Datamedia Display Terminal Family
Elite 30, 60, 90 & ColorScan 90

■ PROFILE

Function • general-purpose, nonprogrammable interactive keyboard-display ASCII terminals • Televideo 950, ADDS Viewpoint compatible (Elite 30); ANSI X3.64, DEC VT100/101/131 compatible (Elite 60); Lear Siegler ADM 3A, Esprit 1420, ADDS Regent 25 compatible (Elite 90 and ColorScan 90); multicolor display (ColorScan 90).

Architectures Supported • any architecture supporting asynchronous ASCII protocol • local/remote attachment to host processor.

Communications • half-/full-duplex asynchronous, 50- to 19.2K-bps, point-to-point, character/block mode transmission • RS-232C or 20-mA current-loop interfaces.

Operating System • none; only in association with host facilities.

Database Management • none; only in association with host facilities.

Transaction Processing Management • none; only in association with host facilities.

Support Software • none; only in association with host facilities.

Processor • display-oriented control and communication logic.

Terminals/Workstations • single keyboard, 1920-/3168-character display with auxiliary port for local printer.

First Delivery • 1985.

Systems Delivered • not available.

Comparable Systems • competitive with a number of general-purpose ASCII display terminals; most notable are ADDS Viewpoint, Lear Siegler ADM, Beehive DM and ALT, DEC VT100/200 and 100, Televideo 900 Series, and IBM 3101.

Vendor • Datamedia Corporation; 11 Trafalgar Square, Nashua, NH 03063 • 603-886-1570.

Canadian Distribution • none.

Distribution • local Datamedia sales offices and distributors nationwide.

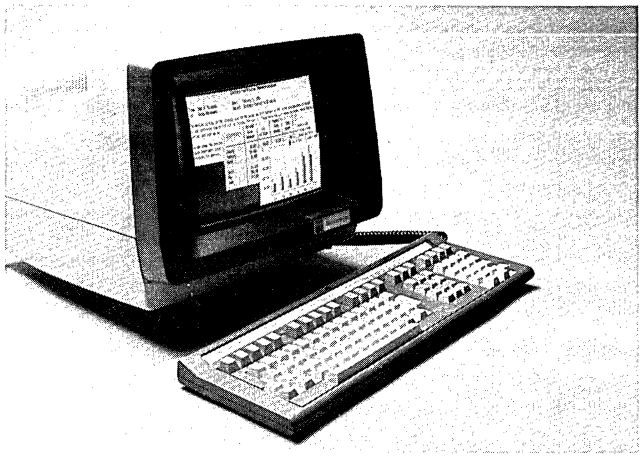
GSA Schedule • unlisted.

■ ANALYSIS

Datamedia has replaced its aging Excel terminal series with an entirely new family of ASCII terminals in an effort to reestablish itself as a viable contender in this shifting segment of the marketplace. The new product line consists of Elite Models 30, 60, and 90, along with ColorScan 90 that boasts full Elite 90 functionality in addition to the advantages provided by a multicolor display. Although no upgrade provision exists for current Excel terminal users, the Elite and ColorScan models offer improved levels of performance at competitive prices. The new display terminals build upon the capabilities found on the superseded Excel terminals with the addition of enhanced display features and improved ergonomic design.

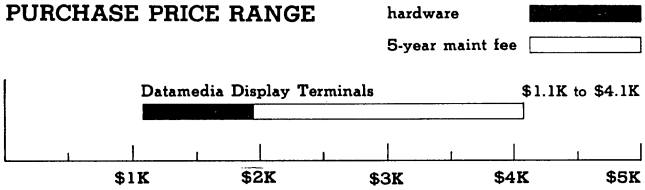
Elite 60, 90, and ColorScan 90 all support standard 24x80/132 display formats and split-screen operation. A 25th status line is also standard on all models. Elite 30 furnishes 128 ASCII characters plus 15-line drawing characters; 95 ASCII characters plus 16 graphics and 16 control characters are supplied on Elite 60, 90, and ColorScan 90. The new Datamedia terminals have also been designed with ergonomic considerations as a top priority. The 4 members of the Datamedia terminal family utilize nonglare screen monitors with a built-in tilt/swivel function and a choice of white, green, or amber phosphors is available on all models except for the low-end Elite 30. Character brightness and screen contrasts are individually adjustable and a 60-image-per-second refresh rate reduces the perception of flicker. The low-profile, detachable keyboards feature sculptured keycaps and tactile feedback. A standard CRT Saver feature prevents image burn-in on unattended terminals. In an effort to facilitate operational ease of use, the Datamedia terminals employ a plain-language set-up menu. Unlike previous set-up methods found on the older Excel terminals, the plain-language set-up menu enables users to choose operating parameters from a menu display.

