the following chart.

32 Flag On	64 Upper Case	32 Flag Off
G00 G16	G32 G48 G64 G80	G96 G112
G01 G17	G33 G49 G65 G81	G97 G113
G02 G18	G34 G50 G66 G82	G98 G114
G03 G19	G35 G51 G67 G83	G99 G115
G04 G20	G36 G52 G68 G84	G100 G116
G05 G21	G37 G53 G69 G85	G101 G117
G06 G22	G38 G54 G70 G86	G102 G118
G07 G23	G39 G55 G71 G87	G103 G119
G08 G24	G40 G56 G72 G88	G104 G120
G09 G25	G41 G57 G73 G89	G105 G121
G10 G26	G42 G58 G74 G90	G106 G122
G11 G27	G43 G59 G75 G91	G107 G123
G12 G28	G44 G60 G76 G92	G108 G124
G13 G29	G45 G61 G77 G93	G109 G125
G14 G30	G46 G62 G78 G94	G110 G126
G15 G31	G47 G63 G79 G95	G111 G127

Display and Character Sets

A character graphics matrix is displayed in expanded form on the left-hand side of the FEDIT screen. It represents the character cell currently being edited. Above the matrix is the code of the character in hex to be edited.



The commands available to move the edit cursor and selection of each character are also shown at the bottom of the display.

Key Sequence	Function
Arrow Key	Moves cursor in cell
Space Bar	Toggles pixel at cursor
Delete	Clears cell
Pg Up	Moves to previous char
Pg Dn	Moves to next char
Home	Moves to first char
End	Moves to last char
Enter	Exits with save
Esc	Exits without save

Use the commands above to practice editing the 88PROCES.FNT file. Any changes made to the file can be aborted by pressing the Esc key.

MAKE SURE TO EDIT ONLY THE FONT FILES ON YOUR HARD DISK DRIVE. Do not edit the font files on the emulator distribution disk.

Since the altered character font will have the same name as the original file, be careful not to get confused which is which. It is advisable to make note of time/date stamp of the newly created filename as your desired file. This should be backed-up to a floppy for archive purposes.

Appendix A
Chart of Character Codes

Character Codes 0 to 31

Decimal Code	Hex Code	Octal Code	Binary Code	Keyboard	Display Symbol	ASCII Char
0	00	000	00000000	Ctrl @		<NUL>
1	01	001	00000001	Ctrl A		<SOH>
2	02	002	00000010	Ctrl B		<STX>
3	03	003	00000011	Ctrl C		<ETX>
4	04	004	00000100	Ctrl D		<EOT>
5	05	005	00000101	Ctrl E		<ENQ>
6	06	006	00000110	Ctrl F		<ACK>
7	07	007	00000111	Ctrl G		<BEL>
8	08	010	00001000	Ctrl H		<BS>
9	09	011	00001001	Ctrl I		<HT>
10	0A	012	00001010	Ctrl J		<LF>
11	0B	013	00001011	Ctrl K		<VT>
12	0C	014	00001100	Ctrl L		<FF>
13	0D	015	00001101	Ctrl M		<CR>
14	0E	016	00001110	Ctrl N		<SO>
15	0F	017	00001111	Ctrl O		<SI>
16	10	020	00010000	Ctrl P		<DLE>
17	11	021	00010001	Ctrl Q		<DC1>
18	12	022	00010010	Ctrl R		<DC2>
19	13	023	00010011	Ctrl S		<DC3>
20	14	024	00010100	Ctrl T		<DC4>
21	15	025	00010101	Ctrl U		<NAK>
22	16	026	00010110	Ctrl V		<SYN>
23	17	027	00010111	Ctrl W		<ETB>
24	18	030	00011000	Ctrl X		<CAN>
25	19	031	00011001	Ctrl Y		<EM>
26	1A	032	00011010	Ctrl Z		<SUB>
27	1B	033	00011011	Ctrl [		<ESC>
28	1C	034	00011100	Ctrl \		<FS>
29	1D	035	00011101	Ctrl]		<GS>
30	1E	036	00011110	Ctrl ^		<RS>
31	1F	037	00011111	Ctrl _		<US>

Character Codes 32 to 63

Decimal Code	Hex Code	Octal Code	Binary Code	Keyboard	Display Symbol	ASCII Char
32	20	040	00100000	Space	G32	
33	21	041	00100001	!	G33	!
34	22	042	00100010	"	G34	"
35	23	043	00100011	#	G35	#
36	24	044	00100100	$	G36	$
37	25	045	00100101	%	G37	%
38	26	046	00100110	&	G38	&
39	27	047	00100111	'	G39	'
40	28	050	00101000	(	G40	(
41	29	051	00101001	)	G41	)
42	2A	052	00101010	*	G42	*
43	2B	053	00101011	+	G43	+
44	2C	054	00101100	,	G44	,
45	2D	055	00101101	-	G45	-
46	2E	056	00101110	.	G46	.
47	2F	057	00101111	/	G47	/
48	30	060	00110000	0	G48	0
49	31	061	00110001	1	G49	1
50	32	062	00110010	2	G50	2
51	33	063	00110011	3	G51	3
52	34	064	00110100	4	G52	4
53	35	065	00110101	5	G53	5
54	36	066	00110110	6	G54	6
55	37	067	00110111	7	G55	7
56	38	070	00111000	8	G56	8
57	39	071	00111001	9	G57	9
58	3A	072	00111010	:	G58	:
59	3B	073	00111011	;	G59	;
60	3C	074	00111100	<	G60	<
61	3D	075	00111101	=	G61	=
62	3E	076	00111110	>	G62	>
63	3F	077	00111111	?	G63	?

Character Codes 64 to 95

Decimal Code	Hex Code	Octal Code	Binary Code	Keyboard	Display Symbol	ASCII Char
64	40	100	01000000	@	G64	@
65	41	101	01000001	A	G65	A
66	42	102	01000010	B	G66	B
67	43	103	01000011	C	G67	C
68	44	104	01000100	D	G68	D
69	45	105	01000101	E	G69	E
70	46	106	01000110	F	G70	F
71	47	107	01000111	G	G71	G
72	48	110	01001000	H	G72	H
73	49	111	01001001	I	G73	I
74	4A	112	01001010	J	G74	J
75	4B	113	01001011	K	G75	K
76	4C	114	01001100	L	G76	L
77	4D	115	01001101	M	G77	M
78	4E	116	01001110	N	G78	N
79	4F	117	01001111	O	G79	O
80	50	120	01010000	P	G80	P
81	51	121	01010001	Q	G81	Q
82	52	122	01010010	R	G82	R
83	53	123	01010011	S	G83	S
84	54	124	01010100	T	G84	T
85	55	125	01010101	U	G85	U
86	56	126	01010110	V	G86	V
87	57	127	01010111	W	G87	W
88	58	130	01011000	X	G88	X
89	59	131	01011001	Y	G89	Y
90	5A	132	01011010	Z	G90	Z
91	5B	133	01011011	[	G91	[
92	5C	134	01011100	\	G92	\
93	5D	135	01011101	]	G93	]
94	5E	136	01011110	^	G94	^
95	5F	137	01011111	_	G95	_

Character Codes 96 to 127

Decimal Code	Hex Code	Octal Code	Binary Code	Keyboard	Display Symbol	ASCII Char
96	60	140	01100000	`	G0 or G96	`
97	61	141	01100001	a	G1 or G97	a
98	62	142	01100010	b	G2 or G98	b
99	63	143	01100011	c	G3 or G99	c
100	64	144	01100100	d	G4 or G100	d
101	65	145	01100101	e	G5 or G101	e
102	66	146	01100110	f	G6 or G102	f
103	67	147	01100111	g	G7 or G103	g
104	68	150	01101000	h	G8 or G104	h
105	69	151	01101001	i	G9 or G105	i
106	6A	152	01101010	j	G10 or G106	j
107	6B	153	01101011	k	G11 or G107	k
108	6C	154	01101100	l	G12 or G108	l
109	6D	155	01101101	m	G13 or G109	m
110	6E	156	01101110	n	G14 or G110	n
111	6F	157	01101111	o	G15 or G111	o
112	70	160	01110000	p	G16 or G112	p
113	71	161	01110001	q	G17 or G113	q
114	72	162	01110010	r	G18 or G114	r
115	73	163	01110011	s	G19 or G115	s
116	74	164	01110100	t	G20 or G116	t
117	75	165	01110101	u	G21 or G117	u
118	76	166	01110110	v	G22 or G118	v
119	77	167	01110111	w	G23 or G119	w
120	78	170	01111000	x	G24 or G120	x
121	79	171	01111001	y	G25 or G121	y
122	7A	172	01111010	z	G26 or G122	z
123	7B	173	01111011	{	G27 or G123	{
124	7C	174	01111100	|	G28 or G124	|
125	7D	175	01111101	}	G29 or G125	}
126	7E	176	01111110	~	G30 or G126	~
127	7F	177	01111111	Del	G31 or G127	<DEL>

