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Terminals & Printers Handbook

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Introduction

Terminals and printers are often the only part of the computer system you see or need to see. They are your direct link to the power and intelligence of your system and they are the tools you will use most often in your work. Naturally, you want them to be effective, easy to use, and sophisticated without being complicated. You want tools that are most responsive to the kind of tasks you have. For this reason, Digital offers an exceptionally engineered, diverse range of video terminals and hardcopy printers designed to fit the individual needs of its customers.

This handbook discusses Digital's terminals, both video and printing, and Digital's printers. Written with both evaluators and users in mind, this handbook will help you choose the terminals and printers that are best suited to your application and help you use them in the most efficient and productive way.

Here are the products you'll find described in this handbook.

Video Terminals

Digital's family of video terminals, the **VT220, VT240**, and **VT241**, continue the tradition of excellence set by the industry-standard VT100 series of terminals. Superior functionality in a sleek design makes the VT200 series even more powerful and easy to use than its predecessors. A menu-driven setup, for example, makes the need for mysterious codes unnecessary. Even first time users find using the VT200 family a breeze—in English, French, and German.

The first in the series is the highly reliable, user-friendly, VT220 text-only, conversational terminal. The VT240 and VT241 terminals provide the added dimension of graphics—monochrome with the VT240 and full color with the VT241.

Ever since their introduction, Digital's **VT100 terminals** have been considered the industry standard for ASCII asynchronous video terminals. Because they set the standards, it's only natural that Digital's VT200 family advanced them. The VT100 family of terminals are fully described in Appendix B—Traditional Terminal Products.

Printing Terminals

Printing terminals are interactive devices that let you communicate with your computer and also receive hardcopy output—all from the same device.

The **Letterwriter 100** (LA100) can be used for applications that require both text and graphics output, such as drafts of business and technical reports, graphs and bar charts. With a choice of draft, letter, or memo-quality printing, the Letterwriter 100 is Digital's most versatile printing terminal.

The **DECwriter III** (LA120) is one of Digital's most popular terminals. It has an enviable reliability record, and the most versatile features. Features like 180 character per second printing and 45 setup features that you can select from the keyboard.

Printers

Different applications have different printing requirements and Digital has a printer for each and every one.

The **Letterprinter 210** (LA210) gives you speed and versatility. It produces drafts at a rate of 240 characters per second and also delivers letter-quality printing at a rate of 40 characters per second. Not only does the LA210 let you choose between different text print modes but it can also handle your graphics printing.

With the **LQP02**and **LQP03 letter-quality printers** you are assured of premium print quality each and every time. The daisywheel print mechanism provides a reliable print speed of 32 characters per second. And you can choose from a variety of different type styles and special purpose fonts.

The **LA50 Personal Printer** gives you more for your money. This compact printer prints draft- and memo-quality documents, at 100 and 50 characters per second, respectively, as well as graphics. You can use either fanfold or cut-sheet paper, and the multinational character set lets you print in 11 languages.

Taking the LA50 to the next level of performance, the **new LA75 Companion Printer** is a versatile and reliable high-speed dot matrix printer that incorporates numerous state-of-the-art printing and user-oriented features. The LA75 prints in any one of five modes—draft, memo, near-letter quality, letter quality, and bit-map graphics. And it has built-in character sets that provide capabilities for personal computing, word processing, business graphics, and other applications. The LA75 is fully compatible with software written for Digital printers and the IBM Proprinter.

If color plays a part in your copy—for highlighting information or filling in graphs or diagrams—Digital offers two color printers. The **LVP16 color pen-plotter** gives you fast, sharply defined, images in ten vibrant colors. For CAD and business graphic applications, The **LCG01 color printer** utilizes ink-jet technology to produce images with more brilliant color and resolution than the images you see on your terminal screen.

When your operations demand large volumes of output, high-speed graphics, or extremely high quality, Digital has a number of solutions. The **LN01** and the **tabletop LN03 laser printers** combine premium quality printing with top speed and extremely quiet operation. An electrophotographic process, which uses a print density of 300-by-300 dots per square inch, makes exceptional print quality possible. Using cutsheet paper, the LN01 can print 12 pages per minute, while the compact, less expensive LN03 prints 8 pages per minute.

Digital's first in a new family of networked laser printservers is the **PrintServer 40.** This exciting new product can be a shared resource available to dozens of users throughout a department or small company. It handles high-volume printing with an input capacity of 2,500 sheets and delivers output at an amazing 40 pages per minute. The PrintServer 40 also features its own powerful built-in page description language that enables it to print typeset quality text and sophisticated graphics.

In the system printer category, Digital has a family of new high-speed text and graphics printers—the **LG01** and **LG02**. The LG family represents a new standard of reliability for 600 line-per-minute impact printers. Both the LG01 (text only) and the LG02 (text and graphics) print correspondence-quality text and high-speed data processing-quality text.

Your choice of a graphics system printer also includes the 300-line-per-minute **LXY12 graphics lineprinter** or the faster 600-line-per-minute **LXY22**. If reliable, large-volume printing is demanded, we offer the **LP25**, which prints up to 300 lines per minute, the **LP26** that prints up to 600 lines per minute, or the heavy-duty **LP27** that can deliver high volumes of data at speeds up to 1200 lines per minute.

Modems and Cables

In order to transfer information between parts of your system or network—CPU to CPU, CPU to terminal, or CPU to printer for remote locations—you need data communication equipment. Chapter 20, *Modems and Intelligent Communications Processors*, describes the Digital products that make communications possible.

CPUs, terminals, and printers need the right cables in order to work together. Chapter 21, *Terminal Interconnect System and Standard Cables*, describes DECconnect, a new family of hardware and communication protocols. DECconnect provides a complete communications solution that allows voice systems, low-speed data terminals, high-speed local area networks, and video transmissions to be connected to a single outlet within a work area. Traditional cabling methods are also described in this chapter.

▪ Handbook Organization

It is not the intention of this handbook to provide every detail about Digital's terminals and printers, but rather to provide enough information for you to evaluate them. We've tried to include information most often requested by our readers.

Each product chapter contains the following major divisions:

- Overview—Outlines terminals' or printers' general capabilities and uses.
- Major Features—Highlights the key features and their importance.
- Screen Attributes or Printing Features—Outlines video display terminal characteristics and different print qualities and their characteristics, including graphics.
- Character Sets—Lists the multinational and special character sets supported.
- Paper—Lists the type of paper and dimensions that the printer can accommodate.
- Options—Lists the major options for the product and their order numbers.
- Accessories and Supplies—Lists the major accessories and supplies for the product and their order numbers.
- Operator Features—Explains the meaning and function of controls and indicators and describes the role of set-up features and configuration switches.
- Programming Information—References often-requested programming information.
- Maintenance—Tells you how to run self-tests and gives you a troubleshooting checklist, enabling you to pinpoint and correct problems commonly encountered.
- Additional Documentation—Lists other documents available, including a brief description of the contents and the order number.
- Specifications—Describes detailed technical specifications.

Appendices

The Appendixes contain supplemental information for Digital's video terminals and printers.

- *Appendix A*—ASCII codes.
- *Appendix B*—Traditional Terminal Products
- *Appendix C*—Terminal Programming Information
- *Appendix D*—Traditional Printer Products
- *Appendix*E—Printer Programming Information.
- *Appendix F*—Additional Documentation

For More Information

If you can't find all the information you need in this handbook, here are some other documents you can ask your sales representative about.

This list outlines more technical documents you can request about your terminal or printer.

- User Guide—Provided with terminal or printer at time of purchase. Details installation, operation, and programming information.
- Installation Guide—Provided with terminal or printer at time of purchase. Tells you how to install it.
- Mini Maintenance Manual—Describes procedures to troubleshoot and repair video terminals.
- Technical Manual—Describes video terminals to detailed block level.
- Illustrated Parts Breakdown—Provides a detailed parts breakdown of the printer's and video terminal's field-replaceable units. Does not contain part numbers for components on the printed circuit boards.
- Print Set—Provides a complete set of electrical and mechanical schematic diagrams for the video terminal and printer.
- Programming Reference Guide—Provides programming information for printers.
- Programming Reference Card—Provides a summary of escape and control sequences for video terminals or printers on a pocket-sized reference card.

If you need catalogs to order systems, accessories, and supplies, you can ask for

- *PDP-11 Systems and Options Catalog* —Provides you with the most accurate and up-to-date information on currently available PDP-11 systems, options, and software products. This customer document is designed to help you select the right Digital product for your needs. A European version is also available. (Quarterly publication)
- *VAX Systems and Options Catalog*—Provides you with the most accurate and up-to-date information on currently available VAX systems, options, and software products. This customer document is designed to help you select the right Digital product for your needs. A European version is also available. (Quarterly publication)

If general reference information is what you need, consider

- *Software Product Descriptions (SPDs)* —Description of Digital's software products. (Monthly)
- *Digital Reference Service (DRS)*—Comprehensive guide to Digital. Contains the full spectrum of Digital's products, applications, and service offerings. The DRS is available on an annual subscription basis with quarterly updates and newsletters.

Digital Equipment Corporation was one of the first computer manufacturers to offer a commercially available video display terminal. Over the years, our experience has taught us a great deal about how to design good video terminals and how terminals should be integrated into the workplace. As a result, Digital's VT100 series and the newest VT200 series of terminals are considered the industry standard for ASCII asynchronous video terminals. Many terminal manufacturers have tried to imitate our popular VT200 series in terms of functionality and design, but none have been able to duplicate the special user features for which Digital is noted.

▪ Ergonomic Design Separates the Original from the Imitators

One factor, often overlooked by terminal manufacturers, is the human factor or ergonomic design of a product. What do we mean specifically by ergonomics? Ergonomics is defined as a group of facts, drawn principally from life sciences (psychology, physiology, anatomy) and engineering (mechanics, physics, statistics), then applied to the interaction between humans and their work environment. The work environment includes everything from equipment, layout, temperature, lighting, sound levels to the atmosphere and social context of the task.

How this information relates to computer equipment is quite simple. The more comfortable and less fatigued people are performing their job, particularly where it involves lengthy interaction with equipment, the higher their efficiency and the better their performance. And increased performance translates to greater productivity for your organization. Digital is committed to enhancing the ergonomic design of its products, particularly in the office area to increase personal job satisfaction, safety, and productivity.

Digital's VT200 series of terminals are an excellent example of sophisticated technology enhanced by human engineering. The following are just some of the features and advantages you'll find when you use any of the VT200 family of terminals.

Ergonomic Feature	User Advantage
Keyboard	
Low-profile, detachable, height-adjustable keyboard	Allows you to comfortably position the keyboard at a suitable typing angle to help reduce arm fatigue.
Left/right cable connection	The 6-foot coiled cable can be run from either the right or left side of the keyboard for the users's maximum comfort.
Matte finish, sculptured keycaps	Matte finish reduces reflected glare. Sculptured keycaps fit the shape of your fingertips for comfort and accuracy.
Recessed home row positioning keys	"F" and "J" keys are recessed for touch typist positioning.
Standard separate numeric keypad	Easy to use with familiar calculator layout.
Host programmable function keys	You can save time and keystrokes by storing frequently used commands and sequences.
Video Display	
Compact monitor with built-in tilt and swivel	Lightweight for easy mobility, takes up little space, can be adjusted to the best angle for comfortable viewing.
Nonglare screen with phosphor in green, amber and black and white	Reduces glare and eye fatigue and allows user preference of color.
Rotary controls for brightness and contrast	Allows you to easily adjust brightness of screen while viewing data to suit individual work environments.
Plain language setup	The setup menus are easy to read and understand. No more setting bits for each characteristic.
Quality character fonts	Words and letters on screen look like printed words in books and newspapers. This helps readability, and reduces eye strain and fatigue.
60 Hz Refresh rate	The terminal's screen is refreshed or updated frequently to reduce flicker that can cause headaches and eyestrain.

▪ A Unique Keyboard Design That Increases Your Productivity

The keyboard is the most common input device and your direct link to the computer. The VT200 keyboard features a superior user-oriented design that makes it the foremost terminal keyboard in the industry. There are a number of design elements that ensure both comfort and ease of use, setting the VT200 keyboard apart from the rest.

For accuracy and comfort, the keycaps are sculptured to fit the shape of the user's fingertips. They have a matte finish that reduces the amount of glare reflected off the keyboard. Special indentations on the "home row" keys (F and J) assure touch typists that their fingers are positioned correctly. The keyboard itself is thin, lightweight, and easy to move around to your favorite typing position. Its low-profile is exactly the right height for people who prefer the palm-on-table writing style. And because the internals of this keyboard are a membrane design instead of the mechanical switch design used by other manufacturers, the keyboard responds quietly to a light touch.

The keyboard is arranged to eliminate errors and increase data-entry speed. The keys are divided into three easy-to-remember keypad areas—the traditional typing keypad, the editing keypad, and the auxiliary keypad. This layout groups specific functions together into logical working areas. Two of the keypads are already familiar to most people; the main keypad is like a typewriter and the auxiliary keypad is just like a calculator.

Special command keys such as ESCAPE, BACKSPACE, BREAK and LINEFEED are located in the top row of function keys above the main keypad. This separates the typing and nontyping functions and eliminates the danger of making costly errors during data entry.

To help you edit text quickly, the editing keypad has special function keys such as SELECT and INSERT that with software support let you move text around easily. Probably the most frequently used function keys are the cursor controls. Digital's keyboards have the cursor controls arranged in a seperate inverted "T" design that lets you easily position the cursor with minimum finger movement. Because this arrangement is easy to remember, more time is spent in paying attention to the work on the screen and less in searching the keyboard for the right key.

Another important set of keys on the keyboard are the programmed and programmable function keys. These keys are tremendous timesavers because they store a series of instructions or keystrokes in a single key. If you want to print a specially formatted document, for example, you can execute the necessary sequence of steps by pressing one key. You don't have to remember command sequences because the terminal remembers them for you. The VT200 series of terminals have 25 programmed keys as well as 15 host-programmable keys to give you the maximum flexibility.

▪ The Video Display—As Easy to Read as the Pages in a Book

Those who spend a good part of their day staring at a terminal screen have a stake in how well that display is designed. The best video displays incorporate design elements that reduce eye strain and fatigue. Once again, the VT200 series takes the lead with display screens that are perhaps the best example of monitor ergonomics in the industry. They demonstrate all the best qualities in a display—high contrast, solid-appearing image, pleasing color, correct viewing angle, and low glare. All these features help determine the most important characteristic to you—the display's readability.

The format and size of the characters on the VT200 terminals are what you are used to seeing in your everyday reading. A minimum 7-by-9 dot matrix for each character permits letters with descenders such as j, g, and q to be far more recognizable. Displays generally provide light characters on dark backgrounds, but our terminals also offer reverse video or dark characters on a light background.

Phosphor color and persistence can also affect the clarity of the display. Different terminals employ CRTs with different phosphors. The most common phosphor glows bluish-white, like a black and white television screen. The VT200 series of terminals also come in green or amber phosphor. Green is noted for stability of image and amber for high contrast. You choose according to personal preference and the type of applications you have. Another phosphor variable is persistence, the amount of time it takes an image to fade after it has been "written" on the screen. A high-persistence phosphor can cause characters to smear when moved, particularly if the terminal uses smooth scrolling. The VT200 terminals use a low-persistence phosphor to assure a sharp quality display. A faster refresh rate of 60 Hz reduces screen flicker by frequently repainting or updating the screen.

All of the best display qualities can be worthless if the user is bothered by outside light reflected off the screen. For this reason, the VT200 screens use a nonglare treatment that reduces glare without dimming or dispersing the screen image. Another way to eliminate glare is to adjust the viewing angle. The VT200 terminals have an adjustable tilt feature and two controls that let you easily adjust the brightness and contrast, just as you would on your television set.

Another attractive feature of the VT200 terminals is their compact size. The unique wedge-shaped monitor and thin lightweight keyboard are portable and easily integrated into the office environment. To help create the most comfortable and attractive workstation, Digital also offers a special line of furniture and accessories to complement our terminals. Worktables, system stands, chairs, copy holders and much more can be ordered directly from Digital.

Digital has made you, the user, the most important factor in the design of its equipment. By studying the way people work, we've developed the tools that make that work easier.

▪ A Word about Regulations

Most countries have government agencies that issue regulations that manufacturers of electrical equipment must meet. These regulations are designed to protect the operator and also prevent interference with other equipment operating in the same area. There are rules that apply to products designed for use in the workplace and more stringent rules that apply to products that are to be used in the home or in residential areas.

The FCC requires that products marketed for use in the workplace must meet Class A standards; those in the home must meet the more stringent Class B standards. Digital's VT200 family meets both class A and B requirements. In addition, the VT200 keyboard meets regulatory approvals on a worldwide basis.

▪ Video Terminal Operation Tips

We've described some of the ergonomic features of our terminals; here are a few things you can do to ensure comfortable and productive operation of your terminal.

- Make sure your seat promotes good posture through proper seat height and lower back support adjustments.
- Keep multiple reading surfaces at equal distances from your eyes.
- Adjust your seat height, tilt the video screen or the screen height to keep your posture comfortable.
- Start with an evenly lighted and well-lighted working area. This should minimize reflections and glare. Also, try to work in an area with little noise and other distractions.
- Your workstation layout should enable you to relax your eyes periodically by looking at an object some distance away from the screen.
- Keep frequently used items within comfortable reach (within 58 centimeters/2 feet) and adjust your working position periodically to relax.

Lighting Adjustments

Most offices are lighted for doing paperwork, not for operating video terminals. Dimmers and individual light adjustments make working a video terminal easier. Lights in and around the work area should be placed so that they minimize your eyes' adjustment to different light levels.

Some lighting suggestions follow.

- If your work area has a window, place the video terminal at a right angle to it.
- Directly lighting the video display causes reflections and glare, and should be avoided. Instead, adjust your terminal's brightness controls for comfortable viewing.
- Position the screen to avoid reflection and glare, perhaps with a tilt/swivel adjustment. Use filters on your video screen to help reduce glare and reflections.
- Have the light coming from the side or behind you to avoid lights shining directly into your eyes (and onto the screen.)
- Keep all work surfaces equally lit.
- Use diffusers over any glaring lights.
- Place lighting so that it does not reflect on the video screen. An angle at least 30 degrees above work surfaces and video screen will usually accomplish this.

For more tips on using computers and video display terminals in your work area, contact Digital's Human Factors Group through your sales representative.

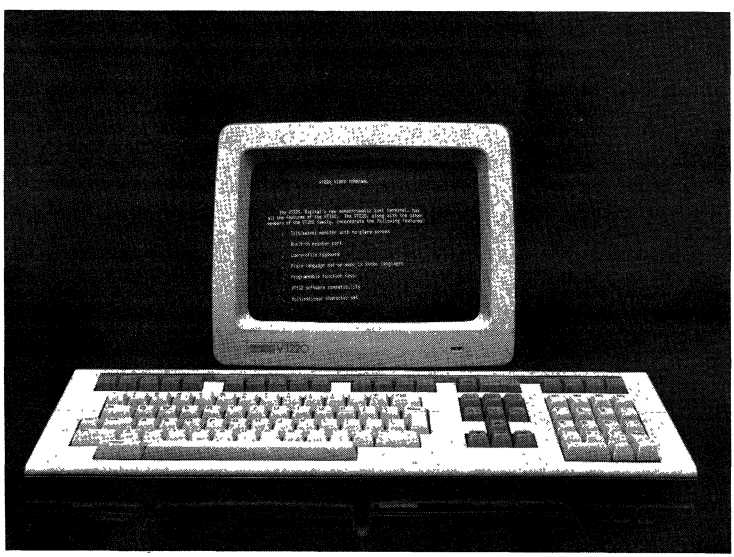
Chapter 2 ▪ VT200 Family of Video Terminals

▪ Overview

Digital's newest family of video terminals, the VT220, the VT240, and the VT241, advance the standard set by Digital's VT100 family of terminals. The VT200 family includes all the universal features of the VT100 family and expands these further by letting you control more of the terminal's operations. So that you can tailor the VT200 family to your application, Digital has developed a series of user-friendly setup menus. These menus contain parameters that you can select and change easily. Just enter setup mode, move the cursor to the field of the characteristic you want to change, and press the ENTER key. It's that simple.

The VT220 and VT240 series can be used with any of Digital's processors. These video terminals can also work with other vendors' systems. And just like the VT100 family, the VT200 family is fully compatible with Digital's printers.

VT220 Video Terminal



The self-contained VT220 terminal is a monochromatic text terminal that lets you tailor their terminal to your application.

The VT220 video display terminal is the low-end member of Digital's VT200 family of video terminals. This monochromatic text terminal not only includes all the capabilities of Digital's VT100 family, but gives you more control of the terminal's operations.

The VT220 video terminal unit is totally self-contained. It consists of a monitor and keyboard. The monitor contains a monochrome cathode ray tube and a terminal controller circuit board. Also contained in the monitor are the power supply and monitor board, host serial communications port, and printer port. An optional integral modem provides the VT220 terminal with remote communications capability.

VT240 Series Text and Graphics Terminals

VT240, a monochromatic text and graphics video terminal, can be upgraded to include an integral modem.

The VT240 is a monochromatic text and graphics video display terminal. As the midrange member of the VT200 family, it incorporates all the features of the VT220 terminal. You can upgrade the VT240 to include the optional integral modem that supports autodialing/autoanswering functions.

The VT240 supports ReGIS (Remote Graphics Instruction Set), Digital's general purpose graphics command language. It allows you to create pictorial data as easily as you can create ASCII text. You can also generate bit-mapped graphics in Tektronix* 4010/4014 emulation, which gives you further access to industry-standard graphics packages. By connecting this terminal to a graphics printer, such as Digital's Letterprinter 210, you can reproduce the screen's content.

The VT240 uses the same keyboard and monitor that is used with the VT220 terminal plus a system box. The system box contains the power supply, controller board, and electrical connectors.

The VT241 terminal, the high-end member of the VT200 family, is a VT240 with a color monitor.

User-oriented Features

- Plain language setup in three languages—Makes it easy for first-time users as well as experienced users to operate the terminal and control setup features. Several menus, which can be displayed in English, French, or German, present a group of choices. From these choices, select the operating characteristics you want to suit your particular application.
- Twenty-five programmed and fifteen programmable function keys—When defined by the host, these keys store a total of 256 bytes to save frequently used commands and character sequences. This feature reduces keystrokes and helps you improve productivity.
- Downline-loadable characters—Lets you design and use special character sets, such as Katakana or Scientific, in the terminal to support your individual application. The 94 characters are loaded from the host when needed.
- Advanced video features—Characters can be assigned bold, blink, reverse video, and underline highlighting on a character-by-character basis. This aids in formatting, prompting, and highlighting portions of text.
- 24 lines by 80 or 132 columns—Allows viewing total format for detailed or spreadsheet work so you can preview reports prior to printing. You get the same results on paper as you see on the CRT screen.
- Serial printer port—Enables you to connect a printer to generate local hardcopy printout of the VT200 screen. These two devices can share the same communications line for added savings.
- Compose feature—The COMPOSE CHARACTER key creates characters that do not exist as standard keys on your keyboard. This feature helps you to access any character in the multinational character set, even if it is not displayed on your keyboard. See your *Owner's Manual* for more details.

- Selective erase—Supports applications in which data is entered by filling in the blanks of a form. This allows the host, with one command, to erase selected areas on the screen. This leaves the form intact for the next data-entry sequence.
- CRT saver—Blanks the screen after 30 minutes of inactivity, prolonging the life of the screen's phosphor. The screen display is restored by pressing any key or if the terminal receives a character from the host.
- Composite video—Allows terminal to drive an auxiliary monitor and display text or graphics on a large screen.

Compatibility Features

- EIA and 20-milliampere interfaces—Both are standard on the VT200 family. With the EIA interface, the VT200 family of video terminals meets industry standards and achieves compatibility with most systems. The 20-milliampere interface supports long-distance operation of the terminal—up to 500 feet away from the host.
- Selectable local echo—This feature lets your terminal display on the screen characters transmitted to the host. This means you can use your terminal on non-Digital systems where echoing is not provided by the host.
- VT52 and VT100 family compatibility modes—VT200 terminals are compatible with present Digital software, as well as application software developed for the VT52 and VT100 terminals.

Multinational Features

- Multiple language keyboards—Keyboard versions are available for many different languages, for example, English, French, German, Spanish, and Italian. The language you want to use is selected in setup.
- 7-bit and 8-bit character support—For compatibility with Digital and non-Digital systems, as well as support of multinational and national replacement character sets.

Easy Serviceability

- Customer installable—Saves you time and money.
- Built-in self-test diagnostics—Reduces the time required to isolate and repair faults.

▪ Screen Attributes

Digital's VT200 family of terminals allows a standard screen display of 24 lines by 80 or 132 characters. For the VT220, individual characters are based on a 7-by-9-dot matrix, while for the VT240 Series it is based on an 8-by-9-dot matrix. These provide clear, crisp text displays.

▪ Operating Modes

The VT200 family has the following operating modes, each selectable via setup from the keyboard or via escape sequences from the host.

- VT200, 7-bit Control Mode executes standard U.S. ANSI functions. This is the default mode of operation.
- VT200, 8-bit Control Mode executes standard ANSI functions. It is used in 8-bit communications environments.
- VT100 Mode is an ANSI mode that emulates a VT100 terminal. It is used for strict compatibility with Digital's VT100 family of terminals. The Digital multinational character set is not supported in this mode.
- VT52 Mode executes Digital private, not ANSI, functions. Use this mode in conjunction with applications designed for Digital's VT52 terminal.
- ReGIS Graphics Mode is available only for VT240 series operation. It can be entered directly from the VT100 or VT200 modes using commands from the keyboard or host. The VT240 series terminal uses ReGIS graphics mode with both software application programs from Digital such as DECslide and DECgraph as well as other vendors' software.
- 4010/4014 Mode is a graphics mode on the VT240 series to permit interaction with applications programs designed for Tektronix 4010/4014 terminals.

These operating modes are described in detail in the *VT220* and *VT240 Programmer's Reference Manuals*.

▪ Options

Part Number	Description
VR241-A	Color monitor. Connects to the VT240 system box in place of the standard monochrome monitor. Standard with the VT241. (Also need BCC03 cable.)
VR24X-AA	Integral modem/autodialer. Consists of a circuit board installed in the VT240 or VT241 system box. This option allows you to dial up the host through the keyboard and eliminates the need for telephone handset or other dialing mechanism.
VR22X-AA	Integral modem/auto answer. Designed to fit snugly under the VT220 and controlled from the keyboard. Allows host to initiate connection without operator attendance. Useful when using a printer via the VT220 printer port.
VT2XX-AA/WW	VT200 Family System Stand
H980-ET	Free-standing Copy Holder
PCXXF-CP/WW	Workable chair, blue/brown, with/without arms

▪ Accessories and Supplies

The following VT200 family accessories, supplies, components, and spares are available for the VT220 and VT240 series video terminals. Check with your sales representative.

Part Number	Description
BCC02-02 (VT240 series only)	0.67-meter (2-foot) cable for connecting the monochrome monitor to the system box.
BCC02-06 (VT240 series only)	2-meter (6-foot) cable for connecting the monochrome monitor to the system box.
BCC03-06 (VT240 series only)	2-meter (6-foot) cable for connecting the color monitor to the system box.
BCC04-10	3.1-meter (10-foot) EIA cable for connecting the VT200 terminal to a modem.
BCC05-10	3.1-meter (10-foot) EIA cable for connecting the VT200 terminal to a printer.
BC05F-15	5.2-meter (15-foot) 20 mA cable for connecting the VT200 terminal to the host.
BC22D-25	8.3-meter (25-foot) EIA null modem cable for connecting the VT200 terminal to the host.
VT1XX-KF	Screen cleaning kit

▪ Maintenance

The VT200 family does not require any preventive maintenance. You can clean the outside of the cabinet occasionally by using a soft cloth dampened with a mild detergent, not a solvent. Monitor screens are cleaned with Digital's screen cleaning kits. Before cleaning the terminal, Digital recommends that you turn off and unplug the terminal.

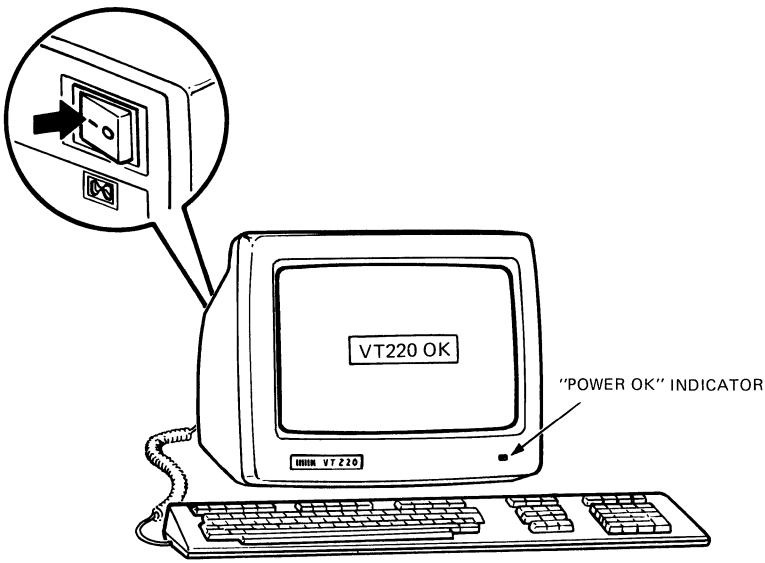


Figure 2-1 ▪ VT220 On/Off Switch and Successful Self-test Message

The VT220 and VT240 series terminals automatically perform a self-test each time they are turned on. To see and hear that the terminal is operating properly:

1. Set the monitor's brightness and contrast controls to the midrange position.
2. Press the power switch to on. Allow time for the terminal to warm up.
3. The terminal will beep and the screen will display the image "VT220 OK" or "VT240 OK." The latter is also seen for the VT241 terminal.

Operator Troubleshooting Checklist

The following is a list of possible operating problems that may be encountered by VT200 family terminal users and the most common solutions to these problems.

Terminal does not power up when the power switch is set to 1 (on).

- Power cord not plugged in.—Plug in terminal power cord. Check that wall outlet provides the correct power level.
- Monitor not powered up.—With VT241 terminal, both the monitor and the system box must be turned on.
- Voltage selector switch incorrectly set.—Consult the *Installation Guide* for the correct setting procedure.

Printer does not print.

- Printer not plugged in.—Make sure that printer is plugged into appropriate power source and that it is turned on.
- Cable disconnected.—Check that the cable connecting the VT200 to the printer is firmly in place.
- Incompatible communications features between terminal and printer.—Check that parity, data bits, and baud rates match.

Terminal display does not resume scrolling.

- If the HOLD light is on, press the HOLD SCREEN key to resume scrolling.

Terminal seems to be locked and does not respond to data sent from the host.

- Clear the terminal using the Clear Comm field in setup.

Nothing is displayed on the screen.

- CRT saver feature may have blanked out the display.—Press any key to restore the image.
- Terminal may be in LOCAL mode.—Change setup feature to ONLINE.
- Keyboard not plugged into monitor.—Make certain that the keyboard is plugged securely to the monitor.
- Cable to the modem or the CPU may not be attached.—Check the cable connection.
- Low setting for brightness and/or contrast control.—Turn brightness and contrast controls until you see the display.

Additional Documentation

The following documents contain more detailed information about the VT200 family of terminals.

- *VT220 Owner's Manual* (EK-VT220-UG)—Provides information needed to operate the VT220.
- *VT220 Programmer's Reference Manual* (EK-VT220-RM)—Describes VT220 character processing and provides the character codes, escape sequences, and control sequences needed to generate terminal control programs.
- *VT220 Installation Guide* (EK-VT220-IN)—Describes the procedures used to install the VT220.
- *VT220 Programmer's Pocket Guide* (EK-VT220-HR)—Provides a quick-reference summary of programming information.
- *VT220 Video Terminal IPB* (EK-VT220-IP)—Provides a detailed parts breakdown of the VT220. Does not provide part numbers for printed circuit board components.
- *VT240 Series Owner's Manual* (EK-VT240-UG)—Provides information needed to operate the VT240.
- *VT240 Series Programmer's Reference Manual* (EK-VT240-RM)—Describes VT240 character processing and provides the character codes, escape sequences, and control sequences needed to generate terminal control programs.
- *VT240 Series Installation Guide* (EK-VT240-IN)—Describes the procedures used to install the VT240.
- *VT240 Programmer's Pocket Guide* (EK-VT240-HR)—Provides a quick-reference summary of programming information.
- *VT240 Pocket Service Guide* (EK-VT240-PS)—Describes procedures used to troubleshoot and repair the VT240 field replaceable units.
- *VT240 Video Terminal IPB* (EK-VT240-IP)—Provides a detailed parts breakdown of the VT240. Does not provide part numbers for printed circuit board components.
- *VT240 Series Integral Modem Installation Guide* (EK-VT24X-IN)
- *VT220 Modem User Guide* (EK-VT22M-UG)
- *VT240 Series Technical Manual* (EK VT240-TM)

- *Installation of VDTs: An Operator's Guide* (EZ-WJ9A1)—Describes recommended procedures for installing snd using VDTs to achieve a comfortable workstation environment.
- *PDP-11* and *VAX Systems & Options Catalogs*—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These customer documents are designed to help you select the right Digital product for your needs. European versions are also available.

If you require information not contained in these documents, contact your local Digital representative, dealer, or distributor.

▪ Specifications

Performance Characteristics
Display:

VT220 CRT	30.5 cm (12 in) diagonal measure; white, green, or amber phosphor; monochrome composite
VT240 CRT	30.5 cm (12 in) diagonal measure; white, green, or amber phosphor; monochrome composite
VT241 CRT	33 cm (13 in) diagonal measure, P4 phosphor, RGB color composite
Text format	24 lines of 80 characters or 132 characters (keyboard- or host-selectable.)
VT240 Series Graphics format	800 horizontal, 240 vertical addressable points, two bits per point 800 by 480 logical address range for 2:1 picture aspect ratio
Character	VT220: 7-by-9-dot matrix with 2-dot descenders VT240 Series: 8-by-9-dot matrix with 2-dot descenders
Character size:	3.35 mm × 2.0 mm (0.132 in × 0.078 in) in 80-column mode 3.35 mm × 1.3 mm (0.132 in × 0.051 in) in 132-column mode
Character set	ASCII, U.K. National, Digital Special Graphics, and Digital Supplemental Character Sets (each 94 printing characters). The ASCII and Digital supplemental character sets make up Digital's multinational character set.
Cursor type	Keyboard-selectable, blinking block character or blinking underline (text) Blinking diamond, visible when graphics mode is active (graphics) Crosshair, visible when graphics input mode is active

Keyboard	
General	105-key detachable unit with a 1.9-m (6-ft) coiled cord attached with a four-pin telephone-type modular connector. Word processing versions and data processing versions are available in multiple languages and country kits.
Key layout	51-key arrangement and sculpturing similar to standard typewriter keyboard with an 18-key auxiliary keypad
Numeric keypad	18-key numeric keypad with period, comma, minus, enter, and four general purpose function keys
Function keys	36 keys, (15 programmable)

Communications

Type	Full-duplex, asynchronous (all models)
Interface	EIA RS-232-C and 20 mA, both standard
Speeds	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19,200 b/s, keyboard selectable
Parity	7- and 8-bit: Even, odd, mark, space or none, keyboard selectable 8-bit only: Mark and space
Character Size	7- or 8-bit, keyboard selectable
Buffer prevention overflow synchronization	Automatic generation of XON and XOFF control codes, slectable in setup mode
Echo	Local echo selectable in setup mode

Power Requirements

Line voltage	90-128 Vac RMS single phase, 3 wire180-268 Vac RMS single phase, 3 wire (switch-selectable)
Line frequency	47-63 Hz
Current (VT220)	0.48 A RMS at 120 Vac RMS 0.24 A RMS at 240 Vac RMS
Current (VT240 Series)	2.2 A RMS at 90 Vac RMS 1.1 A RMS at 180 Vac RMS
Power consumption (VT220)	63 W, maximum
Power consumption (VT240, VT241)	120 W, 183 W maximum

Operating Environment

Temperature	10° to 40°C (50° to 104°F)
Relative humidity	10% to 90% noncondensing
Maximum wet bulb:	28°C (82°F)
Altitude:	2.4 km (8000 ft)

Physical Characteristics

Keyboard (LK201)	
Height	5.1 cm (2.0 in)
Width	53.3 cm (21 in)
Depth	17.1 cm (6.8 in)
Weight	2.0 kg (4.5 lb)
VT220 Monitor	
Height	28.3 cm (11.1 in)
Width	33.3 cm (13.1 in)
Depth	38.7 cm (15.3 in)
Weight	11.8 kg (26 lb)
VT240 Monitor (VR201)	
Height	29.2 cm (11.5 in)
Width	34.9 cm (13.8 in)
Depth	31.1 cm (12.3 in)
Weight	6.4 kg (14 lb)
VT241 Monitor (VR241)	
Height	32.4 cm (12.8 in)
Width	38 cm (15 in)
Depth	42.1 cm (17 in)
Weight	16.6 kg (36.6 lb)
VT240 Series System Box (VS240)	
Height	8.8 cm (3.5 in)
Width	45 cm (18 in)
Depth	30 cm (12 in)
Weight	8.0 kg (18 lb)

▪ Controls and Indicators

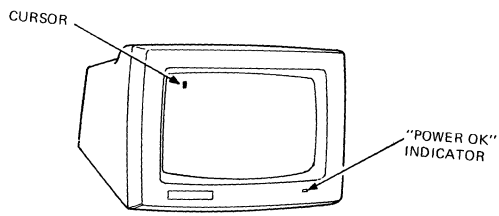


Figure 3-1 ▪ VT220 Power OK Indicator

VT200 family terminals perform two functions. First, they act as an input device to the computer, helping you enter information that is sent to the computer. Second, they simultaneously act as an output device for the computer, displaying data on the video screen. This section describes the controls and indicators found in the VT200 family of terminals.

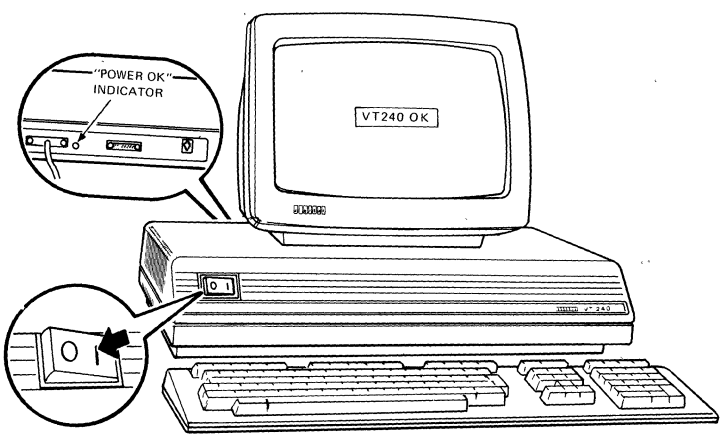


Figure 3-2 ▪ VT240 Series Power OK Indicator

Monitor Controls and Indicators

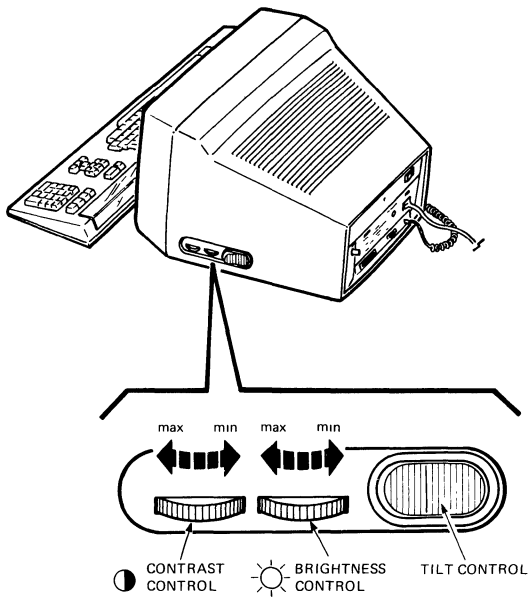


Figure 3-3 ▪ Monitor Brightness, Contrast, and Tilt Controls

Table 3-1 describes the monitor controls and indicators for the VT220 and VT240 Series video terminals.

Table 3-1 ▪ VT200 Family Controls and Indicators

Terminal	Indicator/control	Description
VT220,240,* VT241	Power OK Indicator	Lights up to indicate that power is on.
VT220, VT240,* VT241*	Voltage Selector Switch	Enables the terminal to operate on 120 Vac or 240 Vac.
VT220 VT240*, VT241*	Power Switch	Turns power to the terminal on and off. On the VT241 terminal, there is a power switch on both the monitor and the system box.
VT220, VT240, VT241	Contrast Control	Adjusts the contrast of the display screen.
VT220, VT240, VT241	Brightness Control	Adjusts the brightness of the display screen.
VT220 and VT240 only	Tilt Mechanism Button	Located on the bottom of the monitor. Used to adjust the angle of the monitor by raising or lowering the rear of the monitor.

* These two controls and one indicator are located on the system box.

Keyboard Controls and Indicators

The VT200 family keyboard consists of a main keypad, an editing keypad, an auxiliary keypad, a row of special function keys, four visual indicators, and two audible indicators.

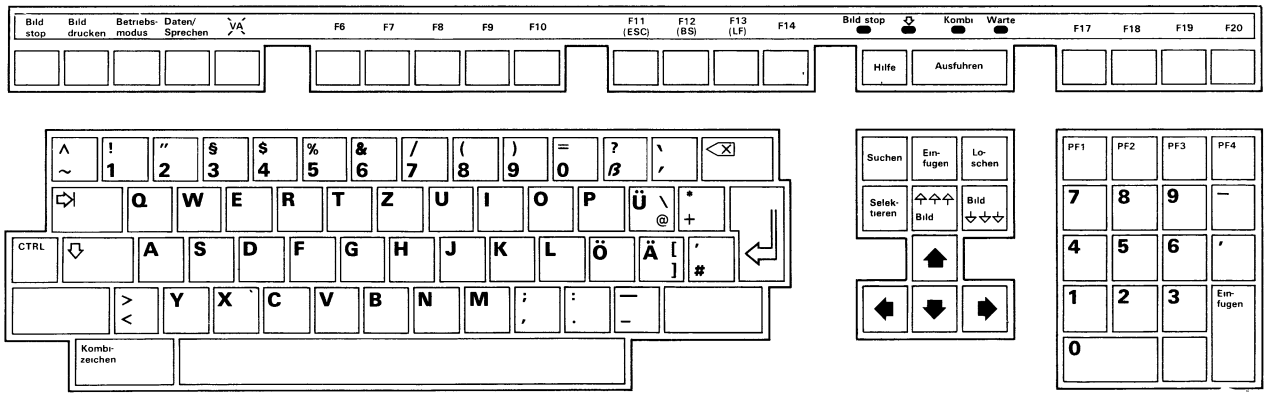


Figure 3-4 ▪ Austrian/German VT200 Family Keyboard

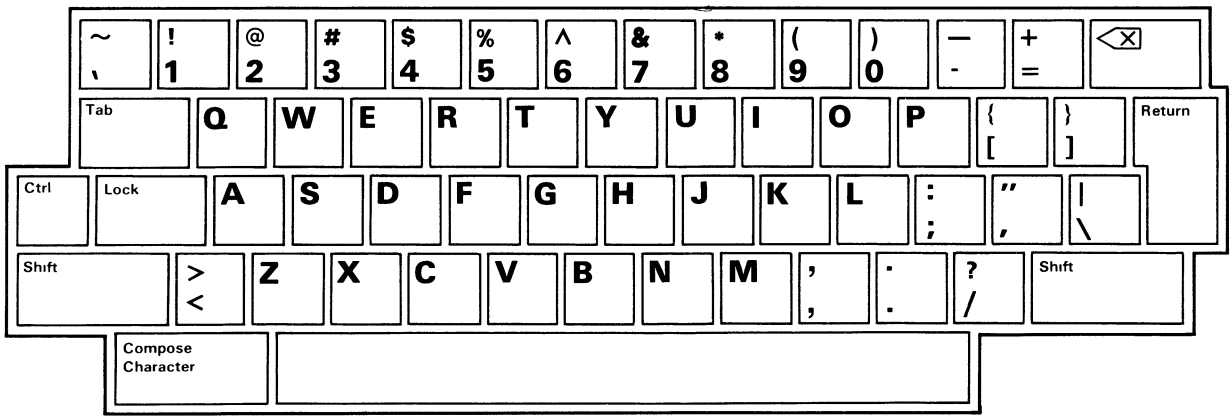


Figure 3-5 ▪ VT200 Family Main Keypad

- *Main Keypad*

The main keypad operates in a way similar to that of a standard typewriter keyboard. When you press a letter, numeral, or symbol key, the character is sent to the host's memory and is displayed on the screen. Uppercase letters and symbols are generated when you press the SHIFT or LOCK keys.

Table 3-2 ▪ Main Keypad Function Keys

Key	Description
Tab	Generates a horizontal tab that normally moves the cursor and the text following it to the next tab stop setting.
CTRL	When pressed in combination with another key, the CTRL key causes the terminal to transmit a code that has a special meaning to your system.
Lock	When pressed, the LOCK key makes the alphabetic keys generate uppercase characters. When the LOCK key is pressed again, the alphabetic keys generate lowercase characters.
Shift (2 keys)	When either the right or left side SHIFT key is pressed, the uppercase function of all keys is enabled. If a key does not have an uppercase function, the SHIFT key will be disregarded. In some cases, this key is used in combination with another key to generate a predefined control function.
Return	Transmits either a carriage return (CR) code or a carriage return (CR) and linefeed (LF) code. In some cases, it moves the cursor to the next line when editing text. If NEW LINE was selected in Set-Up mode, RETURN can be a signal to the applications program that a particular operation is finished.
Delete	Pressing this key generates a DEL character, Normally, this erases one character to the left of the cursor.
Compose Character	This key is used to create special characters, that do not exist as standard keys on your keyboard. Use of this key and compose character sequences are described in detail in the *VT220* and *VT240 Owner's Manual.*

▪ *Editing Keypad*

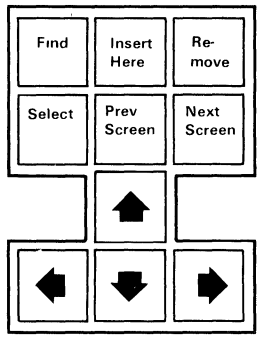


Figure 3-6 ▪ VT200 Family Editing Keypad

The editing keypad consists of four cursor (arrow) keys and six keys directly above them. (See Figure 3-6.) The four arrow keys move the cursor in the direction indicated by the arrow. The six editing keys have functions assigned to them by the applications software in use. See your applications software documentation for details.

▪ *Auxiliary Keypad*

The auxiliary keypad is used to enter numeric data as you would with a standard calculator. In addition, you can assign functions to these keys to be used by the applications software. Again, see your applications software documentation for details.

In some applications, the ENTER key generates either a carriage return or a carriage return and a linefeed. It is also used in setup to select terminal operating characteristics.

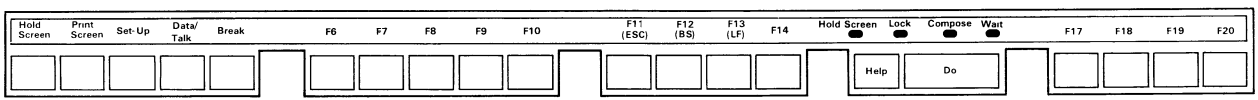


Figure 3-7 ▪ VT200 Family Special Function Keys

▪ *Special Function Keys*

Most of the top-row function keys have functions assigned to them by the software in use. Those keys with Digital-defined functions are listed below.

Table 3-3 ▪ Special Function Keys

Key	Description
HOLD SCREEN	This key freezes the screen display and stops new characters from being displayed. To unfreeze the screen display, just press the key again.
PRINT SCREEN	Pressing this key alone stops all screen activity and sends screen text display to the printer port. Holding down SHIFT and PRINT SCREEN simultaneously stops all screen activity and sends the screen display to the printer. Holding down CTRL and PRINT SCREEN sets or resets the auto print mode.
SETUP	Pressing this key causes the terminal to go into setup mode. Pressing it while the terminal is in setup returns the terminal to either the online or local mode, wherever it was before you entered setup mode.
DATA/TALK	This key functions only if the integral modem option is installed. It sets the modem to data, talk, or dialer mode. See the *VT240 Series Owner's Manual* for details.
BREAK	The BREAK key is used to send a break signal. The SHIFT and BREAK keys initiate a disconnect and is the recommended way to disconnect the terminal from the communications line. See the *VT220* or *VT240 Series Owner's Manual* for details.
F11 (ESC)	F11 is normally a function key used by application programs. In VT100 and VT52 modes, it generates an ESC (escape code) character.
F12 (BS)	F12 is normally a function key used by application programs. In VT100 and VT52 modes, it generates a BS (backspace) character.
F13 (LF)	F13 is normally a function key used by application programs. In VT100 and VT52 modes, it generates an LF (linefeed) code.

▪ *Visual Indicators*

The keyboard has four visual indicators.

- Hold screen—This indicator lights up when the HOLD SCREEN key is pressed. To resume text scrolling, press the HOLD SCREEN key again.

- Lock—This indicator is lit when the LOCK key has been pressed. It indicates that the terminal will generate uppercase characters only.
- Compose—This light is on during a "compose sequence" and is initiated by pressing the COMPOSE key. The light goes out upon the completion of the compose sequence.
- Wait—This light is on when the keyboard is locked, preventing transmission of information because its buffer is full. Once the information in the buffer is accepted by the host, the WAIT light goes out and transmission resumes. Sometimes, the host locks the keyboard.

- *Audible Indicators*

The terminal generates a bell tone as part of the powerup self-test. In setup you can enable or disable the margin bell tone, which sounds when the cursor reaches the right-hand margin, and/or a warning bell tone to indicate operator errors.

You can also enable or disable the keyclick sound when in setup mode. This lets you know that the key has been pressed fully. Exceptions to this are pressing SHIFT or CTRL only, and typing when the keyboard is locked.

Operator Features

The VT200 family stores many of its operating characteristics in a nonvolatile memory that retains these settings even when the power is shut off. These operating characteristics can be changed by entering the setup mode. Some characteristics, such as transmit and receive speed, affect communications with the host and printer. These must be set according to the host's and printer's requirements. Other characteristics, such as the type of cursor to be displayed, can be set according to your preference. Through the keyboard or the host, you can change all the available setup characteristics to tailor the terminal to your preference.

Setup

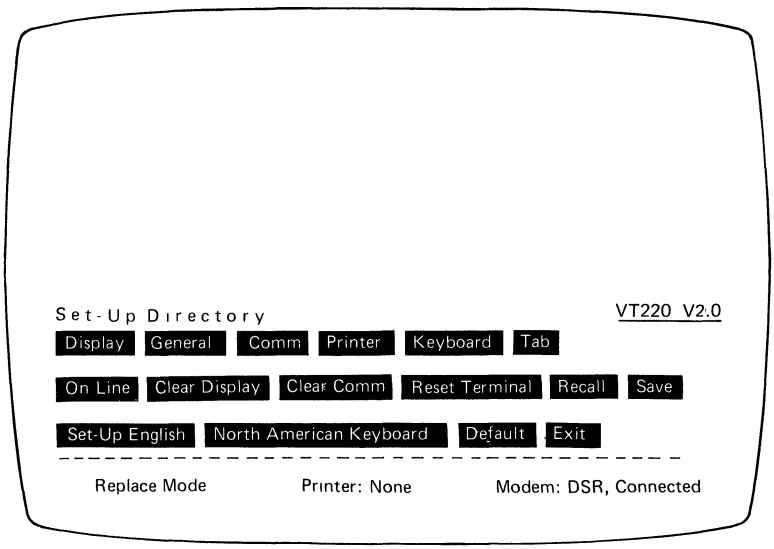


Figure 3-8 ▪ Directory Setup Screen

Setup is based on selectable monitor displays called screens. Only one screen can be displayed at a time. Each one presents a logical grouping of choices from which you can select terminal parameters.

You can even enter setup while you are working in a file without loss of data. The data is redisplayed when you exit setup. Entering setup is achieved by pressing the setup key. The Directory setup screen is displayed immediately. This screen lets you access any other setup screen. It also presents fields you can access to select terminal operating parameters. To select a field, use the arrow keys to position the cursor at the field you want to invoke. Then use the ENTER key to invoke the field.

Setup Screens

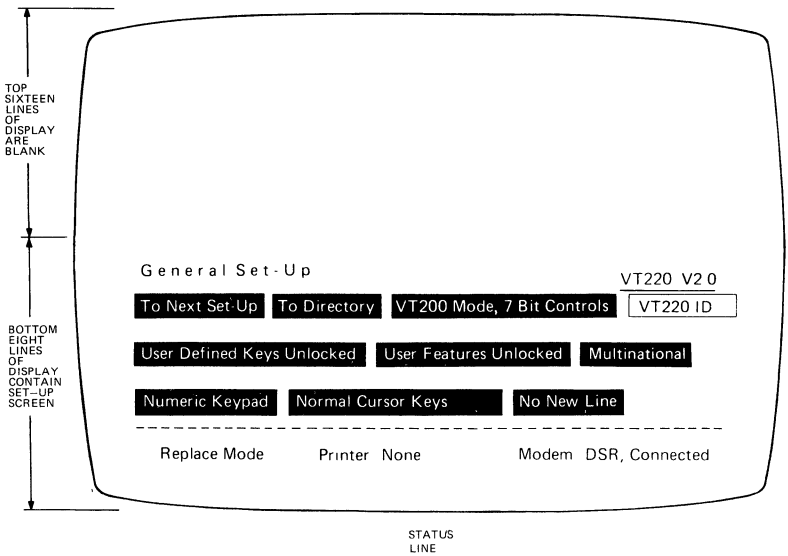


Figure 3-9 ▪ VT220 Sample Setup Screen

Each screen contains

- Screen title—Blinks and identifies the current screen.
- Terminal identifier—Indicates whether the terminal is VT220 or VT240.
- Firmware version number—Identifies the level of terminal firmware.
- Action fields—These are choices that offer a single value. When you select and invoke an action field, a single action is performed. For example, each screen, except the setup Directory screen, has an action field that reads TO DIRECTORY. Invoking this field replaces the current screen with the directory screen.

- Parameter fields (not found on all screens)—These are blocks of self-explanatory text that offer more than one choice. When you select a parameter field, the field offers you a range of choices. For example, if you select the TRANSMIT SPEED parameter field, you can then choose from one of the following speeds: 75, 100, 150, 300, 600, 1200, 2400, 4800, 9600, and 19,200 baud. Each parameter field has a factory default value that is invoked if you do not change it. The value currently in a field is the value that will be invoked when you exit setup.
- Text parameter fields (not found on all screens)—These are fields that require you to make a direct text entry through the keyboard. If you select one of these, the screen prompts you for text input, such as the answerback message.
- Status line—This appears at the bottom of the setup screen. This line is merely a reporting line that gives you a status report on the modem's state, the printer, and the terminal insert/replace mode. See the *VT220* and *VT240 Series Owner's Manual* for more detail.

During setup, the ENTER key can also do the following:

- When the cursor is positioned on an action field, the ENTER key invokes the described action.
- If the cursor is on a parameter field, the field value displayed is changed when you press ENTER. You can use ENTER to toggle through the possible field values. The value you leave displayed is the value invoked.
- When you press ENTER and the cursor is on a text parameter field, the terminal prompts you for text.
- You can also use the ENTER key to toggle through the sequence of setup Screens — General, Display, Keyboard, Communications, Printer, and Tab, plus Graphics and Telephone for the VT240 Series.

- *Directory Setup Screen*

This is the first of the screens displayed in setup mode. The directory setup screen enables you to move through the sequence of setup screens — display, general, communications, printer, keyboard, tab, graphics (VT240 Series only), and telephone.

It also lets you select the following features described in Table 3-4.

Table 3-4 ▪ Directory Setup Screen Features

Field and Field Type	Default	Functions
Graphics (VT240 Series only) Action	None	Replaces the setup directory screen with the graphics setup screen.
Online Parameter	Online	Selects online or local operation.
Clear Display Action	None	Clears the text on the display that becomes visible when setup is exited.
Clear Comm Action	None	Clears communications by aborting print operation, escape or control sequence, or device control string processing; clearing keyboard buffers; putting terminal online; and sending XON to the host port, if XOFF support is enabled.
Reset Terminal Action	None	Sets many terminal features to a known state. See *VT220* or *VT240 Series Owner's Manual.*
Recall Action	None	Replaces all current setup parameters with "saved" values and clears the monitor screen.
Save Action	None	Saves all parameters from the setup screens.
Setup = Parameter	English	Selects the language (English, French, or German) in which you want the setup screens displayed.
Keyboard Parameter	North American	Selects correct terminal operation for the national keyboard you are using.
Default Action	None	Replaces all current setup parameters with factory default settings and clears the monitor screen.
Exit Action	None	Exits setup and returns the terminal to the operating mode, local or online, that was selected in setup.

▪ *Display Setup Screen*

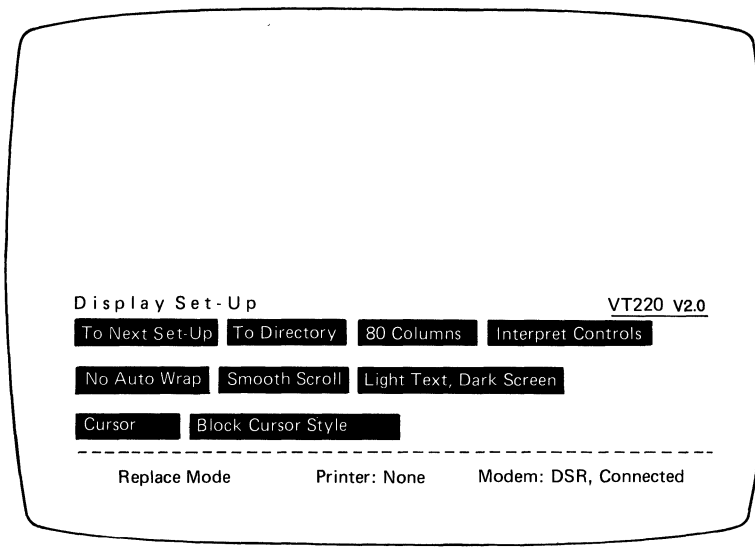


Figure 3-10 ▪ Display Setup Screen

The Display Setup screen lets you define monitor display characteristics.

Table 3-5 ▪ Display Setup Screen Features

Field and Field Type	Default	Functions
To Next Setup action	None	Replaces display setup screen with general setup screen.
To Directory Action	None	Replaces display setup screen with setup directory screen.
Columns Parameter	80 columns	Lets you select 80 or 132 column display.
Controls Parameter	Interpret Controls	Lets you select whether control function codes from the host are displayed as characters and not executed or interpreted as controls and not displayed as characters.

Table 3-5 ▪ Display Setup Screen Features

Field and Field Type	Default	Functions
Auto Wrap Parameter	No Auto Wrap	Selects whether a character received after the right margin is automatically displayed in the first character position on the next line, or overwritten into the last character position on the current line.
Scroll Parameter	Smooth Scroll	Selects the method by which lines on the screen scroll up or down. Your choices are smooth, jump, or no scroll.
Text, Screen Parameter	Light text, dark screen	Lets you select a dark screen with light text or a light screen with dark text.
Display (VT240 only) Parameter	Mono-chrome Display	Selects the color map to operate with monochrome or color monitor, or both (when using both monochrome and color monitors). **Note:** Color display is available only when you have the color monitor option for the VT240.
Text Cursor Parameter	Cursor	Lets you select whether or not a cursor is displayed in text mode.
Cursor Style Parameter	Block Style	Lets you select block or underline cursor style.

▪ *General Setup Screen*

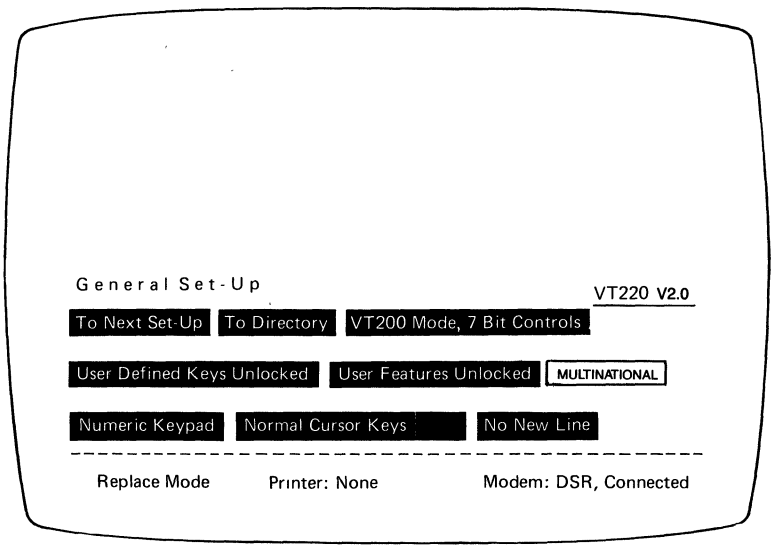


Figure 3-11 ▪ General Setup Screen

The general setup screen lets you define a group of general operating characteristics.

Table 3-6 ▪ General Setup Screen Features

Field and Field Type	Default	Functions
To Next Setup Action	None	Replaces general setup screen with communications setup screen.
To Directory Action	None	Replaces general setup screen with setup directory screen.
Mode Parameter	VT220 mode, 7-bit controls	Selects the basic terminal operating mode: VT220 mode, 7-bit controls; VT200 mode, 8-bit controls; VT100 mode; VT52 mode, and; 4010/4014 mode (VT240 Series only).
VT100 Parameter	VT100 ASCII	Selects the default character set used in the VT100 or VT52 mode. (ASCII or U.K. characters.)

Table 3-6 ▪ General Setup Screen Features

Field and Field Type	Default	Functions
User-defined Keys Parameter	Locked	Lets you select whether or not the host can alter user-defined key definitions.
User Features Parameter	Locked	Lets you select whether or not the host can alter user-preference features you have set, such as auto repeat, scroll, and screen.
Multinational Parameter		Selects multinational or national character sets
Keypad Parameter	Numeric Keypad	Selects whether the keypad transmits ASCII character codes or control codes, used by applications software.
New Line Parameter	No New Line	Lets you select whether the RETURN key generates a carriage return only or a carriage return and a linefeed.
Cursor Keys Parameter	Normal Cursor Keys	Normally selected by the host computer. Selects whether the cursor keys transmit ANSI cursor control sequences or application control functions.

▪ *Communications Setup Screen*

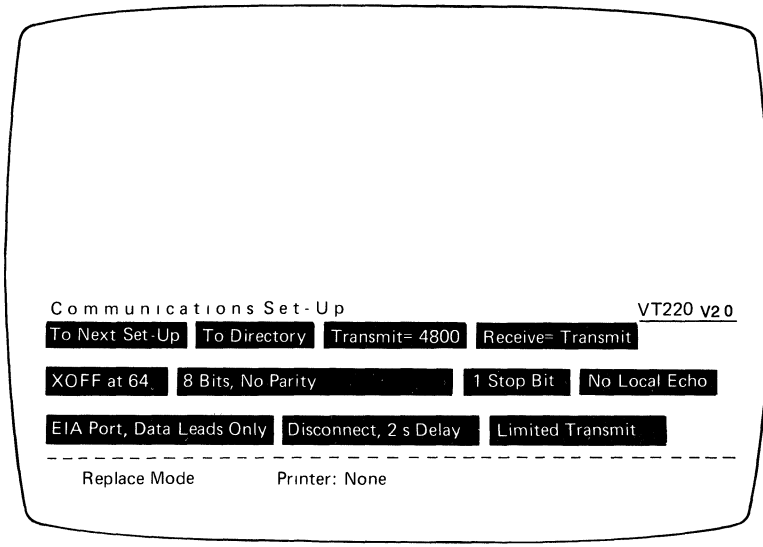


Figure 3-12 ▪ Communications Setup Screen

The Communications setup screen lets you define the terminal-host communications environment.

Table 3-7 ▪ Communications Setup Screen Features

Field and Field Type	Default	Functions
To Next Setup Action	None	Replaces communications setup screen with printer setup screen.
To Directory Action	None	Replaces communications setup screen with setup directory screen.
Transmit = Parameter	4800	Lets you select the rate (75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bits per second) at which the terminal sends data to the field host computer. Terminal transmit speed must equal the computer's receive speed.

Table 3-7 ▪ Communications Setup Screen Features

Field and Field Type	Default	Functions
Receive = Parameter	4800	Lets you select the rate (75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bits per second) at which the terminal receives data from host computer. This must equal the computer's transmit speed. The terminal, however, can send at one speed and receive at another.
XOFF Parameter	XOFF at 64	Lets you select the XOFF point or disable the automatic XON/XOFF flow control. Other choices include no XOFF and XOFF at other speeds. VT240 Series values differ from those of the VT220. See *VT220* or *VT240 Series Owner's Manual* and *VT220* or *VT240 Series Programmer's Reference Manual* for details.
Bits, Parity Parameter	8 bits, no parity	Lets you select the serial character communication format used for communication with the host computer. For other choices, see your *VT220* or *VT240 Series Owner's Manuals*. This does not set the format for communication with a printer.
Stop Bit Parameter	1 Stop Bit	Lets you select the number of stop bits (one or two) used by the host port. This does not set the bits for the printer port.
Local Echo Parameter	No Local Echo	Lets you enable or disable local echo.
Port Parameter	EIA port, Data Leads only	Lets you select the type of port used to communicate with the host. Your choices include 20-milliampere port, EIA port with data leads only, EIA port with modem controls, or integral modem (VT240 Series only). See *VT220* or *VT240 Series Owner's Manual* and *VT220* or *VT240 Series Programmer's Reference Manual* for details.

Table 3-7 ▪ Communications Setup Screen Features

Field and Field Type	Default	Functions
Disconnect, Delay Parameter	Disconnect, 2 s delay (For all countries except the United Kingdom, which uses 60 ms.)	Lets you enable or disable the disconnect feature and, when modem controls are used, to set the time between when the received line signal drops and disconnection.
Transmit Parameter	Limited Transmit	Lets you limit the terminal transmit speed to between 150 and 180 characters per second, regardless of baud rate.

▪ *Printer Setup Screen*

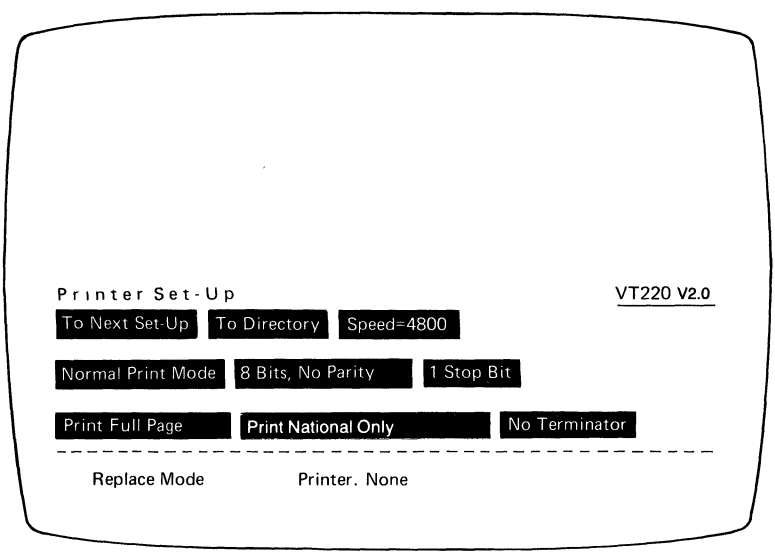


Figure 3-13 ▪ Printer Setup Screen

The Printer Setup Screen lets you define printer operations.

Table 3-8 ▪ Printer Setup Screen Features

Field and Field Type	Default	Functions
To Next Setup Action	None	Replaces printer setup screen with keyboard setup screen.
To Directory Action	None	Replaces printer setup screen with setup directory Screen.
Speed Parameter	4800	Selects the rate (75, 100, 150, 300, 600, 1200, 2400, 4800, 9600, and 19200) at which the terminal sends data to the printer or auxiliary device.
Printer to Host (VT240 Series only) Parameter	No printer to host	Selects whether or not input from the printer or auxiliary device is sent to the host computer.
Mode Parameter	Normal Print Mode	Selects the operating mode—normal, autoprint, or controller—for the printer.
Bits, Parity Parameter	8 bits, no parity	Lets you select the character format of the characters used at the terminal printer port. See the *VT220* or *VT240 Owner's Manual* for details.
XOFF	XOFF	See the *VT220* or *VT240 Owner's Manual* for details.
Stop Bits Parameter	One Stop Bit	Sets the number of stop bits (one or two) to match those used by the printer or auxiliary device.
Print Parameter	Print Full Page	Lets you select how much of the screen (the full screen or just the scrolling region) is to be printed during a print operation.

Table 3-8 ▪ Printer Setup Screen Features

Field and Field Type	Default	Functions
Printed Data Type Parameter	Print Multinational	Selects the type of characters (from the terminal's character sets) sent to the printer. Choose from Multinational, National, or National and Line Drawing.
Term Parameter	No Terminator	The print terminator field lets you select what characters come at the end of a print page operation. Selecting Term FF ends the print page operation with a carriage return, linefeed, and formfeed. Selecting No Term ends the print page operation with a carriage return and linefeed.

▪ *Keyboard Setup Screen*

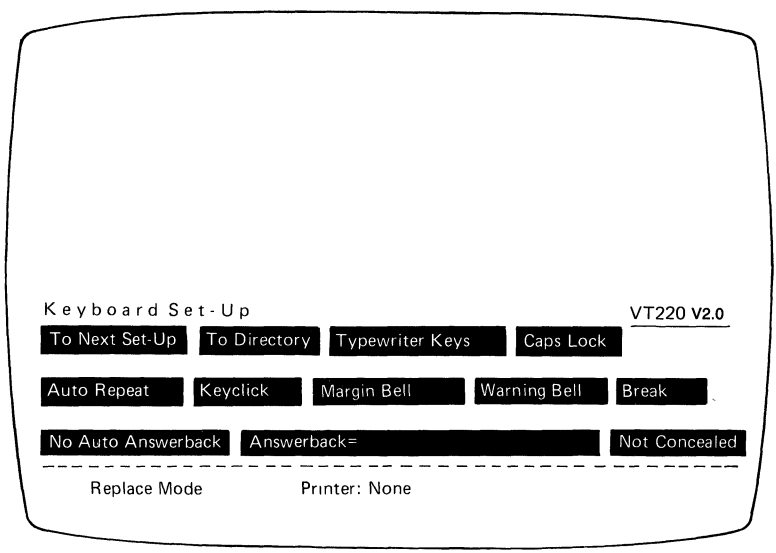


Figure 3-14 ▪ Keyboard Setup Screen

The Keyboard Setup Screen lets you define operating characteristics associated with the keyboard.

Table 3-9 ▪ Keyboard Setup Screen Features

Field and Field Type	Default	Functions
To Next Setup Action	None	Replaces keyboard setup screen with tab setup screen.
To Directory Action	None	Replaces keyboard setup screen with setup directory screen.
Keys Parameter	Typewriting Keys	Lets you select the appropriate keyboard map for the physical keyboard, either typewriter or data processing.
Lock Parameter	Caps Lock	Lets you select the way in which the SHIFT and LOCK keys operate.
Autorepeat Parameter	Autorepeat	Lets you select whether or not keystrokes are automatically repeated when you hold down a key.
Keyclick Parameter	Keyclick	Lets you select whether or not the keyboard generates a click sound each time a key is pressed.
Margin Bell Parameter	Margin Bell	Lets you select whether or not the terminal generates a bell tone when the text cursor reaches the right-hand margin.
Warning Bell Parameter	Warning Bell	Lets you select whether or not the terminal generates a bell tone on receipt of CTRL G or operating errors.
Break Parameter	Break	Lets you enable or disable the Break function.
Auto Answerback Parameter	No Auto Answerback	Lets you select whether or not the answerback message is automatically transmitted to the host after a communication line connection.

Table 3-9 ▪ Keyboard Setup Screen Features

Field and Field Type	Default	Functions
Answerback Text Parameter	None	Provides for user-defined answerback message entry.
Concealed Parameter	Not Concealed	Lets you select whether or not your answerback message is displayable on the setup screen.

▪ *Tab Setup Screen*

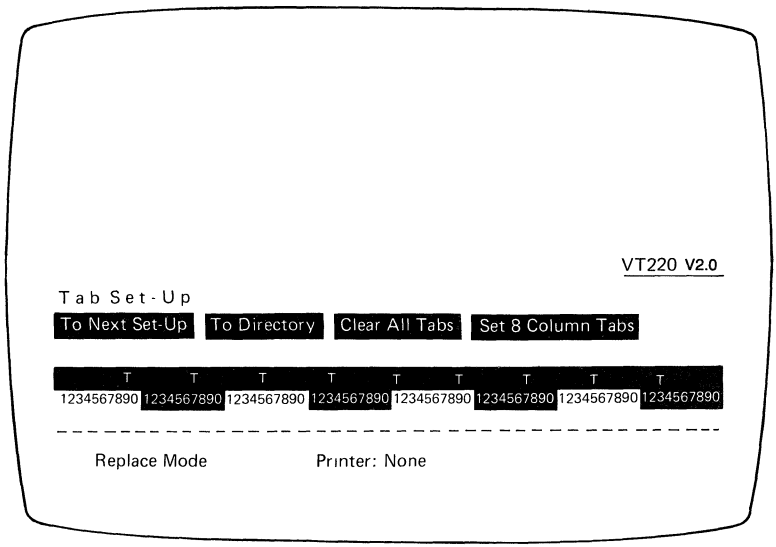


Figure 3-15 ▪ Tab Setup Screen

The Tab Setup Screen lets you set terminal tab stop settings. Beneath the tab stop fields is a ruler which you can reference when setting tabs. Each tab stop field can show a "T" (tab stop setting) or can be blank (no tab stop setting). You control the tab stop field cursor using the arrow keys. Pressing the ENTER key after you select a field places a "T" in a blank field or removes an existing "T".

Table 3-10 ▪ Tab Setup Screen Features

Field and Field Type	Default	Functions
To Next Setup Action	None	Replaces tab setup screen with display setup screen (VT220) or graphics screen (VT240 Series).
To Directory Action	None	Replaces Tab setup Screen with setup Directory Screen.
Clear All Tabs Action	None	Clears all previously set tabs.
Set 8 Column Tabs Action	None	Automatically sets tabs every 8 columns starting with column 9.

▪ *Graphics Setup Screen*

The VT240 series only Graphics Setup Screen lets you define graphics parameters for use by your VT240 Series terminal. To set the Tektronix 4010/4014parameters, refer to the documentation for the applications software you are using.

Table 3-11 ▪ Graphics Setup Screen Features

Field and Field Type	Default	Functions
To Next Setup Action	None	Replaces graphics setup screen with display setup screen or telephone setup screen if optional modem is installed.
To Directory Action	None	Replaces graphics setup screen with setup directory screen.
To 4010/4014 Setup	None	Enters 4010/4014 setup mode
Graphics Cursor-Parameter	Graphics Cursor	Lets you select whether or not the graphics cursor is displayed in graphics mode.
Macrograph Report Parameter	Marcograph Report	Lets you select whether or not the contents of a macrograph report is sent in response to the ReGIS Report Macrograph Command.

Table 3-11 ▪ Graphics Setup Screen Features

Field and Field Type	Default	Functions
Graphics Print Parameter	Compressed Print	Lets you select the size of the image on the graphics printer. Invoking compact graphics produces an image that is approximately 3 × 5 inches. Invoking the expanded graphics choice produces an image that is approximately 7 × 9 inches.
Mono Print Parameter	Mono Print	Lets you select monochrome or color sixel output to the printer port.
HLS/RGB Print Parameter	HLS Print	Selects HLS (hue/lightness/ satyratio n). RGB Print selects RGB (red/green/ blue).
Print Background Parameter	No Print Background	Sends all colors except background colors. Print Background sends all colors, including background colors.

The 4010/4014 Setup Screen allows you to set up parameters for Tektronix 4010/4014 functionality.

Table 3-12 ▪ 4010/4014 Setup

Field and Field Type	Default	Functions
To Next Setup Action	None	Replaces telephone setup screen with display setup screen.
To Directory Action	None	Replaces with setup directory screen.
CR Effect = Parameter	CR	Lets you select whether a received carriage return generates a carriage return only or a carriage return and a linefeed.

Table 3-12 ▪ 4010/4014 Setup

Field and Field Type	Default	Functions
DEL IMPLIES Parameter	LOY	Lets you enable or disable the 4010/4014 "DEL IMPLIES Lo Y" strap option.
LF Effect-Parameter	LF	Lets you select whether a received linefeed generates a received linefeed only or a linefeed and carriage return.
GIN Terminator = Parameter	None	Lets you select the characters that follow graphic input (GIN) address transmission—carriage return, carriage return and end of transmission, or no character.

- *Telephone Setup Screen (VT240 series only)*

The Telephone Setup Screen is available only if you have selected the optional modem for the VT240 Series terminal. This screen lets you store and display telephone numbers for automatic dialing.

Table 3-13 ▪ Telephone Setup Screen Features

Field and Field Type	Default	Functions
To Next Setup Action	None	Replaces telephone setup screen with display setup screen.
To Directory Action	None	Replaces telephone setup screen with setup directory screen.
Manual Answer/ Auto Answer Action	Manual	With manual answer, the VT240 terminal is in talk mode when disconnected or on power up. With auto answer selected, the terminal is in data mode when disconnected or on power up.
Telephone Number A = Text Parameter	None	Lets you enter a user-defined telephone number to be stored for dialing as designator A.
Telephone Number B = Text Parameter	None	Lets you enter a user-defined telephone number to be stored for dialing as designator B.
Concealed Parameter	Not Concealed	This screen has two Conceal fields. Each one conceals or does not conceal the telephone number entered at the left. Invoking Concealed causes the terminal to replace the telephone number with the text concealed. Invoking Not Concealed causes the terminal to display the telephone number as it is entered.

▪ Communications

The VT220, VT240, and VT241 terminals communicate with a host and a printer via full-duplex, asynchronous lines only. There are ten possible transmit/receive speeds that are selectable in setup. Your VT220 and VT240 Series terminals operate in accordance with the following national and international communications standards and recommendations:

- EIA Standard RS-232C
- EIA Standard RS-423
- CCITT Recommendation V.24
- CCITT Recommendation V.26 (V.10)
- CCITT Recommendation V.20 (V.21)

To communicate with the host, the VT220 and VT240 Series terminals use serial character format, which is selected in setup. Digital recommends that the number of data bits be the same for the host port and the printer port. The stop and parity bits, however, can be selected separately for each port.

Host and Printer Port Interfaces

Members of the VT200 family have two asynchronous serial ports—one for communications with a host and another for communication with an auxiliary device such as a printer. The host port has two physical connectors. The EIA or COMM host port connector (EIA RS-232C) connects your terminal to a local or remote host. The 20-milliampere host port connects your terminal to a local host. The printer port, with a single physical connector (RS-232C/RS-423), connects your printer or another device to your video terminal. On the VT240 Series, the printer port operates as a serial input channel as well. Devices such as digitizers and tablets can be used to input data via this port.

Communications with a Host

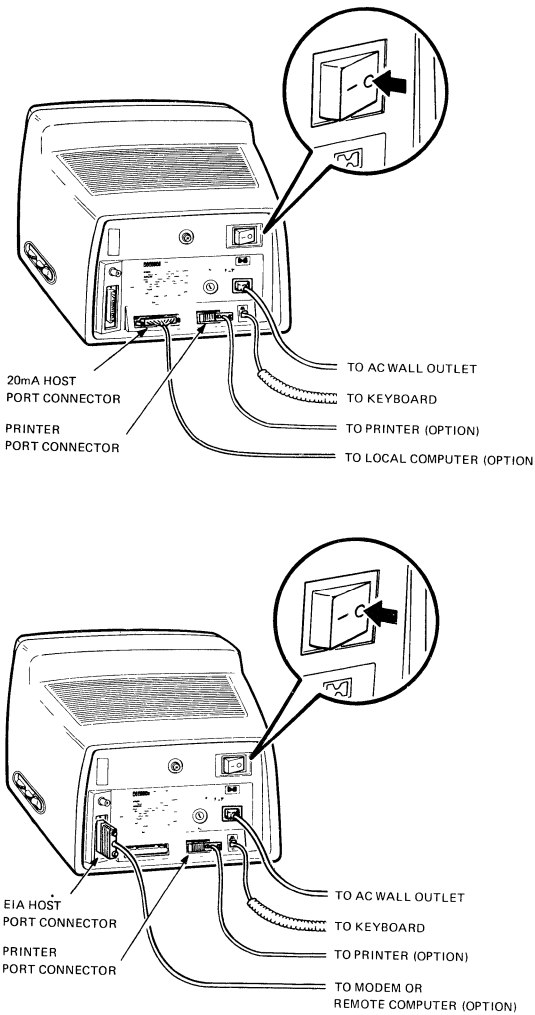


Figure 3-16 ▪ EIA and 20-milliampere Host Port Connectors

The VT220 and VT240 Series can be directly connected to a local host computer or via telephone lines to a remote host computer. To communicate with a local host, use the 20-milliampere current loop connector or EIA host port connector using a null modem cable. Connection of the VT220 and VT240 Series to a remote host is made via telephone lines using a modem or acoustic coupler. The modem used at the video terminal end must be compatible with the modem used at the host computer end. The VT220 and VT240 Series accept compatible modems and acoustic couplers such as Bell 103, 113, and 212, including Digital's DF112 modems. An optional intregral modem provides the VT220 and VT240 Series terminals with remote communications capability.

Communications with a Printer

You can locally connect your aynchronous, serial printer to a VT220 or VT240 printer port using the appropriate cable. Digital's current printers can be used with the VT220 terminal.

The printer port can be used as a serial input channel or input/output device (VT240 Series), as well as an output device. Choose the mode of operation you want in setup. When the printer port is selected as an input device in setup (Printer-to-Host Mode), data from the auxiliary device, as well as data from the terminal keyboard, can be sent to the host. Data from the printer port is treated the same as keyboard data.

If in setup you select the printer port as an output device (No Printer-to-Host), text and graphics print functions can be initiated from the keyboard as well as from the host. In this mode, input from the printer is disabled.

When the printer port is selected in setup as an input/output device (Printer Controller Mode), the device connected to the printer port is treated as the terminal, while the VT240 transparently monitors line traffic. This means all characters from the host are sent directly to the device connected to the printer port with the exception of XON, XOFF, NULL, and control functions from the host. These functions turn the Printer Controller on and off. All characters from the device are sent directly to the host with the exception of XON, XOFF, and NULL. There is a 256 character input buffer to support input from the printer port. See the *VT220* and *VT240 Series Owner's Manuals* for more details.

▪ Printing Screen Display

When your printer is properly connected to a VT220 or VT240 terminal, you can locally print whatever is on the monitor screen. To print a monitor screen display that contains only text, press the keyboard PRINT key. This stops all screen actions and sends the information on the screen to the printer. To abort the printing process, just press the PRINT key again.

To print a monitor screen display that contains graphics (VT240 Series only), press SHIFT and PRINT simultaneously. Just as with printing only text, this action freezes the screen and sends all text and graphics information on the screen to the printer. If you want to stop the printing process, press SHIFT and PRINT together.

The VT220 and VT240 Series of terminals operate in one of four text print modes. These modes, selectable in setup, are normal mode, autoprint mode, printer controller mode, and local controller mode.

Autoprint Mode

Autoprint mode prints a hardcopy of the current text line before the cursor moves to the next line. The cursor moves to the next line when the terminal receives a linefeed, formfeed, or vertical tab. When selected, autoprint mode is indicated by a status line in setup. After you have selected autoprint in setup, invoke the autoprint mode by pressing the CTRL and PRINT SCREEN keys. To stop autoprint mode, press CTRL and PRINT keys again.

Normal Print Mode

Normal print mode lets you select all local printing functions through the keyboard.

Printer Controller Mode

Printer controller mode gives the host direct control of the printer. Characters received from the host go directly to the printer and are not displayed on the video screen. When invoked, printer controller mode is indicated by a status line in setup. This mode cannot be selected from the keyboard, except by entering setup. Printer controller mode does not allow the use of local printing functions, for example, the PRINT SCREEN does not work.

Local Controller Mode

Local controller mode is selected by the local and printer controller setup features in the setup directory. When these features are selected, local controller mode supports keyboard output to the printer. This lets you set up various printers for operation, without involving the host.

▪ The VT220 and VT240/VT241 Modem Options

Two modems specifically designed for the VT200 family of terminals offer convenient communications for the user who needs to access remote hosts. With keyboard control, data/talk connections are simplified. And with their space-saving, integral design, the modem takes up no more room than the terminals themselves. Their features include:

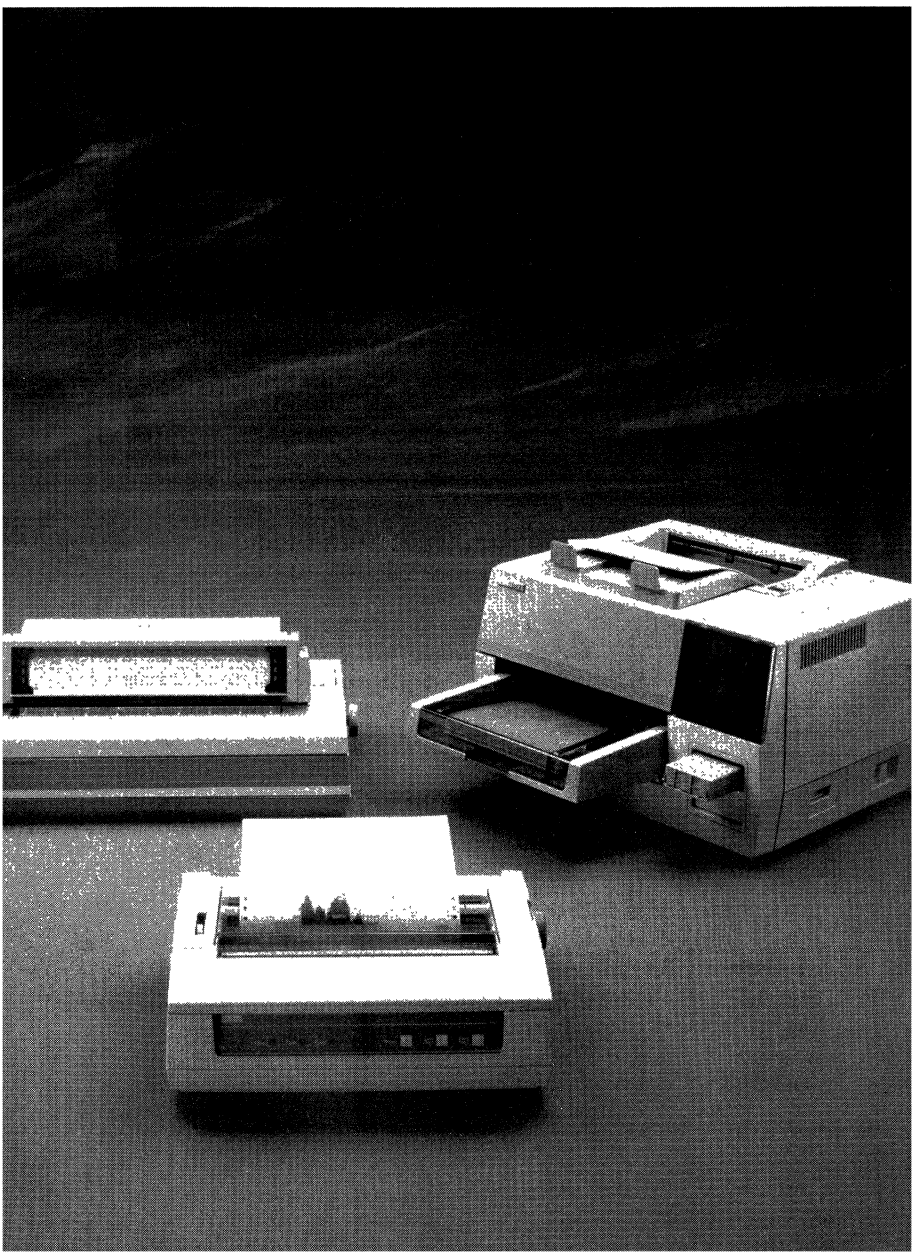
- Compatible with Bell System 103J or 212A modems in asynchronous mode
- Integrated into the award-winning VT200 family design
- Data/talk controlled from the terminal's keyboard
- Modems are powered by the terminal, thus there is no need for an additional power cable
- Connections can be initiated from a host with the automatic answering feature
- Self-diagnosis to permit the operator to easily detect if a fault condition is internal or external to the VT200 family terminal/modem equipment

The VT220 Modem

The VT220 modem fits neatly under your VT220 terminal. The modem, only 40mm (1.6 inches high), allows full use of the terminal's tilt mechanism.

The VT240/VT241 Modem

The VT 240 modem is a board level option that mounts inside the VT240 system box and provides all the features of the VT220 modem. In addition, in setup mode, you can switch from one communications port (EIA, 20mA, or modem) to another, without moving cables.The VT240/VT241 modem also lets you dial a host computer directly from the keyboard. You can store two frequently used telephone numbers in non-volatile memory for convenient autodialed connections.



▪ Hardcopy Terminals and Printers

Digital offers a broad range of high-quality, versatile hardcopy terminals and printers. Printers can be categorized in many ways—for example, according to print speed, print technology, and print quality. Here we have chosen to differentiate among printers according to print speed, that is, the amount of information that can be printed in a given timespan. There are three categories of printers—character printers, line printers, and page printers.

Character Printers

Character printers print one character at a time. Their speed is usually measured in characters per second (char/s) and depends on the print quality. In general, the higher the print quality, the lower the speed of the character printer. Some character printers are bidirectional, which allows for increased throughput of work. The bidirectional feature allows the printhead to move from left to right and then from right to left. This saves printing time because the printhead does not have to return to the left side after each line to print the next line.

Digital's current character printers include the LA50 Personal Printer, the new LA75 Companion Printer, the Letterprinter 210 (LA210), DECwriter III Printing Terminal (LA120), and the LQP02 and LQP03 Letter-Quality Printers. These products are well-suited to general purpose applications and personal computing needs for single users and small groups.

Line Printers

Line printers print one line at a time. In contrast, a page printer prints an entire page at a time. Because lineprinters and page printers are high-speed machines, they are generally used with larger computers and are designed for applications that require large quantities of output. For example, lineprinters can be used for computerized billing of credit card accounts or for printing employee payroll records. Digital's current lineprinters include the new LG01 and LG02, the LP25, LP26, LP27, and the LXY family of lineprinters/plotters.

Page Printers

Page printers, such as Digital's new PrintServer 40, LN01, and LN03 Laser Page Printers, can be used to reproduce large quantities of high-quality text at top speeds. Page printers, especially those that handle and collate large amounts of paper, are ideal for printing documents, forms, reports, and newsletters that receive a wide distribution. The networked PrintServer 40 is recommended for departmental printing, the LN01 for office cluster printing and the LN03 tabletop laser printers are recommended for desktop printing.

KSR and RO Terminals

A KSR (keyboard send and receive) terminal is an interactive terminal. It has a keyboard that allows you to send data to the host computer as well as retrieve and print existing data. Receive-only (RO) terminals do not have a keyboard and simply print the data sent by the host. Because RO terminals are used with systems where the principal user interface is a video terminal, the user can continue to enter data through the video terminal, while the terminal prints. This permits efficient use of CPU time as well as the user's time because the user does not have to wait for the information to finish printing before new information can be entered.

▪ Printing Technologies

Most character printers are impact printers. Impact printers use the same impact printing technique as a regular typewriter. An inked ribbon is pressed against a piece of paper to make a mark. Impact printers can use either a dot-matrix or solid-font method of character formation.

With **dot-matrix** print technology, a set of wires in the printhead strikes the printer ribbon to form a character. Therefore, each character is composed of tiny dots. Dot-matrix printers are faster and usually less expensive, in general, than printers using a solid font, and are usually draft-quality printers. Dot-matrix printers are also more flexible, because the use of dots allows faithful representations of screen displays (providing graphics capabilities) and the creation of international symbols and characters. Some dot-matrix printers have fonts that are capable of enhanced printing capabilities. The microcode resident in these printers produces characters in which the dots are closer together. Thus the character produced is sharper and darker than those produced by draft-quality printers, but not as sharp as a character produced by a solid-character printhead.

When a **solid font** is used, each character is fully formed, similar to typewriter characters, producing clear copies. One popular arrangement for these fully formed, individual letters is on the spoke of a rotating disk—which is called a daisywheel. Daisywheel printers offer excellent print quality and are referred to as letter-quality printers. Digital's LQP03 is a letter-quality printer.

Lineprinters use either **band or drum** printing technology. In **band** technology, the key elements are a flat steel band with raised letters and a hammer bank with 132 hammers (one for each column). As the selected character appears on the moving band, each hammer strikes one character, and is pressed against an inked ribbon to form a mark. An advantage of the character band is that it is user-replaceable. The LP27 uses a character band.

With **drum** technology, paper and inked ribbon pass between a row of hammers and a continuously rotating metal drum. The drum surface contains 132 columns of all print characters. Printing is accomplished by scanning the stored characters in synchronization with the rotating drum characters and actuating the appropriate hammer as the desired characters move into the printing position. The LG01 is a drum printer.

Page printers are presently in the forefront of printing technology. Digital's PrintServer 40, LN01, and LN03 use laser imaging and **xerographic** printing. The laser beam forms an electrostatic image of the page on the print drum. Dry ink is attracted to the charged image, then transferred and fused to the paper with heat. These printers also have sophisticated font-handling capability that results in near typeset-quality graphics and text in a wide variety of typestyles.

Fonts

Digital's laser printers bring typeset-quality printing capabilities to the office environment for the first time. And with those new printing capabilities also comes a new terminology. The terminology of typography. This doesn't mean that if you buy a laser printer, you need to be a typographer. Understanding the basic definitions of type and what they mean in terms of the printer's performance, however, can help you take advantage of the power and flexibility of your PrintServer 40, or LN01, or LN03. The following terms and definitions may clear up any confusion over the printers' features and capabilities.

- *Typeface*

  A set of characters (letters, numbers, symbols, etc.) designed with similar traits, such as height, thickness, and overall style. An example of an individual typeface is the **Times** typeface.

- *Type Family or Font Family*

  A group of typefaces that share a basic style, but vary in terms of angles, proportions, and weight. For example, the Times type family is made up of a number of different Times typefaces, such as Times Roman (normal characters), Times Bold (thicker characters) and Times Italics (slanted characters).

  Within any given type family, characters (letters, symbols numbers) share the same x-height (a vertical dimension equal to the height of the lowercase letters without ascenders or descenders), ascender and descender measure. Laser printing offers an advantage over dot-matrix printing for creating clear, sharp ascenders and descenders that make text more readable.

- *Character Sets*

  A character set is a discrete group of letters, numbers, and symbols created to address the needs of specific applications areas, such as the scientific, mathematical, publishing, and international markets. A typeface can be supported by over 200 distinct letters and symbols. Two examples of character sets are the **Scientific** and **ASCII** character sets.

- *Weight*

  Weight is a character attribute that combines character density and proportion. Some common examples of different type weights are—normal or roman, bold, italic and bold italic.

- *Serifs & Sans Serifs*

  Serifs are small cross-strokes that are hooked on at the terminal points of the main strokes that make up a character. A serif typeface is one made up of characters that have these small cross-strokes. Times is a serif typeface.

  A **sans serifs** (translated: **without serif**) typeface, on the other hand, has characters made up of main strokes of more or less even thickness but without the small cross-strokes. Helvetica is a sans serif typeface.

  Some people believe that serifs help the reader by easing the eye's movement from letter to letter and word to word. Other people believe that sans serif typefaces provide the same advantage.

  Choosing between the two depends largely on the job at hand and on personal preference. There appears to be agreement that sans serif typefaces are often a good choice for display type.

- *Monospaced and Proportionally Spaced Type*

  Monospaced type is made up of individual characters and surrounding white space (together, a **character cell**) that each occupy a fixed amount of space on the printed page like a typewriter. Even though the actual width of the printed character may vary, the total space occupied by each character cell does not.

  Proportionally spaced type means the characters are of proportional, or variable width. Thus, in a document printed with proportionally spaced type, a **W** would occupy a wider space than an **I**.

  In the typographic industry, and other areas in which printed communications are important, monospaced type is generally considered to be less attractive and less readable than proportionally spaced type. People have an easier time reading text that is set the same way as the bulk of the text they encounter in their day-to-day lives. And today, most printed communications—books, magazines, newspapers, advertisements, and so on—are set in proportionally spaced type.

Also, monospaced type consumes a greater amount of space on the page because even thin characters such as **l** must occupy the same amount of space as wider characters such as **w**. In large printing jobs, such as newspapers, books, and documentation, the use of proportionally spaced type can save significant sums of money.

- *Point Size or Type Size*

  Type sizes are commonly measured by the vertical distance between the **baselines**, or bottoms of the characters, in two rows of equally sized, normally spaced type—not counting any descending strokes, as in a **y** or **p**, that may fall below the baseline.

  These measurements are expressed using the **point system**. There are 72 points to the inch. A 72-point typeface, then, has lines that are approximately one vertical inch apart on the printed page.

  Most typefaces vary in size from 6 points to more than 70 points. **Body** types used for printing text or copy typically range from 8 points to 12 points; while **display** or headline type typically range from 14 points on up.

- *Orientation—Portrait and Landscape*

  Portrait printing, the most common and widely used printing orientation, is made up of lines of text that are printed parallel to the short dimension of the sheet. This orientation is typically used for books, newspapers and magazines, reports, letters, memoranda, and other documents.

  Landscape (or **sideways**) printing features lines of text that are printed parallel to the long dimension of the paper. This orientation is typically used for printing very wide text, such as charts, tables, and spreadsheet calculations; or for printing two **standard** pages of copy side by side on a single page.

  The benefit of landscape printing is that it permits greater amounts of information to be included on a single line without the need to choose a smaller typesize (which would reduce the readability and impact of the printed information).

- *Font*

  A font (or type font) is a typeface in one specific point size, weight (thickness), angle and orientation (portrait or landscape). The 10- point Helvetica Bold Landscape font is an example of a single type font.

Graphics Capability

Premium dot-matrix printers will print the same bit-mapped graphics that are displayed on a video terminal screen. This means you can print the exact forms, charts, graphs, logos, or designs created and displayed by your video terminal. Letter-quality printers also can be used to create business-quality graphs and charts. As for color, pen plotters and ink-jet printers offer the best resolution and color definition—better than what you see on your video screen. Laser page printers deliver the advantage of printing text and graphics together on the same page. The PrintServer 40 is the first of Digital's printers to include the POSTSCRIPT page description language. Because POSTSCRIPT stores typefaces as outlines that create the opportunity for some very complex graphics operations.

▪ Digital's Printers, Printer Positioning, and Features

The introduction to the handbook contains brief descriptions of the printers that are discussed at length within individual chapters. The following tables provide further selection information.

Table 4-1 gives a quick overview of Digital's printers and positions them relative to typical systems and users. Detailed descriptions of features and capabilities of each device as well as cross-system capabilities are contained within the chapters that follow. Table 4-2 summarizes the many features of Digital's KSR and RO printers. Table 4-3 summarizes the key features of Digital's system printers. Further details on these products are found in the following chapters and appendices.

Table 4-1 ▪ Digital's Printer Positioning

Applications Environment	Word Processing	Tabular Data	Multipart Forms and Analysis	Text/Graphics for Presentation
Individual Users				
(Video Terminals, Personal Computers, Word Processors)	LQP03 LA210 LN03 LA75	LA75 LA210 LN03 LA120	LA120 LA210 LA75	LA120 LA75 LN03/LN03 Plus LQP03 (Daisy-Aids*)
Small Departments				
(Small PDP-11 Systems & Small VAX Systems)	LN03 LQP02 LA210	LN03 LA210 LA120	LA120 LA210	LN03/LN03 Plus LA210 PrintServer 40
Computer Rooms				
(Large PDP-11 Systems, VAX Systems, DECsystem-10, & DECSYSTEM-20)	LN01 sys. printer LN03 distr. printer LN01 sys. printer LN03 distr. Printer	LP Family of Printers PrintServer 40	LP Family of Printers PrintServer 40	LN03 distr. printing LN01S sys. printer PrintServer 40

*Daisy-Aids is a registered trademark of Escape Computer Software, Inc.

Table 4-2 ▪ Printing Terminal and Printer Selection

Feature	Receive-only Devices			KSR Devices		
	LQP02	**LQP03**	**LA75**	**LA210**	**Letterwriter 100**	**DECwriter III**
Mounting	Desktop	Desktop	Desktop	Desktop	Desktop	Pedestal
Print Technology	Daisywheel	Daisywheel	Dot matrix	Dot matrix	Dot matrix	Dot matrix
Print Speed (Max. chars/s):						
Draft	—	—	250	240	240	180
Memo	—	—	125	80 optional	80 optional	—
Letter Quality	32	25 (Shannon) 34 (AAA)	32	40	30 throughput	—
Paper Style:						
Office Stationery	Standard	Optional	Standard	Optional	Standard	—
Fanfold	Optional	Optional	Standard	Standard	Standard	Standard
Roll	—	—	—	—	Optional	—
Envelopes	—	—	Standard	—	—	—
Characters Per Line:						
Standard Print	132	110	80	132	132	132

Table 4-2 • Printing Terminal and Printer Selection (Cont.)

Feature	Receive-only Devices			KSR Devices		
Compressed Print	158	165	132	217	217	217
Selectable Character Widths	2	3	8 4 (Near-LQ)	8 (draft mode) 4 (Near-LQ)	8 (draft mode)	8
Max. Paper Width:						
In centimeters	38.1	30.48	25.40	38.10	38.10	38.10
In inches	15	12	10	15	15	15
Paper per Form	4	4	4	4	4	6
National Character Sets	25	8	12	10	10	6
User-selectable Typefaces	Optional	Optional	Optional	2	2	—
Bit-mapped Graphics	—	—	Standard	Standard	Standard	—
VT100 Line-drawing Set	—	—	Standard	Standard	Optional	—
Buffer capacity in Kbytes	0.256	0.256	2	2 4 optional	0.4 standard 4 optional	1 standard

Table 4-2 ▪ Printing Terminal and Printer Selection (Cont.)

Feature	Receive-only Devices			KSR Devices		
Communication Interfaces:						
RS232	Standard	Standard	DEC 423	Standard	Standard	Standard
20 mA	—	—	—	Optional	Optional	Optional
Parallel	—	—	—	—	—	—
Integral Modem	—	—	—	—	—	—
Acoustic Coupler	—	—	—	—	—	—

Table 4-3 ▪ System Printer Selection

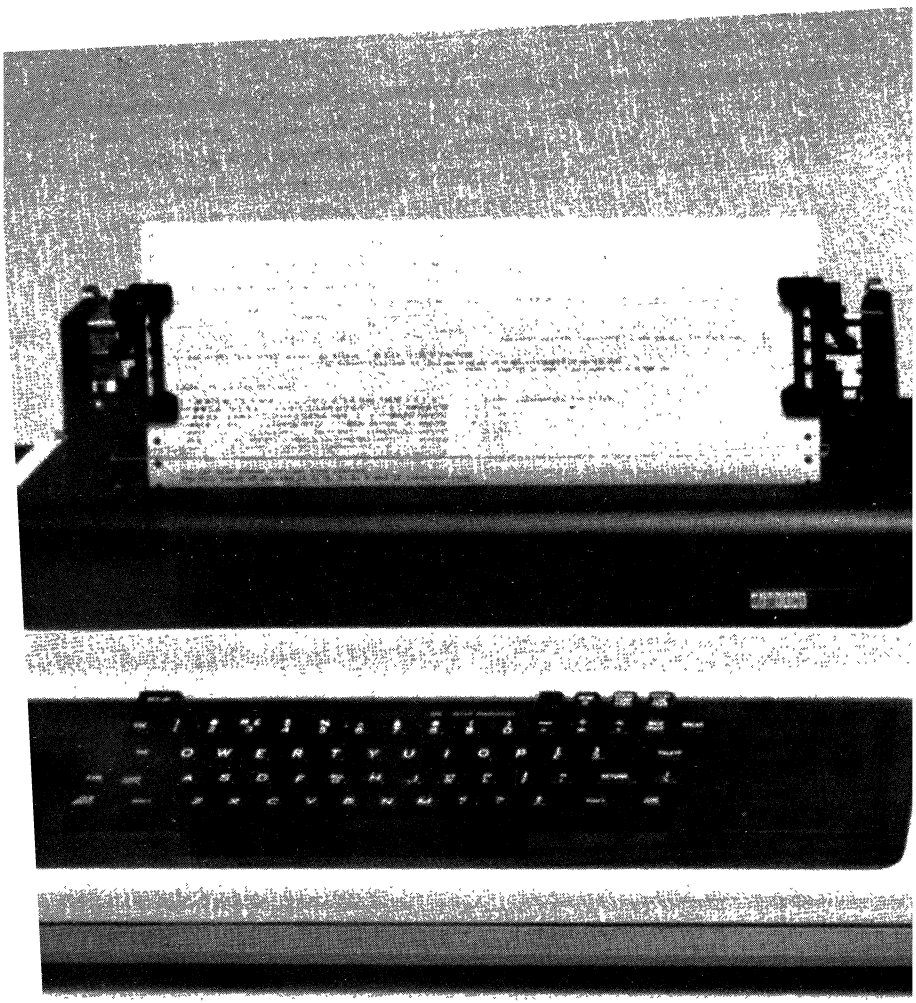
Feature	LN01	LN03, LN03 Plus	LP25, LP32-A, LP32-B	LP26, LP32-E	LP27	LXY12	LXY22	PrintServer 40
Print Speed:								
In pages per minute	12	8	—	—	—	—	—	40
In lines per minute	—	—	300/215	600/450	1250/800	300/240	600/465	—
Character Set:								
Number of Sets	2	3	2	2	2	2	2	8
Characters per Set	188 each	—	64/96	64/96	64/96	64/96	64/96	—
Print Technology:								
Laser	Yes	Yes	—	—	—	—	—	Yes
Band	—	—	Yes	Yes	Yes	—	—	—
Dot Matrix	—	—	—	—	—	Yes	Yes	—
Paper Type Accepted:								

Table 4-3 ▪ System Printer Selection (Cont.)

Feature	LN01	LN03, LN03 Plus	LP25, LP32-A, LP32-B	LP26, LP32-E	LP27	LXY12	LXY22	PrintServer 40
Office Stationery	Yes	—	—	—	—	—	—	—
Single Sheet—								
8.5 by 11	—	Yes	—	—	—	—	—	—
8.5 by 14	—	—	—	—	—	—	—	Yes
11 by 17	—	—	—	—	—	—	—	Yes
7.5 by 10	—	—	—	—	—	—	—	Yes
A3	—	—	—	—	—	—	—	Yes
A4	—	Yes	—	—	—	—	—	Yes
B4	—	—	—	—	—	—	—	Yes
Fanfold	—	—	Yes	Yes	Yes	Yes	Yes	—
Multipart Forms	—	—	Yes	Yes	Yes	Yes	Yes	—
Graphics Capability	—	Yes	—	—	—	Yes	Yes	Yes

Table 4-3 ▪ System Printer Selection (Cont.)

Feature	LN01	LN03, LN03 Plus	LP25, LP32-A, LP32-B	LP26, LP32-E	LP27	LXY12	LXY22	PrintServer 40
Paper Slew SPEED (CM/S)	—	—	37.5	37.5	50	20.3	40.6	—
Line Advance Time (ms)	—	—	25	25	14	8.5–10	8.5–10	—



▪ Overview

The Letterwriter 100 (LA100) is a multi-talented, wide-carriage, tabletop printer/terminal. The LA100's features include multiple maximum speeds of 240 cps draft quality and 30 cps near letter quality, and a variety of dynamically selectable character fonts and bit map graphics. An optional 80 character per second font chip or cartridge is ideal for internal correspondence such as memos.

Depending on the model you choose, your Letterwriter 100 comes standard with either the US/UK character set in two typefaces, such as Courier-10 and Orator-10, or the US/UK international character sets in one typeface. You can easily add more character sets and typefaces by inserting one or two plug-in cartridges at the front panel. During printing the host computer can switch from one to the next character set instantly without manual intervention.

The LA100 offers as an option the APL programming language and Symbols, a set of scientific characters. When used in conjunction with the corresponding primary ROM, international overlays provide national character sets, as well as the VT100 line drawing set.

The Letterwriter 100's graphics can enhance your documents by presenting complex information clearly and simply. When putting together your reports and proposals, you can drop in appropriate graphs, bar charts, or unique characters to add clarity and impact. You can also print on the most popular forms of paper available for small printers: office stationery, roll and fanfold paper, and multipart forms.

There are four versions of the Letterwriter 100.

LA100-BA: Letterwriter 100 US/UK KSR model; 240 characters per second (maximum speed) draft (7 by 9) and 30 characterrs per second (maximum speed) high-resolution (33 by 18) dot-matrix printing; bit map graphics. Comes with 2 font ROM chips: Courier-10 and Orator-10 in ASCII character sets. Includes paper-out switch, numeric keypad, tractors, ribbon cartridge, paper, BC22A-25 cable, positions for 3 optional font ROMs, and 120 Vac setting on 120/240 universal power supply.

LA100-BB: Letterwriter 100 international KSR model; 240 characters per second (maximum speed) draft (7 by 9) and 30 characters per second (maximum speed) high-resolution (33 by 18) dot-matrix printing; bit map graphics. Comes with 2 font ROM chips; Courier-10 ASCII, and Courier-10 international with VT100 line-drawing character sets. Includes paper-out switch, numeric keypad, tractors, ribbon cartridge, paper, BC22A-25 cable, European keycaps, positions for 3 optional font ROMs, and 240 Vac setting on 120/240 universal power supply.

LA100-CA: LA100-BA with Multifont Adapter Option. This allows you to plug in up to two ROM cartridges in the front panel and also allows font selection from the front panel.

LA100-CB: LA100-BB with Multifont Adapter Option. This allows you to plug in up to two ROM cartridges in the front panel.

▪ Major Features

The major features of the Letterwriter 100 are:

- Multiple print modes—Draft- and letter-quality print modes, plus an optional memo-quality print mode, allow you to choose the quality that suits your needs.
- Multiple typefaces—Include the standard Courier and Orator, and optional Gothic and Courier Italics, allow for complete document design flexibility.
- Full bit-map graphics—Permits printing of graphs, bar charts, and bit-map images.
- Multiple characters sets—Print ASCII and national character sets, plus optional VT100 line drawing, APL, and Symbols character sets.
- Multiple paper types—Accepts roll and fanfold paper, office stationery, and multiple form paper.

▪ Printing Features

The Letterwriter 100 offers two program-selectable text printing modes. Using a nine-wire printhead enables the LA100 to print below-the-line descenders, such as on the letters "p," "q," and "y," as well as underlining in all text modes. The graphics mode can be used to plot graphs and draw pictures that include shading and curved lines.

Letter-quality Printing

At a maximum speed of 30 characters per second maximum, the printhead uses a 33 by 18 matrix of dots to produce sharp, clear characters. This letter-quality printing is suitable for your reports, proposals, and business correspondence.

Draft Printing

At a maximum speed of 240 characters per second maximum, the LA100 provides high speed output by using a 7 by 9 dot matrix. This is suitable for draft printing.

Optional Memo Printing

Memo printing is available at 80 characters per second (maximum speed) maximum on an optional ROM cartridge or ROM chip. In memo mode the dot matrix used is 33 by 9 and the result is intermediate to letter-quality and draft printing.

```
   DIGITAL EQUIPMENT CORPORATION is proud to
introduce the LETTERWRITER 100. Designed with the famous
 DECwriter tradition for performance and reliability, it is the most
versatile printer in its class!!

        o 240 CPS DATA PRINTING
          o 30 CPS LETTER PRINTING
            o HIGH SPEED GRAPHICS

For example:

COURIER 10 TYPE FONT   COURIER 10 EXPANDED   DRAFT QUALITY
ORATOR 10 TYPE FONT    ORATOR 10 EXPANDED    DRAFT QUALITY
COURIER 10 TYPE FONT   COURIER 10 EXPANDED   HIGH QUALITY
ORATOR 10 TYPE FONT    ORATOR 10 EXPANDED    HIGH QUALITY
```

Figure 5-1 ▪ LA100 Print Sample

Graphics Printing

The Letterwriter 100 prints bit map graphics in 132 by 72 dots per inch. You can select an optional ROM chip or plug-in cartridge of Digital's line drawing character set. Designed for Digital's VT100 family of video terminals, this character set uses square corners, intersections, and solid horizontal and vertical lines. This character set lets you create handy graphics, like boxes, borders, and dividers for printed forms and charts.

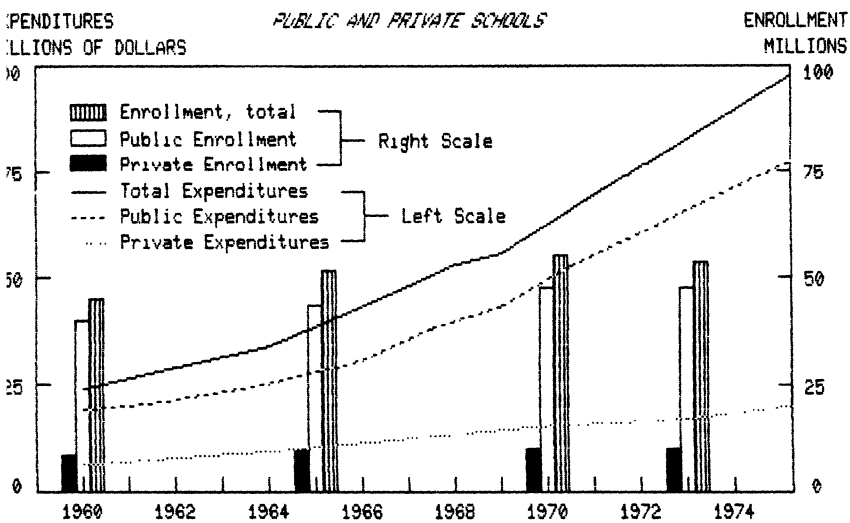


Figure 5-2 ▪ LA100 Graphics Sample. 80% of Actual Size.

Character Sets

The LA100 Letterwriter has a variety of character sets and typefaces for you to select from: These include

- 94-printing-character ASCII set.
- Courier-10, Courier-12, Orator-10, Gothic-10, and Gothic-12 typefaces.
- Symbols-10 scientific character set.
- VT100 line-drawing character set.
- Ten national character sets—English/United States, United Kingdom, Finnish, French, Canadian French, German, Italian, Norwegian/Danish, Spanish, and Swedish.
- Customized character sets and typefaces.

Character sets can be changed any time using set-up mode or the ANSI selection sequences. Refer to your Letterwriter 100 Operator Guide and Programmer Reference Manual for more details. Digital has a Dot Pattern Set (DPS) for such languages as English, French, Italian, and others, as well as technical symbols, APL, and the VT100 line-drawing set. DPS can also cover individual needs such as musical symbols and company logos.

Character size, dependent upon the print mode selected, lets you print double-width and compressed characters.

Normal width, non-compressed character sizes can be chosen from 10, 12, 13.2, or l6.5 characters per inch for draft printing, and 10 or 12 characters per inch for memo or letter-quality printing.

Double-width characters print at 5, 6, 6.6, and 8.25 characters per inch during draft mode and 5 or 6 characters per inch in memo or letter-quality mode.

The compressed font fits 132 columns to display a full spreadsheet on standard 21.6 cm (8.5 in) wide page.

▪ Paper

The versatile LA100 Letterwriter can print on single sheets, roll, and fanfold paper ranging from 7.6 to 37.8 cm (3 to 14.9 in) wide. It can print on four-part forms to a maximum thickness of 0.051 cm (0.020 in).

▪ Options

Part Number	Description
LA10X-EB	The 4K BUffer Option enlarges the input buffer from 400 characters to 4,096 characters.
LA10X-CL	The 20 mA Interface Option connects printers to hosts more than 500 feet apart. The LA100 has space for only one interface at a time.
LA10X-SF	The Sheet Feeder Option is a single tray, cutsheet feeder holding up to 230 sheets of 20 pound paper. It includes a manual feed mode for insertion of single sheets. Customer installable.
LA10X-EL	LA100 Forms Tractor

▪ Supplies and Accessories

Part Number	Description
LA10R-06	Ribbon Cartridge, box of 6
LA10X-SQ	Stand Paper Shelf
LA10X-SW	Terminal Paper Tray
LA10X-SL	Terminal Stand, light oak top with charcoal brown base
H9850-HA	Dust Cover for Terminal when used w/paper roll
H9850-HB	Dust Cover for Terminal when used w/tractor feed
LA10X-FB	Acoustic Cover reduces noise levels to below 55 dBA
LAX34-ZA	Carrying Case

ROM Cartridges

LA10X-AA	Courier-10 Domestic
LA10X-AB	Courier-12 Domestic
LA10X-AC	Gothic-12 Domestic
LA10X-AD	Orator-10 Domestic
LA10X-AE	Symbol-10
LA10X-AF	Gothic-10 Domestic
LA10X-AH	Courier-10 Memo Domestic
LA10X-AJ	Orator-10 Memo Domestic
LA10X-AP	Italics
LA10X-AR	DEC Technical
LA10X-BN	APL-10
LA10X-JN	VT100-10
LA10X-JP	VT100-12
LA10X-JR	VT100-10

ROM Chips

LA10X-CA	Courier-10 ROM Chip
LA10X-CB	Courier-12 ROM Chip
LA10X-CC	Gothic-12 ROM Chip
LA10X-CD	Orator-10 ROM Chip
LA10X-CE	Symbol-10 ROM Chip
LA10X-CH	Courier-10 ROM Chip
LA10X-CJ	Orator-10 ROM Chip

▪ Operator Features

Installation Tests

There are three tests to check proper cartridge installation.

- Cartridge electrical insertion test (described in *Installation* section.)
- Insertion power-up/checksum test
- Status message

To ensure proper operation of DPS ROM cartridges, make sure that you have:

- Fully inserted the cartridge right side up and not bent the DPS ROM pins.
- Inserted the cartridge in the correct slot. For example, if the overlay cartridge has been inserted in slot 2, rather than slot 4, remove it and place it in the right slot.
- Installed an overlay with the corresponding primary DPS ROM.

▪ *Insertion/Power-up Checksum*

When power is applied or when a cartridge is inserted, the printer performs an internal check. It tries to access the DPS ROMs and if a DPS ROM is present, it is tested. If the test fails, the printer indicates the faulty DPS ROM by flashing the DSR and POWER/FAULT lights.

Table 5-1 ▪ Power-Up/Insertion Test Failures

DSR Indicator	POWER/FAULT Indicator	Probable Cause	Corrective Action
1 flash	1 flash	ROM 1 defective or not present	Check DPS ROM for proper installation and reinstall. If there is no change, then replace the ROM.
2 flashes	2 flashes	ROM 2 defective (may be cartridge or plug-in ROM)	Check DPS ROM for proper installation and reinstall. If there is no change, then replace the ROM.
3 flashes	3 flashes	ROM 3 defective	Check DPS ROM for proper installation and reinstall. If there is no change, then replace the ROM.
4 flashes	4 flashes	ROM 4 defective (may be cartridge or plug-in ROM)	Check DPS ROM for proper installation and reinstall. If there is no change, then replace the ROM.
5 flashes	5 flashes	ROM 5 defective	Check DPS ROM for proper installation and reinstall. If there is no change, then replace the ROM.

Table 5-1 ▪ Power-Up/Insertion Test Failures

DSR Indicator	POWER/FAULT Indicator	Probable Cause	Corrective Action
6 flashes	6 flashes	First microcode ROM defective	Reinstall DPS ROM. If there is no change, then replace the ROM.
7 flashes	7 flashes	Second microcode ROM defective	Reinstall DPS ROM. If there is no change, then replace the ROM.
8 flashes	8 flashes	RAM defective	Replace logic board
9 flashes	9 flashes	Optional RAM defective	Replace logic board

If an error is detected, turn off the power to the printer. DPS ROMs are checked sequentially until a failure, if present, is displayed. In the case of a failure, check that the ROM was properly installed. If not, reinstall it correctly. If there is still no change, replace the faulty cartridge and then turn the printer back on. If an error still persists, check your service documentation for more details.

- *Status Message Test*

  Print the status message to check that the printer recognizes an installed DPS. The third line of the status message contains a unique three-digit code for each DPS installed, up to five. Table 10-2 lists the currently available DPS's and their corresponding ROM identification codes.

Table 5-2 ▪ ROM Identification Codes

Identification Code	DPS
001	High-resolution Gothic-10 US/UK primary
002	High-resolution Gothic-10 international
003	High-resolution Gothic-12 US/UK primary
004	High-resolution Gothic-12 international
005	High-resolution Courier-10 US/UK primary
006	High-resolution Courier-10 international
007	High-resolution Courier-12 US/UK primary
008	High-resolution Courier-12 international
009	High-resolution Orator-10 US/UK primary
010	High-resolution Orator-10 international
011	High-resolution Courier-10 italicized primary
069	Medium-resolution Courier-10 US/UK primary
070	Medium-resolution Courier-10 international
073	Medium-resolution Orator-10 US/UK primary
074	Medium resolution Orator-10 international
129	High-resolution Symbols-10 primary
131	High-resolution VT100-10 Line Drawing Set primary
133	High-resolution VT100-12 Line Drawing Set primary
135	High-resolution DEC Technical-10 primary
144	High-resolution Katakana-10 overlay font
145	High-resolution DEC Technical-12 primary font
147	High-resolution Symbols-12 primary font
193	Medium-resolution VT100-10 Line Drawing Set primary font

Notes:

001—064: Indicates high density standard DPS

065—128: Indicates medium density standard DPS

129—192: Indicates high density special purpose DPS

193—200: Indicates medium density special purpose DPS

A standard DPS with an odd identification code indicates a primary DPS containing the U.S. and U.K. character sets. A standard DPS with an even identification code indicates an overlay DPS containing the following character sets:

- USASCII
- ISO United Kingdom
- ISO German
- ISO French
- ISO Italian
- ISO Spanish
- Digital Finnish
- Digital Norwegian/Danish
- Digital Swedish
- Digital French Canadian
- Digital Multinational or Digital VT100 Line Drawing

A DPS is always installed in slot 1 inside the printer, so the status message always prints a three-digit code for DPS 1. If a DPS is installed in slot 2, the message has a three-digit code for slot 2.

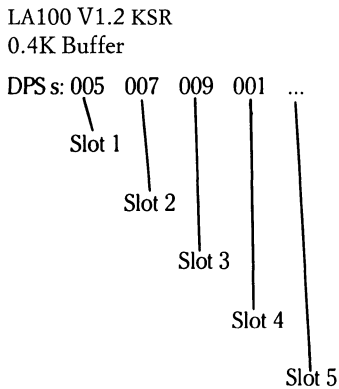


Figure 5-3 ▪ Status Message Depicting DPS Identification Code

If a DPS is not installed or is installed incorrectly, the status message shows three periods, as shown here for DPS 5.

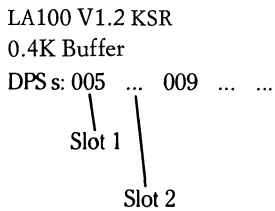


Figure 5-4 ▪ Status Message Depicting Missing Identification Code

This status message indicates that the printer does not recognize that a DPS is installed in slot 2. Check or replace the DPS ROM installed in slot 2.

In order to print a status message, first check that the printer is on. Enter set-up mode and press 8.

Terminal/Printer Controls

The LA100 has four different categories of controls and indicators that you can use to control and monitor terminal operation: terminal/printer controls, keyboard, visual indicators, and audible indicators.

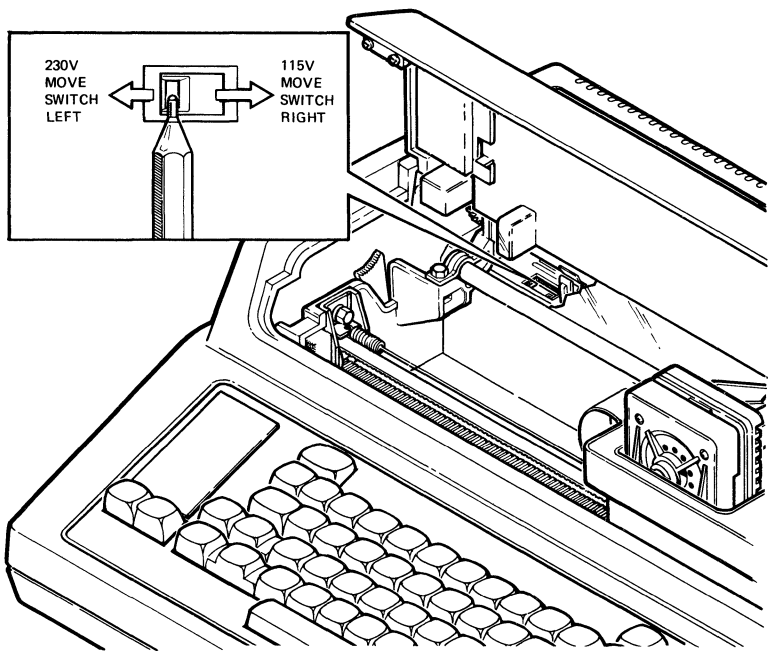


Figure 5-5 ▪ Letterwriter 100 Voltage Selector Switch

▪ *Voltage Selector Switch*

This switch changes the terminal to match the available AC input voltage range. **Note:** Failure to set the voltage selector switch to the correct voltage range may damage the power supply.

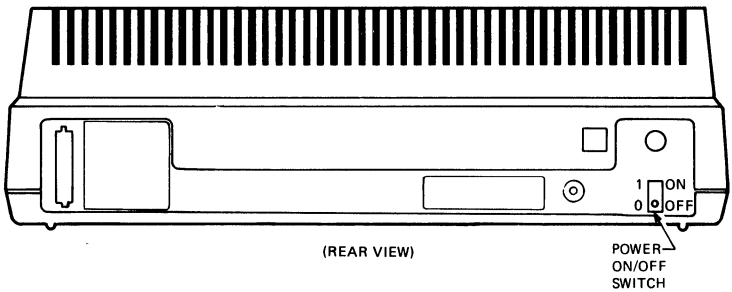


Figure 5-6 ▪ Power On/Off Switch

▪ *Power ON/OFF Switch*
This switch turns power to the terminal on or off. The on position is labeled 1, and the off position is labeled 0. A keyboard indicator goes on to indicate that power is on.

▪ *Paper Adjustment Knobs*
These knobs advance paper 1/48 of an inch at a time.

▪ *Paper Release Lever*
This lever is used to reposition or remove friction-feed paper from the terminal.

▪ *Printhead Adjustment Lever*
This lever controls space between the printhead and the platen. It enables you to adjust the printhead for clear printing on single or multipart forms.

▪ *Ribbon Adjustment Knob*
This knob tightens the ribbon when installing a new ribbon cartridge.

▪ *Paper Out Override Switch*
This switch disables paper out detection.

▪ *Font Selection Switch*
As part of the multiple font option, this switch forces (selects) a font or returns control to the host. Each time the switch is pressed the LA100 advances to the next state, skipping fonts that are not installed. If the currently forced font is removed, the printer advances to the next valid state. **Note:** To force a font means that everything is printed using that font despite all computer commands.

Keyboard

The Letterwriter 100's keyboard is arranged like a standard office typewriter and operates in a similar manner. The keyboard keys are grouped into three categories: standard keys, function keys, and set-up keys.

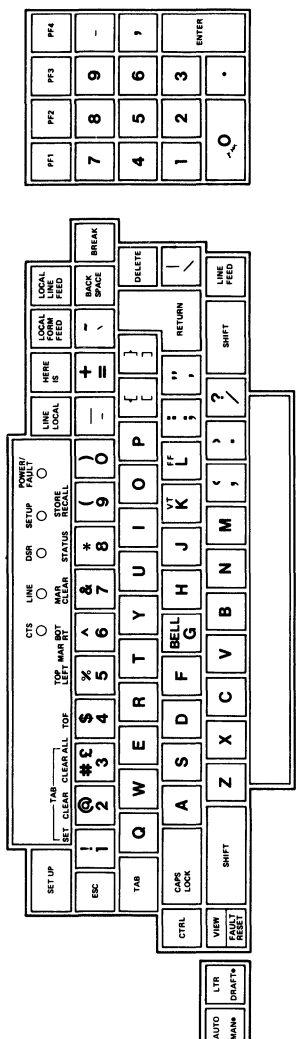


Figure 5-7 ▪ Letterwriter 100 Keyboard

- *Standard Keys*

The standard keys are standard typewriter keys and include CAPS LOCK and SHIFT. These keys are used to send characters to the computer. In local mode or when local echo is selected, they operate the same as typewriter keys.

Automatic repeat allows for a key that is depressed for more than half a second to send its code to the computer repeatedly until the key is released. Normally, you would just press the desired key and release it, sending the desired character to the host computer once.

The CAPS LOCK key is a two-position locking key, similar to the LOCK key on a standard typewriter. When it is in the down position, the alphabetic keys generate uppercase characters, regardless of SHIFT key position. When it is in the up position, the alphabetic keys generate lowercase or uppercase characters. The numeric, special symbol, function, and numeric keypad keys are not affected by the CAPS LOCK key in either position.

Both of the SHIFT keys cause all standard keys on the keyboard to generate uppercase characters or top row symbols, such as ! or #. The SHIFT keys do not affect the function keys or the numeric keypad keys.

- *Function Keys*

The Letterwriter 100 features over 17 function keys. Some of these keys and their functions are:

- ESC—Causes the printer to generate the escape control character.
- CTRL—Causes the terminal to generate control characters when certain control keys on the keyboard are pressed while holding the CTRL key down.
- AUTO/MANUAL—The up AUTO position lets print quality be controlled by the processor, while the down MANUAL position lets you control print quality by using the LETTER/DRAFT key.
- LETTER/DRAFT—In the up LETTER position, the terminal prints letter-quality characters, while in the down DRAFT position, the terminal prints draft mode characters. This feature is enabled only if manual mode has been selected. See AUTO/MANUAL description above.
- LINE/LOCAL—Switches the terminal between on-line mode and local mode. When the terminal is on-line, the LINE indicator is on.
- HERE IS—Sends the answerback message to the host, if the terminal is on-line and an answerback message has been defined and stored.
- BREAK—Causes the terminal to transmit a short break signal with a fixed time duration.

- PF1, PF2, PF3, PF4—These keys cause the terminal to generate escape sequences that are application specific.

- *Set-Up Keys*

The set-up keys allow you to tailor your terminal's operation to your needs. The SET-UP key can be used with almost any other key to let you perform a specific function. The SET-UP key itself lets you enter and exit from Set-Up mode. The Set-Up keys allow you to:

- Set or clear tabs.
- Set or clear the top, bottom, left, or right margins.
- Select the current paper position as the top of the form.
- Position the paper and set page length.
- Print the terminal status message. This status message tells you what Set-Up features have been selected.
- Recall the Set-Up features stored in the nonvolatile memory.
- Store the operator-selected features as well as other features in the nonvolatile memory.

Visual Indicators

When power is applied to the printer, the visual indicators are on for about six-tenths of a second to allow you to check for a bad indicator.

Table 5-3 • Letterwriter 100 Visual Indicators

Indicator	Function
Power/Fault Indicator	When power is applied, this light goes on and stays on until the printer is turned off. If the light is blinking, it indicates a fault in the printer.
Set-Up Indicator	Blinks when the printer is in set-up mode. The indicator stays on for about nine seconds when the operator-selected features are being loaded into the nonvolatile memory.
DSR	Lights when the printer receives the Data Set Ready (DRS) signal. These lights show the state of continuous signals on the EIA port. They are on when the signal is on, and off, when the signal is off. It is also used with the POWER/FAULT indicator to show any errors during the power-up self-test.
Line Indicator	When this indicator is on, the printer is on-line. When it is off, the printer is local.
CTS Indicator	When this is lit, the printer has received the Clear To Send (CTS) signal.
Font Indicator	These indicators show the currently selected font. One light on indicates that the font shown is forced. One light off indicates that no font is forced. The indicator that is off shows the current computer selected font.
ROM Cartridge	Lights when the ROM cartridge is seated correctly in the ROM cartridge socket.
Column Indicator	This shows the current position, by column, of the printhead. Scales are provided for the four horizontal pitch selections.

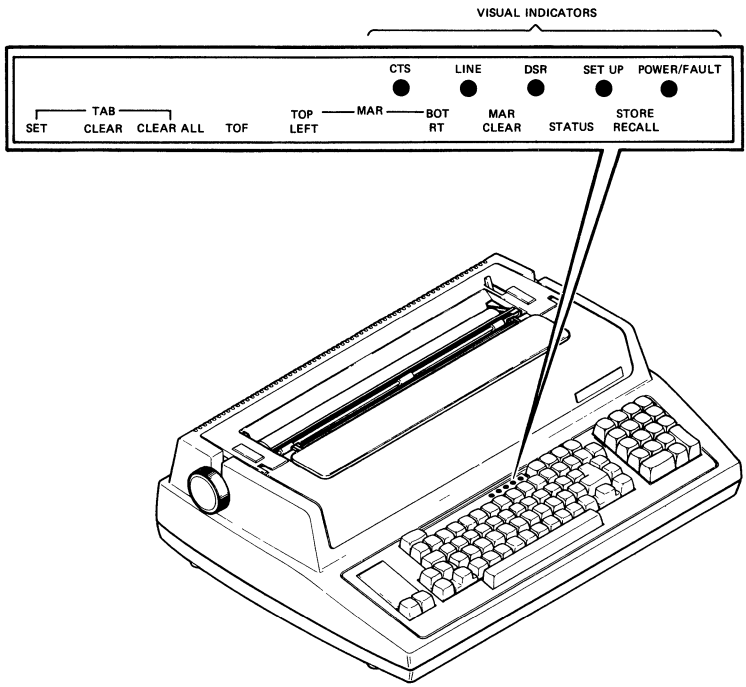


Figure 5-8 ▪ Letterwriter 100 Visual Control Indicators

Audible Indicators

There are two audible indicators in the printer. If the keyclick feature was selected in set-up, a keyclick sound occurs when any key is pressed. A bell tone will sound under any of the following conditions:

- Input buffer overflow—occurs when the printer cannot process characters from the input buffer before the buffer fills.
- Keyboard buffer overflow—caused by typing faster than the printer can transmit characters from the keyboard buffer.
- Bell code—each bell code received by the printer sounds the bell tone. This is useful in interactive applications to call attention to a specific condition.
- Printhead jam—causes the Power/Fault indicator to flash as well as the bell tone to sound.

- Incorrect SET-UP command—caused by pressing an incorrect key during set-up.

The corrective action to take for any of these situations can be found in detail in the *Letterwriter 100 Operator Guide*.

Programming Information

Information on set-up features and escape sequences is outlined in this section. For a summary of set-up features and escape sequences, refer to Appendix E.

Set-Up Features

This section contains brief descriptions of some of the operator-selectable features of the Letterwriter 100. These set-up features enable you to prepare the terminal for specific applications.

Sometimes the specific procedure or escape sequence required to select a particular feature will be described in detail. If you require additional information, consult the *Letterwriter 100 Operator Guide* or the *LA100-Series Programmer Reference Manual.*

```
LA100 V1.2  KSR
0.4K Buffer
DPSs: 005007009011...

***Keyboard Settings :

E-Local echo:Disabled
K-Keyboard:United States
L-Return key:<CR>
Q-Keyclick:Disabled
U-Break Key:Enabled
Y-Keypad mode:numeric

***Printer Settings :

B-Pitch Mode:All Pitches
C-G0 Character set:United States
D-G1 Character set:United States
  G2 Character set:United States
  G3 Character set:United States
F-Form Length:264
H-Horiz pitch (cpi):10
J-End of line control:wrap mode
V-Vert pitch (lpi):6
W-NewLine request char.:none

***Communication Settings :

A-Auto-answerback:Disabled
N-Disconnect on EOT:Disabled
O-Paper fault processing:XOFF (if enabled)
P-Parity:7/S
R-Receiver error:Print error block
S-Speed(bps):9600
X-Auto XON/XOFF:Enabled
Z-Modem Control:No Modem Control-Restraint
```

Figure 5-9 ▪ Sample Status Message

The operator-selectable features can only be changed while the terminal is in SET-UP. The suggested sequence to change or to select set-up features is:

1. Enter Set-Up.
2. Print a status message to check feature settings.
3. Set one or more of the features, such as tabs, baud rate, or character set, to the desired setting.
4. Print a second status message to check that all features are correct.
5. Store the features, if desired, in the nonvolatile memory.
6. Exit set-up.

You should note that storing a feature saves the feature for future use.

Set-up can be entered while in on-line or local mode. To prevent the loss of data, take care to enter set-up only when the host is not transmitting characters, or if the restraint control (XON/XOFF) feature is selected and is recognized by the computer.

- *Communications Features*

In order for the printer to transmit and receive data, the printer must be compatible with the computer and the communication system. The communication feature selections provide you with the means for matching the printer and the system.

Some of the communication features available include the following:

Parity

This feature selects data bits per character and parity. The data bits per character can be set to seven or eight data bits. Parity selects the type of parity bit that the printer generates for transmitted characters and checks for the received character. Your choices are:

- No parity, seven data bits with eighth bit set to mark
- No parity, seven data bits with eighth bit set to space
- Even parity, seven data bits; odd parity, seven data bits
- Even parity, eight data bits; odd parity, eight data bits
- No parity, eight data bits

There is no need to select the number of stop bits since the LA100 automatically matches any host that requests 1 or 2 stop bits.

Baud rate selection

You can select the speed at which the terminal transmits and receives characters. For systems in which transmit and receive speeds are different, you can

select split speed baud rates. Choose from the following:

- 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, or 9600
- 75 send/600 receive, 75 send/1,200 receive, 150 send/600 receive, 150 send/1,200 receive, 300 send/2,400 receive, 300 send/4,800 receive, 600 send/2,400 receive, or 600 send/4,800 receive.

Modem Control

This feature controls the EIA control lines that communicate with the host. More information about this can be found in the *LA100-Series Programmer Reference Manual.* Modem control choices are:

- No modem control, restraint mode
- No modem control, speed control mode
- Modem control, restraint control
- Modem control, speed control mode

If you are using the 20 mA current loop option or if your modem does not use the protocol specified in the *Letterwriter 100 Operator Guide*, do not select modem control. Do not select speed control mode unless using Bell 212 or an equivalent.

Paper Fault

This feature describes the action the printer takes when a paper fault occurs. Four responses are available:

- No action—Usually selected for hardwired installations or when no disconnect is desired.
- Send break—Causes the printer to transmit a 275-millisecond BREAK signal when a paper fault occurs.
- Disconnect—Causes the printer to turn the data printer ready (DTR) signal off immediately.
- Do not answer—Used with the roll paper holder with "paper low" sensor. Lets the printer complete any call in progress. When the call is completed, the printer disconnects (turns off the DTR signal) and does not answer any new calls.

Local Echo

When the local echo feature is chosen, every character sent to the computer is also printed by the printer. If local echo is off, then characters transmitted to the computer are not printed as typed.

Your choice is either local echo or no local echo.

Auto-XON/XOFF

This feature prevents the loss of received characters. When auto-XON/XOFF is on, the printer transmits the XON and XOFF control characters to indicate when the input buffer is almost empty or full. The XOFF character requests the host to stop sending characters, while the XON character means that character transmission can continue.

When Auto-XON/XOFF is disabled synchronization is obtained by using the restraint signals. See your *LA100-Series Programmer Reference Manual* for details.

You can enable or disable this feature.

Answerback

This is a message of up to 30 characters that identifies the printer for the host. This message is transmitted from the printer upon the computer's request or when you press the HERE IS key, or automatically when communication was established by enabling auto-answerback.

Auto-Answerback

Auto-answerback controls automatic transmission of the answerback message when a communication connection is made.

Your choice is to enable or disable this feature.

- *Keyboard Features*

  Some features are available to adapt the keyboard to various printer applications. These include:

Table 5-4 ▪ LA100 Keyboard Features

Feature	Description
Auto-line feed	Permits RETURN key to generate both a carriage return and a linefeed command when desired.
Break	Controls operation of the break key. Disables this key to prevent sending a break signal by mistake.
Keypad	Controls operation of external numeric keypad (optional) to permit generation of single-character codes or escape sequences.
Language	Adapts the keyboard to printer operation in different languages. For most languages, alternate keycaps are required.
Repeat	Enables or disables automatic repeating of most key codes when keys are held down.

▪ *Printer Features*

Printer features allow you to position a form, set or clear margins and tabs, and select vertical and horizontal pitch. These features can be easily selected through the keyboard by typing in the appropriate escape sequence.

You can select from the following features:

End-of-Line Control

This feature prevents received characters from being lost when the host attempts to print beyond the right margin.

When end-of-line control is set to truncate, any characters received beyond the right margin are discarded. When end-of-line control is set to wrap-around, the printer performs an automatic carriage return and linefeed and prints the characters received at the left margin on the next line.

Page Length

The LA100 series can operate in one of two modes: form mode, or no form mode, which is used for roll paper applications. In the no form mode, there is no form length or vertical margins. Printing occurs continuously with lines being spaced apart according to the selected vertical pitch.

When in form mode, the terminal will not print above the top margin or below the bottom margin, and lines are spaced so that the distance between the active line and the top margin is always a multiple of the current vertical pitch.

When a form length of zero is defined, the LA100 printers assume that roll paper is being used and enter the no form mode. When a nonzero form length is given, the printer assumes that form paper is being used, and enters the form mode.

The form length can be set to any length from 1/12 inch per page to 21 inches per page.

Horizontal Pitch

CHARACTERS PER INCH	EXAMPLE
16.5	0123456789AaBbCcD
13.2	0123456789AaBb
12.0	0123456789AaB
10.0	0123456789

Figure 5-10 ▪ Sample Letterwriter 100 Horizontal Pitch Selections

The horizontal pitch selected determines the maximum column width as per the chart below.

Table 5-5 ▪ Horizontal Pitch Selections

Horizontal Pitch	Maximum Number of Columns Per Page
5	66
6	79
6.6	84
8.25	108
10	132
12	158
13.2	168
16.5	217

Horizontal Tabs

A horizontal tab is a preselected point on a line to which the printhead advances when a horizontal tab control character is received. The Letterwriter 100 has 217 possible horizontal tab stops, one for each column. These tab stops are associated with column numbers, not physical positions on the paper. Thus, as was the case with horizontal margins, changing horizontal pitch will also change the physical position of tab stops.

Print Density

With the LA100 you can select high- or medium-resolution printing for greater emphasis.

Vertical Pitch

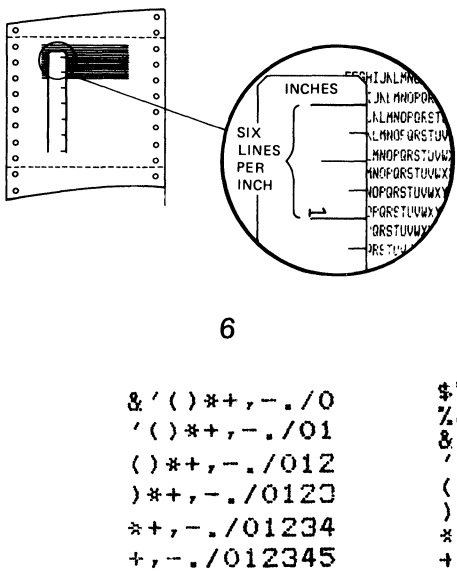


Figure 5-11 ▪ Sample Letterwriter 100 Vertical Pitch Selections

This allows you to vary the number of lines per inch. You can select to use 2, 3, 4, 6, 8, or 12 lines per inch.

Vertical Margins

You can set top and bottom vertical margins with this feature. The top vertical margin specifies the first printable line, while the bottom vertical margin specifies the last printable line. When vertical pitch and form length are changed, the vertical margins must be reset.

Vertical Tabs

A vertical tab is a preselected line to which the printhead advances when a vertical tab control character is received. The printer has 168 vertical tab positions. Vertical tabs can be set and cleared like horizontal tabs. Vertical tab stops are associated with specific line numbers, not physical positions on the paper. Thus, changing vertical pitch changes the printing position of the vertical tabs on the paper.

Escape Sequences

The Letterwriter 100 (LA100) uses escape sequences standardized by the American National Standards Institute (ANSI) to control many of their features. These escape sequences provide additional controls that are not provided by the control characters in the character set. These sequences, multiple-character control functions, are not printed, but are used to control printing and printer operations such as advancing the paper or ringing the margin bell.

Detailed information on escape sequences can be found in the *LA100-Series Programmer Reference Manual* or in Appendix E at the end of this book.

▪ Maintenance

The Letterwriter 100 does not need preventive maintenance. The surfaces and platen can be cleaned with a damp cloth. Do not use excessive water or cleaners with solvents. Rubbing the keycaps with a dry or barely moist cloth is enough to clean them. **Note:** Do not attempt to remove the keycaps to clean them. You can damage the switch contacts if you replace the keycaps incorrectly.

To maintain proper operating temperatures, keep the printer away from extreme temperatures, such as direct sunlight, room heaters, and air conditioners.

Self-tests

The LA100 can perform a power-up self-test and several printer self-tests.