Both the Elite 90 and ColorScan 90 feature concurrent multiwindowing for displaying up to 8 active tasks when operated in conjunction with Datamedia's 932 line of supermicrocomputers. The fact that these high-end models are designed specifically for use with the 932 supermicros demonstrates the firm's changing market focus. After entering the microcomputer foray last fall, Datamedia has committed development efforts to this new line with a series of enhancements including new packaged configurations sporting new peripherals and communication controller options. Presently, the 932 series consists of UNIX-based Models 1610, 1620, and 1624, along with



The ColorScan 90 is Datamedia's top-of-the-line terminal featuring a 12-inch nonglare screen, 24x80/132 display format, 17 precoded function keys, and choice of up to 8 foreground and 8 background colors.

PURCHASE PRICE RANGE



DATAMEDIA DISPLAY TERMINAL SERIES PURCHASE PRICING bar graph covers the price range and associated 5-year maintenance fees between "small" and "large" configurations for hardware • Datamedia **small** configuration consists of an Elite 30 keyboard-display with 4K-byte page buffer and bidirectional printer port • Datamedia **large** configuration consists of ColorScan 90 multicolor display terminal with 1K-byte page buffer and bidirectional printer port.

Datamedia Display Terminal Family
Elite 30, 60, 90 & ColorScan 90

PICK-based Models 20P and 30P. The 1600 line features up to 3M bytes of memory, up to 4 disk drives for a maximum of 572M bytes of storage, and support for up to 16 users. Models 20P and 30P can be expanded to accommodate as many as 26 users, up to 2M bytes of memory, and 572M bytes of disk storage. Purchase prices range from $16,775 for a Model 20P system to $29,950 for a Model 1624.

While Datamedia competes against a number of top-flight terminals (see Comparable Systems), the Elite models and ColorScan 90 are intended to compete head-on with leading-edge vendors such as DEC, Televideo, and ADDS (Applied Digital Data Services). The low-end Model Elite 30 compares favorably on a price/performance basis with Televideo 910, 910 Plus, 921; and ADDS Viewpoint, Viewpoint Plus, and Viewpoint/60 Plus. Overall, these terminals provide the same basic editing and formatting features. The differences originate with the number of programmable function keys—i.e., keys with user-assigned codes that trigger an operation at the host processor—and keyboard mobility. The Elite 30 supports 11 programmable function keys (shiftable to 22 functions) while the Televideo offers 11 programmable function keys (shiftable to 22 functions) on the 910 and 910 Plus, and 16 programmable function keys (shiftable to 32 functions) on the 921. The keyboards on the Elite 30 and the Televideo 921 are detached; however, the 910 and 910 Plus have attached keyboards that reduce placement flexibility. The ADDS offerings provide detachable keyboards and programmable function keys on Viewpoint Plus (3 programmable function keys shiftable to 6 functions) and on Viewpoint/60 Plus (8 programmable function keys shiftable to 16 functions). Both ADDS and Televideo offer French, German, and Spanish character sets; Datamedia has no provision for supporting multinational character sets. The basic price of the Elite 30 is $575 and the Televideo 910, 910 Plus, and 921 are priced at $649, $699, and $695, respectively. The ADDS Viewpoint is priced at $549, the Viewpoint Plus is priced at $595, and the Viewpoint/60 Plus carries a price tag of $749.