Character Codes 128 to 159

Decimal Code	Hex Code	Octal Code	Binary Code	Keyboard	Display Symbol	ASCII Char
128	80	200	10000000	Alt @		
129	81	201	10000001	Alt A		
130	82	202	10000010	Alt B		
131	83	203	10000011	Alt C		
132	84	204	10000100	Alt D		
133	85	205	10000101	Alt E		
134	86	206	10000110	Alt F		
135	87	207	10000111	Alt G		
136	88	210	10001000	Alt H		
137	89	211	10001001	Alt I		
138	8A	212	10001010	Alt J		
139	8B	213	10001011	Alt K		
140	8C	214	10001100	Alt L		
141	8D	215	10001101	Alt M		
142	8E	216	10001110	Alt N		
143	8F	217	10001111	Alt O		
144	90	220	10010000	Alt P		
145	91	221	10010001	Alt Q		
146	92	222	10010010	Alt R		
147	93	223	10010011	Alt S		
148	94	224	10010100	Alt T		
149	95	225	10010101	Alt U		
150	96	226	10010110	Alt V		
151	97	227	10010111	Alt W		
152	98	230	10011000	Alt X		
153	99	231	10011001	Alt Y		
154	9A	232	10011010	Alt Z		
155	9B	233	10011011	Alt [		
156	9C	234	10011100	Alt \		
157	9D	235	10011101	Alt]		
158	9E	236	10011110	Alt ^		
159	9F	237	10011111	Alt _		

Character Codes 160 to 191

Decimal Code	Hex Code	Octal Code	Binary Code	Keyboard	Display Symbol	ASCII Char
160	A0	240	10100000	Atl 0		
161	A1	241	10100001	Ctrl !		
162	A2	242	10100010	Ctrl "		
163	A3	243	10100011	Ctrl #		
164	A4	244	10100100	Ctrl $		
165	A5	245	10100101	Ctrl %		
166	A6	246	10100110	Ctrl &		
167	A7	247	10100111	Ctrl '		
168	A8	250	10101000	Ctrl (		
169	A9	251	10101001	Ctrl)		
170	AA	252	10101010	Ctrl *		
171	AB	253	10101011	Ctrl +		
172	AC	254	10101100	Ctrl ,		
173	AD	255	10101101	Ctrl -		
174	AE	256	10101110	Ctrl .		
175	AF	257	10101111	Ctrl /		
176	B0	260	10110000	Ctrl 0		
177	B1	261	10110001	Ctrl 1		
178	B2	262	10110010	Ctrl 2		
179	B3	263	10110011	Ctrl 3		
180	B4	264	10110100	Ctrl 4		
181	B5	265	10110101	Ctrl 5		
182	B6	266	10110110	Ctrl 6		
183	B7	267	10110111	Ctrl 7		
184	B8	270	10111000	Ctrl 8		
185	B9	271	10111001	Ctrl 9		
186	BA	272	10111010	Ctrl :		
187	BB	273	10111011	Ctrl ;		
188	BC	274	10111100	Ctrl <		
189	BD	275	10111101	Ctrl =		
190	BE	276	10111110	Ctrl >		
191	BF	277	10111111	Ctrl ?		

Character Codes 192 to 223

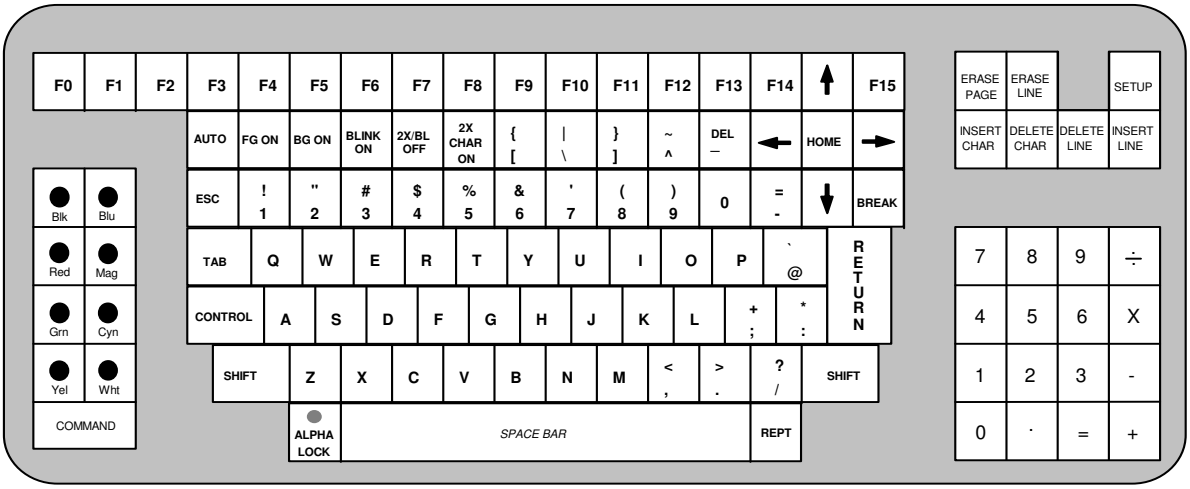
Decimal Code	Hex Code	Octal Code	Binary Code	Keyboard	Display Symbol	ASCII Char
192	C0	300	11000000	Alt '192'		
193	C1	301	11000001	Ctrl F1		
194	C2	302	11000010	Ctrl F2		
195	C3	303	11000011	Ctrl F3		
196	C4	304	11000100	Ctrl F4		
197	C5	305	11000101	Ctrl F5		
198	C6	306	11000110	Ctrl F6		
199	C7	307	11000111	Ctrl F7		
200	C8	310	11001000	Ctrl F8		
201	C9	311	11001001	Ctrl F9		
202	CA	312	11001010	Ctrl F10		
203	CB	313	11001011	Ctrl F11		
204	CC	314	11001100	Ctrl F12		
205	CD	315	11001101	Alt '205'		
206	CE	316	11001110	Alt '206'		
207	CF	317	11001111	Alt '207'		
208	D0	320	11010000	Alt '208'		
209	D1	321	11010001	Shift F1		
210	D2	322	11010010	Shift F2		
211	D3	323	11010011	Shift F3		
212	D4	324	11010100	Shift F4		
213	D5	325	11010101	Shift F5		
214	D6	326	11010110	Shift F6		
215	D7	327	11010111	Shift F7		
216	D8	330	11011000	Shift F8		
217	D9	331	11011001	Shift F9		
218	DA	332	11011010	Shift F10		
219	DB	333	11011011	Shift F11		
220	DC	334	11011100	Shift F12		
221	DD	335	11011101	Alt '221'		
222	DE	336	11011110	Alt '222'		
223	DF	337	11011111	Alt '223'		

Character Codes 224 to 255

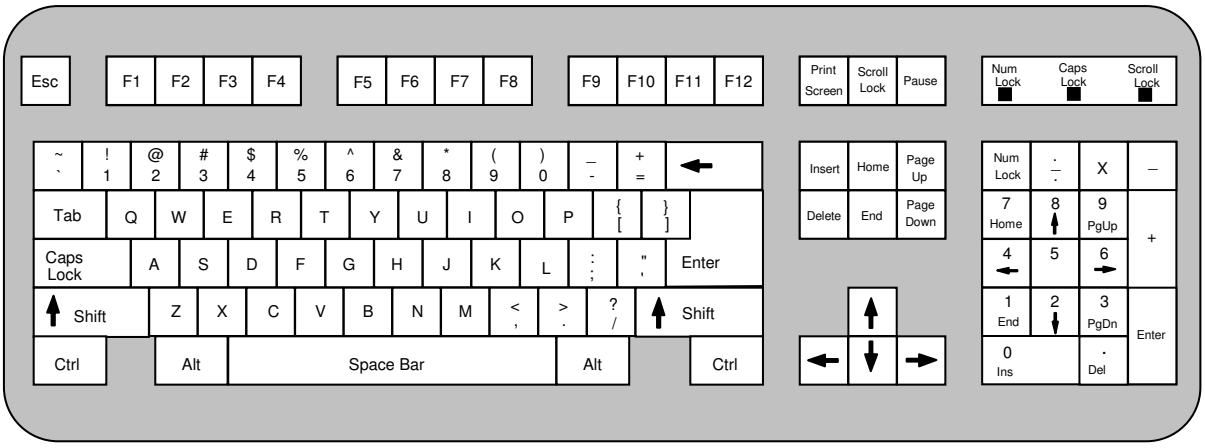
Decimal Code	Hex Code	Octal Code	Binary Code	Keyboard	Display Symbol	ASCII Char
224	E0	340	11100000	Alt ‘224’		
225	E1	341	11100001	Alt F1		
226	E2	342	11100010	Alt F2		
227	E3	343	11100011	Alt F3		
228	E4	344	11100100	Alt F4		
229	E5	345	11100101	Alt F5		
230	E6	346	11100110	Alt F6		
231	E7	347	11100111	Alt F7		
232	E8	350	11101000	Alt F8		
233	E9	351	11101001	Alt F9		
234	EA	352	11101010	Alt F10		
235	EB	353	11101011	Alt F11		
236	EC	354	11101100	Alt F12		
237	ED	355	11101101	Alt ‘237’		
238	EE	356	11101110	Alt ‘238’		
239	EF	357	11101111	Alt ‘239’		
240	F0	360	11110000	Alt ‘240’		
241	F1	361	11110001	F1		
242	F2	362	11110010	F2		
243	F3	363	11110011	F3		
244	F4	364	11110100	F4		
245	F5	365	11110101	F5		
246	F6	366	11110110	F6		
247	F7	367	11110111	F7		
248	F8	370	11111000	F8		
249	F9	371	11111001	F9		
250	FA	372	11111010	F10		
251	FB	373	11111011	F11		
252	FC	374	11111100	F12		
253	FD	375	11111101	Alt ‘253’		
254	FE	376	11111110	Alt ‘254’		
255	FF	377	11111111	Alt ‘255’		