▪ *Power-up Self-test*

A power-up self-test is performed whenever power to the terminal is turned on. Any errors during this self-test are displayed by the keyboard indicators. The table below lists some power-up self-test indicators.

Table 5-6 ▪ Power-up Self-test

DSR/I Indicator	Power/Fault Indicator	Probable Cause	Action
Off	Off, no carriage motion	Power supply	See Troubleshooting Checklist
Off	Off, carriage motion	Defective indicators	Request service
On or off	Flashing, no bell	Cover open or paper fault	Close cover. Press CLEAR FAULT key.
On or off	Flashing, bell tones	Printhead jam	Clear jam. Press CLEAR FAULT key.

▪ *Printer Self-tests*

The printer self-tests provide a visual indication that the printer is working properly. You can perform any one of the following tests:

- Character pattern
- Single character
- Horizontal registration
- Nonprinting
- Loopback

Initiate the tests according to the procedures described below.

Character Pattern Test

- Press and hold CTRL down. Then press SET-UP and release both keys. SET-UP indicator will flash.
- Press "T" and then press RETURN. Prints character pattern self-test continuously until you end the test.
- Press SET-UP to end the test and exit set-up. SET-UP indicator stops flashing.

Single Character Test

- Press and hold CTRL down. Then press SET-UP and release both keys. SET-UP indicator will flash.
- Press "T" and then press any character key. Prints selected character continuously until you end the test.
- Press SET-UP to end the test and exit set-up. SET-UP indicator stops flashing.

Nonprinting Self-test

- Press and hold CTRL down. Then press SET-UP and release both keys. SET-UP indicator will flash.
- Press "T" and then press space bar. Starts nonprinting self-test.
- Press SET-UP to end the test and exit set-up. SET-UP indicator stops flashing.

Loopback Test

- Connect loopback connector to terminal interface.
- Press and hold CTRL down. Then press SET-UP and release both keys. SET-UP indicator will flash.
- Press "T" and then backslash. Terminal prints a pass or fail message.
- Press "T" and then "/". Starts loopback test 2. Terminal prints characters as received.
- Press SET-UP to end the test and exit set-up. SET-UP indicator stops flashing.
- Remove loopback connector from terminal interface.

Operator Troubleshooting Checklist

If your printer is not operating, chances are the problem is minor and you can correct it yourself. Listed below are some of the common problems, their probable cause, and the corrective action that you can take. **Note:** Always turn off the printer before you attempt to correct a problem.

Printer will not turn on when power ON/OFF switch is set to on.

- Power cord not connected, or broken. Check power cord connections; check power cord for damage.
- Power source fault. Check power cord at receptacle.
- Fuse open. Make sure fuse is in place. Replace fuse if blown.

Characters do not print; POWER/FAULT indicator flashes.

- Printer out of paper. Reload paper and press CLEAR/FAULT key to reset.
- Access cover open. Close cover and press CLEAR/FAULT key.

Carriage moves, but there is no printout.

- Printhead too far from paper. Readjust printhead.

Characters do not print, are garbled, or are doubled.

- Data set unplugged. Plug in modem.
- Incorrect communication set-up. Check that data communications features are set to match computer.

Light print.

- Printhead too far from paper. Readjust printhead.
- Ribbon worn. Replace ribbon cartridge.

Ink smudges during printing.

- Paper not firmly wrapped around platen. Lift bail bar and smooth paper over surface of platen. Lower bail bar to original position.
- Printhead too close to paper. Readjust printhead.
- Paper not behind bail bar on tractors. Place paper behind bail bar.
- Platen cage not properly seated. Adjust platen cage.

Paper does not advance.

- Paper not loaded properly. Reload paper.
- Paper release lever incorrectly set. Press paper release lever toward back of paper.
- Feed holes torn. Reload paper.
- Platen cage not properly seated. Adjust platen cage.

Multiple part form paper tears.

- Printhead too close to paper. Readjust printhead.
- Paper not straight in printer. Realign paper stack.
- Tractors incorrectly adjusted. Readjust right tractor.
- Paper or printhead jam. Open access cover and clear jam. Close access cover and press CLEAR/FAULT key.

Additional Documentation

The following documents contain more detailed information about the Letterwriter 100.

- *LA100-Series Programmer Reference Manual* (EK-LA100-RM)—Provides detailed information on the LA100's features: communications, printer configurations, text mode character processing, escape and control sequences, and graphics mode.
- *Letterwriter 100 Installation Guide* (EK-LW100-IN)—Provides site preparation, packing, installation, and jumper selection information.
- *Letterwriter 100 Operator Guide* (EK-LW100-OP)—Tells you how to install, use, maintain, troubleshoot, and configure the Letterwriter 100.

Also of interest are:

- *PDP-11* and *VAX Systems & Options Catalogs*—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These customer documents are designed to help you select the right Digital product for your needs. European versions are also available.

If you require information not contained in these documents, contact your local Digital sales representative.

▪ Specifications

Performance Characteristics

Print speed (maximum)	240 char/s (draft) 30 char/s (letter, throughput speed) 80 char/s (memo, optional)
Print technology	Bidirectional, dot matrix
Print density	Draft quality: 7 by 9 Letter quality: 33 by 18 Memo quality (optional): 33 by 9
Character pitch	16.5 char/in, 13.2 char/in, 12 char/in, 10 char/in, 8.25 char/in, 6.6 char/in, 6 char/in, 5 char/in
Line spacing	2,3,4,6,8, or 12 lines/in
Graphics	132 by 72 dots/in (2:1 aspect ratio)
Linefeed speed	38 ms/line (1/6 line/in)
Buffer capacity	400 characters
Buffer control	XON/XOFF or restraint signal data synchronization

Paper

Type	Single sheet, roll, or fanfold
Dimensions	7.6–37.8 cm (3–14.9 in) wide
Multiple forms	Up to four parts
Thickness	0.051 cm (0.020 in) maximum

Communications

Baud rates	50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600
Split speeds	600 or 1200 receive with 75 or 150 transmit; 2400 or 4800 receive with 300 or 600 transmit
Data interface	Serial RS232-C
Optional interface	20 mA
Parity	7-bit, odd, even, mark, space, or none 8-bit, odd, even, or none

Power Requirements

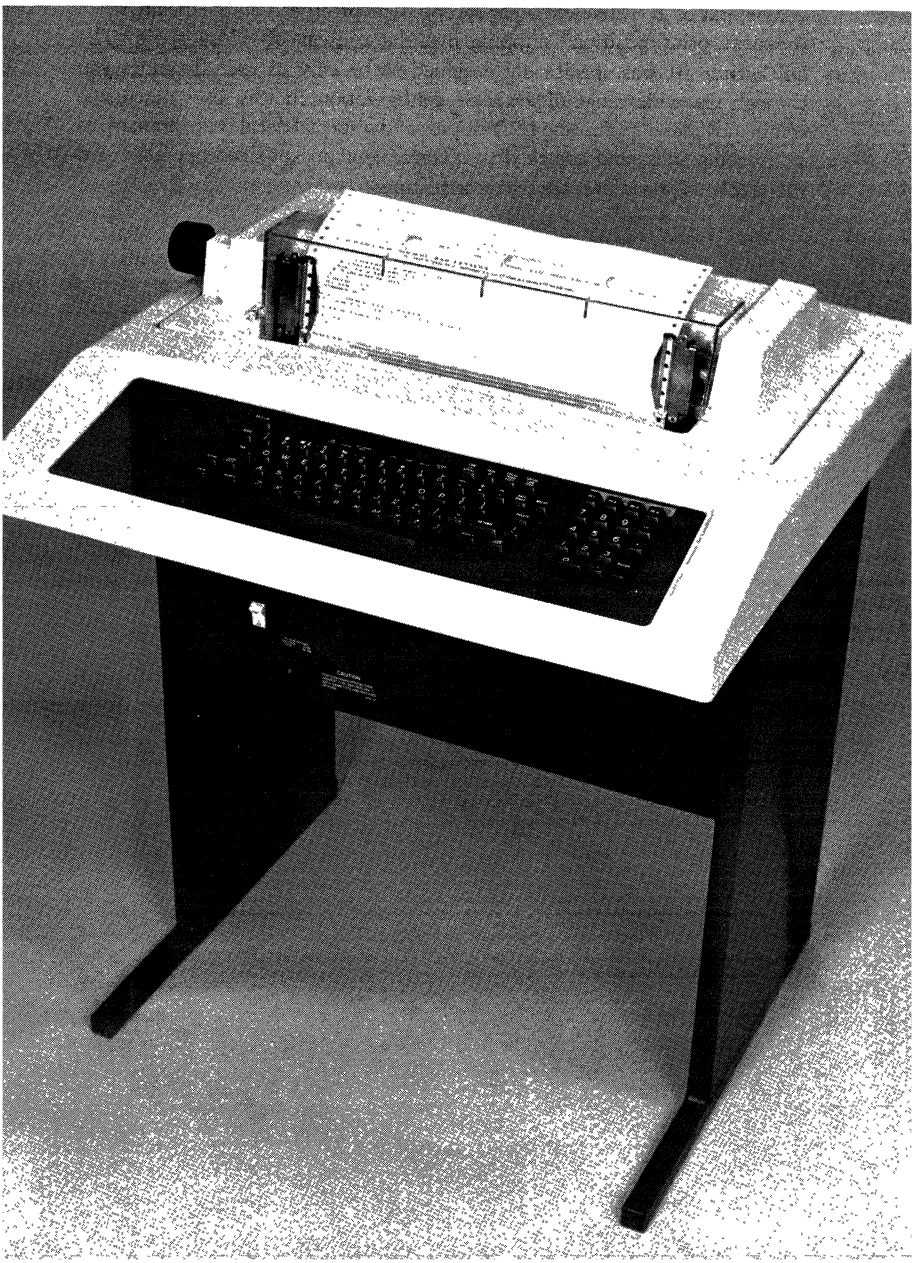
Voltage	87–128 Vac and 174–256 Vac, universal power supply
Frequency	47–63 Hz
Power consumption	138 W, printing maximum

Operating Environmnet

Temperature	10–40°CC (50–104°FF)
Relative humidity	10–90%

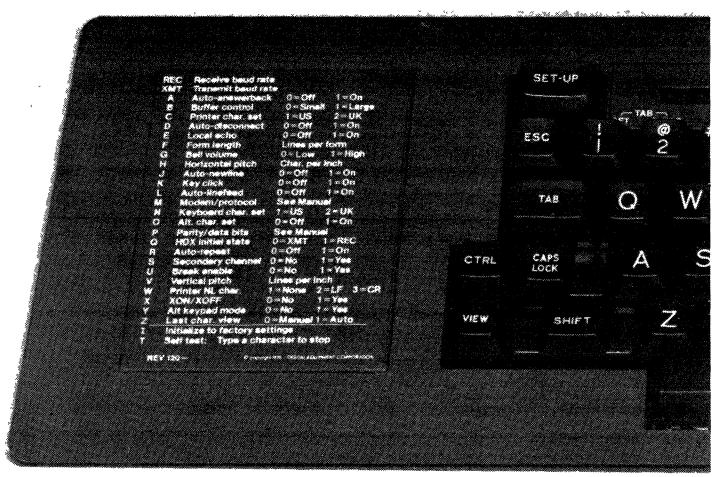
Physical Characteristics

Width	55.9 cm (22 in)
Depth	39.4 cm (15.5 in)
Height	17.8 cm (7 in)
Weight	11.3 kg (25 lb)



▪ Overview

The DECwriter III is a serial, dot-matrix, pedestal-mounted printer that combines bidirectional printing and a 1K character buffer to achieve a maximum throughput of 180 characters-per-second. The printhead automatically seeks the next print position, skipping over large areas of white space. The DECwriter III was specifically designed to be easy to use. It guides you through the wide range of available configuration choices, uses mnemonic commands, has a prompting LED display and a special decal that summarizes setup commands, and comes with a convenient pocket-sized operator card that explains procedures for selecting features.



Located on the left side of the DECwriter III keyboard is a special decal that summarizes setup commands.

The only model available is

- *LA120-DA*: DECwriter III keyboard send/receive printer.

▪ Major Features

The major features of the DECwriter III printer are

- 180 characters-per-second bidirectional printing (maximum)—For fast printing.
- 1,000 characters-per-line buffer—Enables the printer to accept characters faster than it can print them and to look ahead to find the shortest path to the next print position. This eliminates the need for fill characters when operating at 1,200 bits per second, improves throughput, and utilizes the communication line efficiently. There is an optional 4K buffer.
- Selectable baud rates—Offers 14 data rates from 50 to 9600 baud plus eight split baud rates with five different half-duplex and full-duplex modes for versatility in meeting communications requirements.
- Full-duplex and half-duplex modem support—Allows the printer to be connected to a modem or acoustic coupler for compatibility with the dialup telephone network.
- Adjustable margins, tabs, and forms settings—Top, bottom, left, and right margins as well as horizontal and vertical tabs are easily adjustable and the setup commands can be held in nonvolatile memory.
- Multipart form capability—The LA120 prints on 6 part forms and a special model has been developed that prints on 9 part forms.
- Selectable character pitches—With eight different horizontal pitches and six different line spacings, the LA120 provides flexible printed output. Also, the expanded pitch can be used for labels and messages, while the condensed pitch saves paper.
- Optional character sets—National character sets in several languages including Finnish, Danish, Swedish, German, Norwegian, and French. In addition, the APL set is available as an option.
- Nonvolatile memory—Stores feature settings so they can be recalled at any time. There is no need to setup the operating parameters every time the terminal is turned on.
- Universal power supply—Lets you select the voltage setting that's right for your environment.

▪ Printing Features

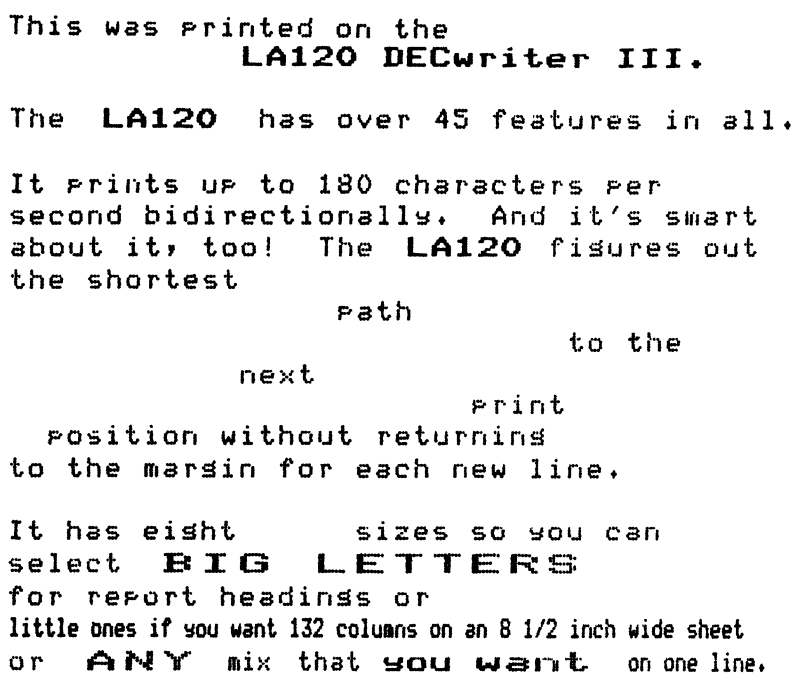


Figure 6-1 ▪ LA120 Print Samples

The DECwriter III offers a seven-by-seven dot-matrix character cell that provides output at the rate of 180 characters per second (maximum). This is suitable for draft and data printing. Printing is done through a bidirectional technique in which the printhead seeks the shortest distance to the next printable character, rapidly skipping over blank spaces.

▪ Character Sets

The DECwriter III offers the full 94-printing-character ASCII set, and prints both uppercase and lowercase characters. Optional international character sets include Finnish, Danish, Swedish, German, Norwegian, and French. In addition, the APL set is also available as an option.

The LA120 printer can print double-width characters and compressed characters. Character sizes range from 10, 12, 13.2, and 16.5 characters per inch. Double-width characters print at 5, 6, 6.6, and 8.25 characters per inch.

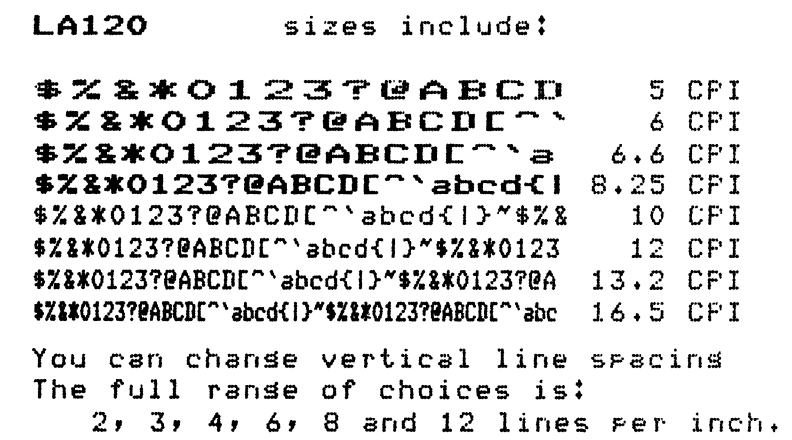


Figure 6-2 ▪ LA120 Character Size Samples

▪ Paper

The LA120 printer accommodates fanfold paper from 7.6 to 37.8 centimeters (3 to 14 7/8 inches) in width. Because the DECwriter III printer has forms-handling capabilities, it can format output to fit preprinted forms, up to six parts. It can also accommodate selectable form lengths up to 35 centimeters (14 inches).

Low-Tear Tractor Option

The low-tear tractor is a simple option for the LA120 that lets you use every single form in a box—instead of throwing one form away for every good printed one. The efficiency of the LA120 forms handling is doubled. By doubling the number of usable forms per box, the low-tear tractor also lengthens the time between reloading and saves you time spent voiding or shreding unused forms.

The low-tear tractor automatically removes the perforated tractor-feed edges from your forms as the paper moves through the printer. You have clean output that is immediately ready for distribution. To achieve the best results with the low-tear tractor option, your forms should meet the following specifications:

Thickness

Maximum thickness of 0.005 inches per ply

Maximum of six parts per form

Maximum total thickness for multipart forms of 0.020 inches

Weight

Maximum 20 pounds per ply

Stubs

0.5-inch-wide perforated stubs, with linefeed sprockets holes on

0.5-inch centers

Carbon Paper

Carbon paper must be perforated at the stubs or must end inside the stub perforations

▪ Options

Option Number	Description
LA12X-DL	4K buffer
LA12X-AL	20mA current loop interface option
LA12X-BB	Parallel interface
LA12X-CB	Data channel interface
LA12X-RL	APL Brown key caps and character ROM
LA12X-RN	APL Grey Key Caps and character ROM
LA12X-SL	European key caps and character ROM
LA12X-TL	APL and European character ROMs

▪ Accessories and Supplies

The following accessories, supplies, components, and spares are available for the DECwriter III. Check with your sales representative for the latest information.

Supplies

Part Number	Description
LAXXR-12	One dozen dual-spool nylon ribbons, 1.3 cm wide by 54.9 m long (0.5 in by 60 yards)

Accessories

Part Number	Description
H9850-FA	Paper caddy with four 5.1 cm (2 in) swivel casters for transporting printer paper, 40 cm wide by 29.8 cm deep (15-3/4 in by 11-3/4 in)
LAXX-KA	Accessory kit includes 1 LAXX-KB, 1 LAXX-KC, and 1 LAXX-KD
LAXX-KB	Caster set, 2 pieces
LAXX-KC	Work surface shelf, 60.9 cm long by 38.1 cm wide by 5.1 cm high (24 in by 15 in by 2 in)
LAXX-KD	Wire shelf, 26.7 cm long by 45.7 cm wide by 5.1 high cm (10.5 in by 18 in by 2 in)
LAXX-NC	Paper basket, 30.5 cm long by 40.6 cm wide by 33 high cm (12 in by 16 in by 13 in)
H981-A	Copy holder
DF01-A	Acoustic telephone coupler, 300 b/s with combination EIA (RS232-C) and 20 mA current loop cable
DF02-AA	Modem, full-duplex direct-connect, originate and auto answer, 300 b/s, Bell 103J equivalent with EIA RS232-C interface
DF02-AC	DF02-AA with integral asynchronous automatic dialing unit
DF03-AA	Direct-connect Bell 212A equivalent, 300//1200 b/s, full-duplex, synchronous, asynchronous modem with EIA RS232-C interface
DF03-AC	DF03-AA with integral asynchronous automatic dialing unit
H9850-HL	Heavy-gauge vinyl dust cover, charcoal brown with Digital logo

Part Number	Description
LA12X-FL	Canadian French character set
LA12X-UA	Blank key cap kit of 50, Row 4
LA12X-UB	Blank key cap kit of 50, Row 1
LA12X-UC	Blank key cap kit of 50, Row 2
LA12X-UD	Blank key cap kit of 50, F&J type
LA12X-UE	Blank key cap kit of 50, SETUP
LA12X-UF	Blank key cap kit of 50, TAB
LA12X-UH	Blank key cap kit of 50, CAP LOCK
LA12X-UJ	Blank key cap kit of 50, SHIFT
LA12X-UL	Main array blank key cap set
LA12X-UM	Blank key cap kit of 50, CR
LA12X-UN	Blank key cap kit of 50, ENTER
LA12X-UP	Blank key cap kit of 50, Num Pad 0
LA12X-UR	Blank key cap kit of 50, Row 3
LA12X-US	Blank key cap kit of 50, Row 5
LA12X-UT	Numeric pad blank key cap set
BC05X-15	20 mA current loop extension cable, 4.6 m (15 ft)
BC05X-25	20 mA current loop extension cable, 7.6 m (25 ft)
BC05X-50	20 mA current loop extension cable, 15.2 m (50 ft)
BC22D-10	EIA RS232 female-female null modem shielded cable, 3.0 m (10 ft)
BC22D-25	EIA RS232 female-female null modem shielded cable, 7.6 m (25 ft)
BC22E-10	EIA RS232 male-female extension shielded cable, 3.0 m (10 ft)
BC22E-25	EIA RS232 male-female extension shielded cable, 7.6 m (25 ft)

▪ Operator Features

Indicators

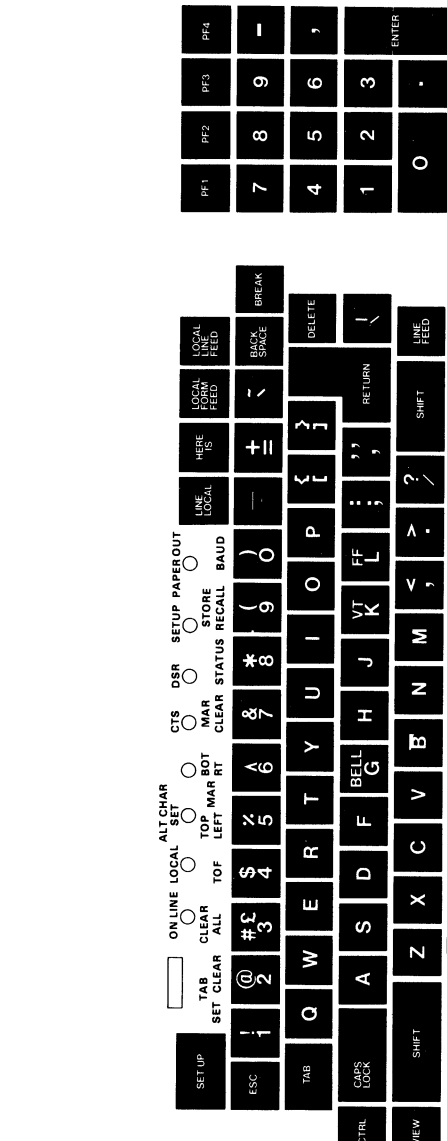


Figure 6-3 ▪ DECwriter III Keyboard and Indicator Lights

The DECwriter III's operator console displays eight indicator lights.

Table 6-1 ▪ DECwriter III Indicators

Indicator	Function	DECwriter III
ON LINE	Data is transmitted and received only while the light is on, indicating the terminal is online.	Yes
LOCAL	When on, this indicator means the terminal is in local mode. The LA120-DA operates only as a typewriter at this time; it does not transmit or receive any data.	Yes
ALT CHAR SET	An optional character set, such as APL, is in use.	Yes
CTS	Transmission of data is enabled.	Yes
DSR	The modem is in data mode.	Yes
SET UP	Flashes to indicate that the printer is in set-up.	Yes
PAPER OUT	Flashes to indicate that the printer is not ready due to a paper out, cover open, or printhead jam condition.	Yes

Voltage Selector/Power Switches

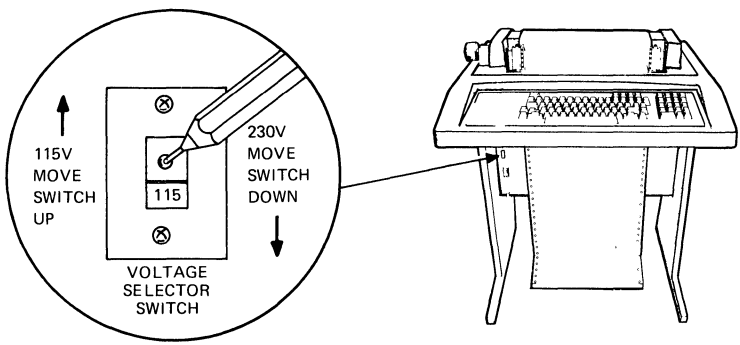


Figure 6-4 ▪ LA120 Voltage Selector Switch

The DECwriter III has a voltage selector switch so you can choose the right voltage. To select the appropriate voltage, place the tip of a pen into the switch indentation, as shown in Figure 6-4. **Note:** Do not use a pencil to change the switch.

The Power on/off switch is located below the voltage selector switch.

Setup

The DECwriter III has an easily accessible setup key located directly on the keyboard. Setup parameters can be stored either permanently or temporarily. Setup allows you to select a variety of features, including:

- Horizontal pitch (lines per inch) and vertical pitch (characters per inch).
- Form length.
- Set or clear right, left, top, and bottom margins.
- Set or clear vertical and horizontal tabs.
- Select auto repeat.
- Last character view.
- Audible features such as bell volume and keyclick.
- Baud rate.
- Automatic answerback.
- Buffer control.
- Keyboard and printer character set.
- Automatic disconnect.
- Local echo.
- Auto linefeed.
- Modem control.
- Secondary channel.
- Parity.
- XON/XOFF.
- Alternate character set.
- Break action.
- Store/recall.

Details on how to select any of the above can be found in the *LA120 User Guide* or Appendix E of this handbook.

▪ Programming Information

The LA120 uses escape sequences standardized by the American National Standards Institute (ANSI). If an escape sequence is received by the LA120 that is not supported, it is ignored. Using escape sequences, you can control the following LA120 features:

- Printer character set.
- Active position.
- Horizontal pitch, margins, and tabs.
- Vertical pitch, margins, and tabs.
- Form length.
- Product identification.
- Alternate keypad mode.

Escape and Control Sequences

The table below describes the function of the most commonly requested escape sequences, and lists the actual escape sequence required. Additional information on escape sequences is in the *LA120 User Guide*.

Table 6-2 ▪ LA120 Commonly Used Escape Sequences

Escape Sequence	Function
ESC (A	Selects UK character set.
ESC (B	Selects US character set.
ESC [w or ESC [ow	Selects 10 char/in.
ESC [1 w	Selects 10 char/in.
ESC [2 w	Selects 12 char/in.
ESC [3 w	Selects 13.2 char/in.
ESC [4 w	Selects 16.5 char/in.
ESC [5 w	Selects 5 char/in.
ESC [6 w	Selects 6 char/in.
ESC [7 w	Selects 6.6 char/in.
ESC [8 w	Selects 8.25 char/in.

Table 6-2 ▪ LA120 Commonly Used Escape Sequences

Escape Sequence	Function
ESC [z or ESC [ )z	Selects 6 lines//in.
ESC [1 z	Selects 6 lines/in.
ESC [2 z	Selects 8 lines/in.
ESC [3 z	Selects 12 lines/in.
ESC [4 z	Selects 2 lines/in.
ESC [5 z	Selects 3 lines/in.
ESC [6 z	Selects 4 lines/in.
ESC [c or ESC [0 c	LA120 transmits ESC [? 2 c, which is its product identification sequence.
ESC =	Enables alternate keypad mode.
ESC	Disables alternate keypad mode.

There are many other escape sequences you can use. For more information, see Appendix E, the *LA120 User Guide*, or the *LA120 Operator's Reference Card*.

▪ Maintenance

Over the years, DECwriter III has been reliable in millions of hours of customer use. The printhead provides time-proven reliability. The wires are permanently lubricated for long life and resistance to wear. Wire curvature and support mechanisms are designed by computer simulation for minimal wear and fatigue. The use of constant-current solenoids and a ruby jewel head bearing ensures precise character formation and uniform density of character impression.

To make the LA120 even easier to maintain, all components and subassemblies are easily accessible. If replacement becomes necessary, the power supply and logic electronics are easily accessed by removing two retaining screws in the back panel. Naturally, servicing should be performed by qualified personnel.

Self-test Procedure

If it appears that a problem exists in the LA120, you can initiate a self-test. Printing and nonprinting self-tests are available. To initiate a printing self-test procedure,

1. Enter SET-UP mode. The setup light will flash to indicate that you are in setup mode.

2. Press the "T" key to initiate the self-test. The LA120 will print out the self-test pattern.
3. To stop the self-test, exit SET-UP or press any character. The self-test will terminate and the setup indicator will go off.

To initiate a nonprinting self-test procedure:

1. Enter SET-UP mode. The setup light will flash to indicate that you are in setup mode.
2. Press and hold "SHIFT" and press the "/." key. The LA120 will perform the nonprinting self-test.
3. To stop the self-test, exit SET-UP or press any character. The self-test will terminate and the setup indicator will go off.

Operator Troubleshooting Checklist

If your printer is not operating, chances are the problem is minor and you can correct it yourself. Listed below are some of the common problems, their probable causes and the corrective action that you can take. **Note:** Always turn off the printer before you attempt to correct a problem.

Printer does not start when power is turned on.

- Power cord not connected, or broken. Check power cord connections; check power cord for damage.
- Power source fault. Check power cord at receptacle.
- Fuse open. Make sure fuse is in place. Replace fuse if blown.

Characters do not print.

- Printer out of paper. Reload paper.
- Printer cover open or ajar. Close cover.
- Printhead too far from paper. Readjust printhead adjustment lever.
- Data line unplugged. Plug it in.
- Incorrect communication set up. Check *LA120 User Manual.* Make necessary correction.

Light print.

- Printhead too far from paper. Adjust printhead adjustment lever.
- Ribbon out of ink. Turn ribbon over or replace it.

Paper does not advance.

- Paper not loaded properly. Check that the tractor covers are closed and the feed holes are properly aligned.
- Feed holes torn. Reload paper. If paper pulls against the tractor pins or bows in the middle, readjust the right tractor. Sometimes the paper stack feeding into the printer is crooked. Realign the paper stack so that the paper feeds straight into the printer.

Paper tearing on multiple part forms.

- Printhead is too close to the paper. Readjust the printhead adjustment lever for a wider headgap, one notch at a time, and examine the last part's print impression. Select the setting that gives you the best last part print quality.
- Tractor incorrectly adjusted. If the paper pulls against the tractor pins or bows in the middle, readjust the right tractor.
- Paper not straight in printer. Realign paper.

Printhead jam or printhead does not move.

- Paper or printhead jam. Clear jam and perform reloading paper/form procedure.

Keyboard frozen or printer won't print.

- Printer cover open or ajar when printer is turned on. Close the cover and turn the printer on. If the condition was caused by a cover-open fault, the printer will reset itself. However, if a paper-out fault condition caused the printer not to print, reset the printer by turning the printer off and then on.

Garbled or double characters.

- Incorrect communication setup. Check that your equipment is compatible with the equipment at the other end of the line.

Additional Documentation

The following documents contain more detailed information about the DECwriter III printer.

- *LA120 DECwriter III IPB* (EK-LA120-IP) —Illustrated parts breakdown for self-maintenance customers.
- *LA120 Operator's Reference Card* (EK-LA120- RG)—Summarizes setup features.
- *LA120 Technical Manual* (EK-LA120- TM)—Provides technical details for self-maintenance customers.
- *LA120 User Guide* (EK-LA120- UG)—Tells you how to install, use, maintain, troubleshoot, and configure the LA120.

Also of interest are:

- *PDP-11* and *VAX Systems & Options Catalog*—Provides you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These documents are designed to help you select the right Digital product. European versions are also available.

If you require information not contained in these documents, contact your local Digital representative, dealer, or distributor.

▪ Specifications

Performance Characteristics

Print speed (Maximum)	180 char/s (draft)
Print technology	Bidirectional, dot matrix
Print density	7 by 7 (draft)
Character pitch	
Compressed print	6.5 char/in; 132 char/l
Double width	8.25 char/in; 66 char/l
Compressed print	13.2 char/in; 105.6 char/l
Double width	6.6 char/in; 52.8 char/l
Elite pitch	12 char/in; 96 char/l
Double width	6 char/in; 48 char/l
Pica pitch	10 char/in; 80 char/l
Double width	5 char/in; 40 char/l
Line spacing	2, 3, 4, 6, 8, or 12 l/in
Linefeed speed	2, 3, 4, 6, 8, or 12 17 52 l/in
Linefeed speed	33 ms/l at 6 l/in
Buffer capacity	1K or optional 4K
Buffer control	XON/XOFF or restraint signal data synchronization

Paper

Type	Fanfold
Dimensions	7.6 cm to 37.8 cm (3 to 14.9 in) wide
Multiple forms	Up to 6 parts (4 to 9 parts on the -RB)
Thickness	0.50 cm (0.020 in) maximum

Communications

Baud rates	50, 75, 110, 134, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600
Split speeds	600 or 1200 receive with 75 or 150 transmit;/l 2400 or 4800 receive with 300 or 600 transmit
Data interface	Serial RS232-C
Parity	7-bit, odd, even, or none8-bit, mark or space

Power Requirements

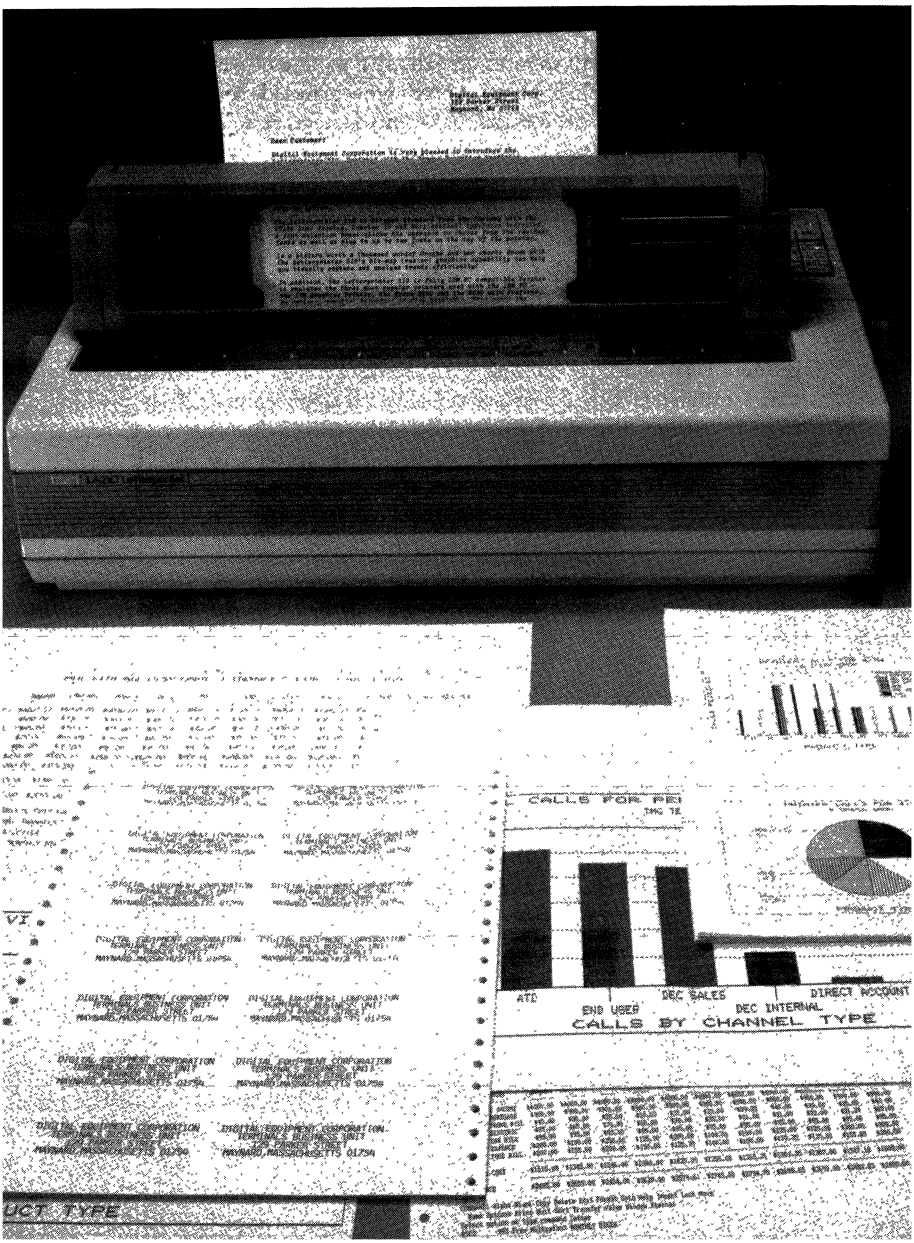
All models	120 or 240 Vac, 50 or 60 Hz
Power consumption	440 W, printing maximum

Operating Environment

Temperature	10 to 40°C(50 to 104°F)
Relative humidity	10 to 90%

Physical Characteristics

Width	69.9 cm (27.5 in)
Depth	61.0 cm (24.0 in)
Height	85.1 cm (33.5 in)
Weight	46.4 kg (102 lb)


CALLS FOR PERI
ATD
END USER
DEC SALES
DEC INTERNAL
DIRECT ACCOUNT
CALLS BY CHANNEL TYPE

▪ Overview

Digital's LA210 Letterprinter is a multimode, dot-matrix, desktop printer that is compatible with Digital computers, IBM,* and IBM-compatible personal computers. This extensive compatibility and a broad range of functions make the LA210 an excellent investment.

You can use the LA210 to meet an extensive variety of personal computer applications. When your application needs grow to include spreadsheets, business graphics and special formats, or when you upgrade to a more powerful computer, the LA210 will support this growth.

The LA210 Letterprinter is compatible with all Digital computer products. It also emulates the three most popular IBM-compatible printers; the Epson MX80,* the Epson MX80 with Graftrax,* and the IBM Graphics Printer.* This emulation allows the LA210 to support a wide range of software that runs on IBM personal computers and IBM personal computer emulators.

The LA210's broad range of functions makes it one of the most versatile printers ever built. Its multiple print modes let you produce high-speed drafts, memo-quality and near letter-quality correspondence, and high-resolution bit-map graphics. With the LA210's multinational character set, you can print your documents in 10 different languages. Its wide carriage lets you print spreadsheets and other wide documents. The nine-element impact dot-matrix printhead allows you to print on multi-part forms that are guided through with the printer's standard tractor.

What's truly remarkable about the LA210 Letterprinter is that you can select from a variety of resident character sets or an even greater selection of plug-in font cartridges. Besides the three resident character sets, two additional plug-in font cartridges can be inserted to provide typeface or character set flexibility. When you combine typeface variety with expanded or compressed character widths and graphics printing, it is easy to see that individualized and customized copies can be created. Any combination of styles can be contained within a single report, page, or even within a single line.

The LA210 was designed for use in personal computer systems, office workstations, and small-business computer systems. Its extensive features and compatibility make the LA210 an excellent investment.

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* IBM is a registered trademark of International Business Machines Corporation; MX80 is a trademark of Epson America, Inc.; Graftrax is a trademark of CompuSoft, Inc.; IBM Graphics Printer is a trademark of International Business Machines Corporation.

There are 23 models of the LA210 desktop, multimode, dot-matrix printer designed for worldwide use. Three character ROM chips come standard with each model, a Courier 10 US ASCII, a Courier-10 Multinational, and a VT100-10 Line Drawing Set. Also standard are the multifont adapter, the unidirectional acoustic forms tractor, ribbon cartridge, user documentation package, and country power cord. Each model has been factory set for the line power voltage of the designated country.

- *LA210-AA* United States (English)
- *LA210-AB* Belgium (Flemish)
- *LA210-AC* Canada (French)
- *LA210-AD* Denmark (Danish)
- *LA210-AE* UK/Ireland (English)
- *LA210-AF* Finland (Suomi)
- *LA210-AG* Germany/Austria (German)
- *LA210-AH* Holland (Dutch)
- *LA210-AI* Italy (Italian)
- *LA210-AJ* Japan (Katakana)
- *LA210-AK* Switzerland (French)
- *LA210-AL* Switzerland (German)
- *LA210-AM* Sweden (Swedish)
- *LA210-AN* Norway (Norwegian)
- *LA210-AP* France/Belgium (French)
- *LA210-AQ* Canada (English)
- *LA210-AR* Non-Spain (Spanish)
- *LA210-AS* Spain (Spanish)
- *LA210-AT* Israel (Hebrew)
- *LA210-AU* Non-Portugal (Portuguese)
- *LA210-AV* Portugal (Portuguese)
- *LA210-AW* Switzerland (Italian)
- *LA210-AZ* Australia/New Zealand (English)

▪ Major Features

The main features of the LA210 are

- Operation at 240 characters-per-second (cps) maximum draft printing speed and 40 cps maximum near letter-quality printing speed, and 80 cps in memo-quality speed (using optional font cartridge)—Allow for application choice between high-speed drafts and high-quality printing, either by operator or host control.
- Full compatibility with Digital computers in both text and bit-map graphics printing applications—Expands your application choices.
- Compatibility with IBM PC, XT, and AT personal computers and with many IBM personal computer emulators—Provides access to a wide range of software capability.
- Wide carriage to accommodate paper ranging in width from 8.9 centimeters (3.5 inches) to 37.8 centimeters (14.9 inches)—Allows your print jobs to range from labels to spreadsheets.
- Standard unidirectional forms tractors—Allow for single sheet, multiple part, continuous form, or label printing.
- Optional paper handling devices that include the automatic single sheet feeder and bidirectional forms tractors—Expand your printing choices.
- Special technical and symbols character sets available with optional plug-in cartridges—Allow the LA210 to function as a workstation printer.
- Choice of graphics mode—Allows you to illustrate your text with the visual impact of business charts and graphs and high-quality pictorials.
- Equipped with three standard character ROMs with over 30 optional cartridges available—Allow for a variety of print style choices.
- Standard unit provides printing capability in 10 languages plus VT100 line-drawing characters; other typefaces in different languages are available through use of optional cartridges—Provide for worldwide use and expanded application.
- 500 million character laminated printhead—Delivers exceptional print quality.
- Styled for office environment—Complements your personal computer system or video terminal.
- Nonvolatile memory—Stores adjustable print format.

▪ IBM Compatibility Feature

The versatile LA210 Letterprinter is compatible with Digital's Rainbow personal computer; Professional 350; the DECmate series of office workstations; and any Digital VAX or PDP-11 system.

In addition to the RS-232C interface, an optional parallel interface can connect the LA210 to the IBM XT, PC, and AT personal computers and to a wide variety of IBM personal computer emulators. The LA210 supports an extensive range of software on these host computers because it emulates three of the most popular IBM-compatible printers. By using a simple, plug-in ROM cartridge, you can print most programs designed for use with the IBM Graphics Printer, the Epson MX80 with mosaic graphics, and the MX80 with Graftrax bit-map graphics.

In order to invoke the emulation modes, you must set the dip switches as delineated in the user manuals and insert applicable font cartridges. For a comparison of the features of the LA210 Letterprinter in three printer emulation modes, see Table 7-1.

Table 7-1 ▪ Features of LA210 in 3 Printer Emulation Modes

	Epson MX80 (Mode 1)	Epson MX80 with Graftrax Plus (Mode 2)	IBM Graphics Printer (Mode 3)
Input Buffer	Selectable, 130 or 2,000 characters	Selectable, 130 or 2,000 characters	Selectable, 130 or 2,000 characters
Paper Width	Selectable, 8 inch or 13 inch	Selectable, 8 inch or 13 inch	Selectable, 8 inch or 13 inch
Character Sets	Courier-10 U.S. ASCII character set and mosaic graphics	Courier-10 U.S. ASCII character set, Courier-10 Italized U.S. ASCII character set, and Graftrax supplemental character set	Courier-10 U.S. ASCII character set plus 3 graphics printer supplemental sets including special IBM symbols
Forms Set Up	Selectable horizontal and vertical tabs, form feeds, carriage returns, and forms length	Selectable horizontal tabs, form feeds, carriage returns, and forms length	Selectable horizontal tabs, form feeds, carriage returns, and forms length

Table 7-1 ▪ Features of LA210 in 3 Printer Emulation Modes (Cont.)

	Epson MX80 (Mode 1)	Epson MX80 with Graftrax Plus (Mode 2)	IBM Graphics Printer (Mode 3)
Line Spacing*	8 or 10 lines per inch or variable 1/72-in	6,8, or 10 lines per inch or variable 1/72-in or 1/216-in spacing	6,8, or 10 lines per inch or variable 1/72-in or 1/216-in spacing
Printing Characteristics	Single or double width characters, bolding, high/low resolution, and compressed characters	Single or double width characters, bolding, high/low resolution plus italics, underlining, sub-scripting, super-scripting, and compressed characters	Single or double width characters, bolding, high/low resolution plus italics, underlining, sub-scripting, super-scripting, and compressed characters
Control Characters	Recognizes all MX80 control characters	Recognizes all MX80 Plus Graftrax control characters	Recognizes all IBM Graphics control characters
Graphics	Prints standard MX80 mosaic graphics	60 dots per inch (dpi) or 132 dpi graphics modes	60 dpi, 132 dpi, or 220 dpi graphics modes

* The LA210 utilizes approximation techniques to achieve IBM compatible line spacing. In a few applications, approximation errors may become visible in graphics modes.

▪ Printing and Graphics Features

As a multimode printer, the LA210 is capable of printing text at near letter quality, draft quality, or optional memo quality. In addition the LA210 prints full bit-map graphics as a standard feature.

The printer uses a nine-element impact dot matrix printhead that enables the printing of below-the-line descenders, such as on the letters "p," "q," and "y," as well as underlining in all text modes. The printhead is mounted on a carriage that moves horizontally across the paper. The ribbon, contained in a disposable cartridge, advances with carriage motion.

The printer operates in text or graphic mode. In text mode, characters define the functions and symbols usually associated with alphanumeric printers. In graphic mode, characters define specific columns of dots to be printed rather than an entire character image as in text mode. The graphics mode can be used to plot graphs and draw pictures that include shading and curved lines.

Near Letter-quality Printing

In near letter-quality mode, the LA210 prints at 40 cps maximum and gives high resolution printing with a 33 by 18 dot matrix. This near letter-quality printing is suitable for your reports, proposals, and business correspondence. Near letter-quality printing is accomplished through a dual pass, printhead shift technique.

Draft Printing

The seven-by-nine dot-matrix character cell provides high-speed output at the rate of 240 characters per second maximum. This is suitable for draft and data printing. Draft printing is done through bidirectional printhead motion where the printhead seeks the shortest distance to the next printable character, rapidly skipping over blank spaces.

Optional Memo Printing

An optional 80 characters-per-second maximum correspondence mode cartridge is available. Ideal for memos and documents that don't require near letter-quality print, this print mode uses a 33 by 9 dot matrix. The characters produced in this mode are darker than draft-quality characters, but are not as clear and dark as letter-quality ones.

EMULATION

The *LA210* emulates the 3 most popular printers used on the IBM PC today:
IBM GRAPHICS PRINTER
EPSON MX80
EPSON MX80 WITH GRAFTRAX

HOST SYSTEMS

The *LA210* attaches to a wide range of host systems using a standard EIA or external parallel interfaces.

SPEED

The *LA210* prints letters at 40 cps and rough drafts at 240 cps.

QUALITY

Select the appropriate print quality:
DRAFT MODE
NEAR LETTER QUALITY

CUSTOM WORK

DIGITAL can create for you customized character sets and typefaces.

PAPERS

Fanfold paper and office stationery are both accepted.

TYPEFACES

Up to 5 fonts can be used concurrently.
This is the Courier Typeface.
This is the Italics Typeface.
This is the Gothic Typeface.

CHARACTER SETS

International material can be printed. APL or scientific character sets are optional.

GRAPHICS

The *LA210* has eight aspect ratios for bit-map graphics: from 330 dots per inch to 74 dots per inch.

STYLING

Elegantly styled, the *LA210* is a welcome addition to any office environment

INTEGRITY

Integrity, reliability, and service come with the DIGITAL name.

For information call: 1:800:DIGITAL

Figure 7-1 ▪ LA210 Print Sample
(65% of Actual Size)

Graphics Printing

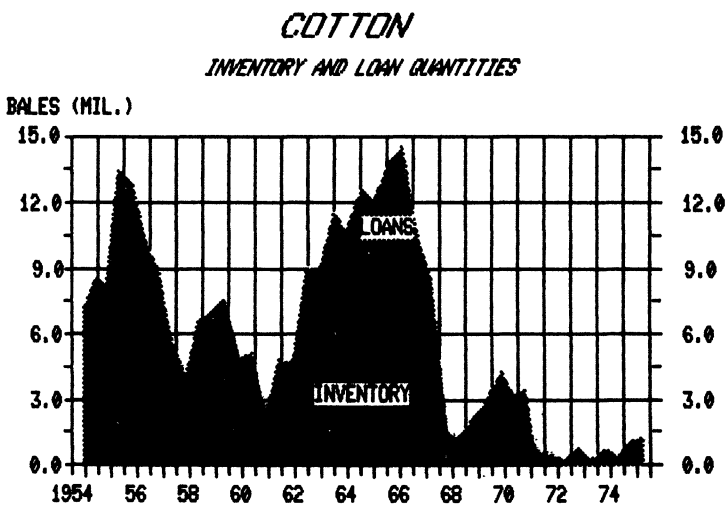


Figure 7-2 ▪ LA210 Graphics Sample, No.1 (90% of original size)

In graphic mode, the host computer controls the dot printing elements individually. The printer can print dot combinations anywhere on a page. Graphic mode provides you with the ability to draw pictures and plot graphs and charts.

The printer has variable horizontal resolution or dot spacing of 74 dots per inch to 330 dots per inch, and a vertical resolution or dot spacing of 72 dots per inch (Figure 7-3). The ratio of the horizontal resolution to the vertical resolution is referred to as the aspect ratio. This selectable dot-aspect-ratio feature allows greater resolution, variable print density, and compatibility with various software packages and video screens.

In Digital graphics mode, you can select from eight predefined dot aspect ratios:

Horizontal to Vertical Resolution	**Aspect Ratio**
74 by 72 dots per inch	1.02
83 by 72 dots per inch	1.12
94 by 72 dots per inch	1.30
110 by 72 dots per inch	1.50
132 by 72 dots per inch	1.83
165 by 72 dots per inch	2.29
220 by 72 dots per inch	3.04
330 by 72 dots per inch	4.58

These let your LA210 print an infinite variety of pictures and graphs, including pie and bar charts, logos, signatures, and unique characters with the correct proportions.

Note: In emulation mode, vertical resolution is 144 dots/inch, with an algorithm to approximate 216 dots/inch.

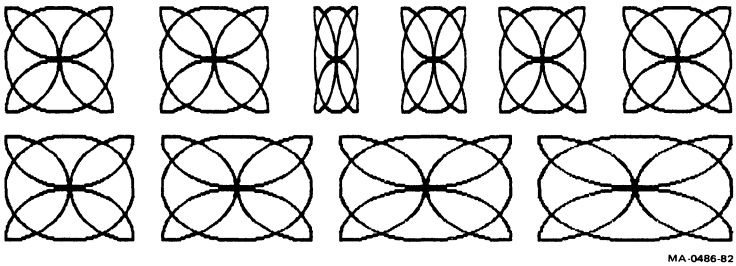


Figure 7-3 ▪ LA210 Variable Dot Spacing

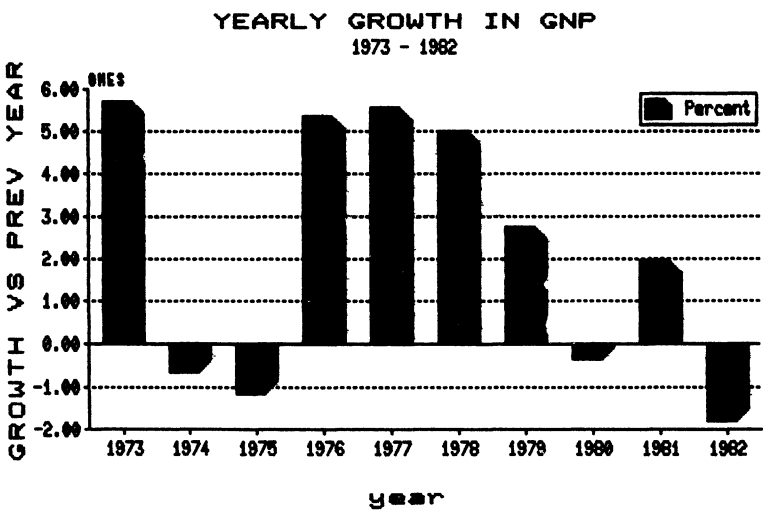


Figure 7-4 ▪ LA210 Graphics Sample, No. 2 (80% of Original Size)

▪ Multiple Fonts and Character Sets

The LA210 comes equipped to print 10 different languages in Courier 10 plus VT100 line drawing characters. The multiple languages supported are versions of English (the United States and the United Kingdom) Finnish, French, German, Italian, Norwegian, Danish, Spanish, Swedish, and French Canadian.

Besides the integral Courier typeface, a wide selection of optional typefaces, such as Gothic, Orator, and Italic; and a variety of character sets, including scientific and technical characters, can be added via convenient plug-in font cartridges.

Character size, dependent upon the print mode selected, lets you print double-width and compressed characters.

Normal width character sizes can be chosen from 10, 12, 13.2, or 16.5 characters per inch for draft printing, and 10 or 12 characters per inch for memo or letter-quality printing.

Double-width characters print at 5, 6, 6.6, and 8.25 characters per inch during draft mode and 5 or 6 characters per inch in memo or letter-quality mode.

The compressed font fits 132 columns to display a full spreadsheet on standard 21.6 cm (8.5 inch) wide page.

If you want a new or a custom font, Digital can create a special one for you. This might include your company's logo, special typeface, or unique character set.

UK	- £
GERMANY	- § Ä ö Ü ä ö ü ß
FRANCE	- £ à ° ç § é ù è ¨
ITALY	- £ § ° ç é ù à ò è ì
SPAIN	- £ § ¡ Ñ ¿ ° ñ ç ~
FINLAND	- Ä Ö A Ü é ä ö å ü
NORWAY/DENMARK	- Ø A Ü ä æ ø å
SWEDEN	- É Ä Ö A Ü é ä ö å ü
FR CANADIAN	- à â ç ê î ô é ù è û

Figure 7-5 ▪ Gothic-12 Overlay European Characters

▪ Paper

The LA210 prints on single sheet and fanfold paper and handles forms with up to four parts. The printer's wide carriage accommodates paper ranging in width from 8.9 centimeters (3.5 inches) to 37.8 centimeters (14.9 inches). Up to 0.038 centimeters (0.015 inches) in paper thickness can be used.

▪ Options, Accessories, and Supplies

The following options, accessories, and supplies are available. Check with your sales representative or Digital's DECdirect channel for the latest information.

Font cartridges for Digital mode operation

The ROM Cartridges are user-installable and plug into the multi-font adapter. The same cartridges are used by the LA100 Letterprinter. Note: In addition to the level of resolution shown for each font cartridge, each cartridge has the capability to print in draft mode resolution.

Part Number	Description
LA10X-AA	High-resolution Courier-10 US/UK primary ROM cartridge
LA10X-AB	High-resolution Courier-12 US/UK primary ROM cartridge
LA10X-AC	High-resolution Gothic-12 US/UK primary ROM cartridge
LA10X-AD	High-resolution Orator-10 US/UK primary ROM cartridge
LA10X-AE	High-resolution Symbol-10 primary ROM cartridge
LA10X-AF	High-resolution Gothic-10 US/UK primary ROM cartridge
LA10X-AH	Medium-resolution Courier-10 US/UK primary ROM cartridge
LA10X-AJ	Medium-resolution Orator-10 US/UK primary ROM cartridge
LA10X-AM	High-resolution DEC Technical-12 primary ROM cartridge
LA10X-AN	High-resolution Symbol-12 primary ROM cartridge
LA10X-AP	High-resolution Courier-10 Italicized primary ROM cartridge

Part Number	Description
LA10X-AR	High-resolution DEC Technical-10 Character set primary ROM cartridge
LA10X-JA	High-resolution Courier-10 Multinational overlay ROM cartridge
LA10X-JB	High-resolution Courier-12 Multinational overlay ROM cartridge
LA10X-JC	High-resolution Gothic-12 Multinational overlay ROM cartridge
LA10X-JD	High-resolution Orator-10 Multinational overlay ROM cartridge
LA10X-JF	High-resolution Gothic-10 Multinational overlay ROM cartridge
LA10X-JH	Medium-resolution Courier-10 Multinational overlay ROM cartridge
LA10X-JJ	Medium-resolution Orator-10 Multinational overlay ROM cartridge
LA10X-JN	High-resolution VT100-10 Line Drawing Set primary cartridge
LA10X-JP	High-resolution VT100-12 Line Drawing Set primary cartridge
LA10X-JR	Medium-resolution VT100-10 Line Drawing Set primary cartridge

IBM Compatible Cartridges

Part Number	Description	Emulation Mode
LA10X-LB	IBM MX80 Mosaic Cartridge	Mode 1: MX80
LA10X-LC	IBM Graftrax Cartridge	Mode 2: MX80 with Graftrax
LA10X-AP	Italics Primary Cartridge	Mode 2: MX80 with Graftrax
LA10X-LA	IBM Line Drawing Cartridge	Mode 3: IBM Graphics Printer
LA10X-LD	IBM Foreign Cartridge	Mode 3: IBM Graphics Printer

IBM Compatibility Packages

Part Number	Description
LA10X-LE	Includes the LA10X-LA and LA10X-LD font cartridges used for Mode 3 emulation
LA10X-LF	Includes the LA10X-LC and LA10X-AP font cartridges used for Mode 2 emulation
LA10X-LH	Includes the LA10X-LE and LA10X-EP for Mode 3 emulation (when the parallel interface is needed)

Other Options

Part Number	Description
LA21X-SF	Single tray cut sheet feeder for 8½ by 11 inch paper in portrait and landscape modes, and 8½ by 14 inch in portrait mode.
LA21X-SH	Single tray cut sheet feeder handles A4 size paper in protrait and landscape modes.
LA21X-SW	Printer paper output tray
LA10X-SP	Stand paper catcher (chrome)
LA10X-SQ	Stand paper shelf
LA21X-AC	Acoustic cover
PCXXF-DJ	Printer stand (gray base)
PCXXF-DK	Printer stand (charcoal brown base)
LA21X-BT	Bidirectional tractor for full page reverse printing capability.
LA10X-EP	External parallel interface

Supplies

Part Number	Description
LA10R-06	Ribbon cartridge (box of 6)

NOTE 1 Primary font ROMs contain UK and US ASCII character sets. Multinational overlay fonts contain German, French, Italian, Spanish, Finnish, Norwegian/Danish, Swedish, French Canadian, and DEC Supplimental character sets.

NOTE 2 International overlay cartridges (LA10X-B series) and chips (LA10X-D series) that contain the VT-100 Line Drawing character set rather than the DEC Supplemental character set are also available.

NOTE 3 Primary chips (LA10X-C series), International chips (LA10X-D series), and Multinational chips (LA10X-K series) are also available but require removing one or more of the resident chips if used.

▪ Fonts

The LA210 Letterprinter can accommodate up to two plug-in cartridge fonts and three internal ROMs.

The font features on the LA210 Letterprinter gives you a choice of a wide variety of standard character sets and fonts. Resident and optional fonts can be changed under program control or by pushing the select button. These fonts let you change any of a character's four attributes—typestyle (font), size (pitch), quality (density), and character set—without changing a printwheel or other print element.

Let's take *U.S./U.K. Courier 10 High Resolution* as an example to illustrate these four character attributes.

- US/UK represents the United States and United Kingdom character sets.
- The typestyle is Courier.
- The character size is 10 characters per inch.
- High density means near letter-quality print.

Installation

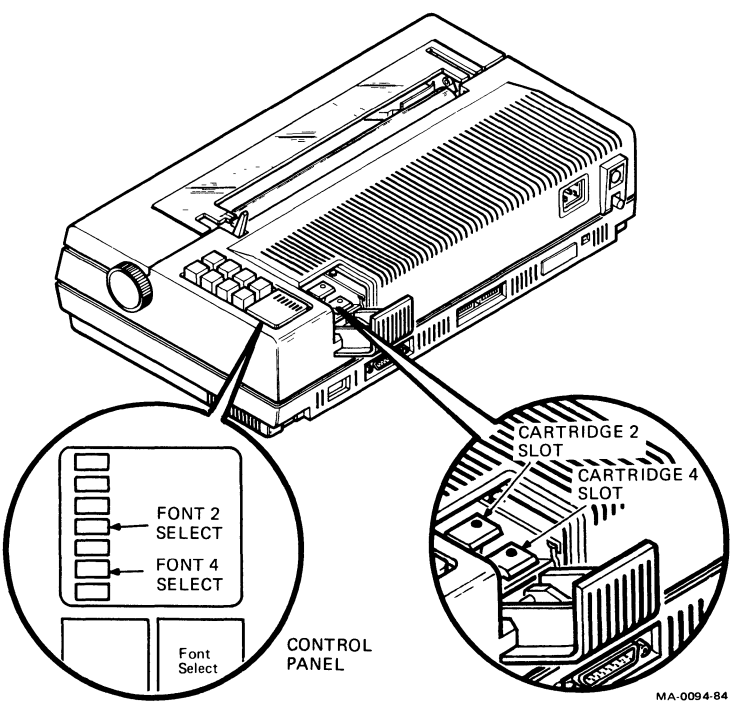


Figure 7-6 ▪ Font Indicators, Font Slots, and Font Selection Switch

You can install a primary cartridge either in slot 2 or slot 4. When installing a primary and overlay pair, you must install the primary in slot 2 and the overlay in slot 4. An overlay cartridge installed without the corresponding primary cartridge will not print.

Whether you install the cartridge or the overlay first is not important, nor is it necessary to turn the printer off. However, if you install or attempt to change a cartridge while the terminal is printing, the contents of the current printing line and the following line will be lost.

Installing a font cartridge is easy. Just follow these steps.

- Open the door on the multiple font adapter.
- Gently slide the font cartridge into the multiple font adapter until it is fully in place.
- Within a few seconds of insertion, check that the font cartridge indicator light is on.

Installation Tests

There are three tests to check proper cartridge installation.

- Cartridge electrical insertion test (described above.)
- Insertion power-up/checksum test
- Status message

To ensure proper operation of font cartridges, make sure that you have

- Fully inserted the cartridge right side up so as not to bend the pins.
- Inserted the cartridge in the correct slot. For example, if the overlay cartridge has been inserted in slot 2, rather than slot 4, remove it and place it in the right slot.
- Installed an overlay with the corresponding primary font.

- *Insertion/Power-up Checksum*

When power is applied or when a cartridge is inserted, the printer performs an internal check. It tries to access the fonts and if a font is present, it is tested. If the test fails, the printer indicates the faulty font by flashing the Font and POWER/FAULT lights.

Table 7-2 ▪ Power-up/Insertion Test Failures

Font Indicator	POWER/FAULT Indicator	Probable Cause	Corrective Action
1 flash	1 flash	Font 1 defective or not present	Check font for proper installation and reinstall. If there is no change, then replace the font.
2 flashes	2 flashes	Font 2 defective cartridge	Check font for proper installation and reinstall. If there is no change, then replace the font.
3 flashes	3 flashes	Font 3 defective cartridge	Check font for proper installation and reinstall. If there is no change, then replace the font.
4 flashes	4 flashes	Font 4 defective cartridge	Check font for proper installation and reinstall. If there is no change, then replace the font.
5 flashes	5 flashes	Font 5 defective cartridge	Check font for proper installation and reinstall. If there is no change, then replace the font.

Table 7-2 ▪ Power-up/Insertion Test Failures (Cont.)

Font Indicator	POWER/FAULT Indicator	Probable Cause	Corrective Action
6 flashes	6 flashes	First microcode font defective—first half	Replace logic board.
7 flashes	7 flashes	Second microcode font defective	Replace logic board.
8 flashes	8 flashes	RAM defective	Replace logic board
9 flashes	9 flashes	Optional RAM defective	Replace logic board
10 flashes	10 flashes	First microcode font defective—second half	Replace logic board.

Fonts are checked sequentially until a failure, if present, is displayed. If an error is detected, turn off the power to the printer. Check that the font was properly installed. If it wasn't, reinstall it correctly. If the failure persists, replace the faulty cartridge and then turn the printer back on. If an error still persists, check your service documentation for more details.

- *Status Message Test*

  Print the status message to check that the printer recognizes an installed font. The fourth line of the status message contains a unique three digit code for each font installed, up to five. Table 7-3 lists the currently available fonts and their corresponding identification codes.

Table 7-3 ▪ ROM Identification Codes

Identification Code	Font
001	High-resolution Gothic-10 US/UK primary font
002	High-resolution Gothic-10 international or multinational overlay font
003	High-resolution Gothic-12 US/UK primary font
004	High-resolution Gothic-12 international or multinational overlay font
005	High-resolution Courier-10 US/UK primary font
006	High-resolution Courier-10 international or multinational overlay font
007	High-resolution Courier-12 US/UK primary font
008	High-resolution Courier-12 international or multinational overlay font
009	High-resolution Orator-10 US/UK primary font
010	High-resolution Orator-10 international or multinational overlay font
011	High-resolution Courier-10 italicized primary font
069	Medium-resolution Courier-10 US/UK primary font
070	Medium-resolution Courier-10 international or multinational overlay font
073	Medium-resolution Orator-10 US/UK primary font
074	Medium-resolution Orator-10 international or multinational overlay font
129	High-resolution Symbols-10 primary font
131	High-resolution VT100-10 Line Drawing Set primary font
133	High-resolution VT100-12 Line Drawing Set primary font
135	High-resolution DEC Technical-10 primary font
136	High-resolution APL-10 overlay font
137	High-resolution MX-80 Mosaic primary font
139	High-resolution IBM Line Drawing primary font
141	High-resolution IBM Foreign primary font
143	High-resolution GRAFTRAX primary font
144	High-resolution Katakana-10 overlay font

Table 7-3 ▪ ROM Identification Codes (Cont.)

Identification Code	Font
145	High-resolution DEC Technical-12 primary font
147	High-resolution Symbols-12 primary font
193	Medium-resolution VT100-10 Line Drawing Set primary font

▪ *Notes:*

001—064: Indicates high-density printing

065—128: Indicates medium-density printing

129—192: Indicates special purpose, high-density printing

193—200: Indicates special purpose, medium-density printing

A standard font with an odd identification code indicates a primary font containing the US and UK character sets. A standard font with an even identification code indicates an overlay font containing the following character sets:

- USASCII
- ISO United Kingdom
- ISO German
- ISO French
- ISO Italian
- ISO Spanish
- Digital Finnish
- Digital Norwegian//Danish
- Digital Swedish
- Digital French Canadian
- Digital Multinational or Digital VT100 Line Drawing

A font is always installed in slot 1 inside the printer so the status message always prints a three-digit code for Font 1. If a font is installed in slot 2, the message has a three-digit code for slot 2.

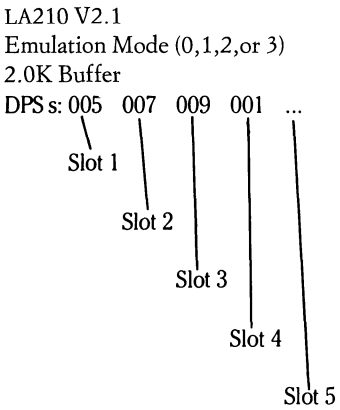


Figure 7-7 ▪ Status Message Depicting Font Identification Codes

If a font is not installed or is installed incorrectly, the status message shows three periods, as shown for Slot 5.

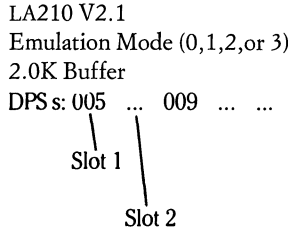


Figure 7-8 ▪ Status Message Depicting Missing Identification Code

This status message indicates that the printer does not recognize that a font is installed in slot 2. Check or replace the font installed in slot 2.

In order to print a status message, first check that the printer is on. Press and lock the ON LINE OFF key in the down position. Press and lock the SELF TEST key in the down position.

▪ Operator Features

Controls and Indicators

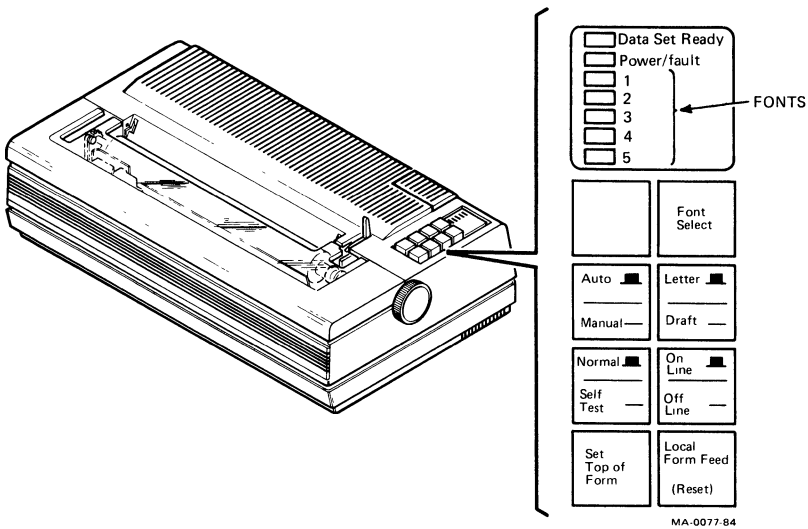


Figure 7-9 ▪ LA210 Control Panel

▪ *Power Switch*
The power switch is located on the rear of the printer. To turn power on, you set the switch to the up (1) position.

▪ *Auto/Manual Switch*
The Auto/Manual Switch specifies whether the computer or the operator has control over letter quality and draft printing. In the Auto (up) position, the computer has control. In the Manual (down) position, the operator has control and uses the Letter/Draft switch to select print quality.

▪ *Letter/Draft Switch*
The Letter/Draft Switch only works when the Auto/Manual switch is set to Manual. Set the Letter/Draft switch up for letter quality, and down for draft printing.

- *On Line/Off Line Switch*
  The On Line/Off Line Switch controls whether the printer is available for printing (online) or in pause mode (offline). Set the switch up for printing and down for pause mode. The Off Line position is used for such functions as entering self-tests, and setting top of form and local form feed.

  Note: Normally, data is not lost when you switch the printer offline (unless the printer is put into self-test mode). When you switch the printer back online, the printer resumes printing where it left off.

- *Normal/Self Test Switch*
  The Normal/Self Test Switch is used to put the printer in self-test mode. To use self-test mode, first set the On Line/Off Line switch to Off Line (down). Next set the Normal/Self Test switch to Self Test (down). For normal print mode operation, both switches should be up.

- *The Set Top of Form Switch*
  The Set Top of Form Switch controls the position of the top of the sheet of paper or form used. To set a new top of form, first set the On Line/Off Line switch to Off Line. Next, fit the top of the paper on the tractors and align to the top of the printhead. Then press the momentary contact Top of Form switch. Reset the On Line/Off Line switch to On Line to continue printing.

  Note: The printer starts printing at the top margin, not the top of form (unless the top margin is at the top of form). See the *LA210 Letterprinter Programmer Reference Manual* for details.

- *Local Form Feed (Reset) Switch*
  When the printer is offline, the Local Form Feed Switch advances the paper to the next top-of-form (or top margin if different) position each time you press it. If you hold down this switch while turning power on, it does not advance paper, but resets the printer to the factory default settings. This switch also resets certain faults (such as cover open) after the fault is cleared.

- *Font Select Switch*
  The Font Select Switch lets you select the font the printer will use, or have the computer control font selection. When the system is first turned on the computer has font control. When you first press the Font Select switch, it selects font 1. Pressing this switch again selects font 2, and so on. Pressing the switch again after you select font 5 returns font selection to the computer. You can select only font positions that contain fonts. Font 2 and 4 can be selected only if optional external fonts are installed.

Visual Indicators

- *The Data Set Ready Indicator*
  The Data Set Ready Indicator is on whenever the DSR (data set ready) signal is present. DSR is sent by the computer (or modem) to indicate that the system is ready and able to transmit and receive data.

- *Power/fault Indicator*
  When power is applied, this light goes on and stays on until the printer is turned off. If the light is blinking, it indicates a fault in the printer.

- *Font Indicators*
  These five indicators show which font is currently selected for printing. If you are selecting fonts manually, the indicator that is on represents the selected font. If the computer selects the font, the indicator that is off represents the selected font; in this case, all other indicators are on.

- *Paper-Low Detector (optional)*
  This connector is for the paper-low detector when you use an optional cut-sheet paper feeder.

Printer Controls

- *Paper Adjustment Knobs*
  Use either knob on the platen to adjust the paper vertically.These knobs advance paper 1/48 of an inch at a time.

  For optimum print quality, adjust the lever to a position that matches the thickness of the paper. Always check lever adjustments by using self-test printouts to determine print quality.

- *Paper Release Lever*
  This lever controls paper holding tension. Put the lever in the forward (released) position for tractor operation.

- *Printhead Release Lever*
  Use this lever only to replace the printhead, if necessary. Move the lever towards the rear of the printer to unlock the printhead. Move it forward to lock the printhead in place.

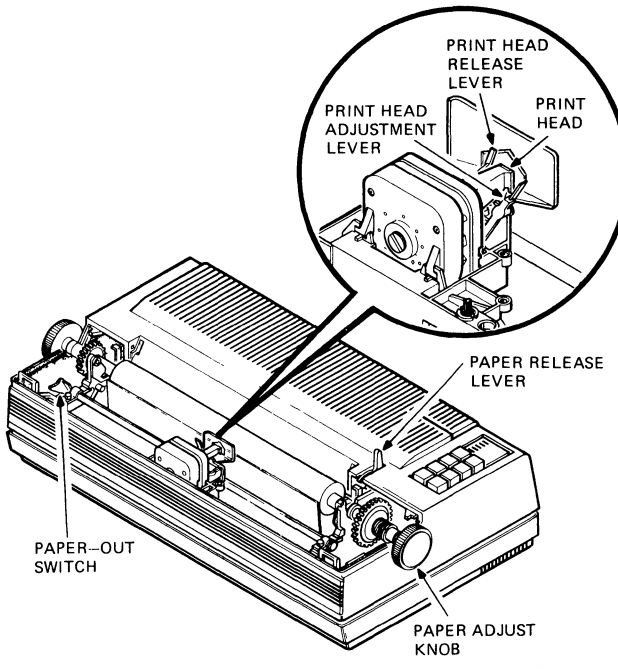


Figure 7-10 ▪ LA210 Letterprinter Adjustment Controls

▪ *Printhead Adjustment Lever*

This lever controls space between the printhead and the platen. It enables you to adjust the printhead for clear printing on single or multipart forms. You can also use this lever to move the printhead away from the platen to change the ribbon.

For optimum print quality, adjust the lever to a position that matches the thickness of the paper. Always check lever adjustments by using self-test printouts to determine print quality.

- *Tractor Release Levers*
  To remove the tractor, push both these levers down while lifting the assembly.

- *Tractor Adjustment Levers*
  These levers adjust the tractor to accommodate different paper widths. After adjusting a tractor, push the levers to the rear to lock in place.

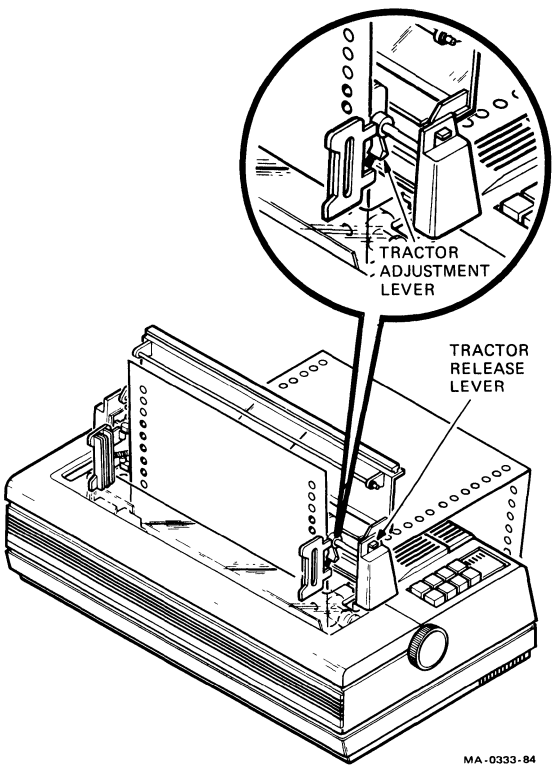


Figure 7-11 ▪ LA210 Tractor Control Levers

- *Paper-Out Switch*

  This switch is under the access cover. Use this switch for paper loading and to disable paper-out detection when paper is loaded from the top of the printer. Pull the switch forward to override paper-out detection, or to load paper. Push the switch back to enable paper-out detection when paper is loaded through the bottom of the printer.

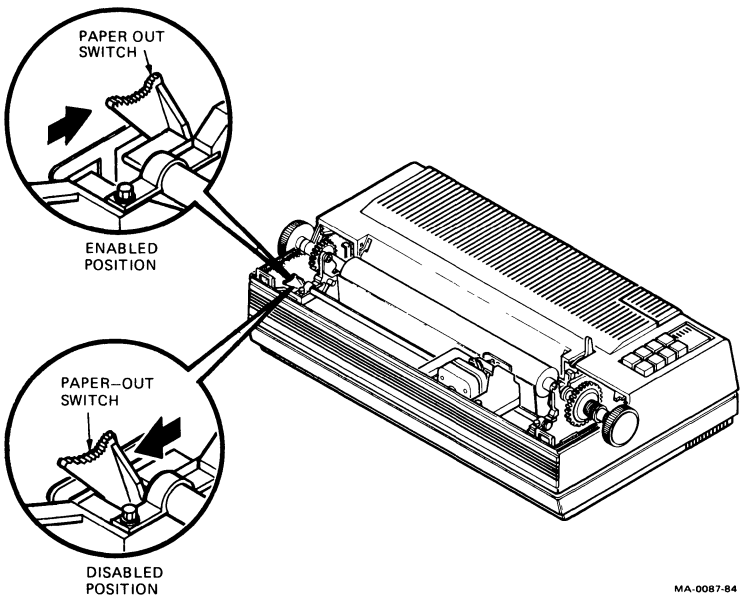


Figure 7-12 ▪ LA210 Letterprinter Paper-Out Switch

Audible Indicators
A bell tone will sound under any of the following conditions:

- Input buffer overflow—occurs when the printer cannot process characters from the input buffer before the buffer fills.
- Keypad buffer overflow—caused by typing faster than the printer can process characters from the keypad buffer.
- Bell code—each bell code received by the printer sounds the bell tone. This is useful in interactive applications to call attention to a specific condition.
- Printhead jam—causes the Power/Fault indicator to flash as well as the bell tone to sound.

The corrective action to take for any of these situations can be found in detail in the *LA210 Letterprinter User Guide.*

▪ Programming Information

Information on setup features and escape sequences is outlined in this section. For a summary of setup features and escape sequences, refer to the Appendix.

Set-Up Features
This section contains brief descriptions of some of the operator-selectable features of the LA210 Letterprinter. These setup features enable you to prepare the terminal for specific applications.

Sometimes the specific procedure or escape sequence required to select a particular feature will be described in detail. If you require additional information, consult the *LA210 User Guide* or the *LA210 Programmer Reference Manual.*

```
LA210  V2.1   R0
Emulation mode 0
2K Buffer
DPSs: 006...131......

*Printer Settings

Form Length (1/24):264
G0 Character set:United States
G1 Character set:Line drawing
G2 Character set:DEC Multinational
G3 Character set:United States
GL Set mapping:G0
GR Set mapping:G2
Pitch Mode:All Pitches
Horiz pitch (cpi):10
Vert pitch (lpi):6
End of line control:wrap mode
New Line request char.:none

*Communication Settings

Auto-answerback:Disabled
Disconnect on EOT:Disabled
Paper fault processing:XOFF (if enabled)
Parity:8/N
Receiver error:Print error block
Speed(bps):4800
Auto XON/XOFF:Enabled
Modem Control:No Modem Control-Restraint
C1 receive:Disabled
C1 transmit:Disabled
```

Figure 7-13 ▪ Sample Status Message

▪ *Communications Features*

The LA210 has a standard RS232C serial interface and an optional external parallel interface.

In order for the printer to transmit and receive data, the printer must be compatible with the computer and the communication system. The communication feature selections provide you with the means for matching the printer and the system.

The communication features available are achieved through proper setting of the easily accessible dip switches located on the back of the LA210 (see Appendix E). The communication features include the following:

Parity

This feature selects data bits per character and parity. The data bits per character can be set to seven or eight data bits. Parity selects the type of parity bit that the printer generates for transmitted characters and checks for the received character. Your choices are

- No parity, seven data bits with eighth bit set to mark
- No parity, seven data bits with eighth bit set to space
- Even parity, seven data bits; odd parity, seven data bits
- Even parity, eight data bits; odd parity, eight data bits
- No parity, eight data bits

There is no need to select the number of stop bits because the LA210 automatically matches any host that requests 1 or 2 stop bits.

Baud rate selection

You can select the speed at which the terminal transmits and receives characters. For systems in which transmit and receive speeds are different, you can select split speed baud rates. Choose from the following:

- 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, or 9600.
- 75 send/600 receive, 75 send/1,200 receive, 150 send/600 receive, 150 send/1,200 receive, 300 send/2,400 receive, 300 send/4,800 receive, 600 send/2,400 receive, or 600 send/4,800 receive.

Modem Control

This feature controls the EIA control lines that communicate with the host. More information about this can be found in the *LA210 Programmer Reference Manual.* Modem control choices are:

- No modem control, restraint mode
- No modem control, speed control mode
- Modem control, restraint control
- Modem control, speed control mode

If your modem does not use the protocol specified in the *Operator Guide*, do not select modem control. Do not select speed control mode unless using Bell 212 or an equivalent.

Paper Fault

This feature describes the action the printer takes when a paper fault occurs. Four responses are available:

- *No action*—Usually selected for hardwired installations or when no disconnect is desired. Printer stops and waits.
- *Send break*—Causes the printer to stop and transmit a 275-millisecond BREAK signal when a paper fault occurs.
- *Disconnect*—Causes the printer to stop and turn the data printer ready (DTR) signal off immediately.
- *Do not answer*—Used in unattended auto-answer operations with "paper low" sensor. Lets the printer complete any call in progress. When the call is completed, the printer disconnects (turns off the DTR signal) and does not answer any new calls.

Auto-XON/XOFF

To prevent loss of received characters, the printer signals Buffer Full using XON/XOFF or the restraint signals or both. When auto-XON/XOFF is on, the printer transmits the XON and XOFF control characters to indicate when the input buffer is almost empty or full. The XOFF character requests the host to stop sending characters, while the XON character means that character transmission can continue.

Synchronization can also be obtained by using the restraint signals. See your *LA210 Programmer Reference Manual* for details.

You can enable or disable this feature.

Answerback

This is a message of up to 30 characters that identifies the printer for the host. This message is transmitted from the printer upon the computer's request, or automatically when communication is established if auto-answerback is enabled.

Auto-Answerback

Auto-answerback conrols automatic transmission of the answerback message when a communication connection is made.

Your choice is to enable or disable this feature.

- *Printer Features*

Printer features allow you to position a form, set or clear margins and tabs, and select vertical and horizontal pitch. These features can be selected from the host by using the appropriate escape sequences.

The host selects from the following features:

End-of-Line Control

This feature prevents received characters from being lost when the host attempts to print beyond the right margin.

When end-of-line control is set to truncate, any characters received beyond the right margin are discarded. When end-of-line control is set to wrap-around, the printer performs an automatic carriage return and linefeed and prints the characters received at the left margin on the next line.

Page Length

The LA210 series can operate in one of two modes—form mode or no-form mode, which is used for roll paper applications. In the no-form mode, there is no form length or vertical margins. Printing occurs continuously with lines being spaced apart according to the selected vertical pitch.

When in form mode, the terminal will not print above the top margin or below the bottom margin, and lines are spaced so that the distance between the active line and the top margin is always a multiple of the current vertical pitch.

When a form length of zero is defined, the LA210 printers assume that roll paper is being used and enter the no-form mode. When a nonzero form length is given, the printer assumes that form paper is being used, and enters the form mode.

The form length can be set to any length from 1/12 inch per page to 21 inches per page.

Horizontal Pitch

CHARACTERS PER INCH	EXAMPLE
16.5	0123456789AaBbCcD
13.2	0123456789AaBb
12.0	0123456789AaB
10.0	0123456789

Figure 7-14 ▪ Sample LA210-Series Horizontal Pitch Selections

The horizontal pitch selected determines the maximum column width as per the chart below.

Table 7-5 ▪ Horizontal Pitch Selections

Horizontal Pitch	Maximum Number of Columns/Page
5	66
6	79
6.6	84
8.25	108
10	132
12	158
13.2	168
16.5	217

Horizontal Tabs

A horizontal tab is a preselected point on a line to which the printhead advances when a horizontal tab control character is received. The LA210 have 217 possible horizontal tab stops, one for each column. These tab stops are associated with column numbers, not physical positions on the paper. Thus, as was the case with horizontal margins, changing horizontal pitch will also change the physical position of tab stops.

Print Density

With the LA210, you can select low-, high-, or medium-resolution printing for greater emphasis.

Vertical Pitch

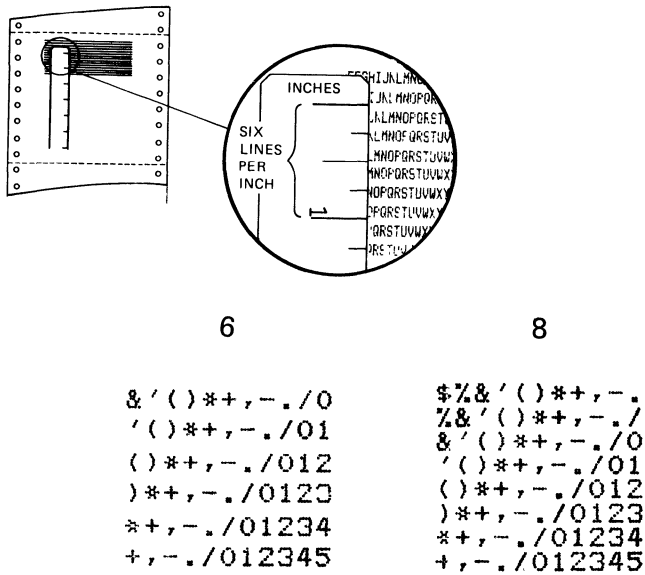


Figure 7-15 ▪ Sample LA210 Vertical Pitch Selections

This allows you to vary the number of lines per inch. You can choose to use 2, 3, 4, 6, 8, or 12 lines per inch.

Vertical Margins

You can set top and bottom vertical margins with this feature. The top vertical margin specifies the first printable line, while the bottom vertical margin specifies the last printable line. When form length is changed, the vertical margins must be reset.

Vertical Tabs

A vertical tab is a preselected line to which the printhead advances when a vertical tab control character is received. The printer has 168 vertical tab positions. Vertical tabs can be set and cleared like horizontal tabs. Vertical tab stops are associated with specific line numbers, not physical positions on the paper. Thus, changing vertical pitch changes the printing position of the vertical tabs on the paper.

Escape Sequences

The LA210 uses escape sequences standardized by the American National Standards Institute (ANSI) to control many of their features. These escape sequences provide additional controls that are not provided by the control characters in the character set. These sequences, multiple-character control functions, are not printed, but are used to control printing and printer operations such as advancing the paper or ringing the margin bell.

Detailed information on escape sequences can be found in the *LA210 Programmer Reference Manual* or in Appendix at the end of this book.

▪ Maintenance

The LA210 Letterprinter does not need preventive maintenance. Clean the outer surfaces and platen with a damp cloth only. Do not use solvents of any kind. For detail on maintenance refer to the *LA210 Letterprinter User Guide*.

Self-tests

The LA210 can perform a power-up self-test and several printer self-tests. The access cover must be on to run the self-tests. If the printer does not pass the tests, refer to the troubleshooting checklist.

Table 7-4 ▪ Power-up Self-test

DSR Indicator	Power/Fault Indicator	Probable Cause	Action
Off	Off, no carriage motion	Power supply	See Troubleshooting Checklist
Off	Off, carriage motion	Defective indicators	Request service
On or off	Flashing, no bell	Cover open or paper fault	Close cover. Press CLEAR FAULT key.
On or off	Flashing, bell tones	Printhead jam	Clear jam. Press CLEAR FAULT key.
Flashing	Flashing	Font problem	Refer to the Troubleshooting Checklist.

▪ *Internal Self-test*

1. Turn the printer power switch on.
2. Press the On Line/Off Line switch down to the Off Line position.
3. Press the Normal/Self Test pushbutton down to the Self Test position. You should see a status message showing the firmware version number, configuration switch settings, and computer selectable features.
4. Press and release the momentary Local Form Feed pushbutton. This starts self-test 1, the print quality test. You should see a printout of all characters.
5. Press and release the Local Form Feed pushbutton to stop test 1 and start self-test 2, the horizontal registration test. You should see a printout of asterisks printed in four (draft) or eight (high-resolution) passes.

6. Press and release the Local Form Feed pushbutton to stop test 2 and start self-test 3, the mechanical operation test. This test moves the carriage to each character position, advances lines, but does not print.
7. Press and release the Local Form Feed pushbutton to stop test 3 and reprint the status message. After the status message prints out again, the printer stops.

▪ *Input/Ouput Loopback Tests*

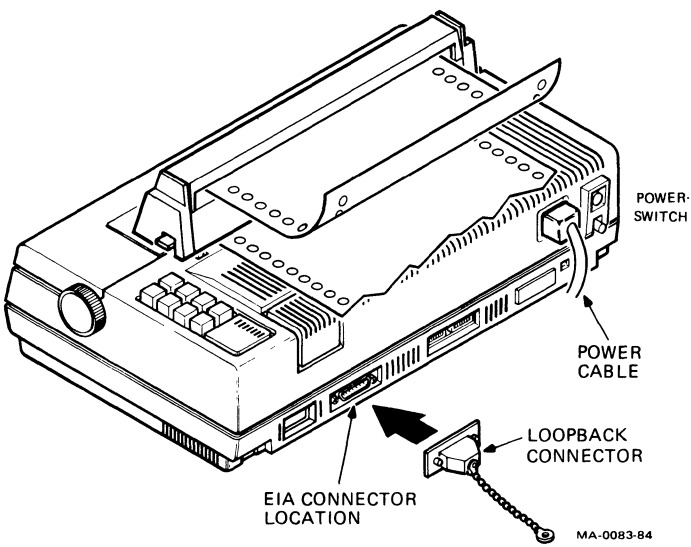


Figure 7-16 ▪ LA210 Loopback Connector and Test Switches

1. Turn the printer power switch off.
2. Plug in the loopback connector.
3. Turn on the power.
4. Press the On Line/Off Line pushbutton down to the Off Line position.
5. Press the Normal/Self Test pushbutton down to the Self Test position.
6. Wait until the printing of the status message stops.

7. Press the Set Top of Form switch. The printer runs a baud rate test and prints a pass or fail message. A sample message is: Data path passed, Control lines passed.
   Next, the printer runs a data communications test. This test prints out all characters and is similar to self-test 1.

Operator Troubleshooting Checklist

If your printer is not operating, chances are the problem is minor and you can correct it yourself. Listed below are some of the common problems, their probable cause, and the corrective action that you can take.

Terminal does not turn on when power switch is turned on.

- The ac power cord is not plugged into wall receptacle or printer. Plug in cord.
- Power is not coming from wall receptacle. Check receptacle with a known working device.
- The ac line fuse is blown. Turn power switch off and replace fuse.

Characters do not print. Power/fault indicator flashes.

- Printer is out of paper. Install paper.
- Access cover is open. Close access cover.

Characters do not print. Carriage moves across paper.

- Printhead is too far from paper. Readjust printhead by moving printhead adjustment lever to the left.
- Ribbon not installed properly. Reinstall ribbon.

Characters do not print or are garbled.

- Data set (modem) is disconnected. Plug in data set.
- Baud rate is incorrect. Make sure baud rate matches computer.
- Communications setup is incorrect. Make sure other communications features are set to match computer.

Character printing is too light.

- Printhead is too far from paper. Readjust printhead by moving printhead adjustment lever to the left.
- Ribbon is out of ink. Replace ribbon.

Characters smudge during printing.

- Paper is not firmly wrapped around platen. Smooth paper over surface of platen.
- Printhead too close to paper. Readjust printhead by moving printhead adjustment lever to the right.

Paper does not advance.

- Paper not loaded correctly. Reload paper.
- Feed holes are torn. Reload paper.
- Friction feed is not released. Move paper release lever forward.

Multipart paper tears.

- Printhead too close to paper. Readjust printhead by moving printhead adjustment lever to right.
- Paper not straight in printer. Realign paper.
- Tractors incorrectly adjusted. Readjust right tractor.
- Paper or printhead jam occurs. Open access cover and clear jam. Close cover and the power switch off and on to reset the printer.

▪ Additional Documentation

The following documents contain more detailed information about the LA210 Letterprinter.

- *LA210 Letterprinter User Guide* (EK-LA210-UG-)—Provides general operating and maintenance information for the LA210 Letterprinter. It describes ribbon and paper installation, operating controls and indicators, data communications, printer adjustments and maintenance, and trouble-shooting.
- *Installing the LA210 Letterprinter* (EK-LA210-IN)—Describes how to unpack, install, power up, and check out the LA210 Letterprinter terminals.
- *LA210 Letterprinter Programmer Reference Manual* (EK-LA210-RM)—Contains detailed information on the LA210 features: interface, communication, character processing, escape and control sequence and graphics mode.
- *LA210 Letterprinter Operator and Programmer Reference Card* (EK-LA210-RC)—Provides a summary of programming information and operator information.
- *LA210 Letterprinter Emulation Modes Reference Guide* (EK-LA210-RG)—contains detailed information on using the LA210 in emulation modes for the Epson MX80, Epson MX80 with Graftrax, or IBM Graphics Pinter.

▪ General Specifications (Digital and IBM Modes)

Performance Characteristics

Print Speed (maximum)	240 char/s (draft) 40 char/s (letter) 80 char/s (memo), optional
Throughput speed	135 lines/min 80 column 90 lines/min 132 column
Print technology	Bidirectional, dot matrix
Print matrix: draft-quality	7 by 9 dots per character cell in Digital mode, 10 by 12 in IBM-emulation modes, at 10 characters/inch

Print matrix: near letter-quality	33 by 18 dots per character cell in Digital mode, 33 by 24 in IBM-emulation modes, at 10 characters/inch
Print matrix: memo-quality (optional)	33 by 9 dots per inch in Digital mode, 33 by 12 in IBM-emulation modes, at 10 characters/inch

Physical Characteristics

Height	12.7 cm (5 in) without tractor 22.8 cm (9 in) with tractor
Width	54.6 cm (21.5 in)
Depth	34.3 cm (13.5 in)
Weight	12.15 kg (27 lb)

Power Requirements

Voltage	120 V nominal (90-128 Vac range) or 240 V nominal (180-256 Vac range), switch-selectable
Frequency	47 to 63 Hz
Power consumption	154 W, printing maximum

Paper

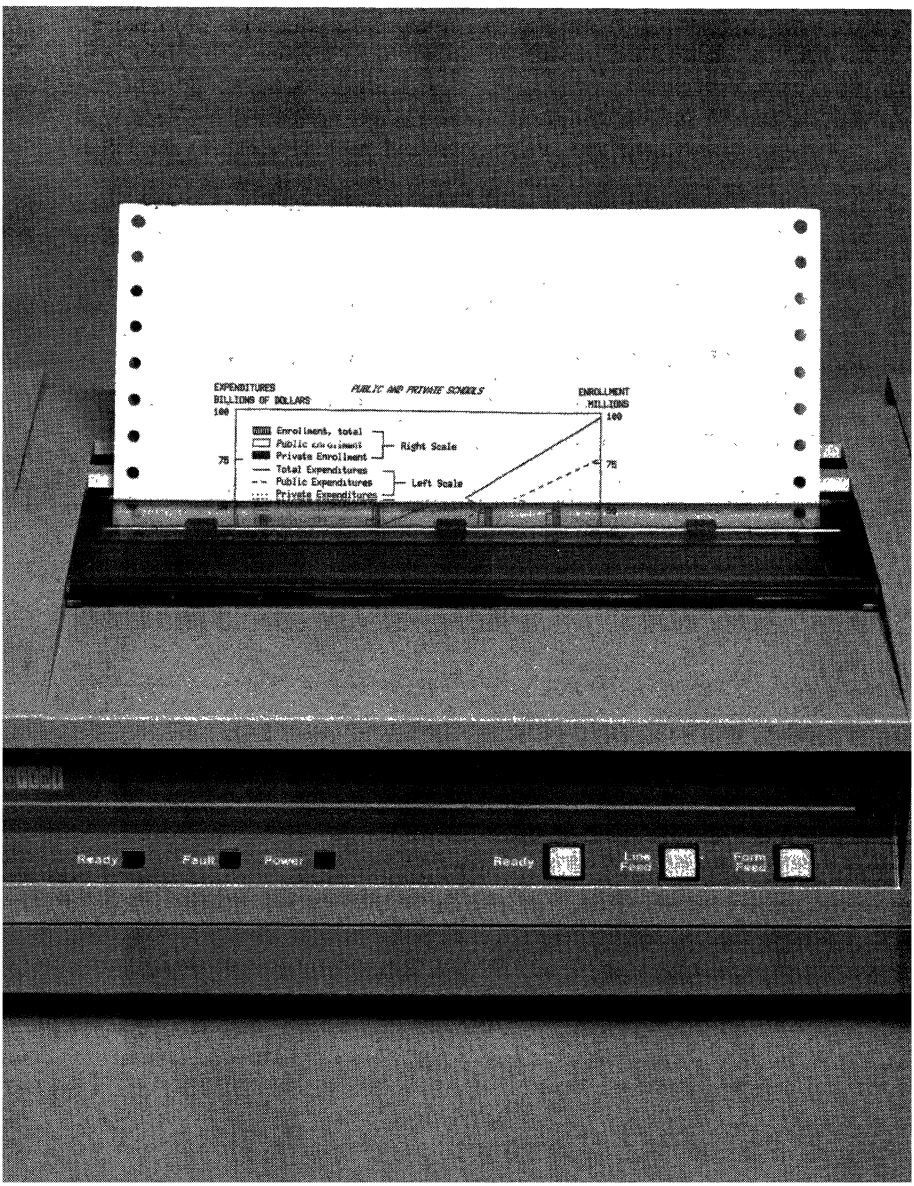
Type	Single sheet or fanfold
Dimensions	8.9 to 37.8 cm (3.5–14.9 in) wide
Multiple forms	Original plus 3 parts (bottom feed only)
Thickness	0.038 cm (0.015 in) maximum

Digital Mode (Mode 0)

Bit map graphics	72 vertical by 74–330 horizontal dots per inch
Aspect ratio	Variable—1.02, 1.12, 1.30, 1.50, 1.83, 2.29, 3.04, 4.58
Character pitch	5, 6, 6.6, 8.25, 10, 12, 13.2, or 16.5 char/in (draft mode) 5, 6, 10, 12 char/in (letter-quality/memo mode)
Line spacing	2, 3, 4, 6, 8, or 12 lines per inch
Input buffer	2000 characters

Communications

Baud rates	50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600
Split speeds	600 or 1200 receive with 75 or 150 transmit; 2400 or 4800 receive with 300 or 600 transmit
Parity	Odd, even, mark, or space; 7 or 8 bits per character selectable


EXPENDITURES
BILLIONS OF DOLLARS
100
75
PUBLIC AND PRIVATE SCHOOLS
ENROLLMENT
MILLIONS
100
75
Enrolment, total
Public Enrollment
Private Enrollment
Right Scale
Total Expenditures
Public Expenditures
Private Expenditures
Left Scale
Ready
Fault
Power
Ready
Line Feed
Form Feed

▪ Overview

The desktop LA50 printer is compact and lightweight and is designed for use with Digital's personal computers and video terminals. A serial printer using dot-matrix technology, the LA50 Personal Printer can be used for applications that require both text or graphics output, such as drafts of business and technical reports, graphs, and bar charts. In addition to draft-quality printing, the LA50 printer also features a memo-quality print mode, which provide higher-quality print output than ordinary draft printing, and a bold print mode for emphasis.

The LA50 Personal Printer is compatible with all Digital's personal computers—RAINBOW 100, DECMATE II, and the Professional 325 and 350. It is also compatible with Digital's VT100 series of video terminals and provides a convenient hardcopy of the screen's content. In addition, the LA50 is also supported on all Digital's processors running the RT-11 and RSTS/E operating systems.

There are four models of the LA50 Personal Printer.

- *LA50-RA*: Desktop printer, tractor feed, and 120 Vac power supply.
- *LA50-RB*: Desktop printer, tractor feed, and 220 Vac power supply.
- *LA50-RC*: Desktop printer, tractor feed, and 240 Vac power supply.
- *LA50-RD*: Desktop printer, tractor feed, and 100 Vac power supply.

▪ Major Features

The LA50 Personal Printer's main features are

- Compact size and lightweight—Can be placed on top of a desk or a table—anywhere you work.
- Friction and tractor feed standard—Comes equipped to handle different paper types.
- Graphics printing—Permits printing of graphs, bar charts, and bit-map images.
- Enhanced printing—Provides a higher-quality print output than ordinary draft printing.
- ASCII/Multinational character sets, including Katakana—Many national character sets are resident, so you can select any character set required for your application.
- VT100 line drawing character sets—VT100 compatibility for drawing continuous vertical and horizontal lines for easy duplication of graphs, charts, and simple forms.

LA50
PERSONAL PRINTER

Hi! I am the LA50, DIGITAL EQUIPMENT's smallest, friendliest printer. Personal computers and video terminals are my specialty, where people love my small size and low price.

S P E C I F I C A T I O N S

Three printing styles:
- 100 character per second draft
- 50 character per second memo
- 50 character per second bolding

Choice of character sizes:

PICA PITCH	PICA DOUBLED
ELITE PITCH	ELITE DOUBLED
COMPRESSED PITCH	COMPRESSED DOUBLED

Word processing features:
- Automatic underlining
- Superscripting: $E = mc^2$
- Subscripting: H_2O

Graphic and international characters:
- Voilà, señor! é à ä î ç ¥ " ø $

Bit-map graphics:
- (check the logo at the top of the page!)

Figure 8-1 ▪ LA50 Print Samples

▪ Printing Features

The LA50 Personal Printer offers three program-selectable print modes. A nine-wire printhead enables the LA50 to print below-the-line descenders, such as the letters p, q, and y, as well as to underline in all text modes. The graphics mode can be used to plot graphs and draw pictures that entail shading and curved lines. In addition to the print modes listed below, the LA50 has a bold print mode in which characters are double-struck for emphasis.

Draft Printing

The seven by nine dot-matrix character cell provides fast output at the rate of 100 characters per second maximum. This is suitable for draft and data printing. Printing is accomplished through a bidirectional technique in which the printhead seeks the shortest distance to the next printable character rapidly skipping over blank spaces.

Memo Printing

The LA50 prints a denser character using a matrix of 13 by 9 dots and produces clearer, darker, more legible characters suitable for correspondence. Memo mode prints at the rate of 50 characters per second maximum.

Graphics Printing

In graphics mode, the LA50 Personal Printer prints 72 dots per inch vertically, and 144 or 180 dots per inch horizontally, depending on the host aspect ratio.

A predetermined escape sequence from the host enables the LA50 to enter the bit-map graphics mode. Microcode control of individual printhead wires makes every dot addressable by the host and enables images displayed on a video terminal to be faithfully reproduced. This allows for the printing of an infinite variety of pictures and graphs, including pie and bar charts, logos, signatures, and unique characters.

▪ Character Sets

The LA50 Personal Printer has 14 operator-selectable character sets resident at all times. The 250 printable characters include

- 96-character ASCII set.
- VT100 special character set.
- 11 national character sets—U.S., British, Finnish/Swedish, French, French Canadian, German, Italian, JIS Katakana, JIS Roman, Norwegian/Danish, and Spanish.

- Digital's eight-bit multinational character set—Compatible with Digital's Professional 325 and 350 Personal Computers' national languages.

Selectable via software, the LA50 Personal Printer can print double-width and compressed characters. Character size can be changed from 10 to 12 characters per inch (pica to elite). In addition, the compressed print fits 132 columns to display a full spreadsheet on standard 21.6 cm (8.5 inch) wide page. Double-width characters print at 5, 6, and 8.25 characters per inch.

▪ Paper

The versatile LA50 Personal Printer can print on single sheets ranging from 7.6 to 22.9 cm (3 to 9 inches) wide. In addition, fanfold paper from 11.4 to 25.4 cm (4.5 to 10 inches) wide can also be used. It prints on three-part forms (one original and two copies) to a maximum thickness of 0.028 cm (0.011 inches).

▪ Options

Not Applicable.

▪ Accessories and Supplies

The following accessories, supplies, and spares are available for the LA50 Personal Printer. Check with your sales representative for the latest information.

Accessories

Part Number	Description
H9850-HN	Dust cover
LA50X-FB	Acoustic cover for noise reduction, 120 volt fan
LA50X-FF	Wire basket paper catcher, will accept any 21.6 cm by 27.9 cm (8.5 by 11 in) sheet paper
LAX12-SL	Printer stand—charcoal colored base with light oak laminated top; 61 cm wide by 53.3 cm deep by 66.1 cm high (24 in by 21 in by 26 in)
PCXXF-CJ	Printer stand—gray, high pressured laminated top with light oak trim, charcoal base, laminated top; 61 cm wide by 53.3 cm deep by 66.1 cm high (24 in by 21 in by 26 in)
PCXXF-CF	Small lightweight stand that sits on desk and has 7.6–12.7 cm (3–5 in) opening for paper storage.

Supplies

Part Number	Description
LA50R-06	Box of 6 ribbons

▪ Operator Features

Controls and Indicators

A total of six controls and indicators are found on the front panel of the LA50 Personal Printer.

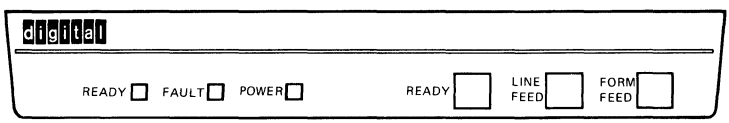


Figure 8-2 ▪ LA50 Controls and Indicators

▪ *Ready Indicator*
The green READY light indicates the operating state of the printer. The light is on when the printer is online, ready to print or is printing. The light is off when the printer is not ready, offline, or the FAULT indicator is on.

▪ *Fault Indicator*
The red FAULT light blinks when the printer detects an electronic fault. The light stays on when the printer is out of paper.

▪ *Power Indicator*
The green POWER light is on when the power is turned on.

▪ *Ready Switch*
The READY switch controls the operating state of the printer. Pressing the switch alternately puts the printer in the ready or not ready state. Check the READY light to determine if the printer is online or offline.

▪ *Line-feed Switch*
Pressing the LINE FEED switch advances the paper one line.

▪ *Form-feed Switch*
Pressing the FORM FEED switch advances the paper one full sheet. Length is set at the factory, but you can change it by using the appropriate escape sequence.

Printer Configurations

The LA50 Personal Printer configuration switches are set for use with Digital systems in the United States. If you need to change the configuration, the switches required for this operation are located under the printer's front access cover. **Note:** Before resetting the switches, check that you have turned the power off.

The switch positions can be easily changed by sliding the switch tabs with a ball-point pen or equivalent. **Note:** Never use a lead pencil.

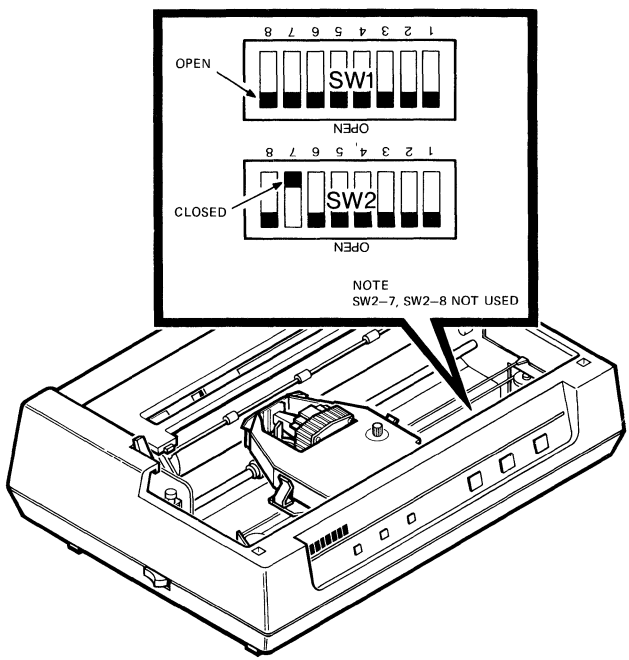


Figure 8-3 ▪ LA50 Configuration Switches

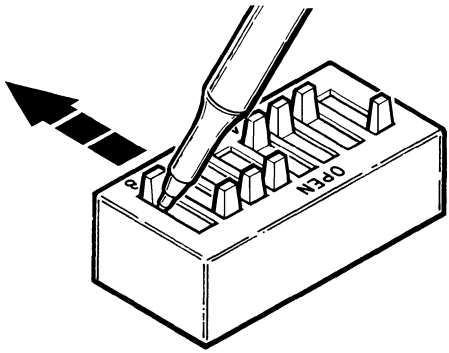


Figure 8-4 ▪ Changing Configuration Switches

▪ *National Character Set Switches*

The national character set switches are designated SW1-1 through SW1-4. These switches are initially set to the United States position—all four switches open. To call up a particular national character set, put the switches in the sequence prescribed in the following chart.

Table 8-1 ▪ Character Set Switch Positions

Nation	SW1 Position			
	SW1-1	**SW1-2**	**SW1-3**	**SW1-4**
United States	Open	Open	Open	Open
Britain	Closed	Open	Open	Open
Finland	Open	Closed	Open	Open
France	Closed	Closed	Open	Open
French Canada	Open	Open	Closed	Open
Germany	Closed	Open	Closed	Open
Italy	Open	Closed	Closed	Open
Japan	Closed	Closed	Closed	Open
Norway/Denmark	Open	Open	Open	Closed
Spain	Closed	Open	Open	Closed
Sweden	Open	Closed	Open	Closed

- *Graphics Ratio Switch*

  Switch SW1-5 changes the horizontal to vertical dot ratio in graphics mode by changing the number of horizontal dots per inch. This switch is initially set for 144 horizontal dots per inch. If your graphics printing looks distorted, you probably are using a system that works on 180 horizontal dots per inch. In this instance, just change the switch setting. The number of vertical dots is kept constant at 72 dots per inch.

Table 8-2 ▪ Graphics Ratio Switch Settings

Ratio	Horizontal Dots per Inch	SW1-5 Position	Application
2 to 1	144	Open (Factory Setting)	VT200 Series VT125 Graphics Rainbow 100 Graphics
2.5 to 1	180	Closed	Professional 350 Graphics

- *XON/XOFF and READY/BUSY Protocol Switches*

  Digital's systems use the XON/XOFF protocol for communications control. Other systems may require the Ready/Busy protocol. Switch SW1-6 selects the XON/XOFF or Ready/Busy protocol as shown below.

  When SW1-6 is open, the XON/XOFF protocol is selected. This is also the factory setting. When the switch is closed, the Ready/Busy protocol will control communications.

  If you select the Ready/Busy protocol, you can choose the polarity of the busy or ready signal. When SW1-7 is open, the signal condition is high—Busy and low—Ready. When the switch is closed, the reverse is true.

- *Right Margin Switch*

  Switch SW1-8 selects the method of controlling a line of characters that exceed the eight-inch line of print. If set to truncate, the printer is limited to printing the first eight inches of characters and it drops the remaining characters. If set to wrap, the printer prints the remaining characters on the next line.

  When switch SW1-8 is open, the line is set to truncate. This is also the factory setting. When closed, switch SW1-8 causes the line to wrap.

- *Baud Rate Switches*

  The switches SW2-1, SW2-2, and SW2-3 select the speed at which the printer communicates with the host.

Table 8-3 ▪ Baud Rate Switch Configurations

Baud Rate (Bits per Second)	SW2-1	SW2-2	SW2-3
4800 (Factory Setting)	Open	Open	Open
2400	Open	Closed	Open
1200	Open	Closed	Closed
600	Closed	Open	Open
300	Closed	Open	Closed
200	Closed	Closed	Open
110	Closed	Closed	Closed

- *Data Format Switches*

Switches SW2-4, SW2-5, and SW2-6 select the data format to enable communication with the computer.

Table 8-4 ▪ Data Format Switch Configurations

Data Format	SW2-4	SW2-5	SW2-6
7 Bits + Odd Parity	Open	Closed	Closed
7 Bits + Even Parity	Closed	Closed	Closed
7 Bits + 8th Bit Mark	Open	Open	Closed
7 Bits + 8th Bit Space	Closed	Open	Closed
8 Bits + Odd Parity	Open	Closed	Open
8 Bits + Even Parity	Closed	Closed	Open
8 Bits, No Parity (Factory Setting)	Open	Open	Open

The factory setting for the data format switches is 8-bit, no parity, which corresponds to the convention for Digital's personal computers.

▪ Programming Information

Escape and Control Sequences

The LA50 Personal Printer uses escape sequences which were standardized by the American National Standards Institute (ANSI). While some features of the LA50 lack an ANSI-standard escape sequence, Digital has defined additional escape sequences that are within the extensions permitted by the ANSI standard. These escape sequences allow expansion of control functions beyond the current limit of 32 control characters.

Using these additional escape sequences, you can control additional LA50 features. Following the brief description of each escape sequence feature will be the summary of the actual escape sequence required. Additional information on escape sequences can be found in the *LA50 Printer Programming Reference Manual.*

- *Partial Line Paper Motion (PLD and PLU)*
  This allows you to move the paper up or down 1/12 inch.

Table 8-5 ▪ Paper Motion Escape Sequences

Name	Escape Sequence	Description
Partial Line Down	ESC K	Moves line down (paper up) 1/12 inch
Partial Line Up	ESC L	Moves line up (paper down) 1/12 inch

- *Horizontal-Pitch and Vertical-Pitch Selection*
  Horizontal-pitch selection allows you to vary the number of characters per inch. You can choose to print 10, 12, or 16.5 single-width characters per inch. If you wish to print double-width characters, you can set the pitch to be 5, 6, or 8.25 characters per inch.

  Vertical-pitch selection allows you to vary the number of lines per inch. You can select to use 2, 3, 4, 6, 8, or 12 lines per inch.

Table 8-6 ▪ Horizontal-pitch and Vertical-pitch Selection Escape Sequences

Escape Sequence	Description
ESC[0 w	Sets horizontal pitch to 10 char/in
ESC[1 w	Also sets horizontal pitch to 10 char/in
ESC[2 w	Sets horizontal pitch to 12 char/in
ESC[4 w	Sets horizontal pitch to 16.5 char/in
ESC[5 w	Selects double-width printing and sets horizontal pitch to 5 char/in
ESC[6 w	Selects double-width printing and sets horizontal pitch to 6 char/in
ESC[8 w	Selects double-width printing and sets horizontal pitch to 8.25 char/in

Table 8-6 ▪ Horizontal-pitch and Vertical-pitch Selection Escape Sequences

Escape Sequence	Description
ESC[0 z	Sets vertical pitch to 6 lines/in
ESC[1 z	Sets vertical pitch to 6 lines/in
ESC[2 z	Sets vertical pitch to 8 lines/in
ESC[3 z	Sets vertical pitch to 12 lines/in
ESC[4 z	Sets vertical pitch to 2 lines/in
ESC[5 z	Sets vertical pitch to 3 lines/in
ESC[6 z	Sets vertical pitch to 4 lines/in

▪ *Page-length Selection*

At power-up, the page length is set to 27.9 cm (11 inches), corresponding to 66 lines with the default vertical spacing.

The page-length command allows you to set the number of lines per page. This is accomplished by using a simple equation to calculate the page length, P_n. Just multiply the page length in inches per page by the current vertical pitch in lines per inch. The result gives you P_n, the number of lines per page.

The following chart gives the required P_n values for a small selection of page lengths.

Table 8-7 ▪ Page-length Selections

Page Length (Inches)	Selected Vertical Pitch					
	2	3	4	6	8	12
11	22	33	44	66	88	132
14	28	42	56	84	112	168

The page length can be set to any length from 1/12 inch per page to 53.3 cm (21 inches) per page at the selected vertical pitch. If the desired page length exceeds 53.3 cm (21 inches), then the printer will default to 53.3 cm (21 inches).

▪ *Character-set Selection*

The normal print mode of the LA50 Personal Printer is text mode. In text mode, the printer is capable of printing the 94 printable characters of the ASCII character set, the 81 additional characters of the multinational character set, the 63 additional characters of the JIS Katakana character set, the 27 additional characters of the VT100 line drawing character set, and the error character, which is a reverse question mark. These 266 different characters are grouped into 14 character sets. The proper escape sequence allows you to select the character set you want for your work.

The printer is considered to be in 7-bit mode if the number of data bits has been set to seven. In 7-bit mode, all characters are printed from the character set designated GL.

The printer is considered to be in 8-bit mode if the number of data bits has been set to eight. In 8-bit mode all characters are printed from the GL character set if the eighth bit is 0 or from another set named GR if the eighth bit is 1. The advantage of 8-bit mode is that two character sets (one in GL and one in GR) can be resident simultaneously.

Once you have selected to work in either the GL (7-bit) or GR (8-bit) character set mode, your next step is to load one of the four intermediate pointers, G0, G1, G2, or G3. Once you have loaded these intermediate pointers into the register, you can access any of the 14 available character sets. For example, if you have selected to work in GL (7-bit) mode, you can load either G0, G1, G2, or G3 into the terminal according to the escape sequences listed in Table 8-7. This table lists the commands and designates how the pointers select the GL or GR set. For example, the LS2 command causes the GL set to select the character set assigned to G2 and the LSR1 command causes the GR set to select the character set assigned to G1.

Table 8-8 ▪ Active Character Set Selection

Command	Mnemonic	Escape Sequence	GL Set	GR Set
Shift in	SI	CTRL/O	G0	—
Shift out	S0	CTRL/N	G1	—
Single shift 2	SS2	ESC N	G2	—
Single shift 3	SS3	ESC O	G3	—
Locking shift 2	LS2	ESC n	G2	—
Locking shift 3	LS3	ESC o	G3	—
Locking shift 1 right	LS1R	ESC	—	G1
Locking shift 2 right	LS2R	ESC]	—	G2
Locking shift 3 right	LS3R	ESC |	—	G3

Once the intermediate pointer is loaded, use the proper escape sequence shown in Table 8-8 to select the character set you need. On the other hand, if you want to work in GR (8-bit) mode, you can load either G1, G2, or G3 as the intermediate pointer. Again, you select the character set of your choice from Table 8-8. The character set escape sequences that assign the character sets to the pointers are shown in Table 8-9.

Table 8-9 ▪ Character Sets

Character Set	G0	G1	G2	G3
ASCII	ESC(B	ESC)B	ESC*B	ESC + B
Britain	ESC(A	ESC)A	ESC*A	ESC + A
Finland	ESC(5	ESC)5	ESC*5	ESC + 5
Finland	ESC(C	ESC)C	ESC*C	ESC + C
France	ESC(R	ESC)R	ESC*R	ESC + R
French Canada	ESC(9	ESC)9	ESC*9	ESC + 9
French Canada	ESC(Q	ESC)Q	ESC*Q	ESC + Q
Germany	ESC(K	ESC)K	ESC*K	ESC + K
Italy	ESC(Y	ESC)Y	ESC*Y	ESC + Y
JIS Roman	ESC(J	ESC)J	ESC*J	ESC + J
JIS Katakana	ESC(I	ESC)I	ESC*I	ESC + I
Norway/Denmark	ESC(6	ESC)6	ESC*6	ESC + 6
Norway/Denmark	ESC(E	ESC)E	ESC*E	ESC + E
Spain	ESC(Z	ESC)Z	ESC*Z	ESC + Z
Sweden	ESC(7	ESC)7	ESC*7	ESC + 7
Sweden	ESC(H	ESC)H	ESC*H	ESC + H
Multinational	ESC(<	ESC)<	ESC*<	ESC + <
VT100 Special Graphics	ESC(0	ESC)0	ESC*0	ESC + 0

▪ *Printing Density Selection (DECDEN)*
This allows you to select either draft-quality or memo-quality printing.

Table 8-10 ▪ Print Density Selection

Escape Sequence	Description
ESC[0"z	Selects normal density printing
ESC[1"z	Selects normal density printing
ESC[2"z	Selects memo (enhanced) density printing

Enhanced printing density and bold printing cannot be performed at the same time. If both are specified, enhanced printing takes precedence. Exceptions to this follow:

- 16.5 char/in—Neither enhanced printing nor bold can be printed.
- 8.25 char/in—Bold printing does print, but enhanced printing does not.
- VT100—Bold printing prints and enhanced printing does not.
- Katakana—Bold printing prints and enhanced printing does not.
- Graphics—Neither enhanced printing nor bold printing print.

- *Bold and Underline Selection*

This allows you to select either bold or underlined printing.

The following sequences select bold or underline as specified by the parameters, P_n. All following printable characters are rendered according to these parameters until the next selection.

Table 8-11 ▪ Bold and Underline Escape Sequences

Name	Mnemonic	Escape Sequence	Description
Select Graphics Rendition	SGR	ESC[P_n;...P_n m	
		When P_n equals 0	Bold printing is turned off, and underline printing is turned off.
		When P_n equals 1	Bold printing is turned on.
		When P_n equals 4	Underline printing is turned on.
		When P_n equals 22	Bold printing is turned off.
		When P_n equals 24	Underline printing is turned off.

Bold printing and underlining cannot be done simultaneously. Enhanced density and bold printing cannot be performed at the same time. If both are specified, enhanced density takes precedence. Exceptions to this are as follows.

- 16.5 char/in—Neither enhanced printing not bold can be printed.
- 8.25 char/in—Bold printing prints and enhanced printing does not.
- VT100—Bold printing prints and enhanced printing does not.
- Katakana—Bold printing prints and enhanced printing does not.
- Graphics—Neither enhanced printing nor bold printing print.

- *Product Identification and Printer Status Request and Report*

  Escape sequences allow the printer to send an answer automatically to a request for device attributes sequence, send an answer to a device status request sequence, and send brief and extended status reports.

  Status reports may be solicited or unsolicited. Unsolicited reports, if enabled, are sent when any reportable status condition changes state. Unsolicited status reports are initially disabled. A brief report indicates whether or not a malfunction was detected. An extended status report can help pinpoint the malfunction as either a hardware failure (printhead position failure), communication failure (parity or framing error or receipt of erroneous character), input buffer overflow, printer deselection, cover open, or paper out.

Table 8-12 ▪ Status Requests and Reports

Name	Mnemonic	Escape Sequence	Description
Device Attribute	DA	ESC[c or ESC0c	This is the sequence sent to the printer.
		ESC[?1 7c	This is the answer sent by the printer that forms the product identification of the printer.
Device Status Request	DSR	ESC[n or ESC[0 n	Either of these sequences sends extended status report.
		ESC[? 1 n	Disables all unsolicited reports.
		ESC[? 2 n	Enables unsolicited brief status report and sends extended status report.
		ESC[? 3 n	Enables unsolicited extended status reports and sends extended status report.

Table 8-12 ▪ Status Requests and Reports (Cont.)

Name	Mnemonic	Escape Sequence	Description
Device Status Report (Brief Report)	DSR	ESC[0 n	Indicates no malfunction was detected.
		ESC[3 n	Indicates that a malfunction was detected.
Device Status Report (Extended Report)	DSR	ESC[0 n followed by ESC[? 2 0 n	Indicates no malfunction was detected.
		ESC[3 n followed by ESC[?P_n;$_n$ n	Indicates that a malfunction was detected.

P_n may be any combination of the following values.

- 21—Hardware failure (The only reportable hardware failure is printhead position failure.)
- 22—Communication failure (event)
- 23—Input buffer failure (event)
- 24—Printer deselected from host
- 26—Cover open
- 27—Paper out

Communication failure may be parity or framing error or receipt of an erroneous character. Failures designated as events are reset upon sending an extended report, and are reportable only when they occur—not when they are reset.

- *Graphics Mode*

In graphics mode, you can select to print individual dot patterns rather than predefined characters from the character sets.

ESC P q enables the printer to enter graphics mode. In this mode, you can specify graphics patterns by sending characters in the range of 077 to 176 (octal) to the LA50 printer. Each of these 64 possible characters specifies a unique pattern formed by the upper six dots of the printhead. The bottom three dots are not used.

The preferred exit from graphics mode to text mode is via the ESC escape sequence or the 220 (octal) control character.

For more details about graphics mode, consult the *LA50 Programmer Reference Manual.*

▪ Maintenance

The LA50 Personal Printer does not need preventive maintenance, but there are a number of tests you can run to be sure your LA50 is operating correctly. To maintain proper operating temperatures, you should keep the printer away from extreme temperatures, such as direct sunlight, room heaters, and air conditioners. Its surfaces and platen can be cleaned with a damp cloth. Do not use cleaners with solvents or excessive water.

Self-test Procedure

To initiate a self-test procedure,

1. Check that the power is off and the cover is on.
2. Push and hold down the FORM FEED button on the front panel and simultaneously turn the power on.
3. Release the FORM FEED button.
4. Check that you get the printout shown in Figure 8-5.
5. After a few lines print out, turn off the power to stop the self-test.
   Note: The self-test prints the U.S. character set only.
6. If the printer passes self-test, you're all set to go. If it doesn't, refer to the next section.

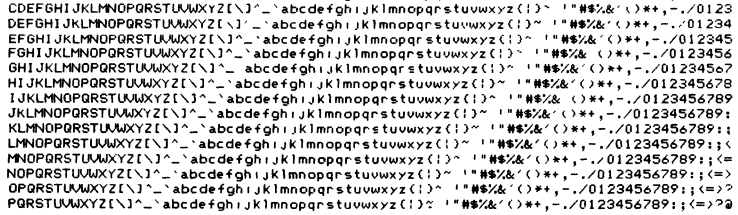


Figure 8-5 ▪ LA50 Self-test Printout

Operator Troubleshooting Checklist

If your printer is not operating, chances are the problem is minor and you can correct it yourself. Listed below are some of the common problems, their probable cause in the first column, and the corrective action that you can take in the second column. **Note:** Always turn off the printer before you attempt to correct a problem.

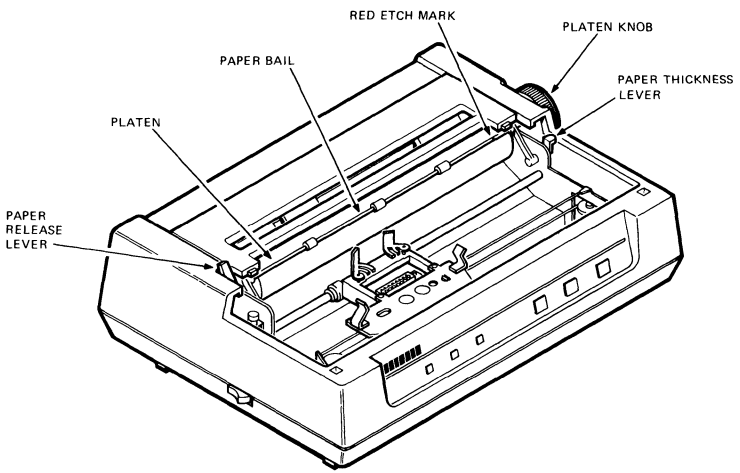


Figure 8-6 ▪ LA50 Printer Controls

Printer does not start when power is turned on.

▪ Power cord not connected, or broken.—Check power cord connections; check power cord for damage.
▪ Power source fault.—Check power cord at receptacle.
▪ Fuse open.—Make sure fuse is in place. Replace fuse if blown.

No printout. Fault light is on. Pressing the Ready button causes the printer to print one line.

▪ Printer out of paper.—Reload paper and press the Ready button.

No printout. Ready light is out and pressing the Ready switch toggles the light, but the printer is still not ready.

- Access cover open.—Close cover and press the Ready button.

Light print.

- Paper thickness lever set incorrectly.—Reset paper thickness lever to a positon closer to the platen.
- Ribbon worn.—Replace ribbon cartridge.

Carriage moves, but there is no printout.

- Paper thickness lever set incorrectly.—Reset paper thickness lever to a position closer to the platen.
- Printhead fault.—Replace the printhead.

Missing dots in print; always in same row.

- Printhead fault.—Replace the printhead.

Paper jams.

- Paper path obstructed.—Clear paper path.
- Paper thickness lever set incorrectly.—Reset paper thickness lever to a position closer to the platen.

Pinfeed paper jams.

- Tractors incorrectly positioned for paper width.—Release and reposition the tractors. Avoid pulling or compressing the paper.

▪ Additional Documentation

The following documents contain more detailed information about the LA50 Personal Printer.

- *Installing and Using the LA50 Personal Printer* (EK-0LA50-UG)—Tells you how to install, use, maintain, troubleshoot, and configure the LA50.

- *LA50 Printer Programmer Reference Manual* (EK-0LA50-RM)—Provides detailed information on the LA50's features: communications, printer configurations, text mode character processing, escape and control sequences, and graphics mode.

Also of interest are

- *PDP-11* and *VAX Systems & Options Catalogs*—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These customer documents are designed to help you select the right Digital product for your needs. European versions of these documents are also available.

If you require information not contained in these documents, contact your local Digital representative.

Specifications

Performance Characteristics

Print speed (maximum)	100 char/s (draft) 50 char/s (memo) 50 char/s (bold)
Print technology	Bidirectional, dot matrix
Print density	7 by 9 (draft) 13 by 9 (memo)
Compressed font character pitch	16.5 char/in; 132 char/line
Double-width compressed font	8.25 char/in; 66 char/line
Elite pitch	12 char/in; 96 char/line
Double-width elite pitch	6 char/in; 48 char/line
Pica pitch	10 char/in; 80 char/line
Double-width pica pitch	5 char/in; 40 char/line
Line spacing	2, 3, 4, 6, 8, or 12 lines/in
Graphics	144 or 180 dots/in, horizontal 72 dots/in, vertical

Line-feed speed	100 ms/line at 6 lines/in
Buffer capacity	2047 characters
Buffer control	XON/XOFF or restraint signal data synchronization

Paper

Type	**Single sheet or sprocket**
Single sheet dimensions	7.6 cm to 22.8 cm (3 to 9 in) wide
Sprocket dimensions	11.4 cm to 25.4 cm (4.5 to 10 in) wide
Sprocket holes	10.2 cm to 24.1 cm (4 to 9.5 in) on center
Thickness	0.028 cm (0.011 in) maximum

Communications

Baud rates	110, 200, 300, 600, 1200, 2400, 4800, switch-selectable
Data interface	Serial RS232-C and RS423 EIA standard
Parity	7-bit, odd, even, mark, or space 8-bit, odd, even, or none

Power Requirements

LA50-RA	120 Vac, 50 or 60 Hz
LA50-RB	220 Vac, 50 or 60 Hz
LA50-RC	240 Vac, 50 or 60 Hz
LA50-RD	100 Vac, 50 or 60 Hz
Power consumption	Less than 180 W

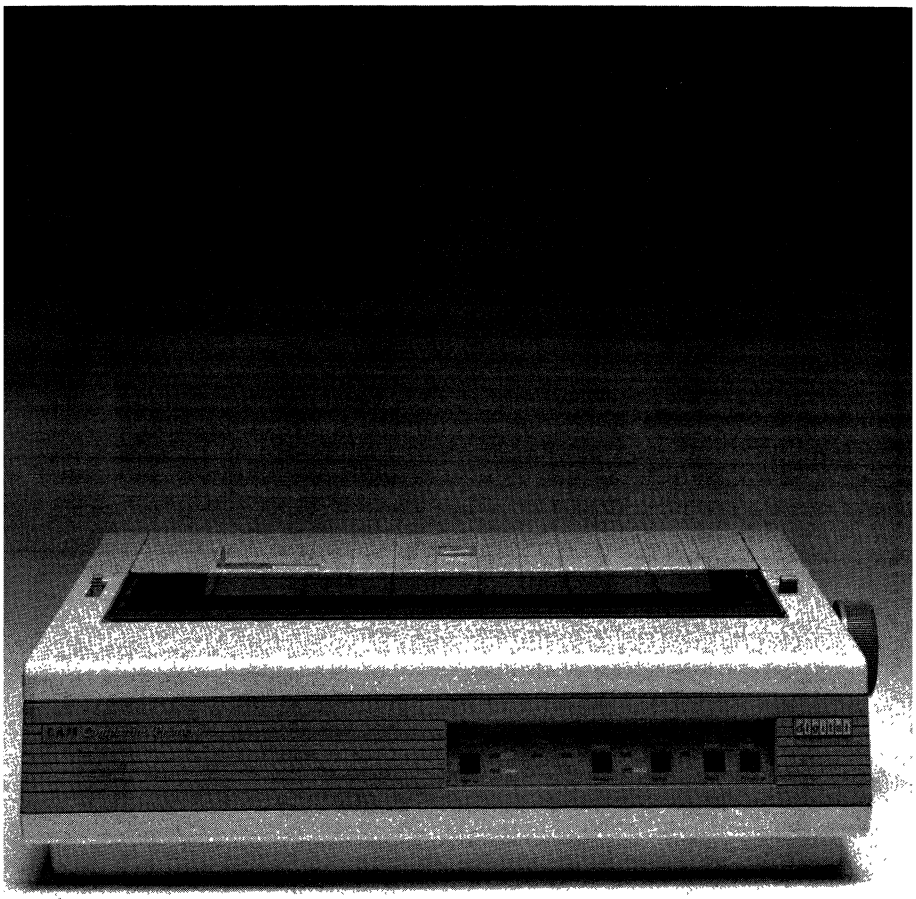
Operating Environment

Temperature	10 to 40°C (50 to 104°F)
Relative humidity	10 to 90%

Physical Characteristics

Width	40 cm (16 in)
Depth	29.5 cm (11.8 in)
Height	14.2 cm (5.6 in)
Weight	8.5 kg (18.7 lb)

Chapter 9 ▪ LA75 Companion Printer



▪ Overview

The LA75 is a versatile and reliable high-speed dot matrix printer that incorporates numerous state-of-the-art printing and user-oriented features. Designed specifically for today's office environments, the LA75 is unusually quiet: at just 55 dBA, the LA75 generates only about half the noise of most impact printers.

The LA75 prints in any one of five modes—draft, memo, near-letter quality, letter quality, and bit-map graphics. The LA75 employs bidirectional printing, resulting in print speeds of up to 250 characters per second. The LA75 has built-in character sets that provide capabilities for personal computing, word processing, business graphics, and other applications.

The LA75 's paper-handling capabilities also represent a significant advance for Digital's low-end, "companion" printer products. With its built-in tractor feed, the LA75 can accept form-fed paper including labels and three-part forms. An integrated tear bar enables users to separate printed from unprinted pages without wasting a single sheet of paper.

Available in both serial and parallel interface models, the LA75 is fully compatible with software written for Digital printers and the IBM Proprinter. It is, therefore, an ideal printing solution for all kinds of Digital computing environments, including those with VAXmates, IBM Personal Computers and PC-compatibles, VT200-family video terminals, and other popular desktop workstations. Easy telephone-style, snap-in, snap-out modular jacks and plugs are used for the host-to-printer communications connection, along with simple adapters.

The LA75 is available in the following models:

LA75-CA—United States (AA)

Canada-French (AC)

Canada-English (AQ)

120 V Spanish (AR)

120 V Portugese (AU)

LA75-CB—Switzerland

French (AK)

German (AL)

Italian (AW)

LA75-CC—Belgium (AB)

Germany (AG)

Austria (AG)

Holland (AH)

France (AP)

LA75-CD—Sweden (AM)

Finland (AF)

Norway (AN)

Spain (AS)

Portugal (AV)

LA75-AD—Denmark (AD)

LA75-AE—England

Ireland

LA75-AI—Italy

LA75-AJ—Japan

LA75-AT—Israel

LA75-AZ—Australia

New Zealand

▪ Major Features

The LA75 printer's main features are

- Compatible with Digital systems, IBM Personal Computers, and PC-compatibles
- Sharp, flexible text printing in letter quality, near letter quality, memo, and draft modes
- Fast printing at speeds up to 250 char/sec
- Versatile paper handling with built-in tractor feed and integrated tear bar
- Built-in DEC Technical, ISO, NRC, DEC Supplemental, and IBM character sets
- Print settings selectable with front panel switches or under software control
- Full bit-map graphics printing
- Ability to intermix text and graphics
- Quieter operation than many laser printers
- Reliable printing with an estimated four years of trouble-free operation
- Compact and lightweight size for minimal desktop intrusion and easy portability
- Uses LA50 accessories and consumables

▪ Printing Features

The LA75 uses a nine-wire, bidirectional, logic-seeking, dot-matrix printhead to print Courier-like characters at speeds from 30 to 250 char/sec. The LA75 can print text in four modes: draft, memo, near letter quality, and letter quality. You can select the near letter quality (NLQ), letter quality (LQ), and default setting using the print quality switch on the front panel or through the setup menu. Any mode can be selected through the setup menu. The mode selected then becomes the default mode.

In both Digital and IBM modes, the LA75 achieves higher print quality and faster print speeds than either the LA50 or IBM's Proprinter. Table 9-1 lists the print speed and print density for each mode.

Table 9-1 ▪ Printing Mode Characteristics

Mode	**Print Speed** (Burst)	**Character Resolution**
Draft	250 char/sec	12 × 9 matrix
Memo	125 char/sec	24 × 9 matrix
Near-letter Quality	42 char/sec	24 × 17 matrix
Letter Quality	32 char/sec	36 × 18 matrix

Graphics Printing

In Digital graphic mode, the LA75 can print bit-map data in accordance with the sixel graphics protocol. Each printable character is printed from 64 possible 1 × 6 dot combinations. The LA75 provides several graphic print densities with the highest at 180 × 144 dots per inch. You can choose different combinations of print densities, aspect ratios, and image scale sizes.

DIGITAL HAS IT NOW ! ! !

****
* *
* INTRODUCING THE *
* **LA75 COMPANION PRINTER** *
* *
****

THE LA75 is a low cost, compact printer setting new standards of quality and performance

- o dot matrix impact technology
- o paper handling, single sheet 3" - 9" wide
- o convenient, versatile paper handling
- o full bit map graphics
- o DEC LA50 and IBM Proprinter compatibility utilizing a serial interface (423)
- o companion printer for VAXMATE, VAX, Video and DEC PC family
- o quiet operation, small desktop footprint
- o auto form parking
- o bold & italics in all print quality modes

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PRINT SPEEDS (maximum)	PRINT DENSITY
DRAFT quality mode 250 cps	DRAFT (12X9)
MEMO quality mode 125 cps	**MEMO (24x9)**
NEAR LETTER quality mode 42 cps	NEAR LETTER (24x17)
LETTER QUALITY mode 32 cps	**LETTER QUALITY (36x18)**

GRAPHICS MATRIX (180H X 144)

PAPER HANDLING bottom & rear feed, sheet feeder, forms tractor, pin feed friction feed, auto form parking, optional cut sheet feeder, envelopes & single sheet paper

PRINT MODES	LA75 COMPANION PRINTER
double width	DIGITAL EQUIPMENT CORPORATION'S LA75
italics	*DIGITAL EQUIPMENT CORPORATION'S LA75*
bold	**DIGITAL EQUIPMENT CORPORATION'S LA75**
underlining	DIGITAL EQUIPMENT CORPORATION'S LA75
DOUBLE underlining	DIGITAL EQUIPMENT CORPORATION'S LA75
Compressed characters	DIGITAL EQUIPMENT CORPORATION'S LA75

superscript AS WELL AS subscript

IBM is a trademark of International Business Machine Corporation
Proprinter is a trademark of International Business Machine Corporation

Figure 9-1 ▪ LA75 Print Samples

IBM Emulation Mode

You can set the LA75 to operate in the IBM emulation mode using the front panel protocol switch or the setup menu. The OTHER indicator on the front panel lights up if the printer is in IBM emulation mode.

In IBM emulation mode, the LA75 can run either as a text printer or a graphics printer.

In IBM text mode, the printer operates as a buffered line printer (as opposed to a character printer). Received characters are stored in a buffer until the printer receives a line terminator character. Then the entire contents of the buffer are printed.

Most of the characters in IBM emulation mode are printed in a 9 × 9 dot matrix (draft font). When you select high-resolution printing, the printer can use either near-letter quality (17 × 17) or letter quality (27 × 18) dot matrix in the same size character cell.

In IBM graphics mode, the LA75 prints at resolutions up to 240 × 72 dots per inch. Graphic escape sequences specify the number of graphic data bytes to follow. When the printer receives the specified number, it prints the graphic data, unless a timeout in data transmission has occurred.

▪ Character Sets

The LA75's built-in character sets provide the maximum flexibility for printing business (national and international) documents, scientific documents and graphic material. In addition to the six resident character sets and the three additional character sets used in IBM mode, the LA75 has memory space allocated to store up to 96 user-defined, downline-loaded draft characters that can be used as an active character set. Once the font is loaded, the printer processes the user-defined characters in the same way as all the other character sets.

The LA75 character sets include

- U.S. ASCII
- National Replacement (NRC)
- ISO 8-bit supplemental
- DEC Supplemental
- DEC Technical
- VT100 Special Graphic (line drawing)

In IBM emulation mode, the LA75 uses the following character sets:

- Line Drawing
- Chart Drawing
- Symbol Drawing

The LA75 can print both double-width and compressed characters. The horizontal pitch of the double-width characters can be 5, 6, 8.25, or 8.55 characters per inch. The compressed fonts with 132 characters per line are perfect for printing spreadsheets. To highlight or emphasize certain characters, the LA75 can also do underlining, double underlining (DEC only), bolding, shadow bolding, italics, overscoring, and superscripts and subscripts.

▪ Paper

The LA75 companion printer's paper handling capabilities are quite advanced over other low-end printer products. It has a built-in tractor feed that can accept form-fed paper and labels. A built-in low-tear bar allows users to separate printed from unprinted pages without wasting a single sheet of paper.

The LA75 allows single sheets of cutsheet paper to be inserted into the unit and printed without removing the tractors or continuous forms paper. Users can insert envelopes into the LA75 for printing in the same fashion. A unique, pivoting "push/pull" tractor design allows the LA100 or LA210 style of bottom feeding the paper through a slot in the printer's underside, as well as conventional paper feeding around the platen. You can also use the LA75's optional single-bin feeder, which accepts up to 100 sheets of cutsheet paper.

The LA75 printer can accept paper from 4.25 inches to 10 inches wide (including perforations) and .002 to .012 inches thick.

▪ Accessories and Supplies

The LA75 uses the same accessories and supplies as the LA50 Personal Printer.

Part Number	Description
H9850-HN	Dust cover
LA50X-FB	Acoustic cover for noise reduction, 120 V fan
LA50X-FF	Wire basket paper catcher, accepts any 21.6 cm × 27.9 cm (8.5 in × 11 in) sheet paper.
LAX12-SL	Printer stand—charcoal-colored base with light oak laminated top; 61 cm wide × 53 cm deep × 66.1 cm high (24 in × 21 in × 26 in)
PCXXF-CJ	Printer stand—gray, high-pressured laminated top with light oak trim, charcoal-colored base, laminated top; 61 cm wide × 53.3 cm deep × 66.1 cm high (24 in × 21 in × 26 in)
PCXXF-CF	Small lightweight stand that sits on desk and has 7.6–12.7 cm (3-5 in) opening for paper storage
LA50R-06	Box of six ribbons

▪ Operator Features

Whether operating in Digital or industry-standard compatibility mode, the LA75 can be controlled by front panel switches, or through software written to drive Digital's LA50, LA100, and LA210 printers, and the IBM Proprinter. Unlike almost every other personal printer, the LA75 lets you change print settings and printer characteristics through well-labeled buttons rather than through inaccessible DIP switches. At the push of one button you can print out the current settings, and front panel LED indicators display the broad range of settings offered by the LA75.

Controls and Operating Modes

At powerup, the LA75 can be placed in one of two operating modes—Print or Setup. Each switch on the LA75 control panel has two functions, one for each of these operating modes.