The Elite 60 is a mid-range product that emulates DEC VT100/101/131 terminals and supports ANSI X3.64 compatibility. The Elite 60 definitely holds its own when pitted against its DEC counterparts. Featuring a 14-inch screen display, the Elite 60 accommodates 15 programmable function keys (shiftable to 30 functions), block mode transmission, plain-language set-up menu, protected and unprotected fields, smooth/jump scroll, and split-screen operation. In contrast, the DEC VT100/101/131 terminals feature 12-inch screen displays, no programmable function keys, block mode transmission on VT131 only, no plain-language set-up menu, smooth/jump scroll, and split-screen operation. In addition, the VT100 supports a 132-character display line just as the Elite 60, but only 14 lines can be assembled versus the 24 for the Datamedia offering. In order to extend the format to 24 lines on the VT100, an extra-cost advanced video option ($140) must be added.

On the other hand, the DEC VT101 does support local echo, a feature lacking on the Elite 60. The Elite 60 cannot be upgraded to an Elite 60 whereas DEC terminals provide users with a consistent upgrade path. As for cost, the Elite 60 is priced lower than any of the DEC products. The Elite 60 is priced at $1,095, the DEC VT100 is priced at $1,945, and the DEC VT101 is priced at $1,350, and the DEC VT131 is priced at $1,695.

Both Elite 90 and ColorScan 90 offer a comprehensive list of features but derive most of their operating flexibility when used with the 932 supermicros. For example, when used independent of the 932 systems, they do not support the multiwidowing capability for handling multitasking applications. They do support advanced features such as columnar insert/delete and replace string, and vertical/horizontal screen viewing/scrolling. These high-end units can be compared with Televideo 950 and 970, DEC VT200 Series, and ADDS Viewpoint/Color. The Televideo offerings are priced higher than the Datamedia terminals but offer several features not found on the Elite 90 or ColorScan 90. For instance, the Televideo 950 and 970 support character/block/local transmission modes, split-screen with line locks, 11 programmable function keys (shiftable to 22 functions) on the 950, and 16 programmable function keys (shiftable to 32 functions) on the 970. In addition, the 970 also supports ANSI X3.64 compatibility. The Elite 90 and ColorScan 90 feature 17 precoded function keys that cannot be reprogrammed without PROM revisions. They are not ANSI compatible and support character mode transmission only. However, the inclusion of color on the high-end ColorScan 90 is a feature not present on any of the Televideo 900 series products.

Although ADDS Viewpoint/Color is priced approximately $900 less than the ColorScan 90, it is limited by its 1920-character capacity and 24-line x 80-column display format. The DEC VT200 Series is priced much higher than the Datamedia terminals but provide beneficial features including full bit-map graphics generation in both ReGIS and Tektronix 4010/4014 mode on the VT240/241. The low-end VT220 also incorporates useful facilities comprising local echo, selective erase, 15 programmable function keys, downline loadable character sets, and multinational character sets. The VT240 supports the same features as the VT220, plus it handles bit-map graphics generation (240x800 resolution) and accommodates the Tektronix 4010/4014 graphics packages and ReGIS protocol. The top-of-the-line VT241 is essentially a VT240 with the addition of the multicolor display. Although the ColorScan 90 supports up to 8 foreground and 8 background colors, an extra-cost graphics board ($1,095) must be added for generating Tektronix Plot 10 graphics. Also, there is presently no support for handling ReGIS graphics protocol. The list price of the Elite 90 is $1,045 and the price of the ColorScan 90 is $1,995. Televideo 950 and 970 terminals are priced at $1,195 and $1,495, respectively. The DEC prices are as follows: $1,395 (VT220), $2,195 (VT240), and $3,195 (VT241).