Appendix B
Keyboard Layouts

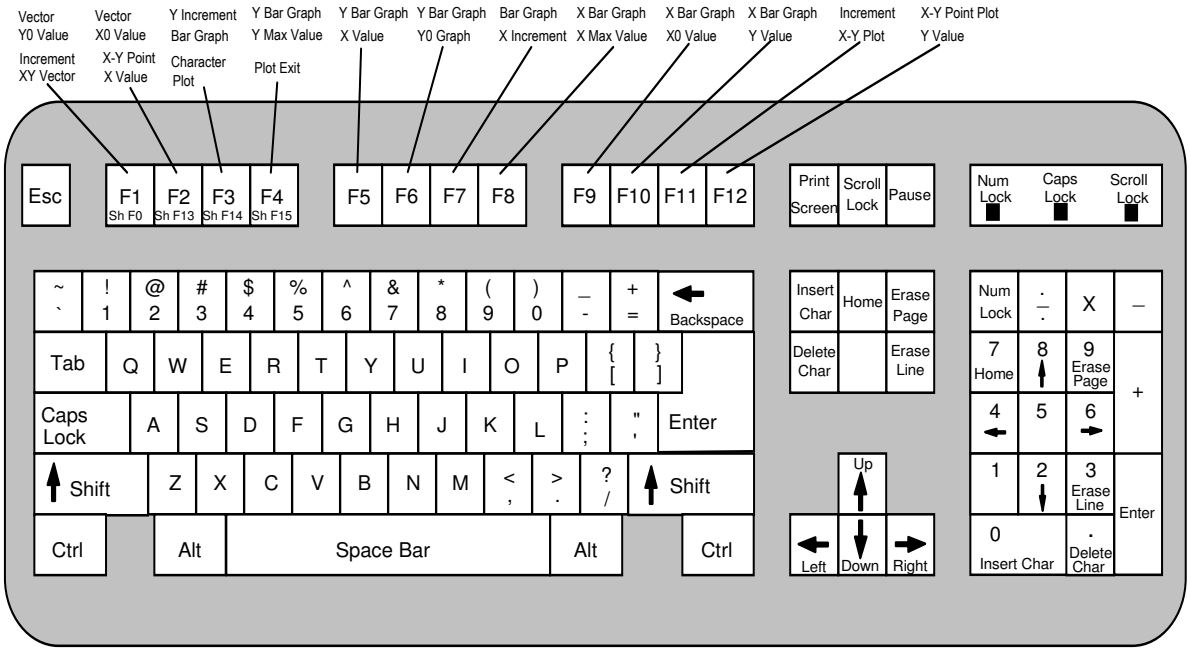
Layout of the 8001/8800 Terminal Keyboard



Layout of a PC Style 101-key Keyboard



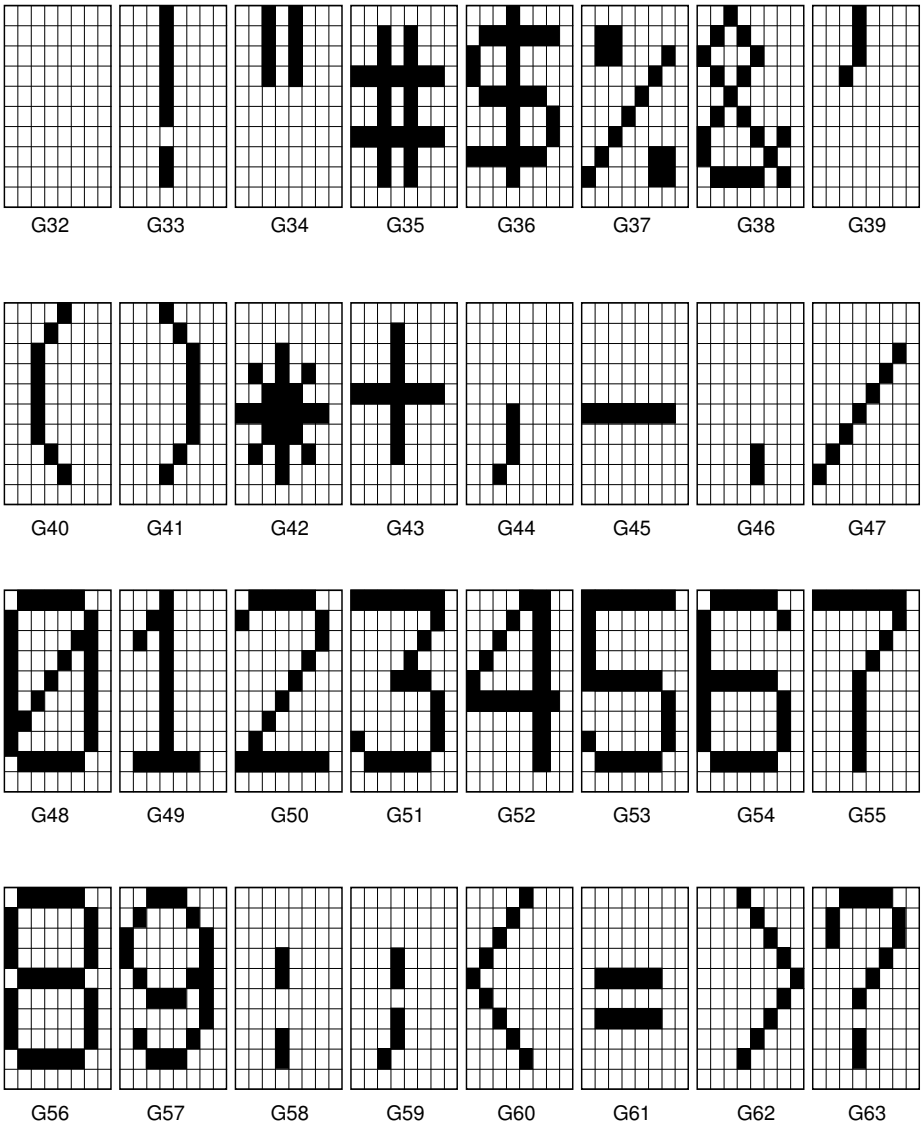
Layout of the PC 101-key Keyboard
Showing Mappings to Terminal Keyboard Keys



Appendix C
Standard Fonts

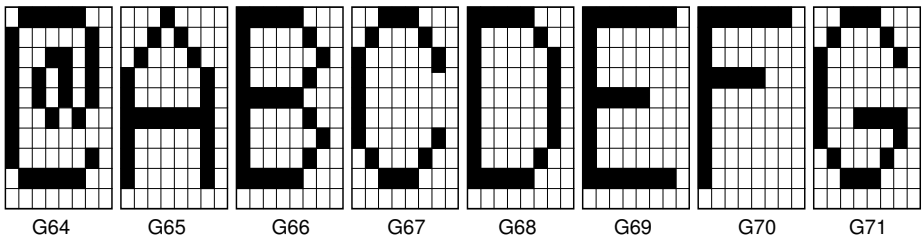
STANDARD UPPERCASE CHARACTERS (G32 THROUGH G63)

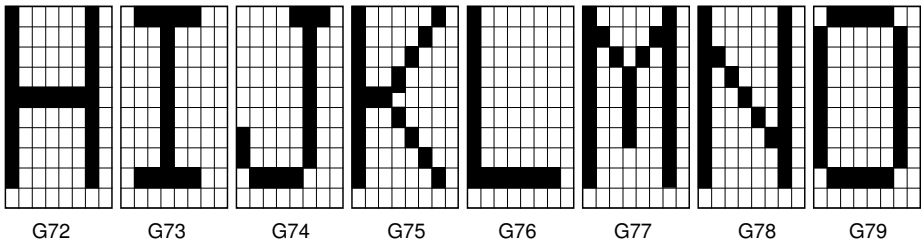
(Common to <u>all</u> font files except PLOT.)

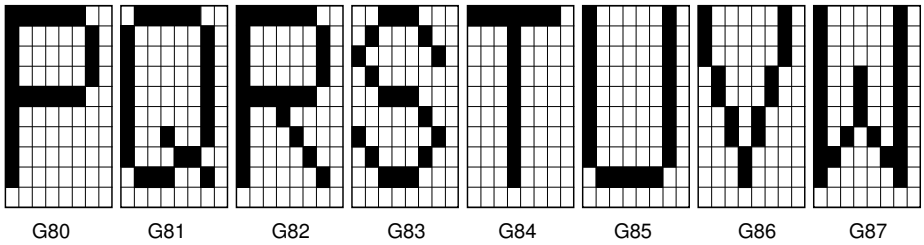


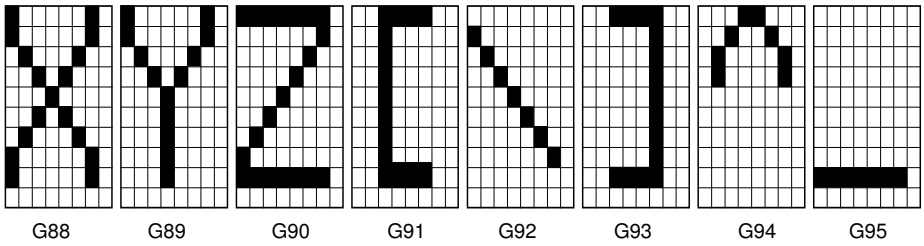
STANDARD UPPERCASE CHARACTERS (G64 THROUGH G95)

(Common to <u>all</u> font files except PLOT.)