In Print mode, the control panel switches perform the functions that appear in white letters above the switch. In Setup mode, the control switches perform the functions that appear in dark gray letters below the switches. The two indicators for Power and Fault operate in all modes. Figure 9-2 shows the front control panel of the printer.

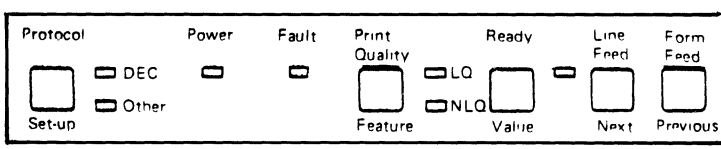


Figure 9-2 ▪ LA75 Control Panel

▪ *POWER Indicator*
The green POWER light is turned on when the printer is powered up.

▪ *FAULT Indicator*
The red FAULT indicator lights and stays on when the paper supply is out or the printhead position error is detected. The FAULT indicator blinks continuously when a hardware error is detected during the self-test.

▪ *PROTOCOL Switch*
The PROTOCOL switch allows you to interface the LA75 to a different host computer. To change between DEC and OTHER (IBM Proprinter) protocols, press the switch once and watch the corresponding indicator light.

- *PRINT QUALITY Switch*

  The PRINT QUALITY switch gives you two choices of print: LQ stands for Letter Quality (32 char/sec); and NLQ stands for Near Letter Quality (42 char/sec). There are two LED indicators (LQ and NLQ) that light up the print quality you have selected.

  NOTE: At powerup, both LEDS are off, and the print quality is controlled by the printer's setup memory menu and software. The LA75 has two other print qualities—memo (125 char/sec) and draft (250 char/sec) that can be selected through the setup menu and software.

- *READY Indicator*

  The READY indicates whether the printer is online or offline. When the ready is lit, the computer is online and will print incoming data from the host computer. When the indicator is off, the printer is offline and cannot receive data.

  If you push the READY button when the printer is printing, the printer completes only the line it is currently printing and then stops.

  If the printer runs out of paper, the FAULT light comes on. You can press the READY switch to print one line at a time. If the access cover is open, the printer is offline. After you close the cover, press the READY switch to put the printer online.

- *LINE FEED Switch*

  The LINE FEED switch advances the paper in the printer one line at a time. Holding the switch down will advance the paper a number of lines.

- *FORM FEED Switch*

  FORM FEED advances the paper in the printer one form length at a time. Holding the switch down will advance the paper a number of form lengths.

  Important: The READY switch remains active while the printer is printing. The LINE FEED, FORM FEED, PROTOCOL, and PRINT QUALITY switches are active only when there is no error condition and the printer is offline or printing is completed and there is no data in the input buffer.

Setup Mode Controls and Operation

In the LA75 setup mode, you can enter the setup menu to change the operating features of the printer. The setup menu gives you access to the LA75 printer's memory. The memory stores the list of all the printer's features and values that either you or the factory have selected to run the printer. To enter this mode, proceed as follows.

1. Press and hold the SETUP switch while you set the power switch to 1 (on).
2. The green POWER LED lights up. The LED next to OTHER on the PROTOCOL switch starts flashing and continues to flash throughout the setup procedure.
3. The printer will automatically
   — Print a list of the features and values stored in the printer.
   — Advance the paper five lines.
   — Enter the Feature Select state (the LED next to NLQ is flashing).
   — Print out the first feature in the list (Baud Rate), and its value.
   — Advance the paper five lines.

Once the printer is in the Feature Select state, you have two choices. If you want to keep the value for the first feature listed, and review the next feature, press NEXT. If you want to change the value for the first, or any other feature listed, you must enter the Value Select state, and proceed as follows.

1. Press the VALUE switch.
   NOTE: The LED on the VALUE switch will begin to flash; the LED on the feature switch will stop flashing.
2. Press NEXT or PREVIOUS to step through the value options for a feature.
3. Stop at the value you want to select. It will be saved and made active when you leave the setup menu.

Now you can return to the Feature Select state by pressing the FEATURE switch that lists the next feature and its value. You can save all the new setup values by pressing the SETUP switch once. The changes are now stored in the printer's setup menu. The printer then automatically returns to Print mode and moves to the next page. Table 9-3 shows the LA75 Setup menu and the factory setting value for each feature.

Table 9-3 ▪ LA75 Features and Values and Factory Settings

Feature Number	Feature	Value Number	Value
1	Baud Rate	1	110
		2	200
		3	300
		4	600
		5	1200
		6	2400
		7	4800 (Factory)
		8	9600
2	Data Bits and Parity	1	7-Even
		2	7-Odd
		3	7-Space
		4	7-Mark
		5	8-Even
		6	8-Odd
		7	8-None (Factory)
3	Protocol	1	DEC (Factory)
		2	Other
4	Form Length	1	12 inches
		2	11 inches (Factory)
5	Character Set (DEC)	1	U.S. ASCII (Factory)
		2	Great Britain
		3	DEC Finland
		4	France
		5	DEC French Canada
		6	Germany
		7	Italy
		8	JIS Roman
		9	DEC Norway/Denmark
		10	Spain
		11	DEC Sweden
		12	Norway/Denmark
		13	DEC Dutch
		14	DEC Swiss
		15	Portugal
6	Supplemental Character Set (DEC)	1	DEC Supplemental (Factory)
		2	ISO Supplemental
		3	DEC Technical
		4	Katakana
7	Print Density (DEC)	1	Draft (Factory)
		2	LQ

Table 9-3 ▪ LA75 Features and Values and Factory Settings (Cont.)

Feature Number	Feature	Value Number	Value
8	Printer ID (DEC)	1 2 3	LA50 ID (Factory) LA210 ID Conformance Level 2
9	Text Mode Right Margin (DEC)	1 2	Truncate (Factory) Wrap
10	Auto LF on CR (DEC)	1 2	Auto LF on CR No Auto LF (Factory)
11	Auto CR on LF (DEC)	1 2	Auto LF on CR No Auto CR
12	CAN Control Code (DEC)	1 2	Cancel Control Functions (Factory) Kill Input Buffer
13	80 or 132 Columns (DEC)	1 2	80 (Factory) 132
14	Paper Out Bell (IBM Emulation)	1 2	Off On (Factory)
15	Slashed Zero (IBM Emulation)	1 2	Zero with slash Zero without slash (Factory)
16	Auto LF on CR (IBM Emulation)	1 2	Auto LF on CR No auto LF (Factory)
17	Active Charcter Set (IBM Emulation)	1 2	Graphics Set A (Factory) Graphics Set B
18	Auto CR on LF (IBM Emulation)	1 2	Auto CR on LF No auto CR (Factory)
19	Powerup Print Quality (IBM Emulation)	1 2	Draft (Factory) LQ
20	NLQ/LQ Select (IBM Emulation)	1 2	NLQ (Factory) LQ

DEC Conformance Levels

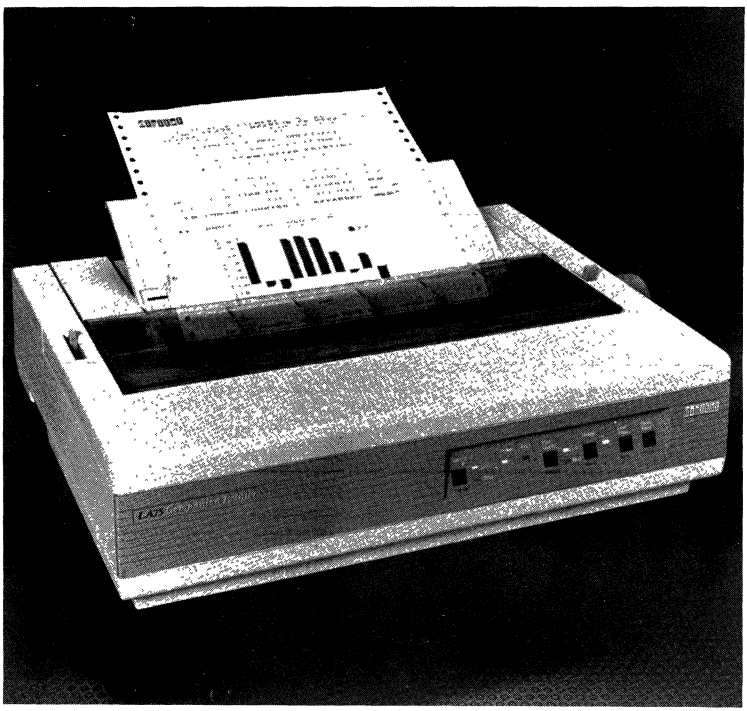
The LA75 can be set to one of two conformance levels that provide basic or enhanced operating and printing capabilities, interface features, and compatibility with appropriate software. Conformance level is a fixed group of functions common to a class of devices that satisfy certain hardware/software compatibility requirements.

The LA75 can operate as a Level 1 or Level 2 device.

Level 1 provides basic printing and interface functions that are always active in the LA75, are LA50-compatible, and can be activated by selecting the LA50 Printer ID in the setup menu.

Level 2 adds the expanded printing functions that can be activated by selecting the Level 2 or LA210 Printer ID in the setup menu. The Level 2 device always has the Level 1 functions active plus a subset of additional functions.

You can select the conformance level with the Printer ID switch in the setup menu, and/or by using the DECSCL control sequence. Refer to the *LA75 Companion Printer Programmer Reference Manual* for more detailed information.



▪ Programmming Information

The LA75 uses escape and control sequences standardized by the American National Standards Institute (ANSI) to control many of its functions. Other LA75 functions have escape sequences defined within the parameters of the ANSI standard. These escape sequences allow expansion of control functions beyond the current limit of 32 control characters.

The following tables summarize the escape sequences used with the LA75 printer. Complete information on escape sequences and their functions can be found in the *LA75 Companion Printer Programmer Reference Manual.*

Table 9-4 ▪ Control Function Equivalents

8-bit Control Character	7-bit Escape Sequence
PLD (8/11)	ESC K (1/11 4/11)
PLU (8/12)	ESC L (1/11 4/12)
SS2 (8/14)	ESC N (1/11 4/14)
SS3 (8/15)	ESC O (1/11 4/15)
DCS (9/0)	ESC P (1/11 5/0)
CSI (9/11)	ESC [(1/11 5/11)
ST (9/12)	ESC \ (1/11 5/12)
OSC (9/13)	ESC] (1/11 5/13)
PM (9/14)	ESC ^ (1/11 5/14)
APC (9/15)	ESC _ (1/11 5/15)
Level 2 Only	
IND (8/4)	ESC D (1/11 4/4)
NEL (8/5)	ESC E (1/11 4/5)
HTS (8/8)	ESC H (1/11 4/8)
VTS (8/10)	ESC J (1/11 4/10)

Character Set Selection

You can select any of 21 character sets in the printer in both 7-bit and 8-bit environments. In a 7-bit environment, only the GL active character set is available. In an 8-bit environment, the printer uses the GL active character set if a character's eighth bit is 0, and the GR active character set if the character's eighth bit is 1.

The Select Character Set (SCS) escape sequences are used to assign any of the LA75 character sets to the G0, G1, G2, and G3 character set designators.

These designators define the contents of the GL and GR printable sets and may be controlled with the single and locking shift command. The following table lists the character sets and SCS sequences.

G0	G1	G2	G3	Character Set
ESC (B	ESC) B	ESC * B	ESC + B	U.S. ASCII
ESC (A	ESC) A	ESC * A	ESC + A	ISO Great Britain
ESC (5	ESC) 5	ESC * 5	ESC + 5	DEC Finland
ESC (R	ESC) R	ESC * R	ESC + R	ISO France
ESC (9	ESC) 9	ESC * 9	ESC + 9	DEC French Canada
ESC (K	ESC) K	ESC * K	ESC + K	ISO Germany
ESC (Y	ESC) Y	ESC * Y	ESC + Y	ISO Italy
ESC (J	ESC) J	ESC * J	ESC + J	JIS Roman
ESC (I	ESC) I	ESC * I	ESC + I	JIS Katakana
ESC (6	ESC) 6	ESC * 6	ESC + 6	DEC Norway/Denmark
ESC (Z	ESC) Z	ESC * Z	ESC + Z	ISO Spain
ESC (7	ESC) 7	ESC * 7	ESC + 7	DEC Sweden
ESC (<	ESC) <	ESC * <	ESC + <	User-preference Supplemental
ESC (0	ESC) 0	ESC * 0	ESC + 0	DEC VT100 Special Graphics
ESC (>	ESC) >	ESC * >	ESC + >	DEC Technical
ESC (\	ESC) \	ESC * \	ESC + \	ISO Norway/Denmark
ESC (4	ESC) 4	ESC * 4	ESC + 4	DEC Holland
ESC (=	ESC) =	ESC * =	ESC + =	DEC Switzerland
ESC (% 6	ESC) % 6	ESC * % 6	ESC + % 6	DEC Portugal
N/A	ESC-0	ESC . 0	ESC / 0	ISO Supplemental
ESC (% 5	ESC) % 5	ESC * % 5	ESC + % 5	DEC Supplemental

▪ Escape Sequences for IBM Emulation

IBM Emulation mode escape sequences are grouped by function as follows:

Terminal management

Vertical form handling

Horizontal form handling

Paper fault handling

Unidirectional/bidirectional control

Alternate character set mapping

Printing modes

Graphics mode

Table 9-5 lists the escape sequences and their functions.

Table 9-5 ▪ IBM Emulation Sequences and Functions

Sequence	Name	Function
ESC c1/11 6/3	Reset to Initial State (RIS)	Resets the printer to its initial (power-on) settings in DEC mode.
ESC [! p 1/11 5/11 2/1 7/0	Soft Terminal Reset (STR)	Resets the printer to its intial (power-on settings in DEC mode.
ESC @ 1/11 4/0	IBM Terminal Reset	Resets the IBM emulation mode to its initial state without returning to DEC mode.
ESC Q 3 1/11 5/1 3/3	Deselect Printer	Prints the contents of the print buffer, then deselects the printer.
ESC 0 1/11 3/0	Set Vertical Pitch (ER8LI)	Sets vertical pitch to 8 lines per inch.
ESC 1 1/11 3/1	Set Vertical Pitch (ER10LI)	Sets vertical pitch to 10.3 lines per inch
ESC 2 1/11 3/2	Set Vertical Pitch (ERNLI2)	Sets vertical pitch to the setting specified in a previous ESC A sequence. If none was set, sets pitch at 6 lines per inch.
ESC A Pn 1/11 4/1 ***	Set Vertical Pitch (ERNLI1)	Sets vertical pitch to 72/Pn lines per inch. maximum Pn = 255. (Doesn't take effect until ESC 2 is sent.)
ESC 3 Pn 1/11 3/3 ***	Set Vertical Pitch (ERNLI3)	Sets vertical pitch to 216/Pn lines per inch.
ESC J Pn 1/11 4/10 ****	Set Vertical Pitch (ERNLI4)	Performs one line feed at a vertical pitch of 216/Pn lines per inch. Performs a carriage return if menu selection 18 is set.

Sequence	Name	Function
ESC C Pn 1/11 4/3 ***	Set Form Length (ERSFL)	Sets form length to lines in the current vertical pitch. Sets top-of-form and clears bottom margin. Max Pn = 151 X current vertical pitch.
ESC C NUL Pn 1/11 4/3 0/0 ****	Set Form Length (ERSFLI)	Sets form length to Pn inches, sets top-of-form, and clears bottom margin. Max Pn = 151.
ESC N Pn 1/11 4/14 ***	Set Bottom Margin (ERSBM)	Sets bottom margin in inches to Pn lines up from the current form length using the current vertical pitch.
ESC 0 1/11 4/15	Clear Bottom Margin (ERCBM)	Clears bottom margin.
ESC B Pn1 Pn2 Pn NUL 1/11 4/2 *** *** *** 0/0	Sets Vertical Tabs	Sets vertical tab stops at Pn1, Pn2, and other designated stops; Pn is a character representing the line number of the desired tab stop. A maximum of 64 tab positions can be specified. (Parameters must be in ascending order.)
ESC 4 1/11 3/4	Set Top of Form	Set the current paper position as top of form.
ESC 5 Ps 1/11 3/5 ***	Enable/Disable Automatic Linefeed	If Ps = 1 (0/1), this sequence causes a linefeed to occur whenever the printer receives a carriage return.

Sequence	Name	Function
ESC W Ps 1/11 5/7 ***	Enable/Disable Set Double-Width Characters (EREDW)	If Ps = 1 (0/1), this sequence sets double-width characters for current and following lines.
ESC W Ps 1/11 5/7 ***	Enable/Disable Set Single-Width Characters (ERDDW)	If Ps = 0 (0/0), this sequence sets single-width characters for current and following lines.
ESC < 1/11 3/12	Carriage Return (PCR1)	Provides a carriage return without performing a linefeed. (unless Auto-LF is enabled by setup feature #16 or ESC 5.)
ESC D Pn1 Pn2 Pn NUL 1/11 4/4 *** *** *** 0/0	Set Horizontal Tabs (ERSHT)	Clears all horizontal tab stops and sets horizontal tab stops at Pn1, Pn2 and other designated stops. A maximum of 28 tab positions can be specified and they must be in ascending order.
ESC R 1/11 5/2	Set All Horizontal Tabs	Sets horizontal tab stops every eight columns beginning with column 9. Resets default horizontal/vertical tab stops.
ESC : 1/11 3/10	Sets Horizontal Spacing to 12 char/in	Sets the printer to 12 char/in if single width, or set to 6 char/in if double width
ESC 8 1/11 3/8	Disable Paper Out (ERDPO)	Disables paper-out handling.
ESC 9 1/11 3/9	Enable Paper Out (EREPO)	Enables paper-out handling. (The printer stops if it is out of paper.)

Name	Sequence	Function
ESC U Ps 1/11 5/6 ***	Enable/Disable Unidirectional Printing (ERDUD)	If Ps = 0 (NUL), bidirectional mode (to print text only) is enabled. If Ps = 1 (0/1), unidirectional left-to-right mode is enabled. (Bit-image graphics always use unidirectional printing.)
ESC 6 1/11 3/6	Select Set B (ERCO2)	Selects the character set B.
ESC 7 1/11 3/7	Selects Set A (ERCO1)	Selects character set A.
ESC \ Pn1 Pn2 1/11 5/12 *** ***	Select All Characters Set	Selects the All Characters set as the active character set. Prints the number of characters specified by Pn1 and Pn2. Max Pn1 = 255, Max Pn2 = 255.
ESC ^ 1/11 5/14	Print Single Character from All Character Set	Allows the next character to be accessed and printed from the All Characters set.
ESC E 1/11 4/5	Enable Shadow Bold (EREBD)	Sets shadow bold printing for all following characters.
ESC F 1/11 4/6	Disable Shadow Bold (ERDBD)	Turns off shadow bold printing for all following characters
ESC G 1/11 4/7	Set Letter Quality/NLQ Printing (EREHR)	Enters LQ or NLQ mode depending on menu feature setting # 20.
ESC H 1/11 4/8	Set Draft (ERDHR)	Enters draft mode.

Name	Sequence	Function
ESC I Ps 1/11 4/9 ***	Select Print Quality	Selects the print quality where the Ps parameter determines the required print quality. Ps = 0 Selects draft Ps = 2 Selects LQ/NLQ Ps = 4 Selects draft Uses downline-loaded set Ps = 6 Selects NLQ Uses downline-loaded set
ESC-Ps 1/11 2/13 ***	Enable/Disable Set/Reset Underline (EREUL)	If Ps = 1 (0/1), it underlines all characters that follow this sequence. If Ps = 0 (0/0), it turns off underlining.
ESC—Ps 1/11 5/15 ***	Enable/Disable Set/Reset Overscore	If Ps = 1 (0/1), it overscores all characters that follow this sequence. If Ps = 0 (0/0), it turns off overscore.
ESC S Ps 1/11 5/3 ***	Enable/Disable Superscript/Subscript (ERESCR)	If Ps = 0 (0/0), all following characters are printed in superscript mode. If Ps = 1 (0/1), all following characters are printed in subscript mode.
ESC T 1/11 5/4	Reset Script (ERDSCR)	Cancels superscript and subscript printing.

Graphics Mode

You can select the graphics mode with the escape sequences described below. After executing the escape sequence, the printer returns to text mode.

- *Escape K (480-bit image graphics mode)*
  This sequence changes printing from the text mode to the bit-image graphics mode at 60 dots-per-inch resolution. The sequence is as follows:

  ESC K Pn1 Pn2 v1 v2 ... vk

  1/11 4/2 *** *** *** *** ***

  Pn1 and Pn2 are data bytes that specify the number of bit-image data bytes to be transferred.

- *Escape L (960 Bit-image Graphics Mode)*
  This sequence changes printing from text mode to the bit-image graphics mode at a 120 dpi resolution. Data input is the same as for the ESC K command. The sequence is as follows:

  ESC L Pn1 Pn2 v1 v2 ... vk

  1/11 4/3 *** *** *** *** ***

- *Escape Y (960 Bit-image Graphics Mode—Normal Speed)*
  This sequence allows printing at the same speed as the 480 bit-image graphics mode. The sequence is as follows:

  ESC Y Pn1 Pn2 v1 v2 ... vk

  1/11 5/9 *** *** *** *** ***

- *Escape Z (1920 Bit-image Graphics Mode)*
  This sequence changes printing from the text mode to bit-image graphics mode at 240 dpi resolution. Data input is the same as for the ESC K command. The sequence is as follows:

  ESC Z Pn1 Pn2 v1 v2 ... vk

  1/11 5/10 *** *** *** *** ***

  The printing is at half the speed of the 480 bit-image graphics mode.

- *Download Character Image to Memory*
  You can use this sequence to initiate character downloading. The sequence is self-terminating; it exits after a specified number of characters have been received. You can define a maximum of 94 download characters. The download sequence setup is as follows:

  ESC = Pn1 Pn2 DC4 Pn3

  1/11 3/13 *** *** 1/4 ***

Pn1 represents the bytes to be downloaded, and Pn3 is the character address for the first downloaded character. The following sequence must then be sent for each character to be downloaded.

Pn4 NUL V1 V2 ...V11

Pn4 is the asending or descending character and V1 through V11 are the 11 bytes of bitmap font data that describe the character to be imaged.

▪ Maintenance

The LA75's high reliability offers an estimated four years of trouble-free operation with normal use and very low maintenance costs. The LA75 does not require preventive maintenance, but there are a number of tests you can run to be sure your LA75 is operating correctly. The LA75 printer has self-tests that check internal logic, printhead/carriage operation, and I/O interface. If the selected test fails, the FAULT indicator on the front panel starts blinking.

Powerup Self-Test
This self-test checks out the internal logic at powerup.

Printing Self-Test
You can start this test by pressing the FORM FEED switch while turning power on. The printer should print 94 ASCII printable characters continuously in a 80-character wide swirl pattern. To stop the test, turn the printer off.

Loopback Self-Test
This test checks the I/O ports and internal logic of the printer. Detach the MMJ connector and use the available loopback connector. You can start this test by holding down the LINE FEED switch while turining on the power. The printer should print a continuous swirl pattern. To stop the test, turn the printer off.

Operator Troubleshooting Checklist
If your printer is not operating, chances are the problem is minor and you can correct it yourself. Listed below are some of the common problems, their probable causes, and the corrective actions that you can take.

NOTE

Always turn off the printer before you attempt to correct a problem.

The printer does not start when power switch is turned on. None of the indicators light.

- No power at receptacle. Check power at receptacle.
- Powercord is not plugged in or is broken. Check powercord connections. Check powercord for damage.
- The ac line fuse is blown. Check for short circuits. Then replace the fuse. If the fuse blows again, replace the power supply. If the problem persists, check the remainder of the electrical components and replace as necessary.
- Fuse F1 on the logic board is blown or the logic board is defective. Check fuse F1 and replace if blown. If fuse continues to blow, replace the logic board.
- Control panel connector is disconnected or the control panel is defective. Check for loose connections. If connections are secure, replace control panel.

The printer does not start, the POWER indicator is on, and the READY indicator is off. Pressing the switch does not turn on the READY indicator.

- The access cover is open. Close the access cover and press the READY switch.
- Fuse F2 on logic board is blown or logic board is defective. Check fuse F2 on the logic board and replace it if blown. If fuse continues to blow, replace the logic board.

The printer stops printing and the FAULT indicator lights. Pressing the READY switch causes the printer to print one line.

- The printer is out of paper. Reload the printer with paper and press the READY switch.

The printer does not start and the FAULT indicator is on.

- The printer is out of paper or the paper-out sensor is defective. Load paper into printer and press the READY button. If the problem persists, replace the printer mechanism.

The printer continues to print when it is out of paper.

- The logic board is defective. Replace the board.
- The paper-out sensor is defective. Replace the printer mechanism.

During a print test, the carriage moves but the printer does not print.

- The printhead cable is disconnected. Check the cable connections and reconnect cable is necessary.
- The printhead is defective. Replace the printhead.
- Logic board is defective. Replace the board.
- Printhead cable is defective. Replace the printer mechanism.

The same dot or dots are missing on every line. This appears as a white streak through each print line.

- The printhead is defective. Replace the printhead.
- The printhead cable is defective. Replace the printer mechanism.
- The logic board is defective. Replace the board.

The carriage moves but the printer does not print.

- The ribbon is installed incorrectly. Install the ribbon correctly making sure the ribbon is inside the smudge guard.
- The printhead is defective. Replace the printhead.
- The logic board is defective. Replace the logic board.

The printed characters are light or are of poor quality.

- Paper is not to specification. Replace paper with correct paper.
- The printhead is too far away from the paper. Adjust the paper thickness lever for single or multipart paper, whichever is appropriate.
- Ribbon cartridge not mounted properly or defective. Reseat or replace the ribbon cartridge.
- Smudge guard needs adjustment or is defective. Check the adjustment of the smudge guard and adjust if necessary. Replace defective guards.
- Printhead is defective. Replace the printhead.

The automatic paperfeed function is defective.

- The logic board is defective. Replace the logic board.
- The control panel is defective. Replace the control panel.

The reverse paperfeed function is defective.

- The autoreverse switch is defective. Replace the sensor assembly.

The printer does not respond to the sheetfeeder.

- The sheetfeeder sensor is defective. Replace the sensor.

The carriage does not move smoothly.

- There is a paper jam. Clear the paper path.
- The printer mechanism is defective. Replace the printer mechanism.
- The carriage motor is defective. Replace the carriage motor.

The carriage does not move and the FAULT indicator is blinking.

- The paper path is obstructed. Clear the paper path.
- The logic board is defective. Replace the logic board.
- The carriage motor is defective. Replace the carriage motor.

The carriage does not move and only the POWER indicator is on.

- Fuse F2 is blown. Replace fuse. If fuse continues to fail, check the logic board.
- Logic board is defective. Replace the logic board.
- The carriage motor is defective. Replace the carriage motor.

When power is turned on, the carriage stays to the right, does not return to the home (left) position, and the FAULT indicator is blinking.

- The logic board or printer mechanism is defective. Replace the logic board. If the problem persists, replace the printer mechanism.

When power is turned on, the carriage stays in the home position and the FAULT indicator is blinking.

- The logic board or printer mechanism is defective. Replace the logic board. If the problem persists, replace the printer mechanism.

A character or characters print unevenly or are not uniform in pitch.

- The platen is defective. Replace the platen.
- The printhead is not touching the platen evenly. Replace the printer mechanism.

The printed lines overlap.

- The paper path is obstructed. Clear the paper path.
- The paper release lever is not in the proper position. Set the lever to the proper position.
- The tractor assembly is defective. Replace the tractor assembly.
- The linefeed motor is defective. Replace the linefeed motor.
- The logic board is defective. Replace the logic board.

The printed characters are on a slant, the paper tears, the paper jams, or the paper does not move.

- The paper release lever is not in the proper position. Set the lever to the proper position.
- If a tractor feed is in use, the paper is not properly positioned on the tractors. Adjust the paper on the tractors. Avoid pulling or compressing the paper.
- The tractor assembly is not securely mounted on the printer. Install the tractor assembly ensuring it is securely mounted.
- The tractor assembly is defective. Replace the tractor assembly.

The printer does not respond to computer commands, and the READY indicator is on.

- The interface cable is disconnected. Check connections.
- The length of the cable exceeds 50 feet. Replace cable with a cable of proper length.
- The cable is defective. Use the loopback test to verify printer interface. If necessary, replace the printer interface cable.

The printer prints an error report and/or characters. The READY indicator is on.

- There is a mismatch in the communication link (baud rates, parity, etc.). Check all connections and check the menu settings.
- The logic board is defective. Replace the logic board.

▪ Additional Documentation

The following documents contain more detailed information about the LA75 Printer.

- *Installing and Using the LA75 Companion Printer.* (EK-0LA75-UG)
  Tells you how to install, use, maintain, troubleshoot, and configure the LA75.
- *LA75 Companion Printer Programmer Reference Manual.* (EK-0LA75-RM)
  Provides detailed information on the LA75's features: communications, text and graphics mode, IBM emulation mode, printer configurations, and escape and control sequences.

▪ Specifications

Performance Characteristics

Printing speed (burst)	250 char/sec (draft mode)125 char/sec (memo mode) 42 char/sec (near letter quality mode) 32 char/sec (letter quality mode)

Print Characteristics

Print density (horizontal × vertical dots)	
Draft mode	12 × 9 matrix
Memo mode	24 × 9 matrix
Near-letter quality mode	24 × 17 matrix
Letter quality mode	36 × 18 matrix
Bit-map graphics mode	180 × 144 (dots per inch)
Characters per inch (horizontal pitch)	10, 12, 16.5, 17.1 (standard-width characters)5, 6, 8.25, 8.55 (double-width characters)
Character sets	U.S. ASCII IBM Proprinter: Character Set A Character Set B All Character Set National Replacement (NRC) ISO 8-bit Supplemental DEC Supplemental DEC Technical VT100 Special Graphic (Line Drawing)
Character attributes	True descenders (j, y, p, g, q)Italics Superscript Bold Shadow Bold Underline Double Underline Overscore/Strikethrough Double-width
Lines per inch (vertical pitch)	2, 3, 4, 6, 8, 12
Paper requirements	4.25 inches to 10 inches wide, .002 to 0.012 inches thickFanfold or cutsheet, including envelopes and multipart forms

Communications

Baud rates	110 to 9600 bits per second
Character code	Seven- or eight-bit ASCII with odd, even, mark, space, or no parity
Connector Interface	6-pin modular MMJ connector EIA standard RS423 interface For hosts with an RS232 serial 25-pin male connector, use the H8571-A adapter. For any other host with an RS232 serial 9-pin male connector, use the H8571-B connector. For IBM Personal Computers, PC-compatibles, and other hosts supporting parallel communications, select the LA75 models that feature an EIA standard RS232C Centronics-type parallel interface.
Buffer Capacity	2,000 characters
Buffer control	XON/XOFF software protocol, READY/OFF-LINE front-panel switch

Power Requirements

Power cord	2.0 meters (6.7 feet) long, detachable
Voltage/Frequency	LA75-A2—(120 V, 50/60 Hz)LA75-A3—(240 V, 50/60 Hz) LA75-A4—(220 V, 50/60 Hz) LA75-A5—(100 V, 50/60 Hz)

Physical Characteristics

Height:	12.1 cm (4.8 in)
Width:	42.7 cm (16.8 in)
Depth:	34.5 cm (13.6 in)
Weight:	9.5 kg (21 lb)

Operating Environment

Temperature range	10°C to 40°C (50°F to 104°F)
Relative humidity	10% to 90%

Reliability/Service

MTBF	10,000 hours (at 217 power-on hours per month, 4 percent duty cycle)
Printhead life	200 million characters

Chapter 10 ▪ LQP02 Letter-Quality Printer

▪ Overview

The LQP02 is a desktop, full-character impact printer. It uses daisywheel technology to produce printed copy much like that from your office typewriter. This makes it ideal for such word processing applications as business correspondence and formal documents.

While designed for use with all of Digital's personal computers, workstations, and video terminals, the LQP02 letter-quality printer is also supported on any Digital processor running the RT-11, RSX-11M, RSX-11M-PLUS, RSTS/E, and VMS operating systems.

The LQP02 and the LQP03 can be used for applications that require graphics output, such as pie and bar charts, and line graphs. This capability is made possible by Digital's new Daisy-Aids*software package, which can be purchased separately. Daisy-Aids is specifically designed for the LQP02 when used in conjunction with Digital's DECmate II, DECmate III, and Rainbow 100, running the CP/M™ operating system.

*Daisy-Aids is a trademark of Escape Computer Software, Inc.

There are two models of the LQP02 letter-quality printer.

- *LQP02-AA*: Desktop, letter-quality printer with Dual Courier 10 font, and 120 Vac power supply.
- *LQP02-AD*: Desktop, letter-quality printer with Dual Courier 10 font, and 240 Vac power supply.

▪ Major Features

The LQP02 letter-quality printer's main features are:

- Full-character impact printing—gives you high-quality print.
- Variable horizontal and vertical pitches selectable via software—allows you the freedom to design your document for your application.
- Daisywheels—provide many fonts and character sets easily and inexpensively.
- Shadow bolding—permits text highlighting.
- Foreign language printing—allows you to print in almost any foreign language.
- Cross-product compatibility—enables Digital's customers to use the LQP02 with most Digital systems.

You are looking at an actual printed sample from the LQP02 Letter-Quality Printer using proportional spacing.

The LQP02 is a full-character, impact printer that uses daisywheel print technology. It is designed for professionals, like you, who require the highest quality printing and complements Digital's DECmate, Rainbow 100, and Professional Series personal computers.

The desk-top LQP02 prints with a speed of 32 characters per second. It is capable of printing various character fonts by interchanging printwheels, and can selectively print at various pitches. This text sample was made with the WP Courier 10 daisywheel.

Other features inherent in the LQP02 are:

o **SHADOW BOLDING**

o UNDERLINING

o **OVERPRINTING**

o SUPERSCRIPTING R^2D^2

o SUBSCRIPTING H_2O

Figure 10-1 ▪ LQP02 Print Sample

▪ Printing Features

The LQP02 letter-quality printer offers full-character, letter-quality printing.

Letter-Quality Printing

LQP02 technology provides letter-quality output at the rate of 32 characters per second. This is suitable for professional-looking correspondence. Printing is accomplished through a bidirectional technique in which the printwheel seeks the shortest distance to the next printable character, rapidly skipping over blank spaces.

Shadow Bolding

A new feature called 'shadow bolding' makes shadow bolded print much more visible than normal bold print. In this technique, characters are struck twice as in normal bolding. But unlike normal bolding, the second strike is slightly offset from the first, resulting in a shadow image.

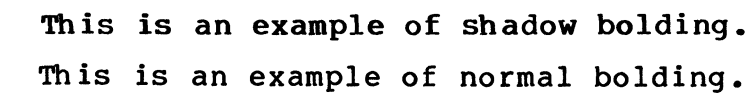


Figure 10-2 ▪ LQP02 Shadow Bolding

▪ Character Sets

Changing character sets or type styles is as easy as changing the printwheel. You can select from UKN Letter Gothic 12, WP Courier 10, WP Pica 10, WP Prestige Elite 12, ANSI OCR-B.10, WPS Boldface Italic PS, Dual Courier 10, European Courier 10, and Greek/Math, as well as others.

With the LQP02, character size can be changed from 10 to 12 characters per inch. When using 10 characters per inch, you can fit 132 columns on legal-sized paper. With 12 characters per inch, 158 columns will fit on legal-sized paper.

▪ Paper

The LQP02's sheet feeder option handles regular office stationery in standard, legal, and European sizes. The adjustable forms tractor option handles fanfold paper from 7.6 centimeters to 38.1 centimeters (3–15 inches) wide, and prints up to 34.3 centimeters (13.5 inches) across.

• Options

Part Number	Description
LQPX2-SF	Dual-tray cutsheet and envelope feeding capability; two trays automatically feed precut paper in either horizontal or vertical fashion. Front tray accommodates lengths from 26.9 cm to 36.8 cm (10.6 in–14.5 in), while back tray holds 19.8 cm to 36.8 cm (7.8 in–14.5 in). Range of widths is between 17.0 cm and 30.5 cm (6.7 in and 12 in).
LQPX2-AA	Forms tractor handles fanfold paper between 7.6 cm and 38.1 cm (3–15 in) wide.
LQPX2-SW	Serial interface switch enables better allocation of printing resources. One LQP02 can be shared between two systems in an environment where printing needs are light. Where there is higher demand for printed documents, two printers can be connected to one system and switched back and forth as needs dictate.
LQPX2-FB	Acoustic cover with 120 Vac fan reduces noise and fits over printer and forms tractor.
LQPX2-FD	Acoustic cover with 240 Vac fan reduces noise and fits over printer and forms tractor.
LQPX2-FJ	Acoustic cover with 120 Vac fan reduces noise and fits over printer and sheet feeder.
DF01-A	Acoustic telephone coupler, 300 b/s with combination EIA (RS232-C) and 20 mA current loop cable.
DF02-AA	Direct, connect, Bell 103J equivalent, 300 b/s, full-duplex, asynchronous modem with EIA RS232-C interface.
DF03-AA	Direct, connect, Bell 212A equivalent, 200/1200 b/s, full-duplex, synchronous, asynchronous modem with EIA RS232-C interface.

▪ Accessories and Supplies

The following accessories, supplies, components, and spares are available for the LQP02 letter-quality printer. Check with your sales representative or Digital's Peripherals and Supplies Group for the latest information.

Supplies

Part Number	Description
LQP02-KA	Six high-quality impression multistrike film ribbons. Single loop, sensor stops printer at ribbon's end before characters are lost.
LQP02-KB	Six continuous-loop nylon ribbons. Use until desired type quality can no longer be obtained.

Accessories

Part Number	Description
LQP02-MB	Printwheel, UKN Letter Gothic 12
LQP02-MD	Printwheel, WP Courier 10
LQP02-ME	Printwheel, WP Pica 10
LQP02-MF	Printwheel, WP Prestige Elite 12
LQP02-MH	Printwheel, Bilingual Courier 10
LQP02-MJ	Printwheel, Bilingual Prestige Elite 12
LQP02-MK	Printwheel, WP Orator 90% 10
LQP02-ML	Printwheel, ANSI OCR-B 10
LQP02-MN	Printwheel, England Pica 10
LQP02-MP	Printwheel, England Courier 10
LQP02-MR	Printwheel, England Prestige Elite 12
LQP02-MS	Printwheel, WP Letter Gothic 12
LQP02-MT	Printwheel, WP Gothic 15
LQP02-MV	Printwheel, ASCII-96 Prestige Elite 12

For LQP02 Printer

Description	
UKN Letter Gothic 12	ABCDE abcde 12345 -=°[];',./æ!@#$%¨&*()_+¨§ø:"<>?Æ
WP Courier 10	ABC abc 123-=°[];',./®!@#$%©&*()_+™§†:"<>?¶
WP Pica 10	ABC abc 123-=°[];',./®!@#$%©&*()_+™§†:"<>?¶
WP Prestige Elite 12	ABC abc 123-=°[];',./®!@#$%©&*()_+™§†:"<>?¶
Bilingual Courier 10	ABC abc 123-=°[];',./½!@#$%^&*()_+´ç¾:"`¨?|
Bilingual Prestige Elite	ABC abc 123-=°[];',./½!@#$%^&*()_+´ç¾:"`¨?|
WP Orator 90% 10	ABC ABC 123-=°[];',./®!@#$%©&*()_+™§†:"<>?¶
ANSI OCR-B.10	ABC abc 123-=`[];',./\!@#$%^&*()_+~{}:"<>?|
England Pica 10	ABC abc 123-=°[];',./½!@£$%¼&*()_+⅞⅝¾:"⅛⅜?|
England Courier 10	ABCDE abcde 12345 -=°[];',./½!@£$%¼&*()_+⅞⅝¾:"⅛⅜?|
England Prestige Elite 12	ABC abc 123-=°[];',./½!@£$%¼&*()_+⅞⅝¾:"⅛⅜?|
WP Letter Gothic 12	ABC abc 123-=°[];',./®!@#$%©&*()_+™§†:"<>?¶
WP Gothic 15	ABCDEFGHI abcdefghi 1234567890-=°[];',./®!@#$%©&*()_+™§†:"<>?¶
ASCII 96 Prestige Elite 12	ABC abc 123-=`[];',./\!@#$%^&*()_+~{}:"<>?|
WPS Boldface PS	ABCD abcd 1234 -=°[];',./®!@#$%©&*()_+™§†:"<>?¶
WPS Title PS	ABCD abcd 1234 -=°[];',./®!@#$%©&*()_+™§†:"<>?¶
WPS Thesis PS	ABCD abcd 1234 -=°[];',./®!@#$%©&*()_+™§†:"<>?¶
Nederland Prestige Elite 12	ABC abc 123-=`[];',./½!¾£$%^&*()_+~¨¼:"<>?ƒ
WPS Boldface Italic PS	*ABCD abcd 1234 -=°[];',./®!@#$%©&*()_+™§†:"<>?¶*
Nederland Pica 10	ABC abc 123-=`[];',./½!¾£$%^&*()_+~¨¼:"<>?ƒ
Dual Courier 10	ABC abc 123-=`[];',./!@#$%^&*()_+~{}:"\<>?|
European Courier 10	ABC abc 123-=`ß;',./ç!¾£$%^&*()_+§¼:"<>?ƒ
Greek/Math	∇∞ψ∥αβψ123≈πο{}}∫÷[μ±‡´/~Å√≻≠•`^¨⊓÷⌋≮∝⊥

Figure 10-3 ▪ LQP02 Daisywheels

LQP02-MW	Printwheel, WPS Boldface PS
LQP02-MX	Printwheel, WPS Title PS
LQP02-MY	Printwheel, WPS Thesis PS
LQP02-MZ	Printwheel, Nederland Prestige Elite 12
LQP02-NA	Printwheel, WPS Boldface Italic PS
LQP02-NB	Printwheel, Nederland Pica 10
LQP02-NC	Printwheel, Dual Courier 10
LQP02-ND	Printwheel, European Courier 10
LQP02-NE	Greek/Math
LQP02-NH	Assorted Printwheels: Courier 10, Pica 10, Elite 12, Orator 90% l0, Letter Gothic 12, Dual Courier 10
H9850-HE	Heavy-gauge vinyl dust cover, charcoal brown with Digital logo
H9850-AT	LQP02 stand
H9850-FA	Paper caddy with four 5.1 cm (2 in) swivel casters for transporting printer paper, 40 cm wide by 29.8 cm deep (15-3/4 in by 11-3/4 in)
STKIT-AA	Systems Terminal Tool Kit (60 Hz)
STKIT-AB	Systems Terminal Tool Kit (50 Hz)

▪ Operator Features

Front Panel Indicators and Switches

A total of eight controls and indicators are found on the front panel of the LQP02 letter-quality printer.

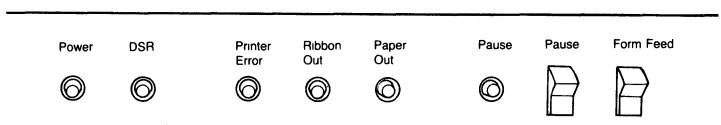


Figure 10-4 ▪ LQP02 Controls and Indicators

- POWER INDICATOR
  The green POWER light indicates the operating state of the printer. The light is on when the printer is online and ready to print or is printing. The light is off when the printer is offline.

- DSR (DATA SET READY) INDICATOR
  The green DSR light stays on when the DSR line is activated and the printer is under modem control. When not under modem control, the light is not on.

- PRINTER ERROR
  The red PRINTER ERROR light blinks when a mechanical or electrical problem is detected by the printer. During a PRINTER ERROR, an audible signal is sounded, and the printer will stop printing.

- RIBBON OUT
  The red RIBBON OUT light blinks when the printer runs out of film ribbon. The RIBBON OUT indicator does not indicate the end of a cloth ribbon, or the breaking or jamming of any type of ribbon. When the end of a film ribbon is detected, a buzzer sounds, and the printer stops printing.

- PAPER OUT
  The red PAPER OUT light blinks, a buzzer sounds, and printing stops when the printer is out of paper, or if the paper is jammed.

- PAUSE INDICATOR
  The yellow PAUSE light blinks and printing stops when the PAUSE switch is on.

- PAUSE SWITCH
  The PAUSE switch is a rocker switch. When the top is pressed, printing stops and the pause light starts blinking. When the bottom is pressed, printing resumes with no loss of characters and the pause light stops blinking.

  Activate the PAUSE switch when changing ribbons or daisywheels, or rolling the paper to the top of the form.

- FORM FEED SWITCH
  When not printing, and the top of the FORM FEED switch is pressed, the paper advances a page.

Printer Controls

The LQP02 letter-quality printer has eight printer controls.

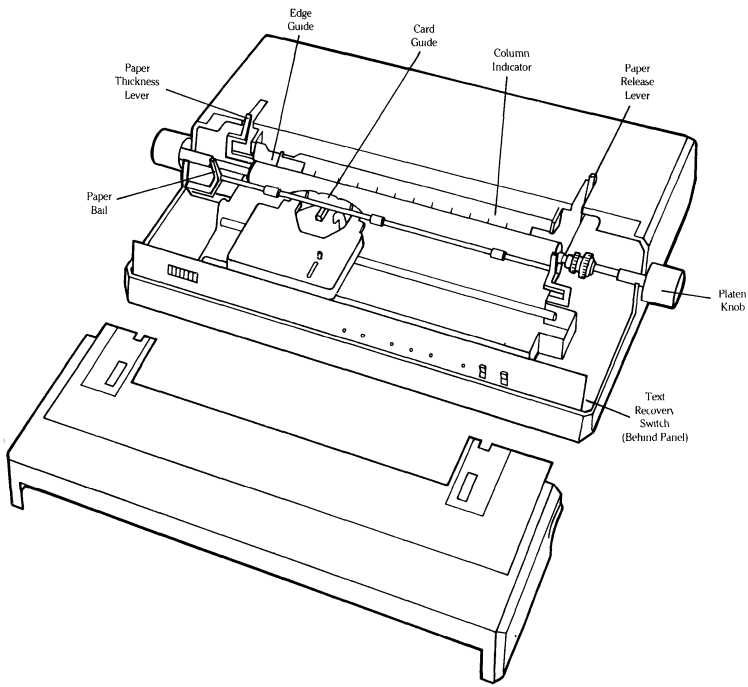


Figure 10-5 ▪ LQP02 Printer Controls

- PAPER BAIL
  The paper bail holds the paper against the platen. The two handles permit adjustment of the entire bail from either side of the printer.

- PAPER THICKNESS LEVER
  The paper thickness lever adjusts spacing between the daisywheel and the platen. For an average thickness, place this lever in the forward position. For thicker sheets, envelopes, and multipart forms, move this lever toward the back of the printer.

- EDGE GUIDE
  This movable edge eases paper insertion at any point along the platen.

- CARD GUIDE
  The card guide establishes a printer reference line for the top edge of the paper and assists in locating the vertical printing position. Paper should never be pulled against the card guide, but rather the form feed switch should be pressed or the platen knob turned.

- COLUMN INDICATOR
  The column indicator assists you in positioning paper on the platen and in locating the horizontal printing position.

- PAPER RELEASE LEVER
  The paper release lever controls pressure applied to the paper by the cradle rollers underneath the platen. Backward movement of this lever holds the paper tightly against the platen. Forward movement releases the paper.

- PLATEN KNOBS
  Two knobs control platen movement. Turning the right platen knob clockwise or the left knob counterclockwise advances the paper through the printer.

- TEXT RECOVERY SWITCH
  When activated, the text recovery switch informs the status protocol handler of the printer's condition. This means that you can signal the host of a printer problem that may cause the loss of text.

Printer Configurations

The LQP02 Letter-Quality Printer contains two banks of configuration switches, which are set for worldwide system operation without a modem. If you need to change the configuration, the switches required for this operation are located on the back of the LQP02. **Note:** Before resetting the switches, check that you have turned the power off

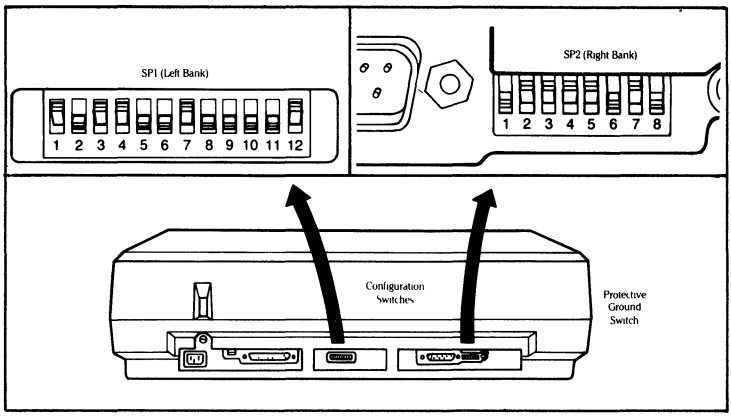


Figure 10-6 ▪ LQP02 Configuration Switches

The switch positions can be easily changed by flipping the position up or down. When the switch is down, it is off. When up, the switch is on. A diagram of the switches can be found underneath the front cover of the LQP02.

- LEFT SWITCH BANK (SP1)
  The left group contains 12 preset switches (SP1-1 through SP1-12). These are factory set at the following:

- SP1-1, Up—Baud rate of 4800 bits per second
- SP1-2, Down—Baud rate of 4800 bits per second
- SP1-3, Up—Baud rate of 4800 bits per second
- SP1-4, Up—Baud rate of 4800 bits per second
- SP1-5, Down—One stop bit
- SP1-6, Down—Restricted modem control
- SP1-7, Up—Space parity
- SP1-8, Down—Space parity
- SP1-9, Down—2s timer
- SP1-10, Down—Paper out sensor enabled
- SP1-11, Down—Status transmission enabled
- SP1-12, Up—Self-test disabled

Baud Rate Select Switches (SP1-1, SP1-2, SP1-3, SP1-4) These switches select the speed at which the printer transmits and receives data from the host processor. The LQP02 is factory set for 4800 baud.

Table 10-1 ▪ Baud Rate Select Switches

Baud Rate Bits per Second	SP1-1	SP1-2	SP1-3	SP1-4
75/600	Down	Down	Down	Down
75/1200	Up	Down	Down	Down
110	Down	Up	Down	Down
134.5	Up	Up	Down	Down
150	Down	Down	Up	Down
200	Up	Down	Up	Down
300	Down	Up	Up	Down
600	Up	Up	Up	Down
1200	Down	Down	Down	Up
1800	Up	Down	Down	Up
2000	Down	Up	Down	Up
2400	Up	Up	Down	Up
3600	Down	Down	Up	Up
4800	Up	Down	Up	Up
7200	Down	Up	Up	Up
9600	Up	Up	Up	Up

Parity Enable Switches (SP1-7 and SP1-8) Switches SP1-7 and SP1-8 select the parity mode.

Table 10-2 ▪ Parity Enable Switches

Parity Mode	SP1-7	SP1-8
Mark	Down	Down
Odd	Down	Up
Space	Up	Down
Even	Up	Up

Remaining Left Bank Switches Table 10-3 names the remaining left bank switches and explains their functions. It also explains the meaning of up and down position settings. Refer to Figure 10-6.

Table 10-3 ▪ Other Left Bank Switches

Switch	Function	Up Position	Down Position
Stop Bits (SP1-5)	Selects one or two stop bits for data format.	Two stop bits	One stop bit
Full/Restricted Modem Control (SP1-6)	Indicates the presence or absence of a modem.	Full-modem control	Restricted modem control.
RLSD Disconnect Timing (SP1-9)	Selects the two second (2 s) timer or 60 ms timer for data channel RLSD (received line signal detector) aborts.	60 milliseconds	2 second timer
Paper Out Enable (SP1-10)	Enables or disables paper out sensor.	Disables	Enables
Status Inhibit (SP1-11)	For system testing, inhibits or enables status transmission for polled requests.	Inhibits a status transmission for polled requests until all printer buffers are empty.	Enables
Self-test (SP1-12)	Selects self-test operation.	Disables	Enables form feed switch to start electronic and mechanical tests of printer operation.

- RIGHT SWITCH BANK (SP2)

The right bank contains eight switches (SP2-1 through SP2-8). Factory settings are indicated by daggers(†). See Figure 10-6.

Table 10-4 ▪ Right Switch Bank

Switch	Name	Function	Up Position	Down Position
SP2-1	Transmitted Data	Allows printer to send data to host via I/O connector pin 2.	Disables	Enables†
SP2-2	Transmitted Backward Channel Data	Allows printer to send data to host via I/O connector pin 14.	Disables†	Enables
SP2-3	Transmitted Backward Channel Signal	Prepares a modem to receive a signal.	Disables†	Enables
SP2-4	Request to Send	Prepares a modem for receiving printer data.	Disables†	Enables
SP2-5	Request to Send Off Level	Enables/ disables send off function.	Disables†	Enables
SP2-6	Ready for Sending	Allows modem to say if it is ready or not to receive data from the printer.	Disables	Enables†
SP2-7	Backward Channel Ready	Selects backward channel ready line.	Disables†	Enables
SP2-8	Data Signaling Rate Selector	Connects data signaling rate selector line to a modem.	Disables	Enables†

- PROTECTIVE GROUND SWITCH

  When a modem is installed in your system, the up position of this switch connects the printer frame to the "protective ground" line (I/O connector pin 1). See Figure 10-6.

  Normally, this switch is in the up position with or without a modem. But in other countries, such as Germany and the United Kingdom, local safety regulations require that the switch be in the down position when the printer frame is not connected to the electrical ground.

▪ Programming Information

The LQP02, like Digital's other receive-only printers, uses escape sequences and features that were standardized by the American National Standards Institute (ANSI). Following the brief description of each escape sequence feature will be the summary of the actual escape sequence required. Detailed information on all LQP02 escape sequences can be found in the *LQP02 Printer Programmer's Reference Manual.*

Escape Sequences

Some frequently used escape sequences are outlined below. **Note:** In this section, VAI stands for vertical advance increment and one VAI equals 1/48 inch. HAI stands for horizontal advance increment, and one HAI is equal to 1/120 inch.

Table 10-5 ▪ Common LQP02 Escape Sequences

Name	Function	Escape Sequence
Printer Initialization	Resets printer to default settings.	ESC c
Perform Next Line Forward	Advances paper to next line.	ESC E
Enter Right Margin Wrap Mode	Set right margin wrap mode.	ESC [? 7 h
Exit Right Margin Wrap Mode	Reset right margin wrap mode.	ESC [? 7 l
Enter New Line Mode	Set new line mode.	ESC [20 h
Exit New Line Mode	Reset new line mode.	ESC [20 l

Set Forms Size	Pn must be between 1 and 169, inclusive.	ESC [Pn t
Set Horizontal Tab at Selective Columns	Pn equals the column number.	ESC [Pn_1 ;... ; Pn_{16} u
Clear Horizontal Tabs	Clears all horizontal tabs.	ESC [3 g
Set Vertical Tabs at Selective Lines	Pn equals the line numbers.	ESC [Pn_1 ;... ; Pn_{16} v
Clear Vertical Tabs	Clears all vertical tabs.	ESC [4 g
Set Right and Left Margins	Pn_1 must be less than Pn_2.	ESC [Pn_1 ; Pn_2 s
Set Top and Bottom Margins	Pn_1 must be less than Pn_2.	ESC [Pn_1 ; Pn_2 r
Set Underlining	Enable underline mode.	ESC [4 m
Set Underlining	Disable underline mode. Ps equals 0 or null.	ESC [Ps m
Set Shadow Printing	Enable shadow printing.	ESC [? 2 m
Set Shadow Printing	Disable shadow printing. Ps equals 0 or null.	ESC [Ps m
Setting VAI and HAI to Numeric Parameters	Pn_v must be between 15 and 960, inclusive. Pn_h must be between 6 and 768, inclusive.	ESC [Pn_v ; Pn_h Space G

▪ SETTING HAI AND VAI

You can also set HAI and VAI to selective parameters.

Table 10-6 ▪ Selecting HAI (ESC [Ps w)

HAI	Ps	Characters per Inch
12	Null	10
12	0	10
12	1	10
10	2	12
10	3	12
10	4	12
12	5	10
12	6	10
12	7	10
12	8	10
8	9	15

Table 10-7 ▪ Selecting VAI (ESC [Ps z)

VAI	Ps	Lines per Inch
8	Null	6
8	0	6
8	1	6
6	2	8
6	3	8
24	4	2
16	5	3
12	6	4

- COMMUNICATIONS PROTOCOLS

Communications protocols can also be established by using escape sequences. See Table 10-8.

Table 10-8 ▪ Communications Protocols

Name	Function	Escape Sequence
Set Status Communication Protocol	Polled report request.	ESC [5 n
	Enable brief unsolicited reports and send an extended report.	ESC [? 2 n
	Enable extended unsolicited reports and send an extended report.	ESC [? 3 n
	Disable all unsolicited reports.	ESC [? 1 n
Send Brief Status Report	Printer response: Ps equals 0, printer is ready, no malfunctions detected.	ESC [Ps n
	Printer response: Ps equals 3, printer is not ready, a malfunction is detected.	ESC [Ps n
Send Extended Status Report	Printer Response: Ps_1 equals 0, printer is ready, no malfunction is detected.	ESC [Ps_1 n ESC [? Ps_2 ;... ; Ps_2 n
	Printer Response: Ps_1 equals 3, printer not ready, there is a malfunction detected.	ESC [Ps_1 n ESC [? Ps_2 ; ... ; Ps_2 n

You should note that Ps_2 can be any of the following values:

- 20—No malfunctions detected in the printer.
- 21—Printer hardware error.
- 22—Communication I/O error.
- 23—Input buffer overflow.
- 24—Pause active.
- 25—Text recovery switch activated.
- 26—Cover open.
- 27—Paper out.
- 28—Ribbon out.
- 29—Printwheel table load error.
- 30—No malfunctions detected in sheet feeder.
- 31—Sheet feeder hardware error.
- 32—Sheet feeder insert error.

• Maintenance

The LQP02 letter-quality printer does not require preventive maintenance. However, in order to ensure proper operation of your LQP02 printer, keep the following items in mind.

- Keep printer away from sources of extreme temperature such as direct sunlight, room heaters, and air conditioners.
- Keep small objects and liquids away from your printer. If they fall inside, they will cause damage.
- Select the right paper for the job. Single-sheet bond paper usually gives the best print quality.
- Make sure that the paper is positioned properly, and that the thickness adjustment lever is in the correct position.
- Use only Digital-approved printwheels and ribbon cartridges in the printer. Others may not provide the same high performance.
- Never scratch or crease ribbons.

Self-test Procedure

To initiate a self-test procedure:

1. Check that the power is off and the cover is on.
2. Insert sheet of paper in horizontal position, as far to the left as it will go.
3. Move self-test configuration switch (SP1-12) down.
4. Press top of power switch.
5. Front-panel lights should blink twice, and carriage should move to the far left.
6. Press FORM FEED switch once. Red printer error, ribbon out, and paper out lights should blink twice.
7. Wait a few seconds, and press FORM FEED switch again. Buzzer should sound, printing should start, and forms tractor or sheet feeder, if installed, should operate.
8. After at least two lines of printout are obtained, press top of PAUSE switch. Printout should include at least one carriage return, one line feed, and all characters on printwheel.
9. If the printer passes self-test, you're all set to go. If it doesn't, refer to the next section.

Operator Troubleshooting Checklist

If your printer is not operating, chances are the problem is minor and you can correct it yourself. Listed below are some of the common problems, their probable cause, and the corrective action that you can take. **Note:** Always turn off the printer before you attempt to correct a problem.

Printer stops or won't turn on (power light off).
▪ Power off.—Press power switch. Check power cable connections.

Printing stops or won't start (power light on).
▪ Access cover open.—Close access cover.

Printing stops or won't start (printer error light on).
▪ Electronic or mechanical malfunction.—Perform self-test procedure.

Power-up failure (power light on, buzzer sounds continuously).
▪ Temporary electronic malfunction.—Switch printer off and then on.

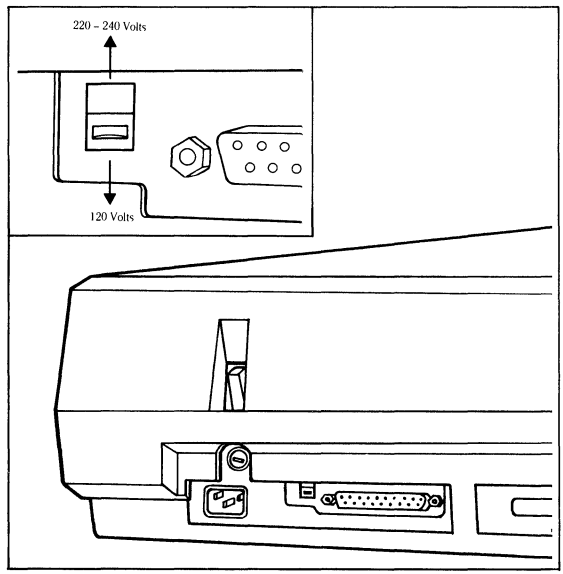


Figure 10-7 ▪ Voltage Selection Switch

Some characters improperly spaced or positioned.

- Damaged printwheel.—Replace printwheel.
- Printwheel not fully seated.—Reinstall printwheel making sure it is all the way down.

Characters too close together or too far apart.

- Wrong printwheel or system pitch setting.—Change printwheel or system pitch setting.

Characters not consistently dark.

- Old or dried out ribbon.—Replace ribbon cartridge.
- Incorrectly set paper thickness lever.—Reset paper thickness lever to allow for thinner paper or multipart forms.
- Defective printwheel.—Replace printwheel.
- Ink or carbon not adhering to coated paper.—Use uncoated paper.

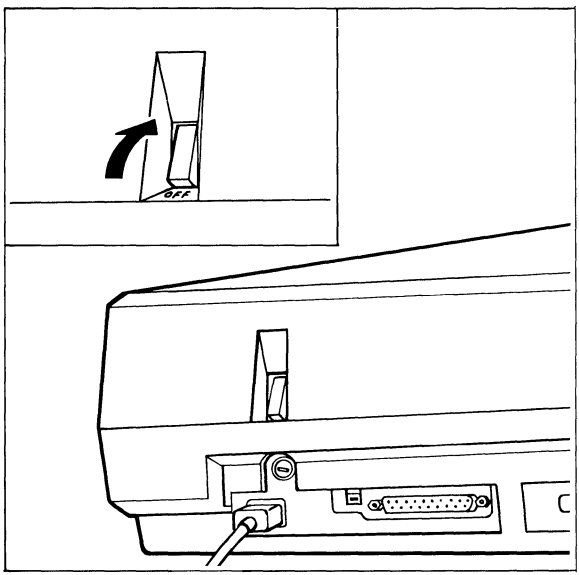


Figure 10-8 ▪ LQP02 Power Switch

Characters not sharp or dark enough.

- Incorrectly set paper thickness lever.—Reset paper thickness lever to allow for thinner paper or multipart forms.
- Worn or dirty printwheel.—Replace or clean printwheel.
- Defective ribbon.—Replace ribbon cartridge.

Parts of characters missing.

- Incorrectly set paper thickness lever.—Reset paper thickness lever to allow for thinner paper or multipart forms.
- Scratched film ribbon.—Advance ribbon to unscratched area or replace cartridge.
- Damaged printwheel character.—Replace printwheel.
- Ink or carbon not adhering to coated paper.—Use uncoated paper.

Top or bottom of characters missing.

- Ribbon folded over behind guides.—Unfold and advance ribbon, reinstall cartridge.
- Interference between card guide and ribbon guides.—Remove foreign object, reinstall ribbon cartridge.

Ribbon breaks or jams.

- Improperly installed ribbon.—Reinstall ribbon cartridge, check printout for loss of characters.
- Rewind knob turned in wrong direction during installation.—Reinstall ribbon cartridge turning knob in proper direction as marked on cartridge, check printout for loss of characters.

Perforated paper.

- Incorrectly set paper thickness lever.—Reset paper thickness lever to allow for thinner paper or multipart forms.

▪ Additional Documentation

The following documents contain more detailed information about the LQP02 letter-quality printer.

- *Installing and Using the LQP02 Printer* (AA-L662A-TK)—Tells you how to install, use, maintain, troubleshoot, and configure the LQP02.
- *LQP02 Printer Programmer Reference Manual* (EK-LQP02-RM)—Provides detailed information on the LQP02's features: communications, printer configurations, text mode character processing, escape and control sequences, and graphics mode.

Also of interest are:

- PDP-11 and VAX Systems and Options Catalogs—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These customer documents are designed to help you select the right Digital product. European versions are also available.

  If you require information not contained in these documents, contact your local Digital representative.

• Specifications

Performance Characteristics

Print speed	32 char/s (letter-quality, Shannon text)
Print technology	Bidirectional, full-character, impact
Print density	Full-character, even density
Character pitch	Variable pitch, software selectable (10 char/in default)
Line spacing	Variable, includes proportional spacing (6 l/in default)
Vertical slew speed	5 in/s
Buffer capacity	256
Buffer control	XON/XOFF

Paper

Type	Cutsheet, fanfold, envelopes
Cutsheet dimensions	7.6 cm–34.3 cm (3–13.5 in) wide
Fanfold dimensions	7.6 cm–38.1 cm (3–15 in) wide
Thickness	0.025 cm (0.011 in) maximum

Communications

Baud rates	75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, and 9600, full-duplex transmission
Data interface	Serial RS232-C EIA standard
Parity	7-bit, odd, even, mark, or space

Power Requirements

LQP02-AA	120 Vac, 60 Hz
LQP02-AD	240 Vac, 50 Hz
Power consumption	120 W, average RMS

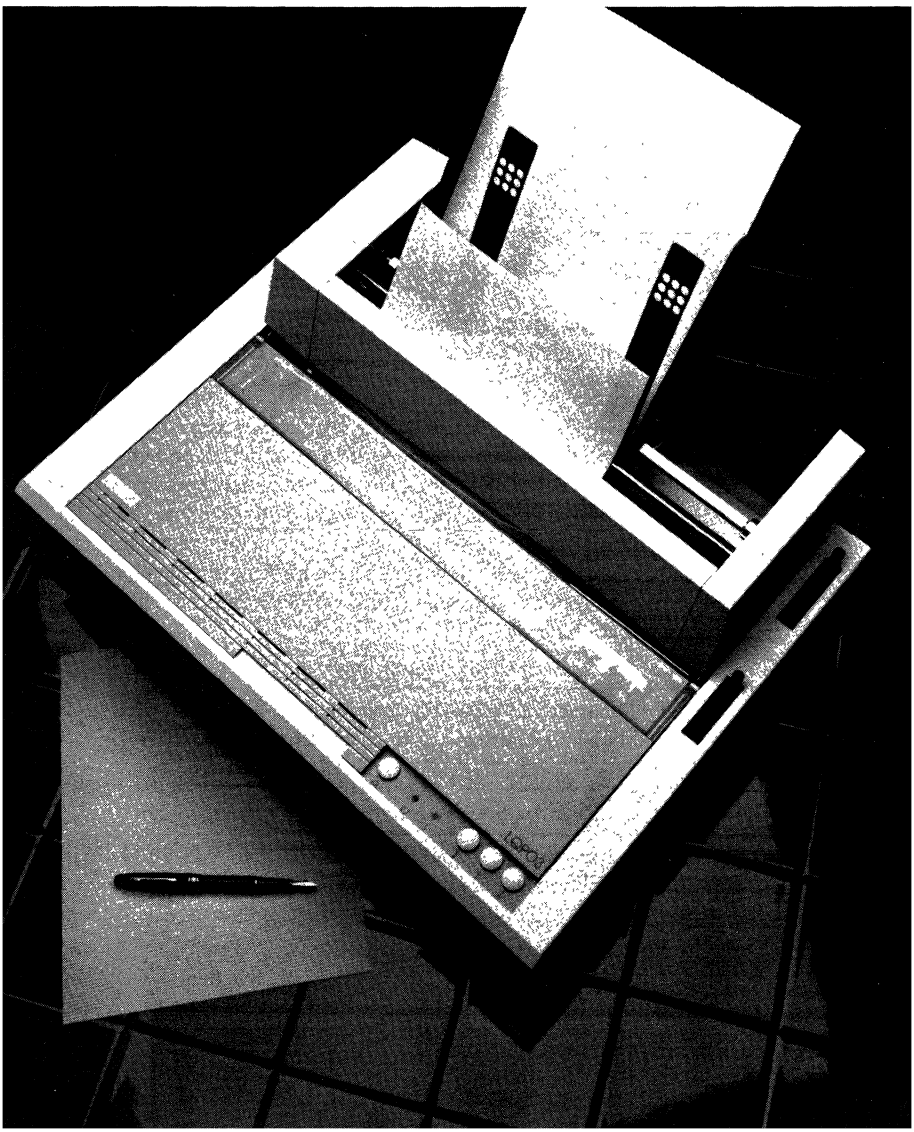
Operating Environment

Temperature	10°C–40°C (50°F–104°F)
Relative humidity	10%–90%

Physical Characteristics

Width	63.5 cm (25 in)
Depth	40.6 cm (16 in)
Height	17.8 cm (7 in)
Weight	22 kg (48 lb)

Chapter 11 • LQP03 Letter-Quality Printer



▪ Overview

The LQP03 is a compact, full-character, letter-quality desktop printer designed for office use or business applications. It offers an expanded character set contained on a single, 130-petal daisywheel. The expanded daisywheel lets you use the full complement of Digital's multinational characters on one wheel. Additional printwheels provide a broad range of typestyles, pitches, and sequences.

The affordable LQP03 printer produces high-quality text as well as business graphics such as pie and bar charts, and line graphs, with a Daisy-Aids* software package. It also produces less noise than conventional typewriters or daisywheel printers.

The optional single-tray cutsheet feeder and/or the bidirectional forms tractor enhance the performance of the LQP03 printer. The optional bidirectional forms-tractor is customer-installable and handles a variety of fanfold paper including continuous preprinted forms. The paper scrolls forward or backward while printing. The single-tray cutsheet feeder option automatically feeds precut paper to the LQP03 in either vertical or horizontal fashion. Either the sheet feeder or the bidirectional tractor option must be used to feed cutsheets to the LQP03 printer.

The LQP03 printer is designed for use with all of Digital's personal computers—RAINBOW, DECmate, and the Professional series. It is compatible with all of Digital's workstations and video terminals. The LQP03 also runs on software packages of other manufacturers. Depending on your software support, the LQP03 can perform overprinting, bolding, underlining, subscripting, and superscripting. A standard serial interface is included for compatibility with existing Digital printers. This extensive compatibility and array of functions make it possible for the LQP03 to meet your present and future application needs.

There are two models of the LQP03 letter-quality printer.

- LQP03-A: Full-character letter-quality printer, 120 Vac, 60 Hz, with multistrike print ribbon and Courier-10 130-character printwheel.

- The LQP03-A_ is available with documentation for the United States, Canada (French, English), South America (Spanish, Portuguese).

- LQP03-B: Full-character letter-quality printer, 220-240 Vac, 50 Hz, with multistrike print ribbon and Courier-10 130-character printwheel.

  The LQP03-B_ is available with documentation for Australia/New Zealand, Belgium (Flemish), Denmark, Finland, France, Germany/Austria, Holland, Italy, Israel, Norway, Portugal, Sweden, Switzerland (French, German, Italian), United Kingdom/Ireland.

*Daisy-Aids is a trademark of Escape Computer Software, Inc.

▪ Major Features

The main features of the LQP03 letter-quality printer are:

- Full-character impact printing—gives you high-quality print for personal and business correspondence.
- Prints at speeds of 25 characters per second in 10-pitch Shannon text and 34 characters per second in 12-pitch triple-A text—allows you to get high-quality printing quickly.
- Interchangeable expanded set (130-character) printwheels—allows you to use the full complement of Digital's multinational characters and other special symbols.
- The LQP03 produces less than 58 decibels, and 45 decibels or less with the use of the acoustic cover—reducing considerably the noise level in your work environment.
- Optional single-tray cutsheet feeder—automatically feeds paper to the printer.

  Note: The single-tray cutsheet feeder does *not* support envelope feeding nor is the printer capable of supporting hand-fed envelopes.
- Optional bidirectional forms tractor handles fanfold paper—allowing you to use continuous paper in the form of company letterhead, preprinted forms, and multipart forms.
- Paper in both United States and European sizes can be used in both vertical and horizontal orientation—providing you the freedom for design flexibility.
- Disposable, multistrike film cartridges—let you change ribbons easily and without mess.
- Shadow bolding—permits you to highlight text.
- Cross-product compatibility—enables Digital customers to use the LQP03 with all Digital personal computers, word processors, workstations, and video terminals.

▪ Printing Features

The LQP03 letter-quality printer offers full-character, letter-quality printing in both proportional and fixed spacing. Refer to Figure 11-1.

You are looking at an actual sample of Digital's new low-cost LQP03 Letter-Quality Printer using a proportionally spaced printwheel. Proportional spacing saves space and gives your documents a professional look.

The LQP03 is a full-character, impact printer incorporating daisywheel print technology. The LQP03 features high print quality, high reliability, and versatility at a low price.

Now, you are looking at an actual printed sample from Digital's new low-cost LQP03 Letter-Quality Printer using a fixed-spaced printwheel. Most LQP03 printwheels utilize the conventional fixed-spacing format.

The LQP03 is a full-character, impact printer incorporating daisywheel print technology. The LQP03 features high quality, high reliability, and versatility at a low price.

Other features of the LQP03 are:

- **SHADOW BOLDING**
- UNDERLINING
- OVERPRINTING
- SUPERSCRIPTING R^2D^2
- SUBSCRIPTING H_2O

Figure 11-1 ▪ LQP03 Print Sample

Letter-Quality Printing

LQP03 technology provides letter-quality output at over 25 characters-per-second. The expanded daisywheel design has only one symbol per spoke rather than two. This means that the carriage does not shift up and down, and excessive wear and misaligned characters do not occur. The result is a more reliable, high-quality printing.

Shadow Bolding

This is an example of shadow bolding

This is an example of normal bolding.

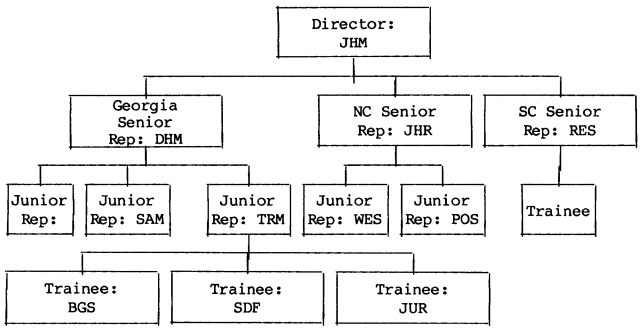
Figure 11-2 ▪ LQP03 Bolding

A feature called 'shadow bolding' makes shadow-bolded print more visible than normal bold print. In this technique, characters are struck twice as in normal bolding. But unlike normal bolding, the second strike is slightly offset from the first, resulting in a shadow image. Shadow bolding captures the reader's attention by highlighting the important parts of your document.

Graphics Printing

With the use of Daisy-Aids plotting software and the DECmate and RAINBOW series of personal computers you can expand the applications of your LQP03 by easily producing graphics and charts. Bar, pie, and organizational charts and line graphs enhance your reports and presentations. Producing graphics and instituting editing changes can be done quickly and cleanly. You can experiment with design options. For instance, one entry allows you to change any graph from scatter to line to bar. It is easy to change size and placement of a graph within the page or report. Segments of a pie chart, bar graph or line chart can be differentiated from one another when the user selects varied densities and slice fills. The graphics created with the Daisy-Aids, shown in Figure 11-3, reflect the high quality and full-character of the LQP03 letter-quality printer.

Allied Manufacturing Corporation
Southeast Sales Organization
As of July, 1983



THE FOLLOWING BUSINESS GRAPHICS WERE
MADE USING DAISY-AIDS (TM) ON THE LQP03
THE CHART BELOW TOOK 4:29 MIN TO PRINT!!

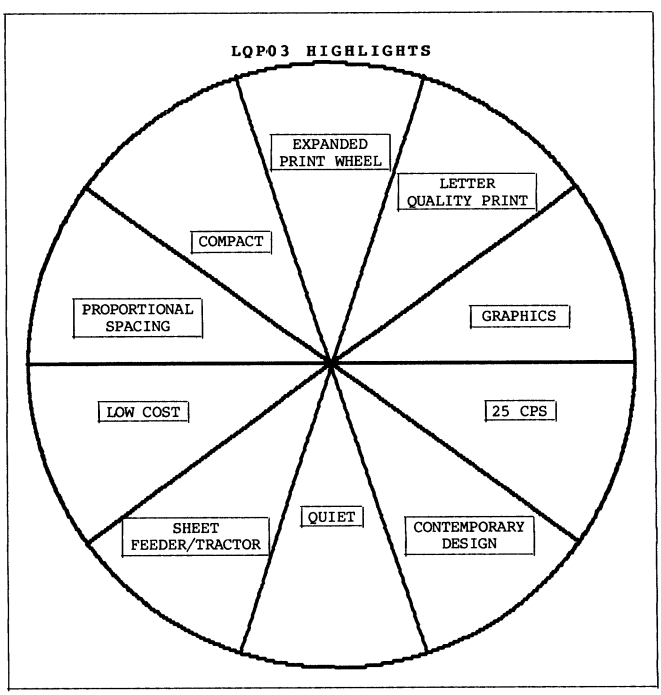


Figure 11-3 ▪ LQP03 Graphics Samples (50% of Actual Size)

• Character Sets

Changing character sets or type styles is as easy as changing the printwheel. You can select from any one of 12 character sets: ASCII, English/U.K., French, French Canadian, German, Italian, Spanish, Finnish, Norwegian/ Danish, Swedish, JIS Roman, and the Multinational graphic character set.

With the LQP03, three different character pitches are available. Using 10 characters per inch, you can fit 110 columns across the page. With 12 characters per inch, 132 columns can be accommodated. With 15 characters per inch, the maximum number of print columns produced is 165.

• Paper

The LQP03's single-tray sheet feeder option handles regular office stationery in standard and European sizes. The bidirectional forms tractor option handles fanfold paper from 25.4 cm minimum to 305 cm maximum (2 to 12 inches). The single-tray sheet feeder does not handle conventional envelopes.

• Options

Part Number	Description
LQPX3-SF	Automatic single-bin sheet feeder holds up to 100 sheets of paper. Maximum and minimum paper width sizes are 30.5 and 20.3 centimeters (12 and 8 inches), while maximum and minimum lengths are 35.6 and 20.3 centimeters (14 and 8 inches). The LQPX3-SF does not support automatic feeding of envelopes.
LQPX3-FT	Bidirectional forms tractor handles fanfold paper including continuous preprinted and multipart forms (an original plus three copies) and reverse feeds up to one inch for superscripts and subscripts.
LQPX3-AC	Acoustic cover with 120 Vac fan reduces noise to 45 dBA or less and fits over printer and forms tractor or sheet feeder. Its on/off switch is frontally located for easy accessibility.
LQPX2-SW	Serial interface switch allows two printers to be attached to one Digital personal computer for an environment in which high demand for printed documents exists.
PCXXF-CZ	Serial interface switch allows two Digital personal computers to be attached to one printer for an environment in which printing needs per computer are light.

Part Number	Description
PCXXA-AA	Crossover switch accommodates two Digital printers to two Digital personal computers. It allows for the flexibility of interchanging between a letter-quality and draft printer.
PCXXF-CK	Stand, brown.
PCXXF-DF	Stand, gray.

▪ Accessories and Supplies

The following accessories, supplies, components, and spare parts are available for the LQP03 letter-quality printer. Check with your sales representative or Digital's Peripherals and Supplies Group for the latest information.

Supplies

Part Number	Description
LQP03-KA	Multistrike film. Box of six, high-quality, single-loop ribbon cartridges. Sensor stops printer at ribbon's end before characters are lost.
H9850-PH	Tractor-feed paper, single-part, white, 2700 sheets/box, fanfold, 9.5 by 11 inches
H9850-PM	Tractor-feed paper, single-part, white, 2600 sheets/box, 12 by 8.5 inches

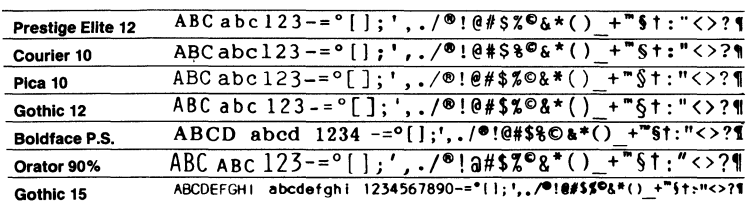
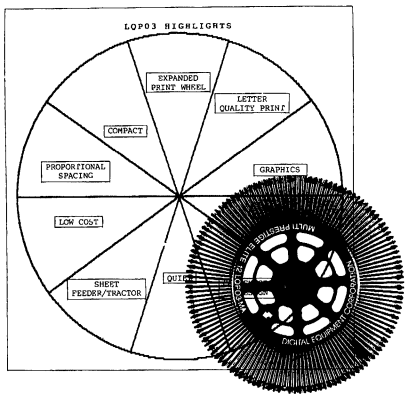


Figure 11-4 ▪ LQP03 Daisywheels



Accessories

Part Number	Description
LQP03-MA	Printwheel, Multinational Prestige Elite 12 (box of six)
LQP03-MB	Printwheel, Multinational Courier 10 (Box of six)
LQP03-MC	Printwheel, WP/DP Pica 10 (Box of six)
LQP03-MD	Printwheel, WP/DP Letter Gothic 12 (Box of six)
LQP03-ME	Printwheel, WP/DP Boldface Proportional Space (Box of six)
LQP03-MF	Printwheel, WP/DP Orator 90% 10 (Box of six)
LQP03-MH	Printwheel, WP/DP Gothic 15 (Box of six)
LQP03-MK	Printwheel, Applied math (Box of six)

▪ Operator Features

Electrical Controls and Indicators

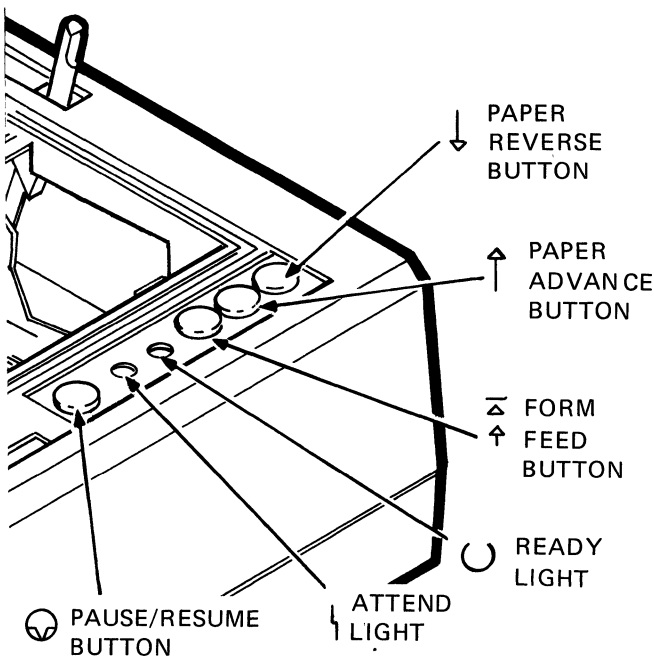


Figure 11-5 ▪ LQP03 Controls and Indicators

▪ POWER SWITCH

The power switch is located to the right side of the printer in easy access to both the operator and field service representative. Pressing the "1" side of the power switch turns the printer ON. Pressing the "0" side of the power switch turns the printer OFF.

▪ PAPER ADVANCE BUTTON

Paper is moved forward in steps by pressing the paper advance pushbutton. Momentarily pressing the paper advance button advances the paper 1/48 inch. Holding the button down continuously advances the paper one line at a time. The paper advance button has no effect if text is currently being printed.

- PAPER REVERSE BUTTON

  Momentarily pressing the paper reverse button reverses the paper 1/48 inch. Holding the button down reverses the paper continuously one line at a time. The paper reverse button has no effect if text is currently being printed.

- FORM FEED BUTTON

  Pressing the form feed button advances the paper a preset number of lines. The form size is normally set to 11 inches but can be changed with a software command. If the sheet feeder option (LQPX3-SF) is installed, a new sheet is automatically inserted to the top of form position.

  The form feed button is also used to start the self-tests in the self-test procedure. The form feed button has no effect if text is currently being printed or if the pause button has been pressed.

- PAUSE/RESUME BUTTON

  When printing, pressing the PAUSE/RESUME button immediately stops the printer without losing any text sent by the computer. Also opening the front access cover will cause the printer to stop. While the printer is in pause, the green READY light continuously flashes, and the form feed button is disabled. Pressing the PAUSE/RESUME button resumes normal printing operation.

  Always press the PAUSE/RESUME button before opening the front access cover.

- READY LIGHT (GREEN)

  When the green READY light is on, it indicates the printer is on, operating normally, and ready to print.

  Flashing of the READY light indicates that the printer has paused. Either the PAUSE/RESUME button has been pressed or, if the attend light is also on, further operator attention is required. The operator may need to close the access cover, snap an unseated cartridge into place, replace cartridge, or reload paper.

  When the READY light is off, power is off. If the ATTEND light is on as well, there is an electronic or mechanical malfunction.

- ATTEND LIGHT (YELLOW)

  When the yellow ATTEND light is on, it indicates that the printer requires operator attention. It will turn on if the printer has automatically paused due to a paper-out or ribbon-out condition.

  When the ATTEND light is off, the printer is operating correctly, or the printer has been stopped by the operator pressing the PAUSE/RESUME button.

- AUDIBLE ALARM
  The alarm sounds whenever operator attention is required to service the printer. The alarm also sounds when a data communication error (parity failure or buffer overflow) has been detected.

- FRONT ACCESS COVER SAFETY SWITCH
  The front access cover safety switch automatically stops the printer and sounds the audible alarm when the front access cover is open to ensure that text being sent from the computer is not lost. When the cover is closed, the carriage and printwheel return to the active position. Printing is resumed by pressing the PAUSE/RESUME button.

Mechanical Controls and Indicators

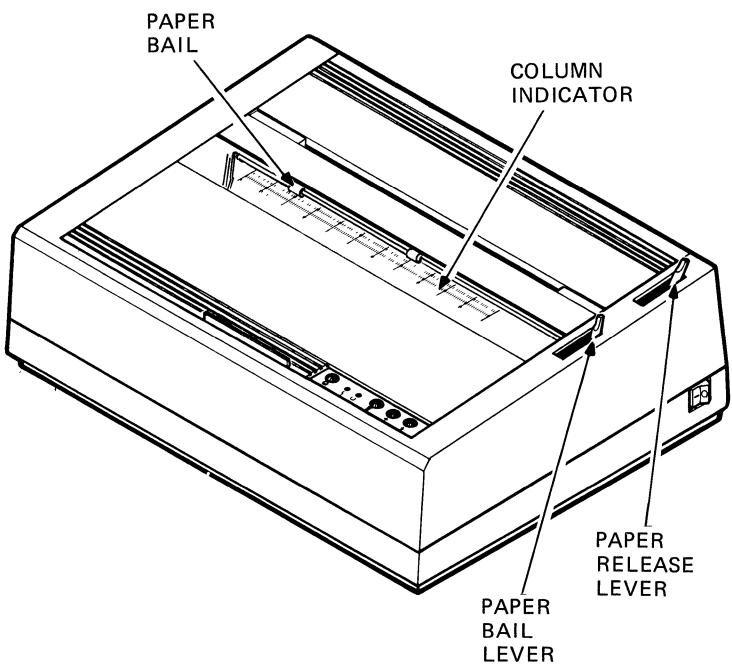


Figure 11-6 ▪ LQP03 Printer Controls

- PAPER BAIL LEVER
  The paper bail lever allows movement of the paper bail when the front access cover is closed. Pushing the lever toward the rear of the printer holds the paper against the platen. Pulling the lever forward releases the paper from the paper bail.

- PAPER RELEASE LEVER
  The paper release lever controls the pressure of rollers beneath the platen. Pushing the lever back holds the paper against the platen; pulling the lever forward releases the paper. The lever must be in the rear position for the printer to move the paper unless the LQPX3-FT Forms Tractor option is installed.

- COLUMN INDICATOR
  The column indicator assists in positioning paper on the platen and locating the horizontal printing position. The column indicator is printed on the clear portion of the front access cover.

- PRINT POSITION INDICATORS
  The horizontal print position indicator is a raised line on the front of the ribbon cartridge. It indicates the center line of the column being printed.

  The vertical print position indicator is a raised line on the sides of the ribbon cartridge. It indicates the center of the line being printed.

Printer Configuration

The LQP03 Letter-Quality Printer contains two banks of configuration switches that are factory set to standard parameters. If you need to change the configuration, the switches required for this operation are located on the top front of the LQP03 for easy access to the user. See Figure 11-7 for factory settings. **Note:** Before resetting the switches, check that you have turned the power off.

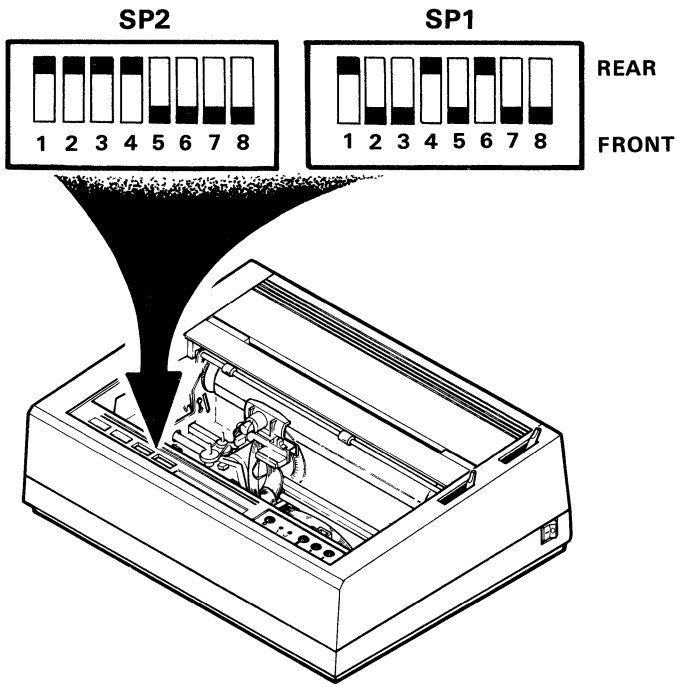


Figure 11-7 ▪ LQP03 Configuration Switches

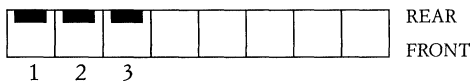
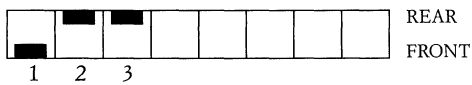
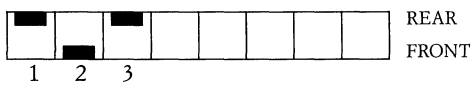
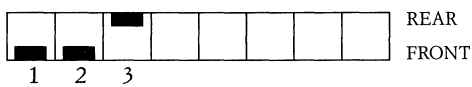
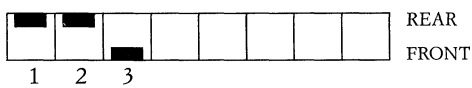
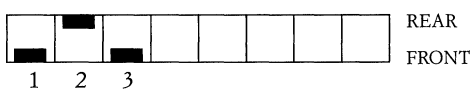
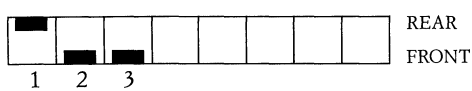
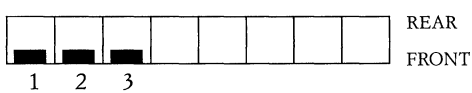
The switch positions can be changed easily by flipping the position to the front or the rear.

- SWITCH PACK 1 (SP1)
  Switch Pack 1 contains eight preset switches (SP1-1 through SP1-8). These are factory set at the following:

  - SP1-1, Rear—Baud rate of 4800 bits-per-second.
  - SP1-2, Front—Baud rate of 4800 bits-per-second.
  - SP1-3, Front—Baud rate of 4800 bits-per-second.
  - SP1-4, Front—Self-test position.
  - SP1-5, Front/Rear—1 stop bit/2 stop bits.
  - SP1-6, Front/Rear—7-bit data/8-bit data.
  - SP1-7, Front—Space parity, 7-bit only.
  - SP1-8, Front—Space parity, 7-bit only.

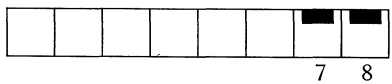
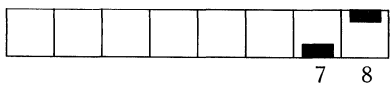
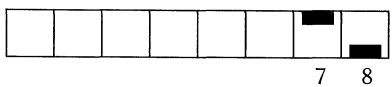
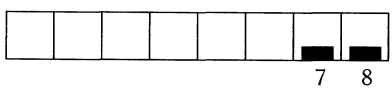
Baud Rate Select Switches (SP1-1, SP1-2, SP1-3,) These switches select the speed at which the printer transmits and receives data from the host processor. The LQP03 is factory set for 4800 baud.

Table 11-1 ▪ Baud Rate Select Switches SP1-1, SP1-2, SP1-3

Baud Rate Bits-per-Second	Baud Rate Select Switch Positions
110	
200	
300	
600	
1200	
2400	
4800	
9600	

Parity Enable Switches (SP1-7 and SP1-8) These two switches select the parity mode.

Table 11-2 ▪ Parity Enable Switches SP1-7, SP1-8

Parity Mode	Switch Position	Bit
Odd		7 or 8
Even		7 or 8
Mark		7 only
Space		7 only

Remaining SP1 Switches Table 11-3 names the remaining SP1 switches and explains their function, and the meaning of front and rear position settings. Refer also to Figure 11-7.

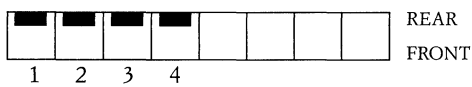
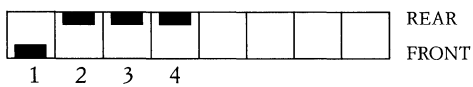
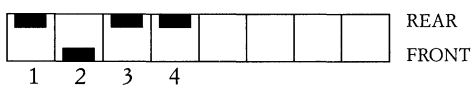
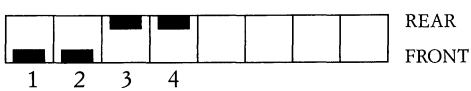
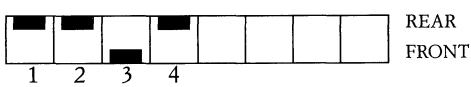
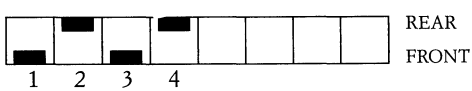
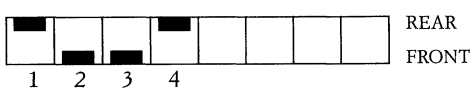
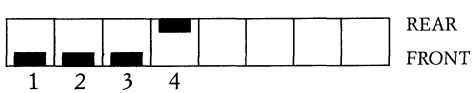
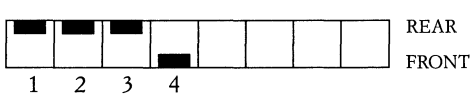
Table 11-3 ▪ Other SP1 Switches

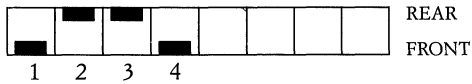
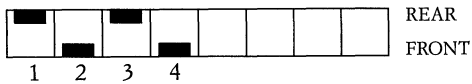
Switch	Function	Front Position	Rear Position
Self-test (SP1-4)	Selects the printer self-tests operation.	Enables form feed switch to start electronic and mechanical tests of printer operation	Disables
Stop Bit (SP1-5)	Selects either one or two stop-bits for data transmission.	One stop bit	Two stop bits
Data Length (SP1-6)	Selects 7- or 8-bit data length.	7-bit data	8-bit data

- SWITCH PACK 2 (SP2)

Switch Pack 2 also contains eight switches. SP2 switches 1, 2, 3 and 4 select the desired printwheel language code. Switches 5,6,and 7 are not used. Switch SP2-8 selects the identifier which the printer uses when communicating with the host computer. The LQP03 is factory set to identify itself as an LQP02 printer to allow compatibility with existing software. Front position identifies the LQP02; rear position identifies the LQP03.

Table 11-4 • Language Code Switches SP2-1, SP2-2, SP2-3, SP2-4

Language	Switch Positions
US/ASCII	
Finnish	
French	
French Canadian	
German	
Italian	
Japanese	
Norwegian/ Danish	
Spanish	

Language	Switch Positions
Swedish	
English/ United Kingdom	

▪ Programming Information

The LQP03, like Digital's other receive-only printers, uses escape sequences that were standardized by the American National Standards Institute (ANSI) to control many of its features. Within the extensions permitted by the ANSI system, additional escape sequences have been defined for the LQP03 features lacking an ANSI standard.

Following the brief description of each escape sequence feature will be the summary of the actual escape sequence required. Detailed information on all LQP03 escape sequences can be found in the *LQP03 Printer Programmer's Reference Manual* (EK-LQP03-RM).

Escape Sequences

Some frequently used escape sequences are outlined below. **Note:** In this section, VAI stands for vertical advance increment and one VAI equals 1/48 of an inch. HAI stands for horizontal advance increment, and one HAI is equal to 1/120 of an inch.

Table 11-5 ▪ Common LQP03 Escape Sequences

Name	Function	Escape Sequence
Printer Initialization	Resets printer to default settings.	ESC c
Set Proportional Spacing	Sets proportional spacing.	ESC [? 27 h
Clear Proportional Spacing	Resets fixed horizontal spacing between characters.	ESC [? 27 l
Set Proportional Mode Space Size	Sets the horizontal increment for proportional mode. Pn must be between 6 and 768, inclusive.	ESC [pn ! y

Name	Function	Escape Sequence
Perform Next Line Forward	Advances paper to next line.	ESC E
Enter Right Margin Wrap Mode	Set right margin wrap mode.	ESC [? 7 h
Exit Right Margin Wrap Mode	Clear right margin wrap mode.	ESC [? 7 l
Enter New Line Mode	Set new line mode.	ESC [20 h
Exit New Line Mode	Reset new line mode.	ESC [20 l
Set Horizontal Tab at Selective Columns	Pn equals the column number. Pn $\leqq$ 165 (HAI units).	ESC [Pn_1 ; ... ; Pn_{16} u
Clearing Horizontal Tabs	Clears all horizontal tabs.	ESC [3 g
Set Vertical Tabs at Selective Lines	Pn equals the line numbers. Pn $\leqq$ 168 (VAI units).	ESC [Pn_1 ; ... ; Pn_{16} v
Clear Vertical Tabs	Clears all vertical tabs.	ESC [4 g
Setting Left and Right Margins	Pn_1 must be less than Pn_2.	ESC [Pn_1 ; Pn_2 s
Setting Top and Bottom Margins	Pn_1 must be less than Pn_2.	ESC [Pn_1 ; Pn_2 r
Character Enhancement—Underlining	Enables underline mode.	ESC [4 m
Character Enhancement—Shadow Printing	Enables shadow printing.	ESC [? 2 m
Clear Character Enhancement	Clears further underlining, bolding, and shadow printing.	ESC [0 m
Setting VAI and HAI to Numeric Parameters	Pn_v must be between 15 and 960, inclusive. Pn_h, must be between 6 and 768, inclusive.	ESC [Pn_v ; Pn_h SPACE G

▪ SETTING HAI AND VAI

You can also set HAI and VAI to selective parameters.

Table 11-6 ▪ Selecting HAI (ESC [Ps w)

HAI	Ps	Characters per Inch
12	Null	10
12	0	10
12	1	10
10	2	12
10	3	12
10	4	12
12	5	10
12	6	10
12	7	10
12	8	10
8	9	15

Table 11-7 ▪ Selecting VAI (ESC [Ps z)

VAI	Ps	Lines per Inch
8	Null	6
8	0	6
8	1	6
6	2	8
6	3	8
24	4	2
16	5	3
12	6	4

▪ COMMUNICATIONS PROTOCOLS

Communications protocols can also be established by using escape sequences. The Device Status Report (DSR) command is used by the host to request a

status report or to enable and disable unsolicited reporting. The DSR command is used by the printer to provide both brief and extended reports.

The escape sequence used is ESC [Ps ; ... ; Ps n

Table 11-8 ▪ Communications Protocols

Name	Function	Escape Sequence Ps Value
Set Status Communication Protocol	Send extended report.	5
	Disable all unsolicited reports.	? 1
	Enable brief unsolicited reports and send one extended report.	? 2
	Enable extended unsolicited reports and send one extended report.	? 3
Send Brief Status Report	Printer is ready; no malfunctions detected.	0
	Printer is not ready; a malfunction is detected.	3
Send Extended Status Reports	Printer is ready; no malfunction is detected.	? 20
	Printer is not ready; a malfunction is detected.	? 21
	Communications I/O error.	? 22
	Input buffer overflow.	? 23
	Pause active.	? 24
	Front access cover open.	? 26
	Paper out.	? 27
	Ribbon out.	? 28
	Attempted to downline-load the LQP03.	? 29
	Sheet feeder ready, no malfunction detected.	? 30
	Sheet feeder insert error.	? 32

• Maintenance

The LQP03 letter-quality printer does not require routine or preventive maintenance. However, in order to ensure proper operation of your LQP03 printer, keep the following items in mind.

- Keep printer away from sources of extreme temperature such as direct sunlight, room heaters, and air conditioners.
- Keep small objects and liquids away from your printer. If they fall inside, they will cause damage.
- Select the right paper for the job. Single-sheet bond paper usually gives the best print quality.
- Make sure that the paper is positioned properly, and that the thickness adjustment lever is in the correct position.
- Use only Digital-approved printwheels and ribbon cartridges in the printer. Other products may not provide the same high performance.
- Never scratch or crease ribbons.

Self-test Procedure

The LQP03 printer performs two self-tests. The logic self-test checks the electronic circuitry and is performed every time the printer is turned on. The printing self-test exercises the electromechanical mechanisms and is performed by following the procedure given below.

To initiate a self-test procedure:

1. If the LQPX3-FT Bidirectional Forms Tractor is installed on the printer, remove it. (Unplug the option cable and lift the forms tractor off the printer.)
2. If the LQPX3-SF single-tray sheet feeder is installed on the printer, load the paper tray with paper in the horizontal position (11 inches across).
3. If a paper handling option is not installed on the printer, insert one sheet of paper in the horizontal position (11 inches across).
4. Press the power switch off (0).
5. Open the front access cover.
6. Using a ballpoint pen, move the self-test configuration switch, SP1-4, toward the front of the printer.
7. Close the front access cover.
8. Press the power switch on (1). The printwheel spins, the carriage moves to the left margin, and the ATTEND and READY lights blink twice. The green READY light remains on.

   If any of these actions do not occur, refer to Table 11-9.

9. Press the form feed pushbutton. The READY and ATTEND lights flash twice. The green READY light remains on.
10. Press form feed again. The printer will begin printing the entire character set for the printwheel that is installed. If it does not, refer to the table on Interpreting Printer Symptoms in the installation manual.

    NOTE: The printer will continue printing until the power switch is pressed off (0). Printout should include at least one carriage return, one line feed, and all characters on printwheel.
11. Inspect the print quality of the printing self-test, noting criteria such as darkness, sharpness and completeness of characters, smudges or streaks, spacing, straightness and evenness of lines.
12. Press the power switch off (0).
13. Using a ballpoint pen, turn the self-test configuration switch, SP1-4, toward the rear of the printer.

If the printer passes the self-test, you're all set to go. If it doesn't, refer to the next section.

Operator Troubleshooting Checklist

If your printer is not operating, chances are the problem is minor and you can correct it yourself. Listed below are some of the common problems, their probable cause, and the corrective action that you can take. **Note:** Always turn off the printer before you attempt to correct a problem.

Printer doesn't respond when power is turned on.

- Power cord not connected. Check power cord connections.
- Power source fault. Check power at wall outlet.
- Fuse blown. Replace fuse.

Some characters improperly spaced or positioned.

- Damaged printwheel. Replace printwheel.
- Printwheel not fully seated. Reinstall printwheel making sure it is all the way down.

Characters too close together or too far apart.

- Wrong printwheel or system pitch setting. Change printwheel or system pitch setting.

Characters not consistently dark or sharp.

- Worn or dried out fabric ribbon. Replace ribbon cartridge.
- Dirty printwheel. Clean printwheel.
- Worn printwheel. Replace printwheel.
- Ink or carbon not adhering to coated or highly textured paper. Use uncoated or less textured paper.

Parts of characters missing.

- Scratched Multi-Strike film ribbon. Advance ribbon to unscratched area or replace cartridge.
- Worn or dried out fabric ribbon. Replace cartridge.
- Damaged printwheel character. Replace printwheel.
- Tab not in square hole of printwheel. Reinstall printwheel.
- Ink or carbon not adhering to coated or highly textured paper. Use uncoated or less textured paper.

Ribbon jams or breaks.

- Improperly installed ribbon. Reinstall ribbon cartridge. Check printout for loss of characters.
- Rewind knob turned in wrong direction during installation. Reinstall ribbon cartridge turning knob in proper direction as marked on cartridge. Check printout for loss of characters.

Perforated paper.

- Incorrectly set paper thickness lever, exceeding the maximum of four sheets. Reduce the number of sheets.

Paper jams.

- Paper path blocked. Clear path.

Ink on back of paper.

- Dirty platen. Clean platen.

Table 11-9 ▪ Interpreting Front Panel Lights

Attend (Yellow)	Ready (Green)	Cause	Remedy
On	Flashing	Front access cover open.	Close access cover.
		Ribbon cartridge not seated.	Snap cartridge into place.
		Spent film ribbon cartridge.	Replace cartridge.
		Paper out of forms tractor or sheet feeder.	Reload paper.
Off	Flashing	Printer has paused.	Press Pause/Resume pushbutton.
On	Off	Electronic or mechanical malfunction.	Perform self-test.
Off	Off	No power.	Check power cord connections. Check power at wall outlet. Replace fuse.

▪ Additional Documentation

The following documents contain more detailed information about the LQP03 letter-quality printer.

- *Installing and Using the LQP03 Printer* (EK-LQP03-UG)—Tells you how to install, use, maintain, troubleshoot, and configure the LQP03.
- *LQP03 Printer Programmer Reference Manual* (EK-LQP03-RM)—Describes the software commands that the host computer uses to control the printer. It provides detailed information on the LQP03's features: communications, printer configurations, text mode character processing, escape and control sequences, and graphics mode.
- *LQP03 Printer Pocket Service Guide* (EK-LQP03-PS)—Guides personnel with some technical background in performing servicing at the Field Replaceable Unit level.
- *LQP03 Printer Technical Manual* (EK-LQP03-TM)—Guides trained personnel, with the necessary equipment, in performing servicing at the component level.

Also of interest are

- *PDP-11* and *VAX Systems & Options Catalogs*—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These customer documents are designed to help you select the right Digital product. European versions are also available.
- *LQP03 Letter-Quality Printer* information sheet (EA30088 54)—Provides you with a brief overview of printer features and specifications. It includes color photographs of the printer and printing samples.

  If you require information not contained in these documents, contact your local Digital representative.

• Specifications

Performance Characteristics

Printing speed	25 char/s (Shannon text at 10 char/in) 34 char/s (triple-A text at 12 char/in)
Paper Feed	Friction feed (standard); adjustable cutsheet feeder (optional); bidirectional forms tractor (optional).
Cutsheet Paper Size	U.S.: 21.6 by 27.9 cm (8.5 by 11 in); A4: 21.1 by 29.7 cm (8.3 by 11.7 in); both in vertical and horizontal orientation; 16–24 lb Bond.

Type Characteristics

Character Sets	ASCII, English/U.K., French, French-Canadian, German, Italian, Spanish, Swedish, Finnish, Norwegian/Danish, JIS Roman, Multinational.
Character Pitches	Printwheels available in 10, 12, and 15 pitches
Maximum Print Columns	110 at 10 pitch; 132 at 12 pitch; 165 at 15 pitch
Margins	Left, right, top, and bottom
Tabs	256 contiguous horizontal; 168 contiguous vertical
Character Code	7-bit and 8-bit ASCII, switch-selectable
Horizontal Pitch	Variable pitch, software-selectable

Vertical Pitch	Variable pitch, software-selectable
Horizontal Resolution	120 increments per inch
Lines per Inch	Variable, includes proportional spacing (6-line-per-inch default)
Characters per Inch	Variable (10 char/in default)

Communications

Baud rates	110, 150, 300, 600, 1200, 2400, 4800, 9600
Data interface	Serial, EIA RS232C, standard
Parity	Odd, even, none, mark, or space, switch-selectable
Transmission Rates	Full-duplex, from 110 to 9600 baud (bits per second)
Buffer Capacity	256 characters
Buffer Control	XON/XOFF
Cable Length	1.9 m (6.3 ft), standard 14-3, 125 V, 15 A

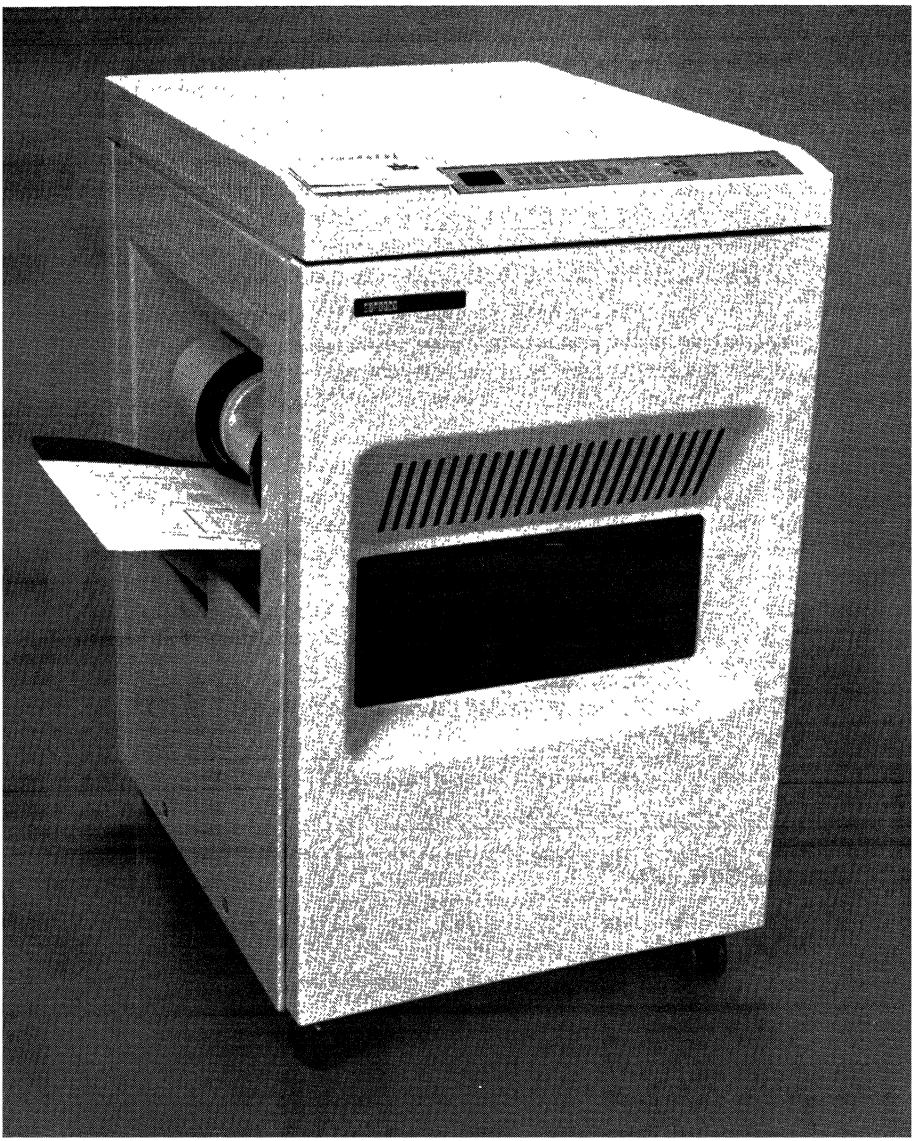
Power Requirements

Voltage/ Frequency	90-132 V, 57 to 63 Hz; 180-264 V, 47 to 53 Hz
Line Current	14 A, maximum starting current; 1 A, nominal operating current
Power Consumption	Less than 100 W, average RMS
Breaker Capacity	15 A
Heat Dissipation	410 Btu/h, nominal operation
Regulatory Approval	Approved by the UL, CSA, FCC, VDE, and BPO

Operating Environment	
Temperature	10 to 40°C (50 to 104°F)
Relative Humidity	10 to 90%

Physical Characteristics	
Width	52.7 cm (20.75 in)
Depth	38.7 cm (15.25 in)
Height	19.7 cm (7.75 in)
Weight	12.7 kg (28 lb)

Chapter 12 ▪ LN01 Family of Laser Page Printers



▪ Overview

The LN01 Family of Laser Printers are nonimpact page printers ideal for applications where print quality and graphics are important. Using electrophotographic technology, the LN01 prints one page at a time, up to a maximum of 12 pages per minute. The printing resolution of 300 by 300 dots per inch produces perfectly formed characters of even density and size. The LN01 printers are at home in environments that demand high-quality documents quickly and conveniently. Letters, memos, reports, and presentations can benefit from the LN01's ability to produce very high quality output in a variety of typestyles and graphics when combined with optional VAX/VMS font software. There are two models of the LN01 printer available—the LN01B and the LN01S.

The LN01B fits in a variety of commercial applications. Business or technical environments that demand high-quality presentations, reports, and proposals can benefit from the LN01B's ability to include a page of ReGIS graphics with high-quality multifont text. CAD/CAM environments using Calcomp plotter-type graphics can use the LN01B to output high-quality graphics.

The LN01S can work as a hardcopy upgrade to a VAX workstation or a multiuser CAD group where Tektronix 4010 or 4014 is being used as the graphics protocol and can combine both multiple-font text and graphics on a single page. One centrally located LN01 can handle the top-quality output needs of a whole department.

Digital's family of nonimpact printers are quiet—there are no noisy paper feed mechanisms or striking hammers. Since nonimpact printers use regular cutsheet paper and standard paper shapes and sizes, they save money. Because image resolution is high, the LN01 prints a sharp, clear character. The following laser printers are available.

- *LN01S-CA*—LN01 with Tektronix 4010/4014 emulation, full bitmap graphics. 120V/60 Hz, LP11 interface, 30 ft. cable
- *LN01S-DA*—Same unit as LN01S-CA but with 120V/60 Hz, DMF32 interface, 30 ft. cable
- *LN01B-CA*—LN01 with PLOTLN software, ReGIS and Calcomp graphics, 120V/60 Hz, LP11 interface, 30 ft. cable
- *LN01B-CB*—Same unit as LN01B-CA with 220/240V/50 Hz, LP11 interface, 30 ft. cable
- *LN01B-DA*—Unit with 120V/60 Hz, DMF32 compatible machine (DMF32 not included), 30 ft cable

- *LN01B-DB*—Same unit with 220/240V/50 Hz, DMF32 compatible machine (DMF32 not included), 30 ft cable

- *QA778-xx*—PLOTLN software and fonts, with documentation and US EPROMs. Can be purchased for LN01S.

Major Features

The basic LN01 Family features include:

- Printing speed of 12 pages per minute—Gives you fast printing to increase your operation's efficiency.

- 300 by 300 dots per inch character formation—Produces high-quality characters of even density and alignment.

- Runs on VAX and UNIBUS PDP-11 systems—Offers you compatibility with Digital systems running the RSX-11M, RSX-11M-PLUS, RSTS//E, and VMS operating systems.

- Cutsheet, plain paper (standard, legal, and A4 sizes)—For savings and convenience.

- Two 250-sheet input trays, program selectable or automatic—Providing the user with increased flexibility.

- Variable fonts, two resident fonts (portrait and landscape), and downline loadable user fonts.

- Output in portrait or landscape mode—Lets you print vertically or horizontally without changing your program.

- 50 and 60 Hz models—To meet your power configuration needs.

- Digital-standard escape sequences—Enables you to easily change margins and tabs, as well as other parameters.

- Built-in self-test features and status codes—Helps you pinpoint problems and maintain uptime.

LN01S Features

When the application calls for top-quality text plus full bit map graphics, you need the LN01S–Digital's high performance laser printer. The LN01S comes with 12 resident fonts, an external controller, full bit map graphics and Tektronix emulation.

LN01S Unique Features

- Tektronix 4010/4014 Emulation
- 12 Resident Fonts
- 1.4 MEGA BYTE Bit Map Memory
- 512 K BYTE Font/page Memory

The LN01S laser printer has an external bit-map graphics controller with 1.4 Mbyte bit-map page memory. The page memory can store a full page of both text and graphics, so you can print complex pages and still maintain the 12-page-per-minute print speed. The Tektronix 4010/4014 interpreter in the controller offloads the host CPU from graphics output processing to give you better performance. If you're using Tektronix applications software, the LN01S gives you the hardcopy you need. There are 12 resident fonts in the controller of the LN01S. Eight of these are Courier-like typefaces, two are scientific, and two are Tektronix. To take advantage of Digital's extensive font library, there's also 512 Kbyte RAM for downline font loading. The firmware portion of the LN01S is operating system-independent. This means that PDP-11 and DECsystem 10/20 users can change fonts using any of the 12 LN01S resident font choices and receive output from Tektronix 4010/4014 files. In a VAX/VMS environment, the LN01S takes advantage of Digital's LN01 font library and the capabilities of the LN01 Font Utility software. Since the LN01S has 512 Kbyte RAM, you can load up to 96 fonts at one time.

- *LN01 Font Utility*

High-quality laser printer output requires a large variety of typefaces, sizes and weights. The LN01 Soft Font Library is intended to satisfy that requirment. The LN01 Soft Font Library is usable either via VAX-11 DECpage or the LN01 Font Utility. While a customer programmer can directly utilize the LN01 Soft Font Library, the use of the LN01 Font Utility is strongly recommended. The LN01 Font Utility is a VAX/VMS layered product which is designed to aid in the management, development and usage of fonts for the LN01 Laser Printer on VAX/VMS system configurations.

▪ LN01B Features

Digital's LN01B delivers multi-font text plus Base ReGIS and Fortran callable Calcomp graphics.

LN01B Unique Features

- PLOTLN VMS Software and EPROMS
- Calcomp and Base ReGIS Translation
- 16 Courier Fonts for Labeling Graphics Figures

The LN01B is not a bit-map laser printer, but the PLOTLN software enables the LN01B to print a page of ReGIS and Calcomp graphics. Complex pages of text and graphics are better handled by a bit-map laser printer. PLOTLN is a VMS-based programming tool for printing images on the LN01B. It includes a library of FORTRAN sub-routines that can be called from any programming language supporting VMS calling conventions. These sub-routines directly produce graphics on the LN01B from programs you've written and developed. And these subroutines have the same format as those commonly used with Calcomp plotters. So existing software that uses standard Calcomp subroutines calls can produce output on the LN01B through the /PENPLOT option within PLOTLN. The LN01B can also print Base ReGIS graphics. PLOTLN included a ReGIS interface, which converts a Base ReGIS command file for printing on the LN01. The ReGIS option of the PLOTLN command verb lets you specify the location, size, and orientation of the graphic image on the page. The image is automatically enlarged or reduced to fill the location you have defined so you can manipulate its size and aspect ratio. There are 16 fonts in PLOTLN. All of these are Courier typefaces used to label graphics figures.

- *PLOTLN*
  - Library of FORTRAN Callable-Calcomp format subroutines
  - A ReGIS interface
  - Base ReGIS and CALCOMP translation to LN01 graphic characters
  - Viewpointing
  - Integration of text and graphics
  - Metafile facility
  - Text fonts in four orientations

▪ Printing Features

The LN01's laser printing process is relatively simple. The LN01 has a conductive drum that is uniformly charged. The charge is removed by the laser from all areas that are not needed for the page's image. This leaves a latent charge image on the drum. This latent image attracts a dry ink substance that is subsequently transferred to the paper. A thermal process fixes the image, making it permanent.

Print Resolution

YOU ARE LOOKING AT A REPRODUCED PRINT SAMPLE FROM DIGITAL'S LN01 LASER PRINTER.

THE LN01 ADVANTAGES INCLUDE:

- PREMIUM QUALITY PRINT AT 300 X 300 DOTS PER INCH
- QUIET OPERATION
- MAXIMUM OF 12 PAGES PER MINUTE
- JUSTIFIED MARGINS
- LANDSCAPE AND PORTRAIT PRINTING
- REGULAR AND BOND PAPER

Figure 12-1 ▪ LN01 Print Sample

The LN01 has a printing resolution of 300 dots per inch both horizontally and vertically. Minimum print area and positional resolution are important factors to consider. The minimum print area requirements are:

- Black dot—minimum of two-pixel by two-pixel array
- White dot—minimum of two-pixel by one-pixel array
- Black line—minimum width of two pixels
- White line—minimum width of one pixel

With positional resolution, characters (bit maps invoked with a single code) will be placed on even pixel positions in the scan direction (long edge of the paper). The positional resolution for characters is therefore 150 dots per inch in the scan direction and 300 dots per inch in the other. Dots within a character are always 300 dots per inch. The LN01 rounds odd-numbered positions to the next lower even number.

▪ Paper

Whether your application requires vertical (portrait) or horizontal (landscape) printing, color paper, or a range of paper stocks between 16 to 24 pounds, the LN01 laser printer can do it. It can even print up to 132 columns of standard lineprinter output in landscape mode on 21.6 by 29.9 centimeter (8.5 by 11 inch) paper.

Cutsheet paper is fed into the machine from two cassettes, each holding up to 250 sheets. You can select from three sizes of trays: standard, 21.6 by 27.9-centimeters (8.5 by 11-inches); legal, 21.6 by 35.6-centimeters (8.5 by 14-inches); or European, 21 by 29.7-centimeters (8.3 by 11.7-inches).

The output stacker holds approximately 500 sheets of paper and accommodates paper ranging from 16 to 24 pounds. When the output stacker is full, printing stops and a C4 status code appears. Printing restarts automatically when you empty the output stacker.

Best results are achieved by using 20-pound ordinary cutsheet paper. Digital LN01X-AB, 21.6 by 29.9-centimeter (8.5 by 11-inch) paper and Digital LN01X-AD, 21 by 29.7-centimeter (8.3 by 11.7-inch) paper, LN01X-AC, 21.6 by 35.6-centimeter (8.5 by 14-inch) paper, or their equivalents yield optimal results. Digital does not recommend the use of gummed labels or transparency stock.

▪ Options

The following options are available for the LN01 family of laser printers. (See also upgrade models in Overview section.)

LN01-AA—Parallel long lines for LN01B

LN01S-LF—Parallel long lines for LN01S

LN01K-LS—Serial RS232 remote lines for LN01B

LN01S-LH—Serial RS232 remote lines for LN01S.

LN100-KA—Optional controller upgrades for LN01B to LN01S.

▪ Accessories and Supplies

The following accessories, supplies, components, and spares are available for the LN01 Page Printer. Check with your sales representative for the latest information.

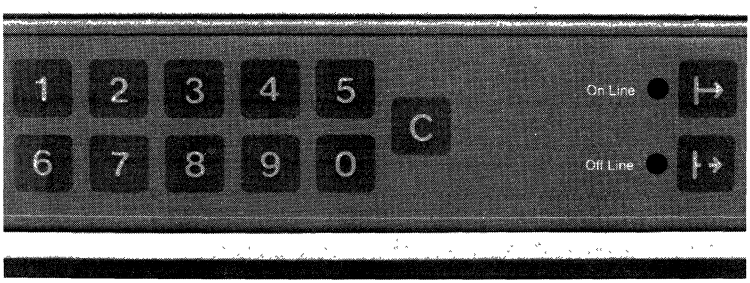
Accessories

Part Number	Description
LN01X-AA	Toner, case of four bottles (enough for 20,000 copies)

Supplies

Part Number	Description
LN01X-AE	21.6 cm × 27.9 cm (8.5 in × 11 in) paper tray
LN01X-AF	21.6 cm × 35.6 cm (8.5 in × 14 in) paper tray
LN01X-AH	A-4 21.1 cm × 29.7 cm (8.3 in × 11.7 in) paper tray

▪ Controls and Indicators



The LN01 LED display gives you status information about the printer's operation, such as if the printer is out of paper or if there is a paper jam.

The front panel of the LN01 contains a numeric keypad, four control buttons, several status indicators, and a variety of control switches.

- *Online Button*
  Selects the on-line mode, illuminates the on-line indicator, and extinguishes the off-line indicator.

- *Offline Button*
  Selects the off-line mode, illuminates the off-line indicator, and extinguishes the on-line indicator.

- *Test Button*
  Allows off-line Image Output Terminal (IOT) diagnostics and Electronic Subsystem (ESS), a printer controller, tests to be run by service personnel.

- *Status Display*
  A two-digit alphanumeric seven-element LED display that represents operational status information. See the *Operator Troubleshooting* section of this chapter for more information on common displays and their meanings.

- *Online Indicator*
  The LN01 is on-line when this indicator is illuminated with no error conditions displayed (flashing display, normal error code, or DC).

- *Offline Indicator*
  When illuminated, this means the printer is off-line.

- *Power Supply Indicator*
  When illuminated, this means the power supply is functioning properly. The front door must be opened to see this indicator.

- *Page Counter*
  A digital meter, which counts each sheet of paper that enters the paper path, is installed inside the front cover.

- *Power On//Off*
  A two-position switch located behind the front cover allows the operator to engage and disengage machine power.

▪ Operation

The LN01 laser printer consists of two basic elements: an LN01 marking engine (also referred to as the Image Output Terminal—IOT) and an LN01 laser printer controller (also known as the Electronic Subsystem or ESS), integrated into a single unit.

The printer mechanism removes individual sheets of paper from a tray, transports the sheets via its paperpath to the printing engine, then deposits the printed sheet into the receiving bin. Printing is accomplished by using a laser electrophotography process within the IOT. The IOT uses a drum whose surface has an electrosensitive material being capacitivity charged by the process of ionization. The charge is removed by the impingement of the modulated laser light. The removal of the charge results in a latent image impressed on the drum surface. The inking or toning medium is attracted to these areas of retained charge, adhere to the drum, and thus produce the pattern or image that is subsequently transferred to a sheet of paper.

The paper path then carries the printed sheet through a thermal operation that makes the deposited image permanent.

▪ Special Nonprinting ASCII Control Codes

The LN01 uses the following special, nonprinting ASCII control codes. More detailed information can be found in the *LN01 Programmers Reference Manual.*

Horizontal Tab
The horizontal tab character advances the active position to the next horizontal stop that is greater than the current active position but no greater than the right margin.

Linefeed
The linefeed character increments the active line, and causes the active column to be moved to the left margin. When the active line is incremented past the bottom margin, it sets the active line to the top margin of the next page.

Vertical Tab
The vertical tab character advances the active line to the next vertical tab stop that is greater than the current active line. If the bottom margin is exceeded, the active line is set to the top line of the next page. The active column is not changed.

Form Feed
The form feed character advances the active line to the top margin of the next page and sets the active position to the first character position of the first line. This causes the current page buffer to be printed.

Carriage Return
The carriage return character causes the active column to be moved to the left margin.

Space
The space character can be considered either a control character or a printable character. Its width is determined by the font set selected.

Cancel
The cancel character indicates that the escape sequence is wrong and should be disregarded, and causes immediate sequence termination. Subsequent characters are not interpreted as part of the control or escape sequence and are processed normally.

Substitute
The substitute character is used to indicate replacement of a character that could not be represented, and causes immediate sequence termination. The SUB character and subsequent characters are not interpreted as part of a control or escape sequence and are processed normally.

Escape
The escape characters are available to user-developed software for font assignment and invocation and to reset the printer to its initial state (RIS).

▪ Maintenance

The LN01 Laser Printer has built-in self-test features for self-diagnosis. The status code indicator is prominently displayed on the front of the LN01. These status codes let you know if you need to:

- check paper cassettes, handles, or paths
- wait while fonts are being loaded, or the print engine is warming up
- add paper or dry imager or
- determine if an electronic failure has occurred

An operator card, like the one found on many of today's office copiers, details how to turn on the power, set-up the printer, and add paper, and what the control panel indicators mean. With the LN01 Laser Printer, there are no bands or ribbons to change—or to wear out.

The moisture content of your paper can affect the smooth operation of the LN01. If the moisture content of your paper is less than six percent, the LN01 will operate properly. Moisture content above six percent can cause paper jams and changes in print uniformity. If you live in an area where high humidity is common, Digital recommends that you remove the paper from the LN01 at the end of the workday and store the paper in a dry environment or that you purchase an optional paper tray heater. Both methods will prevent the paper from absorbing excess moisture.

Page Count Meter

The page count meter counts every page delivered to the output tray. This meter indicates to service personnel when certain print-volume-dependent maintenance actions are necessary. It is also available for billing purposes if you wish to charge the cost of operation to different groups within your department or organization.

Control Panel

The control panel display is clearly visible and displays any abnormal condition, which helps you minimize unnecessary service calls. It also aids service personnel in isolating and repairing faults.

Simple Offline Diagnostics

When the LN01 is powered on without the TEST button depressed, the technical representative can run a simple diagnostic that prints ruled paper. By looking at the output, your service representative can detect faults.

Power-On Diagnostics

When system power is turned on, the LN01 laser printer automatically enters the power-on state of its Online Mode. At that time, self-diagnosing programs are automatically executed to verify the integrity of the LN01 ESS's microprocessors, memory, and IOT interfaces. Successful execution of these diagnostics allows the LN01 printer to advance to its ready-to-print state, once the system achieves proper operating temperature. A summary sheet is then generated. If a failure is detected, the LN01 ESS posts a failure code on the Control Panel Status Display if the failure does not prevent it from doing so.

ESS/IOT Tests

You or your service representative can request the running of on-line tests that exercise all components of the printer. When ESS and IOT tests are active the LN01 does not respond to the host computer. These tests are performed on-line. When on-line tests are being performed, the host computer receives no reply if it tries to communicate with the LN01. The ESS/IOT tests use the LN01's page composition and dynamic font RAM storage. Starting an on-line test aborts any work in progress and requires the reloading of dynamic RAM fonts.The ESS/IOT test includes calibration and character registration adjustment proof and all black and white page generation. The character proof pages are printed in the landscape ROM font.

Operator Troubleshooting Checklist

The printer does not operate.

- Check that the printer is plugged into the wall outlet. If not, plug it in.
- Check that the power switch is in the ON position.—Turn the printer on. Check if the power supply lamp is working.
- Check that the front door is closed.—Close it.
- Verify that the printer is in ONLINE mode.—Place it on-line.
- Check if the status code is visible.—Refer to the Status Code Flip cards on the front of the printer for corrective action.

Print is too light.

- Check dry imager.—Fill if necessary.
- If applicable, turn the Dry Imager Control Knob to the right to the "Darker" position.

Print is too dark.

- If applicable, turn the Dry Imager Control Knob to the left to the "Lighter" position.

Printed information is slanted or skewed.

- Check the paper cassette trays.—Remove and make sure that paper is properly loaded.

Printed copy does not arrive in the output tray.

- Check the control panel to see if a status code is visible. Compare it against the list below. Paper cassette handle disengaged Out of paper

Paper jam: input jam Paper jam: paper failed to reach the exit switch Paper jam: paper failed to leave the exit switch Front door open Output tray full Add toner Wait: warm-up Font loading in progressA flashing code—C3, C4, E2, E3, E4, and E5—indicates that operator intervention is necessary.

Additional Documentation

The following documents contain more detailed information about the LN01 laser printer. These documents are chargeable, and may be ordered directly from the Accessories & Supplies Group in Nashua, New Hampshire. In the United States, call 800-258-1710 to place your order and get pricing and quantity discount information.

- *LN01 Laser Printer Operator Guide* (EK-LN01S-OP)—Provides you with information about the operation and care of your LN01 laser printer and with procedures for you to refer to in addition to the flip cards, labels, and diagrams located on the LN01.
- *LN01 Laser Printer Installation Guide* (EK-LN01S-IN)—Contains information for installing and operating the LN01.
- *LN01 Programmers Reference Manual* (EK-LN01S-RM)—Contains information that will allow you to use the LN01's flexibility by loading and creating various fonts and images.

The documents listed below are free and can be ordered from:

Digital Equipment Corporation

Publishing and Circulation Services

10 Forbes Road

Northboro, Massachusetts 01532

- *PDP-11* and *VAX Systems & Options Catalog*—Provide you with the most accurate and up-to-date information on current PDP-11 and VAX systems, options, and software products. These customer documents help you select the right Digital product. European versions are also available.

If you require information not contained in these documents, contact your local Digital representative, dealer, or distributor.

▪ Specifications

Performance

Printing speed	Up to 12 (21.6 × 29.9 cm or 8.5 × 11 in) pages per minute
Recommended print volume	15,000 pages per month (approximately 750 pages per day)
Paper feed	Two nonadjustable cassettes of standard 21.6 × 29.9 cm paper (8.5 × 11in), 21 × 29.7 cm (8.3 × 11.7 in) for European versions, holding up to 250 sheets per cassette (16 to 24 lb paper)
Paper sizes	
Standard	21.6 cm × 29.9 cm(8.5 in × 11 in)
Legal	21.6 cm × 35.6 (8.5 in × 14 in)
European	21 cm by 29.7 cm (8.3 in × 11.7 in)

Type Characteristics

Character sets	Two fixed-space fonts, one portrait and one landscape, each with 188 characters
Resolution	300 by 300 dots per inch (horizontal and vertical)
Print columns	Up to 132 columns of standard lineprinter output on 21.6 × 29.9 cm paper (8.5 × 11 in paper)
Lines per inch	6/8 U.S. and European
Print mode	Simplex printing (printing on one side only)

Communications

Interfaces	LP11
Cable length	9.1 m (30 ft), standard, up 15.2 m (50 ft) maximum
Power cord length	2.7 m (9 ft)

Power Requirements

Power consumption	1,150 W
Heat dissipation	3,930 Btu/hr, printing 1,380 Btu/hr, standby
Voltage frequency	120 volts at 60 Hz; 220/240 volts at 50 Hz

Physical Characteristics

Height	91.4 cm (36 in)
Width	65.5 cm (25.8 in)
Depth	66 cm (26 in)
Weight	136 kg (300 lb)

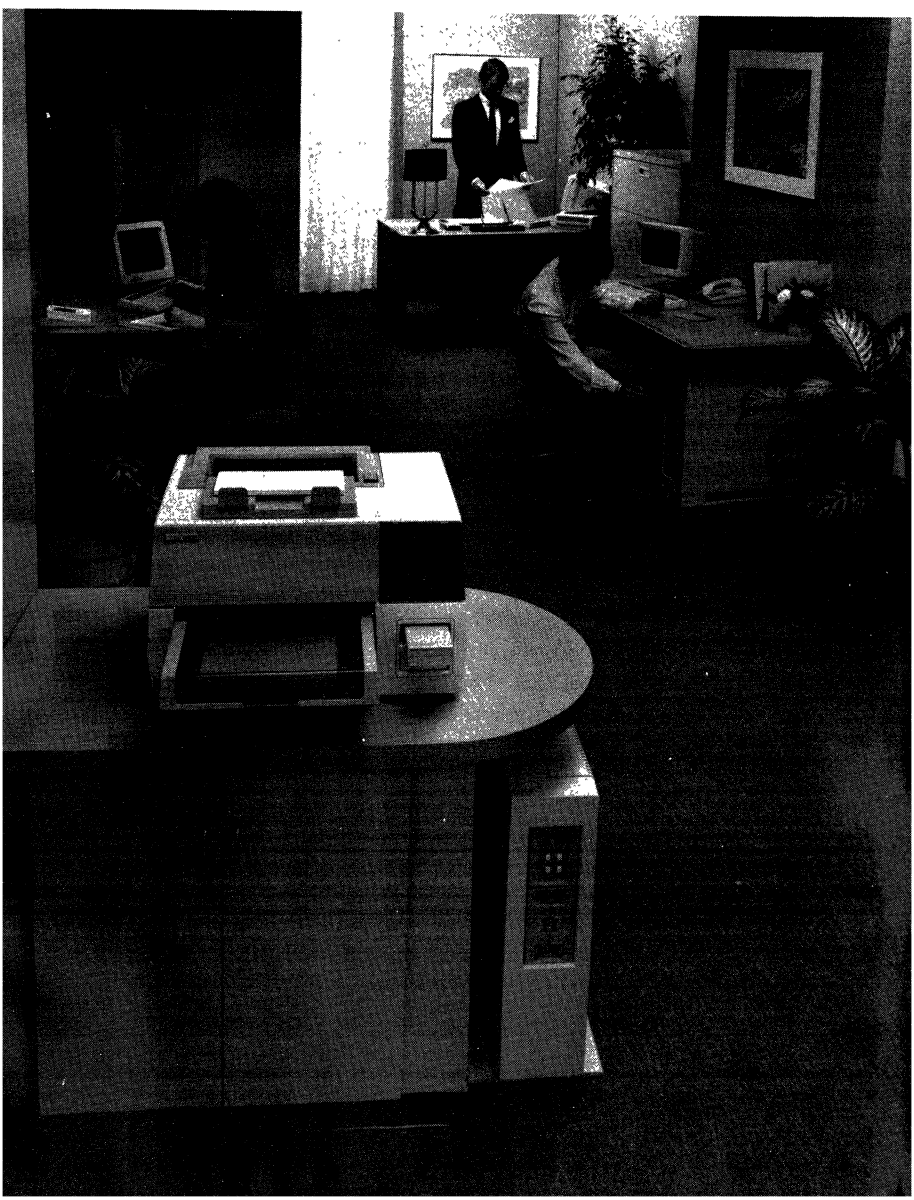
Operating Environment

Temperature range	10°C to 32°C (50°F to 90°F)
Storage temperature	-29°C to 43°C (-20°F to 110°F)
Relative humidity	20% to 80%
Dewpoint temperature	20°C (36°F)
Wet-bulb temperature	25°C (77°F)
Operating altitude	2 km (6,336 ft)
Noise level	Less than 55 dB

Regulatory Compliance

CSA, FCC, ISO, IEC, VDE, UL, BRH

Chapter 13 ▪ LN03/LN03 PLUS Desktop Laser Printers



▪ Overview

LN03

The LN03 is a tabletop, nonimpact page printer that uses laser imaging and xerographic printing techniques. The LN03 laser printer is ideal in both single user and small multiuser system (for example, MicroPDP-11) environments. The LN03 prints at a rate of eight pages per minute (text only), offering outstanding print quality at 300 by 300 dots per inch. This speed and quality is complemented by advanced paper handling features—250-page cut-sheet input cassette with 250-sheet sequenced output capacity, 16-24 pound paper weight range, and the ability to print on transparencies.

The LN03 has an RS232 serial interface included in the base unit that allows easy connection to Digital systems for text printing, and graphics via the sixel standard protocol. The LN03 can be connected to Digital computer systems in stand-alone, multiuser, and clustered system configurations. In addition, the LN03 is compatible with the LA100 and LQP02 printers so users have immediate access to the wealth of existing software that supports these printers.

LN03 PLUS

The LN03 PLUS offers all the features of the LN03 laser printer plus full-page bit-map graphics with outstanding font capabilities. With the LN03 PLUS you get typesetlike text and business graphics, as well as technical and scientific graphics, and vector graphics. Connect the LN03 PLUS to a CAD/CAM workstation or graphics terminal and you can print graphics quickly with full 300-by-300 dot-per-inch density. Because the LN03 PLUS is also compatible with applications developed under the Tektronix 4010/4014 protocol, you can use it to print with virtually any Tektronix 4010/4014 graphics package.

The enhanced capabilities of the LN03 PLUS are added to the standard LN03 through the installation of an upgrade board. This board is included with the LN03 PLUS , and can be added to installed LN03s as a field upgrade. This board enables the LN03 PLUS to print full bit-map, sixel (to ReGIS), and Tektronix 4010/4014 graphics.

Both the LN03 and LN03 PLUS print in portrait and landscape modes. In landscape mode, characters print parallel to the long edge of the paper. In portrait mode, the characters are printed parallel to the short edge of the paper. Because both models have 16 resident fonts in the Courier and Elite typefaces, you can easily generate multifont documents. The LN03/LN03 PLUS can print up to 24 different fonts on each page.

Table 13-1 • LN03/LN03 PLUS Resident Fonts

Typeface/point size	Weight	Orientation
Courier 10 pt, 10 pitch	Regular	Portrait
Courier 10 pt, 10 pitch	Shadow Bold	Portrait
Courier 10 pt, 10 pitch	Regular	Landscape
Courier 10 pt, 10 pitch	Shadow Bold	Landscape
Elite 10 pt, 12 pitch	Regular	Portrait
Elite 10 pt, 12 pitch	Shadow Bold	Portrait
Elite 10 pt, 12 pitch	Regular	Landscape
Elite 10 pt, 12 pitch	Shadow Bold	Landscape
Courier 6.7 pt, 13.6 pitch	Regular	Portrait
Courier 6.7 pt, 13.6 pitch	Shadow Bold	Portrait
Courier 6.7 pt, 13.6 pitch	Regular	Landscape
Courier 6.7 pt, 13.6 pitch	Shadow Bold	Landscape
VT100 Line Drawing	Regular	Portrait
VT100 Line Drawing	Shadow Bold	Portrait
VT100 Line Drawing	Regular	Landscape
VT100 Line Drawing	Shadow Bold	Landscape

Precoded ROM cartridges containing three to seven fonts (depending on typeface and point size) can be plugged in to the LN03-PLUS to add new fonts. In addition to the ROM resident cartridge fonts, up to 31 other monospaced and proportional spaced fonts (based on memory limits) can be loaded from the host computer and stored in Random Access Memory (RAM). The front panel has two open slots for adding two cartridges—ROM for added fonts or RAM for added memory.

In addition to this outstanding font flexibility, the LN03 and LN03 PLUS also support 14 character sets that are resident or downline-loaded from the host. These include:

ASCII–Courier 10 pt, 10.13 pt, 6.7 pt,

Elite 10.12 pt

DEC Technical–Courier 10 pt, 10.13 pt, 6.7 pt,

Elite 10.12 pt

DEC Supplemental–Courier 10 pt, 10.13 pt, 6.7 pt,

Elite 10.12 pt

VT100 Line Drawing–Courier 10 pt, 10.13 pt, 6.7 pt,

Elite 10.12 pt

The LN03 can combine quality text with simple business graphics on the same page. With a software program such as DECpage, the printer can handle any business printing requirement from business letters, to forms, to company newsletters. The LN03 PLUS can handle full bit-map, scientific, and engineering graphics, including vector drawings.

10 POINT 10 PITCH COURIER

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLM
[!"#$%&'()*+,-./\:;<=>?@^_`]{012345

¡¢£¥§¤©ª«°±²³µ¶·¹º»¼½¿ÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÑÒ
ÓÔÕÖŒØÙÚÛÜŸßàáâãäåæçèéêëìíîïñòóôõöœøùúûüÿ

10 POINT 12 PITCH ELITE

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTU
[!"#$%&'()*+,-./\:;<=>?@^_`]{0123456789|~}

¡¢£¥§¤©ª«°±²³µ¶·¹º»¼½¿ÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÑÒ
ÓÔÕÖŒØÙÚÛÜŸßàáâãäåæçèéêëìíîïñòóôõöœøùúûüÿ

6.7 POINT 13.6 PITCH COURIER

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ
[!"#$%&'()*+,-./\:;<=>?@^_`]{0123456789|~}

¡¢£¥§¤©ª«°±²³µ¶·¹º»¼½¿ÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÑÒ
ÓÔÕÖŒØÙÚÛÜŸßàáâãäåæçèéêëìíîïñòóôõöœøùúûüÿ

VT100 LINE DRAWING SET

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789!"
,-./:;<=>?@[\]^ ◆▒␉␌␍␊°±␤␋┘┐┌└┼⎺⎻─⎼⎽├┤

TECHNICAL CHARACTER SETS

⎷┌─⌠⌡│⎡⎣⎤⎦⎛⎝⎞⎠⎨⎬⎲⎳╲╱⌐⌙⟩ ≤≠≥∫∴∝∞÷Δ∇ΦΓ∼≃Θ×
≡ΠΨΣ√ΩΞΥ⊂⊃∩∪∧∨¬αβχδεφγηιθκλν∂πψρστƒωξυζ

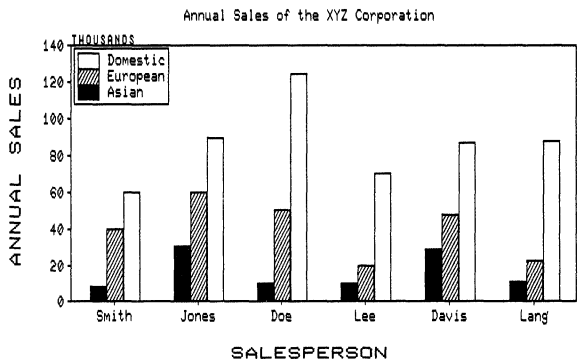
$$b(x)=\int_{\alpha}^{\infty} \varepsilon^{-\lambda\xi}\left(\sum_{K=\alpha}^{\infty}\frac{(\lambda\xi\zeta)^{K}}{K!}\right) b(x)dx$$

Figure 13-1 ▪ LN03 Print Samples

This self test demonstration was created on Digital's new LN03 Laser Printer, a product that will revolutionize the way you think about printers. The LN03 combines the speed of a line printer, the flexibility of a dot matrix printer and the quality of a daisywheel printer, all contained in one quiet unit.