☐ Strengths

The Datamedia Elite and ColorScan terminals offer a full assortment of features now appearing on a variety of competing products as the preceding competitive comparisons illustrate. In addition, Datamedia's incorporation of standard items that, until recently were optional features, reflects the current market trend. A downward migration of sophisticated features to mid-range and low-end products has begun to obscure the classification of terminals as vendors struggle to retain a niche in this changing marketplace. The 24x80/132 display format is standard on Elite 60, 90, and ColorScan 90; a choice of green/amber/white phosphor is standard on Elite 60 and 90; and an optional 20-mA current-loop interface is available on all models at no extra cost.

The 132-column line supports applications employing spreadsheets and large inventory forms which require additional screen capacity. In addition, since most printers support 132-column lines, it relieves the terminal of having to reformat 80-column lines for 132-column printers. The 132-column format also allows users to view a line as it will appear when printed.

Standard sophisticated editing facilities such as character and line insertion and deletion; smooth and jump (incremental) scroll; paging modes; protected fields; tab functions; and split-screen operation are provided on all 4 models. The smooth scroll facility is an advantageous feature because it slows the rate at which data is received. This, in turn, makes it easier for the operator to read.

Datamedia terminals also incorporate ergonomic design considerations for boosting operator productivity. All 4 members of the line-up employ nonglare, tilt and swivel CRTs; low-profile, DIN standard detachable keyboards; 60-Hz refresh rates; and CRT Saver function. Furthermore, the terminals utilize a plain-language set-up menu for selecting operating parameters from a menu-driven display. The inclusion of color on the high-end ColorScan 90 may improve operator productivity even more by highlighting screen areas so that the operator can easily differentiate between diverse types of information.

The bidirectional port is an excellent feature. With it, the attached printer can receive data directly from the host without passing it through the display screen. Thus, the screen can be used for data entry simultaneously with printing.

Additional benefits for users operating in a multiple-vendor environment can be derived from ANSI and DEC compatibility (on the Elite 60), and the ability to emulate various terminals from leading vendors such as Televideo, ADDS, Lear Siegler, and Esprit.

Datamedia Display Terminal Family
Elite 30, 60, 90 & ColorScan 90

☐ Limitations

Although Datamedia has endowed its new line-up with a range of beneficial features, there are still several items missing. For instance, none of the models can accommodate multinational character sets while DEC, Televideo, ADDS, and Lear Seigler terminals can all be equipped with foreign character sets including French, German, Spanish, and U.K. Downline loadable character sets, selective erase and local echo features are also lacking. The selective erase feature, which is present on several competing products including DEC's, is especially suitable for applications requiring data to be entered into form entries. This feature allows the user to erase selected character positions without erasing the entire screen.

Another drawback of the Datamedia line is the absence of a graphics facility. Full bit-map graphics generation in both ReGIS and Tektronix mode are standard on both DEC VT240/241 terminals. According to Datamedia, an extra-cost graphics board can be purchased directly from Datamedia or from board-manufacturer Digital Engineering. The graphics board does enable the Elite 90 and ColorScan 90 to support Tektronix Plot 10 graphics but for an additional cost of $1,095. Combined with the cost of the terminal, this option pushes the Datamedia terminal into the DEC price range. Competing vendor Visual Technology has recently released its own DEC VT240-compatible terminal with standard Tektronix graphics capability for a more reasonable price of $1,695.

Datamedia's method of handling user-assigned function keys is restrictive on the Elite 90 and ColorScan 90. Instead of the programmable function keys furnished on the Elite 30 and 60, the high-end units employ 17 precoded function keys that require PROM revisions for reprogramming. The programmable function keys supplied on Elite 30 and 60 terminals provide "shiftable" programmable functions whereby 2 separate functions are assigned to each key. Thus, the 15 programmable function keys found on the Elite 60 can produce 30 different functions. Not so with the Elite 90 and ColorScan 90. The 17 precoded function keys are established when the initial order is placed and are preprogrammed. User sites with multiple applications may require the use of different function keys that cannot be downline loaded from the host. Instead, a technician must be dispatched to the particular user site in order to make the necessary PROM revisions that can be costly as well as inconvenient.