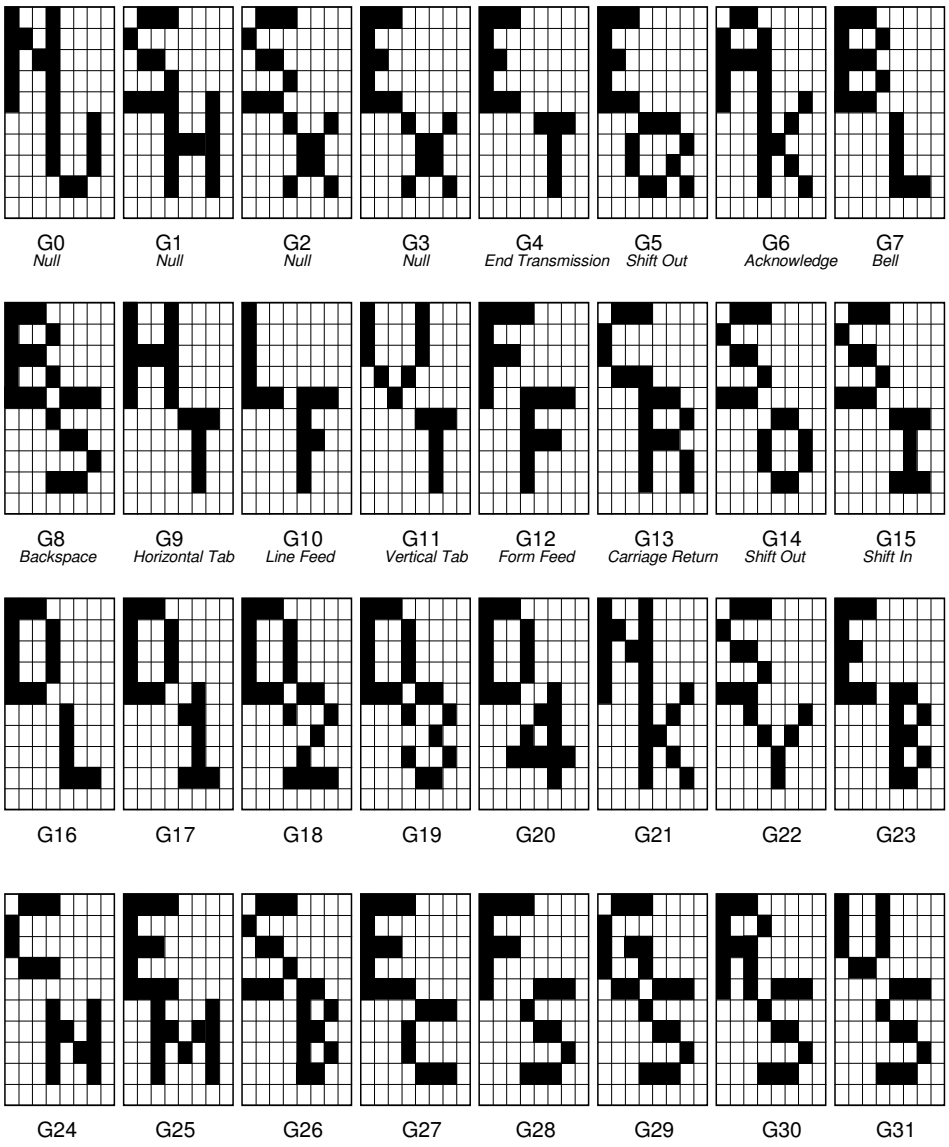






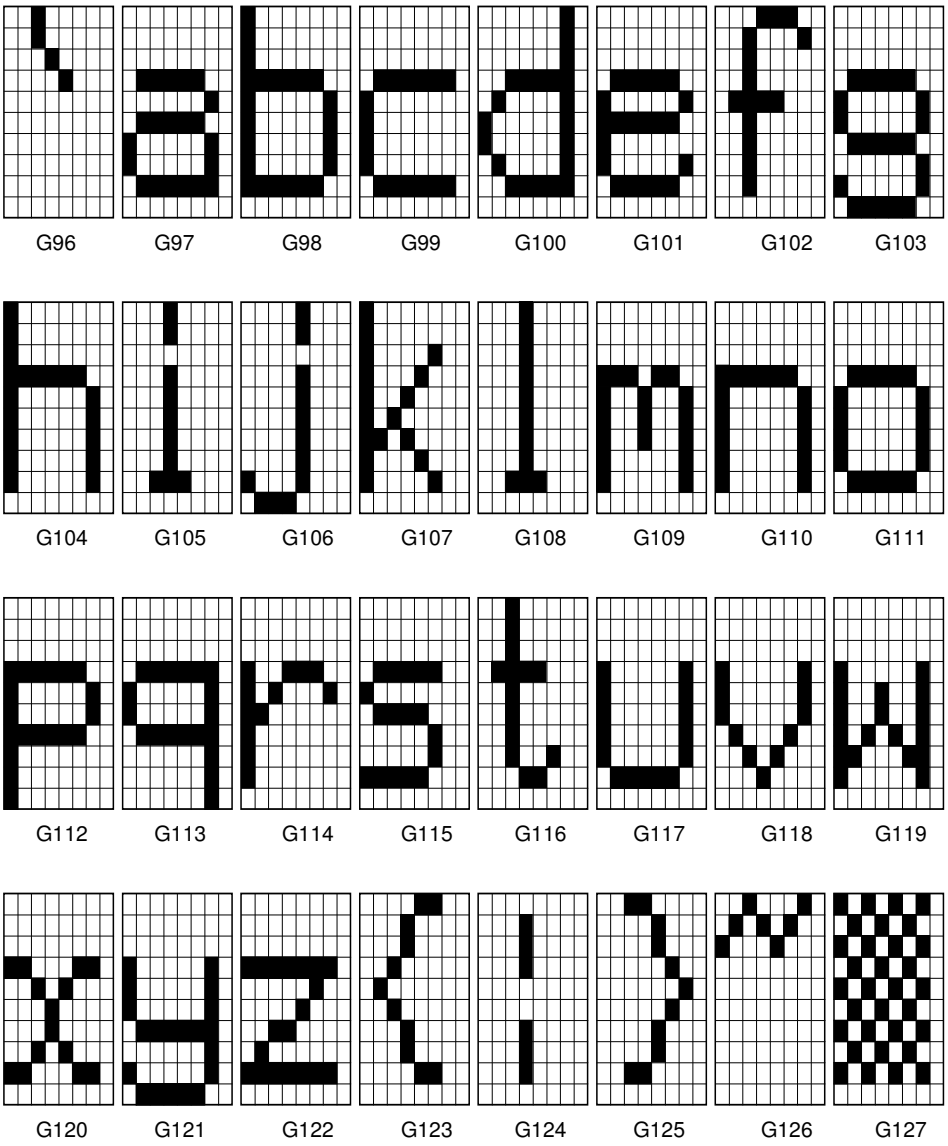
CONTROL REPRESENTATION CHARACTERS - *FLAG ON* (G0 through G31)

(Lowercase ASCII font file only)