SPEED: About 333 cps for a 2500 character document

FLEXIBILITY: Compound documents and multiple fonts



QUALITY: True letter quality - character density of 300 X 300 dots per inch

The LN03 brings this unique combination of features within reach of individuals and small groups of users, **in any part of the world.**

You will see for yourself why the LN03 is the desktop laser printer that all others will compare themselves to.

(50% of Actual Size)

Figure 13-2 ▪ LN03 PLUS Graphics Samples

The following models of the LN03 laser printer are available:

LN03-AA	LN03 Laser Printer, 120 V/50 Hz. Includes two toner cartridges, one OPC (organic photo receptor) cartridge, an AC power cord, one package letter-size paper, and documentation.
LN03-AB	LN03 Laser Printer, 240 V/60 Hz. Includes two toner cartridges, one OPC cartridge, an AC power cord, one package letter-size paper, and documentation.
LN03-AA	LN03-A2 + English Doc 120 V-US
LN03-AB	LN03-A3 + Flemish Doc 240 V-Belgium
LN03-AC	LN03-A2 + Canadian Doc (French)-120 V
LN03-AD	LN03-A3 + Danish Doc 240 V-Denmark
LN03-AE	LN03-A3 + English Doc 240 V-UK/Ireland
LN03-AF	LN03-A3 + Flemish Doc 240 V-Finland
LN03-AG	LN03-A3 + German Doc 240 V-Germany, Austria
LN03-AH	LN03-A3 + Dutch Doc 240 V-Holland
LN03-AI	LN03-A3 + Italian Doc 240 V-Italy
LN03-AJ	LN03-A2 + Japan Doc 120 V-Japan
LN03-AK	LN03-A3 + French Doc 240 V-Switzerland
LN03-AL	LN03-A3 + German Doc 240 V-Switzerland
LN03-AM	LN03-A3 + Swedish Doc 240 V-Sweden
LN03-AN	LN03-A2 + Norwegian Doc 240 V-Norway
LN03-AP	LN03-A3 + French Doc 240 V- France
LN03-AQ	LN03-A2 + Canadian Doc (English) 120 V-Canada
LN03-AR	LN03-A2 + Spanish Doc 120 V-S. America
LN03-AS	LN03-A3 + Spanish Doc 240 V-Spain
LN03-AT	LN03-A3 + Israel Doc 240 V-Israel
LN03-AU	LN03-A2 + S. American Doc 240 V-Portugal
LN03-AV	LN03-A2 + English Doc 120 V
LN03-AW	LN03-A2 + French Doc 120 V-Swiss
LN03-AY	LN03-A3 + Hir Doc 240 V-Japan
LN03-AZ	LN03-A3 + English Doc 240 V-Australia/New Zealand

The LN03 PLUS model numbers are

LN03S-AA	LN03 PLUS Desktop Printer
LN03-UA	LN03 PLUS Upgrade Kit

▪ Major Features

The LN03 laser printers' list of features includes

- Eight page per minute print time—means faster turnaround time for long reports or shared printing jobs. Using a 2,500 character document, for example, the LN03 print speed translates to 333 char/sec or 500 lines/min.
- 300-by-300 dots per inch—gives you superior letter quality for formal letters and documents.
- RS232 serial interface, 1200 to 19,200 baud rate — enables connection to anything from a Rainbow to a VAX as well as to third-party systems.
- LQP02, LA100 compatibility modes—allows LN03 to run many existing applications without alteration.
- Sixel graphics—allows the LN03 to print simple business graphics. Resolution depends on image size and complexity (average 150 dots per inch). Sixel protocol is utilized by Digital video graphics terminals, personal computers, and many application packages such as DECgraph.
- Sixteen resident fonts using Courier and Elite typefaces—make it easy to produce high-quality, multifont documents. See Table 13-1.
- ROM/RAM cartridges—let you add fonts by plugging in precoded ROM cartridge or downline loading host fonts to RAM.
- 96-Kbyte RAM, expandable to 352 Kbytes by plugging in two 128-Kbyte RAM cartridges–provides enough memory for downline loading fonts, and printing full pages of graphics.
- 250-sheet paper input, 250-sheet sequenced output—prints on letterhead, transparencies, and labels (16 to 24 pound) and saves time collating and preparing presentations.
- Quick loading paper tray, advanced paperfeed mechanism, and a short paper path ensure trouble-free operation.
- Extensive self-test diagnostics—show a graphic depiction of dip switch settings for easy set up.
- Illuminated indicator panel gives the operator a visual printer status report for ease of operation, maintenance, diagnosis, and repair.

LN03 PLUS (Only) Features

- Up to 1 Mbyte dynamic RAM for full bit-map graphic image printing. Tektronix 4010/4014 compatibility.
- Sixel graphics at full 300-by-300-dot-per-inch resolution — enables users to print graphics created with DECgraph, DECslide, and other applications at full printer resolution, with smooth curves and reduced terracing and jaggedness.
- Software compatibility with the LN03—means all current software that prints on the standard LN03 will print without alteration on the LN03 PLUS.

Printing Features

Because the laser printing process is nonimpact, the noise level is significantly lower (fewer than 55 decibels) than impact printers. The printing is done by charging the print belt, then removing portions of the charge with a laser. This leaves a negative latent charge image on the belt that attracts a positive dry ink toner that is transferred to paper. A heated roller then fuses the image permanently to the paper. The result is crisp, letter-quality type with each copy as sharp as the first.

The LN03 and LN03 PLUS recognize the ANSI and ISO standard control functions that are used to select character sets and fonts, to set tabs, margins and spacing, and to implement special techniques such as subscripting, superscripting, overstriking, underlining, and justification. Printing can be done with either a portrait or landscape orientation.

In graphics mode, the printer can process sixel data. A sixel is a group of six vertical pixels represented by six bits within the character code. The sixel protocol is generated by Digital video graphics terminals, Digital personal computers, third-party devices, and many application packages such as DECgraph and PROsight. The LN03 prints sixel graphics at 150-by-150 dots per inch resolution, while the LN03 PLUS prints at a 300-by-300 dots per inch resolution.

▪ Fonts and Character Sets

The LN03 and LN03 PLUS come standard with 16 resident fonts in ASCII, multinational and technical character sets. You can select printing characters from one of several character sets and from one of several fonts.

The character set contains the symbols (for example "A") that are to be printed while the font determines the size and style (for example, Courier). If you want to mix type styles and point size, the LN03 and LN03 PLUS can print up to 24 fonts per page.

Some of the character sets and fonts are stored in ROM as font files. Other character sets and fonts are down-line loaded as font files from the host. Font files provide a description of the visual representation of the characters in a specific character set. The resident font files for the LN03 and LN03 PLUS identify the following:

Type Family—DEC Built-in, Courier, Elite, PI

Font—Spacing (proportional, fixed monospace)

Type size (10 point, 6.7 point)

Scale Factor (1:1, no scaling)

Type Style (normal, italic)

Character Weight (normal, bold, faint)

Character Proportion (normal)

Character Sets—ASCII, Multinational, DEC Supplemental, DEC Technical, Line Drawing.

Rotation—All fonts can be rotated internally.

Resolution—300 dots per inch both directions.

Character Subset—Full character set.

File Encoding—Binary.

These character sets and fonts are resident in the LN03. A much wider variety can be stored in one of the cartridges or downline-loaded from the host using a software program such as DECpage. You can choose from a number of typefaces designed for Digital by Compugraphic Corporation for use in commercial, technical, scientific, and publishing applications. These typefaces have been organized into a library of font kits, called the *LN03 Soft Font Library*. Each kit is designed to satisfy the needs typically encountered in specific printing applications. These kits are available through the EAS library and through Compugraphic Corporation.

Soft Font Library

Soft font kits are available in three different packages—the Basic Office Font package, the Upgrade Office Font package, and the Complete Office Font package. Each consists of type fonts designed to be used with the DECpage product, or by custom programs written by customers.

- *Basic Office Font Package*

  The Basic Office Font package, designed for use with DECpage, contains the typefaces, typesizes, and weights appropriate for a wide range of office printing needs. These needs include letters, memos, reports, proposals, notices, contracts, schedules, and agendas. The user can access up to 23 of the 37 typestyles and sizes supported by DECpage.The package contains the following:

Family	Point Size	Weight
Triumvirate	10, 12, 14, 18, 24	Roman, Bold
Triumvirate	10	Roman, Italic
Triumvirate Publishing	10, 12, 14, 18, 24	Roman, Bold
Triumvirate Publishing	10	Roman, Italic
Triumvirate Supplemental	10, 12, 14, 18	Roman, Bold
Triumvirate Supplemental	10	Roman, Italic
Century	10, 12, 14, 18, 24	Roman, Bold
Century	10	Roman, Italic
Century Publishing	10, 12, 14, 18, 24	Roman, Bold
Century Publishing	10	Roman, Italic
Century Supplemental	10, 12, 14, 18, 24	Roman, Bold
Century Supplemental	10	Roman, Italic
OCR-B	10 (pitch)	Roman, Bold

- *Office Upgrade Font Package*

  This kit serves as an upgrade to the Basic Office Font package. Together, these two kits are the equivalent of the Complete Office Font package.

Family	Point Size	Weight
Stymie	10, 12, 14, 18, 24	Light, Bold
Stymie	10	Light Italic
Stymie Publishing	10, 12, 14, 18, 24	Light, Bold
Stymie Publishing	10	Light Italic
Stymie Supplemental	10, 12, 14, 18	Light, Bold
Stymie Supplemental	10	Light Italic
ITC Avant-Garde	10, 12, 14, 18, 24	Book, Demi
ITC Avant-Garde Publishing	10, 12, 14, 18, 24	Book, Demi
ITC Avant-Garde Supplemental	10, 12, 14, 18	Book, Bold
ITC Souvenir	10, 12	Light, Demi
ITC Souvenir	10	Light Italic
ITC Souvenir Publishing	10, 12	Light, Demi
ITC Souvenir Publishing	10	Light, Italic
ITC Souvenir Supplemental	10, 12	Light, Demi
ITC Souvenir Supplemental	10	Light, Italic

- *Complete Office Font Package*
  This package contains all the fonts in the Basic Office and Office Upgrade Font package kits. This complete package enables users to access all 37 typestyles and sizes supported by DECpage.

  Note: The soft font packages described above are available for Digital host systems on 9-track 1600-bpi Magtape and TK50 distribution media. The kits include a single-user license, binaries, and documentation. Support services are not included.

Font Cartridges

In addition to the basic soft font kits, a variety of special application plug-in font cartridges are available for the LN03.

The ROM cartridges are

Proportional typeface (character sets)	Point Size	Weight
CG Times	8, 10, 12	Roman
	10, 12	Bold
	10	Italic
Triumvirate	18	Roman
	18	Bold
	14	Roman

In addition to these font cartridges, the LN03 Plus also offers the following new proportional font cartridges:

Family	Point Size
Triumvirate	24
Triumvirate	8, 10, 12
CG Times	24
CG Times	24
Modern Gothic	14
Legal	10, 10, 10, 14

▪ Paper

The LN03 and LN03 PLUS can accommodate both standard ANSI A (8.5-inch-by-11 inch) and European A4 (8.3-inch-by-11.7 inch) cutsheet paper, plain or letterhead, in a variety of weights ranging from 16 to 24 pounds. They can also handle preprinted single-part forms, plain paper, transparencies.

The LN03 and LN03 PLUS's integral sheetfeeder handles a maximum input of 250 sheets and a maximum output of 250 sheets with automatic page sequencing.

▪ Accessories and Supplies

The following accessories, supplies, and spares are available for the LN03 laser printers.

Part	Description
LN03X-AC	Toner Kit–two toner cartridges (sufficient supply for 6,000 pages), two cleaning pads, and one toner collection bottle.
LN03X-AD	User Maintenance Kit–one OPC cartridge (print belt), one transfer corona, one charge corona, one shield glass and one ozone filter. (Used every 10,000 pages.)
LN03X-AE	LN03 Cabinet
LN03X-AF	8.5-in-by-11-in cut sheet paper (2,500 sheets)
LN03X-AH	A4 (8.3-in-by-11.7-in) paper (2,500 sheets)
LN03X-AJ	8.5.-in-by-11-in transparencies (Box of 50)
LN03X-AK	A4 transparencies (Box of 50)
LN03X-CR	RAM Cartridge (128 Kbytes)
LN03X-CB	CG (Compugraphics) Times font Cartridge–8, 10, 12 point, bold 10 and 12, italic 10. Proportional space.
LN03X-CW	CG Times 14, 18 point normal and 18 point bold
LN03X-CX	CG Times 24 point normal
LN03X-CJ	Triumvirate font cartridge–14, 18 point, 18 point bold. Proportional space.
LN03X-CZ	Triumvirate 24 point normal
LN03X-CY	Triumvirate font cartridge–8, 10, 12 point, 10 point italic, 10, 12 point bold
LN03X-CL	Souvenir font cartridge–8, 10, 12 point, bold 10 and 12, italic 10. Proportional space.
LN03X-CM	ANSI OCR-B font cartridge–8, 10, 12 point, bold 10 and 12. Fixed space.
LN03X-CT	U.S. Legal character sets (no multinational character support). Includes Registered Trademark sign, double underscore, section sign, paragraph sign, dagger, trademark sign in the following character sets: Courier 10/10 normal and italic Elite 10/12 normal and italic Modern Gothic 10/12 normal Modern Gothic 14/8 normal
LN03X-DA	FMS Extended Courier. Includes the following font files:

Size	Orientation	Character set
single	landscape	Overprint
wide	landscape	Line Drawing
wide	landscape	Supplemental
wide	landscape	ASCII

Size	Orientation	Character set
wide	landscape	Overprint
tall	landscape	Line Drawing
tall	landscape	Supplemental
tall	landscape	ASCII
tall	landscape	Overprint
tall	portrait	Supplemental
wide	portrait	Line Drawing
wide	portrait	Supplemental
wide	portrait	ASCII
wide	portrait	Overprint
tall	portrait	Line Drawing
tall	portrait	ASCII
tall	portrait	Overprint
single	portrait	Overprint

In the table above, single means single-high, single-wide; wide is single-high, double-wide; and tall is double-high, double-wide.

▪ Operator Features

The LN03 and LN03 PLUS printers are designed for "pushbutton" easy operation. International symbols and handy operator cards explain how to operate the printer. The only operator control is the online/offline switch located on the front panel for easy access.

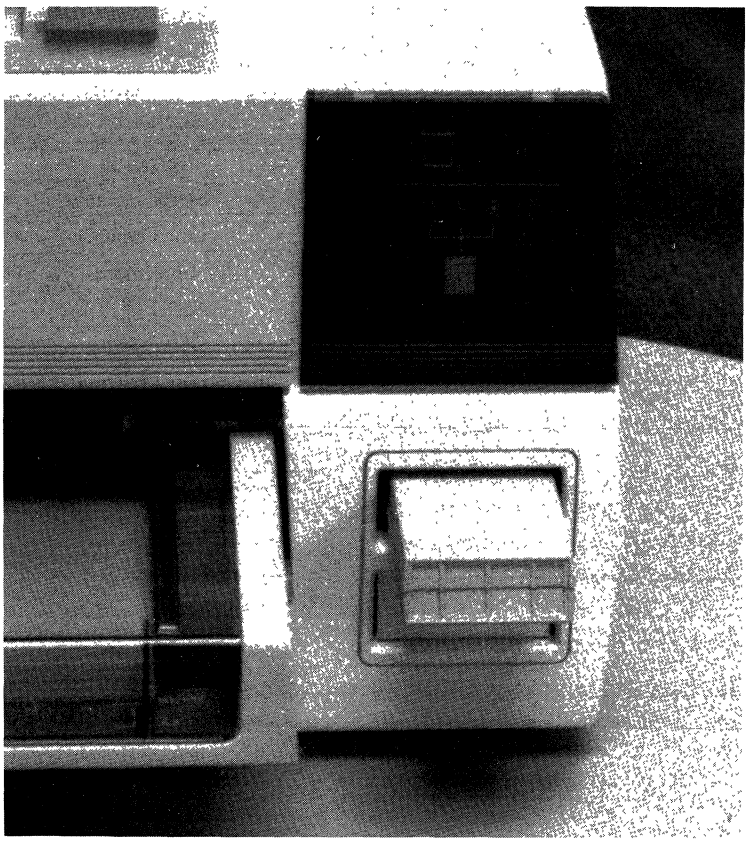


Figure 13-3 ▪ LN03/LN03 PLUS Front Panel Indicators

Indicator Panel Symbols

The following symbols indicate the status of the printer and the need for such items as toner, paper, and other maintenance items.

- *Character Display*

  This symbol displays the number 6 (flashing) to indicate the printer is busy. The printer may be receiving downline loaded fonts or printing a job for example.

It displays the number 6 (steady) to indicate there is still data in the buffer. Press the ON/OFFLINE indicator button twice to eject last page of print or send a formfeed at the end of the document.

This symbol also displays alphanumeric characters associated with controller and printer malfunctions. These codes are listed in the *LN03 Programmers Reference Manual* (EK-OLN03-RM-002). You can also press the Self-Test button to get a brief description of the *nonfatal* condition.

The character display shows the letter C to indicate the development drawer or a cover (paper tray, side door, paper exit) is open.

- *Paper Jam*
  The character display flashes the letter E or F to indicate a paper jam in the exit or feed areas, respectively. Easy clearing instructions are found in the flip cards.

- *Controller Error*
  The character display indicates an error caused by the controller with a flashing alphanumeric character and lightning symbol.

- *ON/OFFLINE Indicator Button*
  Press this button to place the printer online or offline. The LN03 powers up in the online state. When the indicator light is on, the printer is online. The button is also used to eject the last page of print when 6 is displayed on the indicator panel.

- *Ready*
  The ready indicator flashes to indicate the printer is warming up. When the indicator light stays on, the printer is ready to print. The ready indicator light remains off while the LN03 is printing.

- *Power*
  The power light is on when power is applied to the printer.

- *Call Field Service*
  The character display flashes an alphanumeric character, and field service icon symbol to indicate a fatal print error. It may flash with a controller error symbol if the controller is causing the problem.

- *Add Paper*
  This symbol flashes to indicate that the paper tray is empty. Simply lift the paper tray cover and add the paper to the tray (letterhead side up).

- *Replace Toner Cartridge and Cleaning Pad*
  This symbol flashes to indicate when the toner cartridge and cleaning pad should be replaced (LN03X-AC).

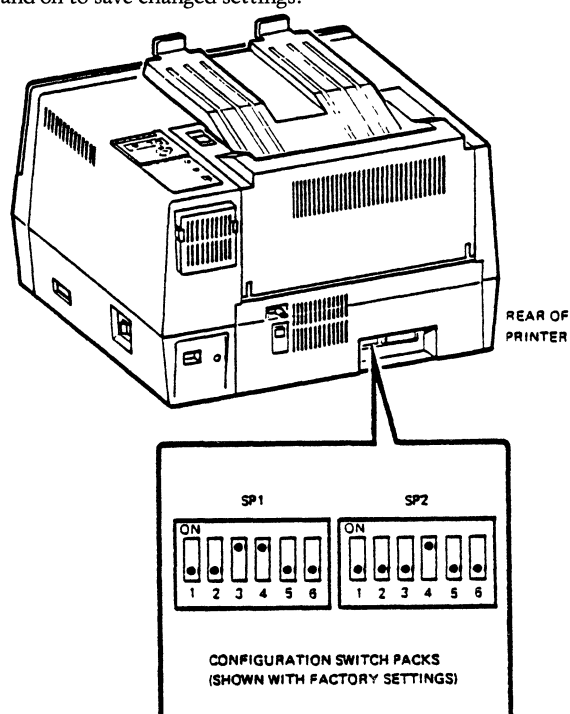
- *Replace Toner Collection Bottle*
  This symbol flashes to indicate that the toner collection bottle is full.

- *Maintenance*
  This symbol flashes to indicate that maintenance is required (LN03X-AD).

Printer Configurations

There are two 6-position configuration switch packs, designated SP1 and SP2, accessible at the rear of the printer. These switches are used to configure the printer operating requirements. Figure 13-2 shows the factory switch settings for the LN03; if necessary, these switches can be changed to match the communications parameters of your host system.

The switch packs are pushed up or down for ON and OFF. A ball-point pen or jeweler's type screwdriver should be used to change the switch settings. Table 13-2 describes the switch settings and parameters. The printer must be powered off and on to save changed settings.



▪ *Switch Pack 1*

Table 13-2 ▪ Switch Pack 1 and 2 Settings

Switch number	Setting	Parameter	Description
1	OFF	Serial Interface	Set according to type of communications interface being used, either serial or parallel.
	ON	Parallel interface	(For future use.)
2	See Table 13-3	Baud Rate	Select the speed (bits per second) at which the printer communicates with the printer.
3	See Table 13-3	Baud Rate	
4	See Table 13-3	Baud Rate	
5	OFF	Eight Data Bits	Set according to the character format being used by the computer, either 7 or 8 bits. (Factory default setting off.)
	ON	Seven Data Bits	
6	OFF	Parity Disabled	Used to enable or disable the parity check. If enabled, the printer checks the parity bit setting. If not enabled, the printer ignores the parity bit in received characters. (Factory default setting off.)
	ON	Parity Enabled	

▪ *Switch Pack 2*

Switch number	Setting	Parameter	Description
1	OFF	Even/Mark Parity Bit	Selects the type of bit the printer checks for when receiving characters and parity is enabled. The printer can be set to check for Even/Mark or Odd/Space parity.
	ON	Odd/Space Parity Bit	
2	See Table 13-4	Device ID	Normally set for an LN03 identification except when the printer is connected to a system that requires an LA100, or LQP02 answerback response. **Note:** Because of differences in printer technology, these switch settings do not constitute strict compatibility with the printer identification selected.
3	See Table 13-4	Device ID	
4	OFF	Autowrap Off	Selects the method of controlling a line of characters that exceed the right margin. If set to Autowrap off, the characters exceeding the right margin are dropped. If set to Autowrap on, the characters are printed on the next line beginning at the left margin.
	ON	Autowrap On	(Factory default setting.)
5	OFF	XON/XOFF enabled	Used to select the protocol. (Factory default setting.)
	ON	Restraint enabled	Restraint is typically used with serially connected devices that do not honor the XON/XOFF protocols.

Switch number	Setting	Parameter	Description
6	OFF	Normal	Selects the polarity of the restraint signal when the restraint enabled protocol is selected. (factory default) Can be implemented in areas of hardwire restraint where XON/XOFF is not used.
	ON	Inverted	Polarity of line condition.

Table 13-3 ▪ Baud Rate Settings

SP1-2	SP1-3	SP1-4	Baud Rate
OFF	OFF	OFF	1200
OFF	OFF	ON	2400
OFF	ON	OFF	3600
OFF	ON	ON	4800 (factory default)
ON	OFF	OFF	7200
ON	OFF	ON	9600
ON	ON	OFF	19,200
ON	ON	ON	19,200

Table 13-4 ▪ Settings for Device ID

SP2-2	SP2-3	Answerback Mode
OFF	OFF	LN03 (factory default)
ON	OFF	LA100
OFF	ON	LQP02
ON	ON	LN03

▪ Programming Information

The LN03 laser printer processes characters in accordance with the ANSI standard X3.4-1977 and the ISO standard DIS 2022-1984. See Appendix , "LN03 Programming", for a chart of escape and control sequences. The escape and control sequences are multiple byte sequences that provide additional control functions not provided by the control characters of the character set. Using the escape/control sequences, the following LN03 functions can be controlled:

- Selecting character sets
- Loading assigning and selecting fonts
- Spacing
- Active column and line
- Print area and print margins
- Tabulations
- Product identification
- Printer status
- Character attributes
- Vectors
- Linefeed
- Autowrap
- Reset or initialization

Each escape sequence, control sequence, and control string defines a specific function.

Loading Font Files

The font files available for printing consist of two types—those that are stored in ROM (resident and cartridge) and those that can be downline loaded into RAM from the host. There are 16 font files of four character sets—ASCII, DEC Supplemental, Line Drawing, and DEC Technical—stored in ROM. If there is enough RAM memory available, including cartridges, up to 31 other font files can be loaded from the host.

Font files can be identified by a Type Family ID, a Font ID, and a Font File ID.

The Type Family ID has seven characters and describes the resident families as follows: Courier-RCOURIR, Elite-RELITE0, DEC Builtin-DBUILTN1, and PI Font-D000000.

The Font ID has 16 characters and describes the seven attributes, including the type family of the resident fonts.

The Font File ID has 31 characters and describes the character set as well as the font attributes.

Before loading any fonts in the printer, it is good practice to print a status sheet that indicates the fonts that are resident. You can also query the printer from the host. If necessary, you can delete downline loaded font files to make space for the new files. Also, the font files are loaded in memory with a specific orientation—portrait or landscape. All 10-, 10.3-, and 12-pitch fonts have portrait orientation and 13.6-pitch fonts have landscape orientation. The printer has the capability to rotate the orientation if there is enough memory available.

The format for the Load Font File Sequence is as follows: DCS Ps1; Ps2; Ps3 y FONT RECORD; COMMENT RECORD ST

Specific fonts are downloaded as a printable font data file. During the downloading operation, the LN03's indicator panel flashes "6" to show that fonts are being loaded into memory. Once font files are loaded in memory, they remain available for printing until one of the following event occurs.

- New fonts are loaded with a parameter 3 (Ps3) value of 0. A 0 in the Ps3 location deletes font files.
- The same font file is loaded again.
- System power is shut off; initial builtin fonts are available at powerup.
- The RAM cartridge that contains the font is removed.

See the *LN03 Programmer Reference Manual* for complete programming details.

▪ Maintenance

The LN03 and LN03 PLUS printers are built for easy maintenance. With the printer's self-test diagnostics and many customer replaceable components, few service calls are necessary. Printer maintenance should always be performed when the Maintenance indicator lights on the indicator panel. If printing continues after the indicator light comes on, the quality of the print may deteriorate rapidly. The LN03 User Maintenance Kit (PN LN03X-AD) contains the following items that are replaced during routine printer maintenance.

- OPC Cartridge
- Shield Glass
- Charge and Transfer Corona Units
- Ozone Filter

In addition to replacing the items above, the quenching lamps and separation pawls are cleaned at this time. Instructions are included in the kit for performing the required maintenance. Customer replaceable components are also color-coded green for easy identification.

To ensure the proper operation of the LN03, keep the following environmental conditions in mind.

- The site should maintain a temperature range of 10°C to 32°C (50°F to 90°F) with a humidity range of 20 to 80 percent to assure consistent image quality and prevent paper jamming.
- Install the LN03 in a well ventilated area to avoid excessive temperature rise in the printer.
- Install the printer in a dust-free area to protect moving parts from unnecessary wear.
- To prevent condensation, install the LN03 in an area in which the printer will not be subjected to sudden changes in temperature or high humidity, or exposed directly to a draft from heating systems or air conditioners.
- Install the printer on a solid, level surface such as a desk or printer stand.
- Do not plug other equipment such as coffeepots, office copiers, or air conditioners into the same power supply line.

Before operating the LN03, you can initiate the self-test by pressing the test button located at the back of the printer. This will cause a summary sheet to be printed. The summary sheet provides information about the current status of the printer including the interface type, available fonts, and error listing if there is an error.

• Operator Troubleshooting Checklist

This section describes some common operating problems with the LN03 and their possible solutions. All solutions are listed in order of probability and should be followed in that order.

The printer does not power up when the power switch is set to 1 (ON).

- Make sure the power cord is plugged into the wall outlet. Check that there is power at the wall outlet by plugging in a lamp to see if it lights.
- Check to see if the circuit breaker has popped out. If it has, press back in. If it pops out again at powerup, call Digital Field Service.

The printer powers up correctly, but will not print.

- Check the configuration switches for the proper operating parameters.

Printing is blank.

- Check to see if the charge and transfer corona units are intact and seated properly. If not, reseat either or both units.

Printing is too black.

- Check to be sure the OPC cartridge is seated properly.

Printing is too light.

- Check to be sure the OPC cartridge is seated properly.
- Replace charge corona unit.
- Replace transfer corona unit.

Stray toner fused to paper.

- Clean quenching lamp.
- Replace cleaning pad.
- Perform printer maintenance.

Streaks on the leading edge of the paper.

- Clean separation pawls.
- Perform printer maintenance.

Ghost of letter printed on previous sheet appears in the same location on the next sheet.

- Clean quenching lamp.

Dirty margins.

- Clean quenching lamp.

Irregular skew.

- Check to see that the paper tray is correctly installed.
- Check to see that the paper guide is flush against the right edge of the paper.

Black lines appear at the same location on every sheet.

- Replace the shield glass.

White lines.

- Replace the shield glass.
- Replace the charge corona unit.

Black lines.

- Replace the shield glass.
- Replace the cleaning pad.
- Perform printer maintenance

Frequent or constant paper jams.

- Check to see the paper is within specification 16-24 pounds.
- Check to see that the paper size switch is in the correct position.

▪ Additional Documentation

The following documents contain more detailed information about the LN03 laser printer.

- *Installing and Using the LN03* (EK-0LN03-UG-002)–Tells you how to install, use, maintain, troubleshoot, and configure the LN03.
- *LN03 Programmer Reference Manual* (EK-0LN03-RM-002)–Provides detailed programming information on communications, character and graphics code processing, and fonts.
- *LN03 Programmer Reference Card* (EK-LN03P-RC-002)

▪ Specifications

Performance Characteristics

Print Speed	Eight pages/min (about 333 char/sec letter-quality, 2,500 char/page.)
Recommended Duty Cycle	3,500 pages/month
Paper Feed	Adjustable 250-sheet cassette (16-to-24-lb paper)
Paper Output	250 sheets sequenced
Print orientation	Portrait–66 lines/page, 120 char/line Landscape–66 lines/page, 150 char/line
Graphics (LN03 PLUS only)	Full bit-map graphics (sixel), 1-Mbyte memory Tektronix 4010/4014 compatibility—supports Alpha Mode, Graph Mode, Point Plot Mode, and Incremental Plot Mode
Resolution	300 × 300 dots per inch
Image Area	2400 dots/scan line × 3225 scan lines (ANSI A) 2400 dots/scan line × 3400 scan lines (A4)
Paper Sizes	Standard ANSI A-21.6 X 27.9 cm (8.5 X 11 in) European A4–21 × 29.7 cm (8.3 × 11.7 in)

Built-in Fonts

Typeface/point size	Weight	Orientation
Courier 10 pt, 10 pitch	Regular	Portrait
Courier 10 pt, 10 pitch	Shadow Bold	Portrait
Courier 10 pt, 10 pitch	Regular	Landscape
Courier 10 pt, 10 pitch	Shadow Bold	Landscape
Elite 10 pt, 12 pitch	Regular	Portrait
Elite 10 pt, 12 pitch	Shadow Bold	Portrait
Elite 10 pt, 12 pitch	Regular	Landscape
Elite 10 pt, 12 pitch	Shadow Bold	Landscape
Courier 6.7 pt, 13.6 pitch	Regular	Portrait
Courier 6.7 pt, 13.6 pitch	Shadow Bold	Portrait
Courier 6.7 pt, 13.6 pitch	Regular	Landscape
Courier 6.7 pt, 13.6 pitch	Shadow Bold	Landscape
VT100 Line Drawing	Regular	Portrait
VT100 Line Drawing	Shadow Bold	Portrait
VT100 Line Drawing	Regular	Landscape
VT100 Line Drawing	Shadow Bold	Landscape

Communications

Interfaces	CCITT V2.4 RS232 serial interface1200-19,200 baud
Power cord length	3-m (10-ft) detachable

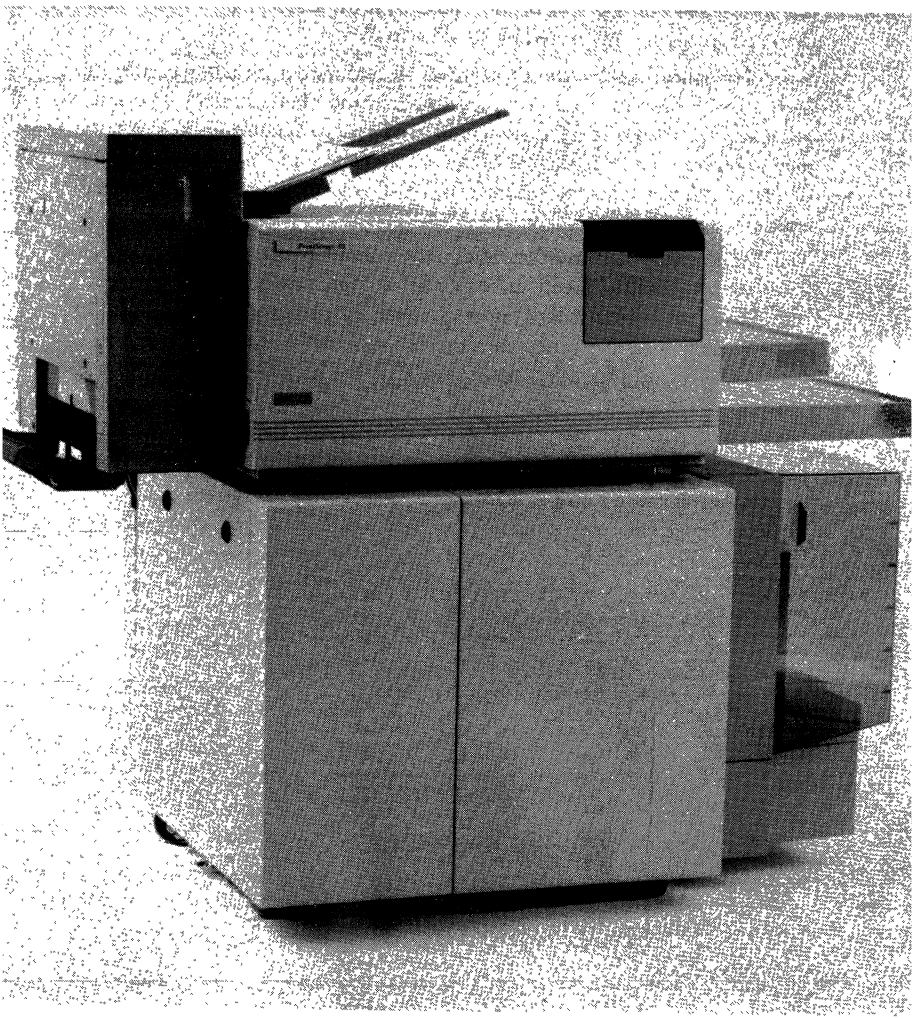
Power Requirements

Voltage/Frequency	85-132 V at 50/60 Hz 187-264 V at 50/60 Hz
Controller	Band buffer technology
Power requirement	1 kVA max.
Power consumption	120 V; 950 Watts max. 240 V, 850 Watts max.
Heat dissipation	120 V; 3240 Btu/h 240 V; 2900 Btu/h

Physical Characteristics

Height	38.1 cm (15 in with exit tray)
Width	53.4 cm (21 in)
Depth	59.7 cm (23 in with tray)
Weight	36.3 kg (80 lb)

Chapter 14 ▪ PrintServer 40 Printer Subsystem



▪ Overview

The PrintServer 40 Printer Subsystem is the first of a new generation of intelligent, printer servers from Digital that are designed expressly for Ethernet networks. The subsystem offers a complete printing solution for VAX and MicroVAX DECnet system users who print approximately 50,000 pages per month and who need a much higher print quality than offered by traditional printers. As a shared peripheral on a network, the PrintServer 40 subsystem enables dozens of users to create documents that look as if they were designed, typeset, and printed by outside vendors.

Suitable applications for the PrintServer 40 subsystem include medium- to high-volume business and technical reports that feature both text and graphics, distributed printing of manuals and service documentation, departmental business and scientific word processing, and high-volume distribution of graphics-based documents such as PERT schedules and organizational charts.

The PrintServer 40 subsystem offers an unbeatable combination of paper handling and printing speed. It has an input capacity of up to 2,500 sheets ranging in size from standard letter, 8.5-inch by 11-inch, to 11-inch by 17-inch sheets. The laser print engine of the PrintServer 40 subsystem turns out paper at up to 40 pages per minute for efficient handling of departmental printing jobs.

The PrintServer 40 subsystem prints both text and graphics on the same page, with a resolution of 300-by-300 dots per inch. A powerful built-in page description language called POSTSCRIPT™ enables the subsystem to turn out highly professional, complex documents with rotated type, textures, patterns, halftones, and images in any size and shape. The PrintServer 40 subsystem comes with 29 resident fonts representing eight different typeface families. These typefaces are listed below.

- Courier (fixed pitch) — Bold, Oblique, Bold Oblique
- ITC Avant Garde Gothic® — Book, Book Oblique, Demi, Demi Oblique
- Times® — Bold, Italic, Bold Italic
- New Century Schoolbook® — Bold, Italic, Bold Italic
- Helvetica® — Bold, Oblique, Bold Oblique
- ITC Lubalin Graph® — Book, Book Oblique, Demi, Demi Oblique
- ITC Souvenir® — Light, Light Italic, Demi, Demi Italic
- Symbol/Math

The PrintServer 40 subsystem includes the following hardware components:

- A MicroVAX II subsystem with 4 Mbytes of memory
- A Raster Image Processor
- A DEQNA Ethernet Controller
- A laser print engine
- A VT200 video terminal printer console

Two models of the LPS40 are available—LPS40-AA, North American; and LPS40-A3, International.

Major Features

- Supports a vast number of users on a network.
- Prints up to 40 pages at 3,000 characters per page per minute.
- Provides near-typographic quality with 300 dot-per-inch resolution.
- Uses a MicroVAX II processor coupled with a unique raster image processor for unmatched data handling and image generation.
- Uses POSTSCRIPT, a powerful page description language, to produce sophisticated text and graphics page compositions.
- Includes PrintServer Client and Host software that enables shared use by DECnet-connected hosts.
- Provides 29 resident typefaces for a wide variety of styles.
- Prints graphics created in ReGIS, Sixel, Tektronix 4010/4014 protocols to ensure software compatibility with current applications.
- Includes a large-capacity input bin and two auxiliary input trays with a total capacity of up to 2,500 pages for maximum time between refills. Output can be stacked face down for easy collating or face up in either of two trays. Each output tray has a capacity of 500 pages.
- Handles a variety of paper and transparency sizes including A3, A4, B4, 8.5- by 11-inches, 8.5- by 14-inches, and 11- by 17-inches.
- Designed for a typical duty cycle of at least 50,000 pages per month.

▪ Printing and Graphics Features

The PrintServer 40 subsystem can handle many users and a variety of printing requirements on a local area network because it uses powerful hardware and software components in its printing process. The following steps outline how each component contributes to the printing process.

1. Each printed page is composed of thousands of dots or pixels that form characters and images. A POSTSCRIPT-compatible application program, running on the host computer, produces commands that are sent over the Ethernet network to the PrintServer 40 subsystem's data controller—a MicroVAX II.
2. The MicroVAX II takes the input data and sends commands to the Raster Image Processor to form a full-page bit map that describes each graphic image and font.
3. The bit maps are sent through a bit-map reader that translates the bits into video signals
4. The laser print engine interprets these signals and, using electrophotography, transfers the image to paper.

Here's a closer look at the hardware and software that make up the PrintServer 40 subsystem.

MicroVAX II Subsystem

The MicroVAX II subsystem is a high-performance, 32-bit, single-board microcomputer that includes a processor and 4 Mbytes of memory. This is the top-level processor of the Data Controller. It runs the Printing Services software that interprets the data sent from the host.

The MicroVAX II has exceptional floating-point performance to speed the execution of instructions, and the virtual memory and addressing scheme to handle huge blocks of data. That's why the PrintServer 40 printer subsystem can print extremely complicated graphics and still maintain its impressive speed performance.

Raster Image Processor

The main function of the image processor is to generate images based on the graphic language input (POSTSCRIPT commands). The image processor controls vertical operations, horizontal start/stop operations, and the construction of lines and curves. Under control of the MicroVAX, images, graphics, and text are processed into a bit map that is subsequently output to the laser print engine as a video signal.

Laser Print Engine

The PrintServer 40 subsystem uses a laser print engine that uses a negative printing process. With this method, the entire page is electrostatically charged by passing over a charged drum. The laser scans the entire page, leaving the areas that are to show as black print unscanned. The laser cancels this charge anywhere it touches the page. The areas the laser does not touch remain charged. These charged areas—in the shape of text and graphics—then attract dry toner. This toner is fused to the paper by heat and pressure. Any residual toner is cleared from the page and drops into a toner reclamation tank.

Negative laser printing provides more precise control of the edges of text and graphics, and also provides a cleaner white background. Text and graphics stand in sharp, well-defined relief against the white background of the paper.

POSTSCRIPT Software

POSTSCRIPT software is a page description language rapidly becoming a standard for graphic and typographic applications. POSTSCRIPT interpreter software resides in the printer and is invisible to the user. It processes commands sent from POSTSCRIPT-based applications running on the host system. POSTSCRIPT application software can run on any host and output can be directed to any POSTSCRIPT printer. It is essentially independent of device type or device resolution.

Because POSTSCRIPT stores fonts as outlines instead of full bit maps, there's room in the printer for dozens of resident typefaces—and each of these is potentially available in unlimited sizes and rotations. Storing fonts as outlines also allows for highly sophisticated graphics operations with the appropriate software. For example, POSTSCRIPT can scale and/or rotate graphic elements to any degree; transform them by stretching, shrinking, or obliquing; overlay and superimpose text and graphics; print text in straight or curved lines; and fill characters with any texture or shade of gray. POSTSCRIPT treats characters in the same way it handles graphic elements. This means graphics and text can be processed together. The result is proportional sizing with accurate placement on the page.

Digital also provides translator software that will enable software packages using other protocols such as ReGIS and Tektronix to output to a POSTSCRIPT printer. Programmers may also develop their own POSTSCRIPT applications using the POSTSCRIPT programming language.

PrintServer 40 Software

Another key piece of software on the PrintServer 40 system is the management software that provides communication about a print job between the host system and the PrintServer 40 subsystem. It controls virtually all print functions, while POSTSCRIPT determines the appearance of the page. The PrintServer 40 software comprises four components that are distributed across the network.

- Client software
- Translator software
- Supporting host software
- PrintServer 40 software

▪ *Client Software*

The client software component consists of

- A print symbiont that processes print requests from a designated print queue.
- Software that transmits the requests over the Ethernet network to the PrintServer 40 subsystem.
- Software to relay system messages from the PrintServer 40 subsystem back to the user.

The client software must be installed on every system that will be providing remote printing services to its users.

▪ *Translator Software*

The translator software component consists of a number of translators, each of which converts a particular data-recording mode into the POSTSCRIPT language. The data recording modes currently supported are ANSI/Sixel, ReGIS, and Tektronix 4010/4014.

The translator software must be installed on every system that will be providing remote printing services to its users.

- *Supporting Host Software*

  The supporting host software component includes support for local and remote management services, resource services, and remote file access. Support host services provide PrintServer 40 subsystem management functions at the PrintServer 40 subsystem console as well as at the supporting host. Resource services locate and forward font data files to the PrintServer 40 subsystem when a required font is not locally available. Remote file access is used to offload the storage of event logging data, accounting data, and PrintServer 40 subsystem configuration data.

  There can be multiple supporting hosts in a network (as well as multiple PrintServer 40 subsystems); however, only one supporting host can be active for any one PrintServer 40 subsystem at any one time.

- *PrintServer 40 Software*

  The PrintServer 40 subsystem software component includes distribution software to transfer print data, control data, and soft resources from a client system or a supporting host to the imaging software.

  Imaging software interprets the data coming from the distribution software, builds the corresponding bit maps, and sends them to the print engine. It also passes any system messages from the print engine, or from itself, to the distribution software to be returned to the appropriate client or supporting host system. The imaging software of the PrintServer 40 subsystem includes an interpreter based on the POSTSCRIPT Page Description Language.

Fonts from PrintServer 40

AvantGarde-Book
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`{[}];:'"<>

AvantGarde-BookOblique
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&()_-+=~`{[}];:'"<>*

AvantGarde-Demi
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`{[}];:'"<>

AvantGarde-DemiOblique
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`{[}];:'"<>

Courier
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*() -+=~`[{}];:'"<>

Courier-Bold
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*() -+=~`[{}];:'"<>

Courier-BoldOblique
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

Courier-Oblique
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&() -+=~`[{}];:'"<>*

Helvetica
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

Helvetica-Bold
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

Helvetica-BoldOblique
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

Helvetica-Oblique
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&()_-+=~`[{}];:'"<>*

LubalinGraph-Book
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

LubalinGraph-BookOblique
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&()_-+=~`[{}];:'"<>*

LubalinGraph-Demi
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

LubalinGraph-DemiOblique
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

NewCenturySchlbk-Bold
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

NewCenturySchlbk-BoldItalic
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

NewCenturySchlbk-Italic
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&()_-+=~`[{}];:'"<>*

NewCenturySchlbk-Roman
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

Souvenir-Demi
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

Souvenir-DemiItalic
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

Souvenir-Light
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*()_-+=~`[{}];:'"<>

Souvenir-LightItalic
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&()_-+=~`[{}];:'"<>*

Symbol
αβχδεφγηιφκλμνοπθρστυϖωξψζ ABXΔΕΦΓΗΙϑΚΛΜΝΟΠΘΡΣΤΥςΩΞΨΖ 0123456789 ,./?∴!≅#∃%⊥&*()_-+=~ [{}];:∋∀<>

Times-Bold
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\|!@#$%^&*() -+=~`[{}];:'"<>

Times-BoldItalic
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\!@#$%^&*()_-+=~`[{}];:'"<>

Times-Italic
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\!@#$%^&()_-+=~`[{}];:'"<>*

Times-Roman
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789 ,./?\!@#$%^&*()_-+=~`[{}];:'"<>

Figure 14-1 ▪ PrintServer 40 Printer Sample Output

▪ Paper

The PrintServer 40 subsystem has three input bins. One accommodates up to 2,000 pages, the others hold up to 250 pages each for a total of 2,500 pages. The PrintServer 40 subsystem has two output trays that hold up to 500 pages each, depending on the thickness or weight of the paper. Pages are output either face down or face up.

The PrintServer 40 subsystem prints on a variety of cutsheet paper, forms, and transparencies. In addition to printing on forms such as invoices and order blanks, the PrintServer 40 subsystem also handles the following national and metric paper sizes—A3, A4, B4, 8.5- by 11-inches, 8.5- by 14-inches, and 11- by 17-inches.

▪ Accessories and Supplies

The following accessories, supplies, and spares are available for the PrintServer 40 subsystem.

Part	Description
LPS4X-AA	Toner Cartridge Kit—contains six cartridges. Toner cartidges must be replaced every 10,000 pages.
LPS4X-AC	Fusing Oil Kit—contains four 400-gram bottles of silicon fusing oil. Oil should be replaced every 15,000 to 30,000 pages.
LPS4X-AB	Kit B—includes all consumables for 100,000 pages. These consumables are developer, cleaning blade, corona wire, cleaning pads/fuser, and toner collection bottle.
LN01X-AB	Paper, 8.5 by 11 inches, 5,000 cut sheets.
LN01X-AC	Paper, 8.5 by 14 inches, 5,000 cut sheets.
LPSXX-PA	Paper, 11 by 17 inches, 5,000 cut sheets.
LPS4X-BA	Small paper tray.
LPS4X-BB	Large paper tray.

▪ Operator Features

Setting PrintServer 40 Subsystem Characteristics

Characteristics of the PrintServer 40 subsystem are determined by such parameters as layout, data type, and fonts. These parameters can be dynamically specified as part of a PRINT command using the /PARAM qualifier (see Table 14-1), or can be set up as defaults in the print server configuration database (see Table 14-2).

The /PARAMETER qualifier in the PRINT command is used to pass print server specific parameters directly to the remote print server. This implies the following:

- All files submitted with the same PRINT command are considered to be a single print job. Therefore, they will each be subject to the parameters passed in the /PARAMETER qualifier.
- Checking of the passed parameters for syntax and value limits will occur at printing time on the remote print server—not when the PRINT command is first issued by the client. When an error is detected by the print server at print time, the job is aborted and an error message is sent to the client system to be forwarded to the user who issued the print request.

Table 14-1 lists the parameters available with the /PARAMETER qualifier.

Table 14-1 • PrintServer 40 /PARAMETER Qualifiers

Parameter	Definition
COPIES = *number*	Specifies the number of times each sheet is to be printed. Note that this means uncollated output. If you want collated output, use the /COPIES qualifier in the PRINT command. The range of values for *number* is 1 through 255.
DATA_TYPE = data_type-name	Specifies the type of data in the print job being sent to the print server. This field is used to select the particular POSTSCRIPT translator that will convert the data type to POSTSCRIPT format. When the data is in the POSTSCRIPT format, it can be processed for output to the PrintServer 40 subsystem by the POSTSCRIPT interpreter. The PrintServer 40 translators support the following data types: ANSI ASCII POSTSCRIPT (default data type) REGIS TEK™ (Tektronix 4010 graphics commands)
FONT_DEFAULT = font-name	Specifies a job default font to be used in printing a job. It overrides the server default font that was defined for the print server in its configuration database. Font-name is a multifield, alphanumeric, case-insensitive string, 31 bytes long.
INPUT_TRAY = tray-name	Selects the server input tray that will supply paper for the job. The acceptable entries for tray name are TOP, BOTTOM, and LC (Large Capacity).
[NO]MESSAGES[= ([PRINT] [,KEEP])]	Specifies the disposition of job-generated messages. Most of these messages are generated by the POSTSCRIPT interpreter. The default is NOMESSAGES.

Table 14-1 ▪ PrintServer 40 /PARAMETER Qualifiers

Parameter	Definition
NUMBER_UP = *n*	Specifies the number of logical pages on a physical sheet of paper. The permissible values for *n* are 1, 2, and 4. The effect of each value on the output is as follows: 1–The output is one logical page on a single sheet placed in an area measuring 8.5 inches wide by 11.0 inches high. 2–The output is arranged in two logical pages on a single sheet and is placed in an area measuring 5.5 inches wide by 8.5 inches high. 4–The output is arranged in four logical pages on a single sheet and is placed in an area measuring 4.25 inches wide by 5.5 inches high.
OUTPUT_TRAY = tray-name	Selects the tray into which the PrintServer 40 subsystem will deposit the printed output. The acceptable entries for tray-name are MAIN (primary tray–face down), and FACE_UP.
PAGE_ORIENTATION = logical-orientation	Specifies the orientation of the printed output on the logical page. The acceptable entries are PORTRAIT and LANDSCAPE.
PAGE_SIZE = logical-size	Specifies the logical size of the pages being printed. This specification defines the scale factor and aspect ratio of the logical pages. The acceptable entries are listed below. A = 8.5 × 11 inch (this is the default) B = 11 × 17 inch LEGAL = 8.5 × 14 inch A4 = 210 mm × 297 mm (8.27 × 11.69 inch) A3 = 297 mm × 420 mm (11.69 × 16.54 inch)

Table 14-1 ▪ PrintServer 40 /PARAMETER Qualifiers

Parameter	Definition
SHEET_COUNT = ([lower-limit,] upper-limit)	Specifies the numbers of the first and last physical sheets of paper to be printed for the job. This determines the number of sheets to be printed. The default is to print the entire job. For example, SHEET_COUNT = 10 prints the first ten sheets of a file. SHEET_COUNT = (5,10) prints sheets five through ten of a file.
SHEET_OFFSET = ([TOP = *n*] [,LEFT = *m*])	Specifies the offset on the sheet for all logical pages on the sheet (used, for example with punched-hole sheets. The units for *n* and *m* are points (one point = 1/72 inch).
SHEET_SIZE = physical size	Specifies the physical size of the sheets being printed. The acceptable entries are the same as those used for the logical page size.

The PrintServer 40 subsystem configuration database is set up and maintained using the PrintServer 40 management interface documented in the *VAX/VMS System Manager's Guide for the PrintServer 40*. The following is a list of SET PRINTER qualifiers, along with the equivalent control when you are in a PrintServer 40 subsystem environment.

Table 14-2 ▪ SET PRINTER Qualifiers

SET PRINTER Qualifier	Equivalent Control
/CR	Insertion of carriage return characters is controlled by the current LAYOUT and DATA TYPE.
/FALLBACK	Translation of DEC Multinational characters is controlled by the current FONT. If the character does not exist in the specified font, the font error character will be printed.
/FF	This has no meaning for the PrintServer 40 subsystem. Mechanical formfeeds are controlled by the current DATA TYPE and the PrintServer 40 controller driver.
/LOWERCASE	The PrintServer 40 subsystem will not translate lowercase to uppercase. The PrintServer 40 subsystem is considered to be a lowercase printer.
/PAGE	The number of lines printed on each page is controlled by the current LAYOUT and FONT.
/PASSALL	Whether the system interprets special characters or forwards them as 8-bit binary data is controlled by the current DATA TYPE.
/PRINTALL	Whether the system interprets special characters or forwards them as 8-bit binary data is controlled by the current DATA TYPE.
/TRUNCATE	Truncation of data that exceeds the limitation imposed by the /WIDTH qualifier is controlled by the current LAYOUT.
/WIDTH	The number of characters allowed on each line of the currently installed paper stock is controlled by the combination of the current LAYOUT, DATA TYPE, and FONT.
/WRAP	Generation of a carriage-return/linefeed by the printer when it reaches the end of a line is controlled by the current LAYOUT.

Controls and Indicators

The PrintServer 40 subsystem has both an indicator panel and an operator panel. The indicator panel is located on the front of the PrintServer 40 subsystem and displays nine symbols that provide the operator with a visual printer status report. (See Figure 14-2.)

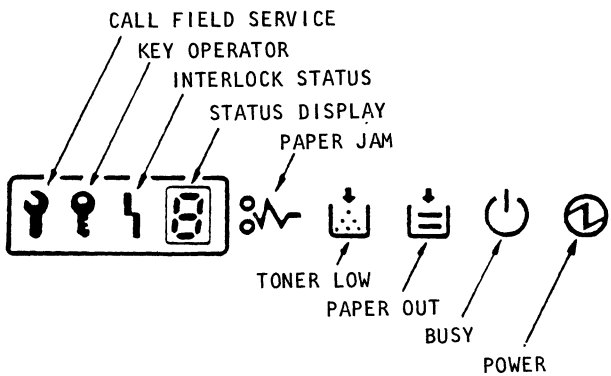


Figure 14-2 ▪ Indicator Panel Symbols

- CALL FIELD SERVICE–Lights an error condition (number) on the Error Display. Indicates that Field Service should be called to correct the problem.
- KEY OPERATOR–Lights an error condition (number) on the Error Display. Indicates that attention is needed by the Key Operator.
- INTERLOCK STATUS–Lights an error condition (number) on the Error Display. Indicates which unit or cover is incorrectly seated.
- STATUS DISPLAY–Displays a number that indicates POSTSCRIPT job status. This display can also indicate an error condition associated with either the Field Service, Key Operator, or Interlock Status symbol.
- PAPER JAM–Lights when there is a paper jam.
- TONER LOW–Lights when the printer needs more toner.

- PAPER OUT–Lights when the paper tray in use is empty.
- BUSY–Light remains on while the printer is warmimg up or printing.
- POWER–Indicates the printer is turned on.

The operator panel is located behind the front operator panel door and includes eight operational switches. It also has a diagram showing paper jam locations. (See Figure 14-3.)

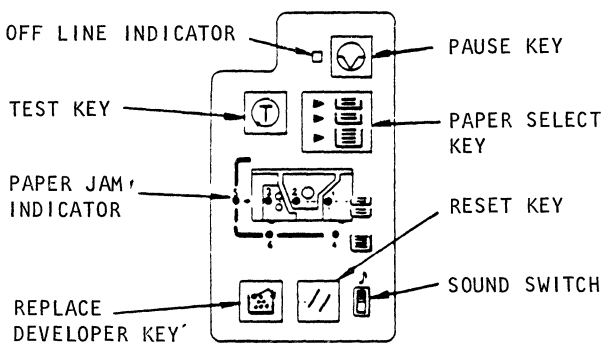


Figure 14-3 ▪ PrintServer 40 Printer Operator Panel

- PAUSE KEY–Places the printer online or offline each time the key is pressed. The OFFLINE indicator is lit when the printer is offline.
- PAPER SELECT KEY (and indicators)–Sequentially selects a paper tray each time the key is pressed. The indicator displays which tray is selected. **Note:** The paper select key can be used only when the printer is offline.
- RESET KEY–Resets the printer after a paper jam and removes the error condition.
- SOUND SWITCH–Sounds a tone when an error or ready condition occurs.
- REPLACE DEVELOPER KEY–Starts the purge cycle when the developer is replaced.

- PAPER JAM INDICATORS–Indicator lights show which section of the printer has the paper jam.
- TEST KEY–Generates a test print each time the key is pressed. If the test key is pressed for two seconds or longer, the printer will generate continuous test prints. To stop the prints, press the key a second time. **Note:** The test key can be used only when the printer is offline.
- ONLINE/OFFLINE INDICATOR–Indicates whether the printer is online or offline (ON = OFFLINE, OFF = ONLINE).

Programming Information

This section summarizes a few of the programming features on the PrintServer 40 subsystem. To take full advantage of the POSTSCRIPT page description language, the key to the PrintServer 40 subsystem's performance, refer to the following documents that are shipped with the subsystem:

- *POSTSCRIPT Language Tutorial and Cookbook* — ISBN-201-10179-3
- *POSTSCRIPT Language Reference Manual* — ISBN-201-10174-2
- *POSTSCRIPT Translators Reference Manual*
- *PrintServer 40 Programmers Supplement*

POSTSCRIPT as a Programming Language

About one-third of the POSTSCRIPT language is devoted to graphics. The remainder makes up a general computer programming language. The POSTSCRIPT language contains elements of many other programming languages, but most closely resembles the FORTH language.

POSTSCRIPT reserves a piece of memory called a stack for the data with which it is working. POSTSCRIPT operators that require numbers or other data (such as **add** and **subtract**) retrieve that data from the stack. To use an operator, you must first place the data or operand on the stack and then call the operator. This style of programming is called *postfix notation*. POSTSCRIPT supports many data types common to other languages including reals, Booleans, arrays, and strings.

POSTSCRIPT is a very flexible language. Functions that do not exist but would be useful for other applications can be defined and used in the same way as other POSTSCRIPT operators. Programs are written entirely in printable ASCII characters. This allows them to be handled as ordinary text files, and ensures easy program readability.

PrintServer 40 Subsystem Parameters

Two kinds of parameters are available for the PrintServer 40 subsystem—nonvolatile and volatile. Because nonvolatile parameters are stored in nonvolatile memory (NVM) located in the printer, their values persist even when the machine is turned off.

Volatile parameters, on the other hand, remain in effect only during the execution of a single job. When a job completes, all changes to nonvolatile parameters revert to the values in effect before the job began.

Table 14-3 lists the nonvolatile parameters available on the PrintServer 40 subsystem, and indicates the extensions you use to change them. Table 14-4 lists and describes the volatile parameters.

Table 14-3 ▪ PrintServer 40 Nonvolatile Parameters

Parameter	Extension
Device controller firmware ID	dcfwid
Duplex stacker status	dupstacker
ID of print engine	engineid
Idle fonts usage	setidlefonts, idlefonts
Large capacity stacker status	lcstacker
Mailbox status	mailbox
Name of printer	setprintername, printername
Page count	pagecount
Paper tray in use	a3tray, a4tray, a5tray, b4tray, b5tray
Password for system administrator	checkpassword, setpassword
Scratch memory values	seteescratch
Test page status	dostartpage
Timeout values, default	setdefaultjobtimeout, defaultjobtimeout

Table 14-4 ▪ PrintServer 40 Volatile Parameters

Parameter	Extension
Timeout value, job	jobtimeout, setjobtimeout
Name of current job	jobname
Name of product	product
Revision of POSTSCRIPT	revision

▪ Maintenance

The PrintServer 40 subsystem is built for trouble-free operation for thousands of pages. Its modular design makes it easy for technicians to provide fast economical maintenance and service. As an added convenience for operators as well as service technicians, the PrintServer 40 subsystem comes with a dedicated VT220 display terminal. The terminal acts as a console device displaying error messages, system status, and print queue status.

Self-test Procedure

After the printer is powered up, use the following procedure to check proper print operation.

1. Open the operator panel door and press the Pause key to place the printer offline. The Offline indicator will light.
2. Choose a paper tray by pressing the Paper Select key. The indicator displays the tray you've selected.
3. Press the Test key to print one copy of the test pattern.

If you want to test for continuous printer operation, go to step 4. If you do not want to test for continuous printer operation, go to step 6.

4. Press the Test key for about two seconds (a beep will sound if the alarm is on) to print the test pattern continuously.
5. Press the Test key gain to stop the continuous test operation.
6. Press the Pause key to place the printer online. The Offline indicator will go out.

If you are able to print a test pattern, the PrintServer 40 subsystem is operating correctly. Check the pattern for print quality. (Is it clean? Any lines? Is the toner fused to the paper?)

If you are not able to print the test pattern, refer to the troubleshooting checklist for a possible solution to the problem.

Operator Troubleshooting Checklist

The following list describes some common operation problems and their possible solutions. All solutions are listed in order of probability and should be followed in that order.

NOTE

Some of the solutions are preceded by the Key Operator symbol (*). This means that the corrective action should be performed by the key operator only.

The printer does not power up when the power switch is set to 1 (ON).

- Make sure the powercord is plugged into the wall outlet.
- Check to see if the printer circuit breaker has popped out and if it has, reset it. If it pops again at powerup, call Digital Field Service.

Printer does not print.

- Run the printer self-test.
- If printer passes the self-test, the problem is either with the software (refer to your software user manuals), or the Ethernet connection (see your system manager).

Printing is blank.

- Run the printer self-test.
- If printer passes the self-test, the problem is either with the software (refer to your software user manuals), or the Ethernet connection (see your system manager).

Printing is black.

- Run the printer self-test.
- If printer passes the self-test, the problem is either with the software (refer to your software user manuals), or the Ethernet connection (see your system manager).

Printing is too light.

- (*) Clean charge corona.
- (*) Clean transfer and detach corona assembly.

Dirty background on print image.

- (*) Clean charge corona.
- (*) Clean precleaning corona.

Black lines or blank spots on print image.

- (*) Clean transfer and detach corona assembly.

Frequent or constant paper jams.

- Check to see that paper is within the specification (16-24 pounds).

Constant paper jams in the fusing area.

- (*) Clean transfer and detach corona assembly.

Vertical black lines appear in the same location on the print image.

- (*) Clean the shield glass.
- (*) Replace the cleaning blade
- Call Digital Field Service

White lines appear on the print images.

- (*) Clean charge corona.
- Call Digital Field Service

Vertical wavy white line(s) appear on the print image.

- (*) Replace the cleaning blade.

Irregular print skew.

- Check to see that paper and paper tray are correctly installed.

Additional Documentation

The PrintServer 40 customer documentation includes both PrintServer 40 specific manuals and PrintServer 40 software manuals. Each of the manuals describes different parts of the system. In general, operators and application programmers use the PrintServer 40 manuals and users and system managers use the Printserver software manuals.

Hardware Manuals

The following hardware manuals are included with the PrintServer 40 subsystem.

- *PrintServer 40 Operators Guide* (EK-LPS 40-OP) This is a hardware manual that contains operating procedures for tasks performed at the printer such as loading paper and toner. The manual also contains operator service procedures for the print engine and data controller, including clearing paper jams.
- *PrintServer 40 Site Prep Guide* (EK-LPS 40-SP)
- *PrintServer 40 Installation Guide* (Field Service only) (EK-LPS40-IN)

Software Manuals

The following software manuals are included with the printer subsystem.

- *VAX/VMS Installation Guide for PrintServer 40 Client Software* (AA-HL83A-TE)
- *VAX/VMS Installation for PrintServer 40 Supporting Host* (AA-HL90A-TE)
- *VAX/VMS Server Manager's Guide* (AA-FP 24A-TE)
- *VAX/VMS User's Guide for PrintServer 40* (AA-FP-19A-TE)
- *PrintServer 40's Programmers Supplement* (AA-HL84A-TE)

This manual includes the following books:

— *POSTSCRIPT Language Reference Manual*
— *POSTSCRIPT Language Tutorial and Cookbook*
— *POSTSCRIPT File Structuring Conventions*
— *Adobe Systems Font Manual*
— *PrintServer 40 Advanced Users Supplement*
— *Inside PrintServer 40*

- *Printserver 40 Translator Reference Manual* (AA-HL85A-TE)

▪ Specifications

Product Description

Product type	Nonimpact printer with MicroVAX II data controller, graphics controller, DEQNA Ethernet interface, POSTSCRIPT and PrintServer 40 software, VT220 console terminal.
Printing technique	Electrophotographic, plain paper, dry toner, heat and pressure fusing
Prerequisite hardware	VAX and MicroVax systems with Ethernet network
Prerequisite software	VMS Operating System, V4.2 (or greater); DECnet Phase IV
Product compatibilty	LN03 using ANSI, ReGIS, or Tektronix protocols

Chapter 15 ▪ LVP16 Color Graphics Plotter

▪ Overview

The LVP16 is a six pen plotter that can produce high-quality color output from your personal computer on both paper and transparencies. The LVP16 provides a choice of six colors out of a possible ten for plotting on paper and a choice of six out of seven colors for use with transparencies. With the LVP16, you can quickly and easily create impressive presentations that will drive home your points with high-resolution color overheads. The Professional series of personal PDP-11's offers outstanding software support for the LVP16, as do several industry software packages for the Rainbow computer. A variety of third party software packages designed for the VAX and PDP-11 families also support the LVP16.

Multicolor high-quality graphics are produced by programmed or front-panel selection of six pens. If you desire additional colors, you can stop the program and manually install additional pens. The fiber tip pens are available in two nib sizes, and selection of ten vibrant colors for paper and seven for transparencies.

The LVP16 prints graphics at a fast 15 inches per second; you can produce fully labeled graphs and charts quickly. Using any of 19 character sets, you can readily annotate your graphs with text in any direction, with or without character slant, and in varying sizes. The LVP16's accuracy (to 0.001 inch) produces high-resolution printing that comes alive with hatch marks and bright solid colors.

▪ Major Features

The LVP16 color graphics plotter's main features are

- Production of 0.001-inch accuracy, high-resolution color graphics—adds the impact of color to your plots, charts, and graphs.
- Printing in addition to plotting capabilities—allow you to add text to your graphics presentations.
- Paper as well as transparency printing—add colorful graphics to your written presentations as well as your visual ones.
- Choice of four sizes of paper (8.5 by 11 in, 11 by 17 in, and European sizes 210 by 297 mm and 210 by 297 mm) used in vertical or horizontal orientation—allows for design options.
- Offer of 10 color pens for paper and 7 color pens for transparency printing (pens come in two nib sizes)—reduces manual intervention.

- Maximum operating speed of 15 inches per second—produces your graphics quickly.
- Compact size and lightweight (only 16 pounds)—allow you to move the plotter where you need it.
- Eavesdropping configuration with a special Y-type cable—allows you to establish a three-way connection between the system computer, the LVP16 plotter, and a system printer (or other compatible input/output peripheral).
- Compatibility with all of Digital's personal computers and third party VAX products that support the Hewlett-Packard Graphics Language (HP-GL) software—enables Digital's customers to use the LVP16 with a variety of Digital systems.

▪ Printing and Graphics Features

The LVP16 is engineered to make graphics and text printing easy. Because color selection is totally under software control, you can create graphics in six colors without manual intervention. Simply insert in the carousel the six colored pens you want to use and load the paper or transparency material. Loading is made easy with a guide control and a light on the front panel that indicates the paper size for which the plotter is set. Pressing the "View" button, when you wish, brings the completed portion of a graph to the front of the plotter for your review.

Manual intervention allows you to use up to a total of 10 vibrant colors for paper printing and 7 for transparencies. You can choose from 19 character sets to print headlines and text to accompany your graphics. For extensive text printing, you can use the LVP16's "eavesdrop" capability to connect the plotter to a serial printer.

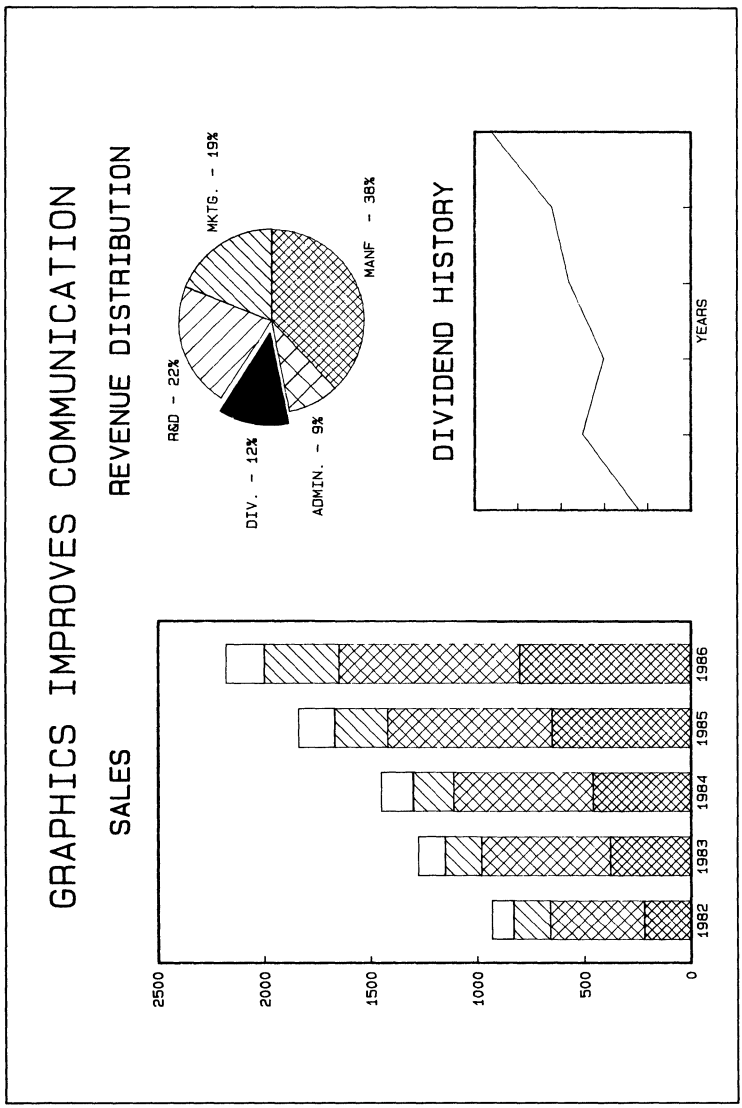


Figure 15-1 ▪ Demonstration Plot Graphics

▪ Eavesdropping Capability

With eavesdropping capability, you use one line to connect both a serial printer and the plotter to a host, thereby making a second port on the host available for other communication needs.

The configuration shown in Figure 15-2 uses a special Y-type cable to establish a three-way connection between the system unit, LVP16 plotter and a system printer or other RS-232-C compatible input/output peripheral. The Y-type connection adds an eavesdropping communication capability that gives the computer a software controlled random access to the printer and plotter. A program command or escape sequence instruction allows you to select one of these peripherals to produce a hardcopy printout of your data.

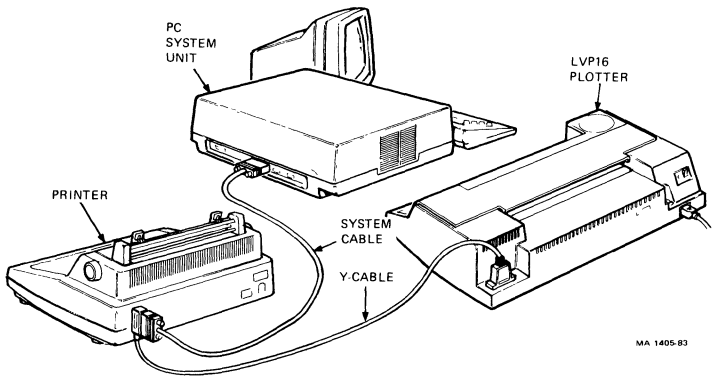


Figure 15-2 ▪ Eavesdropping Configuration

▪ Handshaking

The LVP16 uses a 1024-byte input buffer to synchronize the processing of data with the rate at which it is received. Any one of four handshaking methods can be used to prevent buffer overflow and the resulting loss of data. The computer system's capabilities and requirements dictate which handshake method is appropriate.

- Hardwire Handshake—uses a physical wire, pin 20 of the RS-232-C cable to control handshaking.
- Xon-Xoff Handshake—is managed by the peripheral device.
- Enquire/Acknowledge Handshake—is managed by the computer system and interface.
- Software Checking Handshake—is managed by the applications programmer.

▪ Character Sets

The 19 character sets the LVP16 uses are ANSI ASCII, 9825 Character Set, French/German, Scandinavian, Spanish/Latin American, JIS ASCII, Roman 8 Extensions, Katakana, ISO IRV (International Reference Version), ISO Swedish, ISO Swedish for Names, ISO Norwegian Version 1, ISO German, ISO French, ISO English/U.K., ISO Italian, ISO Spanish, ISO Portuguese, ISO Norwegian Version 2.

▪ Paper

The LVP16 supports single-sheet plotter paper, 8.5 by 11 inches, 8.5 by 17 inches and European equivalents 210 by 297 millimeters and 297 by 420 millimeters. Transparency film is available in 8.5 by 11 inch and 210 by 297 millimeter sizes.

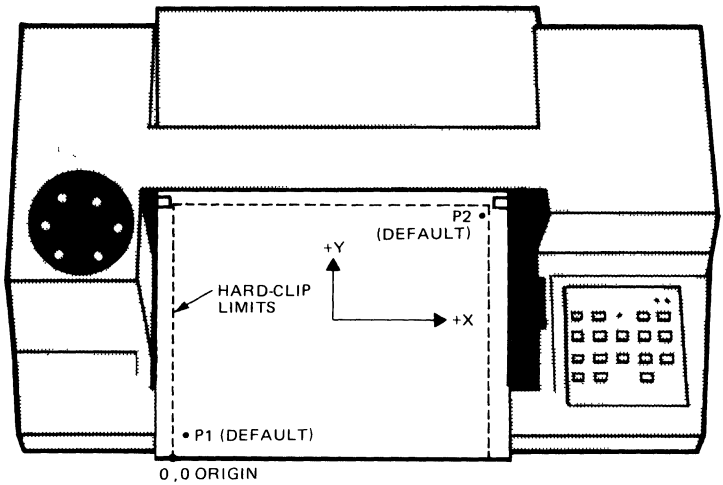
To obtain the highest quality graphics use paper supplied by Digital.

▪ The Plotting Area

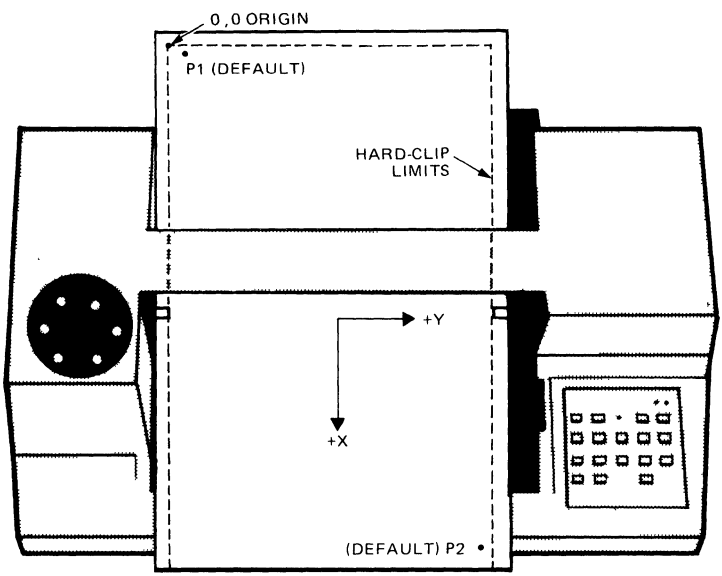
The user sets the paper size switches to correspond with the size of paper to be used. Table 15-1 shows the combination switch setting and the maximum plotting range for all four paper sizes. Figure 15-3 shows the default orientation of the coordinate system.

Table 15-1 ▪ Maximum Plotting Ranges

Paper Size Settings		Selected Paper Size	Maximum Plotting Range (Plotter Units)	
US/MET	**A4/A3**		***X*axis**	***Y*axis**
US	**A4**	A (8.5 by 11 in)	0–10 365 (257.8 mm/ 10.15 in)	0–7962 (198.1 mm/ 7.8 in)
US	**A3**	B (11 by 17 in)	0–16 640 (413.9 mm/ 16.3 in)	0–10 365 (257.8 mm/ 10.15 in)
MET	**A4**	A4 (210 by 297 mm)	0–11 040 (274.6 mm/ 10.81 in)	0–7721 (192.1 mm/ 7.56 in)
MET	**A3**	A3 (297 by 420 mm)	0–16 158 (401.9 mm/ 15.82 in)	0–11 040 (274.6 mm/ 10.81 in)



Default Orientation of Plotter Coordinate System (A/A4 Paper)



Default Orientation of Plotter Coordinate System (B/A3 Paper)

Figure 15-3 ▪ LVP16 Coordinate System Default Orientations

▪ Operator Features

Besides the line power switch and paper-loading lever the LVP16 contains front panel, configuration, and interface controls.

Front panel controls are used to switch between either ANSI A and B or ISO A4 and A3 paper sizes, to manually control pen and paper movement, and to change the locations of scaling points P1 and P2. They can also be used for interaction with a running program.

Configuration controls are contained in two switch packs on the rear panel. Switches determine the power-up default paper size, hard-clip limits, and P1/P2 coordinate values.

Interface controls establish the conditions under which communication between the plotter and computer will occur.

Front Panel Controls and Indicators

Locations of front panel controls and indicators are shown in Figure 15-4.

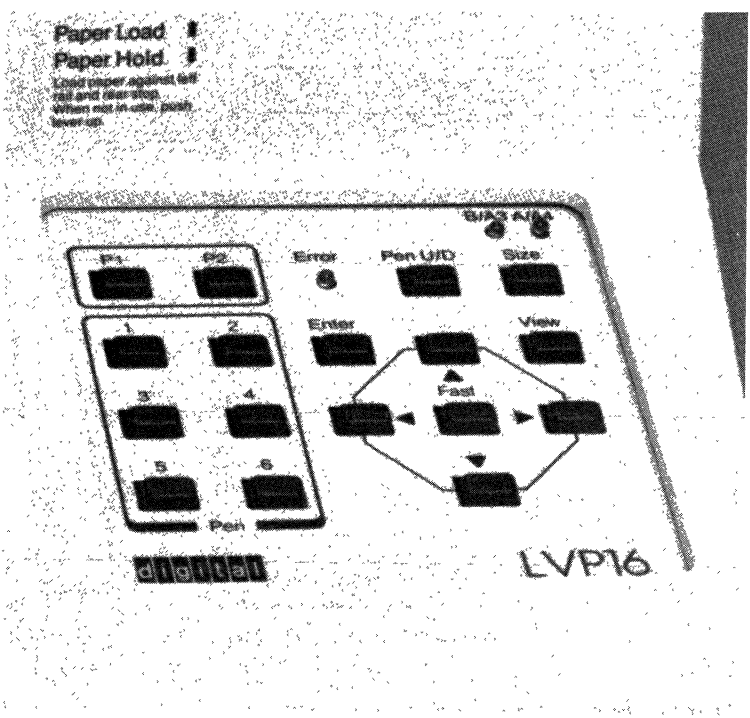


Figure 15-4 ▪ LVP16 Front Panel Controls and Indicators

- *Paper Load/Paper Hold Lever*

  Moving the paper loading lever to the PAPER LOAD position turns on the ERROR light and initiates the following:

  - Raises the pinch wheels and returns any pen currently held in the pen holder to the pen stall from which it was selected, or into the lowest-numbered empty position.
  - Aborts any in-process HP-GL vector or area fill command.

  Returning the paper loading lever to the PAPER HOLD position turns off the ERROR light and initiates the following:

  - Lowers the pinch wheels to secure the plotting medium. The plotter assumes new paper has been loaded, but maintains any previously set P1/P2 coordinate values.
  - Cancels any pending error (ERROR light blinking) associated with paper limits and improper loading.

- *P1/P2 Pushbuttons*

  Pressing P1 and P2 Pushbuttons causes the plotter to raise the pen and move it to the current coordinate location of scaling point P1 or P2. On power up, the default P1 location is in the lower left corner of A/A4 size paper or in the upper left corner of B/A3 size paper. In each case, the default P2 location is in the opposite corner from P1.

  Pressing P1 or P2 simultaneously with the ENTER pushbutton establishes the current pen location as the new coordinates of scaling point P1 or P2.

- *The PEN Pushbuttons*

  Pressing any PEN pushbutton causes the plotter to retrieve the corresponding number pen from the carousel. If the position is empty, the pen holder returns to its previous location. The plotter stores its current pen, if any, before it retrieves the newly selected pen. The old pen is stored either in its previous carousel position, if available, or into the lowest-numbered empty position. If a plot is in progress when the PEN pushbutton is pressed, the plot stops and does not resume until the pen is retrieved and the pen holder returns to its previous location.

  Pressing ENTER simultaneously with any PEN pushbutton causes the plotter to store its current pen into the corresponding numbered carousel position or, if unavailable, into the lowest-numbered empty position.

- *ERROR Light*

  The multi-purpose ERROR light can be off, on, or blinking. When the ERROR light is continuously on, it indicates that the VIEW pushbutton has been pressed or the paper-loading lever is in the PAPER LOAD ↑ position (pinch wheels up).

  When the ERROR light is blinking brightly, it indicates that the plotter has detected an Input/Output error, a paper-moving error, or an HP-GL error for which the error mask has been set.

  When the plotter is not active, the ERROR light will blink very dimly approximately every five seconds. This indicates that internal power supply calibration is being performed. For detailed description of errors, refer to instructions in the Programmer Reference Manual.

- *PEN U/D Pushbutton*

  Pressing the PEN U/D pushbutton reverses the current pen state (up or down). The PEN U/D Pushbutton can be used in conjunction with the cursor pushbuttons to draw lines or to digitize a point. Pressing the PEN U/D pushbutton during program execution, is equivalent to executing an HP-GL PU or PD instruction.

- *B/A3, A/A4 Lights*

  The B/A3 and A/A4 lights indicate the currently selected paper size. When the rear-panel US/MET switch is set to US, the lights indicate A or B paper size; when the switch is set to MET (metric), they indicate A4 or A3 paper size. Because one of the two paper-size lights is always on, these lights also serve as power-on indicators.

- *SIZE Pushbutton*

  Pressing the SIZE pushbutton simultaneously with the ENTER pushbutton selects the alternate paper size. Each time a new paper size is selected, the size status indicator lights reverse, the plotter assumes a new piece of paper is loaded, P1 and P2 are set to their default coordinate locations, and the input window is set to the new hard-clip limits.

- *VIEW Pushbutton*

  Pressing the latching VIEW pushbutton turns on the ERROR light, suspends plotting, raises the pen, and moves the paper so it is fully extended. Now you can manually substitute pens and view the entire plotting area.

  Pressing the VIEW pushbutton once more, turns off the ERROR light, returns the pen to its previous coordinates and status (up or down), and plotting resumes.

- *Cursor Pushbuttons*

The five cursor pushbuttons are used to move the pen within the hard-clip limits as follows.

- Pressing a cursor pushbutton moves the pen in the direction of the arrow and stops the plotting until the pushbutton is released.
- Simultaneously pressing two adjacent cursor pushbuttons moves the pen at a 45-degree diagonal between the two arrow directions.
- When FAST in pressed in conjunction with any cursor pushbutton, cursor speed becomes four times greater.
- Pressing FAST by itself stops plotting as long as the pushbutton is held down.

- *ENTER Pushbutton*

The multi-purpose ENTER pushbutton is used for changing paper size and the locations of scaling points P1 and P2, rotating the coordinate system, storing the currently held pen, resetting the plotter to power-up default conditions, and digitizing.

The enter function is non-latching. This means that the ENTER pushbutton must be pressed simultaneously with one of the following pushbuttons to initiate the defined action.

- ENTER + SIZE—Selects the alternate paper size and initiates the actions defined for the SIZE pushbutton.
- ENTER + P1/P2—Defines the current pen location as the new P1 or P2 scaling point. Remember to set P1 first, because P2 moves when P1 is moved.
- ENTER + FAST—Rotates the coordinate system 90 degrees from its current state.
- ENTER + PEN #—Stores the pen currently held in the pen holder into the corresponding numbered carousel location if this position is empty. The pen holder then returns to its previous location.
- ENTER + VIEW—Resets all power-up default conditions. This is the same as turning the power off and then on again.

- ENTER (digitizing)—The current paper-size light will blink when the plotter receives the HP-GL instruction, DP. This means that the digitizing mode is initiated and the pen should be moved to the point to be digitized. If ENTER is then pressed, the paper-size light stops blinking and the actual *X* and *Y* coordinates of the point and the pen status (up or down) are stored in the plotter's output buffer.

Rear Panel Controls

The rocker switch identified as number 1 on Figure 15-5, controls application of AC power to the plotter. Number 2 is the power-input socket. Number 3 is the line power fuse. For greater detail on any of the control switches or indicators refer to the Reference Manual and Owner Manual.

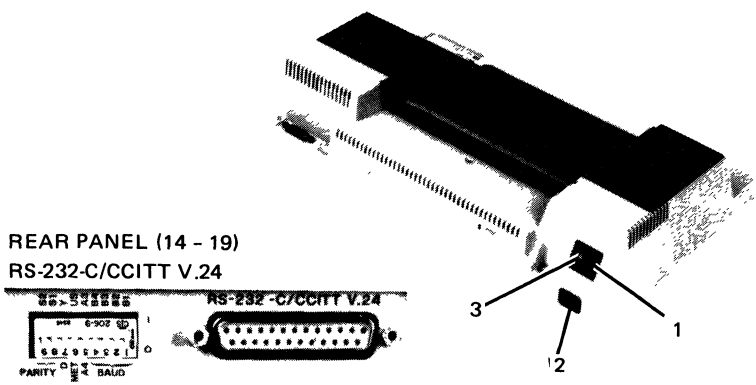


Figure 15-5 ▪ Rear Panel Controls

- *RS-232-C/CCITT V.24 Connector*

  The RS-232-C/CCITT V.24 compatible, 25-pin connector is used to connect the plotter to a host computer.

- *Configuration/Interface Switches*

The DIP switch pack on the rear panel of the plotter has nine switches that should be set up before power is supplied to the plotter. The Standard LVP16 configuration is as follows:

B1 = 1

B2 = 0

B3 = 0

B4 = 1

A3/A4 = 0

MET/US = 1

D/Y = 0

S1 = 0

S2 = 0

PARITY S1 Switch The PARITY S1 rocker switch controls parity generation and checking for data transmission. If set to "0," no parity generation or checking will occur. If set to "1," parity generation and checking will be odd or even, depending on the setting of the S2 switch.

PARITY S2 Switch The PARITY S2 rocker switch establishes the type of parity to be used, either odd or even. Setting S2 to "1" establishes odd parity; "0" establishes even parity.

D/Y Switch The D/Y rocker switch corresponds to the plotter's interconnect configuration. Position D is used when the plotter is directly connected to a computer. Position Y is used when the plotter is connected between a terminal and computer (eavesdrop operating environment).

US/MET Switch The US/MET switch is used in combination with the A4/A3 rocker switch to select one of four possible default paper sizes with the appropriate sized hard-clip limits and default P1/P2 coordinate values.

A4/A3 Switch The A4/A3 rocker switch is used in combination with the US/MET rocker switch to select the default paper size. Combination switch settings of the US/MET and A4/A3 switches are the following: US/A4 setting selects for ANSI A, US/A3 for ANSI B, MET/A4 for ISO A4, and MET/A3 for ISO A3 paper size.

BAUD Rate Switches The four BAUD rate rocker switches are used to select a baud rate that corresponds with your computer's data transmission rate. The baud rate is selected by setting switches B1 through B4 to appropriate binary bit positions. See Table 15-2 for the switch settings.

Table 15-2 ▪ Baud Rate Switch Settings

Baud Rate (Bits per Second)	One-stop Bit				Two-stop Bits			
	B4	B3	B2	B1	B4	B3	B2	B1
External	—	—	—	—	0	0	0	0
75	—	—	—	—	0	0	0	1
110	—	—	—	—	0	0	1	0
150	0	0	1	1	—	—	—	—
200	0	1	0	0	—	—	—	—
300	0	1	0	1	1	0	1	1
600	0	1	1	0	1	1	0	0
1200	0	1	1	1	1	1	0	1
2400	1	0	0	0	1	1	1	0
4800	1	0	0	1	1	1	1	1
9600	1	0	1	0	—	—	—	—

▪ Maintenance

For continuous high-quality production of graphics institute a maintenance routine. Clean the pen carousel periodically to remove ink, lint, or dust deposits. Wipe out the pen cap with a cotton swab moistened with alcohol or pen cleaning solution. Allow the carousel to dry thoroughly before inserting pens.

▪ The Demonstration Plot/Confidence Test

The plotter has a built-in demonstration plot, Figure 15-1, that will run on paper of any size. However, the plot is centered only on A-size paper and approximately centered on A4-size paper. If the plotter is set for larger paper, it will automatically switch to the smaller paper size before running the plot. After the demonstration plot is completed, all plotter functions, except paper size, are returned to their default conditions. The demonstration plot is performed as follows:

1. Loading A-size or A4-size paper and a full carousel into the plotter. The carousel may be filled with any combination of pens. However, the pen widths and colors shown in Table 15-3 are recommended for drawing the demonstration plot.

Table 15-3 ▪ Demonstration Plot Pen Choices

Pen Number	Pen Type and Color
1	P.7, black
2	P.3, black
3	P.3, red
4	P.3, green
5	P.3, blue
6	P.3, violet

2. Initiate the demonstration plot by holding down the P1 and P2 pushbuttons at the same time the plotter is turned on.

▪ Programming Information

The LVP16 Graphics Plotter is a vector plotter activated by the HP-GL graphics programming language. For HP-GL instructions and programming information for the LVP16 refer to Appendix E .

▪ Additional Documentation

The following documents contain more detailed information about the LVP16 color graphics pen plotter.

- *LVP16 Graphics Plotter Owner's Manual* (EK-LVP16-OM), familiarizes the user with the capabilities and operation of the plotter. The manual is designed to show you how to operate, but not to program, the plotter. The information given will enable you to verify that the plotter has not been damaged in shipment. The manual explains each plotter control and indicator, the coordinate system, and how to set up and run the built-in demonstration plot. Information is provided to show you how to install, cable, and test your plotter.
- *LVP16 Graphics Plotter Programmer Reference Manual* (EK-LVP16-RM-001), contains interfacing and programming information for the LVP16 plotter and its interface (RS-232-C/CCITT V.24). It includes all information any programmer needs to program in HP-GL and to interface the plotter with DEC computers.
- The *LVP16 Reference Card* contains a summary of HP-GL and device control instructions, plotter default conditions, and a list of error numbers and their meanings.

▪ Specifications

Plotting Characteristics

Pen velocity, each axis	Pen down: 38.1 cm/s (15 in/s maximum) Programmable from 1 to 38 cm/s in increments of 1 cm/s Pen up: 50.8 cm/s (20 in/s)
Acceleration	Approximately 2 g's (19.62 m/s) at maximum programmed pen speedApproximately 0.5 g's (4.91) at all other pen speeds
Resolution	0.025 mm (0.00098 in) (smallest addressable step size)
Repeatability	With a single pen: 0.0102 cm (0.004 in)From pen to pen: 0.0203 cm (0.008 in)

Physical Characteristics

Height	127 mm (5 in)
Width	568 mm (22.4 in)
Depth	367 mm (14.5 in)
Weight	7 kg (16 lb)

Media

Paper Dimensions	ANSI A (8.5 by 11 in)ANSI B (11 by 17 in) ISO A4 (210 by 297 mm) ISO A3 (297 by 420 mm)
Transparency Dimensions	ANSI A (8.5 by 11 in)ISO A4 (210 by 297 mm)

Character Sets

19 character sets	ANSI ASCII, 9825 character set, French/German, Scandinavian, Spanish/Latin American, JIS ASCII, Roman 8 Extensions, Katakana, ISO IRV (International Reference Version), ISO Swedish, ISO Swedish for Names, ISO Norwegian Version 1, ISO German, ISO French, ISO English/United Kingdom, ISO Italian, ISO Spanish, ISO Portuguese, ISO Norwegian Version 2.

Communications

Baud Rates	75, 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600
Eavesdrop Capability	Eavesdrop cable allows connection to serial printer

Power Requirements

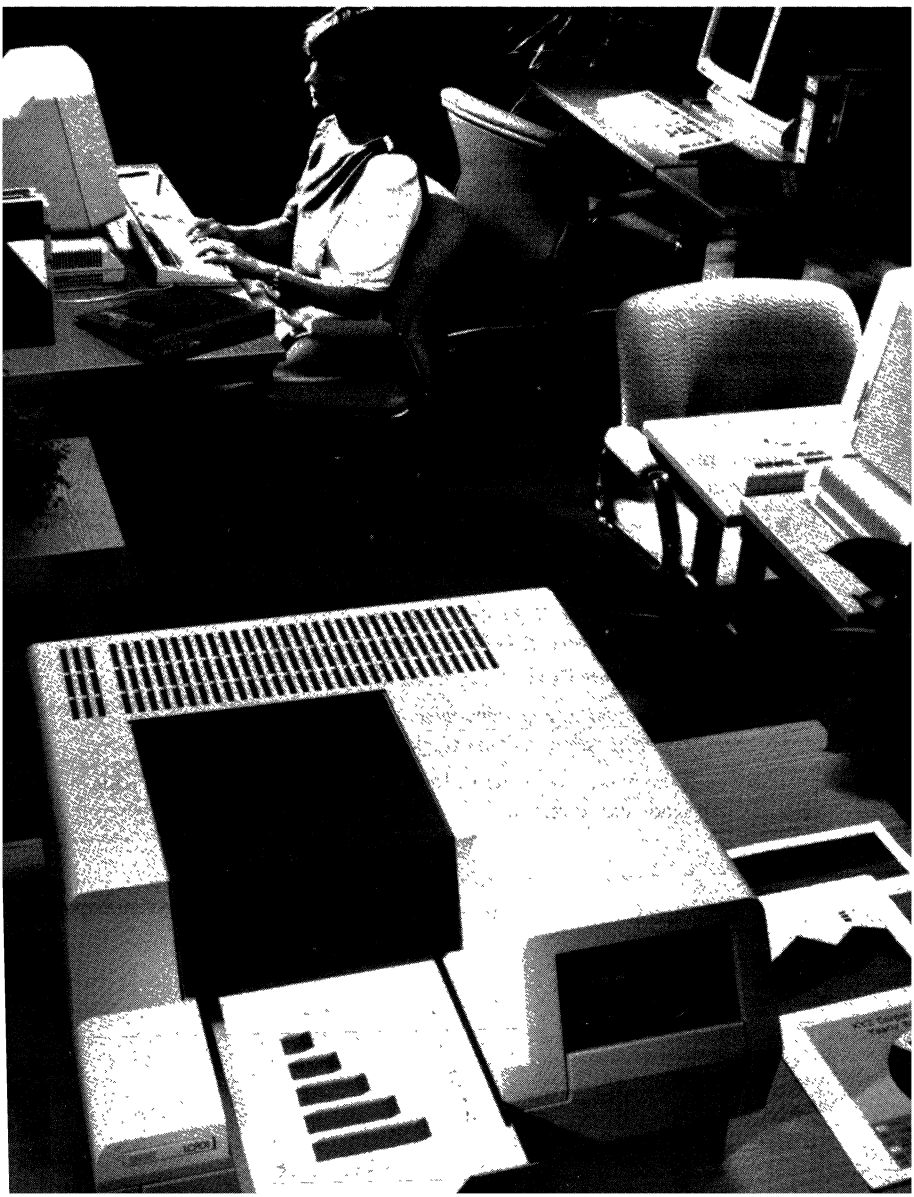
Voltage	100, 120, 220, 240 V
Frequency	Range of 48 to 66 Hz
Power Consumption	35 W max
Heat Dissipation	120 Btu/hr

Operating Environment

Temperature	0 to 55°C (32 to 130°F)
Relative Humidity	5 to 95% at 40°C (100°F)

Nonoperating Environment

Temperature	– 40 to 75°C (– 100 to 165°F)
Cabling	Connects the VT240 and VT241, PC278, PC325, and PC350 using a BCC20 cable assembly. Connects the PC278 using a BCC19 cable assembly.



▪ Overview

Digital's LCG01 Color Printer is more than just another ink-jet color printer. It is an intelligent printing system that processes display files to deliver prints that are sharper and clearer than the graphics on your screen.

Integral graphics processing means your host system doesn't have to format data. Your terminal isn't tied up driving a single-user printer. Several users can prepare graphics at their own terminals and print brilliant color copies on the LCG01 while the CPU runs other tasks. The LCG01 can be a shared resource for a network of graphics terminals and workstations. This translates to cost-effective color printing.

The LCG01 delivers a 154-by-154-dots-per-inch resolution coupled with 216 color shades. The print quality doesn't come at the expense of speed. The LCG01 can produce a perfect color-filled copy in approximately two minutes. You can also choose from up to five different fonts stored in the LCG01, mixing and matching size, style, and color for emphasis and variety.

Reduced system overhead, superior print quality, and swift printing speed are the features that make the LCG01 printer the perfect hardcopy companion for Digital's color graphics workstation— VAXstation II/GPX. The VAXstation II/GPX supports a wide variety of applications ranging from VLSI and PC board layout to mechanical CAD, process control monitoring, technical document preparation, and weather mapping. The LCG01 can capture and transform any of these screen images into vivid hardcopy.

In addition to these design applications, the LCG01 is an excellent tool for generating top-quality business graphics for reports and presentations. It is compatible with Digital's DECslide, DECgraph, DATATRIEVE, and VTX office software as well as third-party packages based on ReGIS, GIDIS, NAPLPS, or Color Sixel protocols.

The LCG01 Color Printer is available in one model:

LCG01-*AA*: Color printing system with graphics protocol processor, US power cords, documentation, and startup kit.

In addition, country kits are available for Continental Europe, United Kingdom, Switzerland, and Australia.

▪ Major Features

The LCG01 Color Printer's main features are

- Serial line interface—Makes it host independent.
- 154 dots per inch resolution—Produces quality hardcopy.
- Eight true colors in yellow, magenta, cyan, red, blue, green, black, and white, in up to 216 combinations and shades—Provides infinite range of creative color printing.
- Automatic sheet-fed paper copy or transparencies—for printed copy or visual presentations.
- ReGIS, GIDIS, NAPLPS, UIS, and bit-map Color Sixel display file processing—Allow for a variety of applications.
- Graphics images scaled to printer coordinates—Allows for the perfect placement of graphics.

▪ Printing and Graphics Features

Ink-jet printing

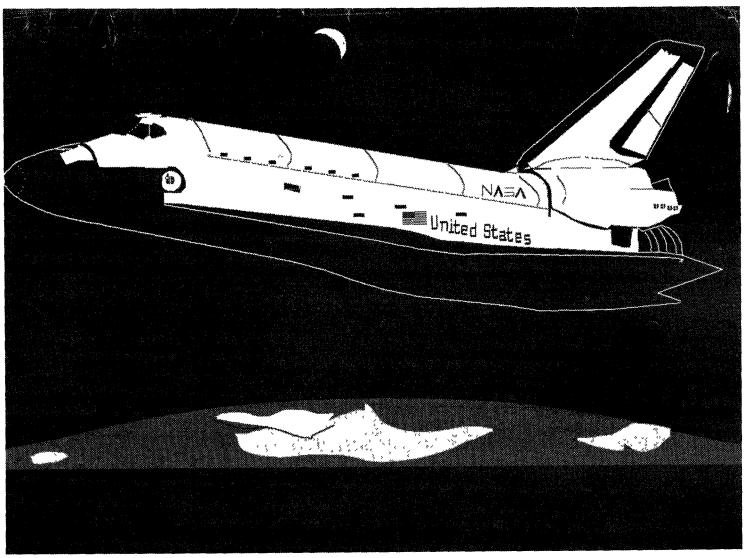
Ink-jet printing is a broad term describing techniques in which drops of ink are projected onto a surface to form a permanent image. The LCG01 uses 'drop-on-demand' ink-jet technology which provides a practical combination of reasonable cost and reliability of performance.

'Drop-on-demand' ink-jet printers have reservoirs for each of the ink colors. The ink reservoirs replenish the ink which is kept in small volumes sitting in a chamber near an exit nozzle. A pizoelectric crystal or miniature heater generates a pressure pulse in the volume and a drop of ink is ejected from the nozzle towards the paper. The drop production rate is usually under 10,000 drops per second. Because the inks are transparent, color mixing is achieved by printing one color on top of another.

The LCG01 utilizes a technology using a rotating drum with a linear scanning head. The plotter paper wraps around the drum which spins at a high speed. The print head sprays an entire scan line on to the paper with ink droplets synchronized to the spinning drum. After each scan line, the head moves over a fraction of a millimeter and sprays the next scan line of dots. Each location on the paper passes under all four color heads in sequence, eliminating the need for multiple passes. High resolution on one axis is produced by close timing of drops with the spinning drum; resolution on the other axis is defined by the small linear steps made by the ink-jet carriage.

Professional-looking Prints and Transparencies

The LCG01 provides up to 1536 by 1152 dots in an A-size image. This is near letter-quality copy, and the resolution you need to create brilliant, professional-looking prints and transparencies. The LCG01 onboard graphics processor smoothes stairsteps in diagonal lines, sharpens jagged characters, and improves definition between colors. A palette of 216 vibrant colors allows for very fine or detailed shading of objects. Whether you're printing a complex mechanical model or a simple bar graph, the LCG01 delivers the same high-quality output.



PRINTED BY
DIGITAL'S LCG01 COLOR PRINTING SYSTEM
(40% of Actual Size)

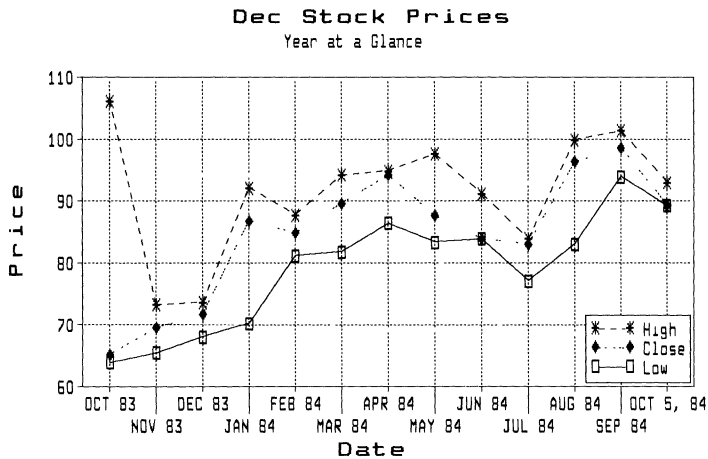
▪ Paper

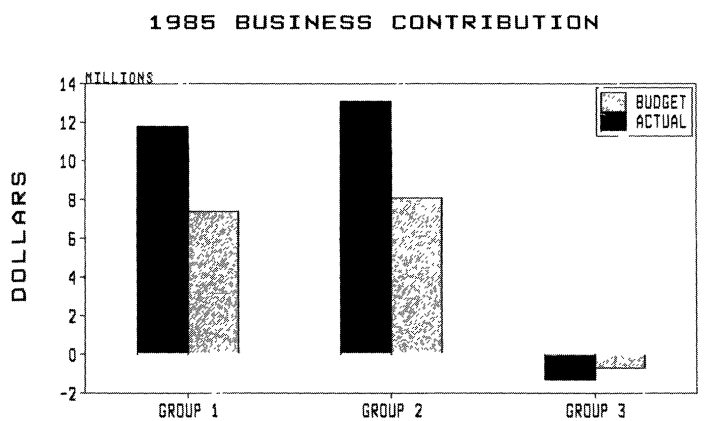
The LCG01 prints on paper sheets and transparencies that are specially coated to achieve the highest quality output. Both paper and transparency sheets are available in sizes 8.5 by 11 inches and A4 (210 by 297 millimeters).

All of the LCG01 Color Printer supplies are easily installable by the operator. Note: Supplies for the LCG01 (ink, paper, transparency) are specially designed to be used with the LCG01; substitute supplies will not always produce the same high quality output.

▪ Ink

The LCG01 uses water-based ink in four colors, black, cyan, magenta, and yellow. The use of water-based ink prevents the clogging of jets. Mixtures of the inks used by the LCG01 can produce up to 216 combinations and shades of colors. The provision of a true black ink cartridge is a definite advantage over the production of an indefinite black achieved by mixing of primary colors.





DECSLIDE/DECGRAPH OUTPUT
PRINTED BY
DIGITAL'S LCG01 COLOR PRINTING SYSTEM

(50% of Actual Size)

▪ Options

Model Number	Description
LCG01-KG	Country Kit — Continental Europe, BN03A-2E (two power cords each)
LCG01-KE	Country Kit — United Kingdom, BN02A-2E (two power cords each)
LCG01-KK	Country Kit — Swiss, BN04A-2E (two power cords each).
LCG01-KZ	Country Kit — Australia, BN05A-2E (two power cords each)

▪ Accessories and Supplies

The ink cartridges are disposable and operator installable. The maintenance cartridge, also user-installable, keeps your ink-jet heads clean and moist, and prevents clogging.

Because of the special ink used in the LCG01 color printer, Digital offers specially coated paper and transparencies that give highest quality hardcopy.

For the latest information on LCG01 accessories and supplies contact your sales representative or Digital's Peripherals and Supplies Group. Orders can be placed directly through DECdirect distribution (800-258-1710).

Ink Cartridges

Part Number	Description
LCGX1-JB	Black Ink Cartridge
LCGX1-JC	Cyan Ink Cartridge
LCGX1-JM	Magenta Ink Cartridge
LCGX1-JY	Yellow Ink Cartridge
LCGX1-JW	Maintenance Cartridge

Transparencies and Paper

Part Number	Description
LCGX1-AA	Transparencies, 8.5 by 11 inch sheets (size A), 100 sheets per package
LCGX1-AE	Transparencies, 210 by 297 millimeters (size A4), 100 sheets per package
LCGX1-PA	Paper, 8.5 by 11 inch sheets (size A), 500 sheets per package
LCGX1-PE	Paper, 210 by 297 millimeters (size A4), 500 sheets per package
LCGX1-PT	Paper tray

▪ Operator Features

Controls and Indicators

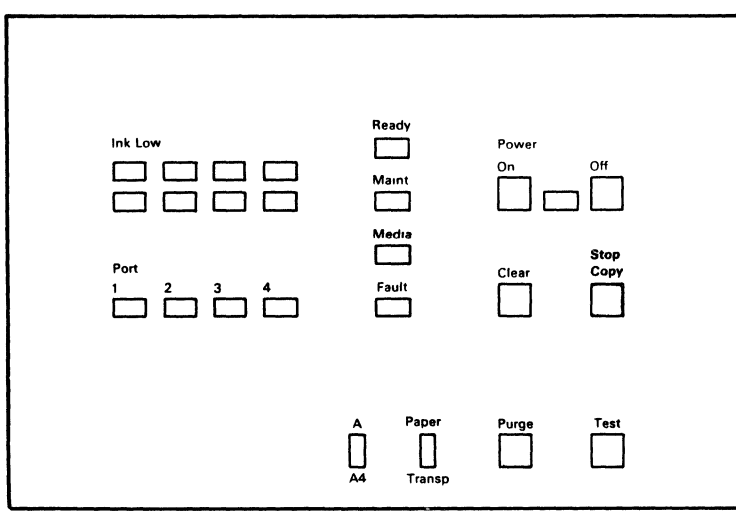


Figure 16-1 ▪ LCG01 Controls

▪ *Power On Button*
The Power On button turns the printer power on. The power indicator lights up.

- *Power Off Button*
  The Power Off button puts the printer into powered-down state, it does not remove the line voltage from the printer. To do so the power cord is removed. To prevent printer damage, wait for the power indicator to stop flashing before disconnecting the power cord from the line voltage.

- *Clear Button*
  The Clear button clears a printer fault indication, or any indication that tells the operator to replace media, ink, or maintenance liquid. Press Clear after fixing the fault cause. This exits the printer from Service mode and places it into Normal mode.

- *Stop Copy Button*
  The Stop Copy button stops any ongoing printing operation, unloads the paper, and then places the printer into a Ready condition for the next copy command.

- *Purge Button*
  The Purge button starts the purge function that expels trapped air and particles from the ink-jet heads and then washes the ink-jet heads. Use the purge feature if poor copy is detected.

- *Test Button*
  The Test button lets the operator display the printer's extended error codes when a fault occurs. Pressing the Test button lets the operator print one of four test patterns (indicated by the lit condition of the Port indicators). Releasing the Test button at the chosen Port tells the printer to print that test pattern.

- *A/A4 Slide Switch*
  The A/A4 Slide switch tells the printer whether A-size or A4-size media has been stacked in the media input tray.

- *Paper/Transp. Slide Switch*
  The Paper/Transp. slide switch tells the printer whether paper or transparency film has been stacked in the media input tray.

Table 16-1 ▪ Summary of Printer Indicators

Indicator	Description
Power	Power light is on when the printer is powered up. the Power indicator will flash when the printer is preparing for power-down.
Ready	The Ready indicator is lit when the printer is ready for operation (print, purge, or test). Flashing indicates that the printer is in transition between conditions.
Fault	The Fault indicator unlit indicates that a printer problem is not detected. When the Fault indicator is lit, a printer problem exists.
Fault Flash/ Ready Flash	Printer has been placed into Service mode. To exit press the Clear button and then the Stop Copy button.
Maint.	The Maintenance indicator provides the status of the fluid in the maintenance liquid cartridge. When unlit, no action is needed. The Maintenance indicator is lit when the printer is performing self-maintenance procedures. Flashing indicates that the maintenance liquid cartridge needs replacing.
Media	Unlit indicator needs no action. Media (lit or flashing)/Fault indicator lit means that the printer requires operator action (reload input tray, check adjustments).
Ink Low	Unlit, there is sufficient ink in all cartridges. Lit, indicates the ink cartridge is getting low on ink.
Ink Low Flash/ Fault Lit	If the Ink Low is flashing and the Fault indicator is lit, the ink cartridge specified by the flashing Ink Low light is empty and needs to be replaced.

Set-up Features

The serial and baud rate switches are located on the rear of the LCG01-CC controller located under the printer. Ask your site manager for the serial and baud rates for your installation. First set all switches down, then set serial and baud rate switches up as shown in Table 16-2.

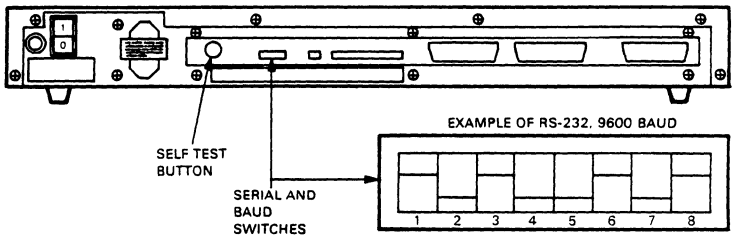


Figure 16-2 ▪ LCG01 Serial and Baud Rate Switches

Table 16-2 ▪ LCG01 Baud Rate Settings

Serial Protocol	Baud Rate	1	2	3	4	5	6
20mA	1200	—	—	DOWN	DOWN	—	UP
	9600	—	—	DOWN	UP	—	UP
RS-232C	1200	DOWN	DOWN	UP	—	—	—
	9600	UP	DOWN	UP	—	—	—
	19200	DOWN	UP	UP	—	—	—
RS-422	1200	—	—	DOWN	DOWN	DOWN	DOWN
	9600	—	—	DOWN	UP	DOWN	DOWN
	19200	—	—	DOWN	DOWN	UP	DOWN

Note: Switches 7 and 8 can be either up or down. Their setting does not affect the system operation.

For a program summary (escape sequences) for the LCG01, refer to Appendix E. For detailed programming information refer to the LCG01 *Color Printing System User's Guide.*

▪ Maintenance

Routine preventive maintenance by the user is suggested for the LCG01. Refer to the Installation/Operator's Manual for detailed explanation on how to replace the maintenance liquid cartridge, cleaning the head carriage rails, drum, media stripper, exit ramp, and head maintenance station.

Self-test Procedures

Self-test procedures print a total of six test patterns. Four of these test printer functionality; two test the entire system (graphics processor and the printer).

▪ *Start and Test the Printer*

1. Push the Power On button on the front panel. You should hear a low motor sound. This is the ink head carriage assembly moving to the left side and automatically washing the ink heads. During this time the Maint. indicator will light. Upon completion of the wash cycle (about 20 seconds), the Ready indicator will light.
2. Open consumables access door.
3. Purge ink lines. Push the Purge button. The ink-jet heads will operate at a higher than normal rate for about 30 seconds. The Maint. indicator will light. Upon completion, the Ready indicator will light.
4. Print a standard test pattern. Push and hold the Test button. Ports 1 through 4 will light in sequence. Release the Test button at Port 2 and the printer will pick up the top sheet from the media tray and will print the Port 2 test pattern. After approximately two minutes, the printer will eject the media into the output tray.
5. At this point you can run the convergence test pattern. Refer to the Installation/Operator's Manual for procedure.
6. The printer is ready to operate when Power and Ready indicators are lit.

▪ *Start and Test the Processor*

1. Set the power switch to l (on position). The processor will beep once and start its self test. In about one minute, it will beep again to indicate a successful test, or sound a long tone to indicate a problem. The four red LED indicators, located on the rear panel, will blink on and off in unison, indicating that the processor RAM software is not yet loaded.
2. Print character set test pattern. Push the Test button, located on the rear panel. The printer will print the ROM resident character set in black and white. This verifies that the processor is working properly and is ready for you to load the processor RAM software.

Troubleshooting Checklist

If the LCG01 Color Printer System fails to operate satisfactorily, check the printer first, then the processor. If the printer does not make a copy, or makes a poor quality copy, find the symptom and institute the solutions indicated in the following list. For further information refer to the Installation/Operator's Manual.

- *Printer Will Not Make Copy Checklist*

Printer does not operate and front panel indicators do not light.

- Check that the power cord is plugged in.
- Press Power On button.
- If the Power On light does not light, unplug the power cord and check the line fuse on the rear of the printer.

Printer does not turn off.

- Make sure you wait at least 30 seconds for normal head maintenance to occur.

Ready indicator does not light.

- Check to see if other front panel indicators such as Ink Low, Maint., or Fault are lit or flashing. If they are not, press the printer's Power Off button, wait for the Power indicator to go out, and then press Power On.

Media indicator lit with Fault lit.

- If media input tray is empty, refill the tray with paper or transparency film.
- Check that the media input tray is fully pressed into the cabinet.

Ink Low indicator flashing.

- Replace the indicated ink cartridge.

Ink Low indicator lit.

- This is a warning that an ink cartridge will soon need replacement.

Fault indicator lit.

- Check if another front panel indicator is lit in combination with Fault. Refer to the operation chart on the inside front panel.

Ink smeared on leading edge of copy.

- Open top cover door and inspect drum media stripper and media exit ramp. If they are dirty, refer to the cleaning procedures described in the Installation/Operator's Manual.

Poor copy quality.

- Check that coated side of paper is facing down. If ink problems occur with one specific color, press the printer's Purge button and wait for the Ready indicator light (about 30 seconds). Then continue with normal printer use.

Printer prints wrong size image on A or A4 size media.

- Check media input tray for proper media size.
- Make sure the A/A4 slide switch setting on the front panel matches the size of media in the tray.

▪ *Poor Copy Quality Checklist*

Ink smeared on trailing edge of copy.

- Wipe off any wet ink on the drum assembly or media stripper. See if the copy is blurred or smeared. Check the media as described in the Installation/Operator's Manual.

Ink colors do not converge properly, they overlap.

- Print the Convergence Test Pattern as described in the Installation/Operator's Manual. If lines do not overlap, call Digital Field Service.

Ink dots randomly appearing in copy.

- Check that the printer is level.
- Indicates an ink-jet or air pressure problem. If a purge operation does not fix the problem, contact Digital Field Service.

Wrong picture orientation on copy.

- Check the host or terminal command used to make the copy.

Copy colors are pale or incorrect.

- Make sure the printer is not printing on the wrong side of the media.
- Check for and remove non-Digital paper or film material placed in the media input tray.

One or more colors are missing.

- Print Test Pattern 2. If a color is missing, perform a purge operation and reprint. Repeat several times if necessary. If colors will not recover, call Digital Field Service.

- *Processor Problem Solutions*

If you have not cleared the operating problem using the printer problem solutions described above, then

- Check the printer by pushing the Test button to print a test pattern. If the printer produces a test pattern, the printer is functioning properly.
- If the problem is not in the printer, then it may be in the processor, the connection to the printer, the connection to the host or in the host computer. First, check the cables to the printer and from the host.
- Then, look at the four LED indicators on the rear of the processor to see if they display any of the states on the following page.
- Find the Indicator State in Table 16-3 and take the Corrective Action.

Table 16-3 ▪ Processor Indicator Meanings

Indicator State	Processor State	Corrective Action
No indicators lit	No power	Check power cord. Perform power-up procedure.
All indicators lit	RAM software loaded ready to operate	Push Test button on rear of processor. Printer should print a test pattern (unique to processor). If it does, processor is okay.
All indicators blinking in unison	RAM Software not loaded	Go to the Install Software Section of the Installation/Operator's Manual and load RAM software. You may confirm RAM software not loaded by pushing Test button. Printer should print a character set in black and white.
Indicators flickering	Loading firmware	Wait for indicators to light steadily.
Some indicators lit, some indicators not lit	Processor Error Message	Push Test button. If indicators remain lit, there is a processor problem. Write down the indicator sequence (example: 1-On 2-Off 3-On 4 Off) and describe the problem to Digital Field Service.

▪ Additional Documentation

The following documents contain more detailed information about the LCG01.

- The LCG01 *Installation and Operator Manual* EK-LCG01-IN—Shows the user how to install, test, and operate the LCG01 Color Printing System in an office environment.
- The LCG01 *User's Guide* EK-LCG01-UG—Contains summary descriptions of the commands in each of the descriptor languages (ReGIS, NAPLPS, GIDIS, Color Sixel) supported by the LCG01. It also includes summary descriptions of the control functions recognized by the LCG01.

▪ Specifications

Mechanical

Height	21.6 cm (8.5 in)
Width	61.0 cm (24.0 in)
Depth	61.6 cm (24.25 in)
Net Weight Printer	31.8 kg (70 lb)
Net Weight Controller	11.7 kg (26 lb)

Electrical

AC input power	120/240 Vac
Input line frequency	50 or 60 Hz
Power consumption	600 W (maximum)
System interfaces	RS232C, RS422, and 20mA

Environmental

Operating temperature	15–35°C (59–95°F)
Relative humidity	15–85 %
Noise	Less than 55 dBA

Graphics

Protocols	ReGIS, NAPLPS, GIDIS, and Color Sixel formatted data
Print reolution	154 dots per inch
Image size	A size (7.5 by 9.95 in) or A4 size (7.27 by 9.95 in)
Print image resolution	1536 by 1152 dots (maximum)
Print colors	Yellow, magenta, cyan, red, green, blue, black, and white
Print shades	216
Print rate	Approximately 2 minutes per copy
Ink cartridge capacity	200 ml (6.8 oz)
Maintenance supply capacity	250 ml (8.5 oz)
Maintenance drain capacity	350 ml (11.9 oz)
Diagnostics	Self-test, VAX-11 Level IIR, and PDP-11 XXDP +

Print Media

Paper	Box of 500 specially coated sheets 8.5 by 11 inches and 210 by 297 millimeters
Transparencies	Box of 100 specially coated sheets 8.5 by 11 inches and 210 by 297 millimeters

Chapter 17 ▪ System Printers—LP25, LP26, and LP27

▪ Overview

The freestanding LP25, LP26, and LP27 system printers are ideal for a variety of environments—data processing, commercial, scientific, industrial, and educational. All versions of the band printer family are supported by UNIBUS PDP-11 and VAX systems, and DECsystem-10s and DECSYSTEM-20s.

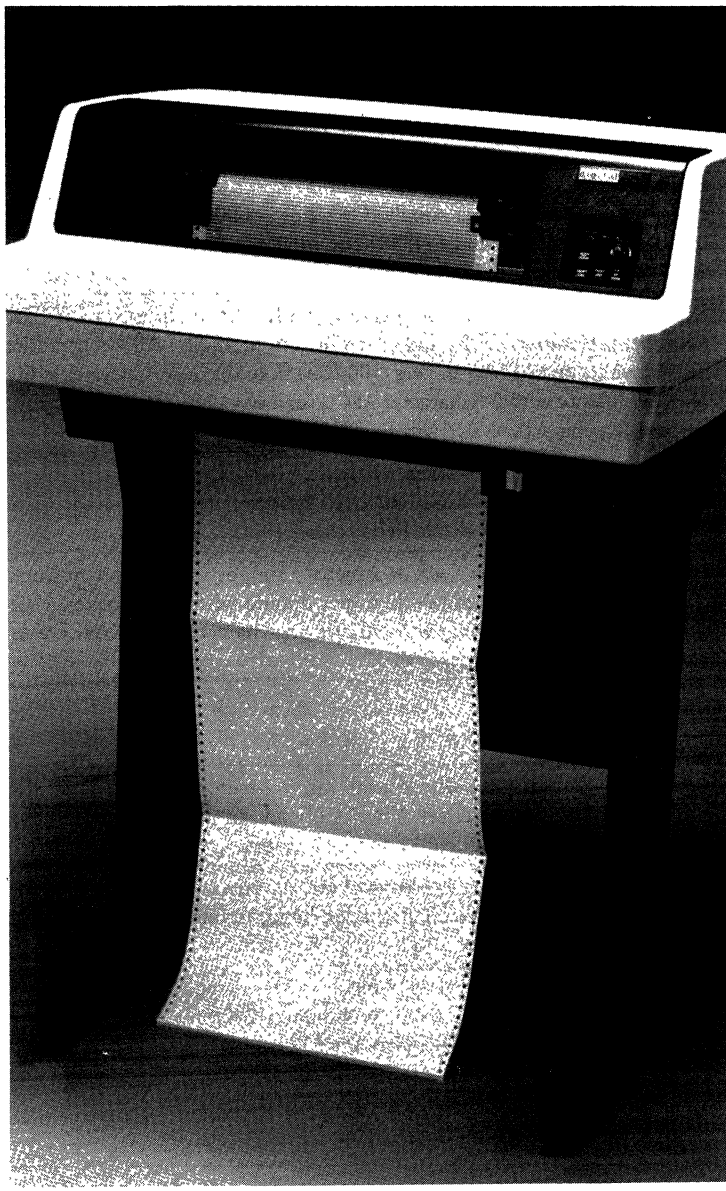
Since this family uses reliable band printer technology, your system printer is up when you need it. And whatever your workload requirements, Digital has a system printer for you. The LP25 and LP26 are made for medium-duty work environments in a one-shift environment, while the LP27 is designed for heavy-duty applications over two shifts or 16 hour-per-day operation.

The LP25 and LP26 printers operate at medium speeds—up to 300 and 600 lines per minute, while the LP27 tackles high-speed jobs at rates up to 1,200 lines per minute.

The following system printers are available.

LP25 Variations

- *LP11-AA*—Band printer with LP11 interconnect kit, 9.2-meter (30-foot) cable, and universal power supply. Operates at 300 lines per minute with 64-character ASCII set. For use with PDP-11s or VAX systems with LP11 controller.
- *LP11-BA*—Band printer with LP11 interconnect kit, 9.2-meter (30-foot) cable, and universal power supply. Operates at 300 lines per minute with 64-character ASCII set and 215 lines per minute with 96-printing-character ASCII set. For use with PDP-11s or VAX systems with LP11 controller.
- *LSP25-CA*—Long-line band printer with control kit, 15.3-meter (50-foot) cable, and universal power supply. Allows operation of the printer up to 152.5-meters (500 feet) from the host. Operates at 300 lines per minute with 64-character ASCII set and 215 lines per minute with 96-printing-character ASCII set. For use with PDP-11s.
- *LP32-AA*—Band printer with 9.2-meter (30-foot) cable, and universal power supply. Operates at 300 lines per minute with 64-character ASCII set. For use with VAX systems. Requires DMF32.
- *LP32-BA*—Band printer with 9.2-meter (30-foot) cable, and universal power supply. Operates at 300 lines per minute with 64-character ASCII set and 215 lines per minute with 96-printing-character ASCII set. For use with VAX systems. Requires DMF32.



The LP25 and LP26 printers operate at medium speeds—up to 300 and 600 lines per minute.

LP26 Variations

- *LP11-EA*—Band printer with LP11 interconnect kit, 9.2-meter (30-foot) cable, and universal power supply. Operates at 600 lines per minute with 64-character ASCII set. For use with PDP-11s or VAX systems with LP11 controller.
- *LP11-EB*—Band printer with LP11 interconnect kit, 9.2-meter (30-foot) cable, and universal power supply. Operates at 600 lines per minute with 64-character ASCII set and 445 lines per minute with 96-printing-character ASCII set. For use with PDP-11s or VAX systems with LP11 controller.
- *LPS26-CA*—Long-line band printer with LP11 interconnect kit, 15.3-meter (50-foot) cable, and universal power supply. Allows operation of the printer up to 152.5-meters (500 feet) from the host. Operates at 600 lines per minute with 64-character ASCII set and 445 lines per minute with 96-printing-character ASCII set. For use with PDP-11s.
- *LP32-EA*—Band printer with 9.2-meter (30-foot) cable, and universal power supply. Operates at 600 lines per minute with 64-character ASCII set. For use with VAX systems. Requires DMF32.
- *LP32-BE*—Band printer with 9.2-meter (30-foot) cable, and universal power supply. Operates at 600 lines per minute with 64-character ASCII set and 445 lines per minute with 96-printing-character ASCII set. For use with VAX systems. Requires DMF32.

LP27 Variations

- *LP27-UA*—Band printer with control kit, 9.2-meter (30-foot) cable. 120 VAC. 64- and 96-character set American band, minimum 1,200/800 lines per minute. For use with PDP-11 and VAX systems.
- *LP27-UB*—Band printer with control kit, 9.2-meter (30-foot) cable. 240 Vac. 64- and 96-character set American band, minimum 1,200/800 lines per minute. For use with PDP-11 and VAX systems.
- *LP27-VA*—Band printer with 9.2-meter (30-foot) cable. 120 Vac. 64- and 96-character set American band, minimum 1,200/800 lines per minute. For use with VAX systems. Requires DMF32 controller.
- *LP27-VB*—Band printer with 9.2-meter (30-foot) cable. 240 Vac. 64- and 96-character set American band, minimum 1,200/800 lines per minute. For use with VAX systems. Requires DMF32 controller.

- *LP27-2A*—Band printer with LP20 controller, 30.5-meter (100-foot) cable, long-line interface, and DAVFU. 120 Vac. 64- and 96-character set American band, minimum 1,200/800 lines per minute. For use with DECsystem-10s and DECSYSTEM-20s.
- *LP27-2B*—Band printer with LP20 controller, 30.5-meter (100-foot) cable, long-line interface, and DAVFU. 240 VAC. 64- and 96-character set American band, minimum 1,200/800 lines per minute. For use with DECsystem-10s and DECSYSTEM-20s.

Major Features

The key features for Digital's system printers are

LP25, LP26, and LP27

- High throughput printers—for high volume output.
- Reliable band technology—for greater uptime.
- User changeable bands—fast and easy replacement.
- Optional character band kits—enable you to choose the right band for your application.
- Error diagnostic codes—helps you pinpoint problems and maintain uptime.
- Low-cost volume output—economical printing and operation.

LP27 Additional Features

- Advanced printer band technology—provides crisp, fully-formed characters of even density regardless of paper stock used.
- Solid construction—ensures consistent high-performance even during prolonged printing and paper slewing at maximum speed.
- Advanced error diagnostic codes—enables your service personnel to quickly identify and correct error conditions.

▪ Printing Features

With LP25, LP26, and LP27 system printers, a flat, steel band with raised metal characters on its face does the printing. This band is mounted on two pulleys—one to the right and one to the left of the paper. The LP26 and LP27 hammer banks have 132 hammers (one for each column), while the LP25's doubled-faced, shared hammer bank uses only 66 hammers. These hammers strike twice, providing odd column hammer strike, followed by an even column scan hammer strike. When the selected character in an odd or even column comes around on the moving band, the corresponding hammer strikes it. On the LP26 and LP27 versions, as the band moves past the paper, every hammer may strike one character per column, thus printing a line. Because the LP26 and the LP27 use 132 hammers, the hammer strikes are randomly intermixed depending on what character in any designated column needs to be printed. For example, you can print characters in seven odd-numbered columns, and then some characters in three even-numbered columns.

LP25 Print Speeds

The LP25 prints at speeds up to 300 lines per minute using an uppercase, 64-character ASCII set and up to 215 lines per minute using the uppercase and lowercase 94-printing character ASCII set. The 64-character compressed band spaces 15 characters per inch, versus the standard 10 characters per inch. Because of this spacing difference, throughput speed decreases to 200 lines per minute.

LP26 Print Speeds

The LP26 band printer handles print speeds of up to 600 lines per minute for an uppercase, 64-character ASCII set. When using the uppercase and lowercase 94-printing character ASCII set, a maximum speed of 445 lines per minute is possible.

LP27 Print Speeds

With this printer, the uppercase, 64-character ASCII set is best for high-speed applications where maximum print speeds do not exceed 1,200 lines per minute. A minimum speed of 800 lines per minute is achieved by using the uppercase and lowercase, 94-printing character band.

▪ Character Sets

The LP25, LP26, and LP27 print the full 94-character printable ASCII set, up to 132 characters per line. Character form is determined by the band style selected. Optional character set bands for the LP26 and LP27 include British, German, Finnish/Swedish, Danish/Norwegian, and Spanish/Portuguese. With the LP25, you can choose any of these, in addition to a compressed printing band, which prints up to 215 characters per line. The band can be easily changed in a matter of minutes.

▪ Paper

The LP25, LP26, and LP27 accept continuous fanfold edge-perforated paper between 7.6 centimeters (3 inches) and 40.6 centimeters (16 inches) wide. Form lengths of 27.9 or 30 centimeters (11 or 12 inches) are possible. They accept single- or multipart carbon forms, and can produce an original and five copies of multipart carbon forms, up to a maximum thickness of 0.06 centimeters (0.025 inches).

▪ Accessories and Supplies

The following accessories, supplies, components, and spares are available for the LP25, LP26, and LP27 system printers. Check with your sales representative or Digital's Installed Base Group for the latest information.

Accessories

Part Number	Description
LP25R-06	Six ribbon cartridges, 2.54 cm wide by 45 m long (1 in wide by 50 yards long), 4 mm thick.

Supplies

Part Number	Description
H9850-FA	Paper caddy with four 5.1 cm (2 in) swivel casters for transporting printer paper, 40 cm wide by 29.8 cm deep (15-3/4 in by 11-3/4 in), charcoal brown.
LP25X-AA	American Band/PROM 64 characters, 10 char/in. For use with LP25.
LP26X-AA	Same as above but for the LP26.
LP25X-AB	American Band/PROM 96 characters, 10 char/in. For use with LP25.
LP26X-AB	Same as above but for the LP26.
LP25X-AC	American Band/PROM 64 characters, 15 char/in. For use with LP25.
LP26X-AC	Same as above but for LP26.
LP25X-BA	UK Band/PROM 64 characters, 15 char/in. For use with LP25.
LP26X-BA	Same as above but for the LP26.
LP25X-B	UK Band/PROM 96 characters, 10 char/in. For use with LP25.
LP26X-BB	Same as above but for the LP26.
LP25X-BC	UK Band/PROM 64 characters, 15 char/in. For use with LP25.
LP26X-BC	Same as above but for the LP26.
LP25X-CA	German Band/PROM 64 characters, 10 char/in. For use with LP25.
LP26X-CA	Same as above but for the LP26.
LP25X-CB	German Band/PROM 96 characters, 10 char/in. For use with LP25.
LP26X-CB	Same as above but for the LP26.

Part Number	Description
LP25X-DA	Finnish/Swedish Band/PROM 64 characters, 10 char/in. For use with LP25.
LP26X-DA	Same as above but for the LP26.
LP25X-DB	Finnish/Swedish Band/PROM 96 characters, 10 char/in. For use with LP25.
LP26X-DB	Same as above but for the LP26.
LP25X-EA	Danish/Norwegian Band/PROM 64 characters, 10 char/in. For use with LP25.
LP26X-EA	Same as above but for the LP26.
LP25X-EB	Danish/Norwegian Band/PROM 96 characters, 10 char/in. For use with LP25.
LP26X-EB	Same as above but for the LP26.
LP25X-JA	Katakana Band/PROM 128 characters, 64-ASCII, 64 Japanese. For use with LP25.
LP25X-AS	Spanish/Portuguese Band/PROM 64 characters, 10 char/in. For use with LP25 and LP26.
LP26X-AS	Same as above but for LP26.
LP25X-SB	Spanish/Portuguese Band/PROM 96 characters, 10 char/in. For use with LP25 and LP26.
LP26X-SB	Same as above but for LP26.
LP27X-AA	American Band, 64 characters, 10 char/in. For use with LP27.
LP27X-AB	American Band 96 characters, 10 char/in. For use with LP27.
LP27X-BA	UK Band, 64 characters, 10 char/in. For use with LP27.
LP27X-BB	UK Band 96 characters, 10 char/in. For use with LP27.
LP27X-CA	German Band, 64 characters, 10 char/in. For use with LP27.
LP27X-CB	German Band 96 characters, 10 char/in. For use with LP27.
LP27X-DA	Finnish/Swedish Band, 64 characters, 10 char/in. For use with LP27.
LP27X-DB	Finnish/Swedish Band 96 characters, 10 char/in. For use with LP27.
LP27X-EA	Danish/Norwegian Band, 64 characters, 10 char/in. For usew with LP27.

Part Number	Description
LP27X-EB	Danish/Norwegian Band 96 characters, 10 char/in. For use with LP27.
LP27X-SA	Spanish/Portuguese Band, 64 characters, 10 char/in. For use with LP27.
LP27X-SB	Spanish/Portuguese Band, 96 characters, 10 char/in. For use with LP27.
70-16560-30	Lineprinter interface cable, 9.2 m (30 ft)
70-16560-50	Lineprinter interface cable, 15.2 m (50 ft)
70-16560-AO	Lineprinter interface cable, 3.0 m (10 ft)
STKIT-AA	System Terminal Tool Kit (60 Hz)
STKIT-AB	Systems Terminal Tool Kit (50 Hz)
STKIT-MS	Metric Supplement Tool Roll

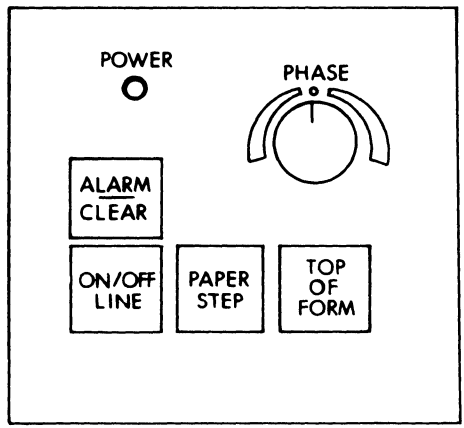
Spares

Part Number	Description
SLP25-00	LP25 spares kit
SLP26-00	LP26 spares kit
SLP27-00	LP27 spares kit

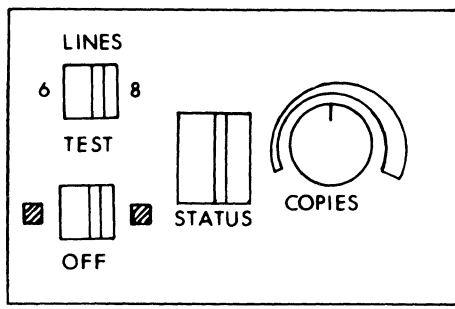
▪ Operator Features

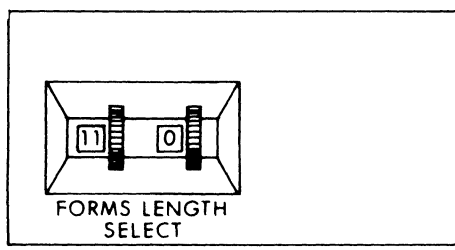
LP25 and LP26 Controls and Indicators

The LP25 and LP26 system printers have two control panels, one that is externally accessible, and one that is inside the printer's cover. See Figure 17-1.



FRONT PANEL





UNDER CONSOLE COVER

Figure 17-1 ▪ LP25 and LP26 Controls and Indicators

- *Power Indicator*
  This LED is lit when power is on.

- *ON/OFF LINE Switch/Indicator*
  When the printer is on-line, the indicator is lit. Pressing the switch alternately puts the printer on-line and off-line. In case a paper low situation is detected, this switch enable you to continue printing to the bottom of the form. To do this, press the switch. Each time the switch is pressed, the printer advances the page one line at a time until the bottom of the page is reached. This is especially important if you are printing on preprinted forms.

- *ALARM/CLEAR Switch/Indicator*
  This is lit during powerup or the presence of a fault condition. The specific alarm condition can be identified by the STATUS indicator display. Pressing the ALARM/CLEAR switch clears the printer logic.

- *PAPER STEP Switch*
  When activated, this switch advances the form one line if the printer is off-line.

- *TOP OF FORM Switch*
  If the printer is off-line, this switch advances the paper to the top-of-the-form position of the next form.

- *PHASE Control*
  This control maintains equal printing density on the right and left side of the characters.

- *LINES per Inch Switch*
  This two-position switch allows you to select either six or eight lines per inch.

- *TEST Switch*
  This three-position switch allows you to obtain one of three possible test patterns. Pressing the ON/OFF switch with the TEST switch in the left or right position places the printer in one of three self-test modes. You can select a sliding pattern, fixed characters, or band image.

- *STATUS Indicator*
  This alphanumeric display indicates either the operation being performed or a fault that caused printer failure.

- *COPIES Control*

This is a variable control that allows you to select printing on single- or multiple-part forms. Use the lowest possible setting that gives a clear printout. This helps you get the maximum life use from the hammers, ribbon, and print band.

LP27 Controls and Indicators

The controls and indicators found on the LP27 system printers are shown in Figure 17-2 and their functions are listed in Table 17-1.

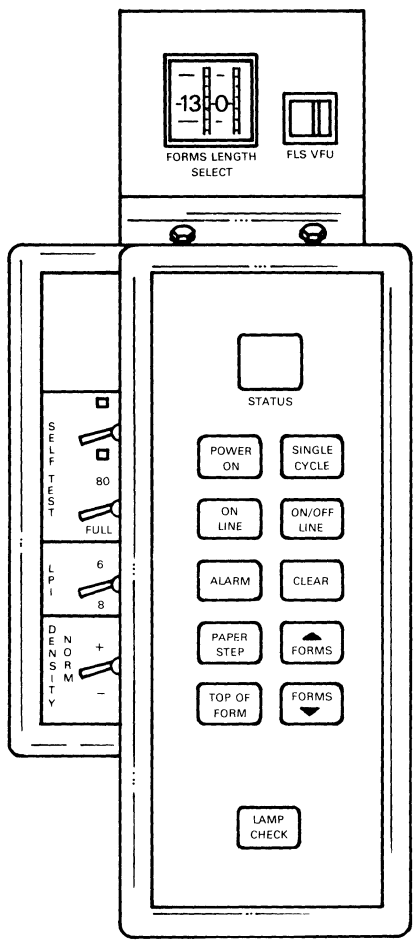


Figure 17-2 ▪ LP27 Controls and Indicators

Table 17-1 ▪ LP27 Controls and Indicators

Control/Indicator	Function
POWER Switch	Allows ac power to be applied to the printer. Indicates ON/1 or OFF/0.
POWER ON Indicator	Lights up when power is on.
On-line Indicator	Illuminates when printer is ready and on-line or in self-test mode.
LAMP CHECK Switch	Activating this switch lights all control panel indicators to verify lamp operation.
CLEAR Switch	When pressed, this switch clears the ALARM indicator and printer logic.
ON/OFF LINE Switch	When depressed, this switch places the printer in the on-line condition, and illuminates the indicator. If the self-test mode is selected, pressing the ON/OFF LINE switch alternately starts or stops self-test mode.
SINGLE CYCLE Switch	Prints one line of data.
TOP OF FORM Switch	This advances the paper to the next top-of-form position. This switch is disabled when the printer is on-line or in self-test mode.
PAPER STEP Switch	Advances the paper one line. When the printer is on-line, in self-test mode, the switch is disabled.
FORMS	This switch advances the paper upward 0.035 centimeters (0.014 inches). If pressed for more than one second, the form advances forward continuously at a rate of 3.6 centimeters per second (1.40 inches per second).
FORMS	This momentary switch reverses the form downward 0.035 centimeters (0.014 inches). If pressed for more than one second, the form moves backwards continuously at a rate of 3.6 centimeters per second (1.40 inches per second).
STATUS Indicator	This alphanumeric display indicates either the operation being performed or a fault that caused printer failure.

Table 17-1 ▪ LP27 Controls and Indicators (Cont.)

Control/Indicator	Function
SELF TEST Switch	This three-position switch allows you to obtain one of three possible test patterns. Pressing the ON/OFF switch with the TEST switch in the left or right position places the printer in one of three self-test modes. You can select a sliding pattern, fixed characters, or band image.
6/8 LPI	Selects either six or eight lines per inch spacing. TOP OF FORM switch must be reset after changing this setting.
DENSITY	This three-position control allows the hammer energy level to determine print density.
80/FULL	When set to 80, each line of print terminates at 80 characters. In the FULL position, a 132-character line is printed. This switch is operable only while the printer is in self-test mode.
FLS/VFU	This two-position switch selects either the forms length switch or the VFU mode for forms control. In the VFU mode, the VFU memory is loaded directly from the user system (DAVFU). **Note:** DAVFU is supported on the LP27-2A and the LP27-2B only.
FORMS LENGTH SELECT Switch	Two thumbwheel switches select the desired length of the forms to be printed.

▪ Operation

The LP11 controller has two internal registers—the Control and Status Register (LXCS) and the Data Buffer Register (LXDB). See Figure 17-3 for a system block diagram.

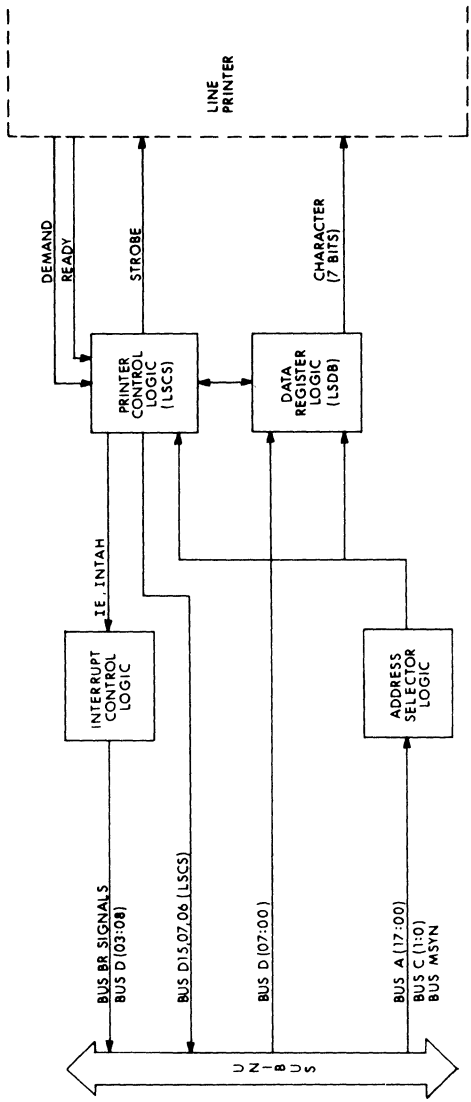


Figure 17-3 ▪ LP11 System Block Diagram

When the READY bit in the control and status register is set, the lineprinter is ready to accept a character from the processor.

The processor loads characters one by one into the data buffer register in the controller. The controller then transfers the characters to the 132-character data buffer in the lineprinter. The line length of 132 characters corresponds directly to this 132-character data buffer.

The current data buffer register (LXDB) contents are automatically printed out whenever any of the three ASCII control codes (Carriage Feed, Line Feed, Form Return) is recognized. The Carriage Return (CR) code prints the line but does not advance the paper. The Line Feed (LF) code advances the paper one line, while the Form Feed (FF) code advances the paper to the top of the next page.

Forms may be as long as 143 lines, and 12 different Vertical Tab Stops (channels) are available.

Start Load Command

The Start Load command initializes the PVFU and causes all subsequent characters to be loaded into the PVFU buffer. The Stop Load command indicates the end of the characters to be loaded into the PVFU buffer. The PVFU buffer allows storage of two characters for each line of the form. The PVFU only uses the low-order six bits of each character. The 12 bits (two characters) stored per line in the PVFU correspond to the 12 Vertical Tab Stops.

A 1 bit in a bit position in one of these two characters assigns a Vertical Tab Stop to that line. Bits 0 through 5 of the first characters correspond to Vertical Tab Stops 1 through 6 while bits 0 through 5 of the second character correspond to Vertical Tab Stops 7 through 12.