■ COMMUNICATIONS FACILITIES OVERVIEW

All models operate point-to-point over switched or dedicated lines in half-/full-duplex modes at speeds of 50 bps to 19.2K bps. Character-only mode operation is provided by Elite 30, 90, and ColorScan 90. The Elite 60 supports block mode transmission. Communication interface is RS-232C, with 20-mA current-loop optional, and supports XON/XOFF flow control.

■ SOFTWARE

The Elite 60 follows ANSI X3.64 programming standard modes. Thus, the Elite 60 generates and responds to coded sequences per ANSI standards X3.41-1974 and X3.64-1979. All other terminals in the family must rely on the host processor for software services.

■ HARDWARE

☐ Terms & Support

Terms • all models offered on purchase basis only • volume discounts available.

Support • nationwide maintenance provided by Datamedia or by third-party organization depending upon geographic location • all service is third party (RCA Service Company) and is available on a 7-day, 24-hour-per-day basis; service contracts quoted by Datamedia or its distributors; typical cost is $288 per year • depot service or demand service also available.

☐ Overview

The Datamedia family of display terminals consists of 4 ASCII keyboard-display terminals designed to provide character-/block-mode operation and transmit data at speeds ranging from 50 bps to 19.2K bps. The overall editing and formatting capabilities of individual members are similar. The Elite 30 is an economical unit with an auxiliary printer port, special graphics characters, and advanced features including protected and unprotected fields and 11 programmable function keys. The Elite 60 represents Datamedia's mid-range, DEC-compatible product offering. The Elite 60, which incorporates a DEC VT200-style keyboard, is the only Elite model to support block mode transmission. A 2000-character buffer allows the assignment of up to 80 characters per function key. In addition, the Elite 60 supports advanced print management capabilities including an enhanced bypass print mode that allows host-retrieved data to be simultaneously displayed and printed. A 5000-character local print buffer supports the use of a locally connected printer without interrupting data flow from the host. The Elite 90 and ColorScan 90 are sophisticated units designed for use with its 932 supermicrocomputer along with other UNIX-based systems. Both are intended for multitasking applications and allow the simultaneous display of up to 8 independent tasks. Horizontal and vertical scrolling aids the display and manipulation of extra-wide or extra-long data formats. ColorScan 90 supports the same overall functions as the Elite 90 in addition to its multicolor display that provides independent colors from a selection including red, green, blue, cyan, magenta, yellow, black, and white.

Model Packages

Elite 30 Display Terminal • keyboard-display ASCII terminal with 12-inch tilt and swivel CRT; displays 2000 characters at 24 lines x 80 columns, 25th status line • 7x9 dot matrix • detached typewriter-style keyboard with separate numeric and editing key clusters; 11 programmable function keys (22 programmable functions) • 128 ASCII character set • double-width/-height characters • smooth/jump scrolling • bidirectional auxiliary printer port • RS-232C communication interface • emulates Televideo 950 and ADDS Viewpoint terminals:

$575 prch	$12 maint

Elite 60 Display Terminal • keyboard-display ASCII terminal with 14-inch tilt and swivel CRT; displays 1920/3168 characters at 24 lines x 80/132 columns; 25th status line • 7x9 dot matrix • detached typewriter-style keyboard with separate numeric and editing key clusters; 15 programmable function keys (30 programmable functions) and 12 precoded function keys • 95 ASCII character set; 16 business graphics characters and 16 control characters • double-width/-height characters • smooth/jump scrolling • split-screen viewing/scrolling • bidirectional auxiliary printer port • RS-232C communication interface • emulates DEC VT100/101/131 terminals • ANSI X3.64 compatible:

1,095	20

Elite 90 Display Terminal • keyboard-display ASCII terminal with 14-inch tilt and swivel CRT; displays 1920/3168 characters at 24 lines x 80/132 columns; 25th status line • 7x9 dot matrix • detached typewriter-style keyboard with separate numeric and editing key clusters; 17 precoded function keys • 95 ASCII character set with 15 business graphics characters and 16 control characters • multiple-windowing capability displays 8 user-defined independent windows • vertical/horizontal screen viewing/scrolling • smooth/jump scrolling • bidirectional auxiliary printer port • RS-232C communication interface • emulates Lear Siegler ADM 3A, Esprit 1420, and ADDS Regent 25 terminals:

1,045	20

ColorScan 90 Display Terminal • same overall features of Elite 90 but with a 12-inch RGB color monitor • displays up to 8 foreground and 8 background colors with up to 64 possible color combinations per character location:

1,995	35

PRCH: purchase price. MAINT: monthly maintenance charge (see Terms & Support for details). NA: not applicable. Prices are current as of August 1985. All prices are single-quantity purchase.

Datamedia Display Terminal Family
Elite 30, 60, 90 & ColorScan 90

☐ CPU & Memory

Elite 30 includes 4 pages of display memory capable of storing four 24-line x 80-column screens of data. All other models contain a single page of display memory.

☐ I/O & Communications

All members support point-to-point asynchronous ASCII transmission over switched or dedicated lines in half-/full-duplex modes. Operating speeds are selectable at 50 bps to 19.2K bps on all models. Standard interface is RS-232C; 20-mA current loop is optional on all models. Transmit, receive, and auxiliary printer port data rates are independent on all terminals with bidirectional printer port. Incoming data on all terminals is stored in a 64-character buffer. XON/XOFF flow-control characters are used to ensure that no data is lost due to receive-buffer overflow.

Keyboard-selectable operating parameters establish 7- or 8-bit character size; even/odd/no parity; data transmission speeds for terminal/printer; and answerback.

Communications interface is RS-232C, with 20-mA current-loop optional. All models support a bidirectional auxiliary printer port that can receive data directly from the host, bypassing the screen.

20-mA Current-Loop Interface • available for all models:

$50 prch	NA maint

☐ Disk

No disk/diskette is offered.

☐ Terminals/Workstations

Configuration • tabletop keyboard-display with typewriter-style keyboard; separate numeric cluster • 11 programmable function keys standard on Elite 30; 15 programmable function keys standard on Elite 60; 12 precoded function keys standard on Elite 60; 17 precoded function keys standard on Elite 90 and ColorScan 90; cursor key cluster with 12 commonly used editing keys standard on Elite 60 and 90 and ColorScan 90.

Display • 12-inch tilt and swivel display standard on Elite 30 and ColorScan 90; 14-inch tilt and swivel display on Elite 60 and 90 • 7x9 dot matrix • 1920 characters at 24 lines x 80 columns on all models; 3168 characters at 24 lines x 132 columns standard on Elite 60, 90, and ColorScan 90 • 128-character ASCII set on Elite 30; 95-character ASCII set on Elite 60, 90, and ColorScan 90 • business graphics and line drawing characters on all models • split-screen on Elite 60, 90, and ColorScan 90 • smooth/jump scroll on all models • 16 control characters on Elite 60, 90, and ColorScan 90 • half-intensity, reverse video, blink, and underline attributes standard on all models; bold, double-width/-height character attributes on all models except Elite 30.

Edit & Format Feature • common features for all terminals include cursor up, down, left, right, home • blinking underline, reverse block cursor • direct cursor addressing, cursor address read/write • line feed, new line • tab forward/backward, tab set/clear, columnar tabs and field tabs • clear character, EOL, EOP, clear unprotected fields, clear screen • insert/delete line, character, and tabs • columnar insert/delete and replace string on Elite 90 and ColorScan 90 • smooth/jump scrolling • split-screen viewing/scrolling on all models except for Elite 30 • vertical/horizontal screen viewing/scrolling on Elite 90 and ColorScan 90 • protected fields • local print.

☐ Printers

Any printer with an RS-232C interface can be attached. Terminals with bidirectional auxiliary ports can receive data destined for the printer without first passing it through the display.