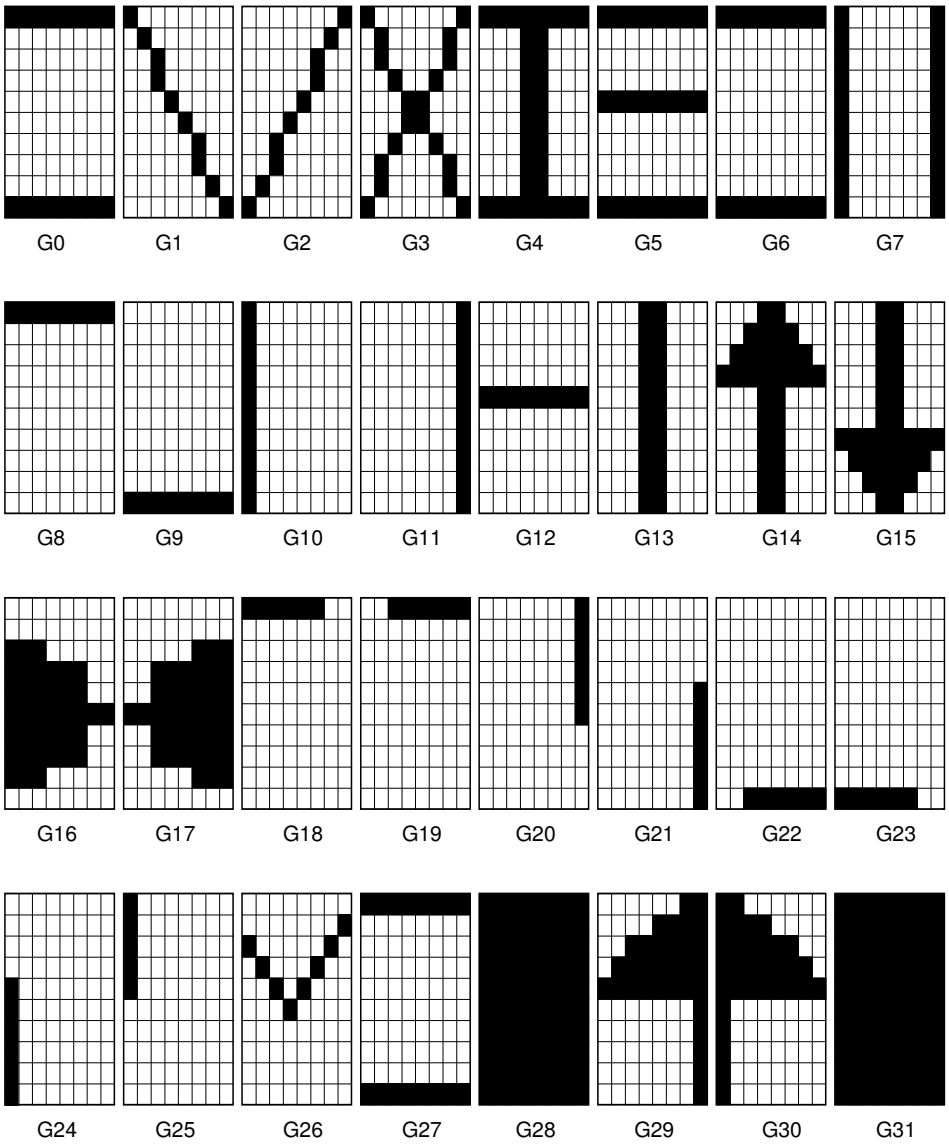
LOWERCASE CHARACTERS - *FLAG OFF* (G96 through G127)

(Lowercase ASCII font file only)



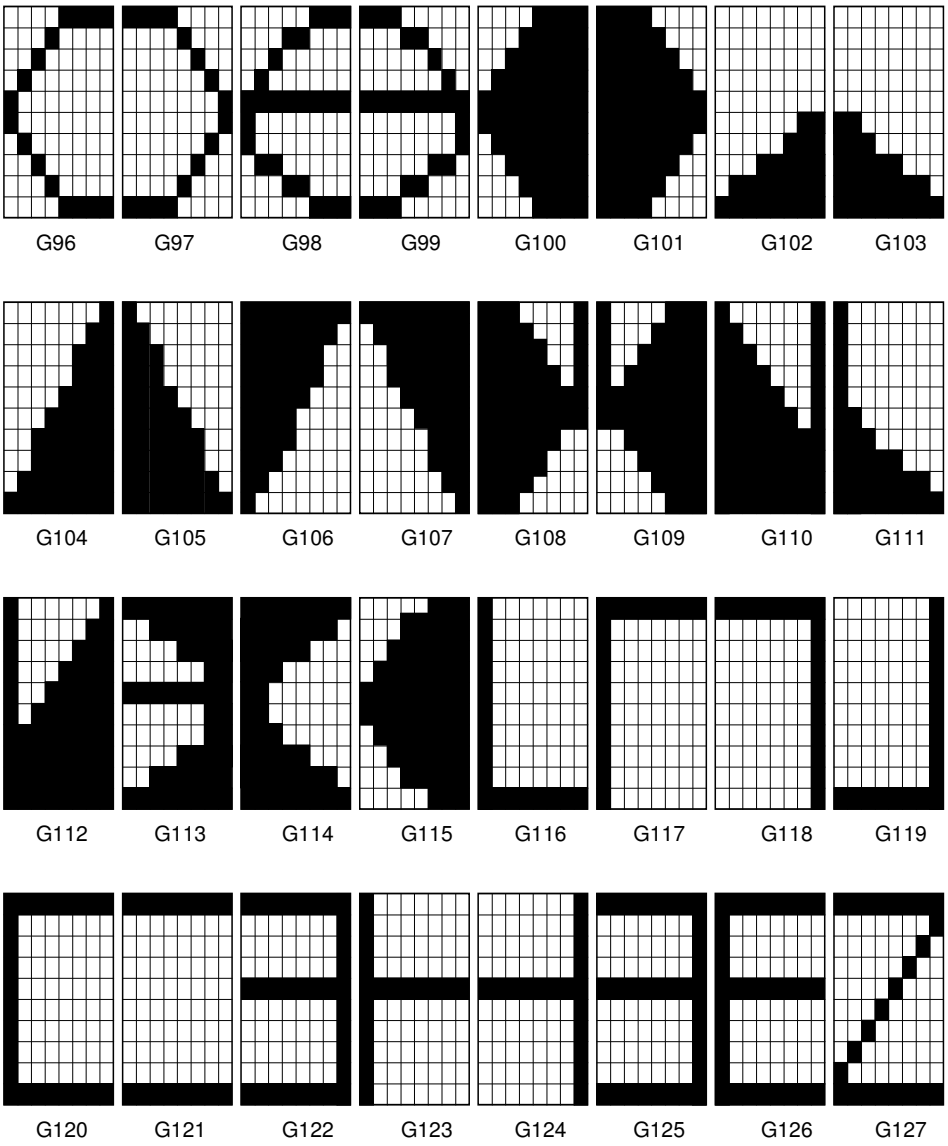
PROCESS CHARACTERS - FLAG ON (G0 through G31)

(PROCESS font file only)



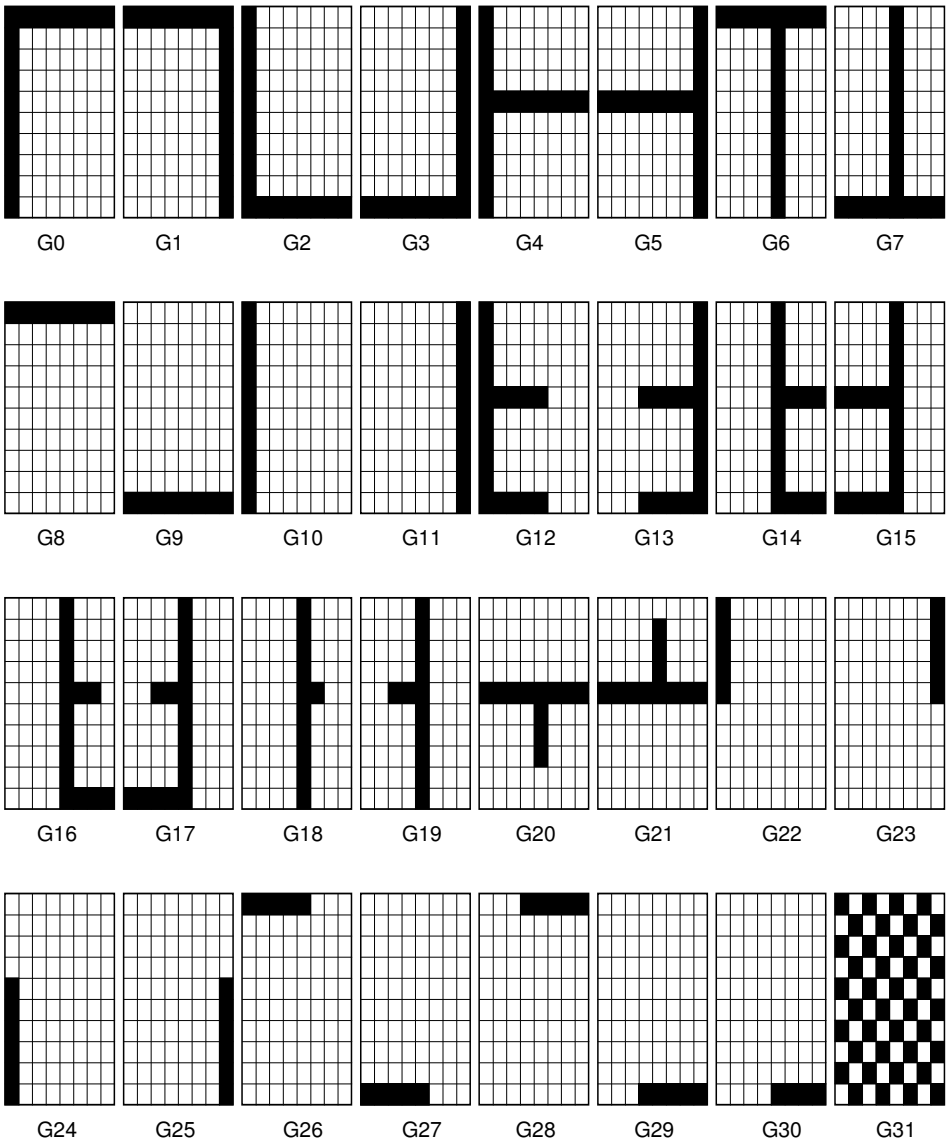
PROCESS CHARACTERS - FLAG OFF (G96 through G127)