Vertical Tab Stop Commands

Vertical Tab Stops are commands 200_8 through 213_8. A Vertical Tab Stop command sent anywhere in a line of characters causes the paper to advance to the next PVFU line indicated by that Vertical Tab Stop command at the next Line Feed code. Line 1 is assigned to Vertical Tab Stop 1 and the last line of the form is assigned to Vertical Tab Stop 12.

Form Movement Commands

Sending command 200_8 causes the paper to advance to the top of the next form. Commands 201_8 through 212_8 correspond to Vertical Tab Stops 2 through 11 and cause the paper to advance to the next line that is loaded with that Vertical Tab Stop. Command 213_8 causes the paper to advance to the bottom of the form.

▪ Interrupts

The LP11 controller uses bus request (BR) interrupts to gain control of the UNIBUS to perform a vectored interrupt, which causes the program to branch to an interrupt service routine. A BR interrupt can occur only if the INTERRUPT ENABLE bit in the control and status register is set. Once INTERRUPT ENABLE bit is set, an interrupt request is generated whenever either the READY or ERROR bit in the control and status register is set.

When the READY bit is set, the lineprinter is ready to accept the next character to be loaded into the data buffer register (LXDB). When the ERROR bit is set, it indicates that some error condition exists. In this case, an interrupt is generated to cause the program to branch to an error handling routine.

The interrupt priority level is 4 and the interrupt vector address is 200. Note that the priority level can be changed with a priority plug and the vector address can be changed by jumpers in the interrupt control logic. However, any Digital programs or other software referring to the priority level or interrupt vector address must also be changed if the priority plug or the vector address is changed.

▪ Maintenance

Digital's LP25, LP26, and LP27 are designed for long life expectancy, high-volume throughput, and continuous smooth performance. While Digital's system printers are designed for a maximum amount of usage with a minimum amount of maintenance, preventive maintenance, such as routine inspections, cleaning, and adjustments, ensure good print quality and printer reliability. Digital recommends that maintenance be handled by trained personnel—whether yours or ours.

Self-test Procedure

The three-position TEST switch allows you to exercise the self-test function and obtain one of three possible test patterns. Pressing the ON/OFF switch with the TEST switch in the left or right position places the printer in the self-test mode.

- With the TEST switch in the right-hand position, pressing the ON/OFF LINE switch produces the printing of a sliding pattern.
- Placing the TEST switch in the left position and pressing the ON/OFF LINE switch produces the printing of a fixed character pattern.

- After producing either the sliding or the fixed pattern, you can place the TEST switch in the center position. This enables the printer to stay in self-test mode, printing full lines of a given character and changing the character for each line printed, reflecting a band image pattern.

To exit from self-test mode, place the TEST switch in the center position and press the ON/OFF LINE switch.

Operator Troubleshooting Checklist

The LP25, LP26, and LP27 system printers have a diagnostic status indicator located on the operator control panel. The indicator displays a status code that depicts the operation being performed or a fault that caused the printer to go off-line. Below are listed some of the common status codes, what they mean, and what corrective action can be taken.

01—Low/out of paper.

- Install paper. Press ALARM/CLEAR switch.

02—Paper fault motion.

- Clear paper jam. Press ALARM/CLEAR switch.

03—Band cover not locked.

- Close band cover or disengage band release handle.

04—Hammer/band gate not closed.

- Close hammer bank latch handle for LP25 and LP26.
- Close band gate for LP27. Press ALARM/CLEAR switch.

06—Ribbon fault.

- Check for ribbon jam. Clean ribbon motion sensor. Press ALARM/CLEAR switch.

17—Loss of print synchronization.

- Press ALARM/CLEAR switch. Check last line of print for incorrect data. If fault persists, call service personnel.

21—Print inhibit.

- Shut down and power up. If fault persists, call service personnel.

67—Self-test mode.

- Place TEST switch to off (center position). Press ALARM/CLEAR switch.

76—ON LINE, print inhibit.

- Shut down and power up. If fault persists, call service personnel.

77—ON LINE.

- Normal indication.

88—OFF LINE, Ready.

- Normal indication

P—Power fault.

- Shut down and power up. If fault persists, call service personnel.

For information on other status indicators, consult your *User's Guide* or *Operator's Guide*.

▪ Additional Documentation

The following documents contain more detailed information about the LP25, LP26, and LP27 systems' printers. These documents are chargeable, and may be ordered directly from the Accessories & Supplies Group in Nashua, New Hampshire. In the United States, call 800-258-1710 to place your order and get pricing and quantity discount information.

- *LP25/LP26 Operator's Guide*—Includes operating sequences, lists all status checks, and describes maintenance and cleaning programs.
- *LP27 Lineprinter User's Guide* (EK-0 LP27-UG)—Contains information for operating and installing the LP27 systems' printer.

Also of interest are:

- *PDP-11* and *VAX Systems & Options Catalogs*—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. This document helps you select the right Digital product. European versions are also available.

If you require information not contained in these documents, contact your local Digital representative.

▪ Specifications

Performance Characteristics

Printing speed	
LP25/LSP25	300 l/min with 64 character set
LP25/LSP25	215 l/min with 96 character set
LP26/LSP26	600 l/min with 64 character set
LP26/LSP26	445 l/min with 96 character set
LP27	1,200 l/min with 64 character set
LP27	800 l/min with 96 character set
Print technology	Full-character, impact, band
Character spacing	10 char/in
Line spacing	6 or 8 l/in

Paper slew speed

LP25/LSP25, LP26/LSP26	37.5 cm/s (15 in/s)
LP27	127 cm/s (50 in/s)

Character Set

LSP25, LSP26, LP27	64, 96-character ASCII (printing and nonprinting characters)
LP25, LP26	64-character ASCII
Buffer capacity	132 characters

Paper

Type	Fanfold
Dimensions	
Fanfold: LP25, LP26	7.6 cm by 40.6 cm (3 in by 16 in)
Fanfold: LP27	8.9 cm by 47.6 cm (3.5 in by 18.8 in)
Multipart forms	Up to 6 parts, fanfold carbon
Thickness: LP25, LP26	0.06 cm (0.025 in)
Thickness: LP27	0.05 cm (0.020 in)

Power Requirements

Line voltage and frequency	90–132 Vac, at 60 Hz
	190–250 Vac, at 50 Hz
Interface (controller) current	1.5 A at 5 Vdc

Power Consumption

LP25	350 W
LP26	475 W
LP27	455 W, standby/line1100 W, printing

Heat Dissipation

LP25	1,200 Btu/hr
LP26	1,619 Btu/hr
LP27	3,754 Btu/hr

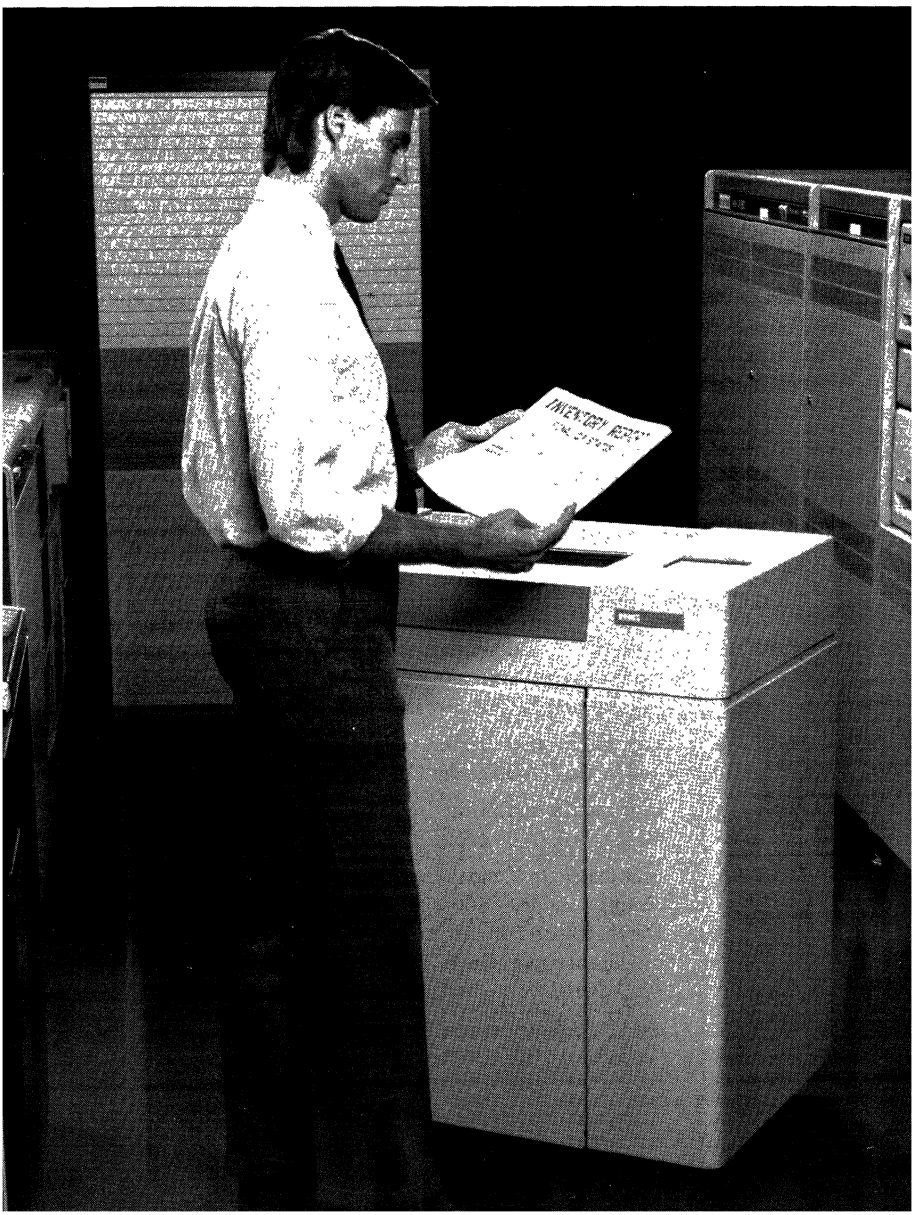
Operating Environment

Temperature	10°C–38°C (50°F–100°F)
Relative humidity	20%–80%

Physical Characteristics

	LP25	**LP26**	**LP27**
Height	111 cm (43.8 in)	111 cm (43.8 in)	124.5 cm (49 in)
Width	76 cm (30.3 in)	76 cm (30.3 in)	88.9 cm (35 in)
Depth	85 cm (33.6 in)	85 cm (33.6 in)	96.5 cm (38 in), with paper puller
Weight	89 kg (195 lb)	89 kg (195 lb)	257.2 kg (567 lb)

Chapter 18 ▪ LG Family of Lineprinters



▪ Overview

The LG family of matrix lineprinters represent a new standard of reliability for 600 lines-per-minute (LPM) impact printers. A new print mechanism eliminates the wear and tear found in traditional print mechanisms that employ cams, sliding joints, bearings and springs that produce friction. The LG family uses a linear motor that drives a hammer bank with a variable speed shuttle system. With friction and wear eliminated, the LG printers require no preventive maintenance, and offer one of the lowest basic monthly maintenance charges in the industry.

The LG family consists of two models—the LG01 text printer and the LG02 text and graphics printer. If you have an LG01 and decide you need graphics capability later, you can turn the LG01 into an LG02 with a simple upgrade kit.

The LG01 and LG02 print both correspondence-quality text, and high-speed data processing-quality text. Both are well suited to the high-volume printing needs of engineering, manufacturing and business. The LG02 prints in both portrait and landscape orientation. For each orientation, the printer has several monospaced fonts available in ASCII, DEC Supplemental and DEC technical character sets. The fonts are permanently stored in the printer's read-only memory (ROM). Each ROM-resident font is stored as a portrait font. However, the LG02 printer can rotate certain fonts to landscape if enough random access memory (RAM) is available.

In plot mode, the LG02 can plot a vector, logo, barcode, block character, or sixel graphic in medium resolution.

The following LG models are available:

LG01-AA	Line matrix text printer, 600 lines/minute in data processing mode 100-120/220-240 V 50/60 Hz with Dataproducts parallel interface, BC27A-30 cable, LP11
LG01-BA	Line matrix text printer, 600 lines/minute, 120/240 Vac, 50/60 Hz, BC27A-30 cable, LPV11
LG01-CA	Line matrix text printer, 600 lines/minute, 120/240 Vac, 50/60 Hz, BC27A-30 cable.
LG02-AA	Line matrix text and graphics printer lines/minute in data processing mode, 100-120/220-240 V 50/60 Hz with Dataproducts parallel interface, RS232 serial interface, and intelligent processor, BC27A-30 cable, LP11.
LG02-BA	Line matrix text and graphics printer, 600 lines/minute in data processing mode, LPV11, BC27A cable.

LG02-CA	Line matrix text and graphics printer, 600 lines/minute in data processing mode, BC27A cable.
LG02-DA	Line matrix text and graphics serial printer, 600 lines/minute in data processing mode, BC22D-25 cable.

▪ Highlights

LG01 Text Printer

- Prints in either data processing or correspondence mode.
- Prints both compressed and expanded print.
- Handles 7- or 8-bit character sets, the Digital multinational, and OCR-A and OCR-B character sets.
- Features a user-friendly control panel that allows the operator to select a variety of optional fonts, type sizes, and form lengths.
- Prints on multipart forms (one to six parts).

LG02 Text and Graphics Printer

- Includes all the text functionality of the LG01 printer.
- Prints Barcode 39, Extended 39, and INTERLEAVE 2 of 5.
- Prints custom forms and logos.
- Prints subscript, superscript, underlining, strike through, bolding, and graphic element rotations.
- Features a fiber optics long-line serial option for remote operation up to 1,000 meters away.
- Supports sixel protocol processing for compatibility with graphics terminals such as the VT240.

▪ Printing Features

New Printing Mechanism

The LG family of printers employs a new printing technology that uses a linear motor to drive a hammer mechanism. The hammer mechanism is a flat steel spring with a tungsten carbide ball that strikes the paper through an inked ribbon to form a dot. The hammer bank, containing an array of 66 hammers, shuttles back and forth displacing the dots horizontally. Vertical displacement occurs when the paper advances. A variable shuttle speed allows the most efficient use of the hammers by shuttling at a rate consistent with the desired dot density.

Two flexures—one at each end of the carriage assembly—support the hammer bank. One end of each flexure is fastened to the movable carriage, and the other, to the printer frame. As the linear motor moves the carriage, the flexures bend slightly. These flexures are designed to flex indefinitely without breaking. Because there are no friction points, the carriage position does not change during the life of the printer, and the hammer bank does not require periodic realignment or adjustment.

The hammer bank is driven by a linear motor that offers the following advantages over traditional mechanical shuttle mechanisms:

- Low noise.
- Electronic reliability.
- Variable speed.
- Very high precision.

Printing and Plotting Modes

There are two modes of operation for the LG printers—print mode and plot mode. Only the LG02 operates in both modes. The default mode for the LG02 is print mode. It enters plot mode only as the result of a specific operation or request from the host. Text can be printed in either print or plot mode, but different fonts are used in each case. At any time, the LG02 has two fonts selected, a print font and a plot font. Either selection can be changed independently of the other, and without forcing a mode change.

Both the LG01 and LG02 print data-processing-quality text at a maximum speed of 600 lines/minute with a print resolution of 60-by-72 dots per inch, and correspondence-quality text at a maximum speed of 280 lines per minute with a print resolution of 120-by-144 dots per inch. In print mode the LG01 and LG02 printers are able to print the following:

- Data processing-quality text at 5, 10, 15 char/in and 6, 8, 10 line/in.
- Correspondence-quality text at 10, 12 char/in and 6, 8, 10, line/in.
- Compressed text at 13.3, 16.6 char/in and 6, 8, 10 line/in. (LG02 only)
- OCR A at 10 char/in and 6, 8, 10 line/in.
- OCR B at 10 char/in and 6, 8, 10 line/in.
- Double and triple height data-processing-quality text.
- Double width data processing-quality text.
- Underlining.

The LG02 enters plot mode to do the following:

- Print justified text.
- Plot a vector, logo, barcode, block character, or sixel graphic.
- Enter landscape mode.
- Use any of the near-letter-quality LG02 fonts.
- Use strike through, bold, and italic.

If plot mode is entered automatically by the printer, for example, by using a pitch that does not match the print font selected, the printer will test for returning to print mode at the end of each line and each page. If plot mode is entered by the user—using the plot mode escape sequence (ESC[?70h,)—the printer returns to print mode at the request of the user.

Fonts and Character Sets

The printer uses character sets and fonts to create the characters printed on the page. Fonts determine the size and style of printed characters. The printer stores the data for character sets and fonts in font files. Each font file is the data for one character set of a font.

Each font file has twelve attributes, including the seven attributes for a single font and the character set attributes. These are

Font Attributes and Examples	**Other Attributes**
Type family – Data Processing	Character set
Spacing – Fixed, monospaced	Rotation
Type size – 10 point	Character subset
Scale factor – 1:1 vert. to horiz.	File encoding
Typestyle – Normal, italic	Resolution
Weight – Normal, bold	
Character Proportion – Normal, expanded, condensed	

Table 18-1 shows the character sets and fonts stored in the LG01 and LG02 printers. Some of the fonts, as noted, are standard only with the LG02.

Table 18-1 ▪ LG Printer ROM Fonts

Type Family	Type size	Character Set
Data Processing Print Fonts		
Original data processing	5 pitch	DEC multinational
Original data processing	10 pitch	DEC multinational
Original data processing	15 pitch	DEC multinational
Compressed Print Fonts (LG02 only)		
Compressed data processing	13.3 pitch	DEC multinational
Compressed data processing	16.7 pitch	DEC multinational
Correspondence Print Fonts		
Correspondence	10 pitch	DEC multinational
Correspondence	12 pitch	DEC multinational
OCRA ANSI Print Font	10 pitch	
OCRB DIN Print Font	10 pitch	
Correspondence Plot Fonts (LG02 only)		
Correspondence	12 point	DEC multinational
Correspondence	12 point	Italic DEC multinational
Correspondence	12 point	Bold DEC multinational
Near-Letter-Quality Plot Fonts (LG02 only)		
Fixed	12 point	Normal DEC multinational
Fixed	12 point	Italic DEC multinational
Fixed	12 point	Bold DEC multinational
Fixed	12 point	DEC technical
Fixed	18 point	Normal DEC multinational
Fixed	18 point	Italic DEC multinational
Fixed	18 point	Bold DEC multinational
Fixed	7.2 point	Normal DEC multinational
Fixed	7.2 point	Bold DEC multinational
Draft Plot Fonts (LG02 only)		
Fixed	10 point	Normal DEC multinational
Fixed	10 point	Bold DEC multinational
Fixed	10 point	DEC technical

Using the font file data stored in the printer, you can select the characters to print or plot in two steps: 1.) Assign a character set/family to a font number. 2.) Select the assigned font by the font number.

You do not have to select a character set every time you use the printer. When you powerup the printer, the default character set is the DEC multinational set (ASCII and DEC supplemental sets).

The general form for the assign font set sequence (LG02 only) is

DCS P1 ; P2 } font ID string ST

The format for the select font sequence (LG01 and LG02) is

CSI	Ps	m
9/11	***	6/13

digital™

THE LG FAMILY OF 600 LINES PER MINUTE PRINTERS

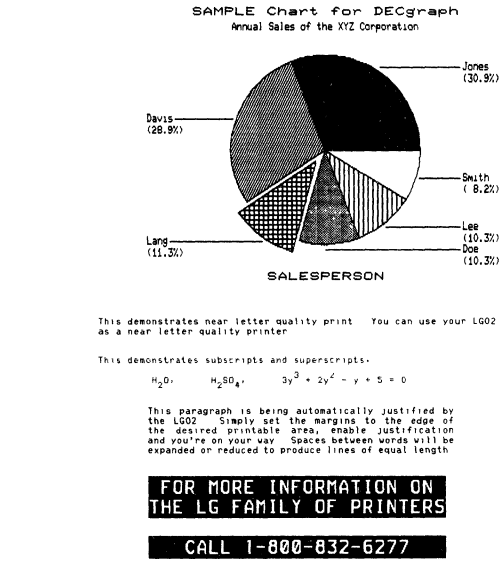
* The LG01 is a Text Printer
* The LG02 is a Text & Graphics Printer

The LG family of Line Matrix Printers are the most reliable and functional 600 lines per minute impact printers ever offered by DIGITAL.

- LG01 -	- LG02 -
DATA PROCESSING MODE PRINTING	BARCODES - 39 (LOGMARS) - 39 (Extended) - Interleave 2 of 5
CORRESPONDENCE MODE PRINTING	
COMPRESSED OR EXPANDED PRINT	SUBSCRIPTS SUPERSCRIPTS ROTATION
UNDERLINING STRIKETHROUGH BOLDING	ABILITY TO CREATE CUSTOM FORMS & LOGOS
MULTI-PART FORMS (1-6 PARTS)	LN03 COMPATIBILITY
MULTIPLE CHARACTER SETS - DIGITAL MULTINATIONAL - OCR-A & OCR-B	SIXEL PROTOCOL PROCESSING
7 OR 8 BIT CHARACTER SETS AND ADDRESSING, ANSI/ISO COMPATIBLE	LONG LINE SERIAL OPTION (FIBER OPTICS)
PARALLEL INTERFACE	PARALLEL INTERFACE SERIAL INTERFACE
FRONT CONTROL PANEL	

NOTE: ALL LG01 TEXT FEATURES ARE ALSO AVAILABLE IN THE LG02.

Figure 18-1 ▪ LG01 Print Samples



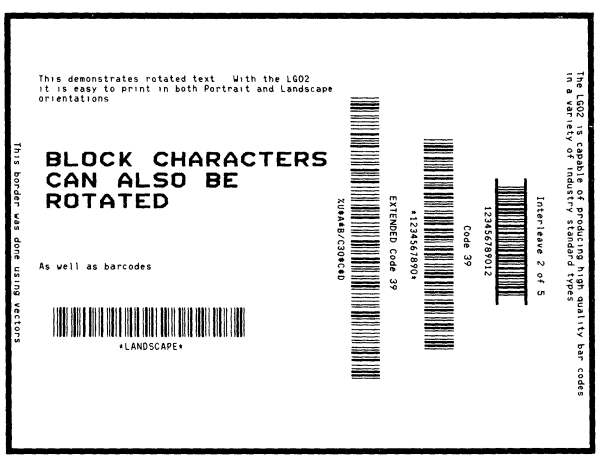


Figure 18-2 ▪ LG02 Graphic Print Samples

▪ Paper

The LG01 and LG02 accommodate a full range of continuous fanfold paper forms. The printers are equipped with four adjustable pin-feed tractors for accurate and repeatable high-performance forms handling. Bidirectional printing also speeds up the printing process. The LG printers can handle one-to-six-part carbon or carbonless multipart forms (single part 15 to 100 pound stock). The forms can range in widths of 4 to 16 inches, lengths of 3 to 20 inches, and thicknesses to 0.025.

▪ Operator Features

Printer Controls and Displays

The lower half of the LG printer control panel contains the keys used for daily routine printing (placing printer online/offline and advancing forms). The upper half contains the keys used to set printing formats and to run tests. For routine printing, keep the control panel cover pulled down, covering the format keys.

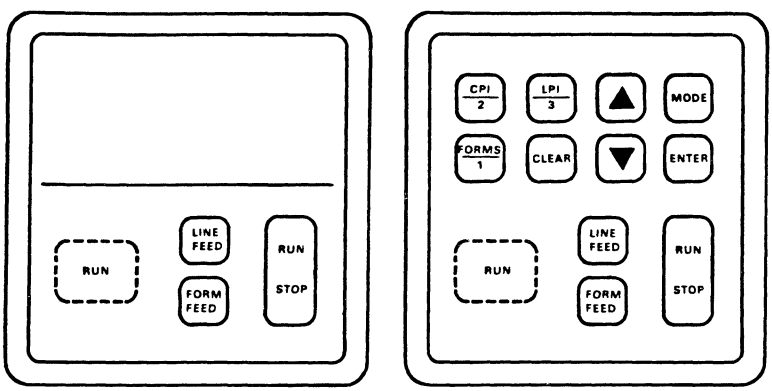


Figure 18-3 ▪ LG01/LG02 Control Panel CS-4825

Table 18-2 ▪ LG01 Control Keys and Functions

Control Key/Display	Function
Display	Shows operator entries and fault codes.
LINEFEED	Advances paper one line.
FORM FEED	Advances paper to top of next form.
RUN/STOP	Alternately places the printer ONLINE/OFFLINE.
MODE	Chooses mode: NORMAL, OPERATOR, or TEST.
FORMS/1	Use to select printout formats.
CPI/2	Use to select printout formats.
LPI/3	Use to select printout formats.
ENTER	Enters the printout format chosen with MODE, FORMS/1, CPI/2, and LPI/3 keys.
UP/DOWN ARROWS	Used for fine vertical adjustment of paper. The up arrow moves paper forward, and the down arrow moves paper backward in small increments. Also used with MODE, FORMS/1, CPI/2, LPI/3 to select printout formats.
CLEAR	The clear key performs a variety of functions depending on the panel keys pressed after pressing CLEAR. Resets printer; clears fault conditions.

Table 18-3 ▪ Clear Key Functions

Current Mode or Condition	Result of pressing CLEAR	
OPER, TEST, PROG, or NORM	Printer returns to normal mode with STOP displayed.	
STOP	1. CLEAR is displayed. 2. The arrow keys may be used to select the desired function. 3. When one of the following clearing functions is selected, pressing the ENTER key performs the function.	
Display	CLEAR	Clears to character mode (if in plot testmode),resets to Data Processing font, resets to 10 char/in, resets to 6 line/in, resets vertical character size to times 1, clears printer from hex dump mode if enabled.
	LBUF	Clears the character line buffer.
	MASK	Clears all error masks.
	ALL	Does all of the CLEAR functions mentioned above.
Fault conditions	1. Clears the following faults automatically when the error has been corrected: - Platen Open (PLTN OPEN) - Paper Out (PAPER OUT) - Ribbon Out (RIBN OUT) 2. Clears other faults using the CLEAR key.	

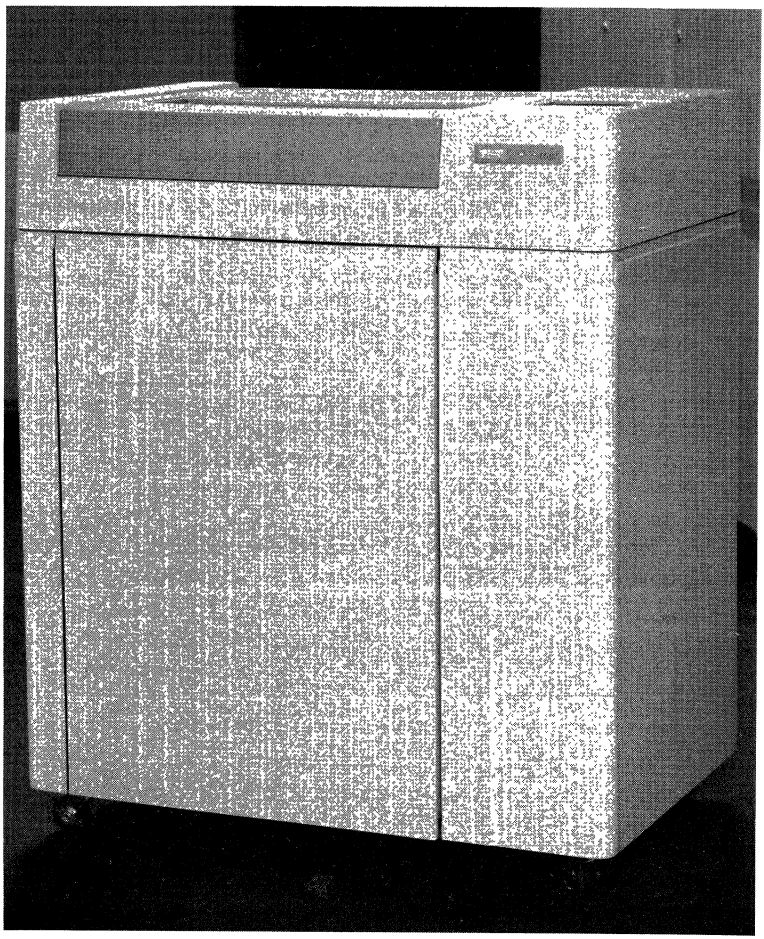


Table 18-4 • LG02 Control Keys and Functions

Key/Display	Function
Display four-character LED	Displays the status of the printer. When error messages are displayed, the display scrolls through the characters.
ON LINE/OFF LINE (Black)	A multifunction key which alternately places the printer in either the online or offline state. • In the online state, only the black arrow keys are active. These keys adjust the top of the form. • In the offline state, the black markings on all keys are active.
LINE FEED (Black)	Advance the paper in the offline state.
FORM FEED (Black)	A multifunction key. • In OFF LINE, it advances the paper to the top of the next form. • In the OFF LINE SELECT state, it selects the communications port parameters (such as serial or parallel).
SELECT (Black)	A multifunction key used to change the printer parameters. When pressed, it activates the amber keys and the black FORM FEED key.
REPRINT (Black) LENGTH (Amber)	A multifunction key. • REPRINT is active in the OFF LINE SELECT state. • LENGTH is active in the OFF LINE SELECT state. • REPRINT prints the last page printed. • LENGTH lets you set the length of the form using the blue + 100, + 10, and + 1 keys. • Press the FONT SAVE key to enter the selected form length as the default.
REPORT (Black) MODE (Amber)	A multifunction key. • REPORT is active in the OFF LINE state. • MODE is active in the SELECT state. • REPORT prints the current configuration of the printer. • MODE lets you select the mode of the printer using the + 1 key. • MODE allows access to linefeed/new line mode, carriage return/new line mode, and autowrap/new line mode. • Press the FONT SAVE key to enter the selected mode as the default.

Table 18-4 ▪ LG02 Control Keys and Functions

Key/Display	Function
SET TOF (Black) MARGIN (Amber)	A multifunction key. ▪ SET TOF is active in the OFF LINE state. ▪ MARGIN is active in the SELECT state. ▪ SET TOF enters the current paper position as the top of form. ▪ MARGIN lets you select the top, bottom, left and right margins. ▪ Set the margins using the blue + 100, + 10, and + 1 keys. Press the FONT SAVE key to enter the selected values as the default.
DOWN ARROW (Black) FONT (Amber) SAVE (Blue)	A multifunction key. ▪ DOWN ARROW is active in the OFFLINE state. ▪ FONT is active in the SELECT state. ▪ SAVE is active when one of the amber keys has been pressed in the SELECT state. ▪ DOWN ARROW moves the paper down one increment from the current position. ▪ FONT lets you select the font by using the blue + 10 and + 1 keys. ▪ Press the FONT SAVE key to enter the selected font as the default value.
RESET (Black) DISPLAY (Red) + 100 (Amber)	A multifunction key. ▪ RESET is active in OFF LINE. ▪ DISPLAY is active only when an error occurs. ▪ + 100 is active when one of the amber keys has been pressed. ▪ RESET returns the printer to the default parameters. ▪ DISPLAY causes the error messages to scroll on the LED display. ▪ + 100 changes the value of the selected parameter by 100.

Table 18-4 ▪ LG02 Control Keys and Functions (Cont.)

Key/Display	Function
TEST (Black) CLEAR (Red) + 10 (Blue)	A multifunction key. ▪ TEST is active in the OFF LINE state. ▪ CLEAR is active when an error occurs. ▪ + 10 is active when one of the amber keys has been pressed. ▪ TEST prints the contents of the current line or plot images, performs a form feed, and prints a rolling test pattern of the ASCII characters. ▪ CLEAR clears the error condition and returns the printer to the OFF Line state. ▪ + 10 changes the value of the selected parameter by 10.
UP ARROW (Black) OVERRIDE (Red) + 1 (Blue)	A multifunction key. ▪ The UP ARROW is active in the ON LINE state and the OFF LINE state. ▪ The UP ARROW moves the paper up one increment. ▪ The OVERRIDE key is active when a paper-out fault occurs. ▪ OVERRIDE prints to the bottom of the current page. ▪ + 1 is active when one of the amber keys is pressed. ▪ + 1 increases the value of the selected parameter by one.

Printer Configurations

Two banks of switches are located on the LG01 parallel I/O board for configuring the printer. The first bank is referred to as Switch 1 or SW1. The second bank is referred to as Switch 2 or SW2. Each bank, or switch, has eight different positions labeled 1 through 8. The factory settings for these switches are in a particular pattern for the Dataproducts compatible interface. Figure 18-4 shows the board switch locations, and Tables 18-4 and 18-5 show the effects of various switch combinations on the printer.

Table 18-5 ▪ Dataproducts SW1 Settings (LG01)

Position Number	Factory Setting (SW1)	ON	OFF
1	OFF	STROBE on falling edge	STROBE on rising edge
2	ON	Always ON	
3	OFF	Paper Instruction	8-bit mode
4	ON	Uppercase/ lowercase	Uppercase
5	OFF	Centronics interface	Dataproducts interface
6	OFF	Invalid	Always OFF
7	Not used		
8	ON	ESC and HT functions enabled	ESC and HT functions disabled

Table 18-6 ▪ Switch 2 (SW2) Settings (LG01)

Position No.	Factory Setting (SW2)	ON	OFF
1	OFF	New line	Overprint
2	ON	Autoprint on	Autoprint off
3	OFF	12-in form length	11-in form length
4	ON	NA	
5	ON	NA	
6	ON	NA	
7	OFF	NA	
8	OFF	NA	

▪ Programming Information

LG01 Printer

The LG01 is controlled by commands from the host computer. These commands include

- Single ASCII control codes.
- ASCII escape sequences.
- Paper instructions.

Table 18-7 lists the control codes and their function.

Table 18-7 ▪ LG01 Printer Control Code Summary

Control Code	Function
BEL* (ASCII)07 (hex)	Bell–Sounds alarm for one-half second.
HT (ASCII)09 (hex)	Horizontal Tabs–Spaces to next preset tab stop.
LF (ASCII)0A (hex)	Linefeed–Advances paper one line (for character printing). Prints a line if preceded by data.
FF (ASCII)0C (hex)	Formfeed–Advances paper to top of next form. Prints a line if preceded by data.
CR (ASCII)OD (hex)	Carriage Return–Returns cursor to beginning of line.
SO* (ASCII)OE (hex)	Shift Out–Shifts to alternate character set.
SI* (ASCII)OF (hex)	Shifts In–Shifts to standard character set.
ESC* (ASCII)1B (hex)	Escape–Interprets code that follows it as a control function.
Any other ASCII code	Any ASCII control code not listed above is replaced by a space.

Escape sequences are used to specify the following:

- Character sets. (Default–Data processing character set.)
- Character height and width. (Default–normal 100-percent size)
- Characters per inch and lines per inch. (Default–10 char/in and 6 line/in)
- Horizontal tab positions. (All Clear)

The escape sequences for selecting character sets are listed in Table 18-8.

Table 18-8 ▪ Escape Sequences for Character Set Selection

Escape Sequence	ASCII	Hex	Description
SEL Graphic Rendition (SGR)	<ESC>[10m	1B 5B 31 30 6D	ASCII Graphic Character and DEC Supplemental Character Set. Data Processing Font
	<ESC>[11m	1B 5B 31 31 6D	ASCII Graphic Character and DEC Supplemental Character Set. Correspondence Font
	<ESC>[12m	1B 5B 31 32 6D	OCR A ANSI
Character Set	<ESC>[13m	1B 5B 31 33 6D	OCR B DIN Character Set

Refer to Appendix C for a complete list of the escape sequences used with the LG01.

LG02

The LG02 printer processes received characters according to ANSI standard X3.4-1977 and ISO DIS 2022-1984. Received characters include printable characters and control functions. Control functions control how the LG02 printer processes, sends, and prints characters. Control functions include

- Control characters.
- Control strings.
- Escape sequences.
- Control sequences.

The printer can process 7-bit and 8-bit data. The 8-bit character set is the default character set when you turn the printer on. Table 18-9 lists the 8-bit and 7-bit control characters.

Table 18-9 • 7-Bit and 8-Bit Control Characters

Name	8-Bit Character	7-Bit Sequence
Index	IND 8/4	ESC D 1/11 4/4
New line	NEL 8/5	ESC E 1/11 4/5
Horizontal tab set	HTS 8/8	ESC H 1/11 4/8
Vertical tab set	VTS 8/10	ESC J 1/11 4/10
Partial line down	PLD 8/11	ESC K 1/11 4/11
Partial line up	PLU 8/12	ESC L 1/11 4/12
Reverse index	RI 8/13	ESC M 1/11 4/13
Single shift 2	SS2 8/14	ESC N 1/11 4/14
Single shift 3	SS3 8/15	ESC O 1/11 4/15
Device control string	DCS 9/0	ESC P 1/11 5/0
Control string introducer	CSI 9/11	ESC [1/11 5/11
String terminator	ST 9/12	ESC \ 1/11 5/12

Escape sequences, control sequences, and control strings provide control functions additional to the control characters. These multiple character sequences let you control

- Character sets.
- Fonts (assigning and selecting.)
- Character attributes (such as bold, italics, and underline).
- Character spacing (for fonts).
- Active column and line.
- Print area and page margins.
- Page density.
- Entering and exiting plot mode.
- Autowrapping.
- Tabs.
- Linefeeds and carriage returns.
- Justification.
- Vectors for line drawing.
- Barcodes.
- Block characters.
- Forms.
- Logos.
- Product identification.
- Printer status.
- Reset or initialization.

An escape sequence uses two or more bytes to define a control function. The format for an escape sequence is

ESC	I	F
1/11	2/0 to 2/15	3/0 to 7/14
Escape sequence introducer	Intermediate characters (zero or more characters)	Final character (one character)

A control sequence uses two or more bytes to define a control function. The format for a control sequence is

CSI	P...P	I...I	F
9/11	3/0 to 3/15	2/0 to 2/15	4/0 to 7/14
Control sequence introducer	Parameter (zero or more characters)	Intermediate (zero or more characters)	Final (one character)

A device control string (DCS), like a control sequence, uses two or more bytes to define specific control functions; however, a DCS also includes a command string. The format for a device control string is

DCS 9/0	P...P 3/0 to 3/15	I...I 2/0 to 2/15	F 4/0 to 7/15	Command String **********	ST 9/12
Device control string introducer	Protocol selector			String	String terminator

▪ Maintenance

Self-test Procedure

To run the printing test on the LG01 do the following:

1. Load the paper in the printer.
2. Insert the ribbon cartridge.
3. Turn the power switch on. OFFLINE is displayed.
4. Run the printing test by pressing the TEST key. The printer will print a rolling ASCII pattern.
5. Compare this printout with the sample.

To run the printing test on the LG02 do the following:

1. Enter the OFF LINE state by pressing the OFF LINE key.
2. Press and hold the SELECT key for three seconds, or until the second tone signal occurs. DIAG is displayed.
3. Select either PRINT (Print Diagnostics), PLOT (Plot Diagnostics), or MISC (Non-printing Diagnostics) by repeatedly pressing the TEST key.
4. To see what diagnostic tests are available, press the OVERRIDE key repeatedly.

5. When the display reads the test you wish to run, press the ON LINE key, and the printer will start running the test you selected. When the test is over, the display will show the test name.
6. To stop the test, press the ON LINE key.
7. To return to the OFF LINE state, press the SELECT key. OFFL is displayed.

Operator Troubleshooting Checklist

This section lists routine operating problems and possible solutions that might be accomplished by the user or a technician.

Printed characters in one line are shorter than normal.

- Turn tension knob clockwise until paper is taut but not too tight.

Paper holes are elongated after going through tractors.

- Turn tension knob counterclockwise until paper is taut but not too tight.

Paper holes are wider than normal after going through tractors.

- Unlock and adjust tractors that are widening holes.

Paper comes out of tractors.

- To change vertical tension, turn tension knob; clockwise tightens tension, counterclockwise decreases tension.
- To change horizontal tension, unlock upper and/or lower right tractor. Move tractor right or left to make adjustment.
- Realign tractors so that lower tractors are directly below upper tractors.

Paper tears at right or left edges along holes.

- Raise Forms-Thickness lever.

Printed characters are too light.

- Replace ribbon cartridge.

Printed characters are shaky.

- Lower Form-Thickness lever.

Printed characters are smeared.

- Raise Forms-Thickness lever.

Additional Documentation

For detailed information on the LG01 and LG02 printers, refer to the following documents.

LG01 600 LPM Text Printer User's Guide (EK-0LG01-UG)

LG01 600 LPM Text Printer Technical Manual (EK-0LG01-TM)

LG02 600 LPM Text and Graphics Installation/Owner's Manual (EK-0LG02-IN)

LG02 600 LPM Text and Graphics Printer Technical Manual (EK-0LG02-TM)

LG02 600 LPM Text and Graphics Printer User's Guide (EK-0LG02-UG)

LG02 600 LPM Text and Graphics Printer Mini-Reference Manual (EK-0LG02-RM)

Specifications

Product Description

Hardware supported	VAX 8200, 8600, VAX-11/780, 730, 785, 750, MicroVax II, PDP-11/73, 83, 11/44
Software supported	VMS, MicroVMS, RSX-11M and RSX-11M-PLUS

Product Performance

Print Resolution	60 × 72 dots-per-inch, Data Processing mode 120 × 144 dots-per-inch, Correspondence-quality Mode
Print Speed	280 lines/minute at maximum dot density (upper case) 600 lines/minute at minimum dot density (upper case)
Character sets	DEC Multinational DEC Technical (LG02 only)
Fonts	Data Processing Correspondence OCR A ANSI OCR B DIN **LG02 Only** Draft Plot Near Letter-Quality DEC Technical Plot Compressed Data Processing
Graphics (LG02 only)	Digital Sixel protocol
Bar Codes (LG02 only)	Interleaved 2 of 5 Code 39 Extended code 39

Communications

Parallel interface	DMF32 or LP(V)11
Serial interface (LG02 only)	DMF32 or DZ11 (VAX systems) DZ11 or DHV11 (PDP-11/44, 70, 11/84) DZV11 or DHV11 (PDP-11/73, 83, and MicroVAX II)
Baud rates (LG02 only)	1200, 2400, 3600, 4800, 7200, 9600, 19,200

Power Requirements

Voltage	90 to 128 Vac 180 to 240 Vac
Power Consumption	1500 watts maximum
Heat Dissipation	3000 Btu/h

Environmental Requirements

Operating temperature	10°C to 40°C (50°F to 104°F)
Relative Humidity	10 to 90%
Altitude	8,000 ft

Physical Characteristics

Height	97.8 cm (38.5 in)
Width	85.1 cm (33.5 in)
Depth	57.2 cm (22.5 in)88.9 cm (35 in) with acoustic cover (LG02)
Weight	157.5 kg (350 lb)

Chapter 19 ▪ LXY Family of Graphics Lineprinters

▪ Overview

The versatile LXY12 and LXY22 are medium-duty printing devices that combine the benefits of a dot-matrix printer and a plotter on many of Digital's UNIBUS PDP-11 and VAX systems. When used as lineprinters, the LXY family is compatible with Digital's other lineprinters, need no special software, and are supported by the RT-11, RSX-11, RSTS/E, and VMS operating systems. When used with Digital's PLXY-11 and BCP graphics software packages, you have full access to all the LXY plotting capabilities, PLXY-11 is currently supported by Digital's RT-11, RSX-11M, RSX-11M-PLUS, RSTS/E, and VMS operating systems, while BCP is supported by the RSX-11M and VMS operating systems.

Designed for use during a standard eight-hour shift in scientific, industrial, and commercial marketplaces, the LXY family of graphics lineprinters accommodates complex, intricate designs. In addition, the LXY12 and LXY22 provide hardcopy output of designs formulated on a graphics terminal, combine text and graphics in a single report, and produce simple forms.

Plotting capabilities, made possible with the PLXY-11 graphics software package, include standard line drawings, (for example, graphs, histograms, and charts) along with plots requiring shaded or solid areas (for example, bar graphs). The BCP Barcode/Block Character software is ideally suited to industrial and distributive applications where products must be coded and labeled using preprinted stationery and/or gummed labels.

The freestanding LXY12 and LXY22 systems include a controller if required by the configuration, a cable for connecting the controller to the graphics lineprinters, a pedestal with basket and paper guide, and a choice of two software packages—the PLXY-11 graphics software and the BCP barcode package.

The LXY12 produces high-quality output at speeds of up to 300 lines per minute when printing and up to 42.4 centimeters per minute when plotting. The LXY22, a higher-speed device than the LXY12, prints up to 600 lines per minute and plots up to 84.6 centimeters per minute. The *PDP-11* and *VAX Systems and Options Catalogs* contain ordering information for different versions of the LXY family.

The following LXY series models are available.

Model	Print Speed	UNIBUS Controller	Serial RS232 Controller	DMF32 Controller
LXY12, 120 Vac, 60 Hz	300 l/min	-CA	-DA	-EA
LXY12, 240 Vac, 50 Hz	300 l/min	-CB	-DB	-EB
LXY22, 120 Vac, 60 Hz	600 l/min	-CA	-DA	-EA
LXY22, 240 Vac, 50 Hz	600 l/min	-CB	-DB	-EB

After selecting the appropriate model graphics lineprinter, choose your software from the chart below.

Operating System	Distribution Media	PLXY-11 Graphics Package	BCP Barcode Package
RT-11	800 b/in magtape	QJS91-XD	—
RT-11	1600 b/in magtape	QJS91-XM	—
RT-11	RL01	QJS91-XQ	—
RT-11	RK06	QJS91-XT	—
RT-11	RX01	QJS91-XY	—
RSX-11M	800 b/in magtape	QJS90-XD	QJS05-AD
RSX-11M	1600 b/in magtape	QJS90-XM	QJS05-AM
RSX-11M	RL01	QJS90-XQ	QJS05-AQ
RSX-11M	RK06	QJS90-XT	—
RSX-11M	RX016	QJS90-XY	QJS05-AY
RSX-11M-PLUS	800 b/in magtape	QJS95-XD	—
RSX-11M-PLUS	1600 b/in magtape	QJS95-XM	—
RSTS/E	800 b/in magtape	QJS92-XD	—
RSTS/E	1600 b/in magtape	QJS92-XM	—
RSTS/E	RL01	QJS92-XQ	—
RSTS/E	RK06	QJS92-XT	—
VMS (11/730)	RX01	QDS01-XG	QC640-XG
VMS (11/750)	TU58	QDS01-XG	QD640-XG
VMS (11/780)	TU58	QES01-XG	QE640-XG

▪ Major Features

The LXY family's main features are

- Printing and plotting capabilities—Allow you to combine both text and graphics within a single document.
- Overlapping dot-print technology—Creates excellent, uniform density print quality.
- PLXY-11 graphics software package—Provides unique plotting capabilities for graphics, histograms, and charts.

- BCP Barcode/Block Character software package—Permits coding and labeling on preprinted stationery and gummed labels, as well as the creation of forms.
- Standard programmable vertical forms unit—Operates under program control and allows slewing to top of form and slewing within a form to a preselected line.
- Hammer bank print mechanism—Eliminates wear that occurs with single printhead printers.

Printing and Graphics Features

In both the LXY12 and the LXY22, printing is accomplished by a bank of spring hammers. The LXY12 hammer bank has 44 hammers, while the LXY22 has 66. These hammers, mounted on a shuttle, are positioned horizontally at every third character position for the LXY12 and every second position for the LXY22. As the shuttle sweeps the hammers back and forth across the character positions, the hammers are activated at each position in which a dot is required. Each hammer prints a single dot.

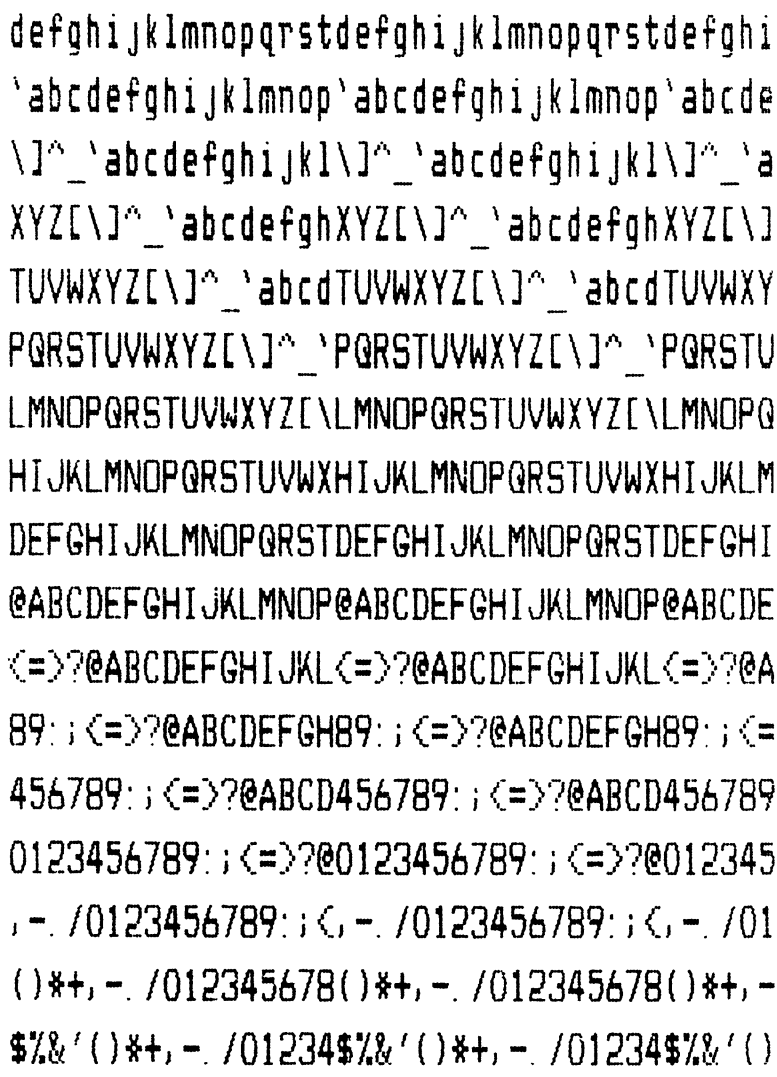
Printing

The LXY family of graphics lineprinters achieves excellent print quality by overlapping dots of 0.05 centimeters (0.02 inches) in diameter, on a dot matrix of nine-by-seven dots or nine-by-nine dots, anywhere on a page. The nine-by-seven matrix enables the printer to overlap dots both horizontally and vertically resulting in solid-looking characters and lines produced with uniform density. The nine-by-nine matrix is used for lowercase letters with descenders, such as the letters "p", "q", and "y."

Double-height characters, as well as underlining are standard features with the LXY12/LXY22.

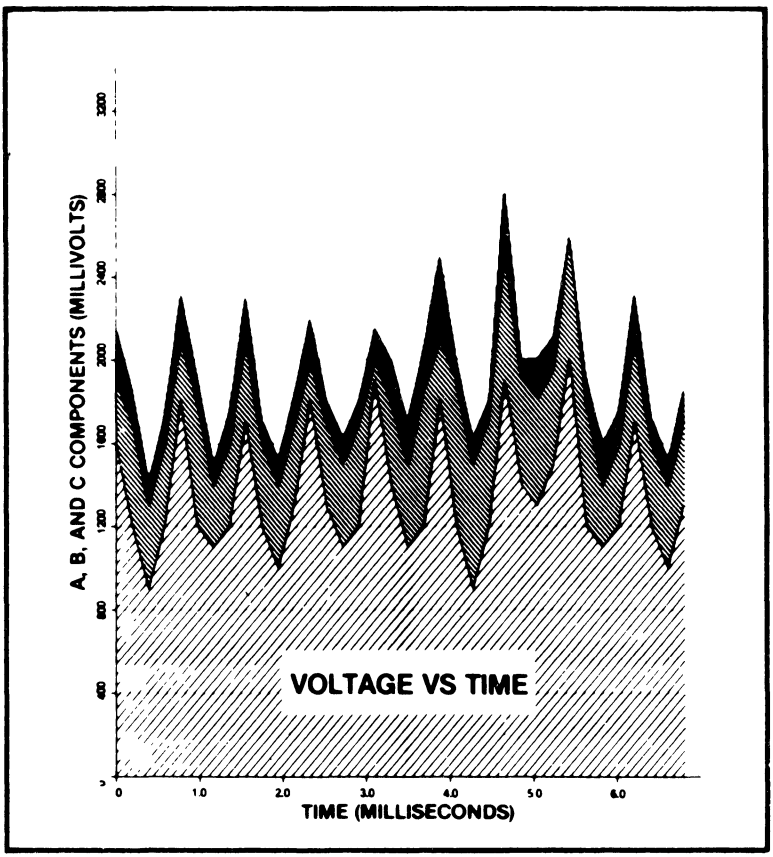
The LXY12 produces high-quality print at speeds of up to 300 lines per minute, 240 lines per minute when underlining or printing lowercase characters with descenders, and 170 lines per minute for double-height characters.

High-speed output of 600 lines per minute is provided by the LXY22 and is suitable for draft and data printing. When underlining or printing lowercase characters with descenders, the output is 465 lines per minute. The LXY22 prints double-height characters at the rate of 320 lines per minute.



By printing dense, overlapping dots, the LXY12 and LXY22 graphics lineprinters produce clear characters.

When used as plotters. the LXY plots up to 42 centimeters per minute (16.7 inches per minute), while the LXY22 plots up to 84.6 centimeters per minute (33.3 inches per minute). Because the LXY12 and the LXY22 print overlapping dots anywhere on the page, plots are always sharp and uniformly dense.



The LXY12 and the LXY22 are ideally suited to provide hardcopy output of designs created on a graphics terminal.

▪ Character Sets

The LXY12/LXY22 print the full 94-character printable ASCII set. Character form is electronically determined by codes stored in PROM devices, which are accessed by the received character codes. Up to 160 different characters may be printed by installing additional PROM devices. Optional character set PROMs include: EBCDIC, Katakana, Arabic, Hebrew, Greek, Cyrillic, and special character sets, such as OCR.

Characters are printed in a line up to 132 characters wide.

▪ Paper

The LXY12/LXY22 accept continuous fanfold edge-perforated paper between 11.4 centimeters (4.5 inches) and 40.6 centimeters (15 inches) wide. They accept single sheets or multipart carbon forms and can produce up to six copies of multipart carbon forms, up to a maximum thickness of 0.06 centimeters (0.025 inches).

▪ Operator Features

Controls and Indicators

Six controls and indicators are found on the front panel of the LXY family of graphics lineprinters.

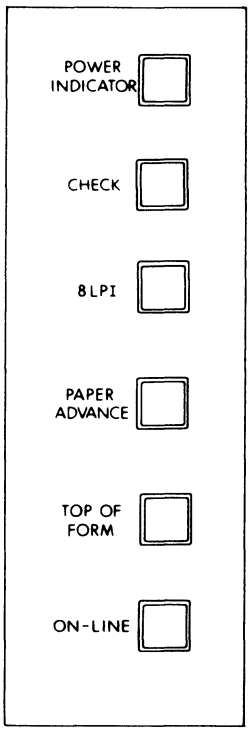


Figure 19-1 ▪ LXY12/LXY22 Front Panel Controls and Indicators

- *Power On/Off Toggle Switch*
  This switch controls application of all power to the graphics lineprinter.

- *Power Indicator*
  When the POWER toggle switch is set to ON, power is applied to the graphics lineprinter and the indicator goes on.

- *Paper Advance Pushbutton*
  While held down, this button advances the paper at the slew rate.

- *Check Pushbutton/Indicator*
  When lit, this button indicates one of the following error conditions.

  - Paper is not loaded properly.
  - Paper has run out.

- Paper is jammed.
- Paper is torn.
- Cover is left open.
- Forms thickness adjustment lever is left up.
- Any internal supply voltage is abnormal.

The light goes out when the fault is cleared. After reloading paper, press the CHECK button and the light will go out.

- *Top-of-Form Pushbutton/Indicator*
  This advances the paper to the top of the next form, or to the top of the form specified by the EVFU, if loaded. This switch operates only when the printer is offline.

- *8LPI Pushbutton/Indicator*
  This switch selects either eight lines per inch (lit), or six lines per inch (unlit). This button operates only when the printer is offline.

- *On-line Pushbutton/Indicator*
  This switch enables or disables printer control through the interface. When the switch is lit, the interface enabled. The printer cannot not go online if the CHECK indicator is lit.

▪ Operation

The LXY12 and the LXY22 have two internal registers—the Control and Status Register (LXCS) and the Data Buffer Register (LXDB).

When the READY bit in the control and status register is set, the graphics lineprinter is ready to accept a character from the processor.

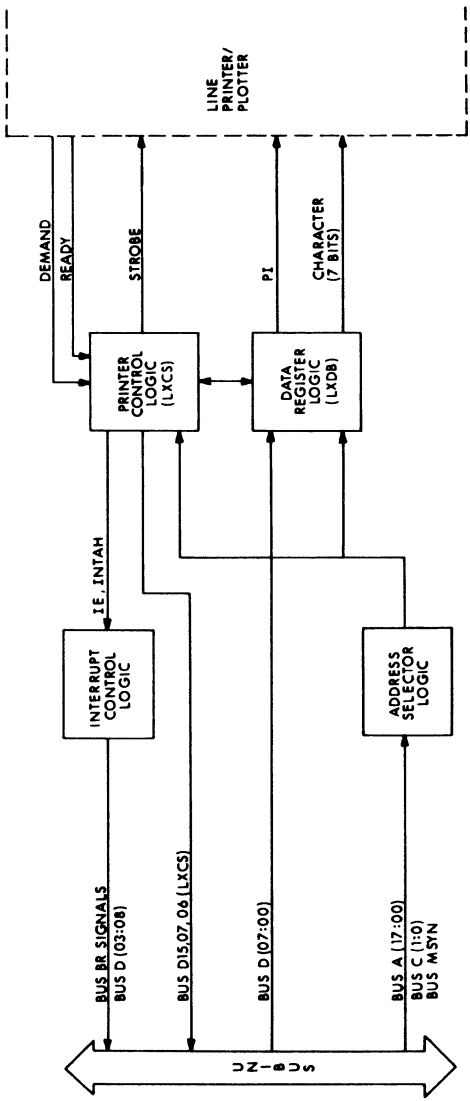


Figure 19-2 ▪ LXY12/LXY22 System Block Diagram

The processor loads characters one by one into the data buffer register in the controller. The controller then transfers the characters to a 132-character data buffer in the graphics lineprinter. The line length of 132 characters corresponds directly to this 132-character data buffer.

The current data buffer register (LXDB) contents are automatically printed out whenever either of the two control codes (Line Feed, Form Feed) is recognized. The Line Feed (LF) code advances the paper one line while the Form Feed (FF) code advances the paper to the top of the next page. If neither of these control codes is recognized, the contents of the data buffer will automatically be printed out when it is full.

An Elongate code (010_8) anywhere in a line of characters causes the entire line to be printed double-height. To underline certain characters in a line, a Carriage Return (CR) code (015_8) is sent following the line of characters, which causes the lineprinter to wait for a line of control characters specifying which of the characters in the line already sent are to be underlined. Unlike the Elongate code which causes an entire line to be printed double-height, the Carriage Return code causes only those characters specified to be underlined.

The Electronic Vertical Format Unit (EVFU) allows you, under program control, to use a variety of form lengths. By specifying a number of lines at the slew speed, you can skip to a preassigned point in the form specified by the VFU channel number. Forms may be as long as 132 lines at six lines per inch.

A Plot Mode code (005_8) anywhere in a line of characters causes the lineprinter to plot the entire line instead of print. When plotting, only one row of dots is printed at a time, and the paper advances only one dot row with each Line Feed code (012_8). The characters are printed as a stream of binary bits; that is, each 1 bit prints as a dot and each 0 bit prints as a blank dot space.

▪ Special Nonprinting ASCII Control Codes

More information on this subject can be found in Appendix A.

Elongate (010_8)
The Elongate code, sent anywhere in a line of characters, causes the entire line to be printed double-height.

Carriage Return (015_8)
The Carriage Return code is used for underlining. It causes the lineprinter to wait for a line of control code characters (Underline, Delete, or Space) before printing out the line of characters already in the data buffer register. Each control code character sent corresponds to a data character currently in the data buffer register. An Underline (137_8) control code character causes the lineprinter to underline the corresponding data character. A Delete (177_8) control code character causes the lineprinter to replace the corresponding data character with a blank space, and a Space (040_8) control code character causes the lineprinter to print the corresponding data character unchanged.

Shift Out (016_8)
The Shift Out code causes all subsequent characters to be selected from the optional character set on the PROM currently in use.

Shift In (017_8)
The Shift In code causes all subsequent characters to be selected from the ASCII character set. A Shift In is automatically generated at the end of every line.

Shift to 8 LPI (006_8)
The Shift to 8 LPI code causes the next Line Feed code (012_8) to advance the paper one-eighth of an inch for eight lines per inch spacing instead of the standard six lines per inch. The lineprinter automatically resets itself to 6 LPI after the Line Feed operation. Shift to 8 LPI is only operational when the 8 LPI switch on the lineprinter is set to 6 LPI.

Plot Mode (005_8)
The Plot Mode code (005_8) sent anywhere in a line of characters causes the lineprinter to plot the entire line instead of printing ASCII characters. There are 1,583 dot positions across the width of the paper, that is, 12 dot positions for each of the 132 characters. Plot Mode allows the printing of only the odd-numbered dots or six dots per character. Bits 0–5 of each character correspond to the six printable dots of that character space. The characters are printed as a stream of binary bits; that is, each 1 bit prints as a dot and each 0 bit prints as a blank dot space. For instance, printing 101_8 ($01\ 000\ 001_2$) causes only dot number 1 to be printed for that character; printing 102_8 ($01\ 000\ 010_2$) prints dot number 3; and printing 055_8 ($00\ 101\ 101_2$) prints dot numbers 1, 5, 7, and 11. Codes 100_8–137_8 must be used instead of codes 000_8–037_8, which cannot be used to plot data because they are control codes and will be interpreted as such, that is, Line Feed (012_8).

Double Density Plot Mode (004_8)
The Double Density Plot Mode (DDPM) code allows printing of all of the even dot positions. A DDPM code sent anywhere in a line of characters causes the lineprinter to plot the entire line instead of printing ASCII characters. Double Density Plot Mode allows the printing of only the even-numbered dots or six dots per character. Note that the Line Feed code at the end of a line of characters does not cause the paper to advance. The DDPM code must always be followed by a Plot Mode Code (005_8), which fills in all of the odd-numbered dot positions.

Start Load (036_8)
The Start Load code initializes the EVFU and causes all subsequent characters to be loaded into the EVFU buffer.

Stop Load (037_8)
The Stop Load code indicates the end of the characters to be loaded into the EVFU buffer. The EVFU buffer allows storage of a Vertical Tab Stop code (channel) for each line of the form. Forms may be up to 132 lines long. Vertical Tab Stops are codes 020_8_035_8. A Vertical Tab Stop code sent anywhere in a line of characters causes the paper to advance to the next PVFU line indicated by that Vertical Tab Stop code at the next Line Feed code. Top of Form code 020_8 is always loaded into line 1 in the PVFU buffer.

Stop code at the next Line Feed code. Top of Form code 020_8 is always loaded into line 1 in the PVFU buffer.

▪ Interrupts

The LXY12/LXY22 system controller uses bus request (BR) interrupts to gain control of the UNIBUS to perform a vectored interrupt, which causes the program to branch to an interrupt service routine. A BR interrupt can occur only if the INTERRUPT ENABLE bit in the control and status register is set. Once the INTERRUPT ENABLE bit is set, an interrupt request is generated whenever either the READY bit or the ERROR bit is set in the control and status register.

When the READY bit is set, the graphics lineprinter is ready to accept a character to be loaded into the data buffer register (LXDB). When the ERROR bit is set, it indicates that some error condition exists. In this case, an interrupt is generated to cause the program to branch to an error-handling routine.

The interrupt priority level is 4 and the interrupt vector address is 200. Note that the priority level can be changed with a priority plug, and the vector address can be changed by jumpers in the interrupt control logic. However, any of Digital's programs or other software referring to the priority level or interrupt vector address must also be changed if the priority plug or the vector address is changed.

▪ Maintenance

Quality assurance means long life expectancy, high-quality output, and continuous smooth performance by your LXY graphics lineprinter. Special design features of the LXY family of lineprinters give these systems qualities of high reliability as well as ease of maintenance.

- The LXY12 and the LXY22 use hammer-bank print mechanisms and are therefore not susceptible to the wear experienced by single-head matrix printers.
- The hammers seldom require adjustment or alignment. The hammer-bank module can be easily removed since it is held in place by two screws.
- Less chance of paper jams than with charaband printers because the paper moves as it prints. As the paper advances, each successive line of dots overlaps to form solid-looking characters.
- Fewer moving parts than charaband and drum printers and 50 percent fewer components than mechanical font printers.
- Modular construction enables parts to be quickly removed and replaced during routine servicing and maintenance.
- The LXY12 and the LXY22 freestanding unit is designed to give stable, quiet operation below 65 dB.

Self-test Procedure

Depressing the CHECK and PAPER ADVANCE buttons simultaneously causes the LXY series of graphics lineprinters to print lines of "E". This continues as long as you hold the buttons down. If lines of "E" fail to print, contact your local Digital field service representative for assistance.

▪ Additional Documentation

The following documents contain more detailed information about the LXY family of graphics lineprinters.

- *LXY Printer User's Guide* (EK-LXY22-UG)—tells you how to use, maintain, troubleshoot, and configure the LXY family.
- *LXY Installation Guide* (EK-LXY22-IN)—tells you how to install the LXY family of printers.

Also of interest are

- *PDP-11* and *VAX Systems & Options Catalogs*—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. This document is designed to help you select the right Digital product. European versions are also available.

If you require information not contained in these documents, contact your local Digital representative, dealer, or distributor.

▪ Specifications

Performance Characteristics

Printing speed	
LXY12	300 l/min;240 l/min for underling or lowercase characters with descenders; 170 l/min for double-height characters
LXY22	600 l/min;465 l/min for underling or lowercase characters with descenders; 320 l/min for double-height characters
Plotting speed	
LXY12	42.4 cm/min (16.7 in/min);21.1 cm/min (8.3 in/min) for double density plotting
LXY22	84.6 cm/min (33.3 in/min);42.4 cm/min (16.7 in/min) for double density plotting
Print technology	Impact, dot matrix
Print density	9 by 7 (uppercase)9 by 9 (lowercase)
Line spacing	6 or 8 l/in
Graphics	60 dots/in, horizontal72 dots/in, vertical

Paper slew speed	
LXY12	20.3 cm/s (8 in/s)
LXY22	40.6 cm/s (16 in/s)
Character set	64, 96-character ASCII (printing and nonprinting characters)
Buffer capacity	132 characters

Paper

Type	**Fanfold**
Dimensions	11.4 cm–40.6 cm (4.5 in–16 in)
Multipart forms	Up to 6 parts, fanfold carbon
Thickness	0.06 cm (0.025 in)

Communications

Data interface	Parallel-bit ASCII code
Data interface options	RS232-C buffered serial interface;Serial-line interface

Power Requirements

LXY AC line voltage/frequency	85–32 Vac, at 60 Hz
	170–264 Vac, at 50 Hz
Interface (controller) current	1.5 A at 5 Vdc
Power consumption	200 W, standby;450 W, nominal; 800 W, maximum
Heat dissipation	1,535 Btu/hr

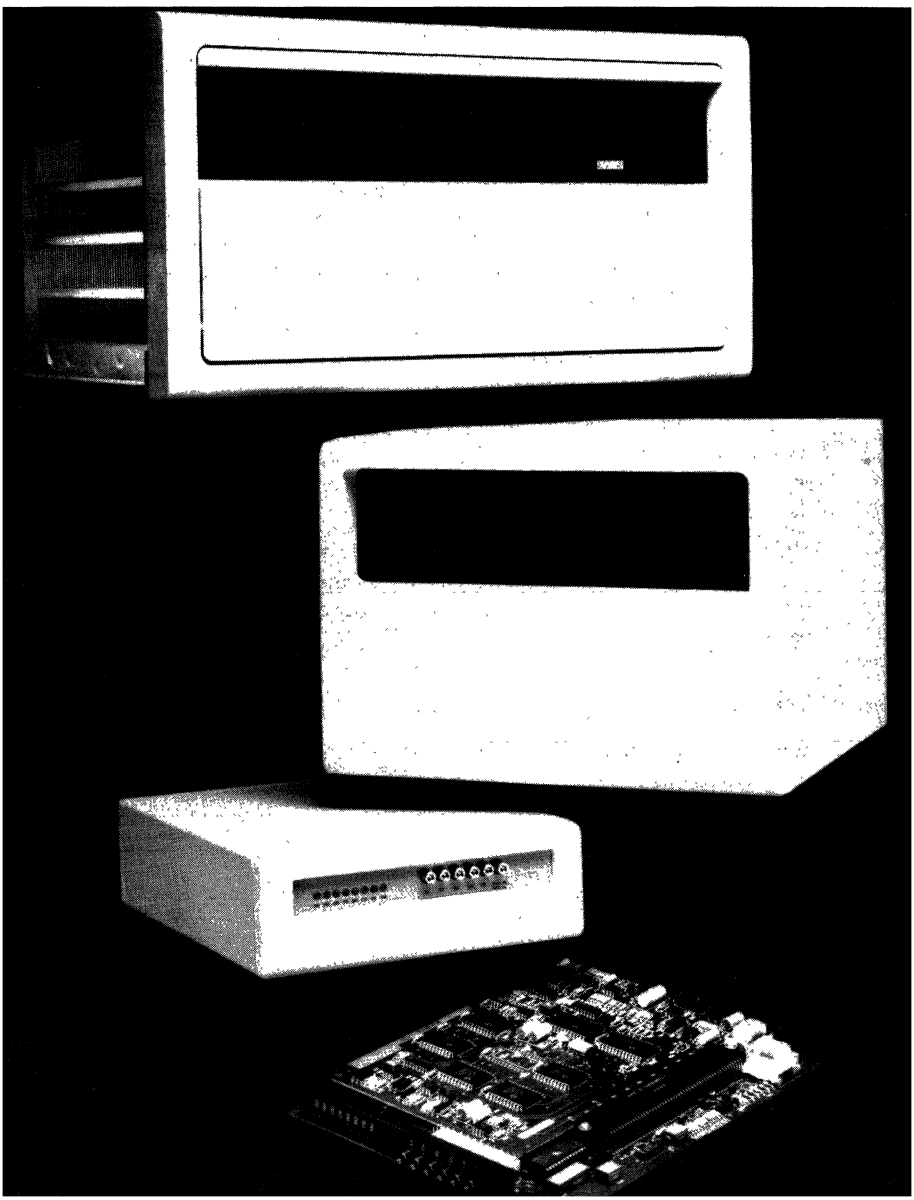
Operating Environment

Temperature	10–38°C (50–100°F)
Relative humidity	30–90%

Physical Characteristics

Height	118 cm (46.5 in)
Width	76.2 cm (30 in)
Depth	61.6 cm (24.3 in)
Weight	90.7 kg (200 lb)

Chapter 20 ▪ Modems and Intelligent Communications Processors



▪ Introduction

Your system, whether composed of one computer and a single terminal or many computers and terminals using highly sophisticated software, forms a communications network. In order to transfer information between members of the network—CPU to CPU, CPU to terminal, or CPU to printer—you need data communication equipment. Modems and intelligent communications processors (ICPs) are the two most popular types. A critical part of the network, modems and ICPs are often the crucial factors in determining network throughput and reliability.

Data terminal equipment transfers information in a digital format. Telephone lines carry information in an analog format, continuously varying voltage and frequency. Thus, it is necessary to convert digital data to analog format for transmission over telephone lines. This is performed by a modem. Information entering the communications link is modulated on a carrier wave. Information leaving the data link is demodulated so that only the original signal exists when it leaves the modem or an ICP with a modem. In effect, the information (digital signal) is impressed on the carrier wave, allowing it to be transmitted over great distances via the telephone network.

Data communications equipment is used in every work environment—commercial, scientific, industrial, and manufacturing. Personal computers, office information systems, word processing workstations, and timesharing systems need data communications equipment to link them to other systems or to other databases.

Digital's modems and intelligent communications processors work with any Digital and most non-Digital processors running an operating system having a terminal driver utility, a communications interface or port, and an EIA terminal or printer.

▪ Selection Criteria

When you decide to buy data communications equipment, there are several factors to consider.

- Your application
- Compatibility with industry standards
- Growth of the present system
- Reliability
- Service and support

- Ease of configuration
- Standard features
- Customer installable

Your Application

A dialup modem allows a single user to tap into many different databases as work demands via public telephone lines. The cost of operating a dialup modem is low because only small amounts of data are being transmitted via telephone lines. The dialup modem gives you the greatest versatility because you are not restricted to a particular database. Digital offers the DF112, DF124, DF126, and DF224 modems.

Multiplexers, such as Digital's DFM series of Intelligent Communications Processors (ICPs), are better for a multiuser remote cluster environment where small groups need to access a central database. In this situation, you generally transmit data via leased lines. Because only the lessee has access to the line, data can be transmitted at a faster rate. Leased lines can be expensive, but for dedicated applications they are efficient and cost effective.

Compatibility with Industry Standards

It is essential for your data communications equipment to be compatible with industry standards. Such standards prevent your application and database from being restricted from future growth. These standards, such as the Bell System's 212A, allow you to transmit data asynchronously at 300 or 1,200 bits per second, or synchronously at 1,200 bits per second. All Digital modems and intelligent communications processors meet industry standards.

Some telephone lines need to be used for both telephone calls and data transmission. If this is the case in your office, then you need a modem with the alternate voice/data feature. This feature enables your telephone line to be used for both telephone calls and data transmission. It is more cost effective because you do not need two separate lines—one line for telephone calls and a separate line for data transmission. The alternate voice/data feature is standard on Digital's DF112, DF124, DF126, and DF224 modems.

Growth Potential
As your operation grows, your network must grow along with it. Your network probably contains equipment from different vendors. For your network to grow, there must be compatibility across the network. As hardware enhancements come along, you must be able to upgrade your existing hardware, not throw it away. As you add new equipment to your network, look for equipment that is similar in operation to existing equipment, so your staff will not require extensive retraining. Look at the different configuration options that are available.

Reliability
The reliability of your modem and ICP is very important. As long as your data terminal equipment is working, your system—whether large or small—continues to transfer data. A system that stays up allows your staff to make efficient use of work time.

Support and Service
Unfortunately, there may be times when you are unable to transmit data. Support after the data communications equipment has been purchased is another factor to think about. It is valuable if you can perform a series of tests to find out where the problem lies. This way, you won't waste valuable time checking many different components—you can go directly to the malfunctioning one and fix it. If you have a service contract, you need to be able to pinpoint where the problem exists, at the transmitting or the receiving end. If you need field service, you want to pay for a call made only at the end that needs help, not the good end as well.

Ease of Configuration
One of the most important considerations is whether or not you can select the baud rate. If the processor and the terminal operate at two different speeds, your modem or ICP can compensate for this by transmitting data at the rate the slower device can handle. Another consideration is whether the cable is included with the modem. Digital lets you order a cable, if you need it, and lets you specify the length required for your application.

Standard Features
Ask: Is autodialing standard or optional? Which internal diagnostics are standard—self-test, loopback self-testing, and analog testing?

Customer Installable
If the modem or intelligent communications processor is designed for customer installation and is sold with everything you need for operation, you can be all set to transmit data in under 30 minutes. Always follow the manufacturer's installation manual to ensure the best results.

▪ DF100 and DF200 Series of Modems

The DF100 and DF200 series of modems consists of modular modems designed for system applications. These series provide a full line of modem products with data speeds ranging from 300/1200 to 9600 bits per second. The DF100 and DF200 Series Comparison Chart identifies speed, functional capability, communication mode, and asynchronous and synchronous data modes for the DF112, DF124, DF126, DF127, DF129, and DF224. Each is then discussed under separate heading.

NOTE

The DF01, DF02, and DF03 modems have been replaced by the DF112 modem family.

Table 20-1 ▪ DF100 and DF200 Series Comparison Table

	DF112	DF124	DF126	DF127	DF129	DF224
Speed	300/1200 bps	2400 bps	2400 bps	4800 bps	9600 bps	2400 bps
Functional Capability	Bell 212A Bell 103J	CCITT V.22 bis Bell 212A	Bell 201 B/C CCITT V.26	CCITT V.27 bis	CCITT V.29	CCITT V.22 bis Bell 212A
Communication Mode	Full-duplex over dialup or leased lines	Full-duplex over dialup or leased lines	Half-duplex over dialup lines Full-duplex over leased lines	Full-duplex over leased lines	Full-duplex over leased lines	Full-duplex over dialup lines
Data Mode	Asynchronous/ synchronous	Asynchronous/ synchronous	Synchronous/ asynchronous	Synchronous	Synchronous	Asynchronous/ synchronous

▪ DF112

Overview

The DF112 is a 300/1200 bps full duplex asynchronous/synchronous modem that allows terminals, personal computers and processors to communicate over dialup or private/leased telephone lines. The DF112 modem is compatible with Bell 103J/212A and replaces the DF03 modems. The modem can operate at data rates between zero and 300 bits per second or 1200 bits per second for asynchronous communication and 1200 bits per second for synchronous communication.

The DF112's extensive flexibility supports both desktop and multiple modem configurations. The modem module may be inserted into the particular enclosure that best serves the remote communication needs. Consequently, it takes only one modem module to be kept as a spare for both desktop and multiple modem configuration resulting in a cost saving.

Two models of the DF112 are available—the DF112-AA and the DF112-AM.

DF112-AA modem module is the desktop model. It consists of a modem module and universal desktop enclosure with integral power supply for those needing individual interconnections to terminals, personal computers, processors, and printers.

DF112-AM modem module mounts into multiple modem enclosures for applications needing more than a single modem. The modem module is conveniently mounted into the front of the DF100-RM and DF100-RT enclosures. These enclosures connect to RJ21X phone service for dialup lines and/or standard 4 wire termination service for private/leased lines.

Major Features

- New microprocessor controlled asynchronous auto-dialer—Simple to operate, the auto-dialer has memory to store up to 5 (26 digit) telephone numbers and is compatible with both rotary pulse and Touch Tone* dialing.
- Extensive built in diagnostic features—Help locate network problems and reduce network downtime.
- Data/Talk switch allows alternate voice/data capability—Allowing either voice or data communications with a standard telephone set.

*Touch Tone is a trademark of American Telephone & Telegraph Company.

Operator Features

It is easy to operate the DF112. Eight LED indicators, located on the modem's front panel, allow the nontechnical user to monitor the modem's operation quickly.

The user-friendly asynchronous auto-dialer allows calls to be originated either from a terminal keyboard or by a software program. Numbers stored in the auto-dialer can be re-dialed by single keystrokes and the auto-dialer can automatically re-dial the last number dialed. A properly programmed processor can access the auto-dialer without manual intervention.

Specifications

General	
Functional Compatibility	Bell 212A; Bell 103J
Data Format	Serial, binary, asynchronous/synchronous data
Operating Mode	Auto originate, autoanswer, manual originate, manual answer
Communication Mode	Full-duplex at all data rates
Data Rate	Low-speed 0-300 bps asynchronousHigh-speed 1200 bps asynchronous/synchronous
Telephone Line Requirement	Dialup (PSTN)RJ11C (US)/CA11A (Canada) RJ41S (US)/CA41A (Canada) RJ45S (US)/CA45A (Canada) Leased Line (P/LTN) 625 connection block RJ14 to RJ11C line connection
Certified for FCC Part 15 (subpart J)	For use in home or office environments
Interface Compatibility	EIA RS232-C/CCITT V.24 and V.28 compatible voltages

General	
Power Requirements	
Power Consumption DF112-AA	120 Vac, 60 Hz
Power Consumption DF112-AM	0.15 amps and 5 Vdc0.015 amps and 12 Vdc 0.045 amps–12 Vdc
Operating Environment	
Temperature	5 to 50°C (41 to 122°F)
Relative Humidity	0 to 95% noncondensing, noncaustic
Physical Characteristics DF112-AA	
Height	74 mm (2.91 in)
Width	217 mm (8.56 in)
Depth	292 mm (11.5 in)
Weight	2.62 kg (5 lb, 12.5 oz)
Physical Characteristics DF112-AM	
Height	25.4 mm (1 in)
Width	203 mm (8 in)
Depth	264 mm (10.4 in)
Weight	0.68 kg (1.5 lb)
Test Features	Analog LoopbackSelf-test Remote Digital Loopback Digital Loopback End-to-End Self-test
Status Indicators	Eight LED status indicators: Send Data (SD), Receive Data (RD), Carrier Detect (CD), Data Terminal Ready (TR), Modem Ready (MR), Off Hook (OH), High Speed (HS), Test Mode (TM)
Operating Controls	Local Loop (LL), Self-test (ST), Remote Loop (RL), Digital Loop (DL), High-speed (HS), Data/Talk (D/T)
Modulation	Low-speed: Frequency Shift Keying (FSK)High-speed: Quaternary Differential Phase Shift Keying (QDPSK)

General	
Auto-dialer Features	Operates 300 and 1200 bps asynchronous using ASCII character set. Compatible with Touch Tone or rotary pulse dialing. Stores up to 5 telephone numbers (4 numbers plus the current number dialed) 26 digits in length. Gives user-friendly responses.

▪ DF124

Overview

The DF124 is an asynchronous or synchronous, full duplex, 2400, and 1200 bps modem for dialup or private/leased line networks. It is compatible with CCITT V.22 bis at 2400 bps and with Bell 212A at 1200 bps.

Until now, your choice of data speeds for full duplex communication over dialup lines has been limited to either 300 or 1200 bits per second. Now, you can transmit data at 2400 bps as well as 1200 bps all in one modem. Because of its compatibility you can be confident that your DF124 will communicate with present and future information database networks.

The DF124 modular design supports three Digital enclosures, desktop, rack-mount, and DFM intelligent communication processor (statistical multiplexer). This allows you to interchange modules into the particular enclosure that best serves your remote communication needs. You save time because modem modules can be replaced and changed without disconnecting ac power or data cables. You save money because one modem module can be used as a spare for three different enclosures.

The two models of the DF124 are the *DF124-AA* Desktop Modem and the *DF124-AM* Modem Module.

Major Features

- Asynchronous transmission of data at 2400 bps over dialup lines—Allows you to communicate twice as fast as at 1200 bps, reducing your telephone connect time and costs.
- Synchronous data transmission at 2400 bps over dialup lines—Avoids the delay and expense of leased line installation.
- User friendly asynchronous auto-dialer stores up to 5 (26 digit) telephone numbers and is compatible with both rotary pulse and Touch-Tone dialing—Provides for a variety of dialup applications.

Specifications

General	
Functional Compatibility	CCITT V.22 bisBell 212A
Data Format	Serial, binary, asynchronous/synchronous data
Operating Modes	Auto originate, autoanswer, manual originate, manual answer
Communication Mode	Full duplex at all data rates
Data Rate	High-speed: 2400 bps asynchronous2400 bps synchronous Low-speed: 1200 bps asynchronous 1200 bps synchronous
Telephone Line Requirement	Dialup (PSTN)RJ11C (US)/CA11A (Canada) RJ41S (US)/CA41A (Canada) RJ45S (US)/CA45A (Canada) Leased Line (P/LTN) Standard leased 2 wire Private/leased phone lines
Terminal Interface Standard	EIA RS232-C, CCITT V.24, V.28
Power Requirements	
Power Consumption	DF124-AA, 120 Vac, 60 HzDF124-AM, 0.7A at + 4 Vdc, 0.2A at + 12 Vdc, 0.15A at -12 Vdc
Operating Environment	
Operating Temperature	10 to 40°C (50 to 104°F)
Relative Humidity	0 to 90% noncondensing, noncaustic

General	
Physical Characteristics	
DF124-AA	Height: 74 mm (2.91 in)Width: 217 mm (8.56 in) Depth: 292 mm (11.5 in) Weight: 2.62 kg (5 lb, 12.5 oz)
DF124-AM	Height: 25.4 mm (1 in)Width: 203 mm (8 in) Depth: 264 mm (10.4 in) Weight: 0.68 kg (1.5 lb)
Test Features	Local analog loopbackLocal digital loopback Remote digital loopback Self-test
Status Indicators	Eight LED status indicators: Send Data (SD), Receive Data (RD), Carrier Detect (CD), Data Terminal Ready (TR), Modem Ready (MR), Off Hook (OH), High-speed (HS), Test Mode (TM)
Operating Controls	Local Loop (LL), Self-test (ST), Remote Loop (RL), Digital Loop (DL), High-speed (HS), Data/Talk (D/T)
Modulation	High-speed: Quadrature Amplitude Modulation (QAM)Low-speed: Four-phase differential phase shift keying
Equalization	Automatic adaptive
Auto-dialer Features	Operates 2400 or 1200 bps asynchronous using ASCII character set. Compatible with Touch Tone or rotary pulse dialing. Stores up to 5 telephone numbers (4 numbers plus the current number dialed) 26 digits in length. Gives user friendly responses.

▪ DF126

Overview

The DF126 is a medium-speed modem that is compatible with Bell 201 B/C. It communicates synchronous and asynchronous data at 2400 bps, **half-duplex** over dialup lines, and full-duplex over 4 wire private and leased lines.

Flexible modular design allows the utilization of the DF126 modem with three standard Digital enclosures—desktop, multiple modem, and statistical multiplexer enclosure. This flexibility allows the modem module to be inserted into the particular enclosure that best serves your remote communication needs. Spare-part costs are significantly reduced since it only takes one modem module to serve as a spare for three different enclosures.

For dialup applications, the DF126 modem has a user-friendly asynchronous auto-dialer that can store up to 5 telephone numbers (26 digits) and is compatible with both rotary pulse and Touch-Tone dialing. In Bell 201-C compatibility mode, the special BC22Y adapter cable allows economical use of the asynchronous auto-dialer logic to establish a connection and then process the synchronous data.

The DF126's extensive built-in diagnostic features support both the dialup and private/leased line telephone network and help locate network problems to reduce costly network downtime. The modem is easy to operate and monitor using the eight LED indicators and six pushbutton switches located on the DF126's front panel.

There are two models of the DF126—DF126-AA Desktop Modem,and the DF126-AM Modem Module. The desktop model consists of a modem module and a universal desktop enclosure. The DF126-AM modem module mounts into Digital's multiple modem enclosures for applications needing more than a single modem. The modem module is conveniently mounted into the front of the DF100-RM and DF100-RTenclosures. These enclosures connect to RJ21X phone service for dialup lines and/or standard 4 wire termination service for private/leased lines. The multiple modem enclosure contains an integral power supply and can house up to 12 combination DF100 modem modules. The DF126-AM modem module also can be used with Digital's DFM multiplexer family.

Major Features

- In Bell 201 C mode, the BC22Y adapter cable allows economical use of the asynchronous auto-dialer logic to establish a connection and then to process synchronous data.
- Works in multiport network applications with Digital's DMP11 and DMV11 type communication interfaces over private/leased lines.
- Integral auto-dialer can store up to 5 (25 digit) telephone numbers.

Specifications

General	
Functional Compatibility	Bell 201 B/CCCITT V.26
Data Format	Serial, binary, synchronous, and asynchronous data
Communication Mode	Half-duplex over 2 wire dial-up lines (PSTN) or full-duplex over 4 wire private/leased lines (P/LTN)
Data Rate	High-speed: 2400 bps synchronous/ asynchronousLow-speed: 1200 bps synchronous/ asynchronous
Telephone Line Requirements	Dialup (PSTN)RJ11C (US)/CA11A (CAN) RJ41S (US)/CA41S (CAN) RJ45S (US)/CA45A (CAN) Leased line (P/LTN) Standard leased 4 wire line termination
Certified for FCC Part 15 (subpart J)	Approved under category B for home or office environment
Terminal Interface Standard	EIA RS232-C/RS 423-A
Power Requirements	
DF126-AA	120 Vac, 60 Hz
DF126-AM	0.4A at + 5 Vdc, 0.15A at + 12 Vdc, 0.1A at -12 Vdc

General	
Operating Environment	
Operating Temperature	10 to 40°C (50 to 104°F)
Relative Humidity	10 to 90% non-condensing,non-caustic
Physical Characteristics	
DF126-AA	Height: 74 mm (2.91 in)Width: 217 mm (8.56 in) Length: 292 mm (11.5 in) Weight: 2.62 kg (5 lb, 12.5 oz)
DF126-AM	Height: 25.4 mm (1 in)Width: 203 mm (8 in) Length: 264 mm (10.4 in) Weight: 0.553 kg (1 lb, 3.5 oz)
Test Features	Analog Loop, Self-test, Digital Loop, Remote Digital Loop
Status Indicators	Send Data (SD), Receive Data (RD), Carrier Detect (CD), Terminal Ready (TR), Modem Ready (MR), Clear to Send (CS), Request to Send (RS), Test Mode (TM)
Operating Controls	Local Loop (LL), Self-test (ST), Remote Loop (RL), Disable Modem (DM), Fallback Speed (FB), Data or Talk (D/T)
Modulation	Normal speed, Four-Phase Differential Phase Shift Keying (DPSK); Fallback speed, Two-Phase Differential Phase Shift Keying (DPSK)
Auto-dial features	2400 and 1200 bps asynchronous ASCII data formatTouch-Tone or rotary pulse dialing, Stores up to 5 telephone numbers (26 digits)

▪ DF127

Overview

The DF127 is a medium-speed, 4800 bps, synchronous private/leased line modem, compatible with CCITT Recommendation V.27. Using LSI and microprocessor technologies, the DF127 provides synchronous, full-duplex, point-to-point, communication over unconditioned 4 wire voice-grade leased lines or half-duplex, point-to-point communication over unconditioned 2 wire voice-grade leased lines.

The DF127's modular design allows the same modem module to be used in three standard Digital enclosures, desktop, rackmount and statistical multiplexer enclosure. This provides you with extensive flexibility. Simply insert the modem module into the particular enclosure that best serves the remote communications need. It only takes one modem module to serve as a spare for three different enclosures.

The DF127's automatic adaptive equalizer continuously adapts to various transmission line characteristics to optimize performance. The equalizer quickly reacts to line conditions to minimize data transmission errors. The modem can fall back to 2400 bps to accommodate poor line conditions. Two models of the DF127 are the DF127-AA Desktop Model, and the DF127-AM Modem Module.

The desktop model consists of a modem module and a universal desktop enclosure with integral power supply.

The DF127-AM modem is a multiple modem module that mounts into Digital's multiple modem enclosures for applications needing more than a single modem. The modem module can be used also as an integral modem with Digital's DFM multiplexer family.

Major Features

- Uses LSI and microprocessor technologies for reliable operation.
- Provides local and remote test features, including power-up self-test.
- Automatic adaptive equalizer optimizes modem performance.

Specifications

General	
Functional Compatibility	CCITT V.27 Data Format Serial, binary, synchronous data
Communication Mode	Half-duplex over 2 wires, full duplex over 4 wire unconditioned private/leased phone lines
Data Rate	High-speed, 4800 bps synchronousLow-speed, 2400 bps synchronous
Telephone Connections	Private/Leased Telephone Network (P/LTN) only 2 wire half-duplex 4 wire full-duplex
FCC part 15 (subpart J) certification	Part 15 certified under category B for home or office environments
Terminal Interface	EIA RS232-C/CCITT V.24, V.28
Power Requirements	
DF127-AA	120 Vac, 60 Hz
DF127-AM	0.9A at + 5 Vdc, 0.07A at + 12 Vdc, 0.25A at -12 Vdc
Operating Environment	
Operating Temperature	10 to 40°C (50 to 104°F)
Relative Humidity	0 to 95% noncondensing, noncaustic

General	
Physical Characteristics	
DF127-AA	Height: 74 mm (2.91 in)Width: 217 mm (8.56 in) Length: 292 mm (11.5 in) Weight: 2.63 kg (5 lb, 12 oz)
DF127-AM	Height: 25.4 mm (1 in)Width: 203 mm (10.4 in) Length: 264 mm (10.4 in) Weight: 0.553 kg (l lb, 3.5 oz)
Test Features	Analog LoopbackSelf-test Digital Loopback Remote Digital Loopback End-to-End Self-test
Status Indicators	Eight LED status indicators: Send Data (SD), Receive Data (RD), Carrier Detect (CD), Clear to Send (CS), Request to Send (RS), Signal Quality (SQ), Fallback (FB), Test Mode (TM)
Operating Controls	Six front panel controls: Local Loop (LL), Test Pattern (TP), Remote Digital Loopback (RL), Digital Loopback (DL), Fallback (FB), Fallback Speed (FS)
Modulation	High Speed: 4800 bps, Eight-Phase Differential Phase Shift Keying (DPSK)Low Speed: 2400 bps, Four-Phase Differential Phase Shift Keying (DPSK)
Equalization	Automatic Adaptive

▪ DF129

Overview

The DF129 is a high-speed, 9600 bps, synchronous private/leased line modem compatible with CCITT Recommendation V.29. Using LSI and microprocessor technologies, the DF129 provides synchronous full-duplex, point-to-point communication over unconditioned, 4 wire, voice-grade leased lines.

The DF129's modular design allows the same modem module to be used in three standard Digital enclosures, desktop, multiple modem enclosure and statistical multiplexer enclosures. This provides extensive flexibility by simply inserting the modem module into the particular enclosure that best serves the remote communication ends. The same modem module will spare all three different enclosures.

The DF129's automatic adaptive equalizer continuously adapts to various transmission line characteristics to optimize performance. The equalizer quickly reacts to line conditions to minimize data transmission errors. The modem has fallback speeds of 7200 and 4800 bps to accommodate poor line conditions.

The two models of DF129 are the DF129-AA Desktop Model, and the DF129-AM Modem Module.

DF129-AA: Desktop model that consists of a modem module and universal desktop enclosure with integral power supply.

DF129-AM: Modem module for multiple modem configurations. The modem module mounts into the front of the DF100-RM and DF100-RT enclosures. The modem module can also be used as an integral modem with the DFM statistical multiplexer family.

Major Features

- Uses LSI and microprocessor technologies for reliable operation
- Automatic adaptive equalizer optimizes modem's performance
- Provides local and remote test features including power-up self-test
- Signal quality indicator LED informs user of poor telephone line conditions

Specifications

General	
Functional Compatibility	CCITT V.29
Data Format	Serial, binary, synchronous data
Communication Mode	Full duplex over 4 wire unconditioned private/leased phone lines
Data Rate	High Speed: 9600 bps synchronousFallback Speed: 7200 and 4800 bps synchronous
Telephone Line Requirement	Leased line (P/LTN) standard leased 4 wire line termination
Certified FCC Part 15 (Subpart J)	Approved under category B for home or office environment
Terminal Interface Standard	EIA RS232-C/CCITT V.24, V.28
Power Requirements	DF129-AA: 120 Vac, 60 HzDF129-AM: 0.4A at + 4 Vdc, 0.15A at + 12 Vdc, 0.1A at -12 Vdc

General	
Operating Environment	
Operating Temperature	10 to 40°C (50 to 104°F)
Relative humidity	10 to 90%
Physical Characteristics	
DF129-AA	Height: 74 mm (2.91 in)Width: 217 mm (8.56 in) Length: 292 mm (11.5 in) Weight: 2.62 kg (5 lb, 12.5 oz)
DF129-AM	Height: 25.4 mm (1 in)Width: 203 mm (8 in) Length: 262 mm (10.4 in) Weight: 0.553 kg (1 lb, 3.5 oz)
Test Features	Analog Loop, Self-test, Digital Loop, Remote Digital Loop, End-to-end Self-test
Status Indicators	Eight LED status indicators: Send Data (SD), Receive Data (RD), Carrier Detect (CD), Clear to Send (CS), Request to Send (RS), Signal Quality (SQ), Fallback Speed (FB), Test Mode (TM)
Operating Controls	Six front panel controls: Local Loop (LL), Test Pattern (TP), Remote Loop (RL), Digital Loop (DL), Fallback (FB), Fallback Speed (FS)
Modulation	High-speed: 16-point Phase Quadrature Amplitude Modulation (QAM)Fallback Speed: 7200, 8-point QAM; 4800, 4-point Differential Phase Shift Keying (DPSK)
Equalization	Automatic Adaptive

▪ DF224: The Scholar Modem

Overview

The DF224, also called the Scholar modem, is a high-performance, low-profile, intelligent asynchronous or synchronous modem that operates full-duplex over dialup lines. You can operate the DF224 at speeds of 2400, 1200, 600 and 300 bps for asynchronous communication, or 2400 and 1200 bps for synchronous communication.

The DF224's front panel Data/Talk switch allows alternate voice or data communications with a standard telephone set. The DF224 modem connects to standard telephone sets using RJ11C phone service or can utilize exclusion key telephone sets connected to RJ41S or RJ45S phone service.

The Scholar modem is compatible with CCITT V.22 bis at 2400 bps. This international standard has been accepted by the modem industry and is fast becoming the preferred speed for remote dial-up communications. At 1200 bps, the DF224 is compatible with Bell standard 212A and CCITT V.22. At 300 bps, it is compatible with Bell standard 103J. Because the DF224 is compatible with the most popular standards in the industry, you can be confident that it will communicate with tomorrow's database networks, as well as today's.

The DF224 is truly the ideal modem, suitable for the home, school, or office environments. The Scholar Modem allows your personal computer, terminal, or microprocessor to access remote databases or networks in a fast and very cost-effective manner.

The model of the DF224 is the *DF224-AA*, a low profile desktop modem with external wallmount power supply.

Major Features

- **Auto Dialer Function**—The DF224's intelligent auto-dialer operates either at 2400, 1200, or 300 bps for asynchronous communication or operates at 2400 and 1200 bps for synchronous communication. It is compatible with both rotary pulse or Touch-Tone dialing systems. You can use also mixed dialing, a combination of pulse and tone dialing, that allows you to access such public long-distance telephone services as MCI or Sprint.

- The auto-dialer lets you dial phone numbers either from your terminal keyboard or by software program control from a personal computer. You don't need to worry about setting switchpacks or dip switches. From your terminal keyboard, you can set operating and auto-dialer features easily by using the Scholar modem's friendly menu driven commands.

- You can store up to 15 phone numbers in the Scholar modem's auto-dialer memory. These numbers can be identified by ID names of up to 6 characters long. These phone numbers can also be linked together so that if the first number is busy or not functioning, the second number will be dialed automatically.

- Use of the auto-dialer, allows the Scholar modem to monitor your phone call progress, informing you of dial tones, busy tones, no answers, and valid connections.

- **Autoanswer**—In autoanswer mode, the Scholar modem automatically senses whether incoming calls are 2400, 1200, or 300 bps. If the modem is set at 2400 bps and a call is received to a modem set at 1200 bps, the Scholar modem will drop down to 1200 bps, tell you that it is doing so on the terminal screen, and wait while you adjust the speed of your terminal or personal computer accordingly.

- **Diagnostics**—The Scholar modem performs a self-test of its internal logic circuits upon each powerup. If a fault is detected, an LED status light comes on to alert you. Built-in diagnostic features such as Local Analog Loopback and Remote Digital Loopback help you isolate network faults and reduce annoying network downtime.

Specifications

General	
Functional Compatibility	2400 bps, CCITT V.22 bis1200 bps, 600 bps, CCITT V.22 1200 bps, Bell 212A 300 bps, Bell 103J
Data Format	Serial, binary asynchronous/synchronous
Communication	Full-duplex at all data rates
Data Rate	High Speed: 2400 bps asynchronous/ synchronousFallback Speed: 1200/600/300 bps asynchronous 1200 bps synchronous
Telephone Line Requirement	Dialup (PSTN) onlyRJ11C (US)/CA11A (CAN) RJ41S (US)/CA41A (CAN) RJ45S (US)/CA45A (CAN)
Certified for FCC Part 15 (subpart J)	Approved under Category B for use in home or office environments
Terminal Interface Standard	EIA RS232-C/CCITT V.24, V.28
Power Requirements	Wall-mounted power supply; 120 Vac, 60 Hz; 0.8A at + 5 Vdc, 0.1A at + 12 Vdc, 0.1A at -12 Vdc
Operating Environment	
Operating Temperature	10 to 40°C (50 to 104°F)
Relative Humidity	10 to 90% noncondensing, noncaustic

General	
Physical Characteristics	
Height	30.3 mm (1.19 in)
Width	152.4 mm (6.0 in)
Depth	219.0 mm (8.62 in)
Weight	2 lb, including power supply
Test Features	Power-up self-test Local analog loopback Remote digital loopback
Operating Controls	Data/Talk switch Local Loop switch
Modulation	High-speed: 2400 bps—Quaternary Amplitude Modulation (QAM)Low-speed: 1200—Phase Shift Keying (PSK); 300—Frequency Shift Keying (FSK)
Equalization	Automatic Adaptive
Auto-dialer Features	Operates asynchronously at 2400, 1200, or 300 bps;synchronously at 2400 and 1200 bps using ASCII character set. Is compatible with rotary pulse, Touch-Tone or mixed dialing. Stores up to 15 (30 digit) telephone numbers or ID name in nonvolatile memory. Reports call-progress detection for dial tone, busy tone, answer tone, no answer, and valid connection. Links phone numbers.

▪ DF100-RM

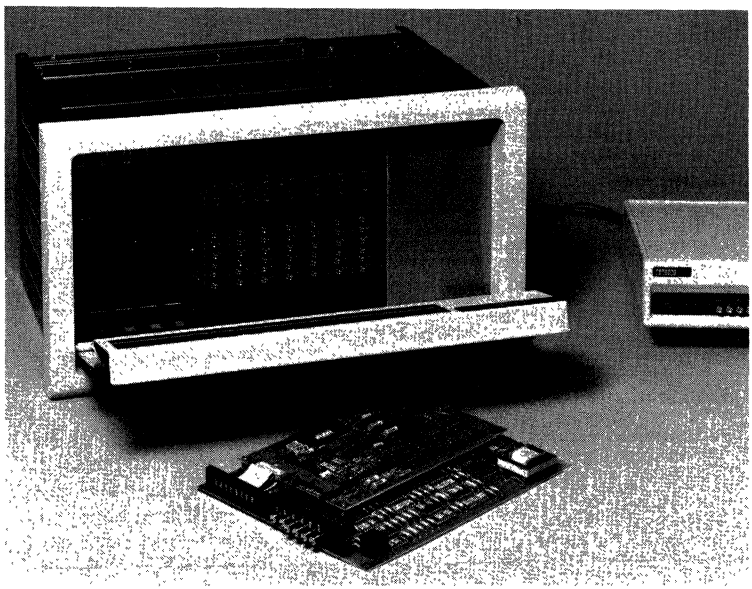


Figure 20-1 ▪ Digital's DF100-RM multiple-modem enclosure houses up to 12 modem modules, like the one shown in the foreground.

Overview

The DF100-RM multiple-modem enclosure is cost-effective when more than five centrally located remote connections are required. It gives you the flexibility to integrate new modems within the enclosure for future expansion. The modem enclosure supports either Public Switched Telephone Network (PSTN) or Private/Leased Telephone Network (P/LTN) applications. The type of modem or modem configuration is determined by the synchronous and asynchronous data formats and has the capability of either 0-to-300 bits-per-second or 1,200-bits-per-second operation. This flexibility allows you to enhance your network application at no additional cost.

Easily installed into a 48.3-cm (19.0-in) cabinet or rack and requiring only 26.7-cm (10.5-in) of vertical mounting space, this space-saving enclosure houses up to 12 DF100-series modem modules. The modem connections use the standard RS-232C 25-pin cinch connector. The rack enclosure with a standard 120-volt power supply also accepts a redundant power regulator option (DF100-PR), which allows it to assume the power load if the primary supply fails.

Multiple DF100-RMs may be mounted in the attractive H9646-CA communication cabinet to make optimum use of computer room space.

Major Features

- Houses 12 single module modems—Reduces cost and saves equipment space.
- Contains internal power supply with optional redundant power regulator—Single complete unit that is ready to install, and allows easy expansion.
- On-line, power applied replacement of modem modules—Allows easy servicing with no disruption to users.

Maintenance

You can install the DF100-RM easily. When a rack-mount modem configuration is used, system availability is enhanced because more ports are available for incoming and outgoing calls. No preventive maintenance is necessary. It can also be installed by Field Service personnel. Field Service maintenance contracts are available for onsite service.

Additional Documentation

- Each DF100-series modem User Guide—Provides details on site preparation and installation, operation, test procedures, modem options, and signal connections.
- Each DF100-series modem Pocket Service Guide—Contains flow charts, block diagrams, circuit descriptions, and fault location charts to help you troubleshoot problems.

Also of interest are

- *DECdirect*™—Color catalog of Digital's accessories and supplies. In the Continental U.S. and Puerto Rico, call 800-258-1710 for further information. Outside, the U.S., contact your Digital representative.
- *PDP-11 and VAX Systems & Options Catalogs*—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These customer documents are designed to help you select the right Digital product for your needs. European versions of these documents are also available.

If you require information not contained in these documents, contact your local Digital representative, dealer, or distributor.

Specifications

▪ *General*

Capacity	12 individual modem modules
Telephone Line Requirement	Ability to connect to 12 telephone lines using any mixture of PSTN lines with RJ21X service and private/leased lines with four-position connector
Mounting Requirements	Standard 48.3 cm (19 in) computer cabinet or rack

▪ *Power Requirements*

Power Consumption	84 VA at 120 Vac/60 Hz
Line Voltage	90-120
Line Frequency	57-63 Hz
Voltage Protection	2.5-A breaker

▪ *Operating Environment*

Operating Temperature	5 to 50°C (41 to 122°F)
Relative Humidity	0 to 95% noncondensing, noncaustic

▪ *Physical Characteristics*

Height	26.7 cm (10.5 in)
Width	48.3 cm (19.0 in)
Depth	34.3 cm (13.5 in)
Weight	12.3 kg (27 lb)—without modules

▪ DFM Series of Intelligent Communications Processors

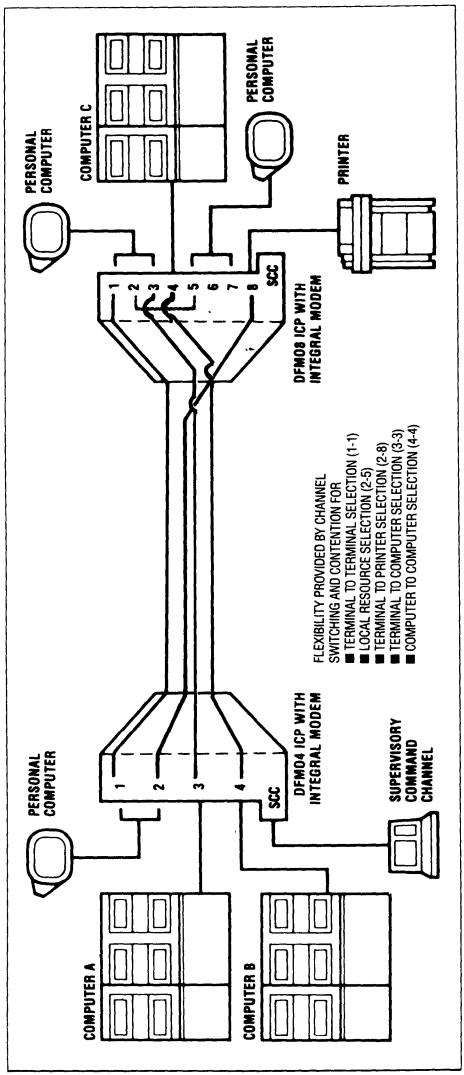


Figure 20-2 ▪ The DFM multiplexer series combines in one high-performance package many of the features of intelligent communications processing including statistical multiplexing, intelligent interfacing, channel switching and contention, and network control and management.

Overview

Digital's DFM series of freestanding Intelligent Communication Processors (ICPs) are based on statistical multiplexing concepts. Designed to allow remotely located terminals to share a common, composite communications link, the multiplexer eliminates the need for individual modems and is an efficient way for you to cluster terminals at a remote site. Multiplexers are ideal for large companies with terminal clusters in branch offices, such as insurance companies; educational and personal computer environments; and large corporations with multiple offices throughout the country, with central area clusters of activity.

The DFM series offers communication cost savings, as well as a variety of new features such as synchronous data handling, channel switching and contention, speed conversion, ease of use, and expandability up to 16 channels.

At present, Digital offers the following variations of the DFM series:

- *DFM04-AA*: 4-channel freestanding ICP without integral modem. Also available are two other models: the DFM04-AB, a 4-channel ICP with integral 4,800 bits-per-second private line modem, and the DFM04-AC, a 4-channel ICP with integral 9,600 bits—per-second private line modem.
- *DFM08-AA*: 8-channel freestanding ICP without integral modem. Also available are two other models: the DFM08-AB, an 8-channel ICP with integral 4,800 bits-per-second private line modem, and the DFM08-AC, an 8-channel ICP with integral 9,600 bits—per-second private line modem.
- *DFM12-AA*: 12-channel freestanding ICP without integral modem. Also available are two other models: the DFM12-AB, a 12-channel ICP with integral 4,800 bits-per-second private line modem, and the DFM12-AC, a 12-channel ICP with integral 9,600 bits—per-second private line modem.
- *DFM16-AA*: 16-channel freestanding ICP without integral modem. Also available are two other models: the DFM16-AB, a 16-channel ICP with integral 4,800 bits-per-second private line modem, and the DFM16-AC, a 16-channel ICP with integral 9,600 bits—per-second private line modem.

Major Features

Digital's DFM series offers a variety of enhancements over today's more traditional multiplexers. These enhancements make the DFM series Digital's first low-cost intelligent communications processor by providing four categories of ICP functions—statistical multiplexing, intelligent interfacing, channel switching and contention, and network management and control.

- *Statistical Multiplexing*

Statistical multiplexing techniques concentrate four to 16 EIA RS-232-C data channels over one high-speed communication link. These data channels interface to terminals, printers, personal computers, workstations, computer ports, and any RS-232-C compatible device.

- Concentration efficiency to 800 %—Saves on recurring telephone line costs.
- Error correction—Allows for greater data throughput.
- Permanent storage—Provides ability for easy network installation and repair.
- Auto down-line loading—Allows for current system/channel status at both ends.
- Channel flexibility—Provides for unrestricted use for all channels.
- Channel priority—Allows for greater efficiency of high-volume users.
- EIA dial-up circuits—Allows for remote uses to communicate via local dialup circuits to save communication line costs.
- System memory, 64 Kbytes per eight channels—Allows for large data buffering.
- Supervisory channel—Allows for easy configuration and network control.

- *Intelligent Interfacing*

Intelligent Interfacing features are unique and user-selectable to provide enhanced network flexibility. These features are not generally available in traditional modem applications.

- Speed conversion—Allows for maximum utilization of equipment capabilities at both ends.
- Automatic speed detection—Allows for a variety of terminals to contend for channel use.
- Flow control conversion—Allows for different types of equipment at either end.
- Local echo—Eliminates excessive delay times, especially in satellite links.
- Dialup handshake—Allows for remote dial-in capabilities.

- Flyback character control—Eliminates overprinting on unbuffered terminals.
- Break character control—Allows for the passing of break characters to the remote end.

- *Switching and Contention*

The DFM series of ICP's provide network flexibility through asynchronous channel switching and contention. To obtain the desired resource, these features allow you the ability to select any data channel that is configured for switching at either the local ICP end of the network or the remote end.

- Channel switching—end to end or local end—Network flexibility to select desired channels at either end of the network.
- Port contention—Allows for many users to obtain access to limited computer resources.
- Autodisconnect—Eliminates users who do not actively pass data.
- Channel security—Allows only authorized channels to select particular resources via grouping.

- *Network Management and Control*

The DFM series of ICPs have an extensive set of network management functions to set-up and monitor operating characteristics such as link efficiency, channel utilization, information, and error statistics. In addition, a complete set of test functions allow you to perform fault isolation from both central and local locations.

- Supervisory channel—Allows access to configuration and maintenance routines from either a dedicated channel or program-enabled user channel.
- Network monitoring—Allows for error logging and efficiency statistics.
- Network diagnostics—Allows for easy problem determination by the user or maintenance personnel.
- Message broadcasting—Allows for communication to all users of the system.
- Password-secured access—Eliminates restricted users from reconfiguration and maintenance.

Operator Features

The DFM Intelligent Communications Processor provides six front panel pushbutton switches. These switches allow you to select initial operating characteristics that are associated with modem facilities and manual maintenance mode. There are also eight front panel LED indicators that verify modem signals, link readiness, error condition flags, and channel activity. Because of the ICP's microprocessor design and built-in software, most of the variables that characterize the DFM network configuration are selected and embedded in the system by software control. This is done by using a terminal that is attached to a special connection called the supervisory command channel. Therefore, your terminal's keyboard is the most significant control for the ICP.

The following summarizes the pushbutton switches and LED indicators found on the integral modem of the ICP.

- *Local loopback (LL)*
  When pressed in, the integral modem is placed in analog loopback mode.

- *Test Pattern (TP)*
  When pressed in, the integral modem outputs a test pattern to all devices attached to that DFM unit.

- *Remote Loopback (RL)*
  When pressed in, this switch forces the integral modem at the other end of the link into digital loopback mode.

- *Digital Loopback (DL)*
  This switch, when pressed in, places the integral modem in digital loopback. This allows the integral modem at the other end of the link to execute loopback.

- *Fallback (FB)*
  When pressed in, the fallback feature is enabled. The fallback speed is determined by the position of the fallback speed switch (FS).

- *Fallback Speed (FS)*
  This switch selects one of two possible fallback speeds (7200 or 4800 b/s) and is functional only if fallback is enabled (FB pushed in.) When the FS switch is out, 7200 b/s is selected, while when in, 4800 b/s is selected.

- *Send Data (SD)*
  When on, this LED indicates that the integral modem is transmitting data.

- *Receive Data (RD)*
  When this LED is lit, the integral modem is receiving data.

- *Carrier Detect (CD)*
  When on, this indicates that an audio carrier from a remote station is present.

- *Clear to Send (CS)*
  When on, this LED indicates that the integral modem is ready to transmit data.

- *Request to Send (RS)*
  When on, this indicator tells you that the DFM is requesting transmission.

- *Signal Quality (SQ)*
  When blinking, the LED indicates that the quality of the telephone line is marginal. When the LED is on, it indicates that the quality of the line is poor.

- *Fallback (FB)*
  When on, this indicator means that the integral modem is in fallback mode due to a high level of errors at the higher speed. Fallback speed is determined by switch FS.

- *Test Mode (TM)*
  When the light is on, the integral modem is in the test mode. More information about operator features and programming information can be found in the *DFM Series Intelligent Communications Processor User Guide.*

Maintenance

You can verify the integrity of individual DFM units by using the System Automatic Self-Test. This determines the condition of hardware components and elements, which are not properly a part of a channel or link.

Each DFM automatically runs through a self-test at power on. This test checks the hardware components to ensure that the system is operational. A restart command from the supervisory command sequence effectively duplicates a power on without going through the password sequence.

A successful power on or restart is indicated by the Device Ready (DR) LED. When the LED comes on, it indicates that self-test has passed. If self-test fails, the failure is reported by front panel LEDs.

Additional Documentation

- *DFM Series Intelligent Communications Processor User Guide* (EK-DFM16-UG)—Provides information on configuring, installing, operating, programming, and maintaining the DFM series.

Specifications

- *General*

Multiplexing technique	Statistical time division, dynamic bandwidth allocation with variable block length.
Multiplexing efficiency	Typically 300 to 500%. Can reach 800% in certain applications.
System design	Multimicroprocessor design with internal DMA bus structure.
Channel buffering	32 Kbytes for each 4 channel expansion module and 64 Kbytes for each 8 channel expansion module.
System configuration	All configuration parameters are done using the supervisory command channel or user data channel with simple to use commands similar to Digital VAX/VMS command structure.
Supervisory command channel	A special terminal connection that allows the system manager to issue commands to program, monitor, and test the DFM system. Access to command level is password protected. The supervisory command channel program can also be accessed from any data channel if program is not in use.
Network control	All network functions (programming, monitoring, and diagnostics) are performed using the Supervisory Command Channel Program. Diagnostic capabilities include system, channel, and link testing. Broadcast messages can be issued by the system manager.

Network monitoring	Monitoring commands allow status and errors to be read for the system, channels, and link. All error counters are cleared by a separate command.
Parameter memory	All configuration parameters are stored in non-volatile, power independent memory (EPROM).
Aggregate speed	Maximum aggregate speed of 153.6 K b/s (9600 b/s simultaneously on all channels).
Channel end-to-end delay	Varies with speed of channel and link, from 16 ms to 140 ms; typically less than 60 ms.

▪ *Channel*

Capacity	4, 8, 12, and 16 channel models
Asynchronous channels	Asynchronous mode for all channels. These channels can be configured dedicated or switched.
Synchronous channels	Synchronous mode supported on one-half of the channels. Each sync channel can support message blocks of 512, 1024, 2048, and 4098.
Protocol	Multiplexes all synchronous data when RTS/CTS flow control is selected independent of protocol. Handles all protocol **not** using RSTS/CTS control in transparent mode. Special handling for DDCMP protocol. No ARQ performed on synchronous data channels.
Switching	Asynchronous switched channels allows users the ability to select any other switched channel using simple commands.
Contention	Asynchronous switched channels can contend for available switched channels. Users can camp-on for busy channels.
Security	Switched channels have group access codes to restrict users from protected channels.
Group selection	Switched channel users can request a particular channel group and DFM searches for first available channel and establishes connection.

Parameter intermix	There are no intermix restrictions.
Automatic parameter upgrade	Channel parameter changes at either end of the network are transferred to each end automatically with upline/downline time.
Non-interfering	Channel programming does not interfere with other active channels.
Speeds	50, 75, 110, 134.5, 150, 300, 600, 1200, 2400, 4800, 9600 b/s; Autobaud 150 to 9600 b/s using CR character; Samebaud: split speeds of 1200/75, 2400/150, 75/1200, or 150/2400 b/s. Synchronous 1200 to 9600 b/s (internal or external clocks).
Speed conversion	Each end of a channel can have different speeds, with automatic speed conversion at each end.
Data format	Async data—5, 6, 7, or 8 bit data with even, odd, or no parity; 1, 1.5, or 2 stop bits async channels. Switched async channels must all have the same data format selections. Sync channels support 8-bit ASCII or EBCDIC with 2, 4, or 6 SYN characters.
Flow control	XON, XOFF, and EIA modem control RTS/CTS.
Flow control conversion	Each channel end can have different flow control conversions, with automatic translation.
Fill character buffering	Allows specified number of NULL characters to be transmitted following a CR character.
Echoplex	Local echo selection at either channel end or both ends.
Priority	Three levels of priority for each channel providing for variable message frames. High: for large data requirements; Low: for background noncritical data; Normal: for typical data requirements in full-duplex configurations.
EIA dialup control	Programmable EIA dial-up modem control allows DFM to control automatic answer and call disconnect at either end or both ends.
Interface	EIA RS-232-C, CCITT V.24, V.28, 25-pin female connector.
EIA signals	Four full-duplex EIA control signals per channel.
Status indicators	Channel activity LED for each channel; channel utilization statistics; channel error LED and error statistics.

Messages	Allows either or both ends of the channel to receive broadcast and error messages.

- *Concentrated Link*

Capacity	Single concentrated link either synchronous or NRZI asynchronous with start and stop bits removed.
Speeds	Synchronous 1200 to 19200 b/s; NRZI asynchronous 9600 b/s.
Protocol	Conforms to ADCCP ANSI Std X3.66. Protocol is a superset of X.25 level II, SDLC, and HDLC.
Error detection correction	ARQ error correction with 16 bit CRC.
Satellite delay	Link protocol functions are enhanced for satellite networks of one hop.
Interface	EIA RS-232-C, CCITT V.24, V.28, 25-pin male connector.
Integral modems	Accepts a Digital modem option. This option is field installable.

- *Power Requirements*

Voltage	115 or 2300 Vac, 50/60 Hz
Power consumption	92 W

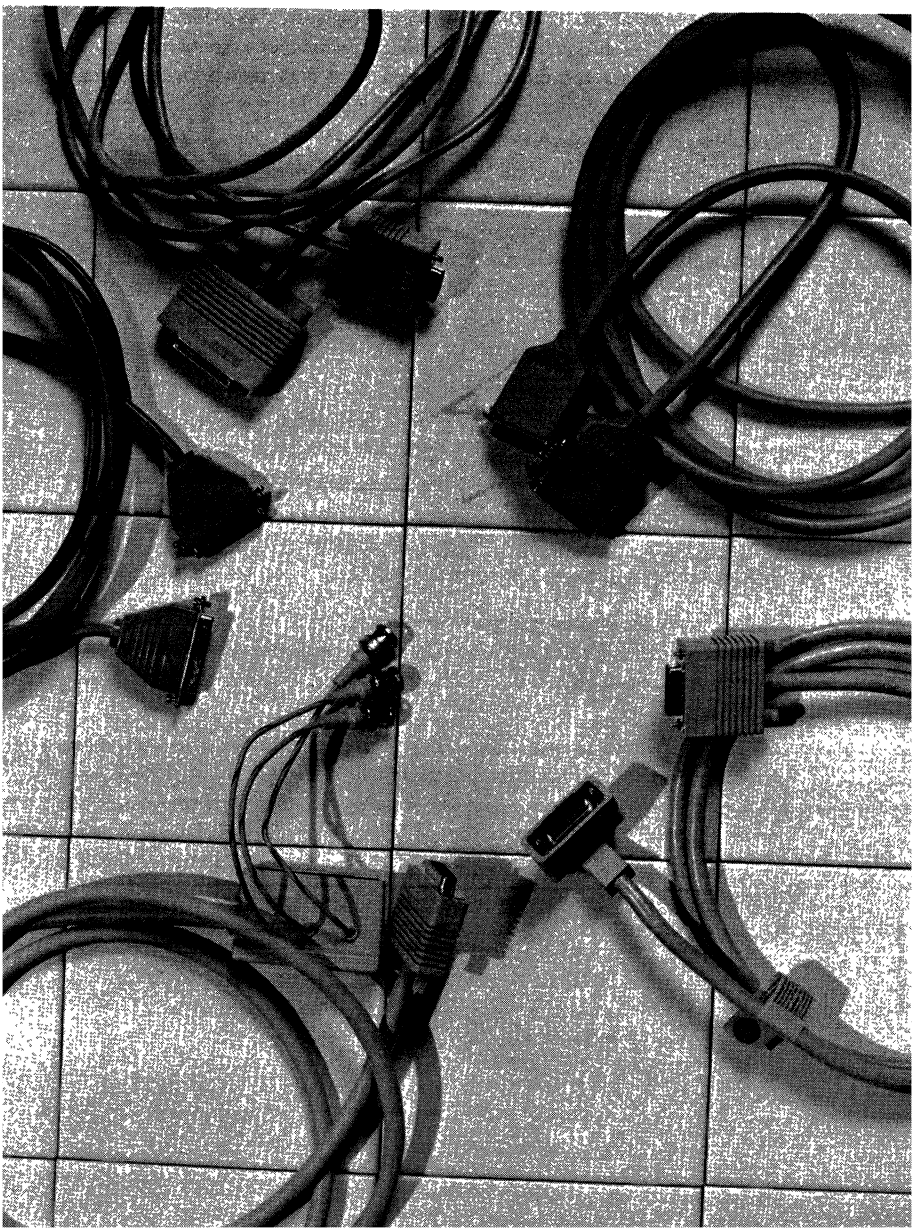
- *Operating Environment*

Temperature	0 to 40°C (32 to 104°F)
FCC Part 15	Meets FCC Part 15J—Class A operation
Relative Humidity	10 to 90%, noncondensing
Altitude	2.4 km (8,000 ft)

- *Physical Characteristics*

Height	22.5 cm (8.9 in)
Width	31.5 cm (12.4 in)
Depth	31 cm (12.3 in)
Weight	6.8 to 8.6 kg, depending on configuration (15 to 19 lb)

Chapter 21 ▪ Terminal Interconnect System and Standard Cables



▪ Introduction

DECconnect is a family of networking hardware and communication protocols that provide a simple and cost-efficient system for connecting Ethernet and enhanced terminal interconnection capabilities to equipment in local offices and work areas. The DECconnect cabling system provides a complete communications solution that allows voice (telephone) systems, low-speed (asynchronous) data terminals, high-speed local area networks, and video transmissions to be connected to a single outlet within a work area. Personal computers, workstations and terminal cables can be easily connected and removed from a faceplate using snap-in connectors similar to those used with telephone equipment.

Digital's new terminal interconnect system significantly increases the speed and transmission distance between video terminals and the host system. The products are based on a new signaling standard DEC423 and on standard unshielded telephone cables with convenient snap-in connectors.

The DECconnect system is compatible with the new ThinWire Ethernet to further enhance network communications.

To support the traditional connection of devices, Digital provides a complete series of standard cables in various lengths to connect processors to video and printing terminals, to communication devices, and to other peripheral devices in both local and remote areas.

▪ DECconnect Cabling System

This section provides an overview of the DECconnect cabling system and products. For detailed information related to the planning, installation, and available hardware, refer to the *Networks and Communications Buyer's Guide*.

DECconnect allows information to be transferred through voice telephone systems, through asynchronous data terminals at rates of up to 19.2 Kbaud per second, through local area network at rates of up to 10 Mbytes per second, and through video transmission systems. When used with the ThinWire cable and Ethernet, the DECconnect cabling system provides Ethernet performance at a fraction of standard Ethernet costs.

The DECconnect system has the following features:

- Radial topology
- ThinWire Ethernet cabling (RG58 C/U coaxial cable)
- DEC423 standard—Standard RS-423 with EOS/ESD protection
- Terminal interconnect support
- Ethernet/IEEE 802.3 standard compliance
- DECsite planning and installation services

Radial Topology

The H3111 faceplate provides the single connecting point for all network services of an area. The hardware associated with a typical terminal interconnect system for an office area is shown in Figure 21-1 and is identified in Table 21-1. The cabling system shown provides voice and DEC423 standard data communication capability through the connectors on the faceplate. The faceplate also includes connectors for video transmission and for ThinWire Ethernet.

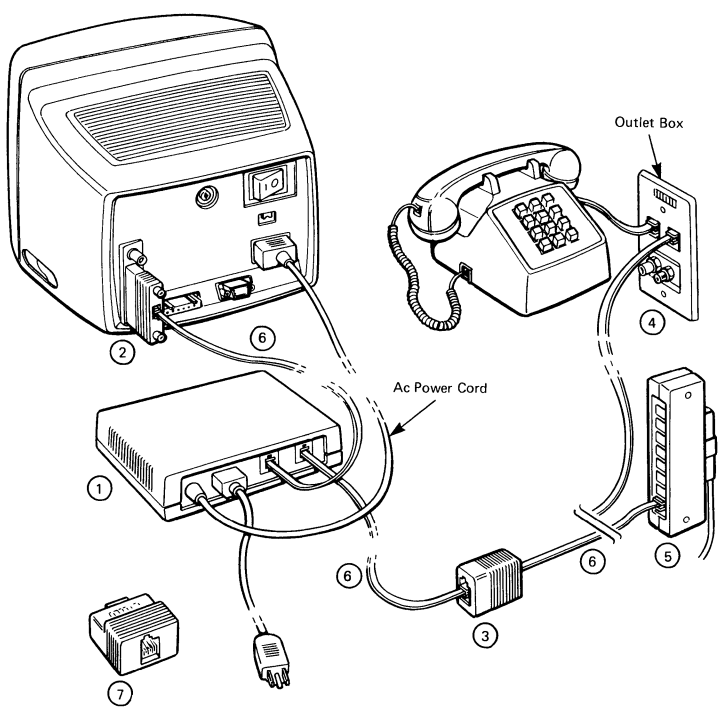


Figure 21-1 • DECconnect Terminal Interconnect System

Table 21-1 ▪ DECconnect Terminal Adapters and Options

Item	Part Number	Description	Connectors*
1	H3105-A (120 Vac) H3105-B (240 Vac)	RS423 signal converter	MMJ to MMJ
2	H8571-A	Comm port adapter	25-pin D submin. to MMJ
3	H8572	Cable extender	MMJ to MMJ
4	H3111	Outlet box faceplate	MMJ and coax (female)
5	H3104	Cable concentrator	36-pin (male) to 8 MMJ
6	BC16E-xx	6-conductor unshielded cable	MMP to MMP
7	H8571-B	Printer port adapter	9-pin D submin. to MMJ
	H3101, H3103, H3277	Loopback connectors (not shown)	

The COMM port and printer port adapters used with the DECconnect system are shown in Figure 21-2. These adapters connect to the terminal ports and enable the use of snap-in connectors and flat 6-conductor cable.

*MMJ = Modified Modular Jack (female)
MMP = Modified Modular Plug (male)

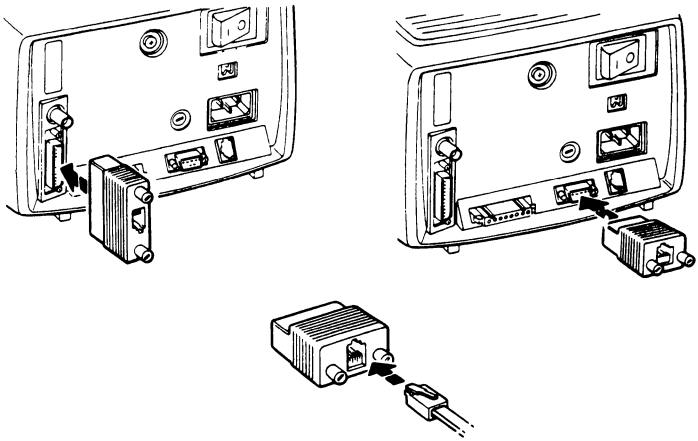


Figure 21-2 ▪ DECconnect Video Terminal Adapters

The H3105 is a desktop RS423 converter that includes a power supply and power cord and provides electrical overstress (EOS) and electrical static discharge (ESD) circuits for system protection. When used with the H8571-A adapter and cables, the converter allows existing RS232C-host and terminal systems to operate with the DEC423 standard signal implementation.

The user's terminal, video input, personal computer or workstation, and telephone cables connect to the four separate connectors provided on the same faceplate. The telephone cable installs into a standard telephone receptacle that uses twisted-pair cable from Digital or a PBX vendor.

Unshielded twisted-pair cables are routed from the faceplates of the work area to a terminal server in the satellite equipment room. Unshielded telephone cables are routed between telephones and the cross-connect voice communications facilities in the satellite room. The ThinWire Ethernet RG58 C/U shielded coaxial cable connects from the faceplate in the work area to a Multiport Repeater (DEMPR) in the satellite equipment room. The DEMPR can also be used in a stand-alone configuration to link desktop systems in several offices of a resource-sharing network.

Figure 21-3 shows a typical wiring configuration of a site between the work areas and a satellite equipment room that contains the computer, data communication and network facilities and video equipment.

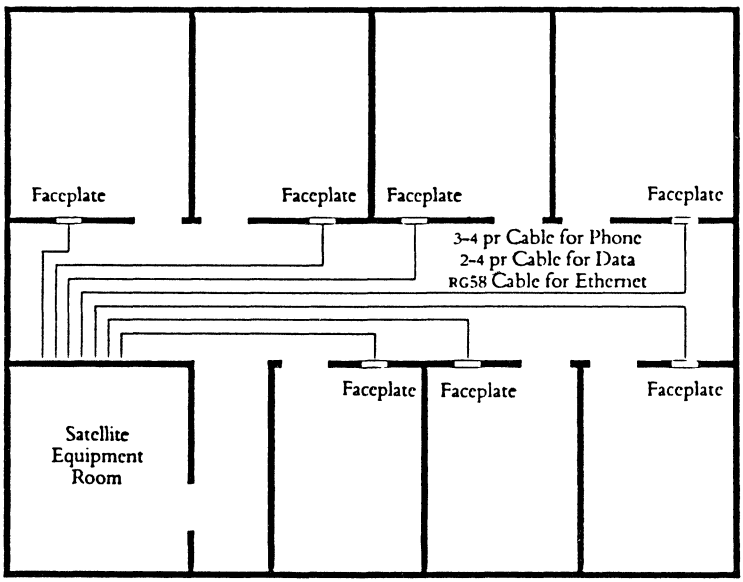


Figure 21-3 ▪ Typical DECconnect Site Cabling Configuration

The H3104 cable concentrator, shown in Figure 21-4, can be used within a work area to connect terminals and devices or in the satellite equipment room. It connects the Microsystem to up to eight terminals using the DECconnect flat cables and snap-in connectors.

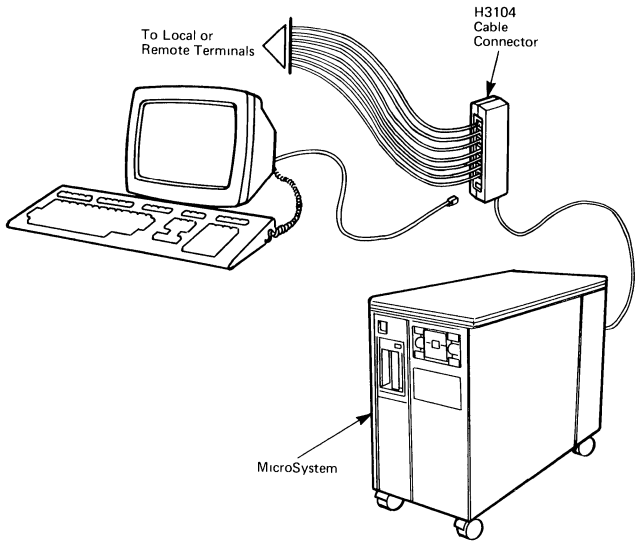


Figure 21-4 ▪ DECconnect Microsystem Cable Wiring

DEC423 Standard

The use of the DEC423 standard eliminates the need for cables that require special shielding or have restrictions to the cable length. DEC423 is an RS423-based cabling system for low speed terminals and provides the improved signaling benefits of RS423 interconnection. The DEC423 includes electrical overstress (EOS) and electrostatic discharge (ESD) to improve reliability and availability by protection against damage caused by static discharge, lightning, and ac power fluctuations. The distance between the CPU and terminal can be up to 1,000 feet at 19.6 Kbaud per second.

Existing terminals that operate with RS232C signals can be used with the DEC423 standard by incorporating the DC423 converter at the work area.

Digital's high-performance MicroVAX and MicroPDP-11 computer systems directly connect to the DEC423 lines through a series of available cabinet kits. These kits operate with the DHV11-M eight-line communications multiplexer as shown in Figure 21-5 and allow increased distances between CPU and terminals. They also provide EOS/ESD protection, increased line density at the rear of the CPU, and simplified cable requirements. Lower cost is achieved through the use of unshielded cable while still conforming to the FCC standards. Table 21-2 lists the kit designation and cable length for the DHV11-M cabinet kit series. All cables have male connectors at both ends.

Table 21-2 ▪ Microprocessor Cabinet Kits

Part Number	Description	Cable Length
CK-DHQ11-WA	Used with BA123 boxes	53.34 cm (21 in)
CK-DHQ11-WB	Used with BA23 boxes	76.20 cm (30 in)
CK-DHQ11-WA	Used with H9642 cabinets	91.44 cm (36 in)

ThinWire Ethernet

Digital's ThinWire Ethernet products enable high-speed, low-cost local area networks to be developed using inexpensive RG58 C/U coaxial cable and BNC connectors. It is a fundamental building block of Digital's Network Architecture (DNA).

Providing full 10-Mbits-per-second performance, ThinWire Ethernet is a cost-effective means of linking personal computers, office workstations, MicroVAX CPUs, and disk and print servers. Existing Ethernet devices—such as the DECserver 100—can also connect to the ThinWire Ethernet through the use of adapters.

Systems and equipment can be connected to each other and to the office wall-plate without the use of repeaters and or additional network equipment. Up to 30 devices can share resources for distances of up to 185 meters on a Thin-Wire Ethernet line.

DECconnect Cables

Table 21-3 lists the Digital part numbers and describes the available DECconnect cable assemblies. Nonstandard cable lengths can be assembled using the wire, connectors, and mounting hardware listed in Table 21-4. Refer to the *Network and Communications Buyer's Guide* for detailed information related to the ThinWire Ethernet components.

Table 21-3 ▪ DECconnect Cables Assemblies

Part Number	Cable Type	Length	Connectors*
BC16E-10	6-conductor flat unshielded	3.05 m (10 f)	MMP/MMP
BC16E-25	6-conductor flat unshielded	7.62 m (25 f)	MMP/MMP
BC16E-50	6-conductor flat unshielded	15.24 m (50 f)	MMP/MMP
BC16-C	36-conductor shielded	3.05 and 7.62 m (10 and 25 f)	36-pin right angle (male) to 36-pin straight (male)
BC16-D	36-conductor shielded (extension)	3.05, 7.62, 15.24, & 45.72 m (10, 25, 50, & 150 f)	36-pin right angle (male) to 36-pin straight (male)

Table 21-4 ▪ DECconnect Cable Options

Part Number	Description	Length	Connectors
H8240	6-conductor flat unshielded	304.8 m (1000 f)	unterminated
H8220	Modified modular plugs		MMP* (50/package)
H8241	Crimping tool		For attaching MMJ† connectors to BC16E cable

In addition to the low-speed asynchronous terminal connections and high-speed Ethernet connections, the DECconnect system provides complete voice, telephone, and PBX connections to AT&T, NTL, Rolm, and other voice and data communication services. Connectors are also available for transmission of video information to terminals. Table 21-5 lists the connector types that are available.

*MMP = Modified Modular Plug (male)

*Modified Modular Plug (male)
†Modified Modular Jack (female)

Table 21-5 ▪ DECconnect Voice and Data Connectors

Part Number	Service	Connector
H31112-A	AT&T	MMJ*
H31112-B	NTL	MMJ
H31112-C	Rolm	MMJ
H31112-D	universal	MMJ
H3115	CATV video	F-style Coaxial

▪ Standard Cable Assemblies

This section describes the most popular cables required to connect video and printing terminals, printer to processor buses, communications equipment, and other peripheral devices in local and remote configurations. This information will assist you in selecting and ordering the cable for your specific application. The information includes interconnect cables for current and traditional products, general purpose cables, EIA and 20-mA cables, and connector kits.

Refer to the *Cables Handbook for the System Builder* for a more complete listing and description of the available cables. This handbook can be ordered through your Digital sales representative.

Interconnect Cabling Tables

Tables 21-6, 21-7, and 21-9 summarize the cables used for Digital's current video terminal, printing terminal, and printer products. Table 21-8 identifies the cabling needs of individual members of the VT100 family and personal computer series. Tables 21-10 through 21-12 summarize cables used for traditional video and printing terminals, and printers.

*Modified Modular Jack (female)

Table 21-6 ▪ Video Terminal Interconnect Cabling

Terminal Interface	VT200 Family	VT100 Family	Modems/ Couplers
DL11*	BC05F	BC05F	N/A
DLV11*	BC05M BC05F	BC05M BC05F	N/A
DL11†	BC22D	BC22D	BC22E
DL11, DLV11E†	BC22D	BC22D	BC22E
DZ11†	BC22D	BC22D	BC22E BC22F
DZ11*	BC04R	BC04R	N/A
DLV11-J, MXV11*	BC22D	BC22D	BC22E
DZV11-B*	BC22D	BC22D	BC22E
DH11†	BC22D	BC22D	BC22E BC22F
DMF32	BC22D	BC22D	BC22E
Printer	BCC05	BC22D	BC22E
Modem/coupler	BC22E BCC04 BCC14 BC22F	BC22E BC22F	N/A

*20 mA
†EIA

Table 21-7 ▪ Host-to-printer Interconnect Cabling

Printer Interface	LA100, LA210	LQP02, LQP03	LA50	LA12	LA120	Modems/ Couplers
DL11*	BC05F	N/A	N/A	N/A	BC05F	N/A
DLV11*	BC05M + BC05F	N/A	N/A	N/A	BC05M + BC05F	N/A
DL11, DL11E†	BC22D	BC22D BC03M	BC22D BC03M	BC22D BC03M	BC22D BC03M	BC22E
DZ11†	BC22D	BC22D BC03M	BC22D BC03M	BC22F	BC22D BC03M	BC22D BC03M
DZ11*	BC04R	N/A	N/A	N/A	BC04R	N/A
DLV11-J, MXV11†	BC22D	BC22D	BC22D	BC22D	BC22D	BC22E
DZV11-B†	BC22D	BC22D	BC22D	BC22D	BC22D	BC22E
DH11†	BC22D	BC22D	BC22D	BC22D	BC22D	BC22E BC22F
DMF32	BC22D	BC22D	BC22D	BC22D	BC22D	BC22E BC22F

*20 mA
†EIA

Table 21-8 ▪ Video Terminal-to-printer Interconnect Cabling

Video	To Connect Video RS232, EIA Port To Modem	To Connect 20mA	To Connect LA50	To Connect LA100	To Connect LA12	To Connect LA120	To Connect LQP02	To Connect LQP03	To Connect LA210	To Connect LN03	To Connect LVP16
VT100AC	BC22E	—	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	—
VT101	BC22E	—	—	—	—	—	—	—	—	—	—
VT102	BC22E	—	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	—	—
VT125	BC22E	—	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	—
VT131	BC22E	—	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	—
VT132	BC22E	—	—	—	—	—	—	—	—	—	—
VT180	BC22E	—	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	BC22D	—
VT220	BC22E	BC05F	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	—
VT240	BC22E	BC05F	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC20
VT241	BC22E	BC05F	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC20
PC100	BCC04/14	—	BCC04/14	BCC04/14	BCC04/14	BCC04/14	BCC04/14	BCC04/14	BCC04/14	BCC04/14	BCC19
PC278	BCC04/14	—	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC20
PC325	BCC04/14	—	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC20
PC350	BCC04/14	—	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC05	BCC20

Table 21-9 ▪ System Printer Interconnect Cabling

System Printer Interface	LN01 LN01B LNO1S	LP25	LP26	LP27	LP32	LXY12 LXY22
LP11	BC27A	BC27A	BC27A	BC27A	BC27A	BC27A
LPV11	N/A	BC27A	BC27A	BC27A	BC27A	BC27A
DMF32	BC27A	BC27A	BC27A	BC27A	BC27A	BC27A

	Long Line Parallel		
System Printer Interface	**LN01**	**LN01B**	**LN01S**
LP11	BN27D	BN27D	BN27D*
DMF32	—— Not supported ——		
DMF32, DZ11, DL11W, DH11†	BC22D	BC22D	BC22D‡
Modem	BC22E	BC22E	BC22E

Table 21-10 ▪ Traditional Video Terminal Interconnect Cabling

Interface	VT52	VT55
DL11*	BC05M + BN52B	BC05M + BN52B
DLV11*	BN52B + BC05M	BN52B + BC05M
DL11†	BN52A + BC22D	BN52A + BC22D
DL11, DLV11E†	BN52A + BC22D	BN52A + BC22D
DZ11†	BN52A + BC22D	BN52A + BC22D
DZ11*	BN52B + BC04R	BN52B + BC04R
DLV11-J, MXV11	BN52A + BC22D	BN52A + BC22D
DZV11-B*	BN52A + BC22D	BN2A + BC22D
DH11†	BN52A + BC22D	BN52A + BC22D
Modem/Coupler	BN52A + BC22E	BN52A + BC22E

*Maximum 1000 feet.
†To printer.
‡Maximum distance depends on the baud rate.

*20 mA
†EIA

Table 21-11 ▪ Traditional Printing Terminal and Printer Interconnect Cabling

Interface	LA34	LA35	LA36	LA38	LA180
DL11*	BC05M	BC05M	BC05M	BC05M	BC05M
DLV11*	BC05M	BC05M	BC05M	BC05M	BC05M
DL11, DLV11E†	BC22D	BC22D	BC22D	BC22D	BC22D
DZ11†	BC22D	BC22D	BC22D	BC22D	BC22D
DZ11*	BC04R	BC04R	BC04R	BC04R	BC04R
DLV11-J, MXV11†	BC22D	BC22D	BC22D	BC22D	BC22D
DZV11-B†	BC22D	BC22D	BC22D	BC22D	BC22D
DH11†	BC22D	BC22D	BC22D	BC22D	BC22D
Modem/ Coupler	BC22E BC22F	BC22E BC22F	BC22E BC22F	BC22E BC22F	BC22E BC22F

Table 21-12 ▪ Traditional System Printer Interconnect Cabling (non-FCC compliant applications)

Interface	LP07	LP14	LP20	LXY01; LXY02	LXY11 LXY21
LP11	70-11212	70-11212	70-11212	70-11212	70-11212
LPV11	70-11212	70-11212	70-11212	70-11212	70-11212
DMF32	BC27B	BC27B	N/A	N/A	BC27B BC27B

Cable Descriptions

The following cables are commonly used for interconnection purposes. More details can be found in the *Cables Handbook for the System Builder.*

BCC04/BCC14 Modem Cable

The BCC04/BCC14 are the modem cables specifically designed for use with the VT200 family of video terminals and the personal computer product family. These cables are used to connect any personal computer with a modem and the Rainbow 100 to a printer only. The cable's features include

- Fully shielded cable and connector assembly.
- Molded-on strain relief.
- Connectors: one male and one female, 25-position, with D-subminiature molded-on construction.
- BCC04 — 25 conductor.
  BCC14 — 16 conductor.

Table 21-13 lists the part numbers and lengths available for the BCC04/BCC14 cable assembly.