• END

Datamedia Excel Display Terminal Family
Models 12, 14, 22, 24, 32, 34, 42, 44, 62, 64, 72D & 74D

■ PROFILE

Function • general-purpose, nonprogrammable interactive keyboard-display ASCII terminal • DEC VT52/100 compatible.

Architectures Supported • any architecture supporting asynchronous ASCII protocol • local/remote attachment to host processor • some ANSI 3.64 compatible.

Communications • half-/full-duplex asynchronous, 50- to 19.2K-bps, point-to-point, character/block mode transmission • RS-232C or 20-mA current-loop interfaces.

Operating System • none.

Database Management • none; only in association with host facilities.

Transaction Processing Management • none; only in association with host facilities.

Support Software • none; only in association with host facilities.

Processor • display-oriented control and communication logic.

Terminals/Workstations • single keyboard, 1920-/3168-character display with auxiliary port for local printer.

First Delivery • 1981.

Systems Delivered • not available.

Comparable Systems • competitive with a number of general-purpose ASCII display terminals; most notable are ADDS Regent, Lear Siegler ADM, Beehive DM and ALT, DEC VT52 and 100, Televideo 900 Series, and IBM 3101.

Vendor • Datamedia Corporation; 7401 Central Highway, Pennsauken, NJ 08109 • 609-665-5400.

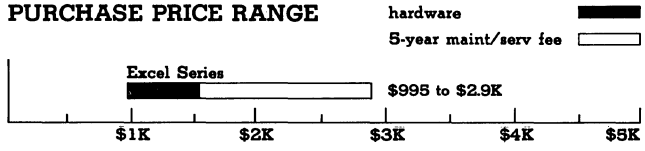
Distribution • local Datamedia sales offices and distributors nationwide.

■ ANALYSIS

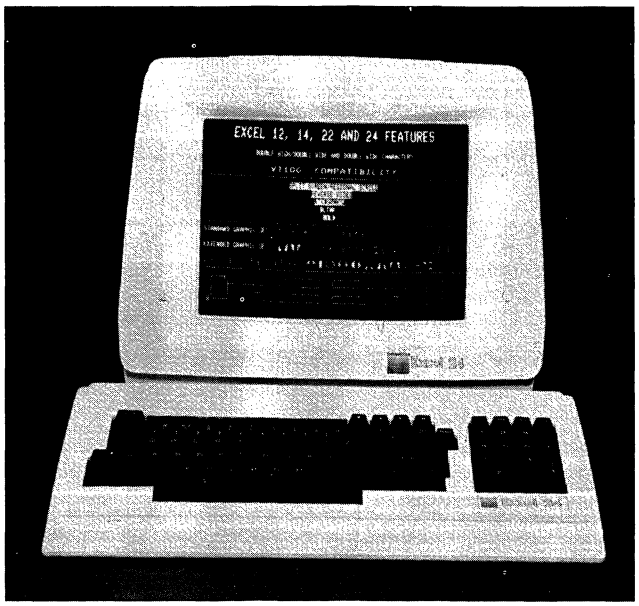
Since our last evaluation of the Excel family, the marketplace has changed considerably. Most vendors have cut their prices, and many have introduced new or greatly enhanced terminals which provide top performance at reasonable prices. While Datamedia has lowered prices for its products, it has not significantly enhanced them. In short, it has fallen behind some principal competitors, and in some cases its prices are not competitive.

While Datamedia competes against a number of top-flight terminals (see Comparable Products), its principal competition should come from ADDS (Applied Digital Data Services), Viewpoint/60 and /90; DEC VT100 and 200; Televideo 900 Series; and Beehive ALT-004 and -008 terminals. These terminals offer features similar to (and in many cases, more advanced than)

PURCHASE PRICE RANGE



DATAMEDIA EXCEL SERIES PURCHASE PRICING bar graph covers the price range and associated 5-year maintenance fee between "small" and "large" configurations for hardware • Excel small configuration consists of an Excel 42 keyboard-display with 4K-byte page buffer and bidirectional print port • large configuration consists of Excel 24 keyboard-display with Advanced Video Option. All prices are single-quantity