(PROCESS font file only)



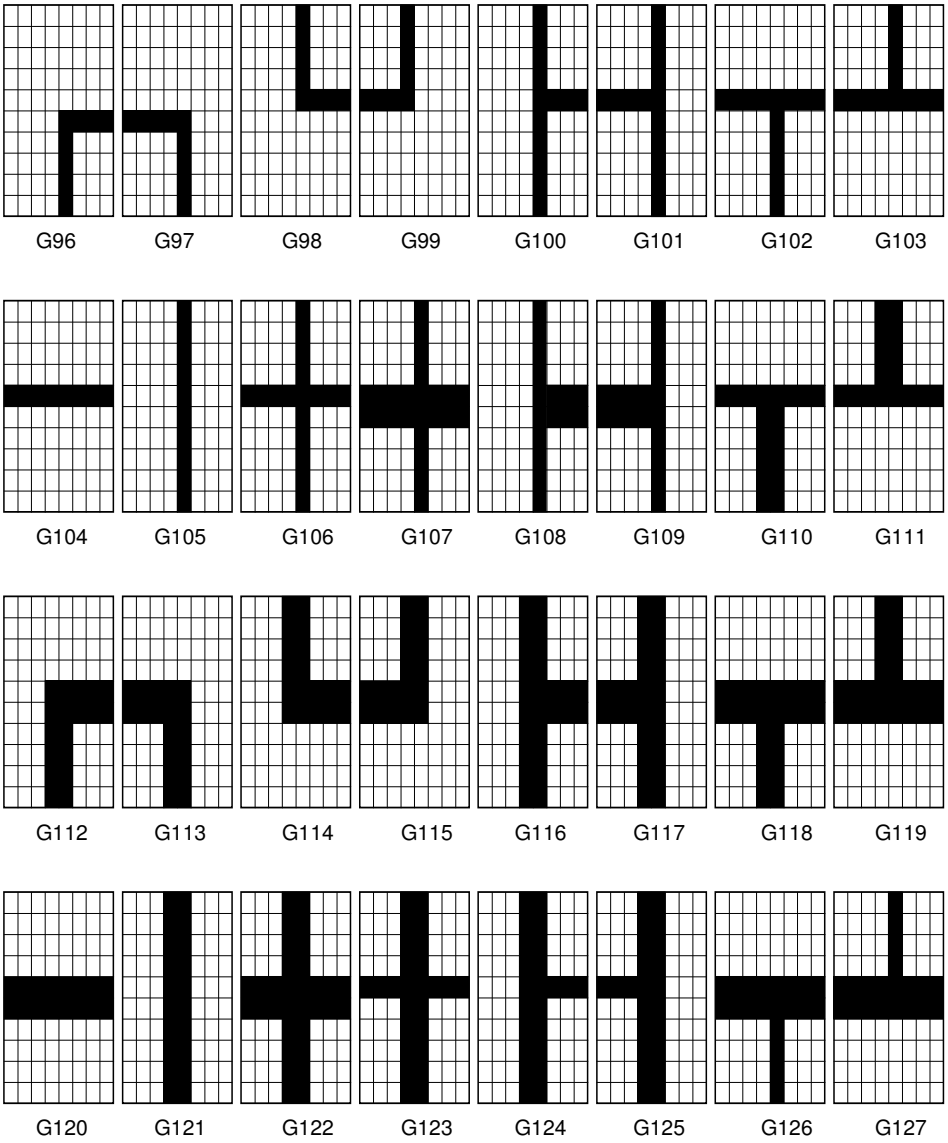
FORMS CHARACTERS - FLAG ON (G0 through G31)

(FORMS font file only)



FORMS CHARACTERS - FLAG OFF (G96 through G127)

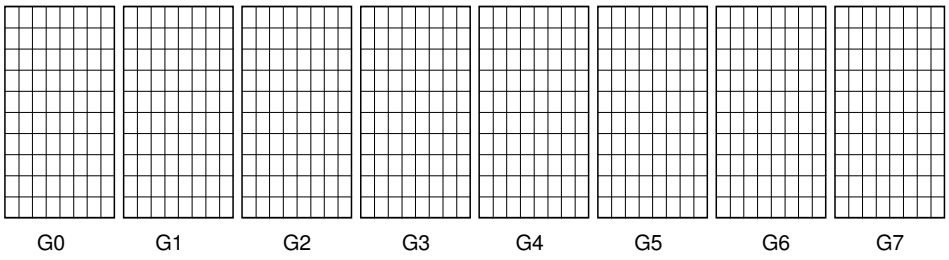
(FORMS font file only)

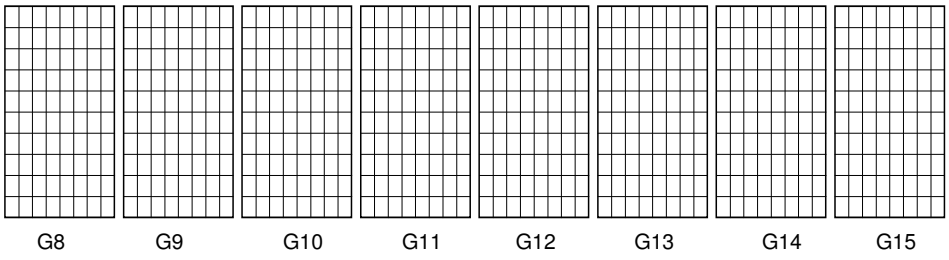


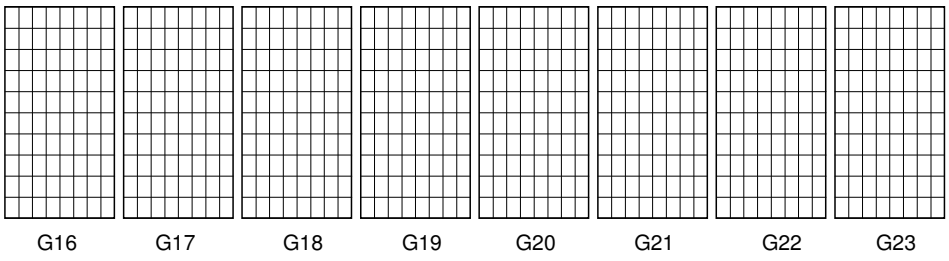
Appendix D
Character Worksheets

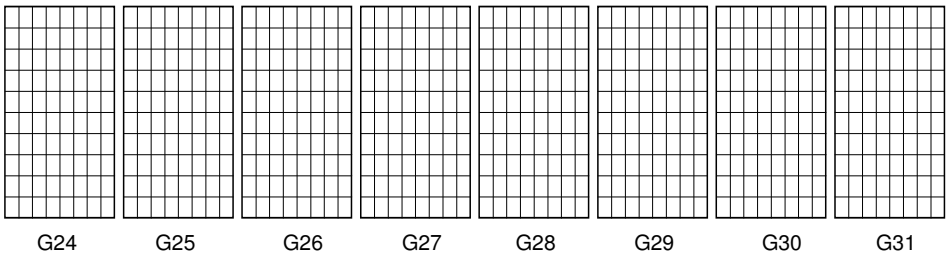
CHARACTER WORKSHEET - *FLAG ON* (G0 through G31)

(Emulator's Standard 8 x 10 Matrix)



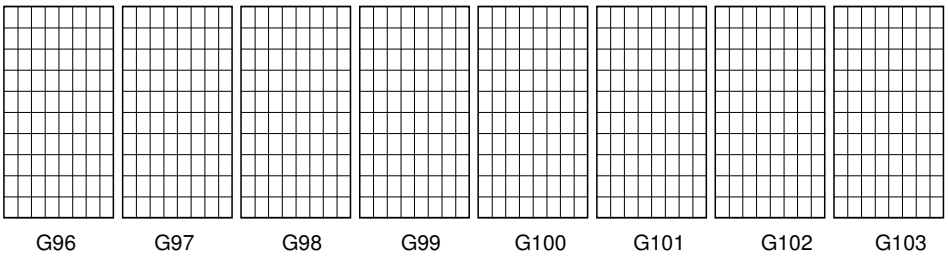




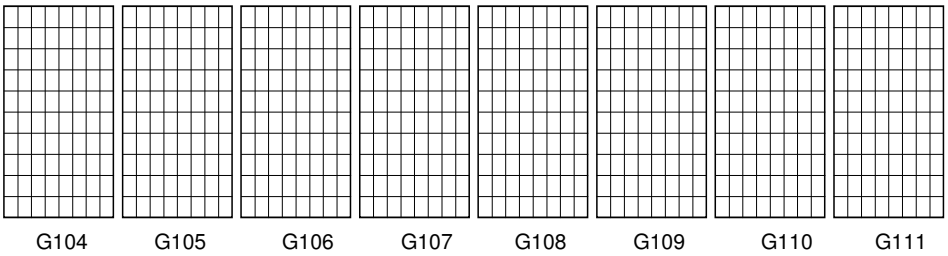


CHARACTER WORKSHEET - *FLAG OFF* (G96 through G127)