Table 21-13 ▪ BCC04/BCC14 Cable Ordering Information

Part Number	Meters	Feet
BCC14-10	3.0	10
BCC04-25	7.6	25
BCC04-50	15.2	50

BCC05 Printer Cable

The BCC05 is the printer cable designed specifically for Digital's VT200 video terminal and personal computer families. The cable is used to connect any personal computer with any of the specified Digital printers. The cable's features include

- Fully shielded cable and connector assembly.
- Molded-on connectors and strain reliefs.
- Connectors: one 9-position female D-subminiature and one 25-position female D-subminiature.

Table 21-14 lists the part numbers and lengths available for the BCC05 cable assembly.

Table 21-14 ▪ BCC05 Cable Ordering Information

Part Number	Meters	Feet
BCC05-10	3.0	10
BCC05-25	7.6	25
BCC05-50	15.2	50
BCC05-A0	30.5	100

BC03M Null Modem Cable

The BC03M is a null modem cable for local EIA connections. It features a 25-pin RS232 female connector at each end. The cable can be used with Digital processors as well as many processors manufactured by other computer manufacturers. A typical hookup is one end to the male connector of the EIA processor interface cable and the other end to a male connector of an EIA terminal. The cable's features include

- Individually shielded conductors.
- 3-TWP to reduce cross-talk on signal lines.
- Compact, rugged construction.
- Connectors: two RS232 female connectors.
- Ideally suited for long-length applications.

Table 21-15 lists the part numbers and lengths available for the BC03M null modem cable.

Table 21-15 ▪ BC03M Cable Ordering

Part Number	Meters	Feet
BC03M-B5	76.2	250
BC03M-E0	152.4	500
BC03M-L0	304.8	1000

Cables over 250 feet are preassembled, with only one end fully terminated so the cable can be run through conduit.

BC05C Input/Output Cable

The BC05C is an EIA input/output cable used for asynchronous, serial line unit interfacing. The cable can be used for full or limited modem control applications. The H856 connector mates with the computer interface, and the RS232 male mates with a modem device or null modem connection. The cable's features include

- Built-in strain relief.
- Compact, rugged structure.
- Connectors: H856 and RS232 (male).

Table 21-16 lists the part numbers and lengths available for the BC05C cable assembly.

Table 21-16 ▪ BC05C Cable Ordering Information

Part Number	Meters	Feet
BC05C-10	3.0	10
BC05C-25	7.6	25
BC05C-35	10.7	35
BC05C-50	15.2	50

BC05M Cable Assembly

The BC05M is a current loop input/output cable assembly. It is used with Digital processors for 20 milliampere current loop interfacing applications. Its three-twisted pairs make it ideal for applications where minimizing crosstalk is necessary. Its performance approaches that of a coaxial cable, but it costs less, is more compact, and is more flexible. The cable's features include

- Shielded structure.
- Built-in strain relief.
- Connectors: H856 connector at one end and a MATE-N-LOK connector at the other; both are female connectors.

Table 21-17 lists the part numbers and lengths available for the BC05M cable assembly.

Table 21-17 ▪ BC05M Cable Ordering Information

Part Number	Meters	Feet
BC05M-2C	0.7	2.25
BC05M-04	1.2	4
BC05M-10	3.0	10
BC05M-25	7.6	25

BC21B Cable Assembly

The BC21B is a cable assembly for use with the DLV11-J or MXV11. It is fabricated from three individually shielded twisted pairs, and has a male EIA RS232 connector with built-in strain relief at one end and a 10-pin keyed socket at the other end. The cable's features include

- Shielded conductors.
- 3-TWP to reduce cross-talk on signal lines.
- Built-in strain relief.
- Connectors: EIA RS232, male, to 10-pin keyed socket H8560.

Table 21-18 lists the part number and length available for the BC21B cable assembly.

Table 21-18 ▪ BC21B Cable Ordering Information

Part Number	Meters	Feet
BC21B-05	1.5	5

BC22D Null Modem Cable

The BC22D is a fully shielded, null modem cable. It is designed to be used in asynchronous applications only. Its shielding characteristics have been tested and proven to limit RFI/EMI emissions in excess of industry standards. The cable has female RS232 connectors molded onto each end. The cable's features include

- Braided and foil shields.
- Shielding effectiveness: 30 dB minimum in 30–200 MHz range.
- Rugged molded-on connectors.
- Backward compatible with BC03M and BC22A.
- Designed to be used with the DMF32, DESCA, and DSRVA.
- Wide variety of standard lengths for flexible system configuration.
- Connectors: two female, D-subminiature.

Table 21-19 lists the part numbers and lengths available for the BC22D null modem cable.

Table 21-19 ▪ BC22D Cable Ordering Information

Part Number	Meters	Feet
BC22D-10	3.0	10
BC22D-25	7.6	25
BC22D-50	15.2	50
BC22D-A0	30.5	100
BC22D-B0	60.9	200
BC22D-B5	76.2	250

BC22E Modem Cable

The BC22E is a fully shielded asynchronous modem cable. Its shielding characteristics have been tested and proven to limit RFI/EMI emissions in excess of industry standards. The cable has one male and one female RS232 molded-on connector. The cable's features include

- Braided and foil shields.
- Shielding effectiveness: 25 dB minimum in 200–500 MHz range.
- Rugged molded-on connectors.
- Backward compatibility with the BC22B.
- Designed to be used with the DMF32 and DESCA.
- Wide variety of standard lengths for flexible system configuration.
- Connectors: one male and one female 25-position D-subminiature.

Table 21-20 lists the part numbers and lengths available for the BC22E modem cable.

Table 21-20 ▪ BC22E Cable Ordering Information

Part Number	Meters	Feet
BC22E-10	3.0	10
BC22E-25	7.6	25
BC22E-50	15.2	50
BC22E-A0	30.5	100
BC22E-B0	60.9	200
BC22E-B5	76.2	250

BC22F Cable Assembly

The BC22F is a fully shielded 25 conductor EIA cable. Its shielding characteristics have been tested and proven to limit RFI/EMI emissions in excess of industry standards. The cable can be used as a replacement in traditional BC05D asynchronous applications. It was also designed as the synchronous cable for use on the DMF32 synchronous port. The cable's features include

- Braided and foil shields.
- Shielding effectiveness: 25 dB minimum in 200–500 MHz range.
- Rugged molded-on connectors.
- Backward compatibility with BC05D.
- Designed to be used with the DMF32 and DESCA.
- Wide variety of standard lengths for flexible system configuration.
- Connectors: one male and one female 25-position D-subminiature.

Table 21-21 lists the part numbers and lengths available for the BC22F cable assembly.

Table 21-21 ▪ BC22F Cable Ordering Information

Part Number	Meters	Feet
BC22F-10	3.0	10
BC22F-25	7.6	25
BC22F-50	15.2	50
BC22F-A0	30.5	100
BC22F-B0	60.9	200
BC22F-B5	76.2	250

BC24C Null Modem Cable Assembly

The BC24C is a null modem cable assembly for use with the DLV11-J or MXV11. It is fabricated from three individually shielded twisted pairs, and has a female EIA RS232 connector with built-in strain relief at one end and a 10-pin keyed socket at the other end. The cable's features include

- Shielded conductors.
- 3-TWP to reduce cross-talk on signal lines.
- Built-in strain relief.
- Connectors: EIA RS232, female, to 10-pin and keyed socket H8560.

Table 21-22 lists the part numbers and lengths available for the BC24C cable assembly.

Table 21-22 ▪ BC24C Cable Ordering Information

Part Number	Meters	Feet
BC24C-10	3.0	10
BC24C-25	7.6	25
BC24C-50	15.2	50

BC26S Cable Assembly

The BC26S is the cable designed as the terminal-to-printer cable or null modem cable for use on the VT278. The cable features two 90 degree, 25-position, D-subminiature, female connectors on both ends, which allows the cable to fit inside the cable cover on the back of VT278. The cable's features include

- Molded-on connectors and strain reliefs.
- Braided and foil shields.
- Variety of standard lengths for flexible configurations.

Table 21-23 lists the part numbers and lengths available for the BC26S cable assembly.

Table 21-23 ▪ BC26S Cable Ordering Information

Part Number	Meters	Feet
BC26S-05	1.5	5
BC26S-15	4.5	15
BC26S-25	7.6	25

70-11212 Cable Assembly for Non-FCC Compliant Applications

The 70-11212 is an 18-twisted pair cable assembly commonly used for connections from LP-type lineprinters (except LP25) to LP11 or LPV11 controllers. It has a Winchester electronics connector at one end and an H856 connector at the other end.

NOTE

For LP25 lineprinter-to-LP11 applications, use cable assembly 70-16560.

The cable's features include

- Rugged outside jacket for protection.
- Twisted pair conductors reduce cross-talk on signal lines.
- Connectors: one Winchester electronics 24-pin and one H856 (mates with H854).

Table 21-24 lists the part numbers and lengths available for the 70-11212 cable assembly.

Table 21-24 ▪ 70-11212 Cable Ordering Information

Part Number	Meters	Feet
70-11212-25	7.6	25
70-11212-50	15.2	50
70-11212-A0	30.4	100

▪ Traditional Cable Descriptions

The following cables are also used for interconnection purposes. More information can be found in the *Cables Handbook for the System Builder.*

BC03L Cable Assembly

The BC03L is a round, 15-conductor, 22-AWG cable. It is used for PDP-11 serial interface panel mountings. It comes with filtered, male H856-RS232 connectors. Table 21-25 lists the part numbers and lengths available for the BC03L cable.

Table 21-25 ▪ BC03L Cable Ordering Information

Part Number	Meters	Feet
BC03L-05	1.5	5
BC03L-10	3.1	10

BC04R Cable Assembly

The BC04R is a round, 4-conductor, 20-AWG cable. It is used for PDP-8 general purpose module termination. It comes with 8-pin, 20 mA–4 rings connectors. The length available for the BC04R cable is given in Table 21-26.

Table 21-26 ▪ BC04R Cable Ordering Information

Part Number	Meters	Feet
BC04R-12	3.65	12

BC27A Cable Assembly

The BC27A is a 26-conductor cable that connects a 37-pin male D-subminiature to a 50-pin male D-subminiature connector. It is used in the interconnection of LP25, LP26, LP27, and LP32 lineprinters. Table 21-27 gives the lengths available for the BC27A cable.

Table 21-27 ▪ BC27A Cable Ordering Information

Part Number	Meters	Feet
BC27A-30	9.2	30
BC27A-50	15.2	50

BN52A Cable Assembly

The BN52A is a round, 6-conductor, 20-AWG cable. It is used in the interconnection of VT52 and VT55 video terminals to the host. It comes with a male EIA RS232 connector. Table 21-28 lists the length available for the BN52A cable.

Table 21-28 ▪ BN52A Cable Ordering Information

Part Number	Meters	Feet
BN52A-7F	7.62	25

70-16560 Cable Assembly

The 70-16560 is a round, 24-conductor, 24-AWG cable. It is used to connect LP25, LP26, and LP27 lineprinters to a non-FCC compliant LP11 controller. It comes with a H856 50-pin plug. Table 21-29 lists the lengths available for the 70-16560 cable.

Table 21-29 ▪ 70-16560 Cable Ordering Information

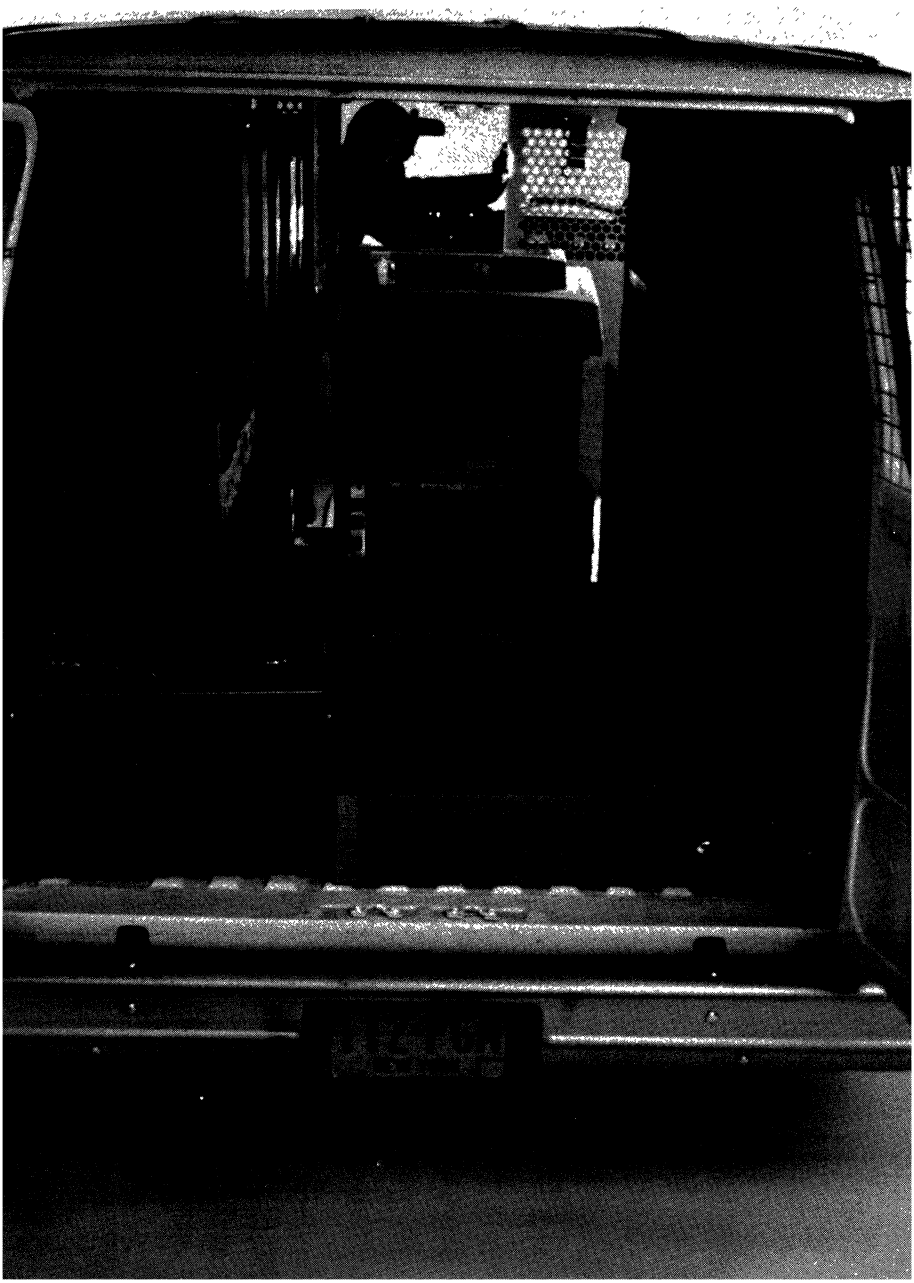
Part Number	Meters	Feet
70-16560-30	9.1	30
70-16560-50	15.24	50
70-16560-A0	30.38	100

▪ Connector Kits

Table 21-30 lists some of Digital's popular connector kits.

Table 21-30 ▪ Connector Kits

Connector Kit	Description
H8562	This connector kit consists of a 40-pin connector housing, 40 sockets, and a strain relief. The H856 is used in a variety of applications requiring connection to a module or interface.
H8560	The H8560 connector kit consists of a 10-pin connector housing, 10 sockets, and a keying plug. The H8560 is used in a variety of applications with the DLV11-J, MXV11, and VK170 options.
H8561	This connector kit consists of a 20-pin connector housing (similar to the H856 connector) and 20 sockets. The H8561 is used in a variety of applications with the VK170 serial video module, for keyboard interfacing.
H856	The H8562 connector kit consist of a 5-pin connector housing and 5 pins. The H8562 is used for a variety of interface needs including the video connector to the VK170 and other DIGITAL terminals.
H8563	This female RS232 connector kit consist of a 25-pin female D-subminiature connector housing, 25 sockets, hood, and hardware. The H8563 is a general purpose connector used for a variety of communications interfacing, and with EIA extension or null modem cabling.
H8564	This male RS232 connector kit includes one 25-pin male D-subminiature housing, 25 pins, hood, and hardware. The H8564 is used for a variety of communications interfacing, general purpose applications, and with EIA Extension Cabling.



▪ Field Service

Digital recognizes how much your business or organization relies on terminals and printers. Terminals and printers enable you to get information to and from your computer system, and if they are unavailable, productivity decreases. That's why at Digital, terminal and printer product support is a process that begins long before you make your purchase.

Quality Assurance

We build our terminals and printers to be reliable right from the start. Product designs are tested for reliability and maintainability. And extensive testing continues throughout the manufacturing process to ensure that you can depend on the high quality of Digital's products.

All of Digital's terminals and printers come with warranty coverage. And, during the warranty period, the same Field Service organization that will support you after warranty provides complete service. Be sure to read your warranty carefully since terms may vary depending on your location. For more detailed information on your warranty coverage, you can contact your nearest Digital Field Service office.

Field Service Organization

To support your terminals and printers after warranty, Digital has one of the largest Field Service organizations in the world. Over 16,000 people work in more than 400 service locations around the world, supporting a wide variety of customer applications—day after day. And because Digital provides the widest range of services in the industry, you get just the support you need, without paying for more service than you want.

You can choose from 24-hour-a-day onsite service for critical applications to self-maintenance support—and everything in between.

Onsite Service Agreements

Digital lets you choose the onsite service plan that's right for you. Both our DECservice and Basic Service Agreements bring service to your computer site. Both sevice plans provide you with the latest Field Change Orders designed to keep your terminals at their peak operating efficiency. And both include all parts and labor in a single monthly charge—so you can plan for service costs and budget for them accordingly.

▪ *Lineprinters*

Because lineprinters are a vital part of your system's performance, they are covered as part of that system.

- *Terminals*
  Terminals may be covered either as stand-alone equipment under their own agreement, or as part of a larger system, under a total system agreement.

- *DECservice*
  DECservice is Digital's most comprehensive hardware service offering. Coverage ranges from normal business hours up to 24 hours a day, 7 days a week for more critical applications.

  Defined Response Time With DECservice, Digital commits to a response time, in writing, as part of your service agreement. Worldwide response times may vary. In the United States, if your computer site is within 100 miles of one of Digital's 400 service locations, Digital will commit that a service representative will arrive at your site within four hours of receiving a call during normal coverage hours. If a site is between 100 to 200 miles from a Digital service location, we will commit to eight-hour response; and if a site is more than 200 miles from a Digital service location, a representative will arrive within 16 hours. Elsewhere, Digital still commits to a specific response time, which is directly related to the distance between your location and your nearest Digital Servicenter.

  Whatever the distance, Digital's service vehicles help ensure that a representative arrives with the parts needed to fix your terminal or printer—right on the spot. These specially-equipped mobile inventory units provide complete service for onsite customers.

  Continuous Repair Effort What's more, with DECservice, service doesn't stop until the problem is fixed—as long as you call us during coverage hours.

  Automatic Problem Escalation In the event that repair efforts exceed predefined time limits, our Automatic Problem Escalation program goes into effect. Digital Field Service technicians have technical support teams to call on—or call in—to help with difficult problems. This support network is in place, the procedure for using it is clearly defined, and your Field Service representative will keep you informed every step of the way.

  Field Change Orders To keep your terminal and printer products reliable and compatible with the latest engineering changes, updates, or modifications made to your terminal or printer are automatically installed—at no extra charge. These changes help maintain the value of your terminals and printers by keeping them technically compatible with the latest models.

- *Basic Service*

  Basic Service was designed as an economical alternative for customers who want onsite support, but who do not have the critical needs to warrant DECservice.

  Basic Service customers receive priority over customers not covered by service agreements. With Basic Service, a Field Service Specialist is usually at your site within 24 hours.

  Like DECservice, Basic Service provides all parts and labor, preventive maintenance, automatic updates, and automatic problem escalation.

- *Per Call Service*

  For self-maintenance customers who want onsite back-up support or for customers who prefer service on a time and material basis, Digital offers per call onsite service. Customers who opt for service on a per call basis may maintain their terminal and printer products and have the technical know-how to do most of their own repairs. Per Call customers pay for parts and labor on an as-needed basis. Travel is charged door-to-door.

Offsite Services

Digital also offers a range of economical offsite services. Offsite service provides Digital-quality service while saving the costs of bringing a service technician onsite.

- *Carry-In Service*

  There are more than 170 Digital Servicenters in cities worldwide where you can bring your terminal or printer for repair. We will diagnose and repair the problem and, in most cases, you can pick the unit up the next day. Carry-In Service offers repair on a contractual or noncontractual basis. Contract customers get unlimited repairs at a fixed monthly rate. This allows them to predict and control their service costs. Noncontract customers pay for parts and labor on a per-event basis.

  Digital also offers an over-the-counter exchange. If you can identify the component causing the problem, simply bring in the module. You then exchange it for a replacement—within minutes.

- *DECmailer*

  For self-maintenance customers with noncritical applications or who keep their own spares inventory, DECmailer offers a low-cost mail-in repair service for modules and components. Turnaround of five days is typical with DECmailer.

The Digital Commitment

We are committed to supporting your Digital terminals and printers. Our worldwide Field Service organization of more than 16,000 people is standing by to ensure that no matter what your service needs, Digital has a service program to support you. Contact your Digital representative for the location of the Digital Servicenter nearest you.

▪ Software Services

Software Services are available to support Digital's customers during any aspect of their system analysis, software development, or implementation efforts. Services available start with the personal attention of a Digital software consultant and continue with the distribution of up-to-date software and software information.

A software specialist often works with your Digital sales representative to evaluate your needs prior to purchase, to recommend hardware and software solutions to problems, and to give advice on the feasibility and costs of proposed solutions.

Depending on the software purchased, specialists are available to install software and provide software warranty support to ensure that purchased software products perform according to Digital's commitments. Ongoing software support is assured through a variety of post-warranty Software Product Services, which offers customers the opportunity to keep their software up-to-date and running smoothly. A full range of additional services are available to assist customers throughout the planning, implementation, and production phases of their systems.

For those software products that require Digital installation, a software specialist will install the software and verify that the system is complete. Software warranty services include telephone assistance and onsite remedial support, if necessary. Services also include automatic delivery of in-warranty Software Product and Documentation Updates and the distribution of a periodic newsletter. Software Performance Reports are included under warranty services as well.

Software Product Services

Software Product Services (SPS) provide informational, preventive, and remedial service to help customers after the period of software warranty. These services provide new software versions, responses to reported software problems, and technical publications that contain programming notes and documentation updates.

The family of Software Product Services includes four levels of service: Software Product Updates, Self-Maintenance Service for Software, Basic Service for Software, and DECsupport Service for Software.

- *Software Product Updates*
  Software Product Updates are the latest available version of software. They contain technical changes, product improvements, and documentation refinements.

- *Software Self-Maintenance Service*
  Tools are provided that enable users to maintain their own system software. These include Software Product and Documentation Updates, sent automatically as they are released; newsletters containing information about new software developments and enhancements; and Software Performance Reports, a formal software problem-reporting mechanism.

- *Basic Service*
  This service is appropriate for users who require some, but not total, support. It includes all the elements of Self-Maintenance Service, plus telephone support for usage and remedial software questions.

- *DECsupport Service*
  This is the most comprehensive software product service available. DECsupport includes new software versions and documentation updates, software interim updates, newsletters, software performance reports, telephone support, remedial maintenance, and scheduled preventive maintenance.

- *Right-To-Copy Service*
  This option allows customers to copy Software Product Updates onto a single, additional CPU. It is suitable for customers who are running identical operating system software on several similar CPUs, and who want to copy the updates only.

Additional Software Services

Digital's software professionals are specifically trained in Digital's products and experienced in designing, coding, and modifying custom software as well as tailoring VAX and PDP-11 software to meet special needs. Software specialists are available to provide system analysis, application design review and optimization, and system/application integration. Resources are available to perform specific project tasks, to supplement a customer's programming staff, or to manage projects from start to completion.

Specialists with varying types of expertise are available, ranging from a programmer to a project manager, depending on customer requirements. These services are available at both resident and per-call rates, and also on a fixed price-per-project basis.

Startup Services

Startup services are a proven combination of direct assistance, documentation review, discussion, and hands-on experience provided onsite by a Digital Software Specialist.

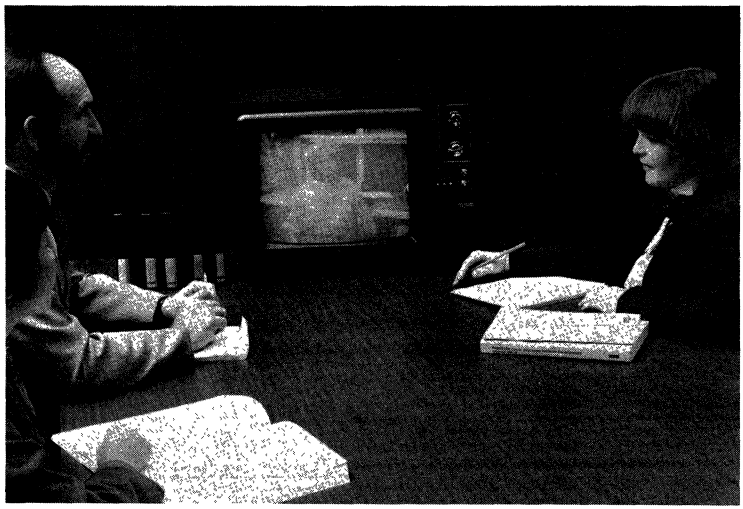
Users learn directly on their own systems and can put their knowledge to use immediately. These on-site services are conducted over a period of time to ensure mastery of the system. Programmers and system managers are taken step-by-step through the techniques required to operate a particular system effectively. Startup service enhances the ability of users to keep their systems running smoothly by teaching them how to troubleshoot problems.

Digital's Software Services group meets customer needs by offering a wide range of options to supplement the standard Startup Services. Because optional services are priced according to the time they require, an estimate can be given for any requirement a customer may be considering. In addition, a Digital Software Specialist can draw up a Customer Support Plan to help you determine any further areas in which you might benefit from additional services.

The Digital Commitment

Although software services are not available for terminals and printers per se, they are available for the Digital systems the terminals and printers are used with.

The foundation of Software Services is the more than 3,000 dedicated software specialists. You can consult with these specialists before and after you make a software decision. The Software Services group sees to the installation of your software purchase, and keeps your software running long after the warranty has expired. Digital software specialists use the most innovative support tools available to ensure that the software you buy and use today meets your needs tomorrow.



Digital's Educational Services designs, develops, and delivers courses that help you learn specific skills and acquire greater expertise in using your computer.

▪ Educational Services

To ensure success with your computer system, Educational Services provides one of the most extensive educational programs offered by a computer manufacturer.

With 27 Educational Centers located worldwide and a staff of over 1700 professionals, Educational Services designs, develops, and delivers courses to help customers learn specific skills and acquire expertise in using computers.

The courses range from introductory to advanced, covering the most basic computer knowledge through to the highest level of technical subjects. More than 500 courses are available and taught in 17 languages.

While many of these courses support Digital's hardware and software products, Educational Services also offers training which is not product-specific.

In addition, Educational Services is continually developing new courses that reflect the latest technological advances in learning, such as interactive video instruction. Currently, training options are available in the following formats:

- Self-paced packaged courses,
- Computer-based instruction (CBI),

- Traditional lecture/lab classroom courses,
- Customized courses, and
- Seminars

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Appendix A ▪ ASCII Codes

Both seven- and eight-bit ASCII codes are referenced here, as well as special graphics sets and the LVP16 ASCII code definitions.

▪ 7-Bit ASCII Code

PRINTABLE CHARACTERS

CHAR	OCTAL	BINARY
A	101	1000001
B	102	1000010
C	103	1000011
D	104	1000100
E	105	1000101
F	106	1000110
G	107	1000111
H	110	1001000
I	111	1001001
J	112	1001010
K	113	1001011
L	114	1001100
M	115	1001101
N	116	1001110
O	117	1001111
P	120	1010000
Q	121	1010001
R	122	1010010
S	123	1010011
T	124	1010100
U	125	1010101
V	126	1010110
W	127	1010111
X	130	1011000
Y	131	1011001
Z	132	1011010

PRINTABLE CHARACTERS

CHAR	OCTAL	BINARY
a	141	1100001
b	142	1100010
c	143	1100011
d	144	1100100
e	145	1100101
f	146	1100110
g	147	1100111
h	150	1101000
i	151	1101001
j	152	1101010
k	153	1101011
l	154	1101100
m	155	1101101
n	156	1101110
o	157	1101111
p	160	1110000
q	161	1110001
r	162	1110010
s	163	1110011
t	164	1110100
u	165	1110101
v	166	1110110
w	167	1110111
x	170	1111000
y	171	1111001
z	172	1111010

PRINTABLE CHARACTERS

CHAR	OCTAL	BINARY
SP	040	0100000
!	041	0100001
"	042	0100010
#	043	0100011
$	044	0100100
%	045	0100101
&	046	0100110
'	047	0100111
(	050	0101000
)	051	0101001
*	052	0101010
+	053	0101011
,	054	0101100
-	055	0101101
.	056	0101110
/	057	0101111
0	060	0110000
1	061	0110001
2	062	0110010
3	063	0110011
4	064	0110100
5	065	0110101
6	066	0110110
7	067	0110111
8	070	0111000
9	071	0111001
:	072	0111010
;	073	0111011
<	074	0111100
=	075	0111101
>	076	0111110
?	077	0111111
@	100	1000000

CONTROL CHARACTERS

CHAR	OCTAL	BINARY
NUL	000	0000000
SOH	001	0000001
STX	002	0000010
ETX	003	0000011
EOT	004	0000100
ENQ	005	0000101
ACK	006	0000110
BEL	007	0000111
BS	010	0001000
HT	011	0001001
LF	012	0001010
VT	013	0001011
FF	014	0001100
CR	015	0001101
SO	016	0001110
SI	017	0001111
DLE	020	0010000
DC1	021	0010001
DC2	022	0010010
DC3	023	0010011
DC4	024	0010100
NAK	025	0010101
SYN	026	0010110
ETB	027	0010111
CAN	030	0011000
EM	031	0011001
SUB	032	0011010
ESC	033	0011011
FS	034	0011100
GS	035	0011101
RS	036	0011110
US	037	0011111
DEL	177	1111111

▪ Special Graphics Characters

Octal Code	Graphic with US or UK Set	Graphic with "Special Graphics" Set
137	—	Blank
140	\	♦ Diamond
141	a	∵ Checkerboard (error indicator)
142	b	HT horizontal tab
143	c	FF form feed
144	d	CR carriage return
145	e	LF line feed
146	f	° Degree symbol
147	g	± Plus/minus
150	h	NL new line
151	i	VT vertical tab
152	j	┘ Lower-right corner
153	k	┐ Upper-right corner
154	l	┌ Upper-left corner
155	m	└ Lower-left corner
156	n	┼ Crossing lines
157	o	⎺ Horizontal line - Scan 1
160	p	⎻ Horizontal line - Scan 3
161	q	─ Horizontal line - Scan 5
162	r	⎼ Horizontal line - Scan 7
163	s	⎽ Horizontal line - Scan 9
164	t	├ Left "T"
165	u	┤ Right "T"
166	v	┴ Bottom "T"
167	w	┬ Top "T"
170	x	│ Vertical Bar
171	y	≤ Less than or equal to
172	z	≥ Greater than or equal to
173	{	π Pi
174	|	≠ Not equal to
175	}	£ UK pound sign
76	~	· Centered dot

▪ Line Drawing Set

Special Characters and Line Drawing Set

B7 B6 B5 / BITS B4 B3 B2 B1	ROW	COLUMN 0			COLUMN 1			COLUMN 2			COLUMN 3			COLUMN 4			COLUMN 5			COLUMN 6			COLUMN 7		
0 0 0 0	0	NUL	0	0		20	16	SP	40	32	0	60	48	@	100	64	P	120	80	♦	140	96	—	160	112
			0	0			10			20			30			40			50			60	SCAN 3		70
0 0 0 1	1		1	1	DC1 (XON)	21	17	!	41	33	1	61	49	A	101	65	Q	121	81	▒	141	97	—	161	113
			1	1			11			21			31			41			51			61	SCAN 5		71
0 0 1 0	2		2	2		22	18	"	42	34	2	62	50	B	102	66	R	122	82	␉	142	98	—	162	114
			2	2			12			22			32			42			52			62	SCAN 7		72
0 0 1 1	3		3	3	DC3 (XOFF)	23	19	#	43	35	3	63	51	C	103	67	S	123	83	␊	143	99	—	163	115
			3	3			13			23			33			43			53			63	SCAN 9		73
0 1 0 0	4		4	4		24	20	$	44	36	4	64	52	D	104	68	T	124	84	␋	144	100	┼	164	116
			4	4			14			24			34			44			54			64			74
0 1 0 1	5	ENQ	5	5		25	21	%	45	37	5	65	53	E	105	69	U	125	85	␌	145	101	┤	165	117
			5	5			15			25			35			45			55			65			75
0 1 1 0	6		6	6		26	22	&	46	38	6	66	54	F	106	70	V	126	86	␍	146	102	┴	166	118
			6	6			16			26			36			46			56			66			76
0 1 1 1	7	BEL	7	7		27	23	'	47	39	7	67	55	G	107	71	W	127	87	±	147	103	┬	167	119
			7	7			17			27			37			47			57			67			77
1 0 0 0	8	BS	10	8	CAN	30	24	(	50	40	8	70	56	H	110	72	X	130	88	␈	150	104	├	170	120
			8	8			18			28			38			48			58			68			78
1 0 0 1	9	HT	11	9		31	25	)	51	41	9	71	57	I	111	73	Y	131	89	␉	151	105	≤	171	121
			9	9			19			29			39			49			59			69			79
1 0 1 0	10	LF	12	10	SUB	32	26	*	52	42	:	72	58	J	112	74	Z	132	90	␊	152	106	≥	172	122
			A	A			1A			2A			3A			4A			5A			6A			7A
1 0 1 1	11	VT	13	11	ESC	33	27	+	53	43	;	73	59	K	113	75	[	133	91	␋	153	107	π	173	123
			B	B			1B			2B			3B			4B			5B			6B			7B
1 1 0 0	12	FF	14	12		34	28	,	54	44	<	74	60	L	114	76	\	134	92	␌	154	108	≠	174	124
			C	C			1C			2C			3C			4C			5C			6C			7C
1 1 0 1	13	CR	15	13		35	29	-	55	45	=	75	61	M	115	77	]	135	93	␍	155	109	£	175	125
			D	D			1D			2D			3D			4D			5D			6D			7D
1 1 1 0	14	SO	16	14		36	30	.	56	46	>	76	62	N	116	78	^	136	94	┼	156	110	·	176	126
			E	E			1E			2E			3E			4E			5E			6E			7E
1 1 1 1	15	SI	17	15		37	31	/	57	47	?	77	63	O	117	79	(BLANK)	137	95	—	157	111	DEL	177	127
			F	F			1F			2F			3F			4F			5F	SCAN 1		6F			7F

KEY

ASCII CHARACTER — ESC — 33 OCTAL / 27 DECIMAL / 1B HEX

▪ US/UK Character Set

B7 B6 B5 / BITS B4 B3 B2 B1	ROW / COLUMN	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
		0	1	2	3	4	5	6	7
0 0 0 0	0	NUL 0 0 0	20 16 10	SP 40 32 20	0 60 48 30	@ 100 64 40	P 120 80 50	` 140 96 60	p 160 112 70
0 0 0 1	1	1 1 1	DC1 (XON) 21 17 11	! 41 33 21	1 61 49 31	A 101 65 41	Q 121 81 51	a 141 97 61	q 161 113 71
0 0 1 0	2	2 2 2	22 18 12	" 42 34 22	2 62 50 32	B 102 66 42	R 122 82 52	b 142 98 62	r 162 114 72
0 0 1 1	3	3 3 3	DC3 (XOFF) 23 19 13	* # / £ 43 35 23	3 63 51 33	C 103 67 43	S 123 83 53	c 143 99 63	s 163 115 73
0 1 0 0	4	4 4 4	24 20 14	$ 44 36 24	4 64 52 34	D 104 68 44	T 124 84 54	d 144 100 64	t 164 116 74
0 1 0 1	5	ENQ 5 5 5	25 21 15	% 45 37 25	5 65 53 35	E 105 69 45	U 125 85 55	e 145 101 65	u 165 117 75
0 1 1 0	6	6 6 6	26 22 16	& 46 38 26	6 66 54 36	F 106 70 46	V 126 86 56	f 146 102 66	v 166 118 76
0 1 1 1	7	BEL 7 7 7	27 23 17	' 47 39 27	7 67 55 37	G 107 71 47	W 127 87 57	g 147 103 67	w 167 119 77
1 0 0 0	8	BS 10 8 8	CAN 30 24 18	(50 40 28	8 70 56 38	H 110 72 48	X 130 88 58	h 150 104 68	x 170 120 78
1 0 0 1	9	HT 11 9 9	31 25 19	) 51 41 29	9 71 57 39	I 111 73 49	Y 131 89 59	i 151 105 69	y 171 121 79
1 0 1 0	10	LF 12 10 A	SUB 32 26 1A	* 52 42 2A	: 72 58 3A	J 112 74 4A	Z 132 90 5A	j 152 106 6A	z 172 122 7A
1 0 1 1	11	VT 13 11 B	ESC 33 27 1B	+ 53 43 2B	; 73 59 3B	K 113 75 4B	[133 91 5B	k 153 107 6B	{ 173 123 7B
1 1 0 0	12	FF 14 12 C	34 28 1C	, 54 44 2C	< 74 60 3C	L 114 76 4C	\ 134 92 5C	l 154 108 6C	| 174 124 7C
1 1 0 1	13	CR 15 13 D	35 29 1D	- 55 45 2D	= 75 61 3D	M 115 77 4D	] 135 93 5D	m 155 109 6D	} 175 125 7D
1 1 1 0	14	SO 16 14 E	36 30 1E	. 56 46 2E	> 76 62 3E	N 116 78 4E	^ 136 94 5E	n 156 110 6E	~ 176 126 7E
1 1 1 1	15	SI 17 15 F	37 31 1F	/ 57 47 2F	? 77 63 3F	O 117 79 4F	_ 137 95 5F	o 157 111 6F	DEL 177 127 7F

*NOTE DEPENDS ON THE CHARACTER SET SELECTED U S =# U K =£

KEY

ASCII CHARACTER — ESC — 33 (OCTAL) / 27 (DECIMAL) / 1B (HEX)

▪ 8-Bit ASCII Code

ROW	COLUMN 0			COLUMN 1			COLUMN 2			COLUMN 3			COLUMN 4			COLUMN 5			COLUMN 6			COLUMN 7		
BITS b8 b7 b6 b5 b4 b3 b2 b1	0 0 0 0			0 0 0 1			0 0 1 0			0 0 1 1			0 1 0 0			0 1 0 1			0 1 1 0			0 1 1 1		
0	0 0 0 0	NUL	0 0 0	DLE	20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
1	0 0 0 1	SOH	1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
2	0 0 1 0	STX	2 2 2	DC2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
3	0 0 1 1	ETX	3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
4	0 1 0 0	EOT	4 4 4	DC4	24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
5	0 1 0 1	ENQ	5 5 5	NAK	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
6	0 1 1 0	ACK	6 6 6	SYN	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
7	0 1 1 1	BEL	7 7 7	ETB	27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
8	1 0 0 0	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
9	1 0 0 1	HT	11 9 9	EM	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
10	1 0 1 0	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
11	1 0 1 1	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
12	1 1 0 0	FF	14 12 C	FS	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C
13	1 1 0 1	CR	15 13 D	GS	35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
14	1 1 1 0	SO	16 14 E	RS	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
15	1 1 1 1	SI	17 15 F	US	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DEL	177 127 7F

C0 CODES — GL CODES (ASCII GRAPHICS)

KEY

CHARACTER: ESC — 33 OCTAL, 27 DECIMAL, 1B HEX

8		9		10		11		12		13		14		15		COLUMN	
1 0 0 0		1 0 0 1		1 0 1 0		1 0 1 1		1 1 0 0		1 1 0 1		1 1 1 0		1 1 1 1		b8 b7 BITS b6 b5 b4 b3 b2 b1	ROW
	200 128 80	DCS	220 144 90		240 160 A0	º	260 176 B0	À	300 192 C0		320 208 D0	à	340 224 E0		360 240 F0	0 0 0 0	0
	201 129 81	PU1	221 145 91	¡	241 161 A1	±	261 177 B1	Á	301 193 C1	Ñ	321 209 D1	á	341 225 E1	ñ	361 241 F1	0 0 0 1	1
	202 130 82	PU2	222 146 92	¢	242 162 A2	2	262 178 B2	Â	302 194 C2	Ò	322 210 D2	â	342 226 E2	ò	362 242 F2	0 0 1 0	2
	203 131 83	STS	223 147 93	£	243 163 A3	3	263 179 B3	Ã	303 195 C3	Ó	323 211 D3	ã	343 227 E3	ó	363 243 F3	0 0 1 1	3
IND	204 132 84	CCH	224 148 94		244 164 A4		264 180 B4	Ä	304 196 C4	Ô	324 212 D4	ä	344 228 E4	ô	364 244 F4	0 1 0 0	4
NEL	205 133 85	MW	225 149 95	¥	245 165 A5	µ	265 181 B5	Å	305 197 C5	Õ	325 213 D5	å	345 229 E5	õ	365 245 F5	0 1 0 1	5
SSA	206 134 86	SPA	226 150 96		246 166 A6	¶	266 182 B6	Æ	306 198 C6	Ö	326 214 D6	æ	346 230 E6	ö	366 246 F6	0 1 1 0	6
ESA	207 135 87	EPA	227 151 97	§	247 167 A7	·	267 183 B7	Ç	307 199 C7	Œ	327 215 D7	ç	347 231 E7	œ	367 247 F7	0 1 1 1	7
HTS	210 136 88		230 152 98	¤	250 168 A8		270 184 B8	È	310 200 C8	Ø	330 216 D8	è	350 232 E8	ø	370 248 F8	1 0 0 0	8
HTJ	211 137 89		231 153 99	©	251 169 A9	1	271 185 B9	É	311 201 C9	Ù	331 217 D9	é	351 233 E9	ù	371 249 F9	1 0 0 1	9
VTS	212 138 8A		232 154 9A	ª	252 170 AA	º	272 186 BA	Ê	312 202 CA	Ú	332 218 DA	ê	352 234 EA	ú	372 250 FA	1 0 1 0	10
PLD	213 139 8B	CSI	233 155 9B	«	253 171 AB	»	273 187 BB	Ë	313 203 CB	Û	333 219 DB	ë	353 235 EB	û	373 251 FB	1 0 1 1	11
PLU	214 140 8C	ST	234 156 9C		254 172 AC	¼	274 188 BC	Ì	314 204 CC	Ü	334 220 DC	ì	354 236 EC	ü	374 252 FC	1 1 0 0	12
RI	215 141 8D	OSC	235 157 9D		255 173 AD	½	275 189 BD	Í	315 205 CD	Ý	335 221 DD	í	355 237 ED	ý	375 253 FD	1 1 0 1	13
SS2	216 142 8E	PM	236 158 9E		256 174 AE		276 190 BE	Î	316 206 CE		336 222 DE	î	356 238 EE		376 254 FE	1 1 1 0	14
SS3	217 143 8F	APC	237 159 9F		257 175 AF	¿	277 191 BF	Ï	317 207 CF	ß	337 223 DF	ï	357 239 EF		377 255 FF	1 1 1 1	15

C1 CODES

GR CODES
(DEC SUPPLEMENTAL GRAPHICS)

ROW	COLUMN	0		1		2		3		4		5		6		7	
	BITS B7 B6 B5 B4 B3 B2 B1	0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
0	0 0 0 0	NUL	0 0 0	DLE	20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50		140 96 60	– SCAN 3	160 112 70
1	0 0 0 1	SOH	1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51		141 97 61	– SCAN 5	161 113 71
2	0 0 1 0	STX	2 2 2	DC2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52		142 98 62	– SCAN 7	162 114 72
3	0 0 1 1	ETX	3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53		143 99 63	– SCAN 9	163 115 73
4	0 1 0 0	EOT	4 4 4	DC4	24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54		144 100 64	┼	164 116 74
5	0 1 0 1	ENQ	5 5 5	NAK	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55		145 101 65	┤	165 117 75
6	0 1 1 0	ACK	6 6 6	SYN	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56		146 102 66	┴	166 118 76
7	0 1 1 1	BEL	7 7 7	ETB	27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57		147 103 67	┬	167 119 77
8	1 0 0 0	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58		150 104 68	│	170 120 78
9	1 0 0 1	HT	11 9 9	EM	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59		151 105 69	≤	171 121 79
10	1 0 1 0	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A		152 106 6A	≥	172 122 7A
11	1 0 1 1	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	┐	153 107 6B	π	173 123 7B
12	1 1 0 0	FF	14 12 C	FS	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	┌	154 108 6C	≠	174 124 7C
13	1 1 0 1	CR	15 13 D	GS	35 29 1D	–	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	└	155 109 6D	£	175 125 7D
14	1 1 1 0	SO	16 14 E	RS	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	┼	156 110 6E	·	176 126 7E
15	1 1 1 1	SI	17 15 F	US	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	(BLANK)	137 95 5F	– SCAN 1	157 111 6F	DEL	177 127 7F

C0 CODES

GL CODES (DEC SPECIAL GRAPHICS)

KEY

CHARACTER ESC 33 OCTAL / 27 DECIMAL / 1B HEX

▪ LVP16 ASCII Code Definitions

Decimal Value	ASCII Character	All Sets
0	NULL	No Operation (NOP)
1	SOH	NOP
2	STX	NOP
3	ETX	End Label Instruction
4	ETO	NOP
5	ENQ	NOP
6	ACK	NOP
7	BEL	NOP
8	BS	Backspace
* 9	HT	Horizontal Tab (½ backspace)
10	LF	Line Feed
11	VT	Inverse Line Feed
12	FF	NOP
13	CR	Carriage Return
14	SO	Select Alternate Character Set
15	SI	Select Standard Character Set
16	DLE	NOP
17	DC1	NOP
18	DC2	NOP
19	DC3	NOP
20	DC4	NOP
21	NAK	NOP
22	SYN	NOP
23	ETB	NOP
24	CAN	NOP
25	EM	NOP
26	SUB	NOP
27	ESC	NOP
28	FS	NOP
29	GS	NOP
30	RS	NOP
31	US	NOP
32	SP	Space

*Using control character horizontal tab (decimal 9) inside a label string moves the pen one-half character space back (equivalent to a CP −.5,0). Use this tab with character set 8, Katakana, where spacing between symbols can alter the meaning of the symbol and hence the word or phrase.

LVP16 ASCII Code Definitions (Continued)

DECIMAL VALUE	SET																		
	0	1	2	3	4	6	7	8	9	30	31	32	33	34	35	36	37	38	39
33	!	!	!	!	!	!	À	｡	!	!	!	!	!	!	!	!	!	!	!
34	"	"	"	"	"	"	Â	「	"	"	"	"	"	"	"	"	"	"	"
35	#	#	£	£	¿	#	È	」	#	#	#	#	#	£	£	£	£	#	#
36	$	$	$	$	$	$	Ê	、	¤	¤	¤	$	$	$	$	$	$	$	$
37	%	%	%	%	%	%	Ë	・	%	%	%	%	%	%	%	%	%	%	%
38	&	&	&	&	&	&	Î	ヲ	&	&	&	&	&	&	&	&	&	&	&
39	'	'	■	'	■	'	Ï	ァ	'	'	'	'	'	'	'	'	'	'	'
40	(	(	(	(	(	(	´	ィ	(	(	(	(	(	(	(	(	(	(	(
41	)	)	)	)	)	)	`	ゥ	)	)	)	)	)	)	)	)	)	)	)
42	*	*	*	*	*	*	ˆ	ェ	*	*	*	*	*	*	*	*	*	*	*
43	+	+	+	+	+	+	¨	ォ	+	+	+	+	+	+	+	+	+	+	+
44	,	,	,	,	,	,	~	ャ	,	,	,	,	,	,	,	,	,	,	,
45	-	-	-	-	-	-	Ù	ュ	-	-	-	-	-	-	-	-	-	-	-
46	.	.		.	.	.	Û	ョ							.				.
47	/	/	/	/	/	/	£	ッ	/	/	/	/	/	/	/	/	/	/	/
48	0	0	0	0	0	0	¯	-	0	0	0	0	0	0	0	0	0	0	0
49	1	1	1	1	1	1		ア	1	1	1	1	1	1	1	1	1	1	1
50	2	2	2	2	2	2		イ	2	2	2	2	2	2	2	2	2	2	2
51	3	3	3	3	3	3	˚	ウ	3	3	3	3	3	3	3	3	3	3	3
52	4	4	4	4	4	4	Ç	エ	4	4	4	4	4	4	4	4	4	4	4
53	5	5	5	5	5	5	ç	オ	5	5	5	5	5	5	5	5	5	5	5
54	6	6	6	6	6	6	Ñ	カ	6	6	6	6	6	6	6	6	6	6	6
55	7	7	7	7	7	7	ñ	キ	7	7	7	7	7	7	7	7	7	7	7
56	8	8	8	8	8	8	¡	ク	8	8	8	8	8	8	8	8	8	8	8
57	9	9	9	9	9	9	¿	ケ	9	9	9	9	9	9	9	9	9	9	9
58	:			.	˙		¤	コ	˙										
59	,	,	,	;	,	,	£	サ	,	,	,	,	,	,	,	,	,	,	,
60	<	<	<	<	<	<	¥	シ	<	<	<	<	<	<	<	<	<	<	<
61	=	=	=	=	=	=	§	ス	=	=	=	=	=	=	=	=	=	=	=
62	>	>	>	>	>	>	ƒ	セ	>	>	>	>	>	>	>	>	>	>	>
63	?	?	?	?	?	?	¢	ソ	?	?	?	?	?	?	?	?	?	?	?

NOTE: Shaded characters have the automatic backspace feature. ■

LVP16 ASCII Code Definitions (Continued)

DECIMAL VALUE	SET																			
	0	1	2	3	4	6	7	8	9	30	31	32	33	34	35	36	37	38	39
64	@	@	@	@	@	@	â	タ	@	@	É	@	§	à	@	§	§	§	§
65	A	A	A	A	A	A	ê	チ	A	A	A	A	A	A	A	A	A	A	A
66	B	B	B	B	B	B	ô	ツ	B	B	B	B	B	B	B	B	B	B	B
67	C	C	C	C	C	C	û	テ	C	C	C	C	C	C	C	C	C	C	C
68	D	D	D	D	D	D	á	ト	D	D	D	D	D	D	D	D	D	D	D
69	E	E	E	E	E	E	é	ナ	E	E	E	E	E	E	E	E	E	E	E
70	F	F	F	F	F	F	ó	ニ	F	F	F	F	F	F	F	F	F	F	F
71	G	G	G	G	G	G	ú	ヌ	G	G	G	G	G	G	G	G	G	G	G
72	H	H	H	H	H	H	à	ネ	H	H	H	H	H	H	H	H	H	H	H
73	I	I	I	I	I	I	è	ノ	I	I	I	I	I	I	I	I	I	I	I
74	J	J	J	J	J	J	ò	ハ	J	J	J	J	J	J	J	J	J	J	J
75	K	K	K	K	K	K	ù	ヒ	K	K	K	K	K	K	K	K	K	K	K
76	L	L	L	L	L	L	ä	フ	L	L	L	L	L	L	L	L	L	L	L
77	M	M	M	M	M	M	e	ヘ	M	M	M	M	M	M	M	M	M	M	M
78	N	N	N	N	N	N	ö	ホ	N	N	N	N	N	N	N	N	N	N	N
79	O	O	O	O	O	O	ü	マ	O	O	O	O	O	O	O	O	O	O	O
80	P	P	P	P	P	P	Å	ミ	P	P	P	P	P	P	P	P	P	P	P
81	Q	Q	Q	Q	Q	Q	î	ム	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
82	R	R	R	R	R	R	Ø	メ	R	R	R	R	R	R	R	R	R	R	R
83	S	S	S	S	S	S	Æ	モ	S	S	S	S	S	S	S	S	S	S	S
84	T	T	T	T	T	T	å	ヤ	T	T	T	T	T	T	T	T	T	T	T
85	U	U	U	U	U	U	í	ユ	U	U	U	U	U	U	U	U	U	U	U
86	V	V	V	V	V	V	ø	ヨ	V	V	V	V	V	V	V	V	V	V	V
87	W	W	W	W	W	W	æ	ラ	W	W	W	W	W	W	W	W	W	W	W
88	X	X	X	X	X	X	A	リ	X	X	X	X	X	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y	ì	ル	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z	Ò	レ	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
91	[	[	[	Ø	[	[	U	ロ	[	A	A	Æ	À	°	[	°	¡	Ã	Ã
92	\	√	ç	Æ	¡	¥	É	ワ	\	Ò	Ò	Ø	Ò	ç	\	ç	Ñ	Ç	Ç
93	]	]	]	ø	]	]	ı	ン	]	Å	Å	Å	Ù	§	]	é	¿	Õ	Õ
94	^	↑	[illegible]	æ	[illegible]	^	ß	"	^	^	Ù	^	^	^	^	^	^	^	^
95	_	[illegible]	[illegible]	[illegible]	[illegible]	_	Ô	°	_	_	_	_	_	_	_	_	_	_	_

LVP16 ASCII Code Definitions (Continued)

DECIMAL VALUE	SET																			
	0	1	2	3	4	6	7	8	9	30	31	32	33	34	35	36	37	38	39
96	`	[redacted]		`	♦	`	Á		`	`	é	`	`	`	`	ù	`	`	`
97	a	a	a	a	a	a	Ã		a	a	a	a	a	a	a	a	a	a	a
98	b	b	b	b	b	b	ã		b	b	b	b	b	b	b	b	b	b	b
99	c	c	c	c	c	c	Đ		c	c	c	c	c	c	c	c	c	c	c
100	d	d	d	d	d	d	đ		d	d	d	d	d	d	d	d	d	d	d
101	e	e	e	e	e	e	Í		e	e	e	e	e	e	e	e	e	e	e
102	f	f	f	f	f	f	Ì		f	f	f	f	f	f	f	f	f	f	f
103	g	g	g	g	g	g	Ó		g	g	g	g	g	g	g	g	g	g	g
104	h	h	h	h	h	h	Ò		h	h	h	h	h	h	h	h	h	h	h
105	i	ı	ı	ı	ı	ı	Õ		ı	ı	ı	ı	ı	ı	ı	ı	ı	ı	i
106	j	ȷ	j	ȷ	ȷ	ȷ	õ		ȷ	ȷ	ȷ	ȷ	ȷ	ȷ	ȷ	ȷ	ȷ	ȷ	ȷ
107	k	k	k	k	k	k	Š		k	k	k	k	k	k	k	k	k	k	k
108	l	l	l	l	l	l	š		l	l	l	l	l	l	l	l	l	l	l
109	m	m	m	m	m	m	Ú		m	m	m	m	m	m	m	m	m	m	m
110	n	n	n	n	n	n	Ÿ		n	n	n	n	n	n	n	n	n	n	n
111	o	o	o	o	o	o	ÿ		o	o	o	o	o	o	o	o	o	o	o
112	p	p	p	p	p	p	Þ		p	p	p	p	p	p	p	p	p	p	p
113	q	q	q	q	q	q	þ		q	q	q	q	q	q	q	q	q	q	q
114	r	r	r	r	r	r			r	r	r	r	r	r	r	r	r	r	r
115	s	s	s	s	s	s			s	s	s	s	s	s	s	s	s	s	s
116	t	t	t	t	t	t			t	t	t	t	t	t	t	t	t	t	t
117	u	u	u	u	u	u			u	u	u	u	u	u	u	u	u	u	u
118	v	v	v	v	v	v	–		v	v	v	v	v	v	v	v	v	v	v
119	w	w	w	w	w	w	¼		w	w	w	w	w	w	w	w	w	w	w
120	x	x	x	x	x	x	½		x	x	x	x	x	x	x	x	x	x	x
121	y	y	y	y	y	y	a		y	y	y	y	y	y	y	y	y	y	y
122	z	z	z	z	z	z	º		z	z	z	z	z	z	z	z	z	z	z
123	{	π	[redacted]			{	«		{	a	a	æ	a	é	{	à	•	ã	ã
124	|	⊢	[redacted]			|	□		|	ò	o	ø	ò	ù	|	ò	ñ	ç	ç
125	}	→	[redacted]			}	»		}	å	å	å	ü	è	}	è	ç	õ	õ
126	~	[redacted]		'	[redacted]	~	±		–	–	ù	–	ß	·	–	ì	~	•	•
127																			

Appendix B ▪ Traditional Terminal Products

This appendix describes Digital's earlier video terminals that have been replaced by new products.

▪ VT Family of Video Terminals

Digital's VT100 video terminal, introduced in 1978, has set industry standards for functionality and reliability. The success of the VT100 led to the development of a "family" of video terminals—the VT101, the VT102, the VT125, and the VT131. Each of these terminals offers all the features found in your VT100.

VT100, VT101, VT102, VT125, and VT131, terminals can be used with any of Digital's processors—PDP-8s, MICRO/PDP-11s, PDP-11s, VAXs, DECsystem-10s, and DECSYSTEM-20s. These video terminals can work with other vendors' systems as well as with Digital systems. Because half-duplex communications and ASCII support are features of the VT102 and VT131 video terminals, they have the capability to work with more systems.

User-Oriented Features

- Detached sculptured keyboard—The keyboard and monitor can be positioned separately for optimum use in your work environment. Since the keyboard has a layout similar to that of an office typewriter, the transition from office typewriter to terminal is easy.

- ASCII character set—Industry standard ASCII characters offer compatibility with Digital and non-Digital systems.

- Numeric/application keypad—The calculator-style numeric keypad ensures fast and easy number entering in data entry and financial applications. The application keypad transmits control sequences instead of numeric codes that act as program function codes to control predefined application-specific routines.

- Cursor control keys—These send codes to the host to let you easily and quickly position the cursor anywhere on the screen with a minimum of keystrokes.

- Keyboard-selectable features—These include communication speeds, key-click, margin bell, dark/light background, and block/underline cursor.—You can configure the terminal to your personal preferences to maximize your productivity.

- Non-volatile memory set-up—Allows you to save and later recall the keyboard features you have selected.

- 80 column by 24 lines display format—Used for standard video terminal applications.

- 132 column by 14 lines (VT100, VT101, VT125) display—Allows you a larger format for detailed or spread sheet work so you can preview reports prior to printing. (**Note:** The advanced video option, which is standard with the VT102 and VT131, provides 132 column by 24 lines display.)

- Selectable bidirectional smooth screen scrolling—With this feature you can select smooth or jump scroll. The smooth scroll feature of the VT100 family, when used with XON/XOFF transmission control, lets you read new lines of text easily, even when transmission speeds are high. When jump scroll is selected, new lines appear on the screen as fast as the host sends them to the terminal. At higher baud rates, data can be difficult to read due to the rapid movement of lines.

- Split-screen capability—With this feature, the host can scroll any subset of the 24-line screen, while the rest of the screen remains fixed. This feature is useful for many applications. For example, the host can maintain status information on a fixed portion of the screen while interactive work is performed in the scrolling area. This permits you to work with two information sources.

- Double-width/double-height characters on a line-by-line basis—This feature can provide versatility in display format for forms, prompting, and text applications.
- Reverse video—This is another selectable feature that allows you to change the screen from black characters/white background to white characters/black background, according to your preference.
- Selectable screen intensity—You can adjust the screen to the amount of light in the room for easier reading, and to suit personal preferences.

Engineering Features

- ANSI-compatible command set—Terminal commands are compatible with ANSI 3.64 standards.
- VT52-compatible command set—Permits compatibility with VT52 software.
- Line drawing character set—The basic character set features 32 line drawing and other graphic characters. These can be used to present solid-line displays of simple forms and data plotting in a format that looks like that of a hardcopy printout. (See Appendix A for more information on the VT100 line drawing character sets.)
- 20-character answerback message—Provides your terminal with the ability to identify itself by sending a message to the host. This message may be sent by the operator or automatically sent to the host without operator intervention.
- EIA RS-232 serial line interface—The VT100 family interfaces to asynchronous communications lines with a 25-pin connector, mounted on the back of the terminal. This meets the requirements of EIA specification RS-232-C, the industry's standard.
- Full-duplex communication—Enables two-way simultaneous transmission between your terminal and the host.
- Automatic XON/XOFF buffer control—Generates synchronizing codes XOFF/XON that can stop or resume data transmission.
- Keyboard-selectable baud rate to 19,200 baud—Achieves compatibility in communications between the video terminal and the host or between the video terminal and another device, such as a printer.

Easy Serviceability

- Self-test diagnostics—These diagnostics automatically or on command test the condition of the terminal's non-volatile and internal memory, keyboard, and advanced video memory (if this option is installed) to determine if a fault is present.
- Modular design—Ensures easy, fast, and inexpensive maintenance.

• Accessories and Supplies

The following VT100 family accessories, supplies, components, and spares are available for the VT100, VT101, VT102, VT131, and VT125 video terminals. Check with your sales representative or Digital's Installed Base Group for the latest information. **Note:** While many of these products are available for sale in European and GIA countries, some items may not conform to national standards. Again, it is recommended that you consult your local Digital dealer/distributor for details.

Spares

Part Number	Description
4A-VT100-00	VT100 spares kit

Hardware Aids

Part Number	Description
12-15336	1 Data Loop Back Connector for RS-232C
70-15503	Data Loop Back Connector for 20 mA

Tools

Part Number	Description
STKIT-AA (60 Hz)	Systems Terminal Tool Kit
STKIT-AB (50 Hz)	Systems Terminal Tool Kit
SPMAK-AA	VT100/101/102/125/131 family maintenance kit, RS-232
SPMAK-AB	VT100/101/102/125/131 family maintenance kit, 20 mA

▪ Controls and Indicators

VT100 family terminals perform two functions. First, they act as an input device to the computer, by sending the information you enter through the keyboard to the computer. Second, they simultaneously act as an output device for the computer, displaying data on the video screen. The controls and indicators described below are found on VT100, VT101, VT102, VT131, and VT125 terminals.

Keyboard Controls

Table B-1 ▪ Control Keys

Control	Description
Set-Up	Used in conjunction with other keys to perform specific functions such as setting tabs, scrolling, and altering terminal characteristics.
Backspace	Transmits a backspace code.
Break	Transmits a break signal.
Delete	Transmits a delete character code to the host system.
Return	Transmits either a carriage return (CR) code or a carriage return (CR) and linefeed (LF) code. This is a set-up selectable feature.
Linefeed	Transmits a linefeed code.
Shift	When pressed, this key enables the uppercase function of all keys. If a key does not have an uppercase function, the SHIFT key will be disregarded.
Reset	When the terminal is in Set-Up mode, this key starts the reset sequence. This action returns the terminal's settings back to the original ones that were in place when the terminal was first powered-up.
80/132 columns	When the terminal is in Set-Up A Mode, this key switches the display line size from 80 to 132 characters per line or from 132 to 80 characters per line.
Receive Speed	When the terminal is in Set-Up B Mode, this key steps the terminal through the receive baud rate settings in ascending order.

Transmit Speed	When the terminal is in Set-Up B Mode, this key steps the terminal through the transmit baud rate settings in ascending order.
Toggle 1/0	When the terminal is in Set-Up B Mode, this key turns the selected operational feature on or off.
Bell G	When pressed in combination with the CTRL key, this key causes a bell code to be sent to the host.
Set-Up A/B/C	When the terminal is in Set-Up Mode, this key switches the terminal from Set-Up Mode A to Set-Up Mode B and back again. Set-Up C is only found with the VT131 terminal.
Line/Local	In Set-Up mode, this key alternately places the terminal on-line or local to your system. When on-line, the terminal communicates with the host, when local, the terminal is disconnected from the host.
Clear all tabs	In Set-Up A Mode, this key clears all horizontal tabs.
Set/Clear Tab	In Set-Up A Mode, this key sets or clears individual tabs.
Caps Lock	Enables the transmission of uppercase alphanumeric characters only. All numeric and special symbol keys remain in lowercase.
No Scroll	When first pressed, this key stops the scrolling of data on the CRT, thus freezing the image. When pressed a second time, scrolling resumes from where it was stopped.
CTRL	When pressed in combination with another key, the CTRL key causes the terminal to transmit a code that performs a specific function, depending on your system.
Tab	Transmits a tab code.
ESC	Transmits the ESC (escape) code to your system. In many applications, it tells your system to treat the next keys pressed as a command.

Keyboard Indicators

Seven indicators are located on the VT100, VT101, VT102, VT131, and VT125 keyboards.

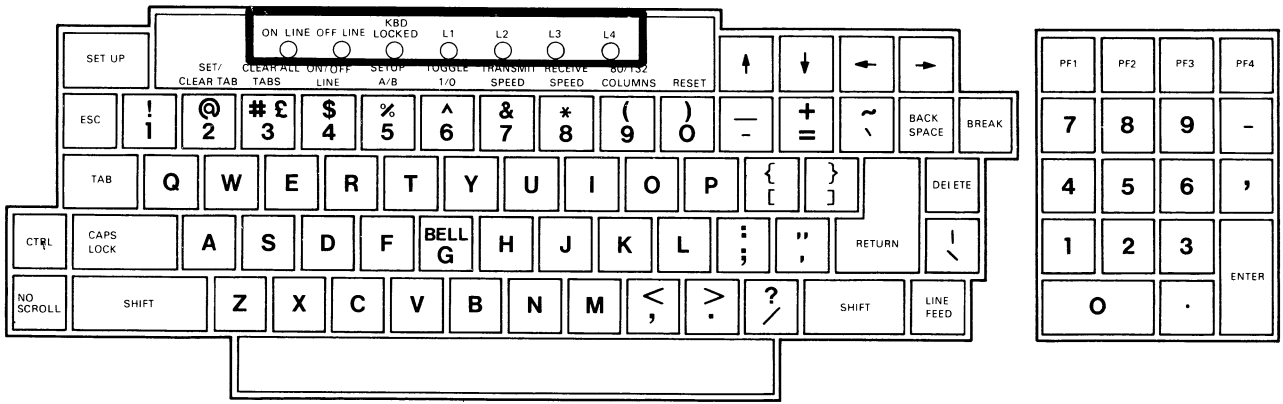

Figure B-1 ▪ VT100 Family Indicators

The On-Line indicator lights to show that the terminal is on-line and ready to transmit or receive messages. The Local indicator lights to show that your terminal is off-line and cannot communicate with the host. In local mode, the keyboard remains active and all characters typed appear on the screen, but are not transmitted to the host.

The Keyboard Locked indicator shows that the terminal's transmit input buffer is full, and the keyboard cannot be used to enter data. Even when the keyboard is off, the terminal can still receive data from the host. Once the data is transmitted, and the buffer empties, keyboard transmission resumes.

LED Indicators—L1, L2, L3, and L4—found on the VT100, VT101, and VT125 terminals, are customer-programmable and can be assigned any meaning for specific applications. The *User Guide* for your specific terminal will have details on the escape sequences necessary to program these LEDs. The VT102 and VT131 terminals have dedicated LEDs. See Chapter 6 or your *User Guide* for more details.

Monitor Controls and Indicators

VT100 family monitors have only two controls: the power switch and the power selector switch, which is used to adapt the terminal to the available ac input voltage range.

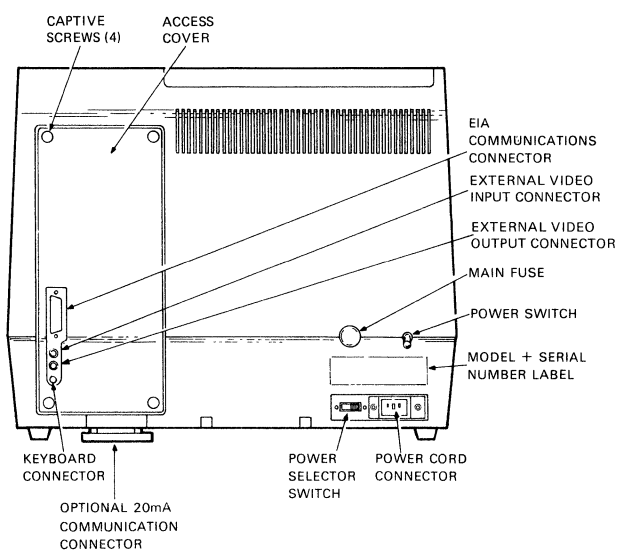

Figure B-2 ▪ Rear View of VT100 Family Terminal

In addition, there are three audible alarms associated with the VT100 family of terminals.

A keyclick is sounded by the terminal whenever a key is pressed. The following are exceptions:

- Shift or CTRL keys do not generate a keyclick because these keys do not transmit a code to the host, but merely modify the codes transmitted by other keys.
- KBD LOCKED indicator is turned on. In this case, the characters typed are lost.
- The keyclick feature was turned off in Set-Up mode.

The long tone (bell) is sounded by your terminal to indicate one of the following:

- A bell code was received from the host.
- The cursor is eight characters away from the right margin and the margin bell is enabled.

Finally, your terminal will sound the long tone several times in rapid succession to indicate that the nonvolatile memory had difficulty in reading or writing the set-up features. If this occurs, check the set-up features and then perform a recall or save operation.

• Operator Features

All VT100 family members incorporate features that can be selected in set-up. Set-up features reflect either factory-installed default values or your choices. They allow the terminal to be configured according to your preference, and provide compatibility to the host and AC power source. Unlike some terminals, the VT100 family does not use switches or jumpers to individually turn the built-in features on or off. Instead, this family uses a nonvolatile memory (NVR) that always remembers what features have been selected, just as if a switch had been set.

Set-up features can be selected by the host or by you through your terminal's keyboard. When Set-Up is entered, the status of the features stored in the nonvolatile memory are shown on the screen. These feature settings can either be stored permanently in the nonvolatile memory or stored temporarily until the terminal is turned off. Pressing SHIFT "S" during Set-up mode stores the current settings as permanent. The terminal operation reflects the current feature selections. If a recall operation is performed, the terminal is reset, or the terminal power is turned off, all temporary feature settings are replaced by the features that have been stored in NVR.

Set-Up

Set-Up mode provides two (or three for the VT131) brief descriptions of the current feature status. Set-Up A displays the location of the tab stops set in the terminal and a visual ruler that numbers each character position on the line. The status of other terminal features is summarized in Set-Up B.

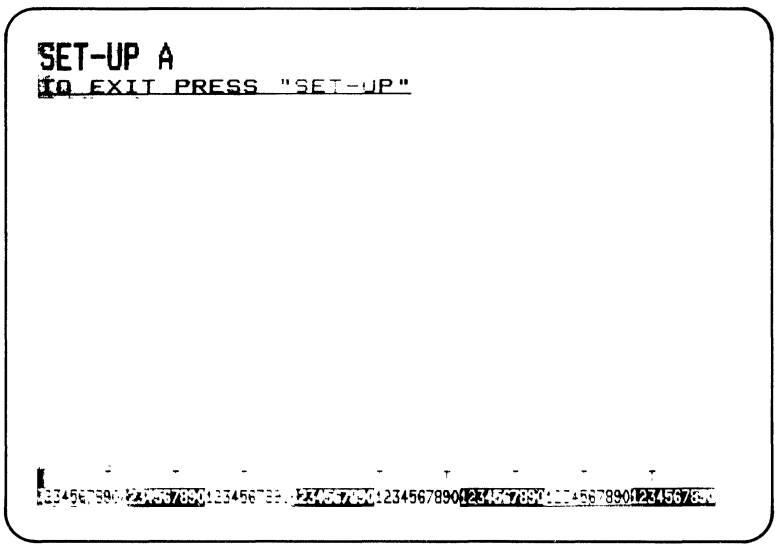

Figure B-3 ▪ Set-Up A Mode Presentation

Entering Set-Up A is achieved by pressing the SET-UP key. The bottom line of the display consists of a ruler, which numbers each character position available on a line. The location of each tab stop is shown by a "T" placed above the ruler. To change a tab, use the space bar to advance the cursor to any of the numbered character positions. Press the Set/Clear Tab key when you reach the position where you want to set or clear a tab. If there is a "T" present, the tab will be cleared. If no "T" is at that location, a tab will be inserted. Once you have finished, you may exit from Set-Up mode A by pressing the SET-UP key again.

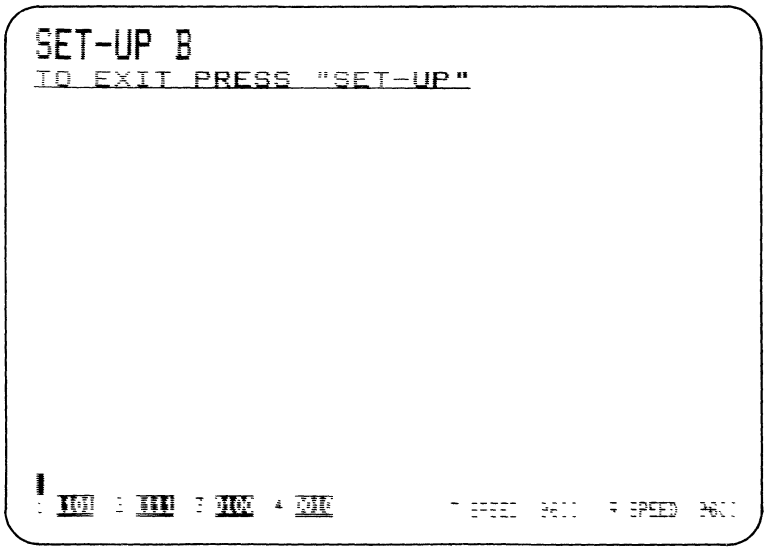

Figure B-4 ▪ Set-Up B Mode Presentation

Set-Up B mode only can be entered from Set-Up A mode. While in Set-Up A, press the 5 key on the main keyboard. This brings you into Set-Up B. See Figure 5-5.

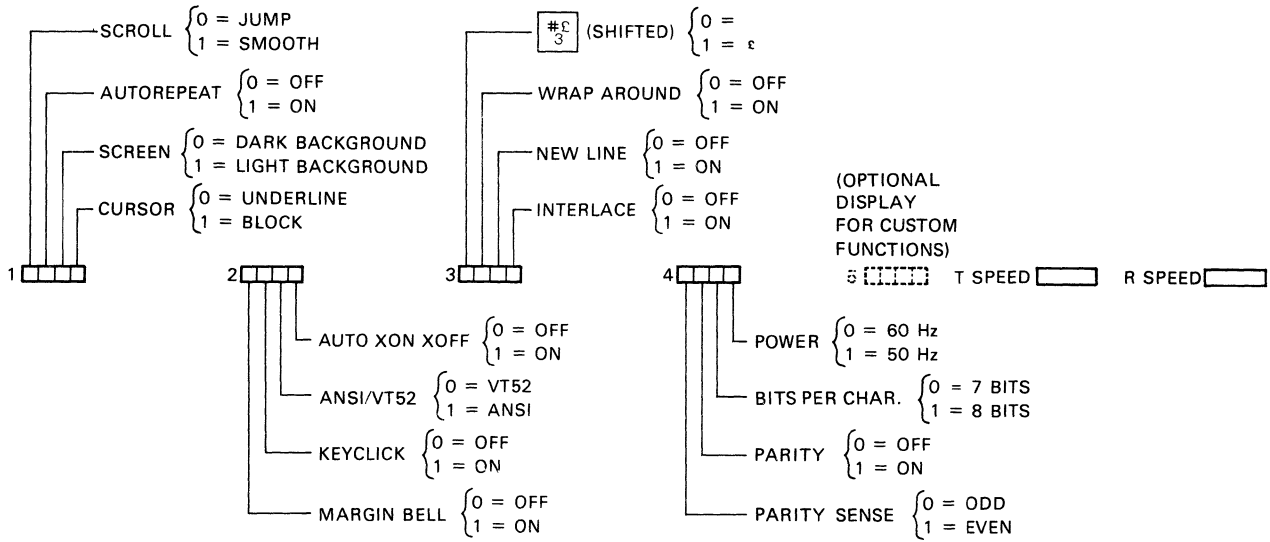

Figure B-5 ▪ Summary of Set-Up B Mode

To change any of the features shown in Figure 5-6, use your space bar to move the cursor to the feature you want to change. Once the cursor is positioned over the block to be changed, press the 6 key. This changes the bit to the opposite of what is displayed—either 1 or 0. After you have selected all the features you want, exit from Set-Up B mode by pressing the 5 key which returns you to Set-Up A mode, or press the SET-UP key again to exit Set-Up mode. The next section describes the features you can change once you are in Set-Up B.

- RECEIVE SPEED
  When the terminal is in Set-Up B Mode, this key steps the terminal through the receive baud rate settings in ascending order.

- TRANSMIT SPEED
  When the terminal is in Set-Up B Mode, this key steps the terminal through the transmit baud rate settings in ascending order.

- SCROLL
  Scrolling is the upward or downward movement of existing lines on the screen to make room for new lines at the bottom or top of the screen. When using jump scroll, new lines appear on the screen as fast as the host sends them to the terminal. Smooth scroll places a limit on the speed at which new lines of data can be sent to the terminal, but since the movement occurs at a smooth, steady pace, the data can be read as it appears on the screen.

- AUTO REPEAT
  Auto Repeat causes a key to be repeated automatically at the rate of approximately 30 characters per second when the key is held down for more than one half second. So if you need a certain character to be repeated, you don't have to retype it.

- DARK OR LIGHT BACKGROUND
  In the normal screen mode, the display contains light characters on a dark background. In the reverse screen mode, the display contains dark characters on a light background. You can select whatever screen mode is more comfortable for you.

- CURSOR
  The cursor display is used to indicate the active position or where the next typed character will appear on the screen. You can select a block or underline cursor.

- XON/XOFF
  The VT100 family members are capable of automatically generating the synchronizing codes XON (DC1) and XOFF (DC3). The XOFF code tells the host to stop the transmitting of data. The XON code tells the host to resume transmitting data. This mode of operation is required when smooth scroll, set-up, or the printer port is to be used. It is also required for baud rates over 4,800 bits per second.

- ANSI/VT52 COMPATIBILITY MODES
  With ANSI mode, the VT100 family will respond to software based on ANSI standards—ANSI X3.4-1977, X3.41-1974, and X3.64-1979. VT52 compatibility mode lets the terminal respond to software written for use with Digital's VT52 video terminal.

- KEYCLICK
  With this, you can choose to have a silent keyboard or hear an audible click each time a key is pressed.

- MARGIN BELL
  The margin bell functions just like the bell in a typewriter. When the margin bell is on, a tone will sound whenever the cursor is eight characters from the end of the current line.

- CHARACTER SETS
  Choose between US. and U.K. character sets. The VT100 family contains character sets for the United States and the United Kingdom. The only difference between these two character sets is one character, the # or the £ symbol. When the standard U.S. character set is selected, the uppercase 3 on the main keyboard displays the # character. The £ character is displayed when the U.K. character set is selected.

- AUTOMATIC WRAPAROUND
  When this feature is selected, characters that would otherwise appear beyond the right margin are automatically placed in the first character position of the next line.

- NEW LINE
  The new line feature enables the RETURN key on your terminal to function like the RETURN key on an electric typewriter. When the new line feature is enabled, pressing the RETURN key generates the carriage return (CR) and the linefeed (LF) codes. When a linefeed code is received, the code is interpreted as a carriage return and a linefeed.

- INTERLACE MODE
  Interlacing allows you to display alternate rows of pixels in successive screen sweeps. Digital terminals are factory set with interlace mode disabled. Although Digital graphics applications do not require interlacing, this feature is user-selectable.

- POWER
  During the initial installation , the terminal display must be set to either the 50 or 60 Hertz power line frequency. In the United States, it is set to 60 Hertz.

- BITS PER CHARACTER
  This feature allows the terminal to transmit and receive either 7- or 8-bit characters. When set for 8-bit operation, bit 8 is set to a space or 0 for characters transmitted, and is ignored for all characters received.

- PARITY
  Parity, when enabled, checks for single-bit errors in data transmission. If a transmission error occurs, members of the VT100 family can often detect it and indicate its presence by placing a checkerboard character on the screen in place of the character with the error. When parity is disabled, no parity bit is transmitted or received.

- PARITY SENSING
  This feature defines which method of parity checking—odd or even—is used. If the parity is turned off, the parity sense selection will be disregarded.

- BAUD RATES
  Members of the VT100 family can transmit data at any one of the following speeds: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600, or 19,200 bits per second. These terminals are also capable of receiving data at any of the following defined speeds: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600, or 19,200 bits per second. The receive speed is independent of the transmit speed. The terminal can receive data at one speed and transmit it at a different speed.

- ANSWERBACK MESSAGE
  Answerback is a feature that provides the terminal with the ability to identify itself by sending a message to the host. This message can be up to 20 characters in length, including control characters. The entire answerback message sequence can take place automatically without affecting the screen or requiring operator action if an ENQ is sent to the terminal. You can send the answerback message by pressing the CRTL and BREAK keys simultaneously.

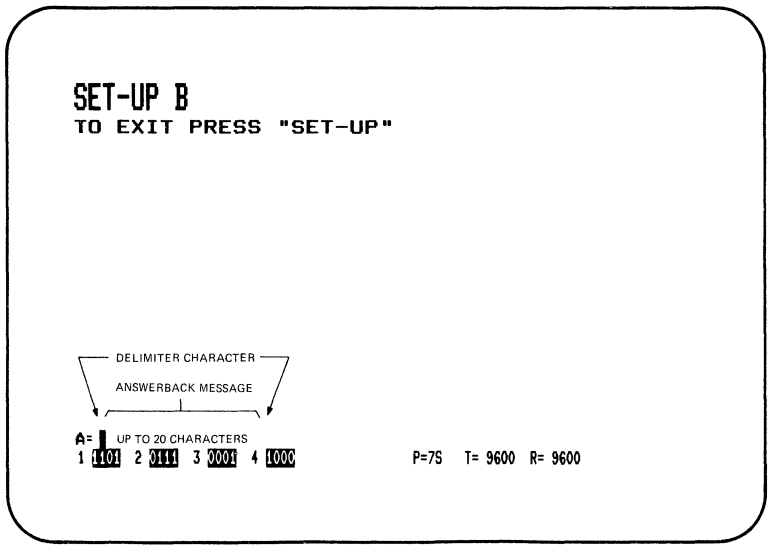

Figure B-6 • Answerback Message Set-up

To set the answerback message, use the following steps.

1. Place the terminal in Set-Up B mode.
2. Press the SHIFT and A keys simultaneously. The terminal will respond by placing A ' on the screen.
3. Type the message delimiter character which may be any character not used in the actual answerback message. The message delimiter character is not part of the answerback message. If you make a mistake when typing the answerback message, type the message delimiter character again and go back to step 2. This is the only way to correct errors in the answerback message.
4. Type the answerback message. The message may be up to 20 characters, including space and control characters. Control characters will be displayed as a blackened diamond-shaped character to indicate their presence in the message.
5. Type the message delimiter character. Once the message delimiter character is typed, the answerback message will disappear from the screen.

Once you have followed these steps, the answerback message will be temporarily stored in the terminal and can be saved with a Save operation.

- SAVE OPERATION

You can change or store set-up features on either a temporary or fixed basis. To temporarily store a feature, just exit set-up mode after changing the feature—the terminal reacts according to the new setting. If a recall operation is performed, or the terminal is reset, or the terminal power is turned off, all temporary feature settings are replaced by the features that have been stored on a fixed basis.If you want to store set-up feature settings on a permanent basis, follow the next two save operation steps. First, place the terminal in set-up mode. Second, press the SHIFT and S keys simultaneously. The screen will clear and the message " wait" will be displayed in the upper-left corner. After a few seconds, the terminal will automatically return to Set-Up A mode. You have now saved your set-up features in nonvolatile memory.

- RECALL OPERATION

It is possible for temporarily stored feature settings to differ from those stored on a fixed basis. If you want to return to the fixed settings, you can perform a recall operation. First, place the terminal in set-up mode. Next, press the SHIFT and R keys simultaneously. The screen will clear and the message "wait" will appear in the upper-left corner of the screen. After a few seconds, the terminal will return to Set-Up A mode. The VT102 and VT131 also have factory default settings that can be recalled with SHIFT "D."

- PRINTING

With the VT100's optional printer port or the standard printer port found on the VT102, VT125, and VT131 terminals, you can attach your video terminal to a serial printer for hardcopy output.

Your video terminal determines if the serial printer is connected and ready to operate by the data terminal ready (DTR) interface signal of the printer. When the DTR signal of the printer is on, the printer is ready to print. If a printer is not connected, requests for printing are ignored.

If the printer is unable to print when a print operation is selected, print requests cause the video terminal to wait for the print operation to be completed or cancelled. During this time, the screen of the terminal will not display new characters. After the print operation is completed or cancelled, the screen displays new characters.

The printer may not be ready to print for one or more of the following reasons:

- AC power is turned off.
- The printer is off-line.
- The printer is out of paper.
- The printer is out of ribbon.

- The printer cover is open.
- The printhead is jammed.

Refer to the documentation provided with your printer to correct any of the above situations, or consult the appropriate chapter within this handbook.

Printing is performed using one of four print operations: auto print which prints one line at a time, print screen, printer controller, and print cursor line. All print operations can be selected by the host while the terminal is on-line. Only auto print and print screen operations can be selected from the video terminal's keyboard. Keyboard-selected print operations are performed while the terminal is on-line or off-line. If the terminal is off-line, the KBD LOCKED indicator goes on until printing finishes. See your *User Guide* for more information.

Printing double-height and double-width characters results in printing the same line twice with single-height and single-width characters. Double-width characters are printed as single-width characters.

- AUTO PRINT

Auto print operation prints the current line before the cursor moves to the next line. The cursor moves to the next line when the terminal receives a linefeed, form feed, or vertical tab character. This character is also transmitted to the printer at the end of the printed line.

If the auto wrap feature is on, characters received when the cursor is at the right margin are automatically wrapped to the next line. Before the cursor moves to the next line, the current line is printed. The auto wrapped line ends with the carriage return and linefeed characters.

Select auto print using the following procedure. After verifying that the printer is ready to print, hold down the CTRL key and press the (PRINT)/ ENTER key, and then release both keys. Although there is no visible indication on the screen, the current line is printed before the cursor moves to the next line. When selected, auto print operation continues until turned off.

If you want to stop printing, enter and exit set-up. The current line is not printed, but the auto print feature stays selected. To turn off auto print, hold down the CTRL key and press the (PRINT)/ENTER key, then release both keys.

- PRINT SCREEN

The print screen command prints a copy of the screen. Depending on the print features chosen in set-up, the scrolling region or complete screen is printed. The scrolling region is the area of the screen between the top and bottom margins. The top and bottom margins are selected by the host.

Select the print screen feature with the following procedure.

- Verify that the printer is ready to print.
- Hold down the SHIFT key, and press the (PRINT)/ENTER key and release both keys. The characters displayed on the screen will be printed.
- To stop the print screen operation before printing is complete, enter and exit set-up.

In the case of both auto print and print screen operations, if printing has been stopped by entering and exiting set-up mode, move the printhead to the left margin. Refer to your printer's documentation for information about local operating procedures used with the printer.

- PRINTER CONTROLLER
  Printer controller gives the host direct control of the printer. When printer controller is selected, characters received from the host are not displayed on the video screen. The characters are sent directly to the printer.

- PRINT CURSOR LINE
  This lets you print the current line without changing the cursor position.

Programming Information

Escape and control sequences provide functions not offered by control characters of the character set. These sequences are multiple character control functions that are not displayed but determine terminal operation. Escape and control sequences are defined by ANSI X3.41-1977 and X3.64-1979. Refer to Appendix C for more information about sequences and sequence formats or consult the *User Guide* for your terminal model.

Maintenance

The VT100 family of terminals is designed to be easy to maintain. No preventive maintenance is required. The terminals have built-in, self-test diagnostics that greatly reduce the time necessary to isolate and repair faults. They also feature automatic self-tests that are run every time the terminals are powered up. Refer to the *User Guide* for your terminal model for more information about self-tests, as well as descriptions of fatal and nonfatal errors. Should a repair become necessary, Digital Field Service is available worldwide.

The VT100 family has proven to be an exceptionally reliable series of terminals. There are just two mechanical switches—one for turning the terminal on, and one for selecting the power supply voltage. The use of pop fasteners instead of screw fasteners reduces the time and cost of repairs by

providing easy access to all components. All other functions, such as baud rates, tabs, and parity, for example, are set via the keyboard and stored in the nonvolatile memory. The elimination of mechanical switches aids the use of diagnostics for testing the terminal functions and adapting to varying environments under host control.

Self-Test

A self-test mode is built into every VT100 family member. It automatically, or on command, tests the condition of the terminal should a fault be suspected. This self-test program checks the following items:

- Advanced video (if included)
- Nonvolatile memory
- Internal memory
- Keyboard

To invoke a self-test, you can:

- turn the terminal on, or
- hit the reset key while in set-up mode.

Operator Troubleshooting Checklist

If it appears that there is a problem in any member of the VT100 family of terminals, initiate the power-up self-test program. This test will help to determine if the problem lies in your terminal or in some other part of the computer system.

Terminal will not turn on when the power switch is set to ON.

- AC power cord is not plugged into the wall outlet. Plug in the cord.
- AC power cord is not plugged into the terminal. Plug in the cord.
- Power is not coming from the wall outlet. Check the outlet with a known working electrical device. If there is no power, contact an electrician.
- AC line fuse is blown. Turn off the terminal and have the fuse replaced.

No keyboard response.

- ON LINE or OFF LINE is not on and keyboard cable is not plugged into the monitor. Plug in the keyboard cable.
- KBD LOCKED indicator is on. Keyboard buffer is full and keyboard cannot accept any more characters since the computer sent the XOFF signal to the terminal. The KBD LOCKED condition may be cleared by entering and exiting the set-up mode. Be careful that characters are not lost during this

procedure. If this condition persists, check with host software documentation for a possible operating error.

- Perform the self-test.

ON LINE or OFF LINE indicator is on with no cursor on the screen.

- Screen brightness is too low. Enter set-up and increase screen brightness.

Garbled or error characters.

- Incorrect set-up feature. Possible set-up features that may be in error: ANSI/VT52 mode, auto XON/XOFF, bits per character, parity, parity sense, receiver speed, or transmit speed. Correct the set-up feature if it is in error and save them. Otherwise, the self-test may reset them to the saved NVR value.
- Perform the self-test operation.

Several successive long tones.

- The terminal has had difficulty in reading or writing the set-up features stored in nonvolatile memory. Check the feature settings and perform the save operation.
- Perform the self-test operation.

Terminal does not respond to typed characters.

- Screen cannot be updated by the computer, terminal transmitted XOFF. Press NO SCROLL button.

Additional Documentation

The following documents contain more detailed information about the VT100 family of terminals.

- *VT100 User Guide* (EK-VT100-UG)—Describes the installation, operation, and programming of the VT100 terminal.
- *VT100 Mini Maintenance Manual* (EK-VT100-J1)—Describes procedures to troubleshoot and repair the VT100 and VT125 terminals. Also identifies what various error codes mean.
- *VT100 Technical Manual* (EK-VT100-TM)—Describes VT100 and VT125 terminals to detailed block level.

- *VT100 Illustrated Parts Breakdown* (EK-VT100-IP)—Provides a detailed parts breakdown of the VT100 field replaceable units. Does not contain part numbers for components on the printed circuit boards.

- *VT100 Print Set* (MP-00633)—Provides a complete set of electrical and mechanical schematic diagrams for the VT100 terminal.

The documents listed below are free and can be ordered from:

Digital Equipment Corporation
Publishing and Circulation Services
10 Forbes Road
Northboro, Massachusetts 01532

- *PDP-11* and *VAX Systems & Options Catalogs*—Provide you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These customer documents are designed to help you select the right Digital product for your needs. European versions are also available.

If you require information not contained in these documents, contact your local Digital representative, dealer, or distributor.

• Specifications

Performance Characteristics

Display	
CRT	30.5 cm (12 in) diagonal measure, P4 phosphor
Text format	4 lines by 80 characters or 14 lines by 132 characters, (keyboard- or host-selectable) or 24 by 132 characters with Advanced Video Option
Character	7 by 9 dot matrix with descenders
Character size:	3.35 mm × 2.0 mm (0.132 in × 0.078 in) in 80-column mode 3.35 mm × 1.3 mm (0.132 in × 0.051 in) in 132-column mode
Active display size	202 mm × 115 mm (8 in × 4.5 in) (text) 195 mm × 115 mm (7.68 in × 4.5 in) (graphics)
Character set	ASCII and U.K. displays 95-displayable characters with (upper/lowercase, numeric, and punctuation), 32-character special graphics set

Cursor type	Keyboard-selectable, blinking block character or blinking underline (text) Flashing crosshair, visible when graphics mode active (graphics)
Keyboard	
General	3-key detachable unit with a 1.9 m (6 ft) coiled cord attached
Key layout	5-key arrangement and sculpturing similar to standard typewriter keyboard with an 18-key auxiliary keypad
Auxiliary keyboard	8-key numeric keypad with period, comma, minus, enter, and four general-purpose function keys

Communications

Type	Full-duplex, asynchronous (all models) True half-duplex, full-duplex, or asymmetric full-duplex (VT102, VT131) Block mode (VT131)
Interface	IA RS-232-C (standard) 20 mA (optional)
Speeds	0, 75, 110 (two stop bits), 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600, 19,200 b/s
Parity	Even, odd, mark, or none—keyboard-selectable
Synchronization	Keyboard-selectable via automatic generation of XON and XOFF control codes

Power Requirements

Line voltage	9-128V RMS single phase, 2 wire 198-256V RMS single phase, 2 wire (switch-selectable)
Line frequency	7-63 Hz
Current (VT100, VT125)	.2 A RMS maximum at 115 Vac RMS 1.1 A RMS maximum at 230 Vac RMS
Current (VT101, VT102, VT131)	.80 A RMS maximum at 120 Vac RMS 0.40 A RMS maximum at 240 Vac RMS
Power consumption (VT100, VT125)	50 W RMS

Power consumption (VT101, VT102, VT131)	0 W RMS
Current limiting (VT100, VT125)	A normal blow fuse
Current limiting (VT101, VT102, VT131)	.25 A fast blow fuse (120 V) 0.75 A slow blow fuse (240 V)
Power cord:	Detachable, 3 prong, 1.9 m (6 ft)

Operating Environment

Temperature	0°C to 40°C (50°F to 104°F)
Relative humidity	0% to 90% noncondensing
Maximum wet bulb:	8 + °C (82 + °F)
Altitude:	.4 km (8,000 ft)

Physical Characteristics

Height	36.8 cm (14.5 in)
Width	45.7 cm (18 in)
Depth	36.2 cm (14.2 in)
Weight	13.6 kg (30 lbs)
Weight (VT125)	14.6 kg (32.2 lbs)
Keyboard	
Height	.9 cm (3.5 in)
Width	5.7 cm (18 in)
Depth	0.3 cm (8 in)
Weight	.0 kg (4.5 lbs)

▪ VT52

The VT52 is an upper- and lowercase ASCII video terminal whose display holds 24 lines of 80 characters. The terminal features multikey rollover and keyclick.

The VT52 provides a two-way numeric keypad. In one mode, the keypad is used to generate program-compatible numeric codes. If your application requires much numeric input, you can use the VT52 without modifying hardware or software; or software can place the VT52 in the alternate mode, in which each key on the keypad transmits a unique escape sequence. This allows the host computer to distinguish between keys typed on the auxiliary keypad and similiar keys on the main keyboard. In this mode, each key on the keypad can be used to invoke a user-defined function.

The VT52 has a wide range of cursor-positioning functions. As well as moving the cursor one position in any direction, software can move the cursor to any position on the screen with a Direct Cursor Addressing command that specifies the destination of the cursor. The VT52 also offers fixed horizontal tabs, a Cursor-to-Home command, and two screen-erasure functions. Data on the screen scrolls up when a linefeed function is performed with the cursor on the bottom line. Data scrolls down when a reverse linefeed function is performed with the cursor on the top line.

▪ VT55

The VT55 is an on-line interactive video terminal. It serves as an alphanumeric, graph drawing, and printer/plotter terminal. It can be used in plotting histograms, waveform and peak analyses, data acquisition, monitoring, trending, simulation, and laboratory charts and forms. The VT55 allows simultaneous display of any combination of text and graphics, and supplies a hardcopy reproduction of the display screen for characters and graphs.

The VT55 can be used as a 24-line programmer's terminal, using only alphanumeric capability with the console keyboard and keypad. The VT55 is packaged in a compact desktop cabinet, and information is displayed on a 12-inch CRT.

The copier option uses a scanning technique similar to methods used in facsimile picture transmission systems. This technique, in conjunction with the use of modern recording paper, generates high-quality copy in a small package with a minimum of moving parts.

For most applications the VT55 will be interfaced to a host computer with a serial line cable and operated in full-duplex communication mode. Data transmitted by the VT55 is received by the host computer. Data received by the VT55 is determined solely by the host computer.

The VT55 may also be set to local mode or to full-duplex with local copy mode of operation. The latter is useful when the host computer does not generate an immediate echo or response to a keyboard transmission, and a visual verification of the information being set is desired.

The VT55 is capable of sending and receiving at rates from 75 to 9600 bits per second. Data is sent in serial digital format for the 20mA interface models. The EIA interface models allow the use of the VT55 with RS232-C signals.

VT55 models with Mate-N-Lok connectors are primarily intended for interfacing with 20mA digital serial line communications interfaces. Units with RS232-C connectors are compatible with RS232-C Standard Data Phone and modem connectors. Connector 283B is a telephone-type plug compatible with DECsystem-10s.

VT101, VT102, and VT131 Video Terminals

The success of the VT100 video terminal led to the development of three additional terminals that offer full VT100 functionality plus additional features.

• VT101

Digital's VT101 terminal the low end product of the VT100 family. If you want all the capabilities of the VT100 but do not require expandability for your application, then the VT101 may be the terminal for you. The VT101's basic functionality is the same as that of a VT100 without options. The VT101 video terminal is totally self-contained, with no functional upgrade options.

The general purpose VT101 terminal can be used in a variety of applications—commercial, educational, and industrial, as well as for small businesses. It includes selectable local echo that allows the VT101 terminal to be used connected to non-Digital computer systems. It does not accept any options except for the 20 mA adapter, which allows for connection of the terminal in remote applications.

• VT102

Digital's VT102 terminal gives you enhanced VT100 functionality. Like the VT101, the VT102 is a low-cost product and incorporates the most popular VT100 options—the advanced video option and the serial printer port—in its base design. The advanced video option provides three capabilities.

- Any combination of bold, blink, reverse video, and underline, that highlights on a per-character basis.
- Space and connectors for an alternate character set that allows you to have additional character sets resident in the terminal.
- Extra screen memory to support 132 column-by-24-line displays.

The serial RS-232 printer port enables you to connect a printing terminal so you can generate a hardcopy printout of your screen's contents.

The VT102 supports the ability to insert or delete characters and lines of characters at the cursor position. The VT102 also supports insert and replace modes for adding characters. Insert mode displays the newly-added characters and moves previously displayed characters to the right. Replace mode adds characters by replacing the character currently at the cursor position.

A nonexpandable, general-purpose video terminal that can be used in commercial, educational, and industrial applications, the VT102 has built into it special communication-oriented features. These include modem support and true half-duplex communication protocols, as well as selectable local echo.

With the VT102 terminal, you can even select a model with a word processing keyboard.

▪ VT131

The VT131 gives you the most popular VT100 options built into the terminal—advanced video and printer port. In addition, the VT131 has the advantage of two modes of transmission, conversational or block mode. The block mode environment lets you locally edit data before transmitting it to the host.

Designed for a variety of data entry applications, the nonupgradeable, block mode VT131 video terminal provides:

- Conversational or local/edit block mode transmission
- Protected fields
- Data compression
- Selectable local echo
- Built-in advanced video
- Built-in printer port
- VT100 and VT102 compatible character transmission
- U.S./European half- and full-duplex communications and modem control

The local edit capability of the VT131 terminal allows you to enter and locally edit a full screen of data before transmitting the data as a block to the host. Local editing also reduces the amount of time the CPU spends processing data entry, since many editing features are built into the terminal, and need not be in your application program. The editing functions of the VT131 terminal include insert/delete character or line, active cursor controls, and forward/back tab. With block mode transmission, the host does not receive data on a

character-by-character basis with each character requiring editing. This block mode feature allows the VT131 to be used on non-Digital systems where block mode transmission is required.

Protected fields prevent certain areas of the screen from being modified by data entry from the keyboard. This is valuable for forms applications. Data compression allows for selectable transmission of all or just unprotected data. This reduces the amount of data transmitted in a forms application.

Digital currently supports the VT131's block mode transmission under VAX/VMS version 3.0 and later versions. Support is at the operating system level, and this requires the use of third-party applications programs to take full advantage of the VT131's features. This allows Digital software OEMs that use block mode terminals to use their software on Digital hardware with minimal modification. Digital has no plans to provide application software for the VT131 in other than VT102 (conversational) mode.

Other than VMS, Digital operating systems are optimized for conversational entry, and thus require careful use or modification in order to efficiently handle a number of VT131s. Modification may include expanding the buffer size of the terminal handler, changing the interrupt routines, etc. The exact modifications are application and system dependent and should only be attempted by those customers who possess operating system expertise. Modification of the operating system is *not* supported by Digital.

▪ Options

Part Number	Description
VT1XX-CA	VT101/VT102/VT131 20 mA current loop option with cable.

▪ Accessories and Supplies

The following VT101, VT102, and VT131 accessories and supplies are available. Check with your sales representative for the latest information.

Spares

Part Number	Description
4A-VT101-00	VT101 spares kit
4A-VT102-00	VT102 spares kit
4A-VT131-00	VT131 spares kit

Figure B-8 ▪ VT131 Keyboard Indicators

Edit Indicator
This is found on the VT131 terminal and shows when the terminal is in edit or interactive mode. When the terminal is in edit mode, the indicator is on. Characters typed on the keyboard are displayed on the screen. The characters on the screen are edited before they are transmitted to the host. When the terminal is in interactive mode, the indicator is off. The terminal immediately transmits each character when typed.

▪ Operator Features

All VT100 family members incorporate features that can be selected in set-up. Set-up features determine how the terminal operates. They allow the terminal to be configured according to your preference, and provide compatibility to the host and AC power source. Unlike most terminals, the VT100 family does not use switches or jumpers to individually turn the built-in features on or off. Instead, they use a nonvolatile memory (NVR) that always remembers what features have been selected, just as if a switch had been set.

▪ Controls and Indicators

The VT101, VT102, and VT131 terminals have the same monitor, keyboard, and audible and visual controls as the other members of the VT100 family. See the *VT101, VT102, or VT131 User Guides* for more information. However, some indicator LEDs have been assigned for specific applications in the VT102 and VT131 terminals.

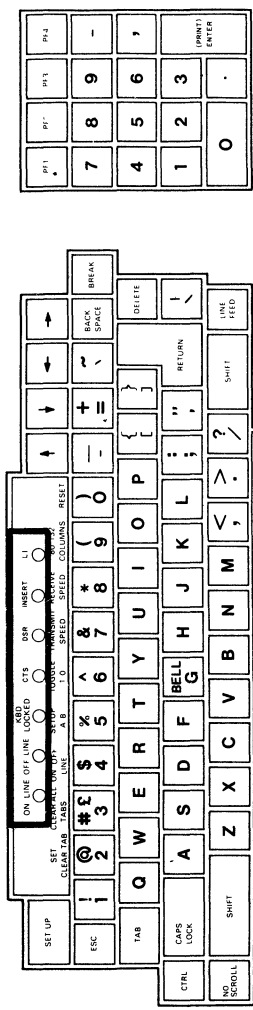

Figure B-7 ▪ VT102 Keyboard Indicators

CTS Indicator
This is found in the VT102 and VT131 terminals. It shows the on and off position of the Clear to Send or Secondary Clear to Send modem connector signals. The internal communication switches of the terminal determine the connector signal used to turn on and off the CTS indicator. The on condition means that characters can be transmitted by the terminal.

DSR Indicator
This is found in the VT102 and VT131 terminals. It shows the condition of the Data Set Ready modem connector signal. The on and off condition of the Data Set Ready signal turns the indicator on and off. The on condition means that the Data Set is ready to transmit and receive characters. **Note:** When the 20 mA current loop option is installed, the DSR signal is not used.

Insert Indicator
This is found in the VT102 and VT131 terminals. It shows when the terminal is in insert or replace mode. When the terminal is in insert mode, the INSERT indicator is on. The terminal inserts characters at the cursor position, moving all previously displayed characters to the right. Characters moved past the right margin are lost. When the terminal is in replace mode, characters are added by writing over previously displayed characters at the cursor position.

Set-Up

Set-Up mode provides two, or in the case of the VT131, three brief descriptions of the current feature status. Set-Up A displays the location of the tab stops set in the terminal and a visual ruler which numbers each character position on the line. The status of other terminal features is summarized in Set-Up B.

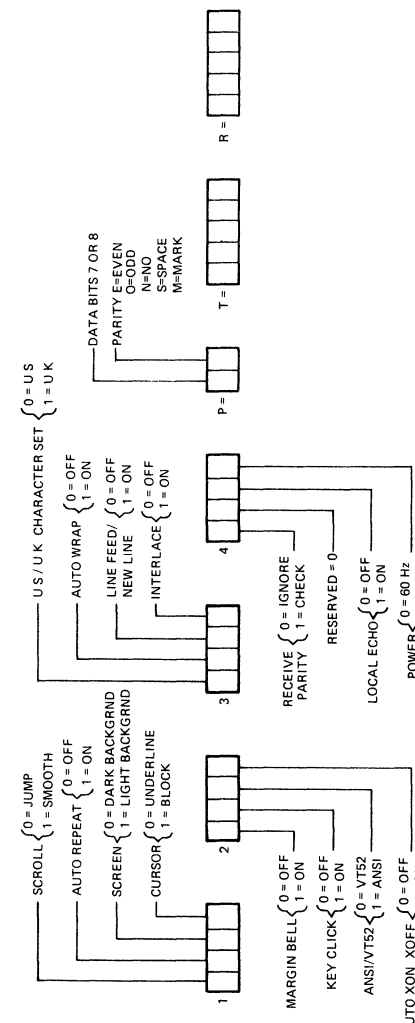

Figure B-9 ▪ Summary of Set-Up B mode for VT101

Set-Up B mode can only be entered from Set-Up A Mode. Because the VT101, VT102, and VT131 terminals have features different from a regular VT100 terminal, Set-Up B has additional features for you to select.

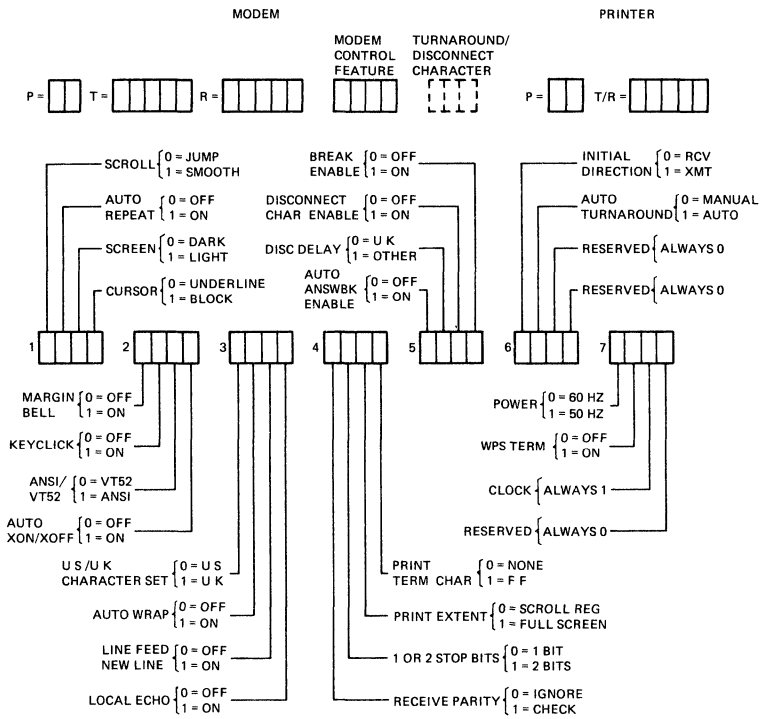

Figure B-10 ▪ Summary of Set-Up B Mode for VT102

In addition to all the Set-Up B features for the VT100 family, the VT101, VT102, and VT131 have some additional set-up choices.

- WPS TERMINAL
  This feature exchanges the position of the linefeed and the backslash key.
  Note: Only on VT102 and VT131.

- LOCAL ECHO
  Most computers echo back characters as they are received, but some do not. If the host does not echo characters, the local echo feature can be selected so that

the terminal prints each character as it is typed. If the host computer does echo each character, the local echo feature can be disabled. **Note:** Only on VT101, VT102 and VT131.

- PRINT TERM CHAR
  The print termination character feature determines if a form feed (FF) control character is transmitted to the printer after a print screen operation. When the print termination character is selected as a form feed, a form feed character is transmitted to the printer after the screen is printed. **Note:** Only on VT102 and VT131.

- PRINT EXTENT
  This feature determines which characters on the screen are printed during a screen operation. When this feature is set for full screen, all characters on the screen are printed. When the feature is set for scrolling region, only the characters located in the scrolling region are printed. **Note:** Only on VT102 and VT131.

- STOP BITS
  Selects the use of one or two bits by the modem interface. This features does not determine the number of stop bits used by the printer interface. **Note:** Only on VT102 and VT131.

- AUTO ANSWERBACK ENABLE
  This lets the terminal automatically transmit the answerback message when a connection is made to the computer. When using half-duplex communication with the initial direction feature selected to receive, the answerback message is not transmitted until the terminal is able to transmit, once it is no longer receiving data. This feature does not affect the transmission of the answerback message. **Note:** Only on VT102 and VT131.

- DISC DELAY
  The disconnect delay feature is only used when the modem control set-up feature is set to full-duplex with modem control. It determines the time allowed before the terminal disconnects from the communication line when the receive line signal detection is lost. **Note:** Only on VT102 and VT131.

- DISCONNECT CHAR ENABLE
  The disconnect character enable feature determines if the terminal disconnects from the communications line when the disconnect character is received. When this feature is on, the terminal disconnects when the disconnect character is received. Also, the terminal automatically transmits the disconnect character when the SHIFT and BREAK key sequence is used. The disconnect character is usually the end of transmission (EOT) control character. [fb]Note:[fr] Only on VT102 and VT131.

Set-Up B

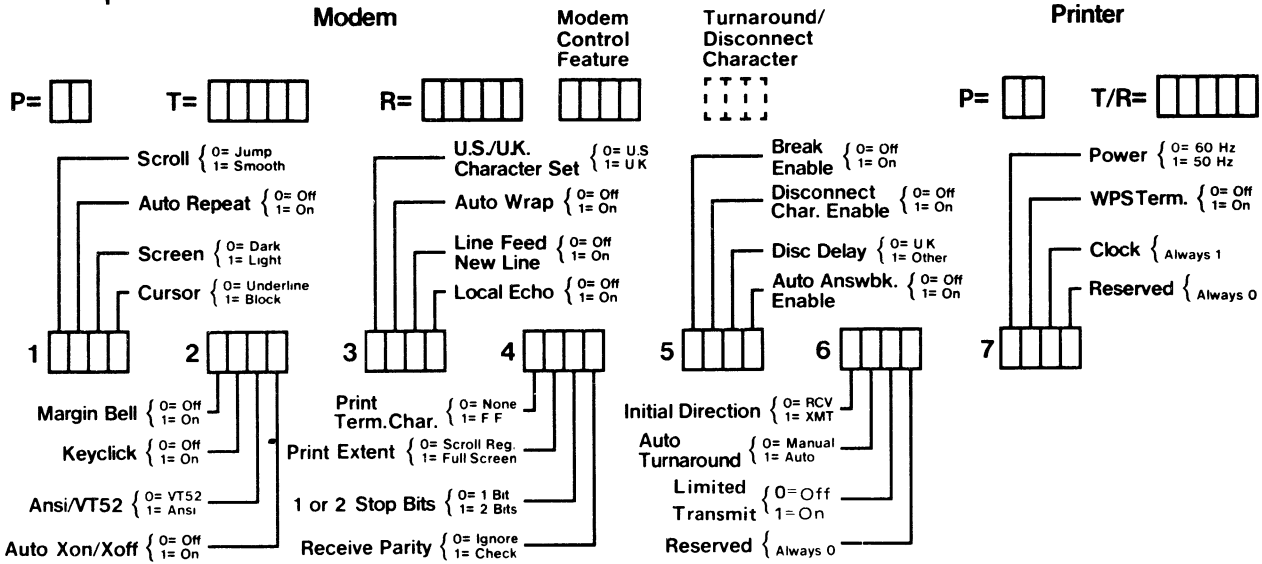

Figure B-11 ▪ Summary of Set-Up B Mode for VT131

- BREAK ENABLE

  The break enable feature determines if a break signal is transmitted when the BREAK key is pressed. If this feature is on, pressing the BREAK key causes the break signal to be transmitted. If the feature is off, the BREAK key does not function when pressed alone. However, all other sequences that use the BREAK key are not affected. **Note:** Only on VT102 and VT131.

- INITIAL DIRECTION

  This is only used when the modem control set-up is selected at half-duplex. This feature checks to determine if the terminal begins half-duplex communication by receiving or transmitting characters. **Note:** Only on VT102 and VT131.

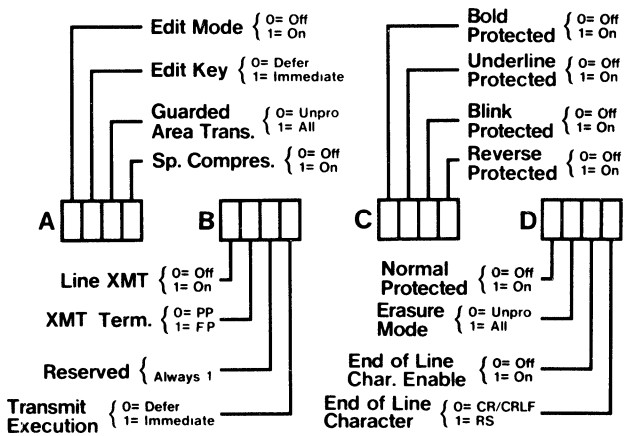

Figure B-12 • Summary of Set-Up C Mode for VT131

- AUTO TURNAROUND

  This is only used when the modem control set-up is selected at half-duplex coded control. Auto turnaround causes the turnaround character to be transmitted automatically. This character is automatically transmitted after the characters transmitted by the RETURN key and the end of the answerback message. **Note:** Only on VT102 and VT131.

- MODEM

  Both the VT102 and the VT131 feature modem control. Modem control signals are used to ensure that a connection exists between the terminal and computer before and during communication. If the connection does not exist, communication is not permitted. This selection is used when communicating with a computer through a full-duplex modem that uses modem control signals. These two terminals also offer asymmetric full-duplex that is full-duplex communication using a half-duplex modem with a secondary channel. The secondary channel of the half-duplex modem provides full-duplex communication by allowing the terminal to transmit characters on the secondary channel. **Note:** Only on VT102 and VT131.

- PRINTER DATA/PARITY BITS

  The printer data/parity bits feature defines two separate but related communications features—data bits per character and parity—when communicating with the printer. Data bits per character defines the number of data bits of the transmit and receive characters, seven or eight bits. When eight bits is selected, however, the eighth bit is set to a space or zero for characters transmitted. The eighth bit of received characters is ignored.

  Parity defines the type of parity bit the terminal generates when transmitting characters, and checks when receiving characters. If no parity is selected, the parity bit is not included in the transmitted character and is ignored in received characters. **Note:** Only on VT102 and VT131.

- DEFAULT MODE

  Default settings can be recalled by pressing SHIFT and D while in set-up mode. This feature is available on the VT101, VT102, and VT131 terminals.

• Programming Information

Escape and control sequences create functions not provided by standard control characters of the character set. These sequences are multiple character control functions that are not displayed but determine terminal operation. Escape and control sequences are defined by ANSI X3.41-1977 and X3.64-1979. Refer to Appendix C for more information about sequences and sequence formats or consult the *User Guide* for your terminal model.

• Maintenance

The VT101, VT102, and VT131 terminals are designed to be easy to maintain. No preventive maintenance is required. They have built-in, self-test diagnostics that greatly reduce the time necessary to isolate and repair faults. These terminals also feature automatic self-tests that are run every time they are powered up. The use of pop fasteners instead of screw fasteners reduces the

time and cost of repairs by providing easy access to all components. Should a repair become necessary, Digital Field Service is available worldwide.

The VT100 family has proven to be an exceptionally reliable series of terminals. There are just two mechanical switches—one for turning the terminal on, and one for selecting the power supply voltage. All other functions, such as baud rates, tabs, parity, etc., are set via the keyboard and stored in the nonvolatile memory. The elimination of mechanical switches aids the use of diagnostics for testing the terminal functions and adapting to varying environments under host control.

Self-Tests

Automatic self-test modes are built into the VT101, VT102, and VT131 terminals.

- VT101 SELF-TESTS

  The VT101 uses two self-tests to verify proper operation: a power-up self-test and a data loopback self-test. The power-up self-test is performed each time the terminal is powered up. The data loopback self-test is performed after the power-up test is successfully completed. To run the data loopback self-test, the terminal must be disconnected from the communication line and an external loopback connector must be installed. See your *VT101 User Guide* for further details.

- VT102 SELF-TESTS

  In addition to the same power-up and data loopback self-tests performed by the VT101 terminal, the VT102 terminal runs an EIA loopback self-test and a printer loopback self-test.

  The EIA loopback self-test verifies that the VT102 terminal can operate its modem control lines. The printer loopback self-test checks that the VT102 terminal printer interface can transmit and receive characters. In the printer loopback test, the transmit and receive lines are connected to each other with an external loopback connector. The terminal transmits characters on the transmit line and receives the characters on the receive line. Details on test procedures are in the *VT102 User Guide*.

- VT131 SELF-TESTS

  The VT131 terminal performs the same self-tests—power-up, data loopback, EIA loopback, and printer loopback—as the VT101 and VT102 terminals. It also runs a printer self-test that verifies that the terminal and the printer can communicate. This test generates sample data for printing and transmits this data to the printer. Check you *VT131 User Guide* for details.

Operator Troubleshooting Checklist

If it appears that there is a problem in the terminal, initiate the power-up self-test program. This test will help to determine if the problem lies in your terminal or in some other part of the computer system.

- VT101, VT102, VT131

Two characters appear on the screen for each one character typed.

- Local echo feature on. Turn this feature off.

- VT102

KBD LOCKED indicator is on.

- When half-duplex communication is selected by the modem control set-up feature, the locked condition occurs whenever the terminal is receiving characters. The terminal cannot simultaneously transmit and receive characters in half-duplex mode. Once the terminal is no longer receiving characters, it can transmit characters via the keyboard.
- When a print operation is selected while off-line. Cleared when the print operation is complete.
- When the terminal is not properly connected to the computer or the communication line signals are not correct for communication. Cleared when a proper connection exists between the computer and terminal.

- VT131

KBD LOCKED indicator is on.

- Terminal transmitting in edit mode. Cleared when transmission is complete.

Printer does not print characters.

- Printer and terminal features do not match. Check set-up feature settings for terminal and printer.

Additional Documentation

The following documents contain more detailed information about the VT100 family of terminals.

- *VT101 User Guide* (EK-VT101-UG)—Describes the installation, operation, and programming of the VT101 terminal.

- *VT101 Series Pocket Service Guide* (EK-VT101-PS)—Describes procedures to troubleshoot and repair the VT101, VT102, and VT131 terminals.
- *VT101 Series Technical Manual* (EK-VT101-TM)—Describes VT101, VT102, and VT131 terminals to detailed block level.
- *VT101 Illustrated Parts Breakdown* (EK-VT101-IP)—Provides a detailed parts breakdown of the VT101 field replaceable units. Does not contain part numbers for components on the printed circuit boards.
- *VT101 Family Field Maintenance Print Set* (MP-01066)—Provides a complete set of electrical and mechanical schematic diagrams for the VT101, VT102, and VT131 terminals.
- *VT101 Terminal Programming Reference Card* (EK-VT101-RC)—Provides a summary of the VT101 escape and control sequences on a pocket-sized reference card.
- *VT102 User Guide* (EK-VT102-UG)—Describes the installation, operation, and programming of the VT102 terminal.
- *VT102 Illustrated Parts Breakdown* (EK-VT102-IP)—Provides a detailed parts breakdown of the VT102 field replaceable units. Does not contain part numbers for components on the printed circuit boards.
- *VT102 Terminal Programming Reference Card* (EK-VT102-RC)—Provides a summary of the VT102 escape and control sequences on a pocket-sized reference card.
- *VT131 User Guide* (EK-VT131-UG)—Describes the installation, operation, and programming of the VT131 terminal.
- *VT131 Illustrated Parts Breakdown* (EK-VT131-IP)—Provides a detailed parts breakdown of the VT131 field replaceable units. Does not contain part numbers for components on the printed circuit boards.
- *VT131 Terminal Programming Reference Card* (EK-VT131-RC)—Provides a summary of the VT131 escape and control sequences on a pocket-sized reference card.

The documents listed below are free and can be ordered from:

Digital Equipment Corporation
Publishing and Circulation Services
10 Forbes Road
Northboro, Massachusetts 01532

- *PDP-11* and *VAX Systems & Options Catalogs*—Provides you with the most accurate and up-to-date information on currently available PDP-11 and VAX systems, options, and software products. These customer documents are designed to help you select the right Digital product for your needs. European versions are also available.

If you require information not contained in these documents, contact your local Digital representative, dealer, or distributor.

VT125 Graphics Terminal

The VT125 Graphics Terminal combines a bit map graphics architecture and the versatile alphanumeric features of the VT100 Video Terminal. It is designed for use in business graphics, and laboratory and scientific applications. As a financial analysis or business data tool, the VT125 is capable of plotting trend lines, bar charts and pie charts. In engineering laboratory applications, it can be used for point plot graphs, and strip charts. To support programs written for the VT105, the VT125 includes a VT105 emulator.

The VT125 is a microprocessor-based terminal that directly executes Digital's general-purpose graphics descriptor, ReGIS (Remote Graphics Instruction Set). ReGIS allows the creation and storage of pictorial data as simple ASCII text. ReGIS is designed for efficient communication of graphics data to remote displays.

Major Features

The following features are unique to the VT125 Graphics Terminal:

- Universal VT100 Features—The VT125 terminal incorporates all of the basic VT100 features.
- Bit Map Graphics Architecture—The bit map architecture of the VT125 allows you to display many things that are difficult or impossible to display on an ordinary CRT, such as pie charts, bar graphs, trend lines, and special symbols. In graphics mode each pixel on the screen is controlled by bit map memory which is manipulated under program control.
- Screen Resolution of 768 by 240 Pixels—The VT125 display is made up of 240 rows of 768 dots. These dots (picture elements or pixels) can be controlled individually by your applications' programs.
- Two Full Graphics Planes—This feature allows the terminal to display images one at a time; two at a time, for comparison; or together to achieve varying shades of gray or color.

- VT105 Emulation Mode—The VT125 Graphics Terminal will support software written for a VT105 Terminal. This saves the time and expense of converting existing VT105 programs to ReGIS.
- Auxiliary Port—This feature allows for the connection of any EIA auxiliary device to the VT125. The primary purpose of this port is to connect a Letterprinter 100, LA50 Personal Printer, or DECwriter Correspondent printer for hardcopy of the image on the VT125 screen. The auxiliary port can communicate with the auxiliary device in 7- or 8-bit ASCII and is capable of communicating at one of four baud rates—300, 1200, 2400, or 9600. The EIA RS-232-C port is bidirectional.
- Color Output for RGB Monitor—This feature allows you to get color output when using the VT125. The VT125 has the capability of displaying 64 colors, four at a time on the color monitor.
- ReGIS Firmware—ReGIS firmware provides the ability for direct execution of ReGIS data plotting commands. The firmware interprets simple ASCII text and converts it into pictures on the video screen using lines, circles, and curves.

▪ Graphics

Graphics capabilities in the ReGIS firmware include:

- Line drawing with pattern mask definition. Allows a dot-dash pattern to be superimposed on a designated line.
- Automatic circle and curve generation.
- Macrographs to store often-used picture parts in the VT125 memory.
- Shading algorithms.
- Text writing and control commands.
- Screen control commands such as attribute selection and time delay before execution.

ReGIS

ReGIS, a graphic descriptor, is a symbol system that describes the parts of a picture. A picture (graphic) is the best way to communicate some types of information. A requirement for a graphic descriptor is to describe the picture with as few symbols as possible to save storage space and communication line time. ReGIS works by considering a picture to be a group of graphic objects. Each graphic object is a standard geometric shape that can be described with a few characters of information. For example, ReGIS understands that the shape of a circle applies to any circle that can be drawn. A circle can be described on the screen by the location of its center and a point on its circumference. The same type of understanding for other graphic objects allows ReGIS to be a compact descriptor of graphic images.

The VT125 Graphics Option can display 184,320 pixels in a 768-by-240-by-2 array and is considered a medium resolution device. The Graphic Option memory can store 196,608 pixels in a 768-by-256-by-2 array. The display of the VT125 is a window that looks into this memory. The window can move in any direction with a screen command to display all parts of the pixel memory, or move an object in the image to the center of the display.

Options

The VT125 Graphics Terminal is a VT100 text terminal with a factory installed Graphics Option. Other options are listed below.

Part Number	Description
VT1XX-AB	Advanced video option for VT100 or VT125. Adds the following features to the text terminal capabilities of the VT125: four alternate character attributes—bold, underline, reverse video, and blink—which can be selected in any combination on a character-by-character basis; extra memory to display a total of 24 lines in either 80 or 132 column format; provision for alternate character sets, which may also be selected on a character-by-character basis.
VT1XX-CA	VT101/VT102/VT131/VT125; 20 mA current loop option with cable.
VT1XX-CE	Upgrade kit to convert your VT100 or VT125 to word processing keyboard.

• Accessories and Supplies

The following VT125 accessories and supplies are available. Check with your sales representative for the latest information.

Spares

Part Number	Description
4A-VT125-00	VT125 spares kit

• Controls and Indicators

The VT125 has the same monitor, keyboard, and audible and visual controls and indicators as other members of the VT100 family. See the *VT125 User Guide*.

• Operator Features

All VT100 family members incorporate features that can be selected in set-up. Set-up features determine how the terminal operates. They allow the terminal to be configured according to your preference, and provide compatibility to the host and AC power source. Unlike most terminals, the VT100 family does not use switches or jumpers to individually turn on or off the built-in features. Instead, these terminals use a nonvolatile memory (NVR) that always remembers what features have been selected, just as if a switch had been set.

Set-Up

Set-up mode provides two brief descriptions of the current feature status. Set-Up A displays the location of the tab stops set in the terminal and a visual ruler that numbers each character position on the line. The status of other terminal features is summarized in Set-Up B.

Set-Up B mode can only be entered from Set-Up A mode. Because the VT125 Graphics Terminal has features not included with a regular VT100 terminal, Set-Up B has additional features for you to select.

• Communications

The VT125 is a serial line interface video terminal. It communicates asynchronously over full-duplex lines. All communications features are keyboard-selectable. Transmit and receive speeds can be set independently at 16 different rates from 50 to 19,200 baud. An EIA RS232-C compatible interface is standard. A 20 mA current loop interface is optional.

The VT125 Graphics Terminal can be connected to a computer directly or through a common carrier facility (telephone line). In both applications, either the Electronic Industry Association (EIA) interface provided with the terminal or the 20 mA current loop interface option are used.

When connecting the terminal to the computer through a telephone line, a modem or acoustic coupler is needed. The modem or acoustic coupler changes the serial characters transmitted between terminal and computer into signals that can be transmitted over the telephone line. Several types of modems can be used with the VT125 terminal. However, the modem used by the terminal must be compatible with the modem used by the computer.

▪ Programming Information

The VT125 terminal responds to three different programming standards:

- In ANSI (American National Standards Institute) mode, the VT125 will support software based on ANSI standards—ANSI X3.4-1977, X3.41-1974, X3.64-1979.
- In VT52 mode, the VT125 terminal will support software written for use with the DIGITAL VT52 video terminal.
- In VT105 mode, the VT125 terminal will respond to software written for use with the DIGITAL VT105 terminal.

Consult your *VT125 User Manual* for detailed information on escape sequences and sequence formats.

▪ Maintenance

The VT125 has an automatic internal self-test that checks the terminal for correct operation every time the power is turned on. The VT125 is easy to maintain. No preventive maintenance is necessary. If a repair should be required, Field Service is available worldwide. The terminal is designed to make machine access and the replacement of parts fast and easy.

Self-Test

The VT125 terminal has several self-tests available for checking the operation of the terminal.

- Power-up self-test
- Computer port data loopback self-test
- Auxiliary port data loopback test
- Display test
- Video bit map memory test

To prepare for all the tests except the power-up test, prepare the terminal by first pressing the power switch to the OFF position. Then disconnect the communications cables from the computer and auxiliary data ports. Third, if a cable was connected to the EIA computer port connector, install an EIA loopback connector on the EIA connector. If the cable was connected to the 20 mA connector, then install the loopback connector that was included with that option. Do not use the EIA loopback connector at the same time as the current loopback connector. Finally, turn the power switch ON. **Note:** To perform auxiliary port tests, consult your *VT125 User Guide* for details.

Operator Troubleshooting Checklist

If it appears that there is a problem in the terminal, initiate the power-up self-test program. This test will help to determine if the problem lies in your terminal or in some other part of the computer system.

Terminal does not respond to typed characters. Keyclicks are generated and keyboard indicators function.

- Print operation cannot be completed. Check printer.

▪ Additional Documentation

The following documents contain more detailed information about the VT125 family of terminals.

- *VT125 User Guide* (EK-VT125-UG)—Describes the installation, operation, and programming of the VT125 terminal.
- *VT100 Mini Maintenance Manual* (EK-VT100-J1)—Describes procedures to troubleshoot and repair the VT100 and VT125 terminals.
- *VT100 Technical Manual* (EK-VT100-TM)—Describes VT100 and VT125 terminals to detailed block level.
- *VT125 Illustrated Parts Breakdown* (EK-VT125-IP)—Provides a detailed parts breakdown of the VT125 field replaceable units. Does not contain part numbers for components on the printed circuit boards.
- *VT125 Print Set* (MP-01053)—Provides a complete set of electrical and mechanical schematic diagrams for the VT125 terminal.
- *VT125 Terminal Programming Reference Card* (EK-VT125-RC)—Provides a summary of the VT125 escape and control sequences on a pocket-sized reference card.

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If you require information not contained in these documents, contact your local Digital representative, dealer, or distributor.

Specifications

Performance Characteristics

VT125 Graphics format	768 horizontal × 240 vertical addressable points, two planes 768 × 480 logical address range for 2:1 picture aspect ratio

VT125 Graphics Communication

Composite video output	Composite video output provides RS170 output with the following nominal characteristics:
Output impedance	Equals 75 ohms, DC coupled sync level 0 V
Black level	Equals approximately 0.3 V when loaded with 75 ohms
White level	Equals approximately 1.0 V with a 75 ohm load
Composite sync waveform	Meets EIA RS170 standards
Vertical interval	composed of six equalizing pulses, six vertical sync pulses, and six more equalizing pulses.

Video Input (J8)

An analog signal applied to the video input will be "ORed" with the internal video signal so the beam intensity at any point on the screen will correspond to the intensity of that signal. This would tend to make the beam brighter at that

point. A video signal on this input affects only the internal screen and does not appear on the composite video output. This input has the following nominal characteristics:

Input impedance	75 ohms, DC coupled
Black level	0 V
White level	1.0 V
Maximum continuous input	± 2.0 V

The external video source must be synchronized to the VT125. It may do this by referencing the composite sync on the composite video output. This means that the video input will not synchronize with any composite video source.

Color Video Output

RGB	DC coupled analog signal
Output impedance	75 ohms
Level ranging	0-1 volt
Synchronization	None embedded

• Ruggedized Terminals

Information is highly critical to manufacturing operations. It must be read, it must be current, and it must be readily available—regardless of local conditions.

Digital's RT family of ruggedized terminals—the RT100, RT102, RT103, and RT137—are specifically designed for use in harsh, industrial environments. But what is a harsh, industrial environment and how can ruggedized terminals withstand the conditions there?

- Manufacturing plants. Great amounts of dust, dirt, and grease can get into unsealed areas of terminals and disrupt their operation. Digital's ruggedized terminals are sealed in outer casings of durable metal.

- Automotive production lines. Here the possibility of paint vapors affecting the operation of nonruggedized terminals and heavy tools being dropped on terminals exist. Ruggedized terminals' outer casings are built of durable metals.

- Steel foundries. Dust and heat can combine to create harsh environments. Digital's ruggedized terminals have cooling fans built right in.

- Milling and grinding operations. Oil droplets and metal particles can get into unsealed areas of terminals and disrupt their operations. Digital's ruggedized terminals are resistant to the effects of these substances because of their durable, sheet metal construction.

- Chemical plants. Here the display unit and keyboard are exposed to liquid spills. Ruggedized terminals have a membrane style keyboard, which provides resistance to most liquids, grease, oil, and dust. Membrane style keyboards are easy to clean. Digital's ruggedized terminals' monitors and associated electronics are housed in a metal enclosure, which makes them resistant to liquid spills too.

- Mines. Ruggedized terminals prevent dirt and dampness from affecting terminal operations.

- Any cluttered shopfloor. Terminals must be positioned for your easy access. Digital's RT terminals can be installed on a bench, table, or shelf. The keyboard is detachable, or can be used perpendicular to or dropped to form a straight plane with the terminal screen.

Digital's RT terminals work with any UNIBUS or LSI-11 PDP-11, VAX, or DECsystem-10 and -20 processor and are supported by all Digital operating systems.

RT100 Ruggedized Terminal

The RT100 ruggedized video terminal combines full VT100 functionality with packaging to withstand the abuse of hostile industrial environments where full data collection capability is needed. Its industrial packaging includes:

- A flat membrane, full alphanumeric keyboard, and numeric keypad. This keyboard allows simple, efficient data entry and interaction. It also is resistant to most liquids, grease, oil, and airborne particles.

- The display and keyboard are housed in durable metal enclosures. The keyboard is detachable, allowing you to mount either the display or keyboard on a shelf or tabletop.

- A fan ventilates the enclosure by exhausting air out the rear of the cabinet. An easy-to-service slide-out air filter greatly reduces dust and particulate infiltration.

- Each terminal is resistant to the effects of airborne particles, of temperature, of humidity to mechanical shock, and to vibration.

The RT100 possesses full universal VT100 performance characteristics and compatibility. Like the VT100, an RT100's performance can be enhanced with the advanced video option, which adds such video attributes as blinking,

underlining, bolding, and reverse video. For more details on the RT100's capabilities, read the description of the VT100 terminal.

RT102 Ruggedized Terminal

The RT102 terminal, a ruggedized version of Digital's VT102 video terminal, contains all the universal performance characteristics of the VT100 terminal, the ruggedized features of the RT100 terminal, and the built-in advanced video option and printer port of the VT102.

For formatting, prompting, guidance, and alarm functions, the RT102's advanced video feature permits any character to be displayed in a user-selectable combination of blinking, underlining, boldface, and reverse video. The advanced video option also increases screen capacity by greater than 70 percent. The RT102 includes the built-in printer port connector. Immediate printout of data on the video display is possible by either operator or host command for use when additional analyses or status documentation is required.

RT100 and RT102 Specifications

- COMMUNICATIONS

Data interface	EIA (RS232) or 20 mA current loop

- POWER REQUIREMENTS

RT100	120/240 Vac; 50/60 Hz
RT102	120/240 Vac; 50/60 Hz
Power Consumption	
RT100	50 W
RT102	0 W

- OPERATING ENVIRONMENT

Temperature	
Operating	5°C to 50°C (41°F to 122°F)
Storage	– 40°C to 66°C (– 40°F to 151°F)
Relative Humidity	
Operating	0% to 90%, non-condensing
Storage	0% to 95%, non-condensing

- PHYSICAL CHARACTERISTICS

Width	52.1 cm (20.5 in)
Depth	67.3 cm (26.5 in)
Height	41.9 (16.5 in)
Weight	39 kg (86 lb)

• RT137 Terminal with Bar Code Capability

Designed for data-collection applications that require or can benefit from machine-readable input, the RT137 combines the flexibility of bar code with RT100 terminal features.

A bar code reader module that is an integral component of the RT137 architecture, a bar code wand, and adaptable bar code keyboard provide versatility for data collection applications. The RT137's construction not only means it can operate reliably in harsh industrial environments, but also allows the terminal to be located right where you need it.

The bar code legend can be used to represent almost any form of data, allowing the encodement of part numbers, quantities, transaction types, warehouse locations, and badge numbers, to name a few.

The RT137 contains all the ruggedized features of the RT100 terminal, but also includes a bar code wand. This wand is a ruggedly constructed visible-light pen that is virtually immune to mechanical shock and vibration.

As with other ruggedized Digital terminals, the RT137 has all the universal performance characteristics of our VT100 terminal, plus the following features.

- The VT100 functionality allows bar code input and data/transaction messages to be displayed and provides double-width/double-height characters, scrolling, reverse video, blinking, underlining, and split screens. These capabilities also make the RT137 useful for FMS and DATATRIEVE data collection reporting applications.

- The RT137 is adaptable to four industry standards: CODE 39 (full alphanumeric); 2-of-5 (numeric, high density); Interleaved 2-of-5 (numeric, high density); and CODE 11 (high density).

- The bar code wand uses a long-life LED visible-light source. The wand is virtually immune to mechanical shock and vibration. It operates efficiently with many types of printed bar code and provides a high first-read rate for bar code printed by dot-matrix printers.

The following RT137 models are available:

- RT137-AA—RT137-AE and VT100 keyboard, 120 Vac, EIA interface.
- RT137-AE—Barcode terminal, keyboard, and wand, 120 Vac, EIA interface.
- RT137-AK—RT137-AE and industrial membrane keyboard.
- RT137-AE without keyboard and wand.
- RT137-BA—RT137-BE, VT100 keyboard, 120 Vac, 20 mA interface.
- RT137-BE—Barcode terminal, keyboard, and wand, 120 Vac, 20 mA interface.
- RT137-BK—RT137-BE and industrial membrane keyboard.

RT137 Specifications

▪ COMMUNICATIONS

Data interface	EIA (RS232) or 20 mA current loop

▪ POWER REQUIREMENTS

Voltage	120/240 Vac
Frequency	50/60 Hz
Power Consumption	150 W

▪ OPERATING ENVIRONMENT

Temperature	
Operating	5°C to 50°C
Storage	– 40°C to 66°C (– 40°F to 151°F)
Relative Humidity	
Operating	10% to 90%, non-condensing
Storage	0% to 95%, non-condensing

- PHYSICAL CHARACTERISTICS

Width	52.1 cm (20.5 in)
Depth	67.3 cm (26.5 in)
Height	41.9 (16.5 in)
Weight	40 kg (88 lb)

* Other specifications are the same as the VT100.

• RT1XX-AE Membrane Keyboard

Digital's RT1XX-AE ruggedized membrane keyboard for the VT100 family extends the range of user environments. These environments include:

- Research labs. "Clean environments" where the keyboard is washed down several times a day and is exposed to liquid spills and other potentially damaging substances. The flat membrane keyboard tolerates most commercial and industrial cleansers and disinfectants and is completely sealed so that liquids cannot seep into the mechanics of the keyboard and disrupt its operations.
- Public libraries. Here terminals are used instead of a card catalog. This means that the keyboard is subjected to constant use and unintentional misuse by unskilled users. The membrane keyboard eliminates the possibility of lost keycaps.
- Light industrial areas. The flat membrane design enables the keyboard to withstand physical abuse and a wide range of liquid, solid, and airborne contaminants.

The RT1XX-AE is functionally compatible with the standard VT100-series keyboard and will work with VT100-series video displays. A full alphanumeric keyboard with a numeric keypad, including auxiliary keys to generate control sequences and cursor commands, lets you take full advantage of the versatile VT100-series terminals.

Appendix C ▪ Terminal Programming Summaries

▪ VT200 Family

TRANSMITTED CODES

Main Keypad Function Keys

Key	Code Transmitted
	DEL character
TAB	HT character
RETURN	CR character only or a CR character and an LF character, depending on the set/reset state of Linefeed/New Line mode (LNM).
CTRL	Does not transmit a code
LOCK	Does not transmit a code
SHIFT (2 keys)	Does not transmit a code
SPACE BAR	SP character.
COMPOSE CHARACTER	Does not transmit a code.

Editing Keys

Key	Code Generated VT200 Mode	VT100, VT52 Modes
FIND	CSI 1 ~	None
INSERT HERE	CSI 2 ~	None
REMOVE	CSI 3 ~	None
SELECT	CSI 4 ~	None
PREV SCREEN	CSI 5 ~	None
NEXT SCREEN	CSI 6 ~	None

Cursor Control Keys

	ANSI Mode* Cursor Key Mode		VT52 Mode*	
	Reset	Set		
Key	Normal	Application	Normal	Application
↑	CSI A	SS3 A	ESC A	ESC A
↓	CSI B	SS3 B	ESC B	ESC B
→	CSI C	SS3 C	ESC C	ESC C
←	CSI D	SS3 D	ESC D	ESC D

Auxiliary Keypad Keys

	VT100/VT200 ANSI Mode*		VT52 Mode*	
Key	Keypad Numeric Mode	Keypad Application Mode	Keypad Numeric Mode	Keypad Application Mode
0	0	SS3 p	0	ESC ? p
1	1	SS3 q	1	ESC ? q
2	2	SS3 r	2	ESC ? r
3	3	SS3 s	3	ESC ? s
4	4	SS3 t	4	ESC ? t
5	5	SS3 u	5	ESC ? u
6	6	SS3 v	6	ESC ? v
7	7	SS3 w	7	ESC ? w
8	8	SS3 x	8	ESC ? x
9	9	SS3 y	9	ESC ? y
–	–(minus)	SS3 m	–	ESC ? m
,	,(comma)	SS3 l	,	ESC ? l†
	(period)	SS3 n	.	ESC ? n
Enter	CR or CR LF	SS3 M	CR or CR LF	ESC ? M‡
PF1	SS3 P	SS3 P	ESC P	ESC P
PF2	SS3 Q	SS3 Q	ESC Q	ESC Q
PF3	SS3 R	SS3 R	ESC R	ESC R
PF4	SS3 S	SS3 S	ESC S	ESC S†

* ANSI mode applies to VT200 and VT100 modes. VT52 mode is an ANSI-incompatible mode

† You cannot generate these sequences on a VT52 terminal.

‡ Keypad Numeric Mode. ENTER generates the same codes as RETURN. You can change the code generated by RETURN with the Linefeed/New Line Mode. When reset, the Linefeed/New Line Mode causes RETURN to generate a single control character (CR). When set, the mode causes RETURN to generate two control characters (CR, LF)

Top Row Function Keys

Name on Legend Strip	Generic Name	Code Generated VT200 Mode	VT100, VT52 Modes
HOLD SCREEN	(F1)*	–	–
PRINT SCREEN	(F2)*	–	–
SET-UP	(F3)*	–	–
DATA/TALK	(F4)*	–	–
BREAK	(F5)*	–	–
F6	F6	CSI 1 7 ~	–
F7	F7	CSI 1 8 ~	–
F8	F8	CSI 1 9 ~	–
F9	F9	CSI 2 0 ~	–
F10	F10	CSI 2 1 ~	–
F11 (ESC)	F11	CSI 2 3 ~	ESC
F12 (BS)	F12	CSI 2 4 ~	BS
F13 (LF)	F13	CSI 2 5 ~	LF
F14	F14	CSI 2 6 ~	–
HELP	(F15)	CSI 2 8 ~	–
DO	(F16)	CSI 2 9 ~	–
F17	F17	CSI 3 1 ~	–
F18	F18	CSI 3 2 ~	–
F19	F19	CSI 3 3 ~	–
F20	F20	CSI 3 4 ~	–

* F1 through F5 are local function keys and do not generate codes.

Keys Used to Generate 7-Bit Control Characters

Control Character Mnemonic	Key Pressed With CTRL (All Modes)	Dedicated Function Key
NUL	2, space	
SOH	A	
STX	B	
ETX	C	
EOT	D	
ENQ	E	
ACK	F	
BEL	G	
BS	H	F12 (BS)*
HT	I	TAB
LF	J	F13 (LF)*
VT	K	
FF	L	
CR	M	RETURN
SO	N	
SI	O	
DLE	P	
DC1	Q†	
DC2	R	
DC3	S†	
DC4	T	
NAK	U	
SYN	V	
ETB	W	
CAN	X	
EM	Y	
SUB	Z	
ESC	3, [	F11 (ESC)*
FS	4, /	
GS	5,]	
RS	6, ~	
US	7, ?	
DEL	8	DELETE

* Keys F11, F12, and F13 generate these 7-bit control characters only when the terminal is operated in VT100 mode or VT52 mode.

† These keystrokes are enabled only if XOFF support is disabled. If XOFF support is enabled, then CTRL-S is a "hold screen" local function and CTRL-Q is an "unhold screen" local function.

RECEIVED CODES

Compatibility Level (DECSCL)

Sequence	Action
CSI 6 1 " p	Set terminal for level 1 (VT100 mode).
CSI 6 2 " p	Set terminal for level 2 (VT200 mode, 8-bit controls).
CSI 6 2 , 0 " p	Set terminal for level 2 (VT200 mode, 8-bit controls).
CSI 6 2 , 1 " p	Set terminal for level 2 (VT200 mode, 7-bit controls)
CSI 6 2 ; 2 " p	Set terminal for level 2 (VT200 mode, 8-bit controls).