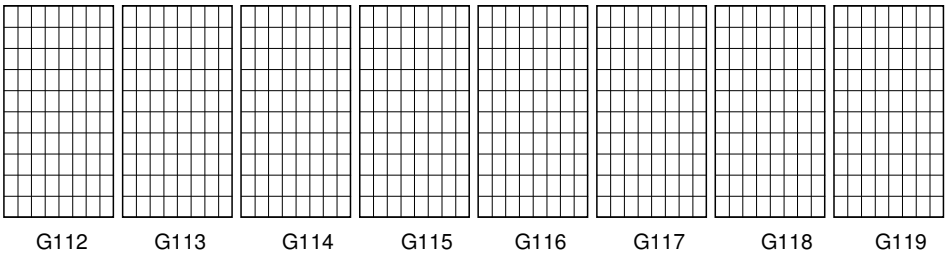
(Emulator's Standard 8 x 10 Matrix)



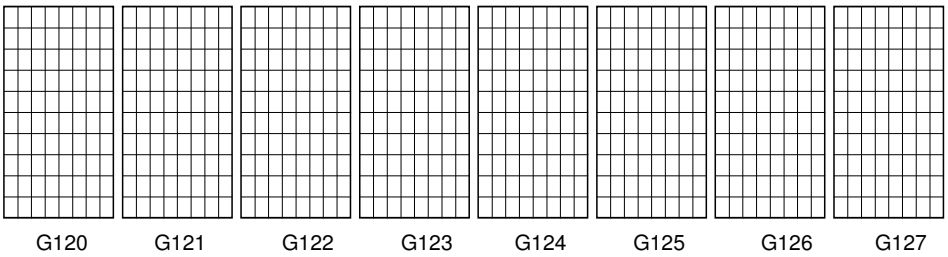
G96 G97 G98 G99 G100 G101 G102 G103



G104 G105 G106 G107 G108 G109 G110 G111



G112 G113 G114 G115 G116 G117 G118 G119



G120 G121 G122 G123 G124 G125 G126 G127

Appendix E
Command Reference

Alpha Mode Commands

Variable arguments are byte values. Curly braces indicate optional arguments and are not themselves parts of commands.

Command	**Syntax**	**Variable Arguments**
Enter Protected Fields Mode	<SOH> *fill_char*	fill_char = the character that will be used to erase the contents of unprotected fields
Enter Plot Mode	<STX>	
Position Cursor	<ETX> *x y* { *bx by bcci* }	x (byte) = column 0 to 79 y (byte) = row 0 to 47 bx (byte) = column 0 to 79, blind cursor, when x > 80 by (byte) = row 0 to 47, blind cursor when x > 80 bcci = composite color byte for blind mode, when x > 80
Set Attributes	<ACK> *cci*	cci = a byte representing a combination of BG color, FG color and blink state. Bits 0-2 = BG color Bits 3-5 = FG color Bit 6 = Blink
Sound Tone	<BEL>	
Cursor Home	<BS>	
Tab Cursor	<HT>	
Cursor Next Line	<LF>	
Erase Line	<VT>	
Erase Page	<FF>	

Alpha Mode Commands, cont.

Variable arguments are byte values. Curly braces indicate optional arguments and are not themselves parts of commands.

Command	Syntax	Variable Arguments
Cursor Beginning of Line	<CR>	
Set 2X High Characters	<SO>	
Set 1X High Characters, Blink Off	<SI>	
Set Color Black	<DLE>	
Set Color Red	<DC1>	
Set Color Green	<DC2>	
Set Color Yellow	<DC3>	
Set Color Blue	<DC4>	
Set Color Magenta	<NAK>	
Set Color Cyan	<SYN>	
Set Color White	<ETB>	
Block Transmit	<CAN>	
Cursor Right	<EM>	
Cursor Left	<SUB>	
Cursor Up	<FS>	
Flag Off	<GS>	
Flag On	<RS>	
Blink On	<US>	

Alpha Mode Commands, cont.

Variable arguments are byte values. Curly braces indicate optional arguments and are not themselves parts of commands.

Command	**Syntax**	**Variable Arguments**
Use Blind Cursor	<ESC> A	
Enter Color Pad Plot Mode	<ESC> B	
Report Cursor	<ESC> C	
Enter Fastscreen Mode	<ESC> D	
Set Local Echo Off	<ESC> F	
Set Local Echo On	<ESC> H	
Set Cursor Autoincrement Vertical Mode	<ESC> J	
Set Cursor Scroll Mode	<ESC> K	
Set Keyboard Local	<ESC> L	
Dump Screen to Printer	<ESC> M *byte_arg*	byte_arg: See discussion in the chapter on printing.
Set Insert Character Mode	<ESC> Q	
Enter Dot Addressable Graphics Mode, or Set Cursor Autoincrement Left Mode	<ESC> T	
Insert Line	<ESC> U	
Delete Line	<ESC> V	
Set Cursor Autoincrement Right Mode	<ESC> X	
Fill Screen	<ESC> Y *char*	char: The character to be used to fill the screen
Set Cursor Autoincrement 45 Degrees Down Mode	<ESC> Z	

Alpha Mode Commands, cont.

Variable arguments are byte values. Curly braces indicate optional arguments and are not themselves parts of commands.

Command	**Syntax**	**Variable Arguments**
Exit Blind Cursor Mode	<ESC> <ESC>	
Erase Dot Addressable Graphics, or Set Cursor Autoincrement 45 Degrees Up Mode	<ESC> \	
Block Receive	<ESC>]	

ANSI X3.64 Extended Alpha Mode Commands (executable when /STRICTG is not used at startup). Curly braces indicated optional arguments and are not parts of the commands.

Command	**Syntax**	**Variable Arguments**
Power Failure Indicator (PFL)	(not implemented)	
Set Mode (SM)	<ESC> [*pn* { ; *pn* ... } h	pn: 2 = Keyboard disable 29 = Default Function Keys 31 = Function Key Rate Fast
Reset Mode (RM)	<ESC> [*pn* { ; *pn* ... } l	pn: 2 = Keyboard enable 29 = User Defined Function Keys 31 = Function Key Rate Slow
Select Character Set (SCS)	<ESC> (*pn*	pn: B = Lowercase ASCII C = Process D = Forms E = Custom 1 F = Custom 2 G = Custom 3 H = Custom 4
Select Page (SP)	<ESC> [*pn* { ; *pn* ... } p	pn: 1, 2, 3 or 4 = writeable page 11, 12, 13 or 14 = displayed page 10 = current displayed page

Alpha Mode Commands, cont.

ANSI X3.64 Extended Alpha Mode Commands are executable when /STRICTG is not used at startup. Curly braces indicated optional arguments and are not parts of the commands.

Command	**Syntax**	**Variable Arguments**
Program Function Key (PPFK)	<ESC> [*pk* ; *pn* { ; *pn* ... } s	pk: 0 to 63 = key identifier pn: decimal code of character to be assigned to key
Set Cursor Position (CUP)	<ESC> [*row* ; *col* H	row: 0 to 47 col: 0 to 79
Erase Display (ED)	<ESC> [*pn* J	pn: 0 = from the active position 1 = to the active position 2 = full screen
Horizontal and Vertical Tabulation (HVP)	<ESC> [*row* ; *col* f	row: 0 to 79 col: 0 to 47
Set Margins (PMRG)	<ESC> [*top* ; *bot* r	top: 0 to 47 bot: 0 to 47
Private Set Mode (PSM)	<ESC> [? *pn* { ; *pn* ... } h	3 = Disable Setup entry 6 = Enable Private Origin Mode 29 = Default Function Keys 31 = Function Key Rate Fast
Private Reset Mode (PRM)	<ESC> [? *pn* { ; *pn* ... } l	3 = Enable Setup entry 6 = Disable Private Origin Mode 29 = User Defined Function Keys 31 = Function Key Rate Slow

Protect Mode Commands

Protected Fields Mode Commands (executable when Protect Mode has been enabled in Setup and the mode has been entered with <SOH>)

Command	**Syntax**	**Variable Arguments**
Exit Protect Mode to Alpha Mode	<SOH> <ESC>	
Move to first unprotected field	<BS>	
Move to beginning of next unprotected field	<HT>	
Move to beginning of first unprotected field on next line	<LF>	
Erase from current position to end of current unprotected field	<VT>	
Erase from current position to end of last unprotected field on page	<FF>	
Transmit contents of unprotected fields to host	<CR>	
Move right in unprotected fields	<EM>	
Move left in unprotected fields	<SUB>	
Move to end of last unprotected field on line above	<FS>	

Plot Mode Commands

Plot Mode Commands are executable when the mode has been entered with <STX>. Commands make reference to a coordinate space defined by (0, 0) at the lower left of the screen and (159, 191) at the upper right of the screen. All x and y arguments refer to this coordinate space. X and y arguments are represented in binary as byte values. Curly braces indicate optional arguments and are not parts of the commands.