C0 (ASCII) Control Characters Recognized

Mnemonic	Name	Action
NUL	Null	Ignored when received
ENQ	Enquiry	Answerback message is generated.
BEL	Bell	Generates bell tone if bell is enabled.
BS	Backspace	Moves cursor to the left one character position if cursor is at left margin, no action occurs.
HT	Horizontal tabulation	Moves cursor to next tab stop, or to right margin if there are no more tab stops Does not cause autowrap
LF	Linefeed	Causes a linefeed or a new line operation, depending on the setting of new line mode
VT	Vertical tabulation	Processed as LF
FF	Form feed	Processed as LF.
CR	Carriage return	Moves cursor to left margin on current line
SO (LS1)	Shift out (lock shift G1)	Invokes G1 character set into GL. G1 is designated by a select-character-set (SCS) sequence

C0 (ASCII) Control Characters Recognized (Cont)

Mnemonic	Name	Action
SI (LS0)	Shift in (lock shift G0)	Invoke G0 character set into GL. G0 is designated by a select-character-set (SCS) sequence.
DC1	Device control 1	Also referred to as XON. If XOFF support is enabled, DC1 clears DC3 (XOFF), causing the terminal to continue transmitting characters (keyboard unlocks) unless KAM mode is currently set
DC3	Device control 3	Also referred to as XOFF. If XOFF support is enabled, DC3 causes the terminal to stop transmitting characters until a DC1 control character is received
CAN	Cancel	If received during an escape or control sequence, terminates and cancels the sequence. No error character is displayed. If received during a device control string, the DCS is terminated and no error character is displayed.
SUB	Substitute	If received during escape or control sequence, terminates and cancels the sequence. Causes a reverse question mark to be displayed. If received during a device control sequence, the DSC is terminated and reverse question mark is displayed.
ESC	Escape	Processed as escape sequence introducer. Terminates any escape, control or device control sequence which is in progress
DEL	Delete	Ignored when received. Note: May not be used as a time fill character

C1 Control Characters Recognized

Control Character	Equivalent 7-Bit Code Extension	Name	Action
IND	ESC D	Index	Moves cursor down one line in same column. If cursor is at bottom margin, screen performs a scroll up
NEL	ESC E	Next line	Moves cursor to first position on next line If cursor is at bottom margin, screen performs a scroll up.
HTS	ESC H	Horizontal tab set	Sets one horizontal zontal tab stop at the column where the cursor is.
RI	ESC M	Reverse index	Moves cursor up one line in same column If cursor is at top margin, screen performs a scroll down
SS2	ESC N	Single shift G2	Temporarily invokes G2 character set into GL for the next graphic character G2 is designated by a select-character-set (SCS) sequence
SS3	ESC O	Single shift G3	Temporarily invokes G3 character set into GL for the next graphic character G3 is designated by a select-character-set (SCS) sequence
DCS	ESC P	Device control string	Processed as opening delimiter of a device control string for device control use

C1 Control Characters Recognized (Cont)

Control Character	Equivalent 7-Bit Code Extension	Name	Action
CSI	ESC [	Control sequence introducer	Processed as control sequence introducer.
ST	ESC \	String terminator	Processed as closing delimiter of a string opened by DCS.

CHARACTER SET SELECTION (SCS)

Designating "Hard" Character Sets

Character Set	Escape Sequence	Designate as:
ASCII	ESC (B	G0 (default)
	ESC) B	G1
	ESC * B	G2 (VT200 mode only)
	ESC + B	G3 (VT200 mode only)
DEC Supplemental (VT200 mode only)	ESC (<	G0
	ESC) <	G1
	ESC * <	G2
	ESC + <	G3
UK National (VT100 mode only)	ESC (A	G0
	ESC) A	G1
DEC Special Graphics	ESC (0	G0
	ESC) 0	G1
	ESC * 0	G2 (VT200 mode only)
	ESC + 0	G3 (VT200 mode only)

Designating "Soft" (Down-Line Loadable) Character Sets

Escape Sequence	Designate As:
ESC (Dscs	G0
ESC) Dscs	G1
ESC * Dscs	G2
ESC + Dscs	G3

Dscs can consist of zero, one, or two intermediate characters and a final character

Intermediate characters are in the range of 2/0 to 2/15, Final characters are in the range of 3/0 to 7/14 (see ASCII Code Table for column/row notation).

Invoking Character Sets Using Lock Shifts

Control Name	Coding	Function
LS0 – lock shift G0	SI	Invoke G0 into GL (default)
LS1 – lock shift G1	SO	Invoke G1 into GL.
LS1R – lock shift G1, right	ESC ~	Invoke G1 into GR. VT200 mode only.
LS2 – lock shift G2	ESC n	Invoke G2 into GL. VT200 mode only
LS2R – lock shift G2, right	ESC }	Invoke G2 into GR. (default) VT200 mode only.
LS3 – lock shift G3	ESC o	Invoke G3 into GL. VT200 mode only.
LS3R – lock shift G3, right	ESC |	Invoke G3 into GR VT200 mode only.

Invoking Character Sets Using Single Shifts

Control Name	Coding	Function
SS2 – single shift G2	SS2 ESC N	Invokes G2 into GL for the next graphic character
SS3 – single shift G3	SS3 ESC O	Invokes G3 into GL for the next graphic character

Select C1 Control Transmission

Control Name	Sequence*	Action
7-bit C1 control transmission (S7C1T)	ESC sp F	Causes all C1 codes returned to the application to be converted to their equivalent 7-bit code extensions.

NOTE
The S7C1T sequence is ignored when the terminal is in VT100 or VT52 mode.

8-bit C1 control transmission (S8C1T)	ESC sp G	Causes the terminal to return C1 codes to the application without converting them to their equivalent 7-bit code extensions.

* sp is a space character

Terminal Modes

Name	Mnemonic	Set Mode	Reset Mode*
Keyboard action†	KAM	Locked CSI 2 h	Unlocked CSI 2 l
Insertion-replacement	IRM	Insert CSI 4 h	Replace CSI 4 l
Send-receive	SRM	Off CSI 12 h	On CSI 12 l
Line feed-new line	LNM	New line CSI 20 h	Line feed CSI 20 l
Cursor key	DECCKM	Application CSI ? 1 h	Cursor CSI ? 1 l
ANSI/VT52	DECANM	N/A CSI ? 2 l	VT52
Column	DECCOLM	132 column CSI ? 3 h	80 column CSI ? 3 l
Scrolling†	DECSCLM	Smooth CSI ? 4 h	Jump CSI ? 4 l
Screen†	DECSCNM	Reverse CSI ? 5 h	Normal CSI ? 5 l
Auto wrap	DECAWM	On CSI ? 7 h	Off CSI ? 7 l
Auto repeat†	DECARM	On CSI ? 8 h	Off CSI ? 8 l
Print form feed	DECPFF	On CSI ? 18 h	Off CSI ? 18 l
Print extent	DECPEX	Full screen CSI ? 19 h	Scrolling region CSI ? 19 l
Text cursor enable	DECTCEM	On CSI ? 25 h	Off CSI ? 25 l
Keypad	DECKPAM DECKPNM	Application ESC =	Numeric ESC >

* The last character of each sequence is lowercase L (6/12)

† User Preference feature

Cursor Positioning

Name	Control Character	Sequence	Action
Cursor up (CUU)	–	CSI Pn A	Moves cursor up Pn lines in the same column.
Cursor down (CUD)	–	CSI Pn B	Moves cursor down Pn lines in the same column.
Cursor forward (CUF)	–	CSI Pn C	Moves cursor right Pn columns
Cursor backward (CUB)	–	CSI Pn D	Moves cursor left Pn columns.
Cursor position (CUP)	–	CSI Pl ; Pc H	Moves cursor to line Pl, column Pc. The numbering of the lines and columns depends on the state (set/reset) of origin mode (DECOM).
Horizontal and vertical position (HVP)	–	CSI Pl ; Pc f	Moves cursor to line Pl, column Pc. The numbering of the lines and columns depends on the state (set/reset) of origin mode (DECOM). Digital recommends using CUP instead of HVP.
Index (IND)	IND	ESC D	Moves cursor down one line in the same column. If the cursor is at the bottom margin the screen performs a scroll-up.
Reverse index (RI)	RI	ESC M	Moves cursor up one line in the same column. If the cursor is at the top margin the screen performs a scroll-down.

Cursor Positioning (Cont)

Name	Control Character	Sequence	Action
Next line (NEL)	NEL	ESC E	Moves the cursor to the first position on the next line If the cursor is at the bottom margin the screen performs a scroll-up
Save cursor (DECSC)	–	ESC 7	Saves in terminal memory the • cursor position • graphic rendition • character set shift state • state of wrap flag • state of origin mode • state of selective erase
Restore cursor (DECRC)	–	ESC 8	Restores the states described for (DECSC) above If none of these characteristics were saved the cursor moves to home position, origin mode is reset, no character attributes are assigned, and the default character set mapping is established.

Tab Stops

NOTE:
These sequences are affected by the User Preference Lock in Set-up.

Name	Control Character	Sequence	Action
Horizontal tab set (HTS)	HTS	ESC H	Sets a tab stop at the current column
Tabulation clear (TBC)	-	CSI g	Clears a horizontal tab stop at cursor position
		CSI 0 g	Clears a horizontal tab stop at cursor position
		CSI 3 g	Clears all horizontal tab stops

Select Graphic Rendition (SGR)
You can select one or more character renditions at a time using the following format

CSI Ps , Ps m

When you use multiple parameters, they are executed in sequence The effects are cumulative For example, to change from increased intensity to blinking-underlined, you can use

CSI 0 , 4 , 5 m

When you select a single parameter, no delimiter (3/11) is used

Ps	Action
0	All attributes off
1	Display at increased intensity
4	Display underscored
5	Display blinking
7	Display negative (reverse) image
2 2	Display normal intensity
2 4	Display not underlined
2 5	Display not blinking
2 7	Display positive image

▪ VT100 Family

This appendix provides a summary of VT100 family escape and control sequences. Sequences unique to the VT101, VT102, and VT131, and the VT125 are in Appendix C and Appendix D, respectively.

CONTROL CHARACTERS

Name	Character Mnemonic	Octal Code	Function
Null	NUL	000	Ignored when received (not stored in input buffer), used as a fill character.
Enquire	ENQ	005	Transmits answerback message.
Bell	BEL	007	Generates a bell tone.
Backspace	BS	010	Moves cursor to the left one character position, unless it is at the left margin, in which case no action occurs.
Horizontal Tab	HT	011	Moves cursor to the next tab stop, or to the right margin if there are no more tab stops.
Line Feed	LF	012	Causes a line feed or a new line operation. (Refer to line feed/new line mode.)
Vertical Tab	VT	013	Processed as LF.
Form Feed	FF	014	Processed as LF.
Carriage Return	CR	015	Moves cursor to left margin on the current line.
Shift Out	SO	016	Selects G1 character set, as designated by a select character set sequence.
Shift In	SI	017	Selects G0 character set, as designated by a select character set sequence.
Device Control 1	DC1	021	Processed as XON. Causes terminal to continue transmitting characters.
Device Control 3	DC3	023	Processed as XOFF. Causes terminal to stop transmitting all characters except XOFF and XON.
Cancel	CAN	030	If received during an escape or control sequence, sequence is cancelled and the substitution character is displayed.
Substitute	SUB	032	Processed as CAN.
Escape	ESC	033	Processed as a sequence introducer.
Delete	DEL	177	Ignored when received (not stored in input buffer).

ANSI COMPATIBLE SEQUENCES

Set Mode

Name	Mnemonic	Mode	Sequence
Line feed/new line	LMN	New line	ESC [20h
Cursor key	DECCKM	Application	ESC [?1h
ANSI/VT52	DECANM	ANSI	N/A
Column	DECCOLM	132 column	ESC [?3h
Scrolling	DECSCLM	Smooth	ESC [?4h
Screen	DECSCNM	Reverse	ESC [?5h
Origin	DECOM	Relative	ESC [?6h
Auto wrap	DECAWM	On	ESC [?7h
Auto repeat	DECARM	On	ESC [?8h
Interlace	DECINLM	On	ESC [?9h

Reset Mode

Name	Mnemonic	Mode	Sequence*
Line feed/new line	LMN	Line feed	ESC [20l
Cursor key	DECCKM	Cursor	ESC [?1l
ANSI/VT52	DECANM	VT52	ESC [?2l
Column	DECCOLM	80 column	ESC [?3l
Scrolling	DECSCLM	Jump	ESC [?4l
Screen	DECSCNM	Normal	ESC [?5l
Origin	DECOM	Absolute	ESC [?6l
Auto wrap	DECAWM	Off	ESC [?7l
Auto repeat	DECARM	Off	ESC [?8l
Interlace	DECINLM	Off	ESC [?9hl

*The last character of the sequence is lowercase L (154_8).

Cursor Key Codes Generated

Cursor	ANSI Character Generated	
	Reset (Cursor)	Set (Application)
Up	ESC [A	ESC O A
Down	ESC [B	ESC O B
Right	ESC [C	ESC O C
Left	ESC [D	ESC O D

Keypad Character Selection

Name	Mnemonic	Sequence
Alternate	DECKPAM	ESC =
Numeric	DECKPNM	ESC >

Auxiliary Keypad Codes Generated

Key	VT52 Alternate Keypad Mode Off (Numeric Mode)	VT52 Alternate Keypad Mode On	ANSI Numeric Keypad Mode	ANSI Alternate Keypad Mode
0	0	ESC ? p	0	ESC O p
1	1	ESC ? q	1	ESC O q
2	2	ESC ? r	2	ESC O r
3	3	ESC ? s	3	ESC O s
4	4	ESC ? t	4	ESC O t
5	5	ESC ? u	5	ESC O u
6	6	ESC ? v	6	ESC O v
7	7	ESC ? w	7	ESC O w
8	8	ESC ? x	8	ESC O x
9	9	ESC ? y	9	ESC O y
– (minus)	– (minus)	ESC ? m	– (minus)	ESC O m
, (comma)	, (comma)	ESC ? l*	, (comma)	ESC O l*
. (period)	. (period)	ESC ? n	. (period)	ESC O n
ENTER	Same as RETURN	ESC ? M	Same as RETURN	ESC O M
PF1	ESC P	ESC P	ESC O P	ESC O P
PF2	ESC Q	ESC Q	ESC O Q	ESC O Q
PF3	ESC R	ESC R	ESC O R	ESC O R
PF4	ESC S	ESC S	ESC O S	ESC O S

*The last character of the sequence is lowercase L (154_8).

Select Character Sets (SCS)

Character Set	G0 Designator	G1 Designator
United Kingdom (UK)	ESC (A	ESC) A
United States (USASCII)	ESC (B	ESC) B
Special characters and line drawing set	ESC (0	ESC) 0
Alternate character ROM	ESC (1	ESC) 1
Alternate character ROM, special graphics characters	ESC (2	ESC) 2
Name	**Mnemonic**	**Sequence**
Single Shift 2	SS2	ESC N
Single Shift 3	SS3	ESC O

Character Attributes

Name	Mnemonic	Sequence
Select graphic rendition (no attributes)	SGR	ESC [m
Select graphic rendition (no attributes)	SGR	ESC [0 m
Select graphic rendition (select attributes, reverse video, or underline as determined by cursor SET-UP feature)	SGR	ESC [4 m
Select graphic rendition (select attribute, reverse video, or underline as determined by cursor SET-UP feature)	SGR	ESC [7 m

Scrolling Region

Name	Mnemonic	Sequence
Set top and bottom margins	DECSTBM	ESC [Pt; Pb r

Cursor Movement Commands

Name	Mnemonic	Sequence
Cursor up	CUU	ESC [Pn A
Cursor down	CUD	ESC [Pn B
Cursor forward (right)	CUF	ESC [Pn C
Cursor backward (left)	CUB	ESC [Pn D
Cursor position	CUP	ESC [Pl; Pc H
Cursor position (home)	CUP	ESC [H
Horizontal and vertical position	HVP	ESC [Pl; Pc f
Horizontal and vertical position (home)	HVP	ESC [f
Index	IND	ESC D
Reverse index	RI	ESC M
Next line	NEL	ESC E
Save cursor (and attributes)	DECSC	ESC 7
Restore cursor (and attributes)	DECRC	ESC 8

Tab Stops

Name	Mnemonic	Sequence
Horizontal tab set (at current column)	HTS	ESC H
Tabulation clear (at current column)	TBC	ESC [g
Tabulation clear (at current column)	TBC	ESC [0 g
Tabulation clear (all tabs)	TBC	ESC [3 g

Line Attributes

Name	Mnemonic	Sequence
Double-height top half	DECDHL	ESC # 3
Double-height bottom half	DECDHL	ESC # 4
Single-width single-height	DECSWL	ESC # 5
Double-width single-height	DECDWL	ESC # 6

Erasing

Name	Mnemonic	Sequence
Erase in line (cursor to end of line)	EL	ESC [K
Erase in line (cursor to end of line)	EL	ESC [0 K
Erase in line (beginning of line to cursor)	EL	ESC [1 K
Erase in line (entire line containing cursor	EL	ESC [2 K
Erase in display (cursor to end of screen)	ED	ESC [J
Erase in display (cursor to end of screen)	ED	ESC [0 J
Erase in display (beginning of screen to cursor)	ED	ESC [1 J
Erase in display (entire screen)	ED	ESC [2 J

Reports

Name	Mnemonic	Sequence
Device status report (request status of VT101)	DSR	ESC [5 n
Response:		
Terminal OK	DSR	ESC [0n
Terminal not OK	DSR	ESC [3n
Device status report (report cursor position)	DSR	ESC [6n
Report cursor position	CPR	ESC [Pl; Pc R
Device attributes (what are you)	DA	ESC [c
Device attributes (what are you)	DA	ESC [0c
Identify terminal (what are you	DECID	ESC Z (not recommended)
Device attributes Response	DA	ESC [?1; Ps 0c

Reset

Name	Mnemonic	Sequence
Reset to initial state	RIS	ECS c

Test and Adjustments

Name	Mnemonic	Sequence
Screen alignment display (Fill screen with "Es")	DECALN	ESC # 8
Invoke confidence test (power-up test)	DECTST	ESC [2; 1 y
Invoke confidence test (Data loopback test, requires test connector)	DECTST	ESC [2; 2 y
Invoke confidence test (repeat power-up test continuously until failure or power-off)	DECTST	ESC [2; 9 y
Invoke confidence test (repeat data loopback test continuously until failure or power-off, requires test connector)	DECTST	ESC [2; 10 y

Keyboard LEDs (Indicators)

Name	Mnemonic	Sequence
Load LEDs (all off)	DECLL	ESC [0
Load LEDs (L1 on)	DECLL	ESC [1 q
Load LEDs (L2 on)	DECLL	ESC [2 q
Load LEDs (L3 on)	DECLL	ESC [3 q
Load LEDs (L4 on)	DECLL	ESC [4 q

VT52 COMPATIBLE MODE

Set and Reset Modes

Name	Sequence
Enter ANSI mode	ESC <

Keypad Character Selection

Name	Sequence
Enter alternate keypad mode	ESC =
Exit alternate keypad mode	ESC >

Character Sets

Name	Sequence
Special graphics character set	ESC F*
Select US/UK character set (as determined by US/UK character SET-UP feature)	ESC G

Cursor Position

Name	Sequence
Cursor up†	ESC A
Cursor down†	ESC B
Cursor right†	ESC C
Cursor left†	ESC D
Cursor to home	ESC H
Direct cursor address	ESC Pl Pc‡
Reverse line feed	ESC I

Erasing

Name	Sequence
Erase to end of line	ESC K
Erase to end of screen	ESC J

Reports

Name	Sequence
Identify (what are you)	ESC Z
Response	ESC / Z

▪ VT101, VT102, and VT131

The VT101 uses the sequences outlines for the VT100 family. See Appendix B.

A summary of VT102 and VT131 escape and control sequences are described in this appendix.

VT102

CONTROL CHARACTERS RECEIVED

Name	Character Mnemonic	Octal Code	Function
End Of Text	ETX	003	This character can be selected as a half-duplex turnaround character.
End Of Transmission	EOT	004	This character can be selected as a disconnect character or as a half-duplex turnaround character. When used as a turnaround character, the disconnect character is DLE-EOT.
Enquire	ENQ	005	This character transmits the answerback message.
Form Feed	FF	014	This character is processed as LF. (See Appendix B.) It can also be selected as a half-duplex turnaround character.
Carriage Return	CR	015	This character moves the cursor to left margin on the current line. It can also be selected as a half-duplex turnaround character.
Device Control 3	DC3	023	This character is processed as XOFF. It causes the terminal to stop transmitting all characters except XOFF and XON. This character can also be selected as a half-duplex turnaround character.

ANSI COMPATIBLE SEQUENCES

Set Mode

Name	Mnemonic	Mode	Sequence
Keyboard action	KAM	Locked	ESC [2 h
Insertion-replacement	IRM	Insert	ESC [4 h
Send-receive	SRM	Off	ESC [1 2 h
Print form feed	DECPFF	On	ESC [? 1 8 h
Print extent	DECPEX	Full Screen	ESC [? 1 9 h

Reset Mode

Name	Mnemonic	Mode	Sequence*
Keyboard action	KAM	Unlocked	ESC [2 l
Insertion-replacement	IRM	Replace	ESC [4 l
Send-receive	SRM	On	ESC [1 2 l
Print form feed	DECPFF	Off	ESC [? 1 8 l
Print extent	DECPEX	Scrolling Region	ESC [? 1 9 l

*The last character of the sequence is lowercase L (154_8).

Character Attributes (VT102 and VT131)

Name	Mnemonic	Sequence
Select Graphic Rendition (select attribute blink)	SCR	ESC [5 m

Editing Functions

Name	Mnemonic	Sequence
Delete character	DCH	ESC [Pn P
Insert line	IL	ESC [Pn L
Delete line	DL	ESC [Pn M

Print Commands

Name	Mnemonic	Sequence
Media copy (enter auto print)	MC	ESC [? 5 i
Media copy (exit auto print)	MC	ESC [? 4 i
Media copy (enter printer controller)	MC	ESC [5 i
Media copy (exit printer controller)	MC	ESC [4 i
Media copy (print screen)	MC	ESC [i
Media copy (print screen)	MC	ESC [0 i
Media copy (print cursor line)	MC	ESC [? 1 i

Reports

Name	Mnemonic	Sequence
Response:		
Printer ready	DSR	ESC [? 10 n
Printer not ready	DSR	ESC [? 11 n
No printer	DSR	ESC [? 13 n

Test and Adjustments

Name	Mnemonic	Sequence
Invoke confidence test (EIA modem control test. Requires test connector.)	DECTST	ESC [2; 4 y
Invoke confidence test (repeat EIA test continuously until failure or power-off. Requires test connector.)	DECTST	ESC [2; 12 y
Invoke confidence test (printer port data loopback test. Requires test connector.)	DECTST	ESC [2; 16 y
Invoke confidence test (repeat printer port data loopback test continuously until failure or power-off. Requires test connector.)	DECTST	ESC [2; 24 y

Keyboard LEDs

Name	Mnemonic	Sequence
Load LEDs (L1 off)	DECLL	ESC [q
Load LEDs (L1 on)	DECLL	ESC [1 q

VT52 COMPATIBLE MODE

Print Commands

Name	Sequence
Enter auto print mode	ESC ^
Exit auto print mode	ESC –
Enter printer controller mode	ESC W
Exit printer controller mode	ESC X
Print screen	ESC]
Print cursor line	ESC V

VT131

CONTROL CHARACTERS RECEIVED

Name	Character Mnemonic	Octal Code	Function
End of text	ETX	003	Can be selected as a half-duplex turnaround character.
End of transmission	EOT	004	Can be selected as a disconnect character or half-duplex turnaround character. When used as a turnaround character, the disconnect character is DLE-EOT.
Horizontal tab	HT	011	Moves cursor to next tab stop, or to right margin if there are no more tab stops. In edit mode, the tab character positions the cursor, and the character is not held in memory. When the character is received, the cursor moves to one of the following locations. • Next tab stop • Next field boundary (if erasure mode is set) • Next unprotected field (if erasure mode is reset) • First unprotected character position in the scrolling region (if the cursor is above the scrolling region) • Last character position of the screen (if the cursor is below the scrolling region) In edit mode, a tab received with no more tab stops or fields, causes the cursor to move to the end of the screen region.
Linefeed	LF	012	Causes a linefeed or a new line operation. (See linefeed/new line mode.) Also causes printing if auto print operation selected.
Form feed	FF	014	Processed as LF. FF can also be selected as a half-duplex turnaround character.
Carriage return	CR	015	Moves cursor to left margin on current line. CR can also be selected as a half-duplex turnaround character.
Device control 3	DC3	023	Processed as XOFF. DC3 causes terminal to stop transmitting all characters except XOFF and XON. DC3 can also be selected as a half-duplex turnaround character.

ANSI COMPATIBLE SEQUENCES

Set Mode

Name	Mnemonic	Mode	Sequence
Guarded area transfer	GATM	All	ESC [1 h
Keyboard action	KAM	Locked	ESC [2 h
Insertion-replacement	IRM	Insert	ESC [4 h
Erasure	ERM	All	ESC [6 h
Send-receive	SRM	Off	ESC [1 2 h
Transfer termination	TTM	Full page	ESC [1 6 h
Editing	DECEDM	Edit	ESC [? 1 0 h
Line transmit	DECLTM	On	ESC [? 1 1 h
Space compression/ field delimiter	DECSCFDM	On	ESC [? 1 3 h
Transmit execution	DECTEM	Immediate	ESC [? 1 4 h
Edit key execution	DECEKEM	Immediate	ESC [? 1 6 h
Print form feed	DECPFF	On	ESC [? 1 8 h
Print extent	DECPEX	Full screen	ESC [? 1 9 h

Reset Mode

Name	Mnemonic	Mode	Sequence*
Guarded area transfer	GATM	Unprotected	ESC [1 l
Keyboard action	KAM	Unlocked	ESC [2 l
Insertion-replacement	IRM	Replace	ESC [4 l
Erasure	ERM	Unprotected	ESC [6 l
Send-receive	SRM	On	ESC [1 2 l
Transfer termination	TTM	Scrolling region	ESC [1 6 l
Editing	DECEDM	Interactive	ESC [?1 0 l
Line transmit	DECLTM	Off	ESC [? 1 1 l
Space compression/ field delimiter	DECSCFDM	Off	ESC [? 1 3 l
Transmit execution	DECTEM	Deferred	ESC [? 1 4 l
Edit key execution	DECEKEM	Deferred	ESC [? 1 6 l
Print form feed	DECPFF	Off	ESC [? 1 8 l
Print extent	DECPEX	Scrolling region	ESC [? 1 9 l

*The last character of the sequence is lowercase L (154_8).

Character Attributes (See VT102)

Editing Functions

Name	Mnemonic	Sequence
Delete character	DCH	ESC [Pn P
Insert line	IL	ESC [Pn L
Delete line	DL	ESC [Pn M

Character Protection

Name	Mnemonic	Sequence*
Protected field attributes (no protection)	DECPRO	ESC [0 }
Protected field attributes (bold protection)	DECPRO	ESC [1 }
Protected field attributes (underline protection)	DECPRO	ESC [4 }
Protected field attributes (blink protection)	DECPRO	ESC [5 }
Protected field attributes (reverse video protection)	DECPRO	ESC [7 }
Protected field attributes (all attributes off protection)	DECPRO	ESC [2 5 4 }

*The last character of each sequence is } (175_8).

Transmission Request

Name	Mnemonic	Sequence
Set transmit state	STS	ESC S

Transmission Enable

Name	Mnemonic	Sequence
Transmit	DECXMIT	ESC 5

End of Block Character

Name	Mnemonic	Sequence*
Transmit termination character (function disabled)	DECTTC	ESC [0 |
Transmit termination character (Form Feed, FF)	DECTTC	ESC [1 |
Transmit termination character (End of Text, ETX)	DECTTC	ESC [2 |
Transmit termination character (End of Transmission, EOT)	DECTTC	ESC [3 |
Transmit termination character (Carriage Return, CR)	DECTTC	ESC [4 |
Transmit termination character (Device Control 3, DC3)	DECTTC	ESC [5 |

*The last character of each sequence is | (174_8).

Print Commands

Name	Mnemonic	Sequence
Media copy (enter auto print)	MC	ESC [? 5 i
Media copy (exit auto print)	MC	ESC [? 4 i
Media copy (enter printer controller)	MC	ESC [5 i
Media copy (exit printer controller)	MC	ESC [4 i
Media copy (print screen)	MC	ESC [i
Media copy (print screen)	MC	ESC [0 i
Media copy (print cursor line)	MC	ESC [? 1 i

Reports

Name	Mnemonic	Sequence
Device status report (request status of printer)	DSR	ESC [? 1 5 n
Response:		
Printer ready	DSR	ESC [? 1 0 n
Printer not ready	DSR	ESC [? 1 1 n
No printer	DSR	ESC [? 1 3 n

Tests and Adjustments

Name	Mnemonic	Sequence
Invoke confidence test (EIA modem control test. Requires test connector.)	DECTST	ESC [2 ; 4 y
Invoke confidence test (repeat EIA test continuously until failure or power-off. Requires test connector.)	DECTST	ESC [2 ; 1 2 y
Invoke confidence test (printer port data loopback test. Requires test connector.)	DECTST	ESC [2 ; 1 6 y
Invoke confidence test (repeat printer port data loop-back test continuously until failure or power-off. Requires test connector.)	DECTST	ESC [2 ; 2 4 y

Keyboard LEDs

Name	Mnemonic	Sequence
Load LEDs (L1 off)	DECLL	ESC [q
Load LEDs (L1 off)	DECLL	ESC [0 q
Load LEDs (L1 on)	DECLL	ESC [1 q

VT52 COMPATIBLE MODE

Character Sets

Name	Sequence
Special graphics character set	ESC F*
Select US/UK character set (as determined by US/UK character SET-UP feature)	ESC G

*Same as special character and line drawing set in ANSI mode; same when sent from the terminal.

Print Commands

Name	Sequence
Enter auto print mode	ESC
Exit auto print mode	ESC–
Enter printer controller mode	ESC W
Exit printer controller mode	ESC X
Print screen	ESC]
Print cursor line	ESC V

• VT125

This appendix provides a summary of VT125 escape and control sequences.

ANSI COMPATIBLE SEQUENCES

NOTE: The VT125 generates the following control characters differently from previous DIGITAL terminals.

Code	VT125 Keys	Previous Terminal Keys
NUL	CTRL–Space bar	CTRL–@
RS	CTRL–~	CTRL–^
US	CTRL–?	CTRL–_

Character Attributes

Name	Mnemonic	Sequence
Select Graphic Rendition	SGR	–
No attributes	–	ESC [m
No attributes	–	ESC [0 m
Select bold attribute	–	ESC [1 m
Select underline attribute	–	ESC [4 m
Select blink attribute	–	ESC [5 m
Select reverse video attribute	–	ESC [7 m

NOTE: Without advance video option (AVO), only underline or reverse attribute is available.

Communication and Graphics Protocol Commands

Name	Mnemonic	Sequence
Device control string	DCS	–
Enter ReGIS at previous command level	–	ESC P p
Enter ReGIS at highest command level	–	ESC P 1 p
Enter ReGIS at previous command level with commands to screen	–	ESC P 2 p
Enter ReGIS at highest command level with commands to screen	–	ESC P 3 p
Enter DECwriter graphics	–	ESC P q
Enter VT105 emulator	–	ESC P t
String terminator	ST	–
Exit graphics	–	ESC \
Media copy	MC	–
Turn off computer to auxiliary port	–	ESC [4 i
Turn on computer to auxiliary port	–	ESC [5 i
Turn off computer to screen	–	ESC [6 i
Turn on computer to screen	–	ESC [7 i
Select auxiliary port for ReGIS hardcopy output	–	ESC [? 0 i
Select computer port for ReGIS hardcopy output	–	ESC [? 2 i

Reports

NOTE: Format is ESC [? 12; <vt100> ; <vt125> ; <version> c

Command	Function
<vt100>	5 = no AVO, 7 = AVO
<vt125>	1 = printer, 0 = no printer
<version>	Graphics firmware

VT100 Tests and Adjustments

NOTE: Do not use VT100 loopback tests with the graphics processor installed. Loopback tests require test connector. Continuous tests end at failure or power-off.

Name	Mnemonic	Sequence
Screen alignment display	DECALN	–
Fill screen with "Es"	–	ESC # 8
Invoke confidence test	DECTST	–
Power-up test	–	ESC [2 ; 1 y
Data loopback test	–	ESC [2 ; 2 y
Power-up and data loopback tests	–	ESC [2 ; 3 y
EIA modem control loopback test	–	ESC [2 ; 4 y
Power-up and EIA loopback tests	–	ESC [2 ; 5 y
Data loopback and EIA loopback tests	–	ESC [2 ; 6 y
Power-up, data loopback, and EIA loopback tests	–	ESC [2 ; 7 y
Repeat power-up test continuously	–	ESC [2 ; 9 y
Repeat data loopback test continuously	–	ESC [2 ; 10 y
Repeat power-up and data loopback tests continuously	–	ESC [2 ; 11 y
Repeat EIA test continuously	–	ESC [2 ; 12 y
Repeat power-up and EIA tests continuously	–	ESC [2 ; 13 y
Repeat data loopback and EIA loopback tests continuously	–	ESC [2 ; 14 y
Repeat power-up, data loopback, and EIA loopback tests continuously	–	ESC [2 ; 15 y

VT125 Tests and Adjustments

NOTE: All tests require loopback connector. Always include power-up test for correct display of error indications.

Name	Mnemonic	Sequence
Invoke confidence test	DECTST	ESC [4 ; 1 ; Ps . . . ; Ps y
VT125 power-up test	–	Ps = 1
VT125 computer port data loopback test	–	Ps = 2
VT125 auxiliary port data loopback test	–	Ps = 3
VT125 display test	–	Ps = 4
VT125 video bit map memory test	–	Ps = 5
Repeat any selected tests continuously until power-off or failure	–	Ps = 9

ReGIS COMMAND SUMMARY

Position Command Summary

Command	Function
P [ ]	Reset pattern memory.
[<position>]	Move to <position>.
<pixel vector> or <pv>	Move <multiplier> pixels in <pv> direction.
(B)	Save current location.
(S)	Save dummy location.
(E)	Move to last saved location.
(W (<temp writing controls>)).	P (W (M<multiplier>)).

Vector Command Summary

Command	Function
V [ ]	Draw dot at current position.
[<position>]	Draw vector to <position>.
<pixel vector> or <pv>	Draw <multiplier> pixels in <pv> direction
(B)	Save current position.
(S)	Save dummy position.
(E)	Draw to last saved position.
(W (<temp. writing controls>))	

Curve Command Summary

Command	Function
C [<position>]	Circle with center at current position, circumference at <position>.
(C) [<position>]	Circle with center at <position>, circumference at current positions.
(A<degrees>) [<position>]	Arc with center at current position, starting at <position> for <degrees>.
(A<degrees>C) [<position>]	Arc with center at <position> starting at current position for <degrees>.
(B) [<pos.>] . . [<pos.>] (E)	Bounded (closed) curve
(S) [ ] [<pos.>]. . . [<pos.>] [ ] (E)	Unbounded (open) curve
(W(<temp. writing controls>))	

Text Command Summary

Command
T (S <size number>) (H <height>) [<spacing>] (S [<width in pixels>, <height in pixels>]) (M [<width pixel multiplier>, <height pixel multiplier>]) (D <direction angle>) (D <string tilt> S <size> D <char tilt>) (T <italic degrees>) (A <pattern set number>) ((B) <temporary attributes block> (E)) (W(<temp. writing controls>))

Writing Controls Summary

Command			Function		
W (C)			Complement		
(E)			Erase		
(R)			Replace		
(V)			Overlay		
(F <foreground planes>)			0 = no planes 1 = plane 1 2 = plane 2 3 = planes 1 and 2		
			Foreground intensity:		
(I	0 or (D)	)	Dark	or	Dark
	1 (R)	)	Dim grey		Red
	2 (G)	)	Light grey		Green
	3 (B)	)	White		Blue
	(C)	)			Cyan
	(Y)	)			Yellow
	(M)	)			Magenta
	(W)	)			White
or					
(I (H <hue angle> L <lightness percent> S <saturation percent>))					
(M <multiplier>)			Pixels per <pv>		
(N 1)			Negative on		
(N 0)			Negative off		
(S 1)			Shading on		
(S 0)			Shading off		
(S [,shading reference])					
(S ' shading character ')					
(P <binary pattern>)			Enter pattern.		
(P <pattern number>)			Use VT125 pattern.		
(P (M <pattern multiplier>))					
(W<i>(P<j>,N<k>))			Custom writing control.		

Screen Controls Summary

Command	Function
S <pixel vector> [<position>]	Scroll.
(A [<position>] [<position>])	Display addressing.
(E)	Erase screen.
(H [<position>] [<position>])	Hardcopy (corner positions. optional).
(H(P[<position>]))	Set hardcopy offset.
	Background intensity:
(I 0 or (D))	Dark or Dark
1 (R))	Dim grey Red
2 (G))	Light grey Green
3 (B))	White Blue
(C))	Cyan
(Y))	Yellow
(M))	Magenta
(W))	White
or	
(I (H <hue angle> L <lightness percent> S <saturation percent>))	
S(M<n>(<mono HLS>)(A<color HLS>))	Output mapping
(S <scale>)	
(S (X<scale>Y<scale>))	
(T <ticks>)	Time delay
(W (temporary writing controls)	

Macrograph

Command	Function
@	Clear all macrographs.
:keyletter character_string @;	Define macrograph.
keyletter	Invoke macrograph.

Character Cell Control Summary

Command	Function
L (A<integer>)	Select for loading.
(A"<name>")	Give name to set.
"<ASCII char>" <hex pair> . . . <hex pair>;	Load cell.

Report Command Summary

Command	Function
R (L)	Set selected for loading.
(M (<keyletter>))	Contents of macrograph.
(M (=))	Use of storage.
"<free>,<total>"	Reply to use.
(P)	Cursor position.

Appendix D ▪ Traditional Printer Products

Appendix D provides a reference guide to Digital's printers and printing terminals that have made a major impact in the marketplace but have been, or are currently being, replaced by new products. Table D-1 at the end of this appendix lists these traditional products and their recommended replacements.

▪ DECprinter IV (LA34)/DECwriter IV (LA38)

The DECprinter/DECwriter IV are 300 baud, 30-characters-per-second desktop terminals that can print at burst speeds up to 45 characters per second. The LA34/LA38 is especially useful for applications that require a terminal with forms-handling capabilities. Because it permanently stores a standard computer printout format, when the terminal is poweredup, it automatically assumes

- Ten-characters-per-inch pitch.
- Six-lines-per-inch vertical spacing.
- Tab stops every eight spaces.
- The left margin set at column 1.
- The right margin set at column 132.

The baud rate is set according to the switch settings on the terminal. However, you can easily change these settings to suit specific application needs. In offline setup mode, you can choose any of the standard settings right from the keyboard.

You can select variable character sizes of 10, 12, 13.2, and 16.5 characters per inch. If you choose to use 13.2 characters per inch, a full 132-character line will fit on an 11-inch-wide piece of paper, while using 16.5 characters per inch, a full 132-character line will fit on an 8.5-inch-wide sheet. If a full width form of 37.8 cm (14 7/8 inches) is used, the terminal can print up to 174 characters per line at 13.2 char/in, and 216 characters per line at 16.5 char/in.

You can also select from six line-spacing settings of 2,3,4,6,8, or 12 lines per inch. Any form width from 7.6 cm to 37.8 cm (3 to 14.9 in) can be used. Also, you can position left and right margins and horizontal tabs anywhere within that form.

The LA34-RA, LA34-VA, and LA34-WA have graphics capabilities. They produce hardcopy graphics and text from printer ports used with the VT125, VT240, or VT241 graphics terminals, as an output device for the GIGI (VK100) terminal, or accept data directly from the CPU.

The basic design of the DECwriter IV contributes to its reliability as well as to its maintainability. A single logic board is used, thus reducing the component count and increasing circuit reliability. It senses printhead jams instantly. When a printhead jam occurs, the power is automatically removed from the printhead drive until the jam is corrected, and the user restarts the terminal. This action prevents motor overloads and blown fuses. The printhead has been designed and tested to print over 100 million characters and can be adjusted to adapt to various forms thicknesses.

The LA34 and LA38 are easy to maintain. Both are designed to operate reliably without scheduled preventive maintenance. If a problem occurs, they can be disassembled easily because of their modular design. Printing self-test diagnostics are built into its basic design, allowing quick and accurate identification of any faulty components. Both the LA34 and the LA38 also use snap-in ribbon cartridges.

Whenever possible, the LA34 and LA38 use ANSI standard escape sequences to control their capabilities. These same escape sequences are also implemented on Digital's LA12, LA100, and LA120 hardcopy terminals and the VT100 series of video terminals.

▪ DECwriter II (LA36)

The DECwriter II is a 96-character ASCII uppercase and lowercase 7-by-7 dot-matrix teleprinter. The DECwriter II accepts one to six part forms or standard 132-column line printer paper. It has five vertical adjustments for accurate forms placement. It is capable of 10 characters per inch horizontal spacing and 6 lines per inch vertical spacing.

The DECwriter II includes many practical, functional, and operator convenience features. Among these is true 30-characters-per-second throughput accomplished by a 60-characters-per-second catchup mode, which is activated any time more than one character is present in the 16-character buffer. The typewriter-style keyboard makes the transition from typewriter to terminal easy. For comfortable use, the LA36 stand is the same height as most typewriter tables.

Other DECwriter II features include paper-out sensor, print window, column scale, pointers, 14-key numeric keypad, half- or full-duplex control on operator's console, and last character visibility. For communication purposes, the terminal includes an integrated 20 mA current loop interface with jumpers for active mode and an EIA interface with modem control. Available options include paper stacking tray, work surfaces, APL/ANSI dual character set, acoustic coupler, EIA interface with timed disconnect, autoanswer, and modem control.

▪ DECwriter Correspondent (LA12)

The DECwriter Correspondent is a plain-paper, dot-matrix teleprinter. The lightweight Correspondent, not much larger than an attache' case, is compact. It combines the printing and forms-handling capabilities of a tabletop terminal with the communications and versatility of a portable teleprinter.

The DECwriter Correspondent's main features are

- Built-in communications options—Some models come with modems and acoustic coupler already installed. Other models allow you to add these features as you need them.
- Impact printing—Designed for use with plain paper and multipart forms. Plain paper is less expensive and more convenient than the thermal paper that other portable teleprinters use.
- Smart bidirectional 150 char/s printing—Allows for fast throughput, and reduces computer connection time and telephone costs.
- Variety of character sets—Choose from U.S. ASCII, multinational, and APL character sets to meet your application needs.
- Small, compact terminal with carrying case—Lets you carry it to where the work is. The small size enables you to fit the Correspondent on a desk or under an airline seat.
- Conversational keyboard setup—Easy to use and simple to change setup features.
- Graphics printing—Allows the integration of charts, diagrams, and graphs anywhere you work.

The DECwriter Correspondent offers program-selectable text and graphics modes. The nine-wire dot-matrix printhead provides high-speed output at the rate of 150 characters per second. By using a nine-wire printhead, the LA12 prints below-the-line descenders, such as in the letters "p," "q," and "y," as well as underlining in all text modes. The Correspondent prints using a bidirectional technique in which the printhead seeks the shortest distance to the next printable character and skips rapidly over blank spaces. This method reduces computer connection time and telephone connection time, thus reducing costs.

Bit-map graphics mode allows for the creation of an infinite variety of pictures and graphs, including bar charts, logos, signatures, and unique characters. Graphics can be integrated with text or data to emphasize points. While the DECwriter Correspondent provides a vertical resolution of 72 dots per inch, it also lets you select any one of eight horizontal resolutions. A predetermined escape sequence from the host enables the LA12 to enter the bit-map graphics mode. Microcode control of individual printhead wires makes every dot addressable by the host and enables images displayed on a video terminal to be faithfully reproduced.

The DECwriter Correspondent can print double-width, compressed, or bold characters via selectable software. Character size can be changed from 10 to 12 characters per inch (pica to elite). In addition, the compressed print displays a full 132 columns for spreadsheet work on standard width (21.6 centimeters (8.5 inches)) pages.

▪ DECprinter I (LA180)

The DECprinter I is a 128-character ASCII upper-case and lower-case 7-by-7 dot-matrix printer. The DECprinter I accepts one to six part forms or standard 132-column lineprinter paper. It prints at a speed of 180 characters per second.

DECprinter I has many operator features that make it easier to use. Included are a forms-length switch that sets the top-of-form to any of eleven common lengths, a paper-out switch and alarm, and a high-reliability printhead. Also featured are infinitely variable forms adjustment, variable forms width, and multipart forms capability.

Other DECprinter I components include the carriage system, ribbonfeed system, and paperfeed system. The carriage system transports the head along the horizontal axis of the machine and provides accurate horizontal positioning for character placement and printhead adjustment for clean impressions on a variety of forms. The ribbonfeed system is driven by the carriage motion only when the carriage is moving from left to right. This prevents smudging when the DECprinter is not printing. The paperfeed system is a stepping-motor-driven tractorfeed. The tractor design provides 3-to-4-pin engagement of the form and a flat bed for control and positive feeding of multipart forms. Paper may be fine-positioned vertically by pushing the linefeed knob inward and rotating it in the direction desired.

▪ DECprinter III (LA120)

The DECprinter III is a serial, dot-matrix, pedestal-mounted printer that combines bidirectional printing and a 1000-character buffer to achieve throughput of 180 characters per second. Utilizing the proven technology of its KSR partner, the DECwriter III, the receive-only DECprinter III delivers high-performance for local printing or communications.

The DECprinter III incorporates an internal Function Control Panel—a series of controls and indicators that permit rapid setup, permanent or temporary storage, and modification of all necessary parameters. In addition to providing complete setup control, the Function Control Panel displays the status condition of the terminal while in the setup mode. An external operator panel provides for the selection of local mode, self-test, and top-of-form operation.

The DECprinter III offers a 7-by-7 dot-matrix character cell in the full 94-printing-character ASCII set, and prints both uppercase and lowercase characters. Optional international character sets include Finnish, Danish, Swedish, German, Norwegian, and French. The APL set is also available as an option. It can print double-width characters and compressed characters. Character sizes range from 10, 12, 13.2, and 16.5 characters per inch. Double-width characters print at 5, 6, 6.6, and 8.25 characters per inch.

The DECprinter III accommodates fanfold paper from 7.6 to 37.8 centimeters (3 to 14 7/8 inches) in width. Because the DECwriter III printer has forms-handling capabilities, it can format output to fit preprinted forms, up to six parts. It can also accommodate selectable form lengths up to 35 centimeters (14 inches).

▪ LP11-C/LP11-D Lineprinters

The LP11-C and LP11-D lineprinters are drum printers designed to handle heavy production loads. They can be used with any UNIBUS PDP-11 or VAX based system.

The LP11-C features a print speed of up to 900 lines per minute using a 64-character set, while the LP11-D is capable of printing up to 660 lines per minute with a 96-character set. Because both can print on single or multipart forms, you can expand your application capabilities. Also, the LP11-C and LP11-D lineprinters have a 132-column line.

In addition to full line buffering, the LP11-C and the LP11-D are program-compatible with other LP11 series lineprinters. Each offers jumper-selectable universal power supply for 120-Vac or 240-Vac operation.

The LP11-C and LP11-D operate by passing paper and inked ribbon between a row of hammers and a continuously rotating metal drum. The drum surface contains 132 columns of all print characters. Data to be printed is received and stored in a full-line buffer. Printing starts when a control character, such as linefeed or carriage return, is sent. If more than 132 characters are sent before the control character, the extra characters are disregarded.

Printing is accomplished by scanning the stored characters in synchronization with the rotating drum characters and actuating the appropriate hammer as the desired characters move into the printing position.

The LP11-C/D represents older drum technology. Digital recommends the LP26, LP27, or the LN01 as replacements, depending on your application.

▪ Letterprinter 100

About the size of a typewriter, 7 inches high, 22 inches wide, and 16 inches deep, the microprocessor-controlled Letterprinter 100 packs a great deal of versatility into a small space. With the Letterprinter 100 you can print a draft of an internal memo one minute, a formal German business proposal the next, and a graph of market trends right after that. The Letterprinter 100 produces these very different pieces without a pause, shifting from one style to another instantly under software control.

The Letterprinter 100 prints letter-quality and draft-quality text with true descenders and underlining. Among the multiple typefaces supported by the Letterprinter 100 are Courier, Orator, and Gothic. Other features include the printing of full bit-map graphics, ASCII and national character sets, and VT100 line drawing and optional APL character sets. The printer's fifteen-inch platen is wide enough for 132- and 217-column spreadsheet work. In addition, the Letterprinter 100 attaches to a wide range of host systems using a standard EIA or optional 20 mA and parallel interfaces.

Table D-1 ▪ Printer Replacement Chart

Traditional Products	Replacement Products
LA34, LA38	LA100-BA,LA100-CA (KSR), LA210-AA (RO), LA12-PA (KSR)
LA35, LA36	LA120-DA, LA120-RA, LA120-RB, LA210-AA
LA100-RA, LA100-YA, LA100-ZA	LA210-AA
LA180	LA120-RA, LA120-RB, LA210-AA
LP11-C, LP11-D	LN01, LP26, LP27
LQP01	LQP02, LQP03, LN03, LA210

Appendix E ▪ Printer Programming Summaries

Appendix E provides programming summaries on the Letterwriter 100, LA12, LA120 LA210, LA50, LQP02, LQP03, LN03, LVP16, LCP01, and the lineprinters.

▪ LA100 Letterwriter

▪ Setup Commands

While in setup, typing the key letter followed by a return prints the available selections for that feature. For example, typing 'E' Return prints the selections for the local echo feature.

While in setup, typing the key letter = your choice, then Return, fixes the feature at that selection. For example: E=A sets local echo to a disabled state.

E—Local Echo
E=A:Disabled E=B:Enabled

K—Keyboard
K=A:United States K=B:United Kingdom K=C:French Canada K=D:Germany K=E:Sweden K=F:France K=G:Finland K=H:Norway

L—Return Key
L=A:<CR> L=B:<CR-LF>

Q—Keyclick
Q=A:Disabled Q=B:Enabled

U—Break Key
U=A:Disabled U=B:Enabled

Y—Keypad Mode
Y=A:Numeric Y=B:Function

B—Pitch Mode
B=A:All Pitches B=B:Font Pitch

C—GO Character Set
C=A:United Kingdom C=B:United States C=K:Germany C=R:France C=Y:Italy C=Z:Spain C=0:Line Drawing C=5:Finland C=6:Norway C=7:Sweden C=9:French Canadian

D—G1 Character Set
D=A:United Kingdom D=B:United States D=K:Germany D=R:France D=Y:Italy D=Z:Spain D=0:Line Drawing D=5:Finland D=6:Norway D=7:Sweden D=9:French Canadian

Form Length
F=264

H—Horizontal Pitch (cpi)
H=A:10 H=B:12 H=C:13.2 H=D:16.5 H=E:5 H=F:6 H=G:6.6 H=H:8.25

J—End of Line Control
J=A:Terminate Mode J=B:Wrap Mode

V—Vertical Pitch (lpi)
V=A:6 V=B:8 V=C:12 V=D:2 V=E:3 V=F:4

W—New Line Request Character
W=A:None W=B:<CR> W=C:<LF>

A—Auto-answerback
A=A:Disabled A=B:Enabled

N—Disconnect on EOT
N=A:Disabled N=B:Enabled

O—Paper Fault Processing
O=A:XOFF (if enabled) O=B:Short Break O=C:Disconnect O=D:Do Not Connect

P—Parity
P=A:7/S P=B:7/M P=C:7/E P=D:7/O P=E:8/E P=F:8/O

R—Receiver Error
R=A:Print Error Block R=B:Print Character

S—Speed (bps)
S=A:50 S=B:75 S=C:110 S=D:134.5 S=E:150 S=F:200 S=G:300 S=H:600 S=I:1200 S=J:1800 S=K:2400 S=L:4800 S=M:7200 S=N:9600 S=O:75T/600R S=P:75T/1200R S=Q:150T/600R S=R:150T/1200R S=S:300T/2400R S=T:300T/4800R S=U:600T/2400R S=V:600T/4800R

X—Auto XON/XOFF
X=A:Disabled X=B:Enabled

Z—Modem Control
Z=A:No Modem Control-Restraint Mode Z=B:No Modem Control-Speed Mode Z=C:Modem Control-Restraint Mode Z=D:Modem Control-Speed Mode

PROGRAMMER INFORMATION

Standard Character Set

B8 B7 B6 B5 / BITS / B4 B3 B2 B1 / ROW	0 0 0 0 / COLUMN 0		0 0 0 1 / 1		0 0 1 0 / 2		0 0 1 1 / 3		0 1 0 0 / 4		0 1 0 1 / 5		0 1 1 0 / 6		0 1 1 1 / 7	
0 0 0 0 0	NUL	0 0 0		20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0 0 0 1 1		1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0 0 1 0 2		2 2 2		22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
0 0 1 1 3		3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
0 1 0 0 4		4 4 4		24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
0 1 0 1 5	ENQ	5 5 5		25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
0 1 1 0 6		6 6 6		26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
0 1 1 1 7	BEL	7 7 7		27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
1 0 0 0 8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1 0 0 1 9	HT	11 9 9		31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1 0 1 0 10	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
1 0 1 1 11	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
1 1 0 0 12	FF	14 12 C		34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C
1 1 0 1 13	CR	15 13 D		35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
1 1 1 0 14	SO	16 14 E		36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
1 1 1 1 15	SI	17 15 F		37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DEL	177 127 7F

C0 CONTROL SET	GL GRAPHIC SET (Shown here filled with ASCII character set)

KEY

ASCII CHARACTER

ESC	33	OCTAL
	27	DECIMAL
	1B	HEX

*NOTE V2 only

C0 CONTROL CHARACTERS

Name	Mnemonic	Octal Code	Function
Null	NUL	000	Used as fill character
End of Transmission	EOT	004	Used as a disconnect character if enabled
Enquiry	ENQ	005	Requests answerback message
Bell	BEL	007	Sounds bell tone
Backspace	BS	010	Moves the active column left one column
Horizontal Tab	HT	011	Advances to next horizontal tab
Line Feed	LF	012	Advances to next line. Performs carriage return if linefeed new line mode is on.
Vertical Tab	VT	013	Advances to next vertical tab
Form Feed	FF	014	Advances to next top margin
Carriage Return	CR	015	Returns to left margin
Locking Shift 1 (Shift Out)	LS1 (SO)	016	Invokes G1 into GL
Locking Shift 0 (Shift In)	LS0 (SI)	017	Invokes G0 into GL
Cancel	CAN	030	Immediately ends any control sequence, escape sequence, or string.
Substitute	SUB	032	Immediately ends any control or escape sequence, but not string. SUB is printed as ":·:," or "?," or in graphics mode, as a one column space.
Escape	ESC	033	Introduces an escape sequence. When executed in graphics mode causes the terminal to exit and start processing the sequence.
Delete	DEL	177	No operation. Not recommended as a filler character.
Graphics Mode C0 Control Characters			
Cancel	CAN	030	Immediately causes an exit from graphics mode.
Substitute	SUB	032	SUB is processed as a one column space
Escape	ESC	033	Causes the terminal to exit graphics mode and start processing the sequence.

NOTE: NUL, EOT, ENQ, BEL, DEL, SI, SO processed as in text mode.

BS, LF, CR, FF, HT, VT are ignored in graphics mode.

Graphics Mode Private Control Characters

Name	Mnemonic	Octal Code	ASCII Character	Function
Graphics Repeat Introducer	DECGRI	041	!	Begins repeat sequence
Graphics Carriage Return	DECGCR	044	$	Returns to graphics left margin
Graphics New Line	DECGNL	055	-	Returns to graphics left margin and advances to next graphics line

NOTE: Graphics printable data is 077 octal plus binary value of 6 dot column with least significant bit (LSB) assigned to the top wire.

ESCAPE AND CONTROL SEQUENCES

Sequence					Mnemonic	Function
Line Feed New Line Mode					**LNM**	
ESC	[	2	0	h		Sets line feed new line mode on
033	133	062	060	150		
ESC	[	2	0	l*		Sets line feed new line mode off
033	133	062	060	154		
Auto Wraparound Mode					**DECAWM**	
ESC	[	'	7	h		Sets auto wraparound mode on
033	133	077	067	150		
ESC	[	'	7	l*		Sets auto wraparound mode off
033	133	077	067	154		

Sequence					Mnemonic	Function
Density Select Mode					**DECDEN**	
ESC	[	0	"	z		Sets density select mode to default (draft) density.
033	133	060	042	172		
ESC	[	1	"	z		Sets density select mode to draft density.
033	133	061	042	172		
ESC	[	2	"	z		Sets density select mode to letter density (medium or high density depending on DPS).
033	133	062	042	172		

*The last character of the sequence is lowercase L (154_8)

Sequence						Function
Pitch Select Mode						
ESC	[	?	2	9	h	Sets pitch select mode to current DPS pitches mode.
033	133	077	062	071	150	
ESC	[	?	2	9	l*	Sets pitch select mode to all pitches mode.
033	133	077	062	071	154	

Select Graphic Rendition SGR

ESC	[	Ps	;	...	;	Ps	m
033	133	***	073	...	073	***	155

Ps	Function
0	Clears underline
4	Selects underline
10	Selects DPS 1
11	Selects DPS 2
12	Selects DPS 3
13	Selects DPS 4
14	Selects DPS 5

Request DPS Configuration

ESC	[	?	1	0	c	Requests that the terminal sends current DPS configuration
033	133	077	061	060	143	

Report Font Configuration

DPS Configuration Report

ESC	[	Pn1	;	Pn2
033	133	***	073	***

A report is sent for each installed DPS.
DPS 1 (Pn1 = 010) always reports last.

Pn1	Location
010	DPS 1
011	DPS 2
012	DPS 3
013	DPS 4
014	DPS 5

Pn2	ROM Identification
001	US/UK Gothic 10 High Density Primary
002	International Gothic 10 High Density Overlay
003	US/UK Gothic 12 High Density Primary
004	International Gothic 12 High Density Overlay
005	US/UK Courier 10 High Density Primary
006	International Courier 10 High Density Overlay
007	US/UK Courier 12 High Density Primary
008	International Courier 12 High Density Overlay
009	US/UK Orator 10 High Density Primary

Character Set Selection SCS

ESC	I1	...	Final
033	***	...	***

I1 selects a repertory and a target (primary/secondary refer to an international list of sets and bears no relation to the primary/overlay distinction between DPS ROMs).

Repertory		
Primary	**Secondary***	**Target**
(	'	G0
050	054	
)	–	G1
051	055	
*	.	G2
052	056	
+	/	G3
053	057	

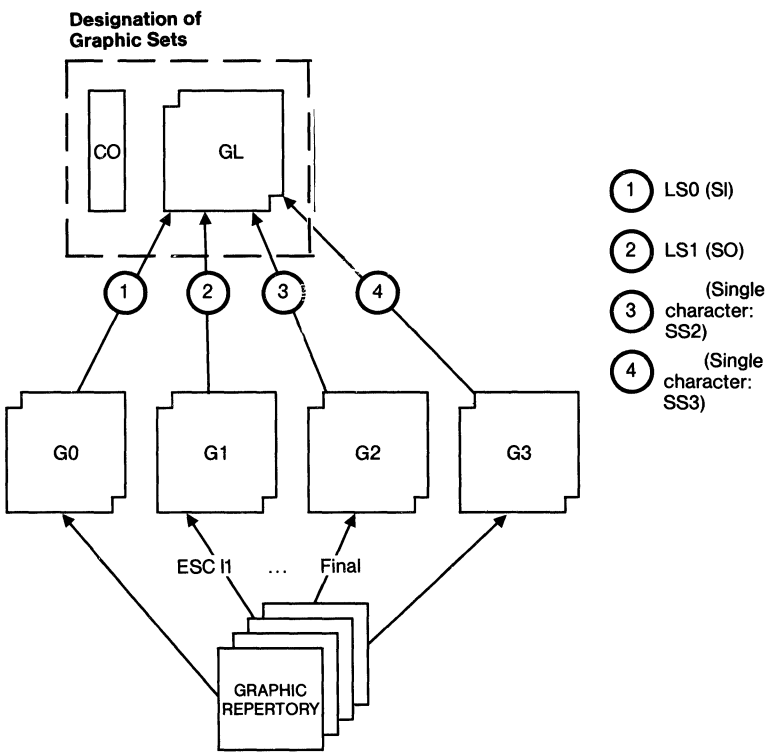
Character Set Designators

Final	Octal	Character Set
0	060	Digital VT100 Line Drawing
4	064	Digital Dutch
5	065	Digital Finnish*
6	066	Digital Norwegian/Danish*
7	067	Digital Swedish*
8	070	Digital APL
9	071	Digital French Canadian*
A	101	ISO UK
B	102	ISO US
K	113	ISO German
R	122	ISO French

I2**	Final	Octal	Character Set
	Y	131	ISO Italian
	Z	132	ISO Spanish

NOTE: Refer to ROM Option Documentation for other designators.
***NOTE: ISO (LA120) finals for these languages are supported but are not recommended. Their use selects the corresponding Digital character set.**

Sequence	Function
ESC (Final 033 050	Sets GO character set
ESC) Final 033 051	Sets G1 character set
ESC . Final	Sets G2 charcter set
ESC + Final 033 053	Sets G3 character set


Designation of Graphic Sets
CO
GL
1
2
3
4
G0
G1
G2
G3
ESC I1 ... Final
GRAPHIC REPERTORY
1 LS0 (SI)
2 LS1 (SO)
3 (Single character: SS2)
4 (Single character: SS3)

Active Column and Active Line

Sequence				Mnemonic	Function
ESC 033	D 104			IND	Increments active line and advances paper
ESC 033	I 133	Pn ***	d 144	VPA	Sets active line to Pn
ESC 033	E 105			NEL	Sets active column to left margin. Increments active line
ESC 033	[133	Pn ***	 140	HPA	Sets active column to column Pn
ESC 033	[133	Pn ***	a 141	HPR	Advances current active column by Pn columns
ESC 033	[133	Pn ***	A 101	CUU	Decrements current active line by Pn lines without going past top margin
ESC 033	[133	Pn ***	e 145	VPR	Advances active line by Pn lines. Stops at the beginning of next page.
ESC 033	K 113			PLD	Moves paper up 1/12" (for subscripts or return from superscripts).
ESC 033	L 114			PLU	Moves paper down 1/12" (for superscripts or return from subscripts).
ESC 033	M 115			RI	Decrements active line and moves paper down one line (prints on preceding line).

Sequence				Mnemonic	Characters/Inch
Horizontal Pitch				**DECSHORP**	
ESC 033	[133	Ps ***	w 167		
Ps					Default (10)
0 060					
1 061					10
2 062					12
3 063					13.2
4 064					16.5
5 065					5
6 066					6
7 067					6.6
8 070					8.25

Horizontal Margins DECSLRM

ESC	[	Pn1	;	Pn2	s
033	133	***	073	***	163

Sets left margin to Pn1, right margin to Pn2.

Horizontal Tabs

Mnemonic	Function
HTS	Sets horizontal tab stop at active column
DECHTS	Sets horizontal tab stop at active column. Not recommended, use HTS instead.
TBC	Clears horizontal tab stop at the active column
TBC	Clears all horizontal tab stops
TBC	Clears all horizontal tab stops
DECAHT	Clears all horizontal tab stops. Not recommended, use TBC instead.
DECSHTS	Sets horizontal tab stops at the given values for Pn (up to 16 stops may be specified).

ESC	H
033	110

ESC	1
033	061

ESC	[	0	g
033	133	060	147

ESC	[	2	g
033	133	062	147

ESC	[	3	g
033	133	063	147

ESC	2
033	062

ESC	[	Pn	;	...	Pn	u
033	133	***	073	...	***	165

Sequence | **Mnemonic** | **Lines/Inch**

Vertical Pitch | **DECVERP**

ESC	[	Ps	z
033	133	***	172

Ps	
0 060	Default (6)
1 061	6
2 062	8
3 063	12
4 064	2
5 065	3
6 066	4

Form Length DECSLPP

ESC	[	Pn	t
033	133	***	164

Sets form length to Pn lines. Sets top margin and active line to line one. Sets bottom margin to line Pn. Default is 1.

Vertical Margins DECSTBM

ESC	[	Pn1	;	Pn2	r
033	133	***	073	***	162

Sets top margin to (Pn1) x (pitch) inches, bottom margin to (Pn2) x (pitch) inches.

Vertical Tabs

Sequence							Mnenomic	Function
ESC 033	J 112						VTS	Sets A vertical tab stop at active line
ESC 033	3 063						DECVTS	Sets vertical tab stop at active line. Not recommended, use VTS instead.
ESC 033	[133	Pn ***	; 073	... ...	Pn ***	v 166	DECSVTS	Sets A vertical tab stop at line Pn (up to 16 lines may be specified).
ESC 033	[133	1 061	g 147				TBC	Clears vertical tab stop at active line
ESC 033	[133	4 064	g 147				TBC	Clears all vertical tab stops
ESC 033	4 064						DECCAVT	Clears all vertical tab stops. Not recommended, use TBC instead.

Product Identification Request

Sequence				Mnemonic	Function
ESC 033	[133	c 143		DA	Requests product identification.
ESC 033	[133	0 060	c 143	DA	Requests product identification.
ESC 033	Z 132			DECID	Requests product identification. Not recommended, use DA instead.

Product Identification Report

	Report							Device
ESC 033	[133	? 077	1 061	0 060	c 143			Version 1 microcode (7-bit only)
ESC 033	[133	? 077	1 061	0 060	; 073	2 062	c 143	Version 2 microcode (7 or 8-bit data)

ANSI Strings

ESC 033	_ 137	Data ***	...	Data ***	ESC 033	/ 134	APC	Application program command
ESC 033	] 135	Data ***	...	Data ***	ESC 033	/ 134	OSC	Operating system command
ESC 033	^ 136	Data ***	...	Data ***	ESC 033	/ 134	PM	Privacy message
ESC 033	/ 134						ST	String terminator for DCS APC, OSC and PM. Mainly used to exit graphics and end of answerback entry.

Graphics String

ESC 033	P 120	Ps ***	g 161	Data ***	...	Data ***	ESC 033	/ 134

Ps	Dot Spacing (mils)
0,1,5	7.57

Answerback Message Entry

ESC 033	P 120	v 166	Data ***	....	Data ***	ESC 033	/ 134

Data consists of up to 30 characters coded in hex.

▪ LA12

The most current operating and programming information on the DECwriter Corespondent is reproduced here.

OPERATOR INFORMATION

SETUP MODE

Key	Function/Comments
CTRL and **SETUP**	Press to enter SETUP; SETUP indicator flashes
SETUP	Press to exit SETUP; SETUP indicator stops flashing

NOTES

1 Do not use SHIFT unless specified

2 The CORRESPONDENT must be in SETUP to select the following feature

COMMUNICATION

Key	Function/Comments
Auto Answerback	
C A = A RETURN	Disables auto-answerback
C A = B RETURN	Enables auto-answerback
Buffer Size	
C B = A RETURN	Sets buffer size to 200 characters
C B = B RETURN	Sets buffer size to 1024 characters
Communications Port	
C C = A RETURN	Enables EIA interface
C C = B RETURN	Enables Direct Connect Modem
C C = C RETURN	Enables Acoustic Coupled Modem
C C = D RETURN	Enables 20 mA interface (optional)
Half-Duplex Disconnect Character	
C D = A RETURN	Sets disconnect character to "none"
C D = B RETURN	Sets disconnect character to ETX
C D = C RETURN	Sets disconnect character to EOT
Local Echo Control	
C E = A RETURN	Disables local echo
C E = B RETURN	Enables local echo

Key	Function/Comments
Fault Actions	
C F = A RETURN	Disables fault action
C F = B RETURN	Sets fault action to XOFF
C F = C RETURN	Sets fault action to BREAK
C F = D RETURN	Sets fault action to DISCONNECT
Half-Duplex Initial Direction	
C G = A RETURN	Sets initial direction to RECEIVE
C G = B RETURN	Sets initial direction to TRANSMIT
Modem Protocol	
C M = A RETURN	Selects full-duplex – data leads only
C M = B RETURN	Selects full-duplex – full control
C M = C RETURN	Selects full-duplex – supervisory
C M = D RETURN	Selects full-duplex – coded w/o reverse channel
Receive Error Override	
C R = A RETURN	Prints error character "ℵ"
C R = B RETURN	Override receive errors
Key	**Function/Comments**
Parity	
C P = A RETURN	Sets parity to 7 bits, parity bit= mark
C P = B RETURN	Sets parity to 7 bits, parity bit= space or 8 bits, parity bit= no space
C P = C RETURN	Sets parity to 7 bits, parity bit= even
C P = D RETURN	Sets parity to 7 bits, parity bit= odd
C P = E RETURN	Sets parity to 8 bits, parity bit= even
C P = F RETURN	Sets parity to 8 bits, parity bit= odd
Polarity – Secondary Request to Send	
C Q = A RETURN	Sets polarity low
C Q = B RETURN	Sets polarity high
Restraint Control	
C R = A RETURN	Disables restraint control
C R = B RETURN	XON/XOFF restraint
C R = C RETURN	Secondary channel restraint
C R = D RETURN	XON/XOFF and secondary restraint
Baud Rates	
C S = A RETURN	Selects high speed baud rate
C S = B RETURN	Selects low speed baud rate
C S = C RETURN	Selects remote speed select to either high or low baud rates (DCM only)
C H = A RETURN	Sets high speed to 50 baud
C H = B RETURN	Sets high speed to 75 baud

NOTE: To set low baud rate substitute the "L" key for the "H" key.

Key	Function/Comments
C H = C RETURN	Sets high speed to 110 baud
C H = D RETURN	Sets high speed to 134.5 baud
C H = E RETURN	Sets high speed to 150 baud
C H = F RETURN	Sets high speed to 200 baud
C H = G RETURN	Sets high speed to 300 baud
C H = H RETURN	Sets high speed to 600 baud
C H = I RETURN	Sets high speed to 1200 baud
C H = J RETURN	Sets high speed to 1800 baud
C H = K RETURN	Sets high speed to 2400 baud
C H = L RETURN	Sets high speed to 4800 baud
C H = M RETURN	Sets high speed to 7200 baud
C H = N RETURN	Sets high speed to 9600 baud
C H = O RETURN	Sets high speed to 75T/600R baud
C H = P RETURN	Sets high speed to 75T/1200R baud
C H = Q RETURN	Sets high speed to 150T/600R baud
C H = R RETURN	Sets high speed to 150T/1200R baud
C H = S RETURN	Sets high speed to 300T/2400R baud
C H = T RETURN	Sets high speed to 300T/4800R baud
C H = U RETURN	Sets high speed to 600T/2400R baud
C H = V RETURN	Sets high speed to 600T/4800R baud
Half-Duplex Turnaround Character	
C T = A RETURN	Disables turnaround character
C T = B RETURN	Enables RETURN as turnaround character
C T = C RETURN	Enables LINE FEED as turnaround character
C T = D RETURN	Enables DC1 as turnaround character
C T = E RETURN	Enables DC3 as turnaround character
C T = F RETURN	Enables EOT as turnaround character
C T = G RETURN	Enables ETX as turnaround character
Power Up – Initial State	
C U = A RETURN	Local
C U = B RETURN	On-line without local echo
C U = C RETURN	On-line with local echo
Modem Frequency Selection	
C V = A RETURN	Selects 212A frequencies
C V = B RETURN	Selects CCITT V.23 frequencies

PRINTING

Key	Function/Comments
Horizontal Tabs	
1	Sets horizontal tab stop at current active column
2	Clears horizontal tab stop at current active column
3	Clears all horizontal tab stops

Key	Function/Comments
Horizontal Margin	
5	Sets left margin at current active column
6	Sets right margin at current active column
7	Clears both horizontal margins
Character Set Printing	
P A = A RETURN	Prints ASCII character set
P A = B RETURN	Prints British character set
P A = C RETURN	Prints French Canadian character set
P A = D RETURN	Prints German character set
P A = E RETURN	Prints Swedish character set
P A = F RETURN	Prints French character set
P A = G RETURN	Prints Finnish character set
P A = H RETURN	Prints Norwegian/Danish character set
P A = I RETURN	Prints Italian character set
P A = J RETURN	Prints Spanish character set
P A = K RETURN	Prints APL character set
P A = L RETURN	Prints line drawing (VT100) character set

NOTES

1. *<P> <A> sets GO character set*
2. *To set G1 character set replace <P> <A> with <P> <B>*
3. *To set G2 character set replace <P> <A> with <P> <C>*
4. *To set G3 character set replace <P> <A> with <P> <D>*

Wraparound Mode	
P E = A RETURN	Disables wraparound
P E = B RETURN	Enables wraparound
Control Character Printing	
P G = A RETURN	Disables control character printing
P G = B RETURN	Enables control character printing without NUL and DEL printing
P G = C RETURN	Enables control character printing with NUL and DEL printing
Horizontal Pitch	
P H = A RETURN	Selects 10 characters per inch
P H = B RETURN	Selects 12 characters per inch
P H = C RETURN	Selects 13.2 characters per inch
P H = D RETURN	Selects 16.5 characters per inch
P H = E RETURN	Selects 5 characters per inch
P H = F RETURN	Selects 6 characters per inch
P H = G RETURN	Selects 6.6 characters per inch
P H = H RETURN	Selects 8.25 characters per inch
New Line Character	
P N = A RETURN	No new line character
P N = B RETURN	Enables RETURN as new line character
P N = C RETURN	Enables LINE FEED as new line character

Key	Function/Comments
Printing Pressure	
P P = A RETURN	Sets print pressure high
P P = B RETURN	Sets print pressure medium
P P = C RETURN	Sets print pressure low
Vertical Spacing	
P V = D RETURN	Selects 2 lines per inch
P V = E RETURN	Selects 3 lines per inch
P V = F RETURN	Selects 4 lines per inch
P V = A RETURN	Selects 6 lines per inch
P V = B RETURN	Selects 8 lines per inch
P V = C RETURN	Selects 12 lines per inch

Key	Function/Comments
Forms Control	
P F = NO. OF STEPS	Sets form length to the desired number of steps (one step = 1/24 inch)
4	Sets top of form to current line
Vertical Margins	
SHIFT 5	Sets the top margin at the current line
SHIFT 6	Sets the bottom margin at the current line
SHIFT 7	Clears both the top and bottom margins
Vertical Tabs	
SHIFT 1	Sets a vertical tab at the current line
SHIFT 2	Clears the vertical tab at the current line
SHIFT 3	Clears all vertical tabs

KEYBOARD

Auto Linefeed	
K A = A RETURN	Disables auto linefeed with RETURN
K A = B RETURN	Enables auto linefeed with RETURN
Break Key	
K B = A RETURN	Disables BREAK key
K B = B RETURN	Enables BREAK key
Keyclick	
K C = A RETURN	Disables keyclick
K C = B RETURN	Enables keyclick

Key	Function/Comments
External Keypad Coding	
K K = A RETURN	Normal numeric mode
K K = B RETURN	Alternate function mode
Keyboard Language	
K L = A RETURN	ASCII keyboard layout
K L = B RETURN	British keyboard layout
K L = C RETURN	French Canadian keyboard layout
K L = D RETURN	German keyboard layout
K L = E RETURN	Swedish keyboard layout
K L = F RETURN	French keyboard layout
K L = G RETURN	Finnish keyboard layout
K L = H RETURN	Norwegian/Danish keyboard layout
Repeat Keys	
K R = A RETURN	Disables keys repeat
K R = B RETURN	Enables keys repeat
Status	
8	Prints out current status information
C	Pints out current communication status information
P	Prints out current printing status information
K	Prints out current keyboard status information
T	Prints out self-test alternatives
SHIFT 9	Stores the current feature status information into non-volatile memory
9 RETURN	Recalls feature status in non-volatile memory
Terminal Reset	
I RETURN	Resets temporarily stored SET-UP feature status to factory set parameters
Key	
Self-Test	
T T RETURN	Prints ripple pattern
T L RETURN	Local loopback self-test
T R RETURN	Remote loopback self-test (DCM only)
T B RETURN	Baud rate and line signal self-test (EIA only)
T T SPACE	Non-printing test
T T and any printable character key	Prints the selected character continually

PROGRAMMING INFORMATION

This sheet provides the escape sequences which can be used to control the correspondent down line. The sequences have been grouped according to function with allowed optional sequences included.

Escape Sequence	Function/Comments
Terminal Initialization and Identification	
ESC c	Reset terminal (10 seconds should be allowed to complete)
ESC Z	Request product identification from terminal
ESC [c	Same as above
ESC [0 c	Same as above
ESC [? 15 ; 1 c	Terminal responds to above requests
Vertical Motion Control	
ESC D	Performs a linefeed
ESC E	Performs a new line function (do a <CR><LF> sequence)
ESC K	Performs a partial line down function
ESC L	Performs a partial line up function
ESC M	Performs a reverse linefeed
ESC J	Sets a tab stop at the current line number
ESC 3	Same as above
ESC [1 g	Clears the tab stop at the current line
ESC [4 g	Clears all tab stops
ESC 4	Same as above
ESC [Pn A	Executes Pn reverse linefeeds (0<Pn<= current form length)
ESC [Pn z	Sets the vertical pitch according to the parameter supplied where, Pn =0,1 Set spacing to 6 lpi 2 Set spacing to 8 lpi 3 Set spacing to 12 lpi 4 Set spacing to 2 lpi 5 Set spacing to 3 lpi 6 Set spacing to 4 lpi
ESC [P1 , P2 r	Sets top margin; bottom margin to the line numbers indicated
ESC [P1 t	Sets page length to P1 lines in the current vertical pitch
ESC [Pn;,,,Pn v	Sets vertical tab stops at the line numbers indicated
ESC [Pn e	Position to relative line number
ESC [Pn d	Position to absolute line number

NOTE: Octal code equivalents are found in Appendix A.

Escape Sequence	Function/Comments
Horizontal Motion Control	
ESC 1	Sets a tab stop at the current active position
ESC H	Same as above
ESC [Pn;...;Pn u	Sets tab stops at the columns indicated
ESC 2	Clears all tab stops
ESC [2 g	Same as above
ESC [3 g	Same as above
ESC [0 g	Clears tab stop at current active position
ESC [P1 ; Pn s	Set left and right margins respectively with values given
ESC [Pn	Positions printhead to column number Pn on the current
ESC [Pn a	Positions the printhead Pn columns to the right of the current position
ESC [Pn w	Sets pitch according to the parameter given; where Pn = 0,1 Select 10 cpi 2 Select 12 cpi 3 Select 13 2 cpi 4 Select 16.5 cpi 5 Select 5 cpi (double width characters) 6 Select 6 cpi (double width characters) 7 Select 6.6 cpi (double width characters) 8 Select 8.25 cpi (double width characters)
ANSI Strings	
ESC P	ANSI DCS string follows – data will be thrown away until the terminator sequence is received (ST, DEL, CAN, SUB)
ESC \	ANSI ST – this is the standard string terminator which is used to inform the terminal that the DCS, OCS, APC, PM string has been sent
ESC]	ANSI OSC string follows – data will be thrown away until the terminator sequence is received
ESC _	ANSI APC string follows – data will be thrown away until the terminator sequence is received
ESC ^	ANSI PM string follows – data will be thrown away until the terminator sequence is received

Escape Sequence	Function/Comments
Printer Mode Selection	
ESC [20 h	Enables new line (ESC E) function
ESC [20 l*	Disables new line (ESC E) function
ESC [? Pn,. Pn h	Sets Privacy Mode: Pn = 0 Changes nothing Pn = 7 Sets auto-wrap mode for lines which are too long Pn = 24 Sets printing to low density operation
ESC [? Pn,. Pn l*	Resets Privacy Mode: Pn = 0 Changes nothing Pn = 7 Clears auto-wrap mode Pn = 24 Sets printing to high density operation

* The last character of the sequence is lowercase L (154_8)

Escape Sequence		Function/Comments
Select G0 Set	Select G1 Set	
ESC (A	**ESC**) A	Selects British as G0 or G1 character set
ESC (B	**ESC**) B	Select United States as G0 or G1 character set
ESC (C	**ESC**) C	Selects Finnish as G0 or G1 character set
ESC (E	**ESC**) E	Select Norwegian (Danish)as G0 or G1 character set
ESC (H	**ESC**) H	Select Swedish as G0 or G1 character set
ESC (K	**ESC**) K	Select German as G0 or G1 character set
ESC (R	**ESC**) R	Selects French as G0 or G1 character set
ESC (Q	**ESC**) Q	Select French-Canadian as G0 or G1 character set
ESC (Y	**ESC**) Y	Selects Italian as G0 or G1 character set
ESC (Z	**ESC**) Z	Selects Spanish as G0 or G1 character set
ESC (0	**ESC**) 0	Selects VT100 line drawing set as G0 or G1 character set
ESC (5	**ESC**) 5	Selects Finnish as G0 or G1 character set
ESC (6	**ESC**) 6	Selects Norwegian (Danish) as G0 or G1 character set
ESC (7	**ESC**) 7	Selects Swedish as G0 or G1 character set
ESC (8	**ESC**) 8	Select APL as G0 or G1 character set
ESC (9	**ESC**) 9	Selects French-Canadian as G0 or G1 character set

Note When the G0 (primary) character set and the G1 (alternate) character sets are selected, a single control character is used to switch character sets Shift in (SI) invokes the G0 character set shift out (SO) invokes the G1 character set At power up, the G0 character set is automatically invoked

Select G2 Set	Select G3 Set	
ESC * A	**ESC** + A	Selects British as G2 or G3 character set
ESC * B	**ESC** + B	Select United States as G2 or G3 character set

Escape Sequence		Function/Comments
ESC * C	**ESC** + C	Selects Finnish as G2 or G3 character set
ESC * E	**ESC** + E	Select Norwegian (Danish)as G2 or G3 character set
ESC * H	**ESC** + H	Select Swedish as G2 or G3 character set
ESC * K	**ESC** + K	Select German as G2 or G3 character set
ESC * R	**ESC** + R	Selects French as G2 or G3 character set
ESC * Q	**ESC** + Q	Select French-Canadian as G2 or G3 character set
ESC * Y	**ESC** + Y	Selects Italian as G2 or G3 character set
ESC * Z	**ESC** + Z	Selects Spanish as G2 or G3 character set
ESC * 0	**ESC** + 0	Selects VT100 line drawing set as G2 or G3 character set
ESC * 5	**ESC** + 5	Selects Finnish as G2 or G3 character set
ESC * 6	**ESC** + 6	Selects Norwegian (Danish) as G2 or G3 character set
ESC * 7	**ESC** + 7	Selects Swedish as G2 or G3 character set
ESC * 8	**ESC** + 8	Select APL as G2 or G3 character set
ESC * 9	**ESC** + 9	Selects French-Canadian as G2 or G3 character set

NOTE *To access the G2 character set from either the G0 or G1 character sets, a single shift 2 (SS2) sequence is used. This causes the first character (only) in the G2 set to print. A single shift 3 (SS3) sequence performs the same function for the G3 character set.*

ALTERNATE KEYPAD MODE

This procedure enables the optional numeric keypad to be used in two ways to generate character codes, or to generate escape sequences The following table describes the characters and escape sequences generated by the 18 keys on the keypad

CHARACTER OR ESCAPE SEQUENCE TRANSMITTED

NUMERIC KEYPAD KEY	NORMAL KEYPAD MODE	ALTERNATE KEYPAD MODE	CODE SEQUENCE
PF1	ESC O P	ESC O P	033 117 120
PF2	ESC O Q	ESC O Q	033 117 121
PF3	ESC O R	ESC O R	033 117 122
PF4	ESC O S	ESC O S	033 117 123
ENTER	Same as RETURN key	ESC O M	033 117 115
(comma)	(comma)	ESC O l	033 117 154
(dash)	(dash)	ESC O m	033 117 155
(period)	(period)	ESC O n	033 117 156
0	0	ESC O p	033 117 160
1	1	ESC O q	033 117 161
2	2	ESC O r	033 117 162
3	3	ESC O s	033 117 163
4	4	ESC O t	033 117 164
5	5	ESC O u	033 117 165
6	6	ESC O v	033 117 166
7	7	ESC O w	033 117 167
8	8	ESC O x	033 117 170
9	9	ESC O y	033 117 171

Note: When in alternate keypad mode and local the numeric keypad cannot be used to print characters.

▪ LA120

The most current operating and programming information on the DECwriter III is reproduced here.

SET-UP

KEY	FUNCTION/COMMENTS
CTRL and SET-UP	Locks LA120 in set-up mode, SET-UP light flashes
	To exit set-up mode press SET-UP
SET-UP	Places LA120 in set-up mode while SET-UP is held down, SET-UP light flashes
	To exit set-up mode release SET-UP

NOTES:

1 **LA120 must be in set-up mode to set the following features.**

2. **Do not use SHIFT unless specified.**

FORMS

KEY	FUNCTION/COMMENTS
SHIFT	Display current line number Releasing SHIFT returns display to current column number
1	Set horizontal tab at current column
SHIFT and 1	Set vertical tab at current line
2	Clear horizontal tab at current column
SHIFT and 2	Clear vertical tab at current line
3	Clear all horizontal tabs
SHIFT and 3	Clear all vertical tabs
4 or SHIFT and 4	Establish top of form (TOF)
5	Set minimum column number (left margin)
SHIFT and 5	Set minimum line number (top margin)

KEY	FUNCTION/COMMENTS
[6]	Set maximum column number (right margin)
[SHIFT] and [6]	Set maximum line number (bottom margin)
[7]	Clear left and right margins
[SHIFT] and [7]	Clear top and bottom margins
[F]	Form Length NOTE Changing form length clears top and bottom margins and establishes TOF

DISPLAY	
1 thru 168	Lines per form

[H] Horizontal pitch (Characters per inch)

NOTE Changing horizontal pitch clears left and right margins

DISPLAY	PITCH
5	5.00 CPI
6	6.00 CPI
7	6.60 CPI
8	8.25 CPI
10	10.0 CPI
12	12.0 CPI
13	13.2 CPI
16	16.5 CPI

[V] Vertical pitch (Lines per inch)

NOTE Changing vertical pitch clears top and bottom margins

DISPLAY	PITCH
2	2 LPI
3	3 LPI
4	4 LPI
6	6 LPI
8	8 LPI
12	12 LPI

OPERATOR COMFORT

KEY	FUNCTION/COMMENTS
[G]	Bell volume 0 = Low Volume 1 = High Volume
[K]	Key click 0 = Off 1 = On

KEY	FUNCTION/COMMENTS
R	Auto repeat 0 = Off 1 = On
Z	Last character view 0 = Manual 1 = Auto

COMMUNICATION

KEY	FUNCTION/COMMENTS
A	Auto answerback 0 = Off 1 = On
B	Buffer control 0 = Small 1 = Large
C	Printer character set 1 = United States 2 = United Kingdom
D	Auto disconnect 0 = Off 1 = On
E	Local echo 0 = Off 1 = On
J	Auto new line at right margin 0 = Off 1 = On
L	Auto line feed (Return key) 0 = Off 1 = On
M	Modem 1 = FDX, No Modem 2 = FDX, Modem 3 = HDX, Supervisory 4 = HDX, EOT 5 = HDX, ETX
N	Keyboard and printer character set 1 = United States 2 = United Kingdom

KEY	FUNCTION/COMMENTS
[O] (letter)	Alternate character set 0 = OFF 1 = ON
[P]	Parity and data bits

DISPLAY	DATA BITS	PARITY REC	PARITY XMT
1	7	IGNORE	MARK
2	7	IGNORE	SPACE
3	7	IGNORE	ODD
4	7	IGNORE	EVEN
5	7	ODD	ODD
6	7	EVEN	EVEN
7	7	NONE	NONE
8	8	NONE	NONE
9	8	ODD	ODD
10	8	EVEN	EVEN

[Q] HDX initial calling state
0 = Transmit
1 = Receive

[S] Secondary channel

DISPLAY	FDX * MODE	HDX * REV CH
0	Speed	No
1	Restraint	Yes

* See M Key, Modem

[U] Break enabled
0 = No
1 = Yes

[W] Printer new line character
1 = None
2 = Line feed (LF)
3 = Return (CR)

[X] XON/XOFF
0 = No
1 = Yes

[Y] Alternate keypad mode
0 = No
1 = Yes

KEY	FUNCTION/COMMENTS
[0] (number)	Selects receive and transmit baud rates and number of stop bits

BAUD RATE (DISPLAYED)	STOP BITS
50	2
75	2
110	2
134	1
150	1
200	1
300	1
600	1
1200	1
1800	1
2400	1
4800	1
7200	1
9600	1

[SHIFT] and [0] Selects split baud rates

[0] selects receive baud rate; [SHIFT] and [0] then offers a choice of three transmit baud rates

RECEIVE BAUD RATE (NOT DISPLAYED)	TRANSMIT BAUD RATE (DISPLAYED)	TRANSMIT STOP BITS
600	75	2
	150	1
	600	1
1200	75	2
	150	1
	1200	1
2400	300	1
	600	1
	2400	1
4800	300	1
	600	1
	4800	1

STORE RECALL AND STATUS

KEY	FUNCTION/COMMENTS
[1] (letter)	Select factory set-up parameters
[8]	Print status message

KEY	FUNCTION/COMMENTS
[9]	Recall set-up parameters
[SHIFT] and [9]	Store set-up parameters

SELF TEST

KEY	FUNCTION/COMMENTS
[T]	Initiate printing self test
[SHIFT] and [>]	Initiate non-printing self test NOTE Type any character in set-up mode to stop self test

▪ LA210 Letterprinter Programming Summary Digital Mode

▪ Switch-Selectable Features

Switch A

▪ SPEED CONTROL/RESTRAINT PROTOCOL SWITCH

A1	Function
D	Selects restraint mode using the EIA BUSY control line.
U	Selects speed control mode using the EIA SPDI (speed indicator) and SPDS (speed select) control lines.

▪ MODEM CONTROL SWITCH

A2	Function
D	Disables modem control.
U	Enables modem control.

▪ FAULT RESPONSE SWITCHES

A3	A4	Function
D	D	Selects no action. (XOFF sent if enabled.)
U	D	Selects send break.
D	U	Selects disconnect. (Drop DTR.)
U	U	Selects do not connect.

▪ END OF TRANSMISSION SWITCH

A5	Function
D	Disables coded disconnect. (Ignores EOT.)
U	Enables coded disconnect. (Disconnects upon receiving EOT.)

U = Up
D = Down

- XON/XOFF PROTOCOL SWITCH

A6	Function
U	Enables auto XON/XOFF.
D	Disables auto XON/XOFF.

- ERROR PROCESSING SWITCH

A7	Function
D	Sets receiver error processing to print substitute character.
U	Sets receiver error processing to print characters as received.

- STORE FEATURES SWITCH

A8	Function
Move switch from down to up.	Stores computer-selectable features in user permanent memory.

NOTE: Moving switch A8 from up to down has no function.

Switch B

- BAUD RATE (SPEED) SWITCHES

B1	B2	B3	B4	B5*	Function (Baud Rate)
D	D	D	D	D	50
U	D	D	D	D	75
D	U	D	D	D	110
U	U	D	D	D	134.5
D	D	U	D	D	150
U	D	U	D	D	200
D	U	U	D	D	300
U	U	U	D	D	600
D	D	D	U	D	1200
U	D	D	U	D	1800
D	U	D	U	D	2400
U	U	D	U	D	4800
D	D	U	U	D	7200
U	D	U	U	D	9600
D	D	D	D	U	75 T / 600 R
U	D	D	D	U	75 T /1200 R
D	U	D	D	U	150 T / 600 R
U	U	D	D	U	150 T /1200 R
D	D	U	D	U	300 T /2400 R
U	D	U	D	U	300 T /4800 R

B1	B2	B3	B4	B5*	Function (Baud Rate)
D	U	U	D	U	600 T/2400 R
U	U	U	D	U	600 T/4800 R

*Switch B5 selects equal (D) or unequal (U) transmit (T) and receive (R) rates.
U = Up
D = Down

- DATA PARITY SWITCHES

		Function	
B6	**B7**	**7 Data Bits**	**8 Data Bits**
D	D	Space	No parity
U	D	Mark	No parity
D	U	Even parity	Even parity
U	U	Odd parity	Odd parity

- DATA FORMAT SWITCH

B8	Function
U	Selects 8 data bits per character.
D	Selects 7 data bits per character.

- PARALLEL INTERFACE SWITCHES

Setting	Function
Both up	Parallel interface clock and power off.
Both down	Parallel interface clock and power on.

Jumper-Selectable Features

- AUTOANSWERBACK (W3)

Jumper State	Function
Installed	Disables autoanswerback.
Removed	Enables autoanswerback. (Answerback message is sent when communication link is established.)

Standard Character Charts

- 8-BIT CHARACTER CHART

BITS B7 B6 B5 / B4 B3 B2 B1	ROW	COLUMN 0		COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4		COLUMN 5		COLUMN 6		COLUMN 7	
0 0 0 0	0	NUL	0 0 0		20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0 0 0 1	1		1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0 0 1 0	2		2 2 2		22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
0 0 1 1	3		3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
0 1 0 0	4	EOT	4 4 4		24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
0 1 0 1	5	ENQ	5 5 5		25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
0 1 1 0	6		6 6 6		26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
0 1 1 1	7	BEL	7 7 7		27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
1 0 0 0	8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1 0 0 1	9	HT	11 9 9		31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1 0 1 0	10	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
1 0 1 1	11	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
1 1 0 0	12	FF	14 12 C		34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	!	174 124 7C
1 1 0 1	13	CR	15 13 D		35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
1 1 1 0	14	SO	16 14 E		36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
1 1 1 1	15	SI	17 15 F		37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DEL	177 127 7F

KEY

ASCII CHARACTER

ESC	1/11 COLUMN/ROW
	33 OCTAL
	27 DECIMAL
	1B HEX

1 0 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
8	9	10	11	12	13	14	15
200 128 80	220 144 90	240 160 A0	260 176 B0	300 192 C0	320 208 D0	340 224 E0	360 240 F0
201 129 81	DCS	241 161 A1 ¡	261 177 B1 ±	301 193 C1 Á	321 209 D1 Ñ	341 225 E1 á	361 241 F1 ñ
202 130 82	222 146 92	242 162 A2 ¢	262 178 B2 2	302 194 C2 Â	322 210 D2 Ò	342 226 E2 â	362 242 F2 ò
203 131 83	223 147 93	243 163 A3 £	263 179 B3 3	303 195 C3 Ã	323 211 D3 Ó	343 227 E3 ã	363 243 F3 ó
204 132 84 IND	224 148 94	244 164 A4	264 180 B4	304 196 C4 Ä	324 212 D4 Ô	344 228 E4 ä	364 244 F4 ô
205 133 85 NEL	225 149 95	245 165 A5 ¥	265 181 B5 µ	305 197 C5 Å	325 213 D5 Õ	345 229 E5 å	365 245 F5 õ
206 134 86	226 150 96	246 166 A6	266 182 B6 ¶	306 198 C6 Æ	326 214 D6 Ö	346 230 E6 æ	366 246 F6 ö
207 135 87	227 151 97	247 167 A7 §	267 183 B7 •	307 199 C7 Ç	327 215 D7 Œ	347 231 E7 ç	367 247 F7 œ
210 136 88 HTS	230 152 98	250 168 A8 ¤	270 184 B8	310 200 C8 È	330 216 D8 Ø	350 232 E8 è	370 248 F8 ø
211 137 89	231 153 99	251 169 A9 ©	271 185 B9 1	311 201 C9 É	331 217 D9 Ù	351 233 E9 é	371 249 F9 ù
212 138 8A VTS	232 154 9A	252 170 AA a	272 186 BA o	312 202 CA Ê	332 218 DA Ú	352 234 EA ê	372 250 FA ú
213 139 8B PLD	CSI 233 155 9B	253 171 AB «	273 187 BB »	313 203 CB Ë	333 219 DB Û	353 235 EB ë	373 251 FB û
214 140 8C PLU	ST 234 156 9C	254 172 AC	274 188 BC ¼	314 204 CC Ì	334 220 DC Ü	354 236 EC ì	374 252 FC ü
215 141 8D RI	OSC 235 157 9D	255 173 AD	275 189 BD ½	315 205 CD Í	335 221 DD Ý	355 237 ED í	375 253 FD ý
216 142 8E SS2	PM 236 158 9E	256 174 AE	276 190 BE	316 206 CE Î	336 222 DE	356 238 EE î	376 254 FE
217 143 8F SS3	APC 237 159 9F	257 175 AF ¯	277 191 BF	317 207 CF Ï	337 223 DF ß	357 239 EF ï	377 255 FF
ADDITIONAL CONTROL SET		DEC SUPPLEMENTAL GRAPHIC SET					

▪ 7-BIT CHARACTER CHART

B8 B7 B6 B5 / BITS B4 B3 B2 B1	ROW	COLUMN 0		COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4		COLUMN 5		COLUMN 6		COLUMN 7	
0 0 0 0	0	NUL	0 0 0		20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0 0 0 1	1		1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0 0 1 0	2		2 2 2		22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
0 0 1 1	3		3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
0 1 0 0	4	EOT	4 4 4		24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
0 1 0 1	5	ENQ	5 5 5		25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
0 1 1 0	6		6 6 6		26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
0 1 1 1	7	BEL	7 7 7		27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
1 0 0 0	8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1 0 0 1	9	HT	11 9 9		31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1 0 1 0	10	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
1 0 1 1	11	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
1 1 0 0	12	FF	14 12 C		34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C
1 1 0 1	13	CR	15 13 D		35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
1 1 1 0	14	SO	16 14 E		36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
1 1 1 1	15	SI	17 15 F		37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DEL	177 127 7F
		ASCII CONTROL SET				ASCII GRAPHIC CHARACTER SET											

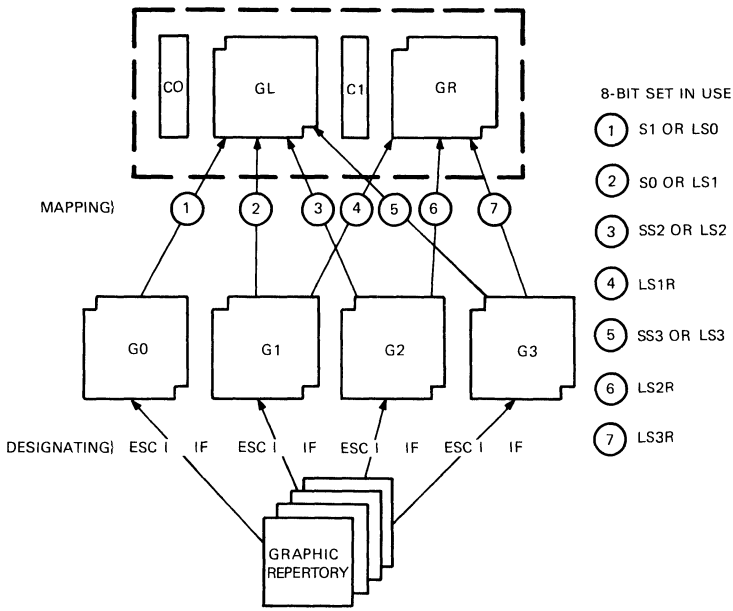
KEY

ASCII CHARACTER

ESC	1/11 COLUMN/ROW
	33 OCTAL
	27 DECIMAL
	1B HEX

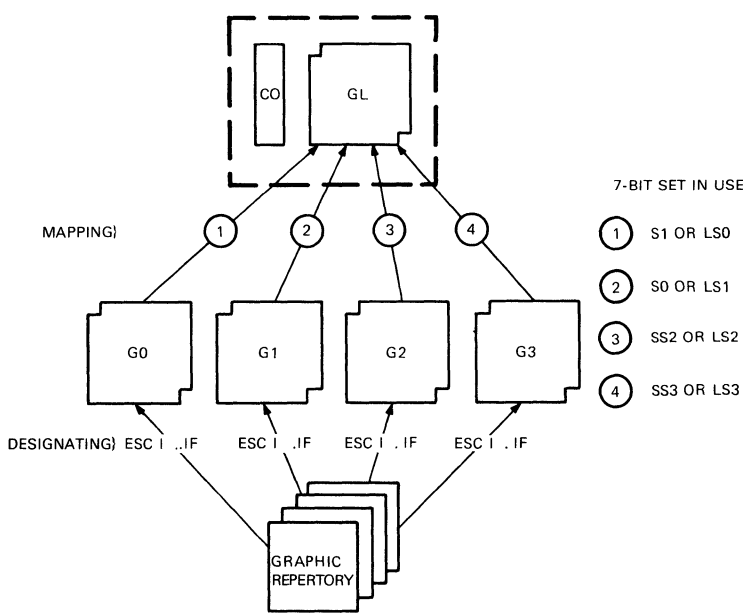
Designating and Mapping Character Sets

- 8-BIT ENVIRONMENT



- 7-BIT ENVIRONMENT

MA-0279-82H



- ANSWERBACK MESSAGE PROTECT (W4)

Jumper State	Function
Installed	Answerback message unprotected. (Message can be erased or changed.)
Removed	Answerback message protected. (Message cannot be erased or changed.)

- BUSY SIGNAL POLARITY (W5)

Jumper State	Printer State	Busy Signal
Installed (standard)	Busy	On (1)
	Ready	Off (0)
Removed (alternate)	Busy	Off (0)
	Ready	On (1)

Control Characters

- C0 Control Characters

Name	Mnemonic	Octal Code	Function
Null	NUL	000	Used for fill characters. See Paragraph 2.3.3 in programmer reference manual.
End of transmission	EOT	004	Used for disconnect character if enabled.
Enquiry	ENQ	005	Requests answerback message.
Bell	BEL	007	Sounds bell tone.
Backspace	BS	010	Moves active column left one column (except in graphics mode).
Horizontal	HT	011	Advances to next tab horizontal tab stop (except in graphics mode).
Line feed	LF	012	Advances to next line. Performs carriage return if enabled (except in graphics mode).
Vertical tab	VT	013	Advances to next vertical tab stop (except in graphics mode).
Form feed	FF	014	Advances to next top margin (except in graphics mode).

Name	Mnemonic	Octal Code	Function
Carriage return	CR	015	Returns to left margin. Performs line feed if enabled (except in graphics mode).
Shift out	SO	016	Maps G1 to GL printer character set.
Shift in	SI	017	Maps G0 to GL printer character set.
Cancel	CAN	030	Immediately ends any control or escape sequence.
Substitute	SUB	032	Immediately ends any control or escape sequence. Replaces characters received with errors by SUB if enabled. SUB prints as—or—. In graphics mode, SUB prints as a one-column space.
Escape	ESC	033	Introduces escape sequence.
Delete	DEL	177	No operation (not stored in input buffer and not to be used as filler).

- C1 CONTROL CHARACTERS

Name	Mnemonic	Octal Code	Function
Index	IND	204	Increments active line and advances paper. Line feed/new line mode does not affect this feature.
Next line	NEL	205	Sets active column to left margin and increments active line.
Horizontal tabulation set	HTS	210	Sets horizontal tab stop at active column.
Vertical tabulation set	VTS	212	Sets vertical tab stop at active line.
Partial line	PLD*	213	Indexes paper up 1/12 down inch. Line feed/new line mode does not affect this sequence.
Partial line	PLU*	214	Indexes paper down 1/12 up inch. Line feed/new line mode does not affect this sequence.

Name	Mnemonic	Octal Code	Function
Reverse index	RI	215	Decrements active line and moves paper down one line. Line feed/new line feed does not affect this sequence.
Single shift 2	SS2	216	Activates G2 character set for 1 character.
Single shift 3	SS3	217	Activates G3 character set for 1 character.
Device control string	DCS	220	Device control string introducer. (See Chapter 5 in the programmer reference manual.)
Control sequencer introducer	CSI	233	Used to select more functions through control sequencing.
String terminator	ST	234	Ends any pending ANSI string and reverts to text processing mode.
Operating system	OSC	235	Starts OSC string. (See Chapter 5 in the command programmer reference manual.)
Privacy message	PM	236	Start privacy message. (See Chapter 5 in the programmer reference manual.)
Application program command	APC	237	Starts application program command. (See Chapter 5 in the programmer reference manual.)

*PLD and PLU do not modify active line or the position counter. To maintain correct vertical forms handling, send the same number of PLDs and PLUs.

- GRAPHICS ANSI CONTROL CHARACTERS

Name	Mnemonic	Octal Code	Function
Cancel	CAN	030	Immediately exits graphics mode.
Substitute	SUB	032	Replaces any character received with errors. When received in graphics mode, SUB is processed as 77 octal (column space).
Escape	ESC	033	Printer exits graphics mode and processes sequence.
All C1 contro codes	(See C1 control codes table.)	200 through 237	Printer exits graphics mode and processes C1 codes.

NOTE: The printer processes NUL, EOT, ENQ, BEL, DEL, SI, and SO as it does in text mode. See C0 control codes table.

The printer ignores BS, LF, CR, FF, HT, and VT in graphics mode.

- GRAPHICS PRIVATE CONTROL CHARACTERS

Name	Mnemonic	Octal Code	ASCII Character	Function
Graphics repeat introducer	DECGRI	041	!	Begins repeat sequence.
Graphics carriage return	DECGCR	044	$	Returns to graphics left margin.
Graphics new line	DECGNL	055	—	Returns to graphics left margin and advances to next graphics line.

Escape and Control Sequences

- 8-BIT CHARACTER EQUIVALENTS FOR 7-BIT ESCAPE SEQUENCES

8-Bit Code	7-Bit Sequence	Character
IND	ESC D	Index
NEL	ESC E	Vertical line
HTS	ESC H	Horizontal tabulation set
VTS	ESC Z	Vertical tabulation set
PLD	ESC K	Partial line down
PLU	ESC L	Partial line up
RI	ESC M	Reverse index
SS2	ESC N	Single shift 2
SS3	ESC O	Single shift 3
DCS	ESC P	Device control string
CSI	ESC [	Control sequence introducer
ST	ESC \	String terminator
OSC	ESC]	Operating system command
PM	ESC ^	Private message
APC	ESC _	Application program command

- C1 CONTROL CHARACTER PROCESSING

Sequence			Function
ESC	SP	F	F enables or disables C1
033	040	***	transmission and reception.

F	Octal	Function
G	107	Enables C1 transmission.
F	106	Disables C1 transmission.
7	067	Enables C1 reception.
6	066	Disables C1 reception.

- PRINTING MODE (DRAFT MODE ONLY)

Sequence					Function
CSI	?	4	1	h	Prints from left to right.
233	077	064	061	150	
CSI	?	4	1	l*	Prints bidirectionally.
233	077	064	061	154	

- ACTIVE COLUMN AND ACTIVE LINE

Sequence			Mnemonic	Function
IND			IND	Increments active line and advances paper.
204				
CSI	Pn	d	VPA	Sets active line to Pn.
233	***	144		
NEL			NEL	Sets active column to left margin. Increments active line.
205				
CSI	Pn		HPA	Sets active column to column Pn.
233	***	140		
CSI	Pn	a	HPR	Advances current active column by Pn columns.
233	***	141		
CSI	Pn	A	CUU	Decrements current active line by Pn lines without going past top margin.
233	***	101		
CSI	Pn	e	VPR	Advances active line by Pn lines or at beginning of next page—whichever is closest.
233	***	145		
PLD			PLD	Moves paper up 1/12 inch (for subscripts or return from superscripts).
213				
PLU			PLU	Moves paper down 1/12 inch (for superscripts or return from subscripts).
214				
RI			RI	Decrements active line and moves paper down one line. (Prints on previous line.)
215				

*The last character of the sequence is lowercase L (154 octal).

• LINE FEED/NEW LINE MODE (LNM)

Sequence				Function
CSI	2	0	h	Sets line feed/new line mode on.
233	062	060	150	
CSI	2	0	l*	Sets line feed/new line mode off.
233	062	060	154	

• CARRIAGE RETURN/NEW LINE MODE

Sequence					Function
CSI	?	4	0	h	Sets carriage return/new line mode on.
23	077	064	060	150	
CSI	?	4	0	l*	Sets carriage return/new line mode off.
233	077	064	060	154	

• AUTO WRAPAROUND MODE (DECAWM)

Sequence				Function
CSI	?	7	h	Sets auto wraparound mode on.
233	077	067	150	
CSI	?	7	l*	Sets auto wraparound mode off
233	077	067	154	(truncated).

• PAGE WIDTH ALIGNMENT (DECPWA)

Sequence						Function
CSI	Pn1	;	Pn2	"	s	Pn1 specifies the left edge of
233	***	073	***	042	163	print area relative to the left edge of platten. Pn2 specifies width of print area. Pn1 and Pn2 are measured in units of 1/12 inch.

*The last character of the sequence is lowercase L (154 octal).

• HORIZONTAL MARGINS (DECSLRM)

Sequence					Function
CSI	Pn1	;	Pn2	s	Sets left and right margins to the given
233	***	073	***	163	values in columns.

- HORIZONTAL PITCH (DECSHORP)

CSI	Ps	w
233	***	167

Ps	Octal	Characters per Inch
0	060	Default (10)
1	061	10
2	062	12
3	063	13.2
4	064	16.5
5	065	5
6	066	6
7	067	6.6
8	070	8.25

- PITCH SELECT MODE (DECPSM)

Sequence					Function
CSI	?	2	9	h	Sets pitch select mode to font pitches.
233	077	062	071	150	
CSI	?	2	9	l*	Sets pitch select mode to all pitches.

*The last character of the sequence is lowercase L (154 octal).

• HORIZONTAL TABS

Sequence	Mnemonic	Function
HTS 210	HTS	Sets horizontal tab stop at active column.
ESC 1 033 061	DECHTS	Sets horizontal tab stop at active column. Not recommended; use HTS instead.
CSI 0 g 233 060 147	TBC	Clears horizontal tab stop at the active column.
CSI 2 g 233 062 147	TBC	Clears all horizontal tab stops.
CSI 3 g 233 063 147	TBC	Clears all horizontal tab stops.
ESC 2 033 062	DECAHT	Clears all horizontal tab stops. Not recommended; use TBC instead.
CSI Pn ; . . . Pn u 233 *** 073 . . . *** 165	DECSHTS	Sets horizontal tab stops at the given values for Pn. (You can specify 16 stops in one sequence, to a total of 217.)

• SET VERTICAL PITCH (DECVERP)

CSI 233	**Ps** ***	**z** 172
Ps	**Octal**	**Lines per Inch**
0	060	Default (6)
1	061	6
2	062	8
3	063	12
4	064	2
5	065	3
6	066	4

- FORM LENGTH (DECSLPP)

Sequence			Function
CSI	Pn	t	Sets form length to Pn lines. Pn = F × VP* Sets top margin to
233	***	164	0 inches and active line to line 1. Sets top of form to current position. Sets bottom margin to form length.

- VERTICAL MARGINS (DECSTBM)

Sequence					Function
CSI	Pn1	;	Pn2	r	Sets top margin to line Pn1. Sets bottom
233	***	073	***	162	margin to line Pn2.

*F = form length in inches
VP = current vertical pitch

- VERTICAL TABS

Sequence						Mnemonic	Function
VTS						VTS	Sets vertical tab stop at
212							active line.
ESC	3					DECVTS	Sets vertical tab stop at
033	063						active line. Not recommended; use VTS instead.
CSI	Pn	;	. . .	Pn	v	DECSVTS	Sets vertical tab stop at
233	***	073	. . .	***	166		line Pn. (You can specify 16 lines in one sequence, to a total of 168.)
CSI	1	g				TBC	Clears vertical tab stop at
233	061	147					active line.
CSI	4	g				TBC	Clears all vertical tab
233	064	147					stops.
ESC	4					DECCAVT	Clears all vertical tab
033	064						stops. Not recommended; use TBC instead.

• QUALITY SELECT MODE (DECDEN)

CSI	Ps	"	z
233	***	042	172

Ps	Octal	Function
0	060	Sets density select mode to default (draft) density.
1	061	Sets density select mode to draft density.
2	062	Sets density select mode to letter density (medium or high density, depending on DPS).

• SELECT GRAPHIC RENDITION (SGR)

CSI	Ps1	;	Ps2	;	. . .	;	Psn	m
233	***	073	***	073	. . .	073	***	155

Ps	Octal	Function
0	060	Reset.
4	064	Selects underline.
10	061, 060	Selects DPS 1.
11	061, 061	Selects DPS 2.
12	061, 062	Selects DPS 3.
13	061, 063	Selects DPS 4.
14	061, 064	Selects DPS 5.
24	062, 064	Clears underline.

• SELECT CHARACTER SET (SCS)

Sequence					Function
ESC	I1	I2	I3	Final	I1 designates a character set from the primary or alternate section of the repertory and the target. I2, I3 and final select the character set.
033	***	***	***	***	
	G0	G1	G2	G3	Designates a primary character set.
I1 =	(	)	*	+	
	050	051	052	053	
	G0	G1	G2	G3	Designates an alternate character set.
I1 =	,	—	.	/	
	054	055	056	057	

Final	Character Set
0 060	Digital VT100 line drawing
5 065	Digital Finnish
6 066	Digital Norwegian/Danish
7 067	Digital Swedish
8 070	Digital APL
9 071	Digital French Canadian
>> 074	Digital multinational
A 101	ISO U.K.
B 102	ISO U.S.
K 113	ISO German
R 122	ISO French
Y 131	ISO Italian
Z 132	ISO Spanish
" 1 042	Digital symbol 061

• SHIFT FUNCTIONS

Name	Mnemonic	Escape Sequence	Function
Locking shift 0	LS0	Same as shift in.	Maps G0 into GL.
Locking shift 1	LS1	Same as shift out.	Maps G1 into GL.
Locking shift 2	LS2	ESC n 033 156	Maps G2 into GL.
Locking shift 3	LS3	ESC o 033 157	Maps G3 into GL.
Locking shift 1 right	LS1R	ESC ~ 033 176	Maps G1 into GR.
Locking shift 2 right	LS2R	ESC } 033 175	Maps G2 into GR.
Locking shift 3 right	LS3R	| ESC 033 174	Maps G3 into GR.
Single shift 2	SS2	SS2 216	Invokes G2 for a single printable character.
Single shift 3	SS3	SS3 217	Invokes G3 for a single printable character.

NOTE: There is no locking shift 0 right. You cannot map G0 into GR.

• REQUEST FONT CONFIGURATION (DECRQSC)

Sequence					Function
CSI	?	1	0	c	Requests printer to send current font configuration.
233	077	061	060	143	

• REPORT FONT CONFIGURATION SEQUENCE

CSI	Ps1	;	Ps2	;	Ps3	;	Ps4	;	Ps5	SP	D
233	***	073	***	073	***	073	***	073	***	040	104

Ps1 represents the DPS location code. This code is the same as the select graphic rendition sequence.

Ps1 (Location Code)	DPS
10	1
11	2
12	3
13	4
14	5

NOTE: DPS location code 10 is always present and is sent last to indicate the end of the report.

PS2 represents the ROM identification code. There are four possible ROM identification categories.

Ps2	Function
1—64	Indicates draft and letter standard DPS.
65—128	Indicates draft and memo standard DPS.
129—192	Indicates draft and letter custom DPS.
192—200	Indicates draft and memo special DPS.

For more detail about a specific number, see the appropriate ROM option documentation.

A standard DPS with an odd identification number contains the US ASCII and ISO United Kingdom character sets. A standard DPS with an even identification number contains the following character sets.

US ASCII
Digital Finnish
Digital Norwegian/Danish
Digital Swedish
Digital French Canadian
Digital multinational or
  Digital VT100 line drawing set
ISO United Kingdom
ISO German
ISO French
ISO Italian
ISO Spanish

Ps3 represents one of the following type style attributes.

Ps3	Function
0	No type style
1	Gothic
5	Courier
9	Orator

Ps4 represents one of the following pitch attributes.

Ps4	Function
8	10 characters per inch/5 characters per inch.
0	12 characters per inch/6 characters per inch.

Ps5 represents one of the following print quality attributes.

Ps5	Function
0	Letter (33 X 18 matrix)
1	Memo (33 X 9 matrix)

▪ PRODUCT IDENTIFICATION REQUEST

Sequence			Mnemonic	Function
CSI 233	c 143		DA	Requests product identification.
CSI 233	0 060	c 143	DA	Requests product identification.
ESC 033	Z 132		DECID	Requests product identification. Not recommended; use DA instead.

▪ PRODUCT IDENTIFICATION REPORT

Report								Device
ESC 033	[133	? 077	1 061	0 060	; 073	3 063	c 143	Base printer (V2 microcode—8-bit)

- ANSI STRINGS

Name	8-Bit Character	7-Bit Sequence	
String terminator	ST 234	ESC 033	\ 134
Application program command	APC 237	ESC 033	_ 137
Operating system command	OSC 235	ESC 033	] 135
Privacy message	PM 236	ESC 033	^ 136
Device control string	DCS 220	ESC 033	P 120

- GRAPHICS STRING

DCS	Ps	q	Data	. . .	Data	ST
220	***	161	***	. . .	***	234

Ps	Octal	Dot Spacing (mils)
0, 1, or 5	060, 061, or 065	7.57
2	062	3.03
3	063	4.54
4	064	6.06
6	066	9.09
7	067	10.60
8	078	12.12
9	071	13.63

▪ REPEAT SEQUENCE

Sequence			Function
!	Pn	dot column	Lets printer print a specified dot column consecutively for Pn times.
041	060 to 071	077 to 176	

▪ ANSWERBACK MESSAGE

Sequence							Function
DCS	1	v	Data	...	Data	ST	Enters an answerback message. Data consists of up to 30 characters coded in hex.
220	061	166	***	...	***	234	

LA210 Letterprinter Programming Summary IBM—Emulation Modes

Emulation Mode 1 Epson/IBM MX80

This mode uses the LA10X-LB mosaic cartridge (font ID 137). Install it in either slot 2 or 4. The other slot can hold any other font cartridge.

Switch-Selectable Features

- SWITCH A

Switch	Setting	Function
A1, A2	Up or down	Not used.
A3	Up	When line buffer is full, printer prints line and advances to next line.
	Down	When line buffer is full, printer drops characters.
A4	Up	Cancel (CAN) character clears line buffer.
	Down	CAN character is ignored.
A5	Up	Delete (DEL) character clears line buffer.
	Down	DEL character is ignored.
A6	Up	Printer performs an automatic line feed when it receives a carriage return (CR) character.
	Down	The printer only performs a carriage return.
A7	Up	When printer receives BELL character, bell sounds.
	Down	BELL character is ignored.
A8	Up	Selects standard 8-inch paper width at power-up.
	Down	Selects 13.2-inch paper width.

- SWITCH B

Switch	Setting	Function
B1 to B4	All up	Enables emulation mode.
B5	Up	Selects emulation mode 1.
B6	Down	Selects emulation mode 1.
B7	Up or down	Not used.
B8	Up	Enables 2K buffer.
	Down	Enables 0.13K buffer.

• Mode 1 Character Set

B8 B7 B6 B5 BITS B4 B3 B2 B1	ROW	COLUMN 0	0	1	2	3	4	5	6	7
0 0 0 0	0	NUL	0 0 0	20 16 10	SP 40 32 20	0 60 48 30	@ 100 64 40	P 120 80 50	` 140 96 60	p 160 112 70
0 0 0 1	1		1 1 1	DC1 21 17 11	! 41 33 21	1 61 49 31	A 101 65 41	Q 121 81 51	a 141 97 61	q 161 113 71
0 0 1 0	2		2 2 2	DC2 22 18 12	" 42 34 22	2 62 50 32	B 102 66 42	R 122 82 52	b 142 98 62	r 162 114 72
0 0 1 1	3		3 3 3	DC3 23 19 13	# 43 35 23	3 63 51 33	C 103 67 43	S 123 83 53	c 143 99 63	s 163 115 73
0 1 0 0	4		4 4 4	DC4 24 20 14	$ 44 36 24	4 64 52 34	D 104 68 44	T 124 84 54	d 144 100 64	t 164 116 74
0 1 0 1	5		5 5 5	25 21 15	% 45 37 25	5 65 53 35	E 105 69 45	U 125 85 55	e 145 101 65	u 165 117 75
0 1 1 0	6		6 6 6	26 22 16	& 46 38 26	6 66 54 36	F 106 70 46	V 126 86 56	f 146 102 66	v 166 118 76
0 1 1 1	7	BEL	7 7 7	27 23 17	' 47 39 27	7 67 55 37	G 107 71 47	W 127 87 57	g 147 103 67	w 167 119 77
1 0 0 0	8		10 8 8	CAN 30 24 18	(50 40 28	8 70 56 38	H 110 72 48	X 130 88 58	h 150 104 68	x 170 120 78
1 0 0 1	9	HT	11 9 9	31 25 19	) 51 41 29	9 71 57 39	I 111 73 49	Y 131 89 59	i 151 105 69	y 171 121 79
1 0 1 0	10	LF	12 10 A	32 26 1A	* 52 42 2A	: 72 58 3A	J 112 74 4A	Z 132 90 5A	j 152 106 6A	z 172 122 7A
1 0 1 1	11	VT	13 11 B	ESC 33 27 1B	+ 53 43 2B	; 73 59 3B	K 113 75 4B	[133 91 5B	k 153 107 6B	{ 173 123 7B
1 1 0 0	12	FF	14 12 C	34 28 1C	, 54 44 2C	< 74 60 3C	L 114 76 4C	\ 134 92 5C	l 154 108 6C	¦ 174 124 7C
1 1 0 1	13	CR	15 13 D	35 29 1D	- 55 45 2D	= 75 61 3D	M 115 77 4D	] 135 93 5D	m 155 109 6D	} 175 125 7D
1 1 1 0	14	SO	16 14 E	36 30 1E	. 56 46 2E	> 76 62 3E	N 116 78 4E	^ 136 94 5E	n 156 110 6E	~ 176 126 7E
1 1 1 1	15	SI	17 15 F	37 31 1F	/ 57 47 2F	? 77 63 3F	O 117 79 4F	_ 137 95 5F	o 157 111 6F	DEL 177 127 7F
		ASCII CONTROL SET			ASCII GRAPHIC CHARACTER SET					

KEY

ASCII CHARACTER

ESC	33	OCTAL
	27	DECIMAL
	1B	HEX

MR-12448
MA-0601-84

Control Characters

1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
8	**9**	**10**	**11**	**12**	**13**	**14**	**15**
NUL 200 128 80	220 144 90	240 160 A0	260 176 B0	300 192 C0	320 208 D0		
201 129 81	DC1 221 145 91	241 161 A1	261 177 B1	301 193 C1	321 209 D1		
202 130 82	DC2 222 146 92	242 162 A2	262 178 B2	302 194 C2	322 210 D2		
203 131 83	DC3 223 147 93	243 163 A3	263 179 B3	303 195 C3	323 211 D3		
204 132 84	DC4 224 148 94	244 164 A4	264 180 B4	304 196 C4	324 212 D4		
205 133 85	225 149 95	245 165 A5	265 181 B5	305 197 C5	325 213 D5		
206 134 86	226 150 96	246 166 A6	266 182 B6	306 198 C6	326 214 D6		
BEL 207 135 87	227 151 97	247 167 A7	267 183 B7	307 199 C7	327 215 D7		
210 136 88	CAN 230 152 98	250 168 A8	270 184 B8	310 200 C8	330 216 D8		
HT 211 137 89	231 153 99	251 169 A9	271 185 B9	311 201 C9	331 217 D9		
LF 212 138 8A	232 154 9A	252 170 AA	272 186 BA	312 202 CA	332 218 DA		
VT 213 139 8B	ESC 233 155 9B	253 171 AB	273 187 BB	313 203 CB	333 219 DB		
FF 214 140 8C	234 156 9C	254 172 AC	274 188 BC	314 204 CC	334 220 DC		
CR 215 141 8D	235 157 9D	255 173 AD	275 189 BD	315 205 CD	335 221 DD		
SO 216 142 8E	236 158 9E	256 174 AE	276 190 BE	316 206 CE	336 222 DE		
SI 217 143 8F	237 159 9F	257 175 AF	277 191 BF	317 207 CF	337 223 DF		
ADDITIONAL CONTROL SET		MODE 1 SUPPLEMENTAL CHARACTER SET					

MR 12448
MA 0602 84

• C0 AND C1 CONTROL CHARACTERS

Name	Mnemonic	Octal Code C0	Octal Code C1	Function
Null	NUL	00	200	Used in escape sequences.
Bell	BEL	07	207	Sounds bell if enabled by switch A7.
Horizontal tab	HT	11	211	Advances to next horizontal tab, if any. Otherwise, takes no action.
Line feed	LF	12	212	Prints buffer's contents, then advances paper by current line spacing.
Vertical tab	VT	13	213	Prints buffer's contents, then moves to next vertical tab, if any. Otherwise, performs line feed.
Form feed	FF	14	214	Advances to next top of form.
Carriage return	CR	15	215	Prints buffer's contents, then performs a carriage return. Also performs a line feed if line feed/new line is enabled by switch A6.
Shift out	SO	16	216	Sets double width for all following characters, until the next line terminator or DC4 is received.
Shift in	SI	17	217	Sets compressed pitch for current line and following lines, until DC2 is received.
Device control 1	DC1	21	221	Enables the printer and clears print buffer.
Device control 2	DC2	22	222	Sets standard pitch for current line and following lines, until SI is received.
Device control 3	DC3	23	223	Disables the printer until DC1 is received.
Device control 4	DC4	24	224	Sets single width for all following characters, until SO is received.
Cancel	CAN	30	230	Clears the print buffer if enabled by switch A4.
Escape	ESC	33	233	Starts escape sequences.

- SPECIAL CHARACTERS

Name	Octal Code	Function
SP	040	Increments the active column without printing.
	240	Same as SP.
DEL	177	Clears the line buffer if enabled by switch A-5.
	377	Same as DEL.

Escape Sequences

- VERTICAL FORM HANDLING

Name (Mnemonic)	Sequence			Function
Set vertical pitch (ER8LI)	ESC 033	0 060		Sets vertical pitch to 8 lines per inch.
(ER10LI)	ESC 033	1 061		Sets vertical pitch to 10.3 lines per inch (72/7).
(ERNLI2)	ESC 033	2 062		Sets vertical pitch to the setting specified in a previous ESC A sequence.
(ERNLI1)	ESC 033	A 101	Pn ***	Sets vertical pitch to 72/Pn lines per inch. Does not take effect until ESC 2 is sent.
Set form length (ERSFL)	ESC 033	C 103	Pn ***	Sets the form length to the number of inches that equal Pn X current pitch.

• VERTICAL TABS

Name (Mnemonic)	Sequence						Function
Set vertical tabs (ERSVT)	ESC 033	B 102	Pn1 ***	Pn2 ***	Pn ***	NUL 000	Clears vertical tabs, then sets tabs at Pn1, Pn2, and other designated stops. Pn is a character representing the line numbers in ascending order. For example, the character DC2 sets a tab at line 18. You can specify up to 16 tabs in one sequence. Tabs must be set in ascending order.

• HORIZONTAL TABS

Name (Mnemonic)	Sequence						Function
Set horizontal tabs (ERSHT)	ESC 033	D 104	Pn1 ***	Pn2 ***	Pn ***	NUL 000	Clears horizontal tabs, then sets tabs at Pn1, Pn2, and other designated stops. Pn is a character representing the column number of the desired tab. For example, the character DC2 sets a tab at column 18. You can specify up to 16 tabs. Tabs must be set in ascending order.

- PAPER FAULT HANDLING

Name (Mnemonic)	Sequence		Function
Disable paper out (ERDPO)	ESC 033	8 056	Disables paper-out handling.
Enable paper out (EREPO)	ESC 033	9 057	Enables paper-out handling.

- PRINTING MODES

Name (Mnemonic)	Sequence		Function
Enable bold (EREBD)	ESC 033	E 105	Sets bold printing for all following characters.
Disable bold (ERDBD)	ESC 033	F 106	Turns off bold printing for all following characters.
Set high resolution (EREHR)	ESC 033	G 107	Enters high resolution mode.
Set low resolution (ERDHR)	ESC 033	H 108	Enters low resolution mode.

• Emulation Mode 2
Epson/IBM MX80 Plus Graftrax

This mode uses two cartidges, the LA10X-AP italic 10 (primary font, ID 011) and LA10X-LC Graftrax (font ID 143). Install the italic cartridge in slot 2 and Graftrax cartridge in slot 4. If another style is desired, install the alternate primary font cartridge in slot 2.

Switch-Selectable Features

• SWITCH A

Switch	Setting	Function
A1	Down	Printer is set to standard horizontal pitch at power-up.
	Up	Printer operates at compressed horizontal pitch.
A2	Up	Sets bottom margin to 1 inch at power-up.
A3	Up	Enables bold printing at power-up.
A4	Up	Enables italic printing at power-up.
A5	Up	Enables slashed zero (ϕ) printing at power-up.
A6	Up	Printer performs an automatic line feed when it receives a carriage return (CR) character.
	Down	Printer only performs a carriage return.
A7	Up	When printer receives BELL character, error bell sounds.
	Down	BELL character is ignored.
A8	Up	Selects standard 8-inch paper width at power-up.
	Down	Selects 13.2-inch paper width.

- SWITCH B

Switch	Setting	Function
B1 to B4	All up	Enables emulation mode.
B5	Down	Selects emulation mode 2.
B6	Up	Selects emulation mode 2.
B7	Up or down	Not used.
B8	Up	Enables 2K buffer.
	Down	Enables 0.13K buffer.

▪ Mode 2 Character Set

Control Characters

BITS B8 B7 B6 B5 / B4 B3 B2 B1	ROW	COLUMN 0	1	2	3	4	5	6	7
0 0 0 0	0	NUL 0 0 0	20 16 10	SP 40 32 20	0 60 48 30	@ 100 64 40	P 120 80 50	` 140 96 60	p 160 112 70
0 0 0 1	1	1 1 1	21 17 11	! 41 33 21	1 61 49 31	A 101 65 41	Q 121 81 51	a 141 97 61	q 161 113 71
0 0 1 0	2	2 2 2	DC2 22 18 12	" 42 34 22	2 62 50 32	B 102 66 42	R 122 82 52	b 142 98 62	r 162 114 72
0 0 1 1	3	3 3 3	23 19 13	# 43 35 23	3 63 51 33	C 103 67 43	S 123 83 53	c 143 99 63	s 163 115 73
0 1 0 0	4	4 4 4	DC4 24 20 14	$ 44 36 24	4 64 52 34	D 104 68 44	T 124 84 54	d 144 100 64	t 164 116 74
0 1 0 1	5	5 5 5	25 21 15	% 45 37 25	5 65 53 35	E 105 69 45	U 125 85 55	e 145 101 65	u 165 117 75
0 1 1 0	6	6 6 6	26 22 16	& 46 38 26	6 66 54 36	F 106 70 46	V 126 86 56	f 146 102 66	v 166 118 76
0 1 1 1	7	BEL 7 7 7	27 23 17	' 47 39 27	7 67 55 37	G 107 71 47	W 127 87 57	g 147 103 67	w 167 119 77
1 0 0 0	8	BS 10 8 8	30 24 18	(50 40 28	8 70 56 38	H 110 72 48	X 130 88 58	h 150 104 68	x 170 120 78
1 0 0 1	9	HT 11 9 9	31 25 19	) 51 41 29	9 71 57 39	I 111 73 49	Y 131 89 59	i 151 105 69	y 171 121 79
1 0 1 0	10	LF 12 10 A	32 26 1A	* 52 42 2A	: 72 58 3A	J 112 74 4A	Z 132 90 5A	j 152 106 6A	z 172 122 7A
1 0 1 1	11	VT 13 11 B	ESC 33 27 1B	+ 53 43 2B	; 73 59 3B	K 113 75 4B	[133 91 5B	k 153 107 6B	{ 173 123 7B
1 1 0 0	12	FF 14 12 C	34 28 1C	, 54 44 2C	< 74 60 3C	L 114 76 4C	\ 134 92 5C	l 154 108 6C	¦ 174 124 7C
1 1 0 1	13	CR 15 13 D	35 29 1D	- 55 45 2D	= 75 61 3D	M 115 77 4D	] 135 93 5D	m 155 109 6D	} 175 125 7D
1 1 1 0	14	SO 16 14 E	36 30 1E	. 56 46 2E	> 76 62 3E	N 116 78 4E	^ 136 94 5E	n 156 110 6E	~ 176 126 7E
1 1 1 1	15	SI 17 15 F	37 31 1F	/ 57 47 2F	? 77 63 3F	O 117 79 4F	_ 137 95 5F	o 157 111 6F	DEL 177 127 7F

ASCII CONTROL SET | ASCII GRAPHIC CHARACTER SET

	8	9	10	11	12	13	14	15
1 0 0 0	NUL 200 128 80	220 144 90	SP 240 160 A0	0 260 176 B0	@ 300 192 C0	P 320 208 D0	T 340 224 E0	p 360 240 F0
1 0 0 1	£ 201 129 81	221 145 91	! 241 161 A1	1 261 177 B1	A 301 193 C1	Q 321 209 D1	a 341 225 E1	q 361 241 F1
1 0 1 0	•• 202 130 82	DC2 222 146 92	" 242 162 A2	2 262 178 B2	B 302 194 C2	R 322 210 D2	b 342 226 E2	r 362 242 F2
1 0 1 1	' 203 131 83	223 147 93	# 243 163 A3	3 263 179 B3	C 303 195 C3	S 323 211 D3	c 343 227 E3	s 363 243 F3
1 1 0 0	‹ 204 132 84	DC4 224 148 94	$ 244 164 A4	4 264 180 B4	D 304 196 C4	T 324 212 D4	d 344 228 E4	t 364 244 F4
1 1 0 1	§ 205 133 85	¬ 225 149 95	% 245 165 A5	5 265 181 B5	E 305 197 C5	U 325 213 D5	e 345 229 E5	u 365 245 F5
1 1 1 0	r 206 134 86	⊢ 226 150 96	& 246 166 A6	6 266 182 B6	F 306 198 C6	V 326 214 D6	f 346 230 E6	v 366 246 F6
1 1 1 1	BEL 207 135 87	⊣ 227 151 97	' 247 167 A7	7 267 183 B7	G 307 199 C7	W 327 215 D7	g 347 231 E7	w 367 247 F7
1 0 0 0	BS 210 136 88	⊤ 230 152 98	(250 168 A8	8 270 184 B8	H 310 200 C8	X 330 216 D8	h 350 232 E8	x 370 248 F8
1 0 0 1	HT 211 137 89	⊥ 231 153 99	) 251 169 A9	9 271 185 B9	I 311 201 C9	Y 331 217 D9	i 351 233 E9	y 371 249 F9
1 0 1 0	LF 212 138 8A	⌟ 232 154 9A	* 252 170 AA	272 186 BA	J 312 202 CA	Z 332 218 DA	j 352 234 EA	z 372 250 FA
1 0 1 1	VT 213 139 8B	ESC 233 155 9B	+ 253 171 AB	, 273 187 BB	K 313 203 CB	[333 219 DB	k 353 235 EB	{ 373 251 FB
1 1 0 0	FF 214 140 8C	¦ 234 156 9C	, 254 172 AC	< 274 188 BC	L 314 204 CC	\ 334 220 DC	l 354 236 EC	/ 374 252 FC
1 1 0 1	CR 215 141 8D	— 235 157 9D	- 255 173 AD	= 275 189 BD	M 315 205 CD	] 335 221 DD	m 355 237 ED	} 375 253 FD
1 1 1 0	SO 216 142 8E	⊥ 236 158 9E	. 256 174 AE	> 276 190 BE	N 316 206 CE	^ 336 222 DE	n 356 238 EE	~ 376 254 FE
1 1 1 1	SI 217 143 8F	+ 237 159 9F	/ 257 175 AF	? 277 191 BF	O 317 207 CF	— 337 223 DF	o 357 239 EF	DEL 377 255 FF

ADDITIONAL CONTROL SET | MODE 2 SUPPLEMENTAL CHARACTER SET

MR 12449
MA 0606-84

KEY

ASCII CHARACTER: ESC | 33 OCTAL | 27 DECIMAL | 1B HEX

MR 12449
MA 0603-84

- C0 CONTROL CHARACTERS

Name	Mnemonic	Octal Code	Function
Null	NUL	00	Used in escape sequences.
Bell	BEL	07	Sounds bell if enabled by switch A7.
Backspace	BS	10	Prints buffer's contents, then moves back one character cell. (Moves back two cells if this is first time in double width.)
Horizontal tab	HT	11	Moves to next horizontal tab, if any. Otherwise, takes no action.
Line feed	LF	12	Prints buffer's contents, then advances paper by current line spacing.
Vertical tab	VT	13	Prints buffer's contents, then performs a line feed.
Form feed	FF	14	Advance to next top of form.
Carriage return	CR	15	Prints buffer's contents, then returns to left margin. Performs line feed if enabled by switch A6.
Shift out	SO	16	Sets double width for all following characters, until the next line terminator or DC4 is received.
Shift in	SI	17	Sets compressed pitch for current line and following lines, until DC2 is received.
Device control 2	DC2	22	Sets standard horizontal pitch for current line and following lines, until SI is received.
Device control 4	DC4	24	Sets single width for all following characters, until SO is received.
Escape	ESC	33	Starts escape sequences.

- SPECIAL CHARACTERS

Name	Octal Code	Function
SP	040	Increments the active column without printing.
	240	Same as SP.
DEL	177	Clears the previous character sent.
	377	Same as DEL.

▪ C1 CONTROL CHARACTERS

Name	Mnemonic	Octal Code	Function
Null	NUL	200	Used in escape sequences.
Pound sign	—	201	*
Umlaut	—	202	*
Opening single quote	—	203	*
Closing single quote	—	204	*
Paragraph	—	205	*
Top level corner	—	206	*
Bell	BEL	207	Sounds bell tone if enabled by switch A7.
Backspace	BS	210	Prints buffer's contents, then moves back one character cell.
Horizontal tab	HT	211	Advances to next horizontal tab stop, if any. Otherwise, takes no action.
Line feed	LF	212	Prints buffer's contents, then advances paper by current line spacing.
Vertical tab	VT	213	Prints buffer's contents, then performs a line feed.
Form feed	FF	214	Advances to next top of form.
Carriage return	CR	215	Prints buffer's contents, then returns to left margin. Performs line feed if enabled by switch A6.
Shift out	SO	216	Sets double width for all following characters, until next line terminator or DC4 is received.
Shift in	SI	217	Sets compressed horizontal pitch for current line and following lines, until DC2 is received.
Device control 2	DC2	222	Sets standard horizontal pitch for current line and following lines, until SI is received.

Name	Mnemonic	Octal Code	Function
Device control 4	DC4	224	Sets single width for all following characters, until SO is received.
Top right corner		225	*
Right T		226	*
Left T		227	*
Top T		230	*
Bottom left corner		231	*
Bottom right corner		232	*
Escape	ESC	233	Starts escape sequences.
Vertical line		234	*
Horizontal line		235	*
Bottom T		236	*
Center cross		237	*

*Indicates a printable character. See the Mode 2 Character Set for examples of these characters.

Escape Sequences

• VERTICAL FORM HANDLING

Name (Mnemonic)	**Sequence**				**Function**
Set vertical pitch (ER8LI)	ESC 033	0 060			Sets vertical pitch to 8 lines per inch.
(ER10LI)	ESC 033	1 061			Sets vertical pitch to 10.3 (72/7) lines per inch.
(ER6LI2)	ESC 033	2 062			Sets vertical pitch to 6 lines per inch.
(ERNLI3)	ESC 033	3 063	Pn ***		Sets vertical pitch to 216/Pn lines per inch.
(ERNLI5)	ESC 033	A 101	Pn ***		Sets vertical pitch to 72/Pn lines per inch.
(ERNLI4)	ESC 033	J 112	Pn ***		Prints buffer's contents, then sets vertical pitch to 216/Pn lines per inch for next line feed only.
Set form length (ERSFL)	ESC 033	C 103	Pn ***		Sets the form length to the number of inches that equal Pn X current pitch.
(ERSFLI)	ESC 033	C 103	NUL 000	Pn ***	Sets the form length to Pn inches.
Set bottom margin (ERSBM)	ESC 033	N 116	Pn ***		Sets the bottom margin to Pn lines from the bottom of the page.
Clear bottom margin (ERCBM)	ESC 033	O 117			Clears the bottom margin. Overrides any margin set by switch A2.

- HORIZONTAL FORM HANDLING

Name (Mnemonic)	Sequence			Function
Set right margin (ERSRM)	ESC 033	Q 121	Pn ***	Sets right margin to Pn (column number).
Set double-width characters (EREDW)	ESC 033	W 127	>0 ***	Sets double-width characters for current line and following lines. Any non-zero character as the third character completes this sequence.
Set single-width characters (ERDDW)	ESC 033	W 127	NUL 000	Sets single-width characters for current line and following lines.

- HORIZONTAL TABS

Name (Mnemonic)	Sequence						Function
Set horizontal tabs (ERSHT)	ESC 033 or ESC 033	D 104 D 104	Pn1 *** Pn1 ***	Pn2 *** Pn2 ***	Pn *** Pn ***	NUL 000 80H 200	Sets horizontal tab stops at Pn1, Pn2, and other designated stops. Pn is a character representing the column number of the desired stop. For example, the character DC2 sets a tab at column 18. You can specify up to 16 tabs. Tabs must be set in ascending order.

- PAPER FAULT HANDLING

Name (Mnemonic)	Sequence		Function
Disable paper out (ERDPO)	ESC 033	8 056	Disables paper-out handling.
Enable paper out (EREPO)	ESC 033	9 057	Enables paper-out handling.

• UNIDIRECTIONAL/BIDIRECTIONAL CONTROL

Name (Mnemonic)	Sequence	Function
Set one-line unidirectional printing (EREUDI)	ESC < 033 074	Prints current line from left to right.
Set bidirectional printing (ERDUD)	ESC U NUL 033 074 000	Prints lines in bidirectional mode.
Set unidirectional printing (EREUD)	ESC U >0 033 074 ***	Prints lines from left to right only. Any nonzero character as the third character completes this sequence.

• CHARACTER SET MAPPING

When you install a primary cartridge other than the italic cartridge in slot 2, all references to the italic set in the following table apply to the character set of the installed primary cartridge.

Switch A4 Setting	Escape Sequence	C0	GL	C1	GR
Down (normal)	None	C0	ASCII	C1	Italic ASCII
Up (italic)	None	C0	Italic ASCII	C1	Italic ASCII
Down (normal)	ER8BS	C1	Italic ASCII	C1	Italic ASCII
Down (normal)	ER8BC	C0	ASCII	C0	ASCII
Up (italic)	ER8BS	C1	Italic ASCII	C1	Italic ASCII
Up (italic)	ER8BC	C0	Italic ASCII	C0	Italic ASCII

Name (Mnemonic)	Sequence	Function
Retain eighth bit (ER8BU)	ESC # 033 043	Keeps 8th bit unchanged. Use current character set.
Clear eighth bit (ER8BC)	ESC = 033 075	Clears 8th bit (sets to 0). Maps the default GL and C0 character set to the C1 and GR range.
Set eighth bit (ER8BS)	ESC > 033 076	Sets 8th bit. Maps the default C1 and GR character set to the C0 and GL range.

• PRINTING MODES

Name (Mnemonic)	Sequence	Function
Enable bold (EREBD)	ESC E 033 105	Sets bold printing for all following characters.
Disable bold (ERDBD)	ESC F 033 106	Turns off bold printing for all following characters.
Set high resolution (EREHR)	ESC G 033 107	Enters high resolution mode.
Set low resolution (ERDHR)	ESC H 033 108	Enters low resolution mode and resets the script setting.
Set underline (EREUL)	ESC — >0 033 045 ***	Underlines all following characters. Any nonzero character as the third character completes this sequence.
Reset underline (ERDUL)	ESC — NUL 033 045 000	Turns off underlining for all following characters.
Select italic (EREIL)	ESC 4 033 064	Selects italic ASCII set as GL.
Select nonitalic (ERDIL)	ESC 5 033 065	Selects nonitalic ASCII set as GL.
Enable superscript (ERESCR)	ESC S NUL 033 123 000	Prints all following characters in superscript mode.
Enable subscript (ERESCR)	ESC S >0 033 123 ***	Prints all following characters in subscript mode. Any nonzero character as the third character completes this sequence.
Reset script and directional printing (ERDSCR)	ESC T 033 124	Resets script setting to no script and resets printing mode to printing bidirectional.

• GRAPHICS MODE

Name (Mnemonic)	Sequence				Function
60 DPI graphics (ERGR6)	ESC 033	K 113	Pn1 ***	Pn2 ***	Enter 60 dots per inch for the next n bytes. Pn1 and Pn2 together specify the number of bytes according to the formula $n = (256 \times Pn2) + Pn1$ The total must be less than the remainder of bytes in the line buffer. If the buffer is empty, the total must be less than 480 (8-inch paper selected) or less than 780 (13-inch paper selected).
132 DPI graphics (ERGR12)	ESC 033	L 114	Pn1 ***	Pn2 ***	Enter 132 dots per inch for the next n bytes. Pn1 and Pn2 together specify the number of bytes according to the formula $n = (256 \times Pn2) + Pn1$ The total must be less than the remainder of bytes in the line buffer. If the buffer is empty, the total must be less than 960 (8-inch paper selected) or less than 1740 (13-inch paper selected).

• RESET

Name (Mnemonic)	Sequence		Function
Reset (ERRIS)	ESC 033	@ 100	Resets all features (previously set by escape sequences) to their initial default settings.

- MODE 2 DEFAULT SETTINGS (RESTORED BY RESET)

Feature	Setting
GL character set	Set to current setting of switch A4. (GL is not italic if A4 is set to down position.)
8-bit operations	Leave 8th bit unchanged.
Print direction	Set to bidirectional.
Script	Set to no superscript or subscript.
Character width	Set to single width.
Underline	Set to no underlining.
Paper fault	Enabled.
Vertical tab	Set to every line.
Horizontal tab	Set every eight columns (1, 9, 17, . . .).
Form length	Set to 11 inches.
Bottom margin	Set to current setting of switch A2 (either no bottom margin or 1-inch margin).
Vertical pitch	Set to 6 lines per inch.
Paper width	Set to current setting of switch A8 (either 8 inches or 13 inches).
Right margin	Set to the current paper width selected by switch A8.
Resolution	Set to low resolution.
Bold	Set to current setting of switch A3.
Horizontal pitch	Set to current setting of switch A1 (either standard or compressed).

• Emulation Mode 3 IBM Graphics Printer

This mode uses two cartridges, the LA10X-LA line drawing (font ID 139) and LA10X-LD foreign style (font ID 141). You can install these cartridges in slot 2 or 4.

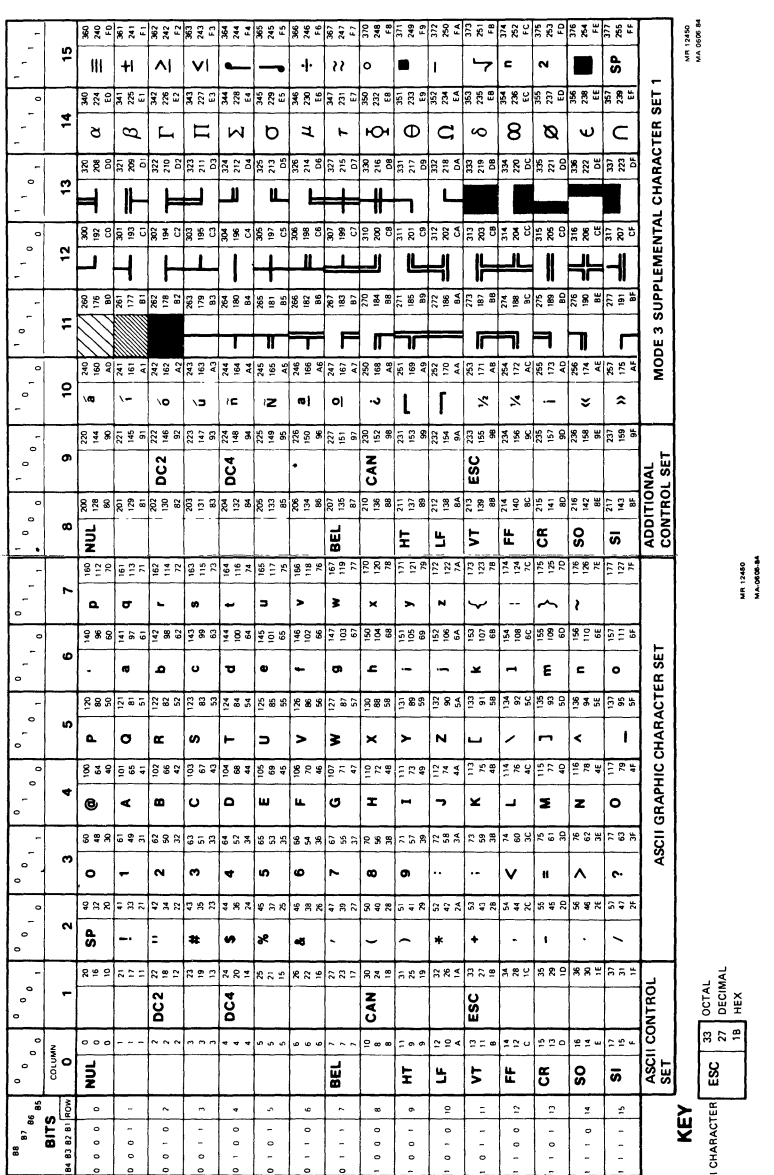
Switch-Selectable Features

• SWITCH A

Switch	Setting	Function
A1, A2	Up or Down	Not used.
A3	Up	When line buffer is full, printer prints line and advances to next line.
	Down	When line buffer is full, printer drops characters.
A4	Up	Cancel (CAN) character clears line
	Down	CAN character is ignored.
A5	Up	Delete (DEL) character clears line buffer.
	Down	DEL character is ignored.
A6	Up	Printer performs an automatic line feed when it receives a carriage return (CR) character.
	Down	Printer only performs a carriage return.
A7	Up	When printer receives BELL character, error bell sounds.
	Down	BELL character is ignored.
A8	Up	Selects standard 8-inch paper width at power-up.
	Down	Selects 13-inch paper width.

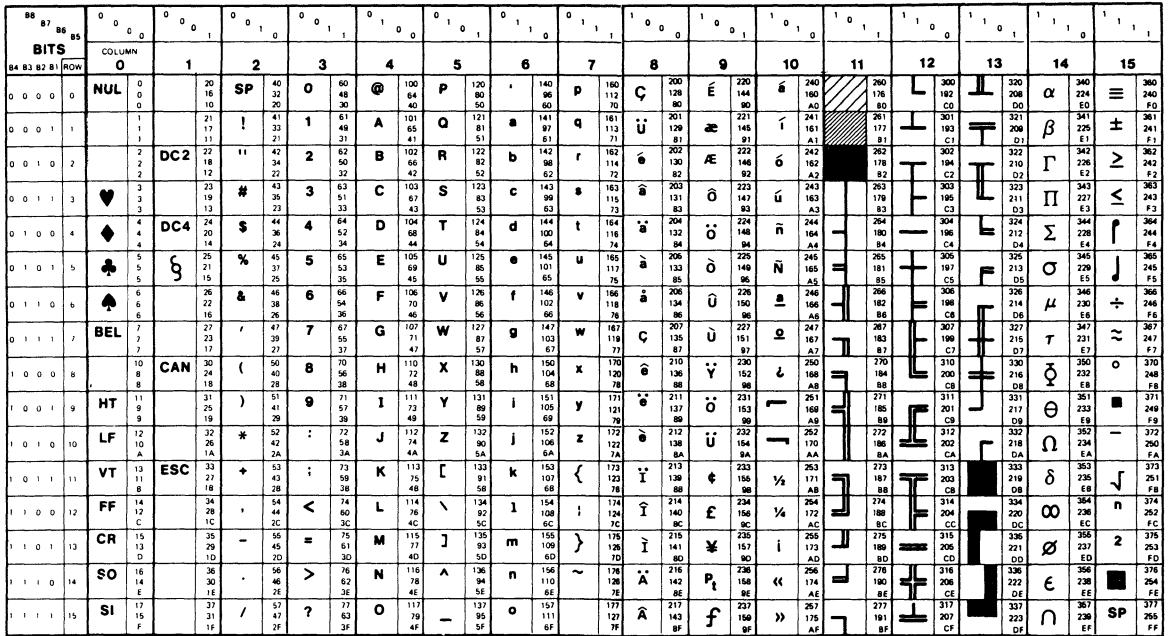
• SWITCH B

Switch	Setting	Function
B1 to B4	All up	Enables emulation mode.
B5, B6	Up	Selects emulation mode 3.
B7	Up or down	Not used.
B8	Up	Enables 2K buffer.
	Down	Enables 0.13K buffer.



Mode 3 Character Set 1

Mode 3 Character Set 2
Control Characters



KEY

ASCII CHARACTER **ESC** — 33 OCTAL, 27 DECIMAL, 1B HEX

MR 12451
MA-0607-84

MR 12451
MA 0608-84

- C0 AND C1 CONTROL CHARACTERS (SET 1)

Name	Mnemonic	Octal Code C0	Octal Code C1	Function
Null	NUL	00	200	Used in escape sequences.
Bell	BEL	07	207	Sounds bell tone if enabled by switch A7.
Horizontal Tab	HT	11	211	Advances to next horizontal tab, if any. Otherwise, takes no action.
Line feed	LF	12	212	Prints buffer's contents, then advances paper by current line spacing.
Vertical tab	VT	13	213	Prints buffer's contents, then performs line feed.
Form feed	FF	14	214	Advances to next top of form.
Carriage return	CR	15	215	Prints buffer's contents, returns to left margin, and performs line feed if enabled by switch A6.
Shift out	SO	16	216	Sets double width for all following characters, until next line terminator or DC4 is received.
Shift in	SI	17	217	Sets compressed horizontal pitch for current line and following lines, until DC2 is received.
Device control 4	DC2	22	222	Sets standard horizontal pitch for current line and following lines, until SI is received.
Device control 4	DC4	24	224	Sets single width for all following characters, until SO is received.
Cancel	CAN	30	230	Clears print buffer if enabled by switch A4.
Escape	ESC	33	233	Starts escape sequences.

• C0 CONTROL CHARACTERS (SET 2)

Name	Mneumonic	Octal Code	Function
Null	NUL	00	Used in escape sequences.
Heart	—	03	Prints a heart symbol.
Diamond	—	04	Prints a diamond symbol.
Clubs	—	05	Prints a club symbol.
Spade	—	06	Prints a spade symbol.
Bell	BEL	07	Sounds bell tone if enabled by switch A7.
Horizontal tab	HT	11	Advances to next horizontal tab, if any. Otherwise, takes no action.
Line feed	LF	12	Prints buffer's contents, then advances paper by current line spacing.
Vertical tab	VT	13	Prints buffer's contents, then performs line feed.
Form feed	FF	14	Advance to next top of form.
Carriage return	CR	15	Prints buffer's contents, then returns to left margin. Performs line feed if enabled by switch A6.
Shift out	SO	16	Sets double width for all following characters, until the next line terminator or DC4 is received.
Shift in	SI	17	Sets compressed horizontal pitch for current line and following lines, until DC2 is received.
Device control 2	DC2	22	Sets standard horizontal pitch for current line and following lines, until SI is received.
Device control 4	DC4	24	Sets single width for all control following characters, until SO is received.
Paragraph	—	25	Prints paragraph symbol.
Cancel	CAN	30	Clears print buffer if enabled by switch A4.
Escape	ESC	33	Starts escape sequences.

- SPECIAL CHARACTERS

Name	Octal Code	Function
SP	040	Increments the active column without printing.
	377	Same as SP.
DEL	177	Clears entire contents of print buffer if enabled by switch A-5.
	240	Prints the foreign character "small a acute."

Escape Sequences

- VERTICAL FORM HANDLING

Name (Mnemonic)	Sequence			Function
Set vertical pitch (ER8LI)	ESC 033	0 060		Sets vertical pitch to 8 lines per inch.
(ER10LI)	ESC 033	1 061		Sets vertical pitch to 10.3 lines per inch (72/7).
(ERNLI2)	ESC 033	2 062		Sets vertical pitch to the setting specified in a previously issued ESC A sequence. If none was set, sets pitch to 6 lines per inch.
(ERNLI1)	ESC 033	A 101	Pn ***	Sets vertical pitch to 72/Pn lines per inch. Does not take effect until ESC 2 is sent.
(ERNLI3)	ESC 033	3 063	Pn ***	Sets vertical pitch to 216/Pn lines per inch.
(ERNLI4)	ESC 033	J 112	Pn ***	Prints buffer's contents and sets vertical pitch to 216/Pn lines per inch for next line feed only.
Set form length (ERSFL)	ESC 033	C 103	Pn ***	Sets the form length to the number of inches that equal Pn X current pitch.
(ERSFLI)	ESC 033	3 063	Pn ***	Sets vertical pitch to 216/Pn lines per inch.
(ERSFLI)	ESC 033	C 103	NUL Pn 000 ***	Sets the form length to Pn inches.

Name (Mnemonic)	Sequence			Function
Set bottom margin (ERSBM)	ESC 033	N 116	Pn ***	Sets the bottom margin to Pn lines from the bottom of the page.
Clear bottom margin (ERSBM)	ESC 033	0 117		Clears the bottom margin.

• HORIZONTAL FORM HANDLING

Name (Mnemonic)	Sequence			Function
Set double-width characters (EREDW)	ESC 033	W 127	>0 ***	Sets double-width characters for current line and following lines. Any non-zero character as the third character completes this sequence.
Set single-width characters (ERDDW)	ESC 033	W 127	NUL 000	Sets single-width characters for current line and following lines.
Carriage return (PCR1)	ESC 033	< 074		Performs carriage return without performing line feed regardless of current switch setting.

- HORIZONTAL TABS

Name (Mnemonic)	Sequence						Function
Set horizontal tabs (ERSHT)	ESC 033	D 104	Pn1 ***	Pn2 ***	Pn ***	NUL 000	Sets horizontal tab stops at Pn1, Pn2, and other designated stops. Pn is a character representing the column number of the desired stop. For example, the character DC2 sets a tab at column 18. You can specify up to 16 tabs. Tabs must be set in ascending order.

- PAPER FAULT HANDLING

Name Function (Mnemonic)	Sequence		
Disable paper out (ERDPO)	ESC 033	8 056	Disables paper-out handling.
Enable paper out (EREPO)	ESC 033	9 057	Enables paper-out handling.

- UNIDIRECTIONAL/BIDIRECTIONAL CONTROL

Name (Mnemonic)	Sequence			Function
Set bidirectional printing (ERDUD)	ESC 033	U 074	NUL 000	Prints lines in bidirectional mode.
Set unidirectional printing (EREUD)	ESC 033	U 074	>0 ***	Prints lines from left to right only. Any nonzero character as the third character completes this sequence.

• ALTERNATE CHARACTER SET MAPPING

Name (Mnemonic)	Sequence	Function
Select set 2 (ERC02)	ESC 6 033 066	Selects the alternate character set (set 2).
Select set 1 (ERC01)	ESC 7 033 067	Selects character set 1. (This character set is the default set when the printer is powered on.)

• PRINTING MODES

Name (Mnemonic)	Sequence	Function
Enable bold (EREBD)	ESC E 033 105	Sets bold printing for all following characters.
Disable bold (ERDBD)	ESC F 033 106	Turns off bold printing for all following characters.
Set high resolution (EREHR)	ESC G 033 107	Enters high resolution mode.
Set low resolution (ERDHR)	ESC H 033 108	Enters low resolution mode.
Set underline (EREUL)	ESC — >0 033 045 ***	Underlines all following characters. Any nonzero character as the third character completes this sequence.
Reset underline (ERDUL)	ESC — NUL 033 045 000	Turns off underlining for all following characters.
Enable superscript (ERESCR)	ESC S NUL 033 123 000	Prints all following characters in superscript mode.
Enable subscript (ERESCR)	ESC S >0 033 123 ***	Prints all following characters in subscript mode. Any nonzero character as the third character completes this sequence.

Reset script and directional printing (ERDSCR)	ESC 033	T 124			Resets script setting to no script and resets printing mode to bidirectional.

- GRAPHICS MODE

Name (Mnemonic)	**Sequence**				**Function**
60 DPI graphics (ERGR6)	ESC 033	K 113	Pn1 ***	Pn2 ***	Enter 60 dots per inch for the next n bytes. Pn1 and Pn2 together specify the number of bytes according to the formula $n = (256 \times Pn2) + Pn1$ The total must be less than the remainder of bytes in the line buffer. If the buffer is empty, the total must be less than 480 (8-inch paper selected) or less than 780 (13-inch paper selected).
132 DPI graphics (ERGR12)	ESC 033	L 114	Pn1 ***	Pn2 ***	Enter 132 dots per inch for the next n bytes. Pn1 and Pn2 together specify the number of bytes according to the formula $n = (256 \times Pn2) + Pn1$ The total must be less than the remainder of bytes in the line buffer. If the buffer is empty, the total must be less than 960 (8-inch paper selected) or less than 1740 (13-inch paper selected).

Name (Mnemonic)	Sequence				Function
132 DPI graphics (ERGS12)	ESC 033	Y 131	Pn1 ***	Pn2 ***	Enter 132 dots per inch for the next n bytes. Pn1 and Pn2 together specify the number of bytes according to the formula n = (256 × Pn2) + Pn1 The total must be less than the remainder of bytes in the line buffer. If the buffer is empty, the total must be less than 960 (8-inch paper selected) or less than 1740 (13-inch paper selected). ESC Y prints every other dot.
220 DPI graphics (ERGD24)	ESC 033	Z 132	Pn1 ***	Pn2 ***	Enter 220 dots per inch for the next n bytes. Pn1 and Pn2 together specify the number of bytes according to the formula n = (256 × Pn2) + Pn1 The total must be less than the remainder of bytes in the line buffer. If the buffer is empty, the total must be less than 1920 (8-inch paper selected) or less than 2895 (13-inch paper selected). ESC Z prints one dot in any three consecutive positions.

▪ LA50

The most current operating and programming information on the LA50 is reproduced here.

Escape Sequence Summary

Name/Mnemonic	Escape Sequence/Description
Set horizontal pitch DECSHORP	ESC [Pn w 033 133 *** 167 Pn= 0 1 2 4 5 6 8 10 10 12 16.5 5 6 8.25 CPI
Set vertical pitch DECVERP	ESC [Pn z 033 133 *** 172 Pn= 0 1 2 3 4 5 6 6 6 8 12 2 3 4 LPI
Page length selection DECSLPP	ESC [Pn t 033 133 *** 164
Pn = 0 to 252	Pn (lines/page) = Paper length (inches/page) × Vertical pitch (lines/inch)
Partial line down PLD	ESC K Move down 1/2 line (paper up 1/12 inch) 033 133
Partial line up PLU	ESC L Move up 1/2 line (paper down 1/12 inch) 033 114
Select density DECDEN	ESC [Pn " z 033 133 *** 042 172 Pn = 0, 1 Select normal density printing Pn = 2 Select enhanced density printing
Select graphic rendition SGR	ESC [Pn , Pn m 033 133 *** 073 *** 155 Pn = 0 – Reset Pn = 1 – Bold on Pn = 22 – Bold off Pn = 4 – Underline on Pn = 24 – Underline off

Escape Sequence Summary (Cont)

Name/Mnemonic	Escape Sequence/Description						
Device attribute	ESC	[	c				
DA	033	133	143				
	Sends back identification code						
	ESC	[	?	1	7	c	
	033	133	077	061	067	143	
Device status report	ESC	[	n			Send extended	
DSR	033	133	156			status report	
	ESC	[	?	1	n	Disable all unsolicited	
	033	133	077	061	156	status reports	
	ESC	[	?	2	n	Enable unsolicited	
	033	133	077	061	156	brief reports and send extended status report	
	ESC	[	?	3	n	Enable unsolicited	
	033	133	077	063	156	extended report and send extended status report	
Brief status report	ESC	[	0	n		No malfunction	
(sent back by printer)	033	133	060	156		detected	
DSR	ESC	[	3	n		Malfunction detected	
	033	133	063	156			
Extended status reports	ESC	[	0	n		No malfunction	
(sent back by printer)	033	133	060	156		detected	
DSR	followed by						
	ESC	[	?	2	0	n	
	033	133	077	062	060	156	
	ESC	[	3	n		Malfunction detected	
	033	133	063	156			
	followed by						
	ESC	[	?	Pn	,	Pn	n
	033	133	077	***	073	***	156
	Pn = 21	Hardware failure					
	Pn = 22	Communication failure (event)					
	Pn = 23	Input buffer overflow (event)					
	Pn = 24	Printer deselected					
	Pn = 26	Cover open					
	Pn = 27	Paper empty					
Enter graphics mode	ESC	P	q	Enter graphics mode			
	033	120	161				
	! n	Repeat introducer, n = 0 to 65535					
	$	Graphic carriage return					
	-	Graphic new line					
Exit graphics mode	ESC	\					
	033	134					

Character Set Selection

SO	CTRL/N	(016)	Select G0 to be GL
SI	CTRL/O	(017)	Select G1 to be GL
SS2	ESC N	(033 116)	Select next character from G2
SS3	ESC O	(033 117)	Select next character from G3
LS2	ESC n	(033 156)	Select G2 to be GL
LS3	ESC o	(033 157)	Select G3 to be GL
LS1R	ESC ~	(033 176)	Select G1 to be GR
LS2R	ESC }	(033 175)	Select G2 to be GR
LS3R	ESC |	(033 174)	Select G3 to be GR

Assign Character Sets

ESC Gn Ch
Assign set ch to Gn where Gn is

"(" = G0	"*" = G2
")" = G1	"+" = G3

and ch is from the list below

B – ASCII	J – JIS Roman
A – Britain	I – JIS Katakana
5 – Finland*	6 – Norway/Denmark*
C – Finland	E – Norway/Denmark
R – France	Z – Spain
9 – French Canada*	7 – Sweden*
Q – French Canada	H – Sweden
K – Germany	< – Multinational
Y – Italy	0 – VT100 Special Graphics

* Preferred

O = OPEN; C = CLOSED

	Switch Bank 1			
			Switch	
Country	**4**	**3**	**2**	**1**
US (ASCII)	O	O	O	O
Britain	O	O	O	C
Finland	O	O	C	O
France	O	O	C	C
French Canada	O	C	O	O
Germany	O	C	O	C
Italy	O	C	C	O
Japan	O	C	C	C
Norway/Denmark	C	O	O	O
Spain	C	O	O	C
Sweden	C	O	C	O

Notes

1. **For all countries except Japan:**
   G0 = Selected country, G1 = VT100, G2 = Multinational, and G3 = ASCII.

2. **For Japan:**
   G0 = JIS Roman, G1 = Katakana, G2 = Katakana, and G3 = ASCII.

	Switch Bank 2		
	Switch		
Baud Rate	**1**	**2**	**3**
4800	O	O	O
2400	O	C	O
1200	O	C	C
600	C	O	O
300	C	O	C
200	C	C	O
110	C	C	C

	Switch Bank 2		
	Switch		
Data Format	**4**	**5**	**6**
7 Bits + odd parity	O	C	C
7 Bits + even parity	C	C	C
7 Bits + 8th bit mark	O	O	C
7 Bits + 8th bit space	C	O	C
8 Bits + odd parity	O	C	O
8 Bits + even parity	C	C	O
8 Bits + no parity	O	O	O

O = OPEN; C = CLOSED

Switch Bank 1

Aspect Ratio	**(Switch 5)**	**Protocol Switch**	**(Switch 6)**
2 1	O	XON/XOFF	O
2 5 1	C	Ready/Busy	C
Signal Level	**(Switch 7)**	**Right Margin**	**(Switch 8)**
Busy = Hı Ready = Lo	O	Truncated	O
Busy = Lo Ready = Hı	C	Wrap	C

Power Up Conditions

Printer selected – on-line
Printer status report – disable unsolicited report
Horizontal pitch – 10 characters/inch
Vertical pitch – 6 lines/inch
Page length – 11 inches
Active position – top leftmost position
Bold, underline, double width – off
Printing density – normal
7-bit mode – GL = G0
8-bit mode – GL = G0, GR = G2
Character sets, aspect ratio, protocol, right margin, and data format are selected per switch settings

	Vertical Pitch (Characters/Inch)					
Attributes	**16.5**	**12**	**10**	**8.25**	**6**	**5**
Enhanced		X	X		X	X
Bold		X	X	X	X	X
Underline	X	X	X	X	X	X
Maximum characters/line	132	96	80	66	48	40

• LQP02 Programming Summary

• LQP02 Command Set Summary

Vertical Motion Commands

Mnemonic	Sequence	Function
LF		Line Feed
VT		Vertical Tab (Form Feed if no Tab Set)
FF		Form Feed
VPA	ESC [Pn d	Set Active Line to Line Pn
VPR	ESC [Pn e	Move Active Line Pn Lines Down the Page
VPB	ESC [Pn k	Move Active Line Pn Lines Up the Page
IND	ESC D	Line Feed by Adding VAI
RI	ESC M	Negative Line Feed by Subtracting VAI
PLD	ESC K	1/2 VAI Line Feed (subscript)
PLU	ESC L	Negative 1/2 VAI Line Feed (superscript)
NEL	ESC E	Line Feed and Carriage Return to Left Margin

Horizontal Motion Commands

SP		Move Carriage to the Right One Space
BS		Move Carriage to the Left One Space
HT		Move Carriage to the Right to the Next Tab Stop, or to the Right Margin if no Tab Present (if Wraparound Enabled, to the Left Margin, Next Line)
CR		Return Carriage to the Left Margin
HPA	ESC [Pn '	Absolute Horizontal Tab to Set Active Column to Column Pn
HPR	ESC [Pn a	Move the Active Column Pn Spaces to the Right (Relative Position Command)
HPB	ESC [Pn j	Move the Active Column Pn Spaces to the Left (Relative Position Command)
NEL	ESC E	Carriage Return to Left Margin and Line Feed

Control Functions

Mnemonic	Sequence	Functions
DECPTS	ESC [Ps! x	Select Printwheel Table 1, When Ps = 0 or 1 Select Printwheel Table 2, When Ps = 2
DECUND	ESC [Pn! w	Select Underline Character Pn Other Than Default Character
DECFPP	ESC # 9	Perform Pending Motion
DECASFC	ESC [Ps! v	Perform a Sheet Feed Operation
RIS	ESC C	Initialize Printer
DA	ESC [Ps c ESC [?13; Pnc	Printer Identification Request Printer Response Format
DSR	ESC [5n ESC [? 2n ESC [? 1n ESC [? 3n	Polled Report Request Enable Brief Unsolicited Reports and Send an Extended Report Disable All Unsolicited Reports Enable Extended Unsolicited Reports and Send an Extended Report

Format Commands

Mnemonic	Sequence	Function
TBC	ESC [4; 3 g	Clear All Vertical and Horizontal Tabs
SPI	ESC [Pnv; Pnh Sp G	Set Vertical and Horizontal Advance Increments Where Pnv and Pnh Are in 1/720 Inch Increments
DECSHORP	ESC [Ps w	Set HAI To a Preset Value
DECVERP	ESC [Ps z	Set VAI To a Preset Value
DECSCPP	ESC [Pn t	Set Form Length to Pn Lines
DECSS	ESC [Pn ! y	Set Horizontal Space Increment (Proportional Spacing Mode)
HTS	ESC H	Set Horizontal Tab
TBC	ESC [Ps g	Clear Horizontal Tab
DECSHTS	ESC [Pn1; Pn2;...Pn16 u	Set Horizontal Tabs List for Columns Pn1 to Pn16
TBC	ESC [3 g	Clear Horizontal Tabs List
VTS	ESC J	Set Vertical Tab

Format Commands

Mnemonic	Sequence	Function
TBC	ESC [1 g	Clear Vertical Tab
DECSVTS	ESC [Pn1; Pn2;...Pn16 v	Set Vertical Tabs List for Lines Pn1 to Pn16
TBC	ESC [4 g	Clear Vertical Tabs List
DECSLRM	ESC [Pn1; Pn2; s	Set Left Margin to Column Pn1 and Right Margin to Column Pn2
DECSTBM	ESC [Pn1; Pn2 r	Set Top Margin to Line Pn1 and Bottom Margin to Line Pn2
DCS	ESC P u ESC	Innovation Sequence Terminate Above
DECFIL	ESC [Pn1; Pn2;...! s	Enter Control Parameters Pn1, Pn2,...! s for Right Hand Justification

Feature Enable/Disable Commands

PUM	ESC [11 h ESC [11 1	Enable/Disable Horizontal and Vertical Positioning Mode Functions
DECAWN	ESC [?7 h ESC [?7 1	Enable/Disable Right Margin Wrap-around
LNM	ESC [20 H ESC [20 1	Enable/Disable Line Feed on Carriage Return or Wraparound
DECPSP	ESC [?27 h ESC [?27 1	Enable/Disable Proportional Spacing Mode
SGR	*ESC [4 m	Enable Underlining
	*ESC [1 m *ESC [?1m	Set Primary Overprint Mode Set Secondary Overprint Mode
	*ESC [8 m	Hammer Disable Mode
	*ESC [? 2m	Enable Shadow Print
	*ESC [Ps m	Disables Above Functions Where Ps = 0 (null)

Full Modem Control Signal Requirements

The following signals are required for Full Modem Control.

DB25P Pin No.	Signal Description	Source	CCITT Circuit No.
1	Protective Ground		101
2	Transmitted Data	Printer	103
3	Received Data	Modem	104
4	Request to Send	Printer	105
5	Ready for Sending	Modem	106
6	Data Set Ready	Modem	107
7	Signal Ground		102
8	Data Channel Received Line Signal Detector	Modem	109
13	Backward Channel Ready	Modem	121
14	Transmitted Backward Channel Data	Printer	118
19	Transmitted Backward Channel Line Signal	Printer	120

DB25P Pin No.	Signal Description	Source	CCITT Circuit No.
20	Data Terminal Ready	Printer	108/2
23	Data Signaling Rate Selector	Printer	111

Restricted Modem Control Signal Requirements

The following signals are required for Restricted Modem Control.

DB25P Pin No.	Signal Description	CCITT Circuit No.
1	Protective Ground	101
2	Transmitted Data	103
3	Received Data	104
4	Request to Send	105
7	Signal Ground	102
20	Data Terminal Ready	108/2

The printer assumes an ON condition on the following lines, regardless of their actual state.

DB25P Pin No.	Signal Description	CCITT Circuit No.
5	Ready for Sending	106
6	Data Set Ready	107
8	Data Channel Received Line Signal Detector	109

• LQP02 Default Parameters

Parameter	Default
Horizontal Pitch	10 Character Inch
Vertical Pitch	6 Lines/Inch
Forms Length	66 Lines
Horizontal Tabs	Every 8 Columns to Column 153
Vertical Tabs	Every 8 Lines to Line 121
Left Margin	Column 1
Right Margin	Column 132
Top Margin	Line 1
Bottom Margin	Line 66
Active Position	Column 1, Line 1
Sheet Feeder	Tray 1
New Line Mode	Disabled
Right Margin Wrap Mode	Disabled
Proportional Spacing Mode	Disabled
Right Justification	Disabled
Underlining	Disabled
Underline Wheel Position Table 1	55
Underline Wheel Position Table 2	15
Over Printing	Disabled
Shadow Printing	Disabled
Programmed Composite Characters	Cleared
Printwheel Parameters	Default Tables 1 (WP) and 2 (WPS) Reprogrammable
Active Printwheel Table	Table 1
Positioning Unit Mode	Disabled
Unsolicited Status Reports	Disabled

▪ LQP03

CONFIGURATION SWITCHES
The printer configuration switches are as follows.

Switch Pack 1

Baud Rate Select Switches (SP1-1, 2, and 3) – These switches select the data communication baud rate

Baud Rate	SP1-1	SP1-2	SP1-3	
110	Rear	Rear	Rear	
200	Front	Rear	Rear	
300	Rear	Front	Rear	
600	Front	Front	Rear	
1200	Rear	Rear	Front	
2400	Front	Rear	Front	
4800	Rear	Front	Front	(factory setting)
9600	Front	Front	Front	

Self-Test Switch (SP1-4) – This switch enables the printer self-tests when in the front position. This switch is factory set to the rear position

Stop Bit Switch (SP1-5) – This switch selects either 1 or 2 stop bit transmission.

1 stop bit. front position (factory setting)
2 stop bits. rear position

Data Length Switch (SP1-6) – This switch selects either 7- or 8-bit data length.

7-bit data· front position
8-bit data. rear position (factory setting)

Parity Enable Switches (SP1-7 and 8) – These switches select the parity mode.

Parity	SP1-7	SP1-8		
Odd	Rear	Rear	(7- or 8-bit)	
Even	Front	Rear	(7- or 8-bit)	
Mark	Rear	Front	(7-bit only)	
Space	Front	Front	(7-bit only)	(factory setting)

Switch Pack 2

Printwheel Language Code Switches (SP2-1, 2, 3, and 4) – These switches select the printwheel language code

Language	SP2-1	SP2-2	SP2-3	SP2-4	
US/ASCII	Rear	Rear	Rear	Rear	(factory setting)
Finnish	Front	Rear	Rear	Rear	
French	Rear	Front	Rear	Rear	
French Canadian	Front	Front	Rear	Rear	
German	Rear	Rear	Front	Rear	
Italian	Front	Rear	Front	Rear	
Japanese	Rear	Front	Front	Rear	
Norwegian/Danish	Front	Front	Front	Rear	
Spanish	Rear	Rear	Rear	Front	
Swedish	Front	Rear	Rear	Front	
United Kingdom	Rear	Front	Rear	Front	

Printer Identifier Selection Switch (SP2-8) – This switch selects the identifier used by the printer when it communicates with the host computer The LQP03 is factory set to identify itself as an LQP02 printer to allow compatibility with existing software

LQP02 identifier: front position (factory setting)
LQP03 identifier. rear position

Table 4-1 Control Characters

Name	Mnemonic	Octal Code	Function
Backspace	BS	010	Controls active column
Horizontal tab	HT	011	Controls tab stops
Line feed	LF	012	Controls active line
Vertical tab	VT	013	Controls tab stops
Form feed	FF	014	Controls active line
Carriage return	CR	015	Controls active column
Space	SP	040	Controls active column
Increment active line by VAI	IND	204	Controls active line
Increment active position to next line	NEL	205	Controls active position
Set horizontal tab at active column	HTS	210	Controls tab stops
Set vertical tab at active line	VTS	212	Controls tab stops
Increment active line by one-half VAI	PLD	213	Controls active line
Decrement active line by one-half VAI	PLU	214	Controls active line
Decrement active line by VAI	RI	215	Controls active line
Control sequence introducer	CSI	233	Controls sequence syntax

Table 4-1 Control Characters (Cont)

Name	Mnemonic	Octal Code	Function
Null	NUL	000	For timing, not stored in buffer Causes no operation.
End of transmission	EOT	004	Disconnects modem line
Bell	BEL	007	Sounds alarm
Transmission start	DC1	021	Tells host to send data
Transmission stop	DC3	023	Tells host to stop sending data
Cancel	CAN	030	Cancels previous character or current control function
Substitute	SUB	032	Prints error character O (117) overprinted by X (130)
Escape	ESC	033	Introduces escape and control sequences
Delete	DEL	177	For timing, not stored in buffer Causes no operation

PARAMETER DEFAULTS

When the LQP03 is turned on or reinitialized (RIS escape sequence command), the following parameters assume their default values

Parameter	Default
Horizontal pitch	10 characters/inch
Vertical pitch	6 lines/inch
Form length	66 lines
Left margin	Column 1
Right margin	Column 110
Top margin	Line 1
Bottom margin	Line 66
Active position	Column 1, line 1
Horizontal tabs	Every 8 columns to column 161
Vertical tabs	Every 8 lines to line 105
Unsolicited status reports	Disabled
Right margin wrap mode	Disabled
New line mode	Disabled
Underlining	Disabled
Bolding (bold 1, bold 2)	Disabled
Shadow printing	Disabled
Positioning unit mode (PUM)	Disabled
Proportional space	Disabled
Right justification	Disabled
Active printwheel table	Monospaced
Underline character	ASCII code (137)
GL set	Defined by G0
GR set	Defined by G2
G0 pointer	Switch selectable (shipped with ASCII)

Parameter	Default
G1 pointer	ASCII
G2 pointer	Multinational
G3 pointer	ASCII

CONTROLLING THE ADVANCE INCREMENTS

Setting VAI and HAI Using Numeric Parameters (SPI)

ESC	[	Pnv	;	Pnh	SP	G
033	133	***	073	***	040	107

$15 \leq Pnv \leq 960$ (1/720-inch units)
$6 \leq Pnh \leq 768$ (1/720-inch units)

Setting HAI Using a Selective Parameter (DECSHORP)

ESC	[	Ps	w
033	133	***	167

Ps Value	Horizontal Pitch (Columns/Inch)	HAI Size (1/120-Inch Units)
Ps omitted	10	12
0 1 5 6 7 8 060, 061, 065, 066, 067, or 070	10	12
2 3 4 062, 063, or 064	12	10
9 071	15	8

Setting VAI Using a Selective Parameter (DECVERP)

ESC	[	Ps	z
033	133	***	172

Ps Value	Vertical Pitch (Lines/Inch)	VAI Size (1/48-Inch Units)
0 1 060, 061, or no Ps	6	8
2 3 062 or 063	8	6
4 064	2	24
5 065	3	16
6 066	4	12

Setting Proportional Spacing (DECPSP)

ESC	[	?	2	7	h
033	133	077	062	067	150

Sets proportional spacing.

ESC	[	?	2	7	l (lowercase L)
033	133	077	062	067	154

Clears proportional spacing

Setting the Proportional Mode Space Size (DECSS)

ESC	[	Pn	!	y
033	133	***	041	171

$6 \leq Pn \leq 768$ (decipoint units, 1/720 inch)

Setting the Positioning Unit Mode (PUM)

ESC	[	1	1	h
033	133	061	061	150

Sets the positioning unit mode.

ESC	[	1	1	l (lowercase L)
033	133	061	061	154

Clears the positioning unit mode.

Mnemonic	Name
HPA	Setting the active column to an absolute position
HPB	Decrementing the active column to a relative position
HPR	Incrementing the active column to a relative position
VPA	Setting the active line to an absolute position
VPB	Decrementing the active line to a relative position
VPR	Incrementing the active line to a relative position

CONTROLLING THE ACTIVE COLUMN

Setting the Active Column to an Absolute Position (HPA)

ESC	[	Pn
033	133	***	140

PUM clear	$0 \leq Pn \leq 165$	(HAI units)
PUM set	$0 \leq Pn \leq 7920$	(1/720-inch units, 1/120-inch increments)

Decrementing the Active Column to a Relative Position (HPB)

ESC	[	Pn	j
033	133	***	152

PUM clear	$0 \leq Pn \leq 165$	(HAI units)
PUM set	$0 \leq Pn \leq 7920$	(1/720-inch units, 1/120-inch increments)

Incrementing the Active Column to a Relative Position (HPR)

ESC	[	Pn	a
033	133	***	141

PUM clear $0 \leq Pn \leq 165$ (HAI units)
PUM set $0 \leq Pn \leq 7920$ (1/720-inch units, 1/120-inch increments)

CONTROLLING THE ACTIVE LINE

Setting the Active Line to an Absolute Position (VPA)

ESC	[	Pn	d
033	133	***	144

PUM clear $0 \leq Pn \leq 168$ (VAI units)
PUM set $0 \leq Pn \leq 15360$ (1/720-inch units, 1/120-inch increments)

Decrementing the Active Line to a Relative Position (VPB)

ESC	[	Pn	k
033	133	***	153

PUM clear $0 \leq Pn \leq 168$ (VAI units)
PUM set $0 \leq Pn \leq 15360$ (1/720-inch units, 1/120-inch increments)

Incrementing the Active Line to a Relative Position (VPR)

ESC	[	Pn	e
033	133	***	145

PUM clear $0 \leq Pn \leq 168$ (VAI units)
PUM set $0 \leq Pn \leq 15360$ (1/720-inch units, 1/48-inch increments)

Incrementing the Active Line by VAI (IND)

ESC	D		IND
033	104	or	204 (8-bit character)

Decrementing the Active Line by VAI (RI)

ESC	M		RI
033	115	or	215 (8-bit character)

Incrementing the Active Line by One-Half VAI (PLD)

ESC	K		PLD
033	113	or	213 (8-bit character)

Decrementing the Active Line by One-Half VAI (PLU)

ESC	L		PLU
033	114	or	214 (8-bit character)

CONTROLLING THE ACTIVE POSITION

Incrementing the Active Position to the Beginning of the Next Line (NEL)

ESC	E		NEL
033	105	or	205 (8-bit character)

Sum and Perform Pending Motion (DECFPP)

ESC	#	9
033	043	071

CONTROLLING PAGE MARGINS

Setting the Left and Right Margins (DECSLRM)

ESC	[	Pnl	;	Pnr	s
033	133	***	073	***	163

0 ≤ Pnl, Pnr ≤ 256 (HAI units)
Pnl ≤ Pnr

Setting the Top and Bottom Margins (DECSTBM)

ESC	[	Pnt	;	Pnb	r
033	133	***	073	***	162

0 ≤ Pnt, Pnb ≤ 168 (VAI units)
Pnt ≤ Pnb

Setting Lines per Page (DECSLPP)

ESC	[	Pn	t
033	133	***	164

Pn ≤ 168 (VAI units)

Setting the Right Margin Wrap Mode (DECAWM)

ESC	[	?	7	h
033	133	077	067	150

Sets the right margin wrap mode.

ESC	[	?	7	l (lowercase L)
033	133	077	067	154

CONTROLLING TAB STOPS

Setting the Horizontal Tab at the Active Column (HTS)

ESC	H		HTS
033	110	or	210 (8-bit character)

Setting the Vertical Tab at the Active Line (VTS)

ESC	J		VTS
033	112	or	212 (8-bit character)

Setting Horizontal Tab Stops (DECSHTS)

ESC	[	Pn1	;	...	;	Pn16	u
033	133	***	073	...	073	***	165

Pn ≤ 165 (HAI units)

Setting Vertical Tab Stops (DECSVTS)

ESC	[	Pn1	;	. .	;	Pn16	v
033	133	***	073	...	073	***	166

Pn ≤ 168 (VAI units)

Clearing Tabs (TBC)

ESC	[	Ps	g
033	133	***	147

Ps Value	Function
0 060, or no Ps	Clears the horizontal tab at the active column
1 061	Clears the vertical tab at the active line.
3 063	Clears all horizontal tabs.
4 064	Clears all vertical tabs.

CONTROLLING HIGH LEVEL PRINTER FUNCTIONS

Right Justification (DECFIL)

ESC	[	Pn1	;	Pn2	;	Pn3	;	Pn4	!	s
033	133	***	073	***	073	***	073	***	041	163

$0 \leq Pn1 \leq 1535$ (1/720-inch units, 1/120-inch increments)
$0 \leq Pn2 \leq 255$ (number of printing characters)
$0 \leq Pn3 \leq 1535$ (1/720-inch units, 1/120-inch increments)
$0 \leq Pn4 \leq 255$ (number of spaces)

Character Enhancement: Underlining (SGR)

ESC	[	4	m
033	133	064	155

Selecting the Underline Attribute (DECUND)

ESC	[	Pn	!	w
033	133	***	041	167

$32 \leq Pn \leq 126$ (decimal ASCII code)

Character Enhancement: Bolding (SGR)

ESC	[	1	m
033	133	061	155

Sets bold 1

ESC	[	?	1	m
033	133	077	061	155

Sets bold 2

Character Enhancement: Shadow Printing (SGR)

ESC	[	?	2	m
033	133	077	062	155

Disable Print Hammer (SGR)

ESC	[	8	m
033	100	070	155

Clear Character Enhancements (SGR)

ESC	[	0	m
033	133	060	155

Reinitialization (RIS)

ESC	c
033	143

Device Identification Request/Report (DA)

ESC	[	c
033	133	143

Device Status Request/Report (DSR)

ESC	[	Ps	;		;	Ps	n
033	133	***	073	.	073	***	156

CONTROLLING PRINTER OPTIONS

Sheet Feeder Paper Insert/Eject (DECASFC)

ESC	Ps	!	v
033	***	041	166

Table A-1 Active Character Set Selection

Command	Mnemonic	Control Command	GL Set	GR Set
Locking shift 0	LS0	LS0 017	G0	–
Locking shift 1	LS1	LS1 016	G1	–
Single shift 2	SS2	ESC N 033 116	G2*	–
Single shift 3	SS3	ESC O 033 117	G3*	–
Locking shift 2	LS2	ESC n 033 156	G2	–
Locking shift 3	LS3	ESC o 033 157	G3	–
Locking shift 1 right	LS1R	ESC ~ 033 176	–	G1
Locking shift 2 right	LS2R	ESC } 033 175	–	G2
Locking shift 3 right	LS3R	ESC 033 174	–	G3

Table A-2 Character Set Selection Escape Sequences

G0	G1	G2	G3	Character Set
ESC(B	ESC)B	ESC*B	ESC+B	ASCII
ESC(A	ESC)A	ESC*A	ESC+A	United Kingdom
ESC(5	ESC)5	ESC*5	ESC+5	Finnish
ESC(C	ESC)C	ESC*C	ESC+C	Finnish
ESC(R	ESC)R	ESC*R	ESC+R	French
ESC(9	ESC)9	ESC*9	ESC+9	French Canadian
ESC(Q	ESC)Q	ESC*Q	ESC+Q	French Canadian
ESC(K	ESC)K	ESC*K	ESC+K	German
ESC(Y	ESC)Y	ESC*Y	ESC+Y	Italian
ESC(J	ESC)J	ESC*J	ESC+J	JIS Roman (Japanese)
ESC(6	ESC)6	ESC*6	ESC+6	Norwegian/Danish
ESC(E	ESC)E	ESC*E	ESC+E	Norwegian/Danish
ESC(Z	ESC)Z	ESC*Z	ESC+Z	Spanish
ESC(7	ESC)7	ESC*7	ESC+7	Swedish
ESC(H	ESC)H	ESC*H	ESC+H	Swedish
ESC(<	ESC)<	ESC*<	ESC+<	Multinational

BITS B8 B7 B6 B5 / B4 B3 B2 B1	COLUMN / ROW	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0 0 0 0	0	NUL		SP	0	@	P	`	p								
0 0 0 1	1		DC1 (XON)	!	1	A	Q	a	q			¡	±	Â	Ñ	ã	ñ
0 0 1 0	2			"	2	B	R	b	r			¢	2	Ã	Ò	â	ò
0 0 1 1	3		DC3 (XOFF)	#	3	C	S	c	s			£	3	Ä	Ó	ã	ó
0 1 0 0	4			$	4	D	T	d	t	IND				Å	Ô	ä	ô
0 1 0 1	5	ENQ		%	5	E	U	e	u	NEL		¥	µ	Ö	Õ	å	õ
0 1 1 0	6			&	6	F	V	f	v				¶	Æ	Ö	æ	ö
0 1 1 1	7	BEL		'	7	G	W	g	w			§	•	Ç	Œ	ç	œ
1 0 0 0	8	BS	CAN	(	8	H	X	h	x	HTS		¤		È	Ø	è	ø
1 0 0 1	9	HT		)	9	I	Y	i	y			©	1	É	Ù	é	ù
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z	VTS		ª	º	Ê	Ú	ê	ú
1 0 1 1	11	VT	ESC	+	;	K	[	k	{	PLD	CSI	«	¼	Ë	Û	ë	û
1 1 0 0	12	FF		,	<	L	\	l	|	PLU			½	Ì	Ü	ì	ü
1 1 0 1	13	CR		-	=	M	]	m	}	RI				Í	Ý	í	ý
1 1 1 0	14	LS1 (SO)		.	>	N	^	n	~	SS2				Î		î	
1 1 1 1	15	LSO (SI)		/	?	O	_	o	DEL	SS3		¿		Ï	ß	ï	

C0 CONTROL SET	GL GRAPHIC SET (SHOWN HERE FILLED WITH ASCII CHARACTER SET)	C1 CONTROL SET	GR GRAPHIC SET (SHOWN HERE FILLED WITH DIGITAL MULTINATIONAL SET)

LEGEND

CHARACTER		
A	101	OCTAL
	65	DECIMAL
	41	HEX

BLANK CHARACTERS ARE RESERVED FOR FUTURE USE AND WILL BE PRINTED AS ERRORS

MA-10-0870

▪ LN03 Programming Summary

The most current operating and programmng information on the LN03 is reproduced here.

Printer Common Spec. Sequence Summary

Function	Mnemonic	Format
Autowrap Mode	DECAWM	CSI ? 7 h —enables 9/11 3/15 3/7 6/8 autowrap mode CSI ? 7 1 —disables 9/11 3/15 3/7 6/12 autowrap mode (initial state is taken from hardware switches)
Carriage Return New Line Mode	DECCRNLM	CSI ? 4 0 h —enables LF 9/11 3/15 3/4 3/0 6/8 to go with CR CSI ? 4 0 1 —disables 9/11 3/15 3/4 3/0 6/12 (initial)
Cursor Up	CUU	CSI Pn A 9/11 *** 4/1 Pn = 0 (default) = n decimal value that specifies lines to move
Draw Vector	DECVEC	CSI P1 ; P2 ;... P5 ! | 9/11 ** 3/11 ** 3/11 ** 2/1 7/12 P1 = 0 draw X line = 1 draw Y line ! values P2 = X start value ! in either P3 = Y start value ! decipoint P4 = line length ! or pixels P5 = line width ! per SSU
Request Font Status	DECRFS	CSI P1 ; " [String ST 9/11 ** 3/11 2/12 7/11 ****** 9/12 Ps = 0 send status of all fonts = 1 send status of ROM resident, downline loaded, and cartridge = 2 send status of memory bytes remaining for host loaded fonts. String = type family and font
Font Status Report	(DECFSR)	CSI 2 " nnn ST 9/11 3/2 2/2 *** 9/12 nnn = number of bytes remaining in memory.
Graphic Size Modification	GSM	CSI Ph ; Pw SP B 9/11 ** 3/11 ** 2/0 4/2 Ph = 100 (initial value) Ph = decimal value that specifies a percentage of height set by GSS Pw = 100 (initial value) Pw = decimal value that specifies a percentage of width set by GSS.

Graphic Size Select	GSS	CSI Pn SP C 9/11 ** 2/0 4/3 Pn = decimal value that specifies the height of the font in units set by the SSU sequence.
Horizontal Pitch	DECSHORP	CSI Ps w 9/11 *** 7/7 Ps Pitch Position Unit (approx.) 0 determined by current font (default) 1 10 .100 inch 2 12 .083 inch Note: horizontal 3 13.2 .075 inch tabs ARE scaled 4 16.5 .060 inch by DECSHORP 5 5 .200 inch 6 6 .166 inch 7 6.6 .150 inch 8 8.25 .120 inch 9 15 .066 inch
Horizontal Position Absolute	HPA	CSI Pn 9/11 ** 6/0 Pn = 0 value of 1 (default) = n numeric value in character, decipoint, or pixel units per SSU sequence and PUM setting.
Horizontal Position Relative	HPR	CSI Pn a 9/11 *** 6/1 Pn = 0 value of 1 (default) = n numeric value in character, decipoint or pixel units per SSU sequence and PUM setting.
Horizontal Position Backward	HPB	CSI Pn j 9/11 *** 6/10 Pn = 0 value of 1 (default) = n numeric value in character, decipoint or pixel units per SSU sequence and PUM setting.
Horizontal Spacing, Select	SHS	CSI Ps SP K 9/11 ** 2/0 4/11 Ps Horiz. Char. Pitch Horiz. Char. Position Unit 0 10 char. per inch 1/10 inch (initial) 1 12 char. per inch 1/12 inch 2 15 char. per inch 1/15 inch 3 6 char. per inch 1/6 inch
Horizontal Tabulation Stops, Set	DECSHTS	CSI Pn ;..... ; Pn u 9/11 *** 3.11... 3/11 *** 7/5 (max. number of parameters is 16) Pn = numeric value in character, decipoint or pixel units per SSU sequence and PUM setting.

Justify	JFY	CSI Ps SP F 9/11 *** 2/0 4/6 Ps = 0 stop justification 2 start justification ?2 justify w/o limits
Linefeed New Line Mode	LNM	CSI 2 0 1 = increment line 9/11 3/2 3/0 6/12 with no return to left margin (initial) CSI 2 0 h = increment line with 9/11 3/2 3/0 6/8 return to left margin
Lines Per Physical Page	DECSLPP	CSI Pn t 9/11 *** 7/4 Pn = form length setting (numeric value in character, decipoint or pixel units per SSU sequence and PUM setting)
Assign to Font File	DECATFF	DCS P1 ; P2] ID String ST 9/0 *** 3/11 *** 7/13 ****** 9/12 P1 = 1 assign by font (default) = 2 assign by font family P2 = font number for use with SGR ID String = name associated with font number
Delete Type family or font file	DECDTFF	DCS Ps ~ ID String ST 9/0 ** 7/14 ******* 9/12 Ps = 0 ID string is type family = 1 ID string is font ID String = 7 letter family name or 16 letter font ID
Load Font File	DECLFF	DCS 0 ; P2 ; P3 y 9/0 3/0 3/11 ** 3/11 ** 7/9 Fnt-Rcrd ; Comment Record ST ********3/11 ********** 9/12 P2 = 0 print summary sheet = 1 don't print summary sheet P3 = 0 delete all fonts = 1 replace fonts with same ID Fnt-Rcrd = data for font set; Comment Record = user supplied text
Margin, Set Left and Right	DECSLRM	CSI P1 ; Pr s 9/11 ** 3/11 ** 7/3 P1 = left margin setting-numeric value in characters, decipoint or pixel units per SSU sequence and PUM setting Pr = right margin setting-numeric value in characters, decipoint or pixel units per SSU sequence and PUM setting

Margin, Set Top and Bottom	DECSTBM	CSI Pt ; Pb r 9/11 ** 3/11 ** 7/2 Pt = top margin setting-numeric value in character, decipoint or pixel units per SSU sequence and PUM setting Pb = bottom margin setting-numeric value in character, decipoint or pixel units per SSU sequence and PUM setting
Origin Placement Mode	DECOPM	CSI ? 5 2 h Set 9/11 3/15 3/5 3/2 6/8 places origin to corner of paper CSI ? 5 2 1 Reset 9/11 3/15 3/5 3/2 6/12 origin to corner of printable area (initial)
Page Format Select	PFS	CSI Ps SP J 9/11 ** 2/0 4/10 Ps Description 0 Tall Basic Text Communication Format 1 Wide Basic Text Communication Format 2 Tall Basic A4 Format 3 Wide Basic A4 Format 4 Tall North-American Letter Format 5 Wide North-American Letter Format 6 Tall Extended A4 Format 7 Wide Extended A4 Format ?20 Tall Extended North-American Letter Format ?21 Wide Extended North-American Letter Format ?22 Tall Extended A4 Format ?23 Wide Extended A4 Format
Partial Line Down	PLD	PLD (subscripting) 8/11 (or ESC L)
Partial Line Up	PLU	PLU (superscripting) 8/12 (or ESC K)
Pitch Select Mode	DECPSM	CSI ? 2 9 1 9/11 3/15 3/2 3/9 6/12 —use any pitch (initial) CSI ? 2 9 h 9/11 3/15 3/2 3/9 6/8 —ignore DECSHORP
Proportional Spacing	DECPSP	CSI ? 2 7 h 9/11 3/15 3/2 3/7 6/8 PSP set—enable proportional spacing CSI ? 2 7 1 9/11 3/15 3/2 3/7 6/12 PSP reset—force mono-space (initial)

Select Graphic Rendition	SGR	CSI Ps m 9/11 ** 6/13 Ps = 10 DBULTN1 family = 11 RCOURIR family = 12 RELITEO family = 13 Courier 10/10 font = 14 Elite 10/12 font = 15 Courier 6.7/13.6 font = 16 Courier 10/10.3 font = 17 cartridge family = 18 cartridge family = 19 cartridge family Ps = 0 renditions off = 1 bold on = 3 italics on = 4 underline on = 9 strike through on = 22 bold off = 23 italics off = 24 underline off = 29 strike through off
Position Unit Mode	PUM	CSI 1 1 1 9/11 3/1 3/1 6/12 PUM reset—spacing unit increment equals one character position (initial) CSI 1 1 h 9/11 3/1 3/1 6/8 PUM set—spacing unit increment per the SSU sequence
Select Size Unit	SSU	CSI Ps SP I 9/11 ** 2/0 4/9 Ps = 2 decipoint units (720/in.) (initial) = 7 pixel units (300/in.)
NOTE: CSI may be replaced by 9/11		ESC [1/11 5/11
DCS may be replaced by 9/0		ESC P 1/11 5/0
ST may be replaced by 9/12		ESC \ 1/11 5/12
Soft Terminal Reset	DECSTR	CSI ! p 9/11 2/1 7/0 (does the same things as RIS)

Spacing Pitch, Incremental	SPI	CSI Pv ; Ph SP G 9/11 ** 3/11 ** 2/0 4/7 Pv = 0 determined by current font (initial) = n vertical spacing increment; numeric value in decipoint, or pixel per SSU sequence. Ph = 0 determined by current font = n horizontal spacing increment-numeric value in decipoint or pixel units per SSU sequence.
Tabs Clear	TBC	CSI Ps g 9/11 ** 6/7 Ps = 0 clear one horiz. tab at active pos. = 1 clear one vert. tab at active pos. = 2 clear all horizontal tabs = 3 clear all horizontal tabs = 4 clear all vertical tabs
Vertical Pitch	DECVERP	CSI Ps z 9/11 *** 7/10 Ps Pitch (lines/inch). 0 (default) determined by current font 1 6 2 8 3 12 4 2 5 3 6 4
Vertical Position Absolute	VPA	CSI Pn d 9/11 ** 6/4 Pn = 0 initial value of 1 = n numeric value in character, decipoint or pixel units per SSU sequence and PUM setting.
Vertical Position Backward	VPB	CSI Pn k 9/11 *** 6/11 Pn = 0 initial value of 1 = n numeric value in character, decipoint or pixel units per SSU sequence and PUM setting.
Vertical Position Relation	VPR	CSI Pn • 9/11 *** 6/5 Pn = 0 initial value of 1 = n numeric value in character, decipoint or pixel units per SSU sequence and PUM setting.

Select Vertical Spacing	SVS	CSI Ps SP L 9/11 *** 2/0 4/12	
		Ps	Vert. Char. Pitch / Vert. Char. Positioning Unit
		0	6 lines per inch / 1/6 inch (default value)
		1	4 lines per inch / 1/4 inch
		2	3 lines per inch / 1/3 inch
		3	12 lines per inch / 1/12 inch
		4	8 lines per inch / 1/8 inch
		5	6 lines per 30 mm / 5 mm
		6	4 lines per 30 mm / 7.5 mm
		7	3 lines per 30 mm / 10 mm
		8	12 lines per 30 mm / 2.5 mm
		9	2 lines per inch / 1/2 inch
Vertical Tabs	DECSVTS	CSI Pn ; ..... ; Pn v 9/11 ** 3/11 3/11 ** 7/6 (maximum number of parameters is 16) Pn = numeric value in character, decipoint or pixel units per SSU and PUM sequence settings.	

Sixel Information

DCS <macro> ;0; <horizontal grid size> q <picture data> ST

dev	macro	h-grid size	vert:horz		v-grid size
default	0	.0075″	200:100	2:1	.0150″
VT125	1	.0075″	200:100	2:1	.0150″
PRO350	5	.0075″	183:100	2:1	.0137″
isometric	9	.0135″	100:100	1:1	.0135″

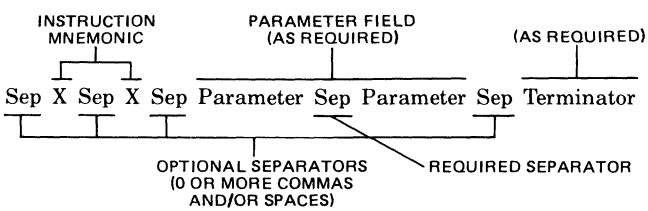
▪ LVP16 Programming Information

The LVP16 Graphics Plotter is a vector plotter activated by the HP-GL graphics programming language. An HP-GL instruction consists of a two-letter mnemonic followed by its parameter field, if any, and a terminator. If parameters follow the mnemonic, they must be separated from each other by at least one comma or space, or by a + or – sign that may be preceded by commas or spaces. Optional commas and/or spaces may be used as separators before, after, and between the mnemonic and before the terminator.

HP-GL Control Instructions

LVP16 Control Instructions (HP-GL)

Mnemonic	For readability, the mnemonic is shown uppercase and separated from the parameters and/or terminator.
Necessary Parameter	All typeset items are required parameters.
( )	All items in parentheses are optional.
c...c	Any number of labeling characters.
(,...)	Any number of X, Y coordinate pairs.
Terminator	A ; or the next mnemonic. An instruction followed by a parameter must include a terminator.



HP-GL Syntax

LPV16 Instruction Set

The following codes are used in the table
[c] = character format
[d] = decimal format, – 128.0000 to + 127.9999
[i] = integer format, – 32768 to + 32767
[sd] = scaled decimal format, – 32768.0000 to + 32767.9999

Instruction	Description	Function
AA X[i/sd], Y[i/sd], arc angle [i] (,chord angle [i])	Arc absolute	Draws an arc with the center point located at a specified absolute point. The arc can be drawn clockwise (CW) or counterclockwise (CCW). It subtends the specified arc angle, and conforms to the specified or default chord angle.
AR X[i/sd], Y[i/sd], arc angle [i] (,chord angle [i])	Arc relative	Draws an arc of specified number of degrees with specified smoothness; centered relative to current pen position, using current pen status (up or down). The arc can be drawn clockwise (CW) or counterclockwise (CCW).
CA n[i]	Designate alternate set n	Designates one of the 19 character sets (0-4, 6-9, or 30-30) as the alternate character set.
CI radius [i/sd], (,chord angle [i])	Circle	Draws a circle of a specified radius and chord angle. Center of circle at current pen position.
CP spaces [d], lines [d]	Character plot	Moves the pen the number of spaces and lines specified.
CS n[i]	Designate standard set n	Designates one of the 19 character sets (0-4, 6-9, and 30-39) as the standard character set.
DC	Digitize clear	Terminates digitize mode without entering a point from the front panel.
DF	Set default values	Returns plotter functions to a predefined state.
DI run [d], rise [d]	Absolute direction	Sets the direction of characters for labels.

DP	Digitize point	Places plotter in digitize mode waiting for point to be entered from front panel.
DR run [d], rise [d]	Relative direction	Sets the direction of characters for labels.
DT c [c]	Define terminator	Specifies the character to be used as the label terminator.
EA X [i/sd], Y [i/sd]	Edge rectangle absolute	Draws the edge of a rectangle in absolute coordinates.
ER X [i/sd], Y [i/sd]	Edge rectangle relative	Edges a rectangle using relative plotting coordinates.
EW radius [i/sd], start angle [i], sweep angle [i] (,chord angle [i])	Edge wedge	Draws the edge of any arc segment of a circle of a specified radius.
FT type [i] (,spacing [sd] (,angle [i]))	Fill type	Selects the type of area fill for use with an RA, RR, or WG instruction.
IM e [i]	Input e mask	Controls the conditions under which HP-GL error status is reported.
IN	Initialize	Returns the plotter's graphics conditions to the inital power-on state by program control. This instruction has no effect on handshake protocol or the plotter's state (programmed on or off) in an RS-232-C environment.
IP $P1_x$ [i], $P1_y$ [i] (,$P2_x$ [i], $P2_y$ [i])	Input P1 and P2	Sets scaling points $P1_x$, $P1_y$, and $P2_x$, $P2_y$.
IW X_{lo} [i], Y_{lo} [i], X_{hi} [i], Y_{hi} [i]	Input window	Restricts programmed pen motion to a rectangular area of the plotting surface. This area is called the "window."
LB c...c [c]	Label ASCII string	Letters text, expressions, or string variables using the currently defined character set.

LT t [d] (,1 [d])	Designate line type	Sets the line type and length to be used in drawing lines with PA and PR instructions.
OA [i return]	Output actual position and pen status	Outputs the *X* and *Y* coordinates and pen status (up or down) to show pen's physical position at time of instruction.
OC [i/sd return]	Output commanded position and pen status	Outputs the *X* and *Y* coordinates and pen status (up or down) associated with the last valid pen position instruction.
OD [i return]	Output digitized point and pen status	Used to output the physical pen position and status for the last digitized point.
OE [i return]	Output error	Outputs the decimal equivalent of the first HP-GL error (if any).
OF [i return]	Output factors	Outputs the number of plotter units per millimeter in each axis.
OH [i return]	Output hard-clip limits	Outputs the lower left (LL) and upper right (UR) coordinates of the current hard-clip limits.
OI [c return]	Output identification	Used to output the plotter's identification.
OO [i return]	Output options	Outputs eight option parameters, which are features implemented on the plotter.
OP [i return]	Output P1 and P2	Makes the current coordinates of P1 and P2 available for output.
OS [i return]	Output status	Outputs the decimal equivalent of the status byte.
OW [i return]	Output window	Obtains the *X* and *Y* coordinates of the lower left and upper right corners of the window area in which plotting can now occur.
PA X [i/sd], Y [i/sd] (,...)	Plot absolute	Moves the pen to the point or points specified by the *X* and *Y* coordinate parameters.

PD (X [i/sd], Y [i/sd] (,...))	Pen down	Lowers the pen.
PR X [i/sd], Y [i/sd] (,...)	Plot relative	Moves the pen relative to its current location by the number of units specified by the *X* and *Y* increment parameters.
PS paper size [i]	Paper size	Used to toggle between A and B, or A3 and A4 paper sizes.
PT thickness [d]	Pen thickness	Determines the spacing between the lines drawn in a solid fill.
PU (X [i/sd],Y [i/sd] (,...))	Pen up	Raises the pen.
RA X [i/sd], Y [i/sd]	Shade rectangle absolute	Defines and shades a rectangle using absolute coordinates.
RO n[i]	Rotate coordinate system	Rotates the plotter unit/user-unit coordinate systems by 90 degrees.
RR X [i/sd], Y [i/sd]	Shade rectangle relative	Defines and shades a rectangle using relative coordinates.
SA	Select alternate character set	Selects the alternate set designated by the most recent CA instruction as the character set to be used for subsequent labeling.
SC X_{min} [i]. X_{max} [i], Y_{min} [i], Y_{max} [i]	Scale	Scales the plotting area into user units.
SI width [d], height [d]	Absolute character size	Sets actual size (width and height) of characters and symbols in centimeters for labels.
SL tan θ [d]	Absolute character slant (from vertical)	Establishes the slant for labeled characters.
SM c [c]	Symbol mode	Used with PA and PR instructions, causes specified symbol or a single character to be drawn at each plotted point.
SP n [i]	Select pen	Selects and/or stores a pen.

SR width [d], height [d]	Relative character size	Specifies the size of characters and symbols as a percentage of the distance between scaling points P1 and P2.
SS	Select standard character set	Selects the standard set designated by the CS instruction as the character set to be used for all labeling.
TL tp [d] (.tm [d])	Tick length	Specifies the length of the tick marks drawn by the plotter. The tick lengths are specified as a percentage of the horizontal and vertical distances between the scaling points P1 and P2.
UC (pen [i],) X [d], pen [i] (,...)	User defined character	Draws characters or symbols designed by user.
VS v [d]	Select velocity v	Specifies the pen-down speed for plotting and labeling operations. Note: This instruction is used to set velocity to a speed other than the default velocity of 38.1 cm/s and to change the acceleration from its default value of 2 g (980 cm/s^2). This instruction should be used to slow velocity to 10 cm/s when plotting on transparency film. A slightly thicker line can be created by slowing down the pen speed on any medium. A pen nearing the end of its life will write with a clearer, sharper, more solid line if the velocity is slowed.
WG radius [i/sd], start angle [i], sweep angle [i] (,chord angle [i])	Shade wedge	Defines and shades any arc segment of a circle of a specified radius.

XT	*X*axis tick	Draws a vertical *X* tick mark of the length specified by the TL instruction, at the current pen position.
YT	*Y*axis tick	Draws a horizontal *Y* tick mark of the length specified by the TL instruction, at the current pen position.

RS-232-C Device Control Instructions

Device control instructions establish the handshake protocol to be used by the LVP16 plotter. The instructions control the method by which data is transferred between the computer and the plotter and give the computer the ability to query and to receive information from the plotter.

Device Control Instructions

Escape Sequence	Description	Function
ESC . (or ESC . Y	Plotter on	Places the plotter in a programmed-on state.
ESC .) or ESC . Z	Plotter off	Places the plotter in a programmed-off state.
ESC . @	Set plotter configuration	Enables or disables hardwire handshake mode, monitor mode, and data transmission mode.
ESC . B	Output buffer space	Outputs the number of byte spaces currently available for data in the buffer.
ESC . E	Output extended error	Outputs a decimal code to identify the type of RS-232-C related error that occurred.
ESC . H	Set handshake mode 1	Establishes parameters for handshake mode 1, used when response to handshake enable character requires ESC . M parameters.
ESC . I	Set handshake mode 2	Establishes parameters for handshake mode 2, used when response to handshake enable character does not require ESC . M parameters.

ESC . J	Abort device control	Aborts any partially decoded or executed device control instructions including outputs.
ESC . K	Abort graphic instruction	Aborts any partially decoded HP-GL instruction and discards instructions in buffer.
ESC . L	Output buffer size	Outputs the buffer size in bytes.
ESC . M	Set output mode	Sets parameters for the plotter's communication format.
ESC . N	Set extended output and handshake mode	Establishes extended parameters for any output instruction.
ESC . O	Output extended status	Outputs the plotter's extended status, giving information about the state of the buffer, pinch wheels, and VIEW button.
ESC . R	Reset handshake	Resets the handshake to its default value. It is the same as sending the commands ESC.@, ESC.H, ESC.I , ESC.M, and ESC.N without parameters.

▪ LGPO1 Programming Summary

LCG01 Escape Sequences

Mnemonic	Code	Name
CSI	ESC [	Control sequence introducer
RIS	ESC c	Reset to initial state
PLD	ESC K	Partial line down
PLU	ESC L	Partial line up
HTS	ESC H	Horizontal tab set
VTS	ESC J	Vertical tab set
SM	ESC [Ps h	Set mode
PUM	ESC [11 h	Position unit mode
LNM	ESC [20 h	Line feed new line mode
DECBWRM	ESC [?51 h	Black/white reversal mode
DECBPM	ESC [?55 h	Bold page mode
RM	ESC [Ps l	Reset mode

Mnemonic	Code	Name
SGR	ESC [Ps m	Select graphics rendition: Ps = 0 Reset to initial setting Ps = 10 Select font 1 Ps = 11 Select font 2 Ps = 12 Select font 3 Ps = 13 Select font 4 Ps = 14 Select font 5 Ps = 30 Black (color 0) foreground Ps = 31 Red (color 1) foreground Ps = 32 Green (color 2) foreground Ps = 33 Yellow (color 3) foreground Ps = 34 Blue (color 4) foreground Ps = 35 Magenta (color 5) foreground Ps = 36 Cyan (color 6) foreground Ps = 37 White (color 7) foreground Ps = 40 Black (color 0) background Ps = 41 Red (color 1) background Ps = 42 Green (color 2) background Ps = 43 Yellow (color 3) background Ps = 44 Blue (color 4) background Ps = 45 Magenta (color 5) background Ps = 46 Cyan (color 6) background Ps = 47 White (color 7) background Ps = 49 No background
SGR	ESC [c or ESC [0 c	Device attributes
DECFCR	ESC [" x	Font configuration request.Response: ESC [? Pn ; Pm SP D
DSR	ESC [5 n	Device status request.Response: ESC [? Ps n Ps = 20 No printer errors Ps = 21 Printer hardware error Ps = 22 Communications I/O error Ps = 23 Input buffer overflow Ps = 24 Printer deselected Ps = 27 Out of consumables (ink/paper) Ps = 28 Program load failure Ps = 42 Font load failure Ps = 44 Font memory exceeded Ps = 104 Too many fonts
PFS	ESC [Pn SP J	Page format selection.Pn = 0 Portrait orientation Pn = 1 Landscape orientation

Mnemonic	Code	Name
SSU	ESC [Pn SP I	Select size unit
DECSLRM	ESC [Pn ; Pm s	Set left and right margins
GSS	ESC [Ph ; Pw SP C	Graphic size set
GSM	ESC [Ph ; Pw SP B	Graphic size modification
SPI	ESC [Pv ; Ph SP G	Set spacing increment
DECSHTS	ESC [Ps u	Set horizontal tab stops
DECSTBM	ESC [Pn ; Pm r	Set top and bottom margins
DECSVTS	ESC [Ps v	Set vertical tab stops
TBC	ESC [Ps g	Tabulation clearPs = 3 Clears all horizontal tabs Ps = 4 Clears all vertical tabs
HPA	ESC [Pn ‘	Horizontal position absolute
VPA	ESC [Pn d	Vertical position absolute
HPB	ESC [Pn j	Horizontal position backward
HPR	ESC [Pn a	Horizontal position relative
VPB	ESC [Pn k	Vertical position backward
VPR	ESC [Pn e	Vertical position relative
DECTST	ESC [6 ; Pn y	Test Pn = 1 Power-up self-tests Pn = 2 Print a test pattern
DECSNC	ESC [Pn & q B	Set number of copies

Special Control Functions

Mnemonic	Code	Name
DCS	ESC P	Device control string
ESC P p	Enter ReGIS mode without initialization	
ESC P 1 p	Enter ReGIS mode with initialization	
ESC Pn ; Pm q	Enter Sixel mode:Pn = 0,1 2:1 aspect ratio Pn = 9 1:1 aspect ratio Pm = 0,2 clear Sixel background Pm = 1 retain existing image	
ESC P ! q	Enter GIDIS mode	
ESC P v	Start answerback definition	
ST	ESC \	String terminator (end DCS string)
DECSCCS	ESC % 4	Enter NAPLPS mode
DECTCS	ESC % 0	Exit NAPLPS mode

- Lineprinter Registers

LP25, LP26, and LP27 Series Registers

The system printers described in chapter 16 can use the same controller. Following are the register drawings and bit definitions of the controller's two registers: the Control and Status Register and the Data Buffer Register.

Control and Status Register (LXCS) 777514

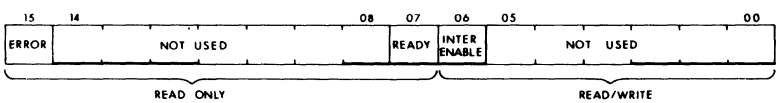


Figure J-1 Control and Status Register (LXCS) 777514

Bit	Name
15	**Error** Set whenever an error condition exists in the graphics lineprinter. Error conditions are power off, graphics lineprinter off-line, no paper, torn paper, band gate open, over-temperature alarm, or line-printer off-line. Generates an interrupt if INTERRUPT ENABLE 06 is also set. Cleared by correcting the error condition.
14 – 08	**Not Used**
07	**Ready** Set when the graphics lineprinter is ready for the next character to be loaded into the data buffer register. Generates an interrupt if INTERRUPT ENABLE . 06 is also set.
06	**Interrupt Enable** When set allows an interrupt to occur when either the ERROR 15 or READY . 07 is also set. Cleared by loading with a 0. Also cleared by INIT.
05 – 00	**Not Used**

Data Buffer Register (LXDB) 777516

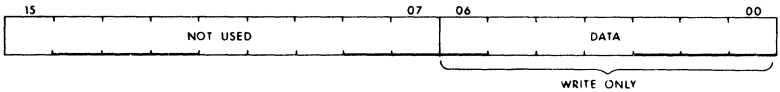


Figure J-2 Data Buffer Register (LXDB 777516

Bit	Name
15 – 07	**Not Used**
06 – 00	**Data** 7-bit ASCII character buffer. Characters are transferred to the lineprinter by loading this buffer.

LXY12/LXY22 Series Registers

While the LXY12/LXY22 graphics lineprinters systems described in this appendix use different controllers depending on the model selected, each controller has two registers: the Control and Status Register and the Data Buffer Register. The following are the controller's register drawings and bit definitions.

Control and Status Register (LXCS) 777514

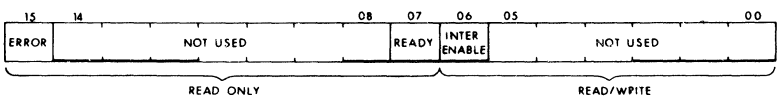


Figure J-3 Control and Status Register (LXCS) 777514

Bit	Name
15	**Error** Set whenever an error condition exists in the graphics lineprinter. Error conditions are power off, graphics lineprinter off-line, no paper, form paper or form thickness adjustment lever left up. Generates an interrupt if INTERRUPT ENABLE <06> is also set. Cleared by correcting the error condition.
14 – 08	**Not Used**

07 **Ready**

Set when the graphics lineprinter is ready for the next character to be loaded into the data buffer register. Generates an interrupt if INTERRUPT ENABLE <06> is also set.

06 **Interrupt Enable**

When set allows an interrupt to occur when either the ERROR <15> or READY <07> is also set.

Cleared by loading with a 0. Also cleared by INIT.

05 – 00 **Not Used**

Data Buffer Register (LXDB) 777516

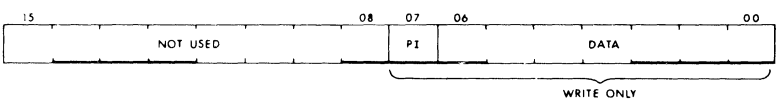


Figure J-4 Data Buffer Register (LXDB) 777516

Bit	Name
15 – 08	**Not Used**

07 **Paper Instruction (PI)**

Used to advance the paper up to 15 lines when DATA BIT <04> is also set. Data bits <03–00> contain the number of lines to be advanced. When the PLXY-11 plot software is used with some operating systems, the PI is disabled by installing jumper W5 on the controller logic board "A."

06 – 00 **Data**

Seven-bit ASCII character buffer. Characters are transferred to the lineprinter by loading this buffer.

▪ LA75 Printer

The most current operating and programming information on the LA75 printer is reproduced here.

DEC MODE

CONFORMANCE LEVEL 1 FUNCTIONS

Partial-line Paper Motion

Name	Mnemonic	Sequence	
Partial line down	PLD	*ESC K*	Advances paper 1/12 inch.
Partial line up	PLU	*ESC L*	Reverses paper 1/12 inch.

Horizontal Pitch

Mnemonic	Sequence
DECSHORP	*CSI Ps w*

Ps =

0 or none	10 char/in (default)
1	10 char/in
2	12 char/in
4	16.5 char/in
11	17.1 char/in
5	5 char/in
6	6 char/in
8	8.25 char/in
12	8.55 char/in

Vertical Pitch

Mnemonic	Sequence
DECVERP	*CSI Ps z*

Ps =

0 or none	6 lines/in (default)
1	6 lines/in
2	8 lines/in
3	12 lines/in
4	2 lines/in
5	3 lines/in
6	4 lines/in

Page Length

Mnemonic	Sequence	
DECSLPP	*CSI Pn t*	Set active line to top-of-form position and set page length to Pn units of current vertical pitch.

Character Set Selection

Designate Character Sets

94-Character Sets			
G0	*ESC (*	B	U.S. ASCII
G1	*ESC)*	A	Great Britain
G2	*ESC **	5	DEC Finland
G3	*ESC +*	R	France
		9	DEC French Canada
		K	Germany
		Y	Italy
		J	JIS Roman
		I	JIS Katakana
		6	DEC Norway/Denmark
		Z	Spain
		7	DEC Sweden
		<	User-Preference Supplemental
		0	DEC VT100 Special Graphics
		>	DEC Technical
		'	Norway/Denmark
		4	DEC Holland
		=	DEC Switzerland
		% 6	DEC Portugal
		% 5	DEC Supplemental
96-Character Sets			
G1	*ESC –*	A	ISO Supplemental
G2	*ESC .*		
G3	*ESC /*		

Invoke Active Character Set

ESC N	G2 → GL for one character
ESC O	G3 → GL for one character
ESC n	G2 → GL
ESC o	G3 → GL
ESC ~	G1 → GR
ESC }	G2 → GR
ESC |	G3 → GR

Assign User-Preference Supplemental Character Set

Mnemonic	Sequence
DECAUPSS	*DCS Ps ! u D....D ST*

Ps = 0 or none	94-character set
= 1	96-character set
> 1	Ignore this control string.

D....D are as follows:

% 5	DEC Supplemental	(Ps = 0)
A	ISO Supplemental	(Ps = 1)
I	JIS Katakana	(Ps = 0)
>	DEC Technical	(Ps = 0)

ANSI Announcer Sequence

ESC SP L	Load ASCII set into G0 and invoke it into GL. Load ISO Supplemental set into G1 and invoke it into GR.
ESC SP M	Same as above.
ESC SP N	Load ASCII set into G0 and invoke it into GL only.

Printing Density (Quality) Selection

Mnemonic	Sequence	
DECDEN	*CSI " z*	Default to draft printing.
	CSI 0 " z	Default to draft printing.
	CSI 1 " z	Select draft printing.
	CSI 2 " z	Select letter quality (LQ) printing.
	CSI 3 " z	Select memo printing.
	CSI 4 " z	Select near letter quality (NLQ) printing.

Text Highlighting

Name	Mnemonic	Sequence
Select graphic rendition	SGR	*CSI Ps ; ... ; Ps m*

Ps =

0 or none	Turn off bold, italics, underline, and double underline printing.
1	Turn on bold printing.
3	Turn on italics printing.
4	Turn on underline printing; turn off double underline printing.
21	Turn on double underline printing; turn off underline printing.
22	Turn off bold printing.
23	Turn off italics printing.
24	Turn off underline and double underline printing.

DEC Private SGR Sequence

CSI ? Ps ; ... Ps m

Ps =

0 or none	Turn off superscript, subscript and overline.
4	Turn on superscript and turn off subscript.
5	Turn on subscript and turn off superscript.
6	Turn on overline.
24	Turn off superscript and subscript.
26	Turn off overline.

Automatic Sheet Feeder Control

Mnemonic **Sequence**

DECASFC *CSI Ps ! v*

Ps =

	0 or none	Eject current page
	1	Insert next sheet
>	1	Insert next sheet

CONFORMANCE LEVEL 2 FUNCTIONS

Set Page Width Alignment

Mnemonic **Sequence**

DECHPWA *CSI Pn1 ; Pn2 " s*

Set left reference (PN1) and print area width (PN2).

Pn1 = 0 to 95
Pn2 = 1 to 96

Set Left and Right Margins –

Mnemonic **Sequence**

DECSLRM *CSI Pl ; Pr s*

Pl = 0 or none,	No change to left margin
Pr = 0 or none,	No change to right margin
If Pr > right most printable position,	Right margin is set at right most printable position
If Pl > Pr,	Command is ignored

Horizontal Tabulation Set Control Code

HTS *ESC H*

Set horizontal tab stop at active column.

Set Horizontal Tabulation Stops

DECSHTS *CSI Pn ; ..... ; Pn u*

Pn = 1 to 137
If Pn > 37, it is ignored

Horizontal Tabulation Set

DECHTS *ESC 1*

Set horizontal tab stop at active column

Tabulation Clear

TBC *CSI 0 g*

Clear horizontal tab at active column

CSI 2 g
CSI 3 g

Clear all horizontal tab stops

Clear All Horizontal Tabs

DECCAHT *ESC 2*

Clears all horizontal tab stops

Set Top and Bottom Margins

DECSTBM *CSI Pt ; Pb r*

Pt = top margin setting (default = 1st line).
Pb = bottom margin setting (default = line 66)

Vertical Tab Set Control Code

VTS *ESC J*

Set vertical tab stop at active line.

Vertical Tab Set

DECVTS *ESC 3*

Set vertical tab stop at active line

Set Vertical Tab Stops

DESCVTS *CSI Pn ; ... ; Pn v*

Set vertical tab stop at specified Pn; up to 16 vertical tab stops in one sequence; to a total of 252.

Tabulation Clear

TBC *CSI 1 g*

Clear one vertical tab at active line.

CSI 4 g

Clear all vertical tab stops.

Clears All Vertical Tabs

DECCAVT *ESC 4*

Clear all vertical tab stops.

Forward Index Control Code

IND *ESC D*

Performs line feed (LF) function.

Next Line Control Code

NEL *ESC E*

Set active column to left margin and increments active line

Autowrap Mode

DECAWM *CSI ? 7 h*

Set to autowrap

CSI ? 7 l

Reset to truncate.

Carriage Return New Line Mode

DECCRNLM *CSI ? 4 0 h*

Perform line feed (LF) with carriage return (CR).

CSI ? 4 0 l

Perform carriage return (CR) only.

Linefeed New Line Mode

LNM *CSI 2 0 h*

Perform carriage return (CR) with line feed (LF)

CSI 2 0 l

Perform line feed (LF) only

Horizontal Position Absolute

HPA *CSI Pn '*

Set active column to Pn

Horizontal Position Relative

HPR *CSI Pn a*

Advances active column by Pn columns.

Vertical Position Absolute

VPA *CSI Pn d*

Set active line to line Pn

Vertical Position Relative

VPR *CSI Pn e*

Advances active line by Pn lines.

Unidirectional/Bidirectional Printing

DECUPM *CSI ? 4 1 h*

Set to unidirectional (left to right) printing.

CSI ? 4 1 l

Set to bidirectional printing

Character Set DownLoading

Name	**Mnemonic**
Download Control String	DECDLD

DECDLD consists of DCS introducer and Dscs control string

DCS introducer
DCS Pfn ; Pcn ; Pe ; Pcmw ; Pss ; Pu ; Pcmh ; Pcss {

Control string
Dscs Sxbp1 ; Sxbp2 ; ... ; Sxbpn ST

STATUS, REPORT AND RESET SEQUENCES

Set Conformance Level

Mnemonic		Sequence
DECSCL		*CSI Ps " p*
	Ps = 71	Reset to initial state and enable Conformance Level 1 functions
	= 72	Reset to initial state and enables Level 1 and Level 2 functions

Primary Device Attributes

Name	Mnemonic	Sequence
Device Attribute	DA	*CSI 0 c* or *CSI c* Host computer requests printer ID
		Printer responds with:
Printer ID = LA50		*ESC [? 1 7 c*
Printer ID = LA210		*ESC [? 1 0 ; 3 c*
Printer ID = Level 2		*ESC [? 7 2 ; 5 ; Ps3 ; 7 c*

where 72 = Level 2
5 = Katakana set.
Ps3 = 6 = Sheet feeder (if sheet feeder is installed).
7 = Down-Line Loading

Secondary Device Attributes

Name	Mnemonic	Sequence
Device Attribute	DA	*CSI > c* or *CSI > c* Host computer sends this sequence as request for secondary DA.
		Printer responds with:
		ESC [> 1 6 ; Ps2 c

where 16 = LA75
Ps2 = firmware revision level (currently = 1)

Device Status Request

Name	Mnemonic	Sequence
Device status request	DSR	*CSI n* or *CSI 5 n* Send extended status report *CSI ? 1 n* Disable all unsolicited status reports *CSI ? 2 n* Enable unsolicited brief status report and send extended status report *CSI ? 3 n* Enable unsolicited extended status reports and send extended status report

Device Status Report

Name	Mnemonic	Sequence
Device status report	DSR	Printer responds to host computer's status request
Brief Report		*ESC [0 n* No malfunction detected *ESC [3 n* Malfunction detected
Extended Report		*ESC [0 n* No malfunction detected, followed by *ESC [? 2 0 n* *ESC [3 n* Malfunction detected, followed by *ESC [? Pn; ... Pn n*

Pn	Failure
21	Hardware failure
22	Communication failure
23	Input buffer overflow
24	Printer deselected
26	Access cover open
27	Paper out
30	Automatic sheet feeder is installed and operates correctly
32	Automatic sheet feeder failure caused by paper error

Reset To Initial State

Mnemonic	Sequence
RIS	*ESC c* Reset to DEC-compatible initial state

Soft Terminal Reset

Mnemonic	Sequence
DECSTR	*CSI ! p*
	Reset to DEC-compatible initial state

IBM Proprinter Emulation Mode

Mnemonic	Sequence
DECIPEM	*CSI ? 5 8 h*
	Enable IBM Proprinter emulation mode.
DECIPEM	*CSI ? 5 8 l*
	Disable IBM emulation mode and return to DEC mode

Loading Factory Nonvolatile Memory Settings

Name	Mnemonic	Sequence
Loading factory NVR settings	DECFNVR	*CSI Ps1 ; Ps2 ; ... Psn ! u*
		Store set-up parameters in printer's memory for later use on next power-on
		Ps1 Psn are set-up features.

POWER-ON (INITIAL) STATUS IN DEC MODE

Selectable Parameters	Program Control Function	Power-on Status
Printing status		On-Line (Ready)
Horizontal pitch	DECSHORP	10 char/in
Vertical pitch	DECVERP	6 lines/in
Forms length	DECSLPP	Set by menu
Active position		Column 1, line 1
Compatibility mode	DECIPEM	Set by menu
Underlining	SGR	Disabled
Double underlining	SGR	"
Bolding	SGR	"
Italics	SGR	"
Superscript	SGR	"
Subscript	SGR	"
Unsolicited status	DSR	"
Printing density	DECDEN	Set by menu
GL character set		Same as G0
GR character set		Same as G2
G0 to G2		Set by menu
G3		U.S. ASCII
Horizontal tabs	HTS, DECSHTS, DECHTS	Set at every eight columns
Vertical tabs	VTS, DECSVTS, DECVTS	Set at every line
C1 Transmit	S7C1T, S8C1T	7-bit ESC Fe sequences

CONTROL CHARACTERS

C0 (7-Bit) Text Mode Control Characters

Mnemonic	Function
BEL	Bell
BS	Backspace
HT	Horizontal tab
LF	Line feed
VT	Vertical tab
FF	Form Feed
CR	Carriage return
SP	Space
SO	Shift out
SI	Shift in
NUL	Null
DC1	Device Control 1 (XON)
DC3	Device Control 3 (XOFF)
CAN	Cancel
SUB	Substitute
ESC	Escape
DEL	Delete

C1 (8-Bit) Text Mode Control Characters

Mnemonic	Function
PLD	Partial line down
PLU	Partial line up
IND	Forward index (Level 2)
NEL	Next line (Level 2)
HTS	Horizontal tab set (Level 2)
VTS	Vertical tab set (Level 2)
SS2	Single shift 2
SS3	Single shift 3
DCS	Device control string
CSI	Control sequence introducer
ST	String terminator
OSC	Operating System command
PM	Privacy Message
APC	Application Program Command

Control Function Equivalents

8-Bit (GR) Control Character	7-Bit (GL) Escape Sequence
PLD	ESC K
PLU	ESC L
SS2	ESC N
SS3	ESC O
DCS	ESC P
CSI	ESC ST
ESC	OSC
ESC PM	ESC
APC	ESC
Level 2 Only	
IND	ESC D
NEL	ESC E
HTS	ESC H
VTS	ESC J

SIXEL GRAPHIC MODE

Device Control String (DCS) Format

DCS <macro> ; <horizontal grid size> ; q <picture data> ST

Macro	Horizontal grid size (inches)	Pixel Aspect Ratio (vertical	horizontal)	Image scale size
0 or none	1/144 (0.0069)	200:100	2:1	Full Scale
1	1/144 (0.0069)	200:100	2:1	Full Scale
4	1/180 (.0056)	250.100	2 5:1	Full Scale
9	1/72 (.0139)	100:100	1:1	Full Scale

Sixel Control Character

SUB	Enter text mode, then process SUB.
CAN	Enter text mode, then process CAN.
ESC	Enter text mode, then process ESC.

IBM PROPRINTER EMULATION MODE

TERMINAL MANAGEMENT COMMANDS

Reset To Initial State

Mnemonic	Sequence
RIS	*ESC c*

Reset to DEC mode and advance to next top-of-form

Soft Terminal Reset

STR	*ESC [! p*

Reset to DEC mode and advance to next top-of-form

IBM Terminal Reset

ESC =

Reset ONLY IBM emulation to its initial state without returning to DEC mode, and advance to next top-of-form

Deselect Printer

ESC Q 3

Print contents of print buffer, then deselect the printer

OPERATING COMMANDS

Set Vertical Pitch

ER8LI — *ESC 0*

Set vertical pitch to 8 lines per inch

ER10LI — *ESC 1*

Set vertical pitch to 10.3 lines per inch

ERNLI2 — *ESC 2*

Set vertical pitch as specified in ESC A sequence or to 6 lines per inch

ERNLI1 — *ESC A Pn*

Set vertical pitch to 72/Pn lines per inch. Does not take effect until ESC 2 is sent If Pn = 0, retain previous ESC A setting Maximum Pn = 255

ERNLI3 — *ESC 3 Pn*

Set vertical pitch to 216/Pn lines per inch
Max Pn = 255, Pn = 0 is ignored

ERNLI4 — *ESC J Pn*

Perform one line feed at a vertical pitch of 216/Pn lines per inch
Maximum Pn = 255, Pn = is ignored.

Set Form Length

ERSFL *ESC C Pn*

Set form length to Pn (required number of lines) times current vertical pitch. Set top-of-form, and clear bottom margin
Max. Pn = 255, Pn = 0 is ignored.

ERSFLI *ESC C NUL Pn*

Set form length to Pn inches, set top-of-form, and clear bottom margin.
Max Pn = 151, Pn = 0 is ignored.

Set Bottom Margin

ERSBM *ESC N Pn*

Set bottom margin to Pn lines up from current form length using current vertical pitch.
Max Pn = 255, Pn = 0 is ignored.

Clear Bottom Margin

ERCBM *ESC 0*

Clear bottom margin.

Set Vertical Tabs

ESC B Pn1 Pn2 Pn NUL

Set in ascending order vertical tab stops at Pn1, Pn2, and other designated stops.

Set Top-Of-Form

ESC 4

Set current paper position at top-of-form

Enable/Disable Automatic Line Feed

ESC 5 Ps

If Ps = 1, perform line feed whenever carriage return (CR) is received.

If Ps = NUL, disable automatic line feed on receiving carriage return (CR).

Set Double-Width Characters

EREDW *ESC W Ps*

If Ps = 1, set double-width character printing.

Set Single-Width Characters

ERDDW *ESC W Ps*

If Ps = NUL, set single-width character printing.

Carriage Return

PCR1 *ESC <*

Performs carriage return (CR) without line feed, unless auto line feed is menu-enabled

Set Horizontal Tabs

ERSHT *ESC D Pn1 Pn2 Pn NUL*

Clear all horizontal tab stops and set horizontal tab stops in ascending order at Pn1, Pn2, and other designated stops.

Set All Horizontal Tabs

ESC R

Set horizontal tab stop every eighth column beginning with column 9, and clear vertical tab stops.

Set Horizontal Spacing to 12 CPI

ESC :

Sets to 12 cpi if single width, or to 6 cpi if double width.

Disable Paper Out

ERDPO *ESC 8*

Disable paper-out handling.

Enable Paper Out

EREPO *ESC 9*

Enable paper-out handling

Set Bidirectional Printing

ERDUD *ESC U 0*

Enable bidirectional mode

Set Unidirectional Printing

EREUD *ESC U 1*

Enable unidirectional (left-to-right) mode

NOTE: Bit-image graphics always uses unidirectional printing.

CHARACTER SETS

Select Set B

ERC02 *ESC 6*

Select character set B

Select Set A

ERC01 *ESC 7*

Select character set A.

Select All Characters Set

ESC / Pn1 Pn2

Select All Characters set.
Pn1 and Pn2 = number of characters that follow which are to be printed from the All Characters Set.

Pn1 = 0 to 255
Pn2 = (Pn2 × 256)
Total characters = Pn1 + (Pn2 × 256)

Print Single Character From All Character Set

ESC ^

Print next character from All Characters Set.

PRINT SELECTIONS

Enable Shadow Bold

EREBD *ESC E*

Set shadow bold printing for all characters that follow.

Disable Shadow Bold

ERDBD *ESC F*

Turn off shadow bold printing.

Set Letter Quality/NLQ Printing

EREHR *ESC G*

Enters LQ or NLQ mode depending on menu feature setting #20.

Set Draft Printing

ERDHR *ESC H*

Enable draft printing.

Select Printing Mode

ESC I Ps

Ps = 0 Select draft mode.
2 Select LQ / NLQ mode.
4 Select draft mode and use downline-loaded set.
6 Select NLQ mode and use downline-loaded set.

Set/Reset Underline

EREUL *ESC – Ps*

If Ps = 1, enable underlining of all characters that follow
If Ps = NUL, underlining is off.

Set/Reset Overscore

ESC — Ps

If Ps = 1, enable overscoring of all characters that follow
If Ps = NUL, overscoring is off.

Enable Superscript/Subscript

ERESCR *ESC S NUL*

Print all following characters as superscript

ESC S 1

Print all following characters as subscript.

Reset Script

ERDSCR *ESC T*

Cancel superscript and subscript.

IBM EMULATION GRAPHICS MODE

480 Bit-image Graphics Mode

ESCAPE K — *ESC K Pn1 Pn2 v1 v2 ... vk*

Enable bit-image graphics mode at 60 dpi resolution
Total bytes = 480
Pn1 = 0 to 255
Pn2 = (0 or 1) × 256

960 Bit-image Graphics Mode

ESCAPE L — *ESC L Pn1 Pn2 v1 v2 ... vk*

Enable bit-image graphics mode at 120 dpi resolution
Bytes = Pn1 + (256 × Pn2) but cannot exceed 960

960 Bit-image Graphics Mode — Normal Speed

ESCAPE Y — *ESC Y Pn1 Pn2 v1 v2 ... vk*

Enable bit-image graphics mode at 120 dpi resolution but at half the speed of ESCAPE K mode
Bytes = Pn1 + (256 × Pn2) but cannot exceed 960

1920 Bit-image Graphics Mode

ESCAPE Z — *ESC Z Pn1 Pn2 v1 v2 ... vk*

Enable bit-image graphics mode at 240 dpi resolution but half the speed of ESCAPE K mode.
Bytes = Pn1 + (256 × Pn2) but cannot exceed 1920

Character Downloading

Set-up — *ESC = Pn1 Pn2 DC4 Pn3*

Initiate character dowloading and specify number of data bytes

Character data — *Pn4 NUL v1 v2 ... v11*

Clear download buffer — *ESC = NUL NUL*

CONTROL CHARACTERS

Mnemonic	Name
NUL	Null
BEL	Bell
BS	Backspace
HT	Horizontal tab
LF	Line feed
VT	Vertical tab
FF	Form feed
CR	Carriage return
SO	Shift out
SI	Shift In
DC1	Device control 1
DC2	Device control 2
DC4	Device control 4
CAN	Cancel
ESC	Escape

Appendix F ▪ Additional Documentation

There are two types of documentation available to you from Digital–promotional and technical. The promotional documentation is free of charge. The technical documentation is not.

▪ Promotional Documentation

Promotional documentation may be ordered from Digital by mail. Send all requests to:

Digital Equipment Corporation
Publishing and Circulation Services
10 Forbes Road
Northboro, MA 01532.

Please allow two weeks from the approximate time the order is received in Northboro and the time you receive it. Shipping times vary according to the distance between your facility and our Northboro facility. Table F-1 lists the titles of all the promotional documentation available now and its order number.

Table F-1 ▪ Promotional Documentation

Document Title	Order Number
Printer Documentation	
LA12 Correspondent Information Sheet	ED-26060-56
LA12 Flyer without indicia	EC-27541-56
LA50 Personal Printer Information Sheet	ED-26054-56
LA50 Personal Printer Flyer with indicia	EC-26249-56
LA50 Personal Printer Flyer without indicia	EC-26250-56
LA75 Companion Printer Information Sheet	ED-29531-56
LA75 Companion Printer Flyer with indicia	EC-29532-56
LA75 Companion Printer Flyer without indicia	EC-29268-56
LA100 Printer Flyer with indicia	EC-26205-56
LA120 DECwriter III Information Sheet	ED-26052-56
LA120-RA DECprinter III Information Sheet	ED-26053-56
LA210 Information Sheet	ED-27916-56
LA210 Flyer without indicia	EC-27407-56
Letterprinter 100 Information Sheet	ED-30059-54
Letterwriter 100 Information Sheet	ED-26047-56
LN03 Flyer with indicia	EC-27386-56
LN03 Flyer without indicia	EC-27404-56
LN03/LN03 Plus Information Sheet	ED-29143-56
LN03 Plus Flyer with indicia	EC-28913-56
LN03 Plus Flyer without indicia	EC-28957-56
LQP02 Data Sheet	ED-25332-54
LQP03 Brochure	EA-30088-56
LVP16 Pen Plotter Product Bulletin	ED-26364-56
PrintServer 40 Brochure	EA-28561-56
PrintServer 40 Information Sheet	ED-28560-56
Video Products Documentation	
VT200 One Thing Our Imitators Can't Begin to Imitate Brochure	EA-27280-56
VT220 Information Sheet	ED-26037-56

Table F-1 ▪ Promotional Documentation

Document Title	Order Number
VT240/241 Information Sheet	ED-26038-54
Miscellaneous Documentation	
Guide to Computer Graphics for Business	EB-26192-56
LA210 Quick Demo Guide	EJ-27452-56
Programmable Function Keys Flyer	EC-26271-56

▪ Technical Documentation

Technical documentation may be ordered by telephone from Digital's Peripherals and Supplies Group by calling 1-800-258-1710. That group's personnel will provide you with pricing information and take your order. The documentation available is listed in Table F-2.

Table F-2 ▪ Technical Documentation

Document Title	Order Number
Printer Documentation	
Installing and Using the LA50	EK-OLA50-UG
Installing the LA210 Letterprinter	EK-LP210-IN
Installing and Using the LN03	EK-OLN03-UG
Installing and Using the LQPX3-FT Forms Tractor	EK-LQ3FT-UG
Installing and Using the LQPX3-SF Automatic Sheet Feeder	EK-LQ3SF-UG
LA12 DECwriter Correspondent Technical Manual	EK-CPE12-TM
LA12 DECwriter Correspondent Operator Guide	EK-CPE12-OP
LA12 DECwriter Correspondent Programmer Reference Manual	EK-CPE12-RM
LA12 Correspondent Reference Card	EK-CPE12-RC
LA50 Programmer Reference Manual	EK-OLA50-RM
LA100 Letterprinter User Documentation Kit*	EK-LP100-UG
LA100 Letterwriter User Documentation Kit*	EK-LW100-UG
LA120 Illustrated Parts Breakdown	EK-LA120-IP
LA120 Operator Reference Guide	EK-LA120-RG
LA120 Pocket Service Guide	EK-LA120-SV
LA120 Pocket Service Guide Addendum	EK-ALA12-SV
LA120 Technical Manual	EK-LA120-TM
LA120 User Guide	EK-LA120-UG
LA210 Letterprinter Emulation Modes Reference Card	EK-LA210-RG
LA210 Letterprinter Operator and Programmer Reference Card	EK-LP210-RC

*The Kit consists of an Operator Guide, Installation Guide, and Series Programmer Reference Manual.

Table F-2 ▪ Technical Documentation

Document Title	Order Number
LA210 Letterprinter Programmer Reference Manual	EK-LP210-RM
LCP01 Installation and Operator Manual	EK-LCP01-IN
LCP01 User's Guide	EK-LCP01-UG
Letterprinter 210 User Guide	EK-LP210-UG
LN03 Programmer Reference Manual	EK-OLN03-RM
LQP02 Pocket Service Guide	EK-LQP02-PS
LQP03 Installation and User Guide	EK-LQP03-UG
LQP03 Pocket Service Guide	EK-LQP03-PS
LQP03 Programmer Reference Manual	EK-LQP03-RM
LQP03 Technical Manual	EK-LQP03-TM
LVP16 Graphic Plotter's Owner's Manual	EK-LVP16-OM
LVP16 Graphics Plotter Programmer Reference Manual	EK-LVP16-RM
PrintServer 40 Installation Guide	EK-LPS40-IN
PrintServer 40 Operator's Guide	EK-LPS40-OP
PrintServer 40 PostScript Translator's Reference Manual	AA-HL85A-TE
PrintServer 40 Programmers Supplement	AA-HL84A-TE
PrintServer 40 Reference Cards	EK-LPS40-RC
PrintServer 40 Site Preparation Guide	EK-LPS40-SP
PostScript Language Tutorial and Cookbook	AA-HL87A-TE
PostScript Language Reference Manual	AA-HL86A-TE
VAX/VMS Installation Guide: PrintServer 40 Client	AA-HL83A-TE
VAX/VMS Installation Guide: PrintServer 40 Supporting Host	AA-HL90A-TE
VAX/VMS Management Guide: PrintServer 40 Client	AA-FP19A-TE
VAX/VMS Management Guide: PrintServer 40 Supporting Host	AA-FP24A-TE
Video Products Documentation	
VT100 Illustrated Parts Breakdown	EK-VT100-IP
VT100 Mini Maintenance Guide	EK-VT100-J1

Table F-2 ▪ Technical Documentation

Document Title	Order Number
VT100 Printer Port User Guide	EK-VT1AC-UG
VT100 Programming Reference Card	EK-VT100-RC
VT100 Series Technical Manual	EK-VT100-TM
VT100 User Guide	EK-VT100-UG
VT101 User Guide	EK-VT101-UG
VT102 Illustrated Parts Breakdown	EK-VT102-IP
VT102 User Guide	EK-VT102-UG
VT125 Illustrated Parts Breakdown	EK-VT125-IP
VT125 ReGIS Primer	EK-VT125-GI
VT125 User Guide	EK-VT125-UG
VT125 User Guide Addendum	EK-VT125-N1
VT131 Illustrated Parts Breakdown	EK-VT131-IP
VT131 User Guide	EK-VT131-UG
VT220 Illustrated Parts Breakdown	EK-VT220-IP
VT220 Installation Guide	EK-VT220-IN
VT220 Owner's Reference Manual	EK-VT220-UG
VT220 Pocket Service Guide	EK-VT220-PS
VT220 Programmer Pocket Guide	EK-VT220-HR
VT220 Programmer's Reference Manual	EK-VT220-RM
VT240 Series Illustrated Parts Breakdown	EK-VT240-IP
VT240 Series Installation Guide	EK-VT240-IN
VT240 Series Integral Modem Installation Guide	EK-VT24X-IN
VT240 Series Modem User Guide	EK-VT22M-UG
VT240 Series Owner's Manual	EK-VT240-UG
VT240 Series Pocket Service Guide	EK-VT240-PS
VT240 Series Programmer's Pocket Guide	EK-VT240-HR
VT240 Series Programmer's Reference Manual	EK-VT240-RM
VT240 Series Technical Manual	EK-VT240-TM

Glossary

This glossary provides definitions and explanations of common terms and abbreviations used in connection with video terminals and printers. Basic communication terms are also included.

A

Absolute Plotting: Plotting to a point whose location is specified relative to the origin (0,0).

ACKO, ACK1 (Affirmative Acknowledgment): The replies (DLE sequences in binary synchronous communications) indicate that the previous transmission block was accepted by the receiver and that it is ready to accept the next block of the transmission. Use of ACKO and ACK1 alternately provides sequential checking control for a series of replies. ACKO is also an affirmative (ready to receive) reply to a station selection (multipoint), or to an initialization sequence (line bid) in point-to-point operation. See also: *DLE (data link escape)* and *binary synchronous communications*. Compare with: *negative acknowledgment* and *WACK*.

Acoustic coupler: A device that converts electrical signals into audio signals, enabling data to be transmitted over the public telephone network via a conventional telephone handset.

ADC: See: *analog-to-digital converter.*

Alphanumeric: Pertaining to a character set that contains both letters and numbers.

Analog: Pertaining to signals, and other quantities, that can occur anywhere on some continuous scale.

Analog-to-digital converter: An A/D (or ADC) converter is a device that converts continuous electrical signals from sensors (analog signals) to a digital form that can be handled by a computer. Used primarily for monitoring instruments or processors, or as part of a control arrangement. Compare with: *digital-to-analog converter.*

ANSI: American National Standards Institute.

Answerback: The ability of a terminal to transmit a stored message that identifies it. This message may be sent from the keyboard or transmitted automatically when the terminal receives an inquiry character (ENQ). See also: *ENQ.*

ASCII: American Standard Code for Information Interchange. The code that has assigned a binary number to each alphanumeric character and several nonprinting characters used to control printers and communication devices. The binary number (code) assigned to each alphanumeric character is called ASCII code. ASCII characters are seven or eight bits long and may have an additional parity bit for error detection. See also: *bit, control character,* and *parity*.

ASCII keyboard: A keyboard that sends an ASCII character to a computer when the user presses the corresponding key. See: *ASCII*.

Aspect ratio: The ratio of horizontal to vertical dots per inch in graphic printing devices (video displays or printers). See: *dot matrix printer* and *video display terminal.*

ASR: (Automatic Send/Receive). Refers to terminals, usually printing terminals, that have papertape or other local storage.

Asynchronous: A communications method in which data is sent as soon as it is ready, as opposed to methods in which data is sent at fixed intervals. It is commonly used at speeds of 110 to 19,200 b/s. Compare with: *synchronous*.

Asynchronous transmission: Transmission in which time intervals between transmitted characters may be of unequal length. Transmission is controlled by start and stop elements at the beginning and end of each character. Also called start/stop transmission. Compare with: *synchronous transmission*.

Auto repeat: If a key on a terminal keyboard is held down for a half-second or so, it begins to repeat automatically until it is released.

Automatic Dialing Unit (ADU): A device capable of automatically generating dialing digits.

Automatic Calling Unit (ACU): A dialing device supplied by the communication common carriers that permits a business machine to dial calls automatically over the communication networks. See: *common carrier.*

▪ B

Band printer: A lineprinter that uses a rotating steel band as the character transfer device.

Baud rate: The speed at which data is transmitted over a communications link. Usually measured in bits per second.

Baudot code: A code for the transmission of data in which five bits represent one character. It is named for Emile Baudot, a pioneer in printing telegraphy. The name is usually applied to the code used in many teleprinter systems, which was first used by Murray, a contemporary of Baudot.

Bidirectional printing: A printing terminal technique to increase printing throughput by printing lines from right to left in addition to printing others left to right, thus using the carriage return time. If the printer is buffered, the data may be sent in the usual order even if it is to be printed right to left.

Binary digit (bit): In binary notation either of the characters 0 or 1. "Bit" is the commonly used abbreviation for binary digit.

Binary Synchronous Communications (BSC): A uniform discipline, using a defined set of control characters and control character sequences, for synchronized transmission of binary coded data between stations in a data communications system. Also called BISYNC.

BISYNC: IBM's 1968 Binary Synchronous Communication Protocol (BSC), still widely used today.

Bit: Abbreviation for binary digit.

Bit-map graphics: A technology that allows control of individual pixels on a display screen to produce graphic elements of superior resolution, permitting accurate reproduction of arcs, circles, sine waves, or other curved images that block-addressing technology cannot accurately display. See also: *pixels*.

Bit transfer rate: The number of bits transferred per unit time, usually expressed in bits per second (b/s, formerly bps).

Block: A group of bits transmitted as a unit, over which a coding procedure is usually applied for synchronization or error control purposes. See also: *error control*.

Block check character (BCC): The result of a transmission verification algorithm accumulated over a transmission block, and normally appended at the end, for example, CRC or LRC. See: *block*.

Block mode terminal: A block mode terminal saves up to a screenful of keystrokes before sending them in a block to the computer. See: *block*.

Broadcast: When a message is sent to all devices connected to a network, it is said to be broadcast to them.

Buffer: A place where data can be stored temporarily. Terminals can store data in a buffer if data is received faster than it can be processed or displayed.

Byte: A binary element string operated upon as a unit and usually shorter than a computer word; usually eight bits.

▪ C

Carriage Return/Line Feed (CR/LF): Two print functions often done together. LF rolls the paper up one line and CR moves the printhead to the left margin.

Carrier: A continuous frequency capable of being modulated or impressed with a signal.

Carrier system: A means of obtaining a number of communication channels over a single path by modulating each channel upon a different carrier frequency and demodulating at the receiver to restore the signals to their original form.

Cathode-ray tube (CRT): A television-like picture tube used in video terminals. See: *video terminal.*

CCITT: Committee Consultatif Internationale de Telegraphie et Telephonie. An international consultative committee that sets international communications usage standards.

Char/in: Abbreviation for characters per inch. Formerly cpi.

Char/s: Abbreviation for characters per second. Formerly cps.

Character: A single printable letter (A through Z), numeral (0 through 9), or symbol, (for example, % . $,) used to represent data. Text symbols also include those that are not visible as characters, such as, a space, a tab, or a carriage return.

Character code: A code that assigns numerical values tocharacters, such as ASCII code. See *ASCII.*

Character printer: A printer that prints one character at a time like a typewriter. Compare with: *lineprinter.*

Client: An agent (usually an operating system) that makes services and associated resources available to users of that system.

Clipping: Clipping is the process of restricting plotting to a portion of the plotting area by establishing a window of a certain size.

Cm/s: Abbreviation for centimeters per second.

Code:

1. A set of unambiguous rules specifying the way in which data may be represented, for example, the set of correspondences in Standard Code for Information Interchange.
2. In data communications, a system of rules and conventions according to which the signals representing data can be formed, transmitted, received, and processed.
3. In data processing, to represent data or a computer program in a symbolic form that can be accepted by a data processor.

Common carrier: In data communications, a public utility company that is recognized by an appropriate regulatory agency as having a vested interest and responsibility in furnishing communication services to the general public, for example, Western Union and the Bell System.

Communication control character: In ASCII, a functional character intended to control or facilitate transmission over data networks. There are 10 control characters specified in ASCII that form the basis for character-oriented communications control procedures. See: *control character.*

Communication link: The physical connection, typically a phone line, between a terminal and a computer or another peripheral device.

Compatibility: The ability of an instruction, source language, or peripheral device to be used on more than one computer.

Computer network: A interconnection of computer systems, terminals, and communications facilities.

Concentrator: A communications device that provides communications capability between many low-speed, usually asynchronous channels and one or more high-speed, usually synchronous channels. Usually different speeds, codes, and protocols can be accommodated on the low-speed side. The low-speed channels usually operate in contention requiring buffering. The concentrator may have the capability to be polled by a computer, and may in turn poll terminals. See also: *asynchronous, protocol,* and *synchronous.*

Conditioning: The addition of equipment to leased voice-grade lines to provide specified minimum values of line characteristics required for data transmission, for example, equalization and echo suppression. See also: *echo suppression* and *voice-grade channel.*

Configuration: A particular selection of host computer, peripherals, and interfacing equipment that are functioning together. Also a list of the devices and computers of a computer system.

Control character: 1. A character whose occurrence in a particular context initiates, modifies, or stops a control function. 2. In the ASCII code, any of the 32 characters in the first two columns of the standard code table. See also: *communication control character.*

Control unit: A device, usually incorporated into a terminal, that allows data to be encoded and decoded for transmitting and receiving.

Console: A console is another name for a terminal. A "system console" or an "operator's console" is a special, privileged terminal used to control the computer system.

Conversational: Pertaining to a mode of processing that involves step-by-step interaction by means of keyboard and display between the user at a terminal and a computer. See also: *interactive.*

Conversational mode: A procedure for communication between a terminal and the computer in which each entry from the terminal elicits a response from the computer and vice versa.

Converter: An interface to transform information from one form to another. See: *analog-to-digital converter, digital-to-analog converter,* and *interface.*

CPU (Central Processing Unit): Commonly called a "computer". A set of electronic components that control the transfer of data and perform arithmetic and logic calculations.

CRC: See: *cyclic redundancy check.*

CRT terminal: Another name for a video terminal. See: *cathode ray tube.*

Current loop interface: Current loop interfaces are used to connect terminals directly to computers and are primarily used for long direct-wired hookups or for use where there may be a lot of electrical noise, as in factories. Also called 20mA interface.

Cursor: On a video terminal screen, the cursor is a distinctive mark (such as a flashing square or underline) that indicates where the next character will be displayed.

Cyclic redundancy check (CRC): An error detection scheme in which the check character is generated by taking the remainder after dividing all the serialized bits in a block of data by a predetermined binary number. Compare with: *block character check*, *longitudinal redundancy check*, and *vertical redundancy check.*

▪ D

DAA: A Data Access Arrangement is a protective circuit, sometimes built within a modem and sometimes housed in a small box that is between the modem and the telephone system. The FCC requires a DAA to protect the telephone network from possible damage caused by failure of the data equipment attached directly to the telephone line. Acoustic couplers are not attached directly to the telephone line, and therefore do not require DAAs. See also: *acoustic coupler* and *modem.*

Daisywheel: A printhead that forms full characters rather than characters formed of dots. It is shaped like a wheel with many spokes, with a letter, numeral, or symbol at the end of each spoke. The print method used is similar to that of a regular typewriter.

Daisywheel printing: A type of printing that uses a circular wheel containing fully formed characters on the end of petals radiating out from the center of the wheel. Compare with: *dot-matrix printing* and *thermal printing.*

Database: A large collection of organized data that is required to perform a task. Typical examples are personnel files or stock quotations.

Data collection: A mode of data processing whereby data collected by a terminal, group of terminals, light pen, or card reader is sent back to the CPU.

Data communication: The interchange of data messages from one point to another over communications channels.

Data distribution: A mode of data processing whereby a terminal or group of terminals serves as receptacle for data supplied by the CPU.

Data integrity: A performance measure based on the rate of undetected errors. See: *error.*

Data-Phone Digital Service (DDS): A communications service of the Bell System in which data is transmitted in digital rather than analog form, thus eliminating the need for modems.

Data set:
1. A modem. See also: *modem.*
2. A collection of data records, with a logical relation of one to another.

DAVFU: **D**irect **A**ccess **V**ertical **F**ormat **U**nit. Programmable handling of varied form lengths to allow rapid paper slewing within individual forms. See also: *slew speed.* Compare with: *EVFU.*

DDCMP (Digital Data Communications Message Protocol): A uniform discipline for the transmission of data between stations in a point-to-point or multipoint data communications system. The method of physical data transfer used may be parallel, serial synchronous, or serial asynchronous.

DECnet: Digital networks.

DEC423 Standard: DEC423 Standard is an RS423-based cabling system for low speed terminals and provides the improved signaling benefits of RS423 interconnection.

Demodulation: The process of retrieving an original signal from a modulated carrier wave. This technique is used in modems to make communication signals compatible with computer signals. Compare with: *modulation.*

Diagnostic: Pertaining to the detection and isolation of malfunctions or mistakes.

Dial-up: The use of a dial or pushbutton telephone to initiate a station-to-station telephone call. Dial-up allows an electrical connection of a terminal with a CPU over voice-grade phone lines via a modem.

Digital-to-analog converter: A D/A converter (or DAC) is an interface that converts data in a digital form to data in analog form. Used to permit analog output from a digital computer. Compare with: *analog-to-digital converter.*

Digitizing: Converting information to digital information so that it can be understood by the computer.

Display unit: A device that provides a visual representation of data. See also: *video terminal.*

Direct cursor addressing: A video terminal feature that allows the computer to move the cursor anywhere on the screen to write the next group of data. See also: *cursor.*

Direct memory access (DMA): A facility that permits I/O transfers directly into or out of memory without passing through the processor's general registers; performed either independently of the processor or on a cycle-stealing basis.

DLE (Data Link Escape): A control character used exclusively to provide supplementary line control signals (control character sequences or DLE sequences). These are two-character sequences where the first character is DLE. The second character varies according to the function desired and the code used. See: *control character.*

DNA (Digital Network Architecture): A hardware and software scheme for interconnecting Digital's computers in a network. It is composed of three elements: Data Access Protocol (DAP), Network Services Protocol (NSP), and Digital Data Communications Message Protocol (DDCMP). See: *DDCMP.*

Dot density: The number of dots per unit of measure in dot-matrix printing. Usually expressed as dots per character (dots/char) or dots per inch (dots/in). See: *dot matrix printing.* Compare with: *text density.*

Dot-matrix printing: A printing technique that forms characters from a two-dimensional array of dots. More dots in a given space produce images with greater resolution. See also: *band printer, daisywheel printing, laser printing,* and *thermal printing.*

Dots/in: Abbreviation for dots per inch. Formerly dpi.

Dots/s: Abbreviation for dots per second. Formerly dps.

Downtime: The time interval during which a device is inoperative.

Draft mode: A print mode characterized by high speed, lower resolution printing.

Draft-quality printer: A printer, usually high-speed, that produces characters that are very legible, but of less than typewriter quality. Typically used for internal documents for which type quality is not a major factor. Compare with: *letter-quality printer.*

Duplex: In communications, pertaining to a simultaneous, two-way independent transmission in both directions. Also called full-duplex. Compare with: *half-duplex* and *simplex.*

Duty cycle: For printers, this usually refers to the ratio of time spent printing to the total number of power-on hours.

▪ E

Eavesdropping: A method of communicating with multiple peripherals through a single system port, such as using one line to connect both a serial printer and a plotter to one host.

EBCDIC (Extended Binary Coded Decimal Interchange Code): An eight bit character code used primarily in IBM equipment. The code provides for 256 different bit patterns. Compare with: *ASCII.*

Echo: The printing of characters typed by the operator by an I/O device, such as a terminal or CRT. When the host computer sends back a character just received to the terminal that sent it, the character is said to have been "echoed."

Echo check: A method of checking the accuracy of transmission of data in which the received data is returned to the transmitting end for comparison with the original data.

Echo suppresser: A device used to suppress the effects of an echo.

Editor: A program that interacts with the programmer to enter new programs into the computer and edit them as well as modify existing programs. Editors are language-independent and can edit anything in alphanumeric representation.

Electronic Industries Association (EIA): A standards organization specializing in the electrical and functional characteristics of interface equipment.

EIA RS232-C interface: A standard means for connecting terminals and computers to modems. It is useful for short (generally less than 10 m/50 feet) direct-wired hookups. The full EIA interface also provides several control and status signals between the modem and the digital device.

Engaged signal (UK): An audible signal indicating that the required circuit or intermediate apparatus used in setting up the connection is busy, that is, not available.

ENQ (Inquiry): Used as a request for response to obtain identification and/or an indication of status. In binary synchronous (BSC) transmission, ENQ is transmitted as part of an initialization sequence (line bit) in point-to-point operation, and as the final character of a selection or polling sequence in multipoint operation. See also: *binary synchronous communications.*

Ergonomics: The science of human engineering that combines the study of human-body mechanics and physical limitations with industrial psychology to aid in new product design.

Error: Any discrepancy between a computed, observed, or measured quantity and the true, specified, or theoretically correct value or condition. Systematic error: A constant error or one that varies in a systematic manner (for example, equipment misalignment). Random error: An error that varies in a random fashion (for example, an error resulting from radio static).

Error control: A technique whereby errors occurring in the transmission of data characters can be caught, based upon one of several calculations performed on the bit string. In some systems, refinements are added that will correct the detected errors, either by operations on the received data or by transmission from the source. See: *error and parity check*.

Escape sequence: A special sequence of ASCII characters beginning with the escape character (ESC) used to send special text-formatting or editing commands to terminals. See also: *ASCII*.

EVFU: **E**lectronic **V**ertical **F**ormat **U**nit. Programmable handling of varied form lengths to allow rapid paper slewing within individual forms. Compare with: *DAVFU*. See also: *slew speed*.

▪ F

Fanfold paper: A continuous sheet of paper whose pages are folded accordion-style and separated by perforations.

Fill character: Fill characters and nonprinting characters are transmitted to allow the receiver enough time to process data already sent. The ASCII characters NUL and DEL are most commonly used as fill characters.

Flight timing: The speed and time interval in which a hammer strikes the print mechanism of a lineprinter.

Foldover: Lineprinter mechanism that senses whether a 64- or 96-character set print band is in use, and prints accordingly.

Font: A complete set of letters, numerals, and symbols of the same typestyle of a given typeface. Examples of typefaces are Baskerville, Century, and Helvetica. Examples of fonts are Baskerville Italic, Baskerville Bold, and Baskerville Bold Italic. Fonts may be a piece of hardware, such as a font cartridge, or they may be resident in the software.

Font File: A data file that can be used to reproduce a particular font.

Frame: See: *block*.

Full-duplex (FDX): Full-duplex describes a communication channel on which simultaneous two-way communication is available. Compare with: *half-duplex* and *simplex*.

Full-character: A print type normally associated with typewriters and letter-quality printers. These form a full impression of the character upon impact, as opposed to the type of character formed by a dot-matrix printer.

Fully-formed character printing: A type of printing that uses typewriter-style fonts to form printed characters. Compare with: *dot-matrix printing*, *laser printing*, and *thermal printing*.

▪ G

GIDIS (General Image Display Instruction Set): GIDIS is a low-level graphics language developed by Digital.

Graphics: The use of lines and figures to display data, as opposed to the use of printed characters. See: *bit-map graphics*.

▪ H

Half-duplex (HDX): Half-duplex describes a communication channel on which only one-way communication is permitted at a time. The line can be "turned around" to allow data to flow the other way. Some half-duplex links provide a special "reverse channel" in the direction opposite to the flow of data that permits transmission of control signals only. Compare with: *full-duplex* and *simplex*.

Handshaking: The control of the exchange of information between two system components.

Hardcopy: Hardcopy refers to paper printout, as opposed to video displays which cannot be saved. Compare with: *softcopy*.

Hardware: The physical equipment that makes up a computer system. Compare with: *software*.

Hertz (Hz): A unit of frequency equal to one cycle per second. Cycles are referred to as Hertz in honor of the experimenter Heinrich Hertz.

Host computer: A computer attached to a network that provides such services as computation, database access, or special programs or programming languages. See: *network*.

Host interface: The interface between a communication processor and a host computer. See: *interface*.

▪ I

Information: The organizational content of a signal.

Input:

1. Data to be processed.
2. The process of transferring data to memory from a mass storage device or from other peripheral devices that read data from other media (a papertape reader or ADC, for example).
3. The process of transferring data onto a mass storage device from a papertape reader, ADC, or other devices that read other media.
4. The peripheral device used in the transfer described above.

Compare with: *output*.

I/O (Input/Output): Pertaining to devices that accept data for transmission to a computer system (input) or that accept data from a computer system for transmission to a user or process. Devices that perform both functions are known as I/O devices (for example, terminals).

In/s: Abbreviation for inches per second. Formerly ips.

Impact printer: A printer that forms characters on paper by striking the paper with a character-forming element.

Impact matrix printhead: A printhead that prints characters by hitting a column of wires onto a ribbon to form a character on the paper behind the ribbon. See also: *nine-wire printhead* and *printhead.* Compare with: *daisywheel.*

Integral modem: A modem built into a terminal rather than packaged separately. See: *modem.*

Interactive: Capable of carrying on a dialog through a keyboard with the user, rather than simply responding to commands. See also: *conversational.*

Interactive terminal: A terminal capable of eliciting immediate response to individual user requests, which may instantly update the database of a central computer, for example.

Interface: 1)2)3)

1. A shared boundary defined by common physical interconnection characteristics, signal characteristics, and meanings of interchanged signals.
2. Equipment or a device that makes interoperation between two systems possible, for example, a hardware component or a common storage register.
3. A shared logical boundary between two software components.

▪ K

K: In the computer field, loosely two to the tenth power, which is 1,024 in decimal notation. Hence, a 4K memory has 4096 words.

KB: Equals 1,024 bytes. Also known as Kbytes.

KB/s: Abbreviation for Kbytes per second.

Kbyte (KB): See: *KB.*

Keyboard: On a typing/printing device, the array of buttons which cause letters to be generated when pushed.

Keypad: A keypad is a small auxiliary keyboard, often used for entering numeric data, for editing, or for similar special functions.

KSR: Keyboard Send/Receive. Refers to a terminal with a keyboard and printer (or display) but no local storage medium. Compare with: *receive-only.*

L

Label Terminator: The final character in every label string used as a programming control instruction.

Laser printing: **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation. Electrophotographic technology used in many industries for its speed, quality, and precision.

L./cm: Abbreviation for lines per centimeter.

Letter-quality printer: Printer often used to produce high-quality documents. It produces printing comparable in quality to that of a typewriter. Compare with: *draft-quality printer.*

Light pen: A device resembling a pencil or stylus which emits a light and reads the reflectance. Used to input information to a CRT display system or send coded information to the host.

L/in: Abbreviation for lines per inch. Formerly lpi.

Line: 1)2)3)

1. The portion of a circuit external to the apparatus that consists of the conductors that connects a telegraph or telephone set to the exchange or that connects two exchanges.
2. The group of conductors on the same overhead route in the same cable.
3. The information deposited during one horizontal pass of a printer.

Line Feed (LF): The printer operation which advances the paper by one line.

Lineprinter: A high-speed printer that prints an entire line of characters at a time. While one line is being printed, the next line is held in a buffer until the device is ready to print it. Compare with: *character printer.*

L/min: Abbreviation for lines per minute. Formerly lpm.

Local: Hardwired connection of a computer to another computer, terminal, or peripheral device, such as in a local area network. Compare with: *remote.*

Longitudinal redundancy check (LRC): An error checking technique based on an accumulated exclusive-OR of transmitted characters. An LRC character is accumulated at both the sending and receiving stations during the transmission of a block. This accumulation is called Block Character Check (BCC), and is transmitted as the last character in the block. The transmitted BCC is compared with the accumulated BCC character at the receiving station for an equal condition. An equal comparison indicates a good transmission of the previous block. Compare with: *block character check, cyclic redundancy check,* and *vertical redundancy check.*

LP: Lineprinter.

▪ M

M: Equals $1,024^2$.

MB: One million bytes. Also known as Mbytes.

MB/s: Abbreviation for Mbytes per second.

Message switching: A mode of data processing whereby the CPU is used as a switching center where data is distributed or switched between remote terminals.

Modem: Contraction of Modulator/Demodulator. Modems convert digital data from a terminal or CPU into analog signals for transmission over telephone lines and convert the receiver data back to digital format.

Modulation: The process by which some characteristic of a high-frequency carrier signal is varied in accordance with another, a lower frequency "information" signal. This technique is used in modems to make business-machine signals compatible with communication facilities.

Msec: Abbreviation for millisecond(s), one-thousandth of a second.

MTBF: Mean time between failure. Usually given in hours.

MTTR: Mean time to repair. Usually given in hours.

Multimode: The ability of a dot-matrix printer to print at different print speed/dot density combinations. This permits varying print qualities and graphics printing. See: *dot-matrix printing.*

Multiplexer: A device used for multiplexing. It may or may not be a program stored in the computer. Also a device for connecting a number of communications lines to a computer.

Multiplexing: A division of a transmission facility into two or more channels.

Multipoint line: A single communications line to which more than one terminal is attached. Use of this type of line normally requires some kind of polling mechanism, addressing each terminal with a unique ID. Also called multidrop. Compare with: *point-to-point connection.*

▪ N

NAPLPS (North American Presentation Level Protocol Syntax): NAPLPS is the ANSI/CSA standard protocol for the presentation of graphics and text information.

Negative acknowledgment (NAK): Indicates that the previous transmission block was in error and that the receiver is ready to accept a retransmission of the erroneous block. NAK is also the "not ready" reply to a station selection (multipoint) or to an initialization sequence (line bid) in point-to-point operation. See: *block.* Compare with: *ACKO, ACK1,* and *WACK.*

Network:
1. A series of points interconnected by communications channels.
2. The switched telephone network is the network of telephone lines normally used for dialed telephone calls.
3. A private network is a network of communications channels confined to the use of one customer.

Nine-wire printhead: An impact matrix printhead that can print a column of nine dots at a time along the vertical axis. Other common designs have seven or eighteen dot printing capability. Compare: *daisywheel.*

Node: An end point of any branch of a network, or a junction common to two or more branches of a network.

Noise: Undesirable electrical or acoustical disturbances in a communications system. Noise can generate errors in transmission.

Nonimpact printing: Technique whereby the print mechanism does not physically touch the paper during printing. Compare with: *band printer, daisywheel printing* and *dot-matrix printing.*

Nontransparent mode: Transmission of characters in a defined character format, for example, ASCII or EBCDIC, in which all defined control characters and control sequences are recognized and treated as such. See also: *ASCII, control character,* and *EBCDIC.*

▪ O

Off-line: Pertaining to equipment or devices not under direct control of the central processing unit. May also be used to describe terminal equipment not connected to a transmission line. Compare: *on-line.*

On-line: Pertaining to equipment, devices, and events in direct communication with the CPU and thereby under its control in some way. Regarding terminals, a terminal is said to be "on-line" when it is ready to send or receive data via a communication link.

One-way-only operation: A mode of operation for a data link in which data is transmitted in a preassigned direction over one channel. Also called simplex operation. Compare with: *two-way alternate operation* and *two-way simultaneous operation.*

Operating system: A collection of computer programs that control the overall operation of a computer and perform such tasks as assigning places in memory to programs and data, processing interrupts, scheduling jobs, and controlling the overall input/output of the system. See: *program.*

Output:
1. Data that has been processed.
2. The state or sequence of states occurring on a specified output channel.
3. The device or collective set of devices used for taking data out of a device.
4. A channel for expressing a state of a device or logic element.
5. The process of transferring data from an internal storage device to an external storage device.

Compare with: *input*.

▪ P

Packet switching: A data transmission process, which utilizes addressed packets, in which a channel is occupied only for the duration of transmission of the packet. NOTE: In certain data communication networks the data may be formatted into a packet or they may be divided and then formatted into a number of packets (either by the data terminal equipment or by equipment within the network) for transmission and multiplexing purposes. See also: *multiplexing*.

Parallel transmission: Method of data transfer in which all bits of a character or a byte are transmitted simultaneously either over separate communication lines or on different carrier frequencies on the same communication line. See also: *bit* and *byte*. Compare with: *serial transmission*.

Parity: A common technique for error detection in data transmission. Parity check bits are added to the data so that each group of data bits include an even number of "ones" for even parity and an odd number for odd parity.

Parity check: Addition of noninformation bits to data, making the number of ones in each grouping of bits either always odd for odd parity or always even for even parity. This permits single error detection in each group. See also: *error* and *error control*.

Password: A word or string of characters that is recognizable by the system and that permits a user access to protected storage, files, or input or output devices.

Pixels: Picture elements. Definable locations on a display screen that are used to form images on the screen. Pixels refer to the basic unit of graphics resolution. See *bit-map graphics*.

Platen: A hard surface roller found in impact printers against which the print mechanism strikes.

Plotter: A device that produces a printed copy of a computer's graphics. Pen plotters use felt-tipped pens to draw line and bar graphs, pie charts, flowcharts, analytical drawings, and geometric and graphic designs. The print medium may either be paper or other media such as transparency film.

P_n: Used generically throughout Digital's literature to indicate a parameter that can be changed.

Point-to-point connection:

1. A network configuration in which a connection is established between two, and only two, terminal installations. The connection may include switching facilities.
2. A circuit connecting two points without the use of any intermediate terminal or computer.

Compare with: *multipoint line.*

Polling: A technique for determining the order in which nodes take turns accessing the network. This is done so that access collision can be avoided.

Port: A port is the place of hookup on the CPU where physical connection is made between the central computer and a terminal, printer, modem, another computer, or a communications line.

Printer: A device that produces a paper copy of computer output. There are a variety of printing technologies: band, matrix, and non-impact. Unlike a terminal, there is virtually no communication from printer to CPU. See: *draft-quality printer* and *letter-quality printer.*

Printhead: The element in a printer that forms a printed character. See: *daisywheel.*

Printout: An informal expression referring to almost anything printed by a computer peripheral device; any computer-generated hardcopy.

Print symbiont: Client software that processes a user's print request, arranges data translation if required, and transfers the data for printing by the printer.

Printing terminals: Printing terminals, also called hardcopy terminals, display data on paper by one of several printing techniques, including impact (band, daisywheel, or dot-matrix), thermal, laser or inkjet. Impact printers can generally make multiple copies on a single pass, while nonimpact technologies cannot. See also: *band printer, daisywheel printing, dot-matrix printing, laser printing,* and *thermal printing.*

Printwheel: See *daisywheel.*

Program: The complete sequence of instructions and routines needed to solve a problem or to execute directions in a computer. See also: *operating system.*

Protocol: A formal set of conventions governing the format and relative timing of message exchange between two communicating processes.

PSTN: **P**rivate **S**witched **T**elephone **N**etwork. Generic term for European telephone carriers. See: *carrier.*

▪ R

Receive-only (RO): A receive-only terminal cannot transmit data back over the communication link, but merely prints, punches, or displays what is sent to it. RO terminals often have no keyboard except for a few control keys such as paper feed and XON/XOFF. Compare with: *KSR*.

ReGIS (Remote Graphics Instruction Set): Digital's graphics command interface to terminals for putting shapes on the terminal screen. Digital's VT125 terminal contains a ReGIS interpreter.

Relative Plotting: Plotting to a point whose location is specified relative to the current pen position. The point moved to becomes the effective origin for the next parameter of a plot relative instruction.

Remote: Not hard-wired; communicating via switched lines such as telephone lines. Usually refers to peripheral devices (for example, printers or video terminals) that are located at a site away from the CPU. Compare with: *local*.

Response time: The elapsed time between the generation of the last character of a message at a terminal and the receipt of the first character of the reply. It includes terminal delay, network delay, and service node delay.

Reverse video: A feature on a display unit that produces the opposite combination of characters and background from that which is usually employed, that is, white characters on a black screen, if having black characters on a white screen is normal. Part or all of the data may be displayed as black on white instead of the usual white on black.

Rollover: A characteristic of a keyboard that can continue to send the proper codes when several keys are held down at one time. A keyboard with two-key rollover will handle depression of two keys at a time. N-key rollover describes keyboards with no limit to the number of keys that can be depressed without interfering with code generation.

▪ S

Scaling: Process of dividing the plotting area into convenient application units. When the term is used in plotting, scaling units need not be the same physical size in both axes, nor does there need to be an equal number of units in the *X* and *Y* axes.

Scaling Points: The points on the plotting surface indicated by P1 and P2 positions. These points are assigned user-unit values specified by the parameters of scaling instructions.

Scrolling: When a video terminal's screen is full, a new line of data can be displayed by adding it at the bottom of the screen and shifting all the previous lines upward, discarding the top line. This process is known as scrolling. When the upward movement is continuous rather than in line steps, it is called smooth scrolling.

Selective addressing: On a multidrop line, selective addressing allows a sender to address a message to a particular receiver (or group of receivers) by sending the intended destination before the message. See: *multipoint.*

Self-test: A procedure whereby a program or peripheral checks its own operation. With printing terminals, an off-line generation of print patterns is used to verify the functioning and registration of the print mechanism. With video terminals, a series of test patterns is displayed on the screen as the self-test procedure is performed. See also: *diagnostic.*

Serial transmission: A method of information transmission in which each bit of information is sent sequentially on a single path rather than simultaneously as in parallel transmission. Compare with: *parallel transmission.*

Server: A node that is dedicated to performing a specific service or set of related services. i

Simplex: In communications, pertaining to a channel that operates in one direction only, as in a public address system or a commercial music radio. Compare with: *full-duplex, half-duplex.*

Simplex mode: Operation of a channel in one direction only, with no capability for reversing direction.

Sixel: Six vertical pixels of an image of a single color. A series of sixels and related control codes are used to transmit bit-map data of a serial line.

Slew speed: Speed with which a lineprinter skips over lines that contain no print.

SNA: IBM's **S**ystem **N**etwork **A**rchitecture—Similar to the Digital Network, it provides a common method of support for a wide range of communication activities sharing a single communications network. SNA is composed of three elements: Virtual Telecommunication Access Method (VTAM), Network Control Program/Virtual Storage (NCP/VS), and Synchronous Data Link Control (SDLC). Compare with: *DNA (Digital Network Architecture).*

Softcopy: Alphanumeric or graphical data (or both) presented in nonpermanent form, on a video terminal screen. Compare with: *hardcopy.*

Software: A set of computer programs, procedures, rules and associated documentation concerned with the operation of network computers, e.g., compilers, monitors, editors, utility programs. Compare with: *hardware.* See also: *operating system* and *program.*

Solenoid:
1. A cylindrical coil of insulated wire in which and axial electromagnetic field is established by a flow of electric current.
2. An assembly often used as a switch which consists essentially of a coil and a metal core free to slide along the coil axis under the influence of the magnetic field.

Synchronous: A technique in which data bits are sent at precisely timed intervals. Synchronous channels are capable of higher data rates than asynchronous ones, often running at 56,000 bits per second. Compare with: *asynchronous*.

Synchronous idle (SYN): Character used as a time-fill in the absence of any data or control character to maintain synchronization. The sequence of two continuous SYNs is used to establish synchronization (character phase) following each line turnaround. See: *BISYNC*.

Synchronous transmission: Transmission in which the data characters and bits are transmitted at a fixed rate with the transmitter and receiver synchronized. This eliminates the need for start/stop elements, thus providing greater efficiency. Compare with: *asynchronous transmission*.

▪ T

Telegraphy: A system of communication for the transmission of graphic symbols, usually letters or numerals, by use of a signal code.

Teleprinter: Term used to refer to the equipment used in a printing telegraphy system: a teletypewriter.

Teletype™: Trademark of Teletype Corporation. Usually refers to one of their series of teleprinters.

Teletypewriter exchange service (TWX): A public teletypewriter exchange (switched) service in the United States and Canada, formerly belonging to AT&T Company, now owned by the Western Union Company. Both Baudot and ASCII-coded machines are used. See: *ASCII, baud rate*.

Telex Service: A Western Union worldwide teletypewriter exchange service that uses the public telegraph network. Baudot equipment is used.

Terminal: An input-output device generally used for communication between the operator or user of a computer system and the system itself. See: *hardcopy, softcopy*.

Terminal installation:

1. The totality of equipment at a user's installation including data terminal equipment, data communication equipment, and necessary support facilities. See also: *terminal.*
2. A set composed of data terminal, a signal converter, and possibly intermediate equipment; this set may be connected to a data processing machine or may be part of it.

Terminal noise: Electromagnetic noise emitted from hot bodies; sometimes called Johnson noise.

Text:

1. A sequence of characters that form part of a transmission sent from the data source to the data sink, which contains the information to be conveyed. It may be preceded by a header and followed by an "End of Text" signal.
2. In ASCII as well as in general communications usage, a sequence of characters treated as an entity if preceded by a "Start of Text" and followed by an "End of Text" control character.

Text density: The number of printed characters per line of text in a document.

Thermal printing: Thermal printing produces dot-matrix characters on special paper that blackens when heated. Since the paper deteriorates with time, thermal printed output is not suitable for permanent records. Compare with: *daisywheel printing, dot-matrix printing,* and *laser printer.*

Thermal transfer printing: A method of thermal printing which can print on plain paper, as well as specially coated thermal paper. See: *thermal printing.*

Timesharing: A mode of data processing that allows many terminal users to utilize a computer's resources to perform a variety of tasks simultaneously.

Tractorfeed: An attachment used to move paper through a printer. The roller that moves the paper has sprockets on each end that fit into the fanfold paper's matching pattern of holes. See: *fanfold paper.*

Translator: A stored program that translates a particular imaging data syntax such as text or graphics into the PostScript page description language. (Refer to PrintServer 40)

Transparent mode: Transmission of binary data with the recognition of most control characters suppressed. In binary synchronous communications, entry to and exit from the transparent mode is indicated by a Data Link Escape (DLE) character sequence. See: *DLE.*

Turnaround time:
1. The elapsed time between submission of a job to a computing center and the return of results.
2. In communications, the actual time required to reverse the direction of transmission from sender to receiver or vice versa when using a two-way alternate circuit. Time is required by line propagation effects, modem timing, and computer reaction. See: *two-way alternate operation.*

Two-way alternate operation: A mode of operation of a data link in which data is transmitted in both directions, one way at a time. Also called: half-duplex operation (U. S.). Compare with: *one-way only operation* and *two-way simultaneous operation.*

Two-way simultaneous operation: A mode of operation of a data link in which data is transmitted simultaneously in both directions over two channels. **Note:** One of the channels is equipped for transmission in one direction while the other is equipped for transmission in the opposite direction. Also called full-duplex or duplex. Compare with: *one-way only operation* and *two-way alternate operation.*

TWX: See *teletypewriter exchange service.*

Typeface: See *font.*

▪ U

UASSCII: See *ASCII.*

Unattended operation: The automatic operation of a station that permits the transmission and reception of messages on an unattended basis.

User-defined key (UDK): A key that remembers and stores a series of keystrokes, which allows the user to save the keystrokes needed to perform a specific operation, and then initiate them in the proper sequence by pressing only one key.

▪ V

Vertical redundancy check (VRC): A check or parity bit added to each character in a message so that the number of bits in each character, including the parity bit, is odd (odd parity) or even (even parity). Compare with: *block character check, cyclic redundancy check,* and *longitudinal redundancy check.* See also: *parity* and *parity check.*

Voice-grade channel: A channel used for speech transmission, usually with an audio frequency range between 300 and 3,400 Hertz. It is also used for transmission of analog and digital data. Up to 10,000 bits per second can be transmitted on a voice-grade channel.

VT: Video Terminal.

Video display terminal: See: *video terminal.*

Video terminal: A terminal using a television-like screen for displaying information. Video terminals' advantages include silent operation, the ability to operate at very high data rates, and the capability to put new data anywhere on the screen and to erase data already displayed.

▪ W

WACK (Wait Before Transmitting Positive Acknowledgment): In binary synchronous communications, this DLE sequence is sent by a receiving station to indicate that it is temporarily not ready to receive data. Compare with: *ACKO, ACK1,* and *negative acknowledgment.* See also: *binary synchronous communications* and *DLE.*

WATS (Wide Area Telephone Service): A service provided by telephone companies in the United States that permits a customer to make calls to or from telephones in specific zones for a flat monthly charge. The monthly charges are based on size of the zone instead of number of calls. WATS may be used on a measured-time or full-time basis.

Window: A window is the rectangular part of the plotting area in which plotting of points, lines, and labels can occur.

Word: The greatest number of bits a computer is capable of handling in any one operation. Usually subdivided into bytes. See: *bit* and *byte.*

Word processing system: A system that processes text, performing such functions as paragraphing, paging, left and right justification, rearrangement of lines, and printing the text.

Word-wrapping: The automatic shifting of words from a line that is too long to the next line.

▪ X

XON/XOFF: XON and XOFF are the names of two ASCII characters used in Digital systems and elsewhere for controlling the flow of data across a full-duplex communications channel. If the receiver sends the transmitter an XOFF character, the transmitter stops sending until the receiver signals it to resume by sending the transmitter an XON character.

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