Command	**Syntax**	**Variable Arguments**
Exit Plot Mode to Alpha Mode	<255>	
Enter Character Plot Submode	<254>	
Point Plot	<253> *x0 y0* { ... *xn yn* } <252> *y0 x0* { ... *yn xn* }	x0 (byte) = 0 to 159 y0 (byte) = 0 to 191 etc.
Incremental Point Plot	<251> *inc* { ... *inc* }	inc (byte) = a value representing two increments from a given base. bit 0 = negative dy2 bit 1 = positive dy2 bit 2 = negative dx2 bit 3 = positive dx2 bit 4 = negative dy1 bit 5 = positive dy1 bit 6 = negative dx1 bit 7 = positive dx1
Horizontal Bar Graph or Histograph	<250> *x_base y0 x0* { ... *yn xn* }	x_base (byte) = 0 to 159 y0 (byte) = 0 to 191 x0 (byte) = 0 to 159
Continue Horizontal Bar Graph	<249> *y0 x0* { ... *yn xn* } <248> *x0 y0* { ... *xn yn* }	x0 (byte) = 0 to 159 y0 (byte) = 0 to 191 etc.
Incremental Horizontal Bar Graph	<247> *inc* { ... *inc* }	inc (byte) = a value representing two increments from a given base.

Plot Mode Commands, cont.

Command	**Syntax**	**Variable Arguments**
Vertical Bar Graph or Histograph	<246> *y_base x0 y0* { *... xn yn* }	y_base (byte) = 0 to 191 x0 (byte) = 0 to 159 y0 (byte) = 0 to 191
Continue Vertical Bar Graph	<245> *x0 y0* { *... xn yn* } <244> *y0 x0* { *... yn xn* }	x0 (byte) = 0 to 159 y0 (byte) = 0 to 191 etc.
Incremental Vertical Bar Graph	<243> *inc* { *... inc* }	inc (byte) = a value representing two increments from a given base.
Vector Plot	<242> *x0 y0 x1 y1* { *... xn yn* } <241> *y0 x0 y1 x1* { *... yn xn* }	x0 (byte) = 0 to 159 y0 (byte) = 0 to 191 etc.
Incremental Vector Plot	<240> *inc* { *... inc* }	inc (byte) = a value representing two increments from a given base.

Locator Commands

Locator Commands are executable when /STRICTG is not used at startup. Locator report formats are discussed in the chapter on locator devices. Commands follow ANSI conventions. Variable arguments are strings of numeric characters representing decimal numbers.

Command	**Syntax**	**Variable Arguments**
Report Locator System Version	<ESC> [? 250 ; 1 d	
Restore Saved Defaults	<ESC> [? 251 ; 1 d	
Enable/Disable Device	<ESC> [? 1 ; *pn* d	pn: 1 = disable 2 = enable 3 = disable on pick 250 = report enable state
Select Device	<ESC> [? 2 ; *pn* d	pn: 1 = None 2 = Arrow and Home keys 4 = IR touchscreen 6 = LX200 trackball 7 = Logitech C7 mouse 8 = Microsoft mouse 250 = report current selection
Set Locator Position	<ESC> [? 3 ; *row* ; *col* d	row: 0 to 47, or 250 col: 0 to 79, or 250 Note: If either parameter is 250 a position report is requested.
Set Locator Cursor Mode	<ESC> [? 4 ; *pn* d	pn: 1 = host cursor only 2 = locator cursor only 3 = use both cursors 250 = report mode
Set Locator Cursor Style	<ESC> [? 5 ; *pn* d	pn: 1 = underscore 2 = under/overscore 3 = block 10 = invisible 250 = report state

Locator Commands, cont.

Locator Commands are executable when /STRICTG is not used at startup. Locator report formats are discussed in the chapter on locator devices. Commands follow ANSI conventions. Variable arguments are strings of numeric characters representing decimal numbers.

Command	**Syntax**	**Variable Arguments**
Set Report/Pick Mode	<ESC> [? 7 ; *pn* d	pn: 1 = tracking w/exit pick 2 = tracking w/movement picks 3 = entry point mode 4 = continuous pick mode 10 = no pick mode 250 = report state
Set Report Format	<ESC> [? 8 ; *pn* d	pn: 1 = no reports 2 = pick report 3 = 8001 style 4 = 8001 style (short) 5 = ANSI style 6 = ANSI style (short) 7 = VT100 style 250 = report state
Report Locator Position	<ESC> [? 9 d	

Legacy Locator commands.

Command	**Syntax**	**Variable Arguments**
Enable/Disable Locator Device	<ESC> [*pn* d	pn: 0 = Disable 1 = Enable
Enable/Disable Locator Device	<ESC> [*pn* t	pn: 0 = Disable 1 to 255 = Enable
Set Pick Mode	<ESC> [*pn* q	pn: 0 = Tracking with exit pick 1 = Tracking with movement pick 2 = Entry pick 3 = Continuous pick
Initialize Locator Device	<ESC> [v	

Graphics Mode Commands

Dot Addressable Graphics Mode Commands (executable when dot-addressable graphics has been enabled in Setup and the mode has been entered with "<ESC> T"). The coordinate space referenced by the commands is defined by (0, 0) at the lower left of the screen, and (479, 383) at the upper right of the screen. All x and y arguments refer to this coordinate space and are representable as strings of ASCII numeric characters. Curly braces indicate optional arguments and are not parts of the commands. Argument delimiters are shown here as commas.

Command	**Syntax**	**Variable Arguments**
Exit to Alpha Mode	?	
Select Graphics Page	X *write_page* , *display_page* ,	write_page = 1 to 4, 255 display_page = 1 to 4, 255 Note: If either value is 255 a status report is sent to the host
Relative Vector	% *dx0* , *dy0* , { ... *dxn* , *dyn* , }	dx = displacement on x dy = displacement on y
Circle	(*x* , *y* , *r* ,	x = coord of center y = coord of center r = radius
Display Superpixel	* *x0* , *y0* , { ... *xn* , *yn* , }	
Concatenated Vector	+ *x0* , *y0* , { ... *xn* , *yn* , }	
Point	. *x0* , *y0* , { ... *xn* , *yn* , }	
Vector	/ *x0* , *y0* , { ... *xn* , *yn* , } L *x0* , *y0* , { ... *xn* , *yn* , }	
Relative Point	: *dx0* , *dy0* , { ... *dxn* , *dyn* , }	dx = displacement on x dy = displacement on y
Rectangle	< *x0* , *y0* , *x1* , *y1* ,	
Arc	A *x* , *y* , *r* , *start* , *end* ,	x = coord of center point y = coord of center point r = radius start = angle in degrees end = angle in degrees

Graphics Mode Commands, cont.

Command	**Syntax**	**Variable Arguments**
Superpixel Bar	B *x* , *y* , *width* , *height* ,	x = coord of lower left corner y = coord of lower left corner width = number superpixels height = number superpixels
Clear Plane	C *pmask* ,	pmask = 0 to 7 Note: Value is obtained by ORing values of individual planes. Red = 1, green = 2, blue = 4.
Display Enable Plane	D *pmask* ,	pmask = 0 to 7 Note: Value is obtained by ORing values of individual planes. Red = 1, green = 2, blue = 4.
Fill Plane	E *pmask* ,	pmask = 0 to 7 Note: Value is obtained by ORing values of individual planes. Red = 1, green = 2, blue = 4.
Write Enable Plane	W *pmask* ,	pmask = 0 to 7 Note: Value is obtained by ORing values of individual planes. Red = 1, green = 2, blue = 4.
Fill Region	F *x* , *y* , *bound_color* , *pindex* ,	x = coord of interior point y = coord of interior point bound_color = color index of bounding line pindex = fill pattern index
Select Color Index	H *index* ,	index = 0 to 7

Graphics Mode Commands, cont.

Command	**Syntax**	**Variable Arguments**
Define Color Index	J *index* , *color* ,	index = 0 to 7 color = 0 to 7
Enable Color Definition(s)	I	
Define Fill Pattern	P *definition*	definition: an undelimited string of 8 characters defining an 8x8 pixel matrix. The first character in the string defines the bottom row of the matrix
Read Color at Point	R *x* , *y* ,	
Define Superpixel	S *hue* , *sat* , *intensity* ,	hue = 0 to 95 sat = 0 to 16 intensity = 0 to 16 Note: for hue, 0 = red, 32 = green and 64 = blue
Define Line Style	T *dots_on* , *dots_off* ,	dots_on = number of pixels dots_off = number of pixels
Begin Polygon	[	
End Polygon	]	

Fastscreen Mode Commands

Fastscreen Commands are executable when Fastscreen Mode has been enabled in Setup and the mode has been entered with <ESC> D. Arguments to commands are ASCII character strings. Curly braces indicate optional arguments.

Command	**Syntax**	**Variable Arguments**
Exit to Alpha Mode	<ESC> <ESC>	
Initialize Storage Device	INI *dev* <CR>	dev = RX0: or RX1:
Select Storage Device	DEV *dev* <CR>	dev = RX0: or RX1:
Load Stored Display	LOA {*dev*} *file* <CR>	dev = RX0: or RX1: file = display filename
Save Display	SAV {*dev*} *file* {*start - end* } <CR>	dev = RX0: or RX1: file = display filename start = address (in hex) corresponding to screen position end = address (in hex) corresponding to screen position Note: Address 8000h corresponds to row 0, column 0. Address 9DFFh corresponds to row 47, column 79.
Delete Stored Display	DEL {*dev*} *file* <CR>	dev = RX0: or RX1: file = display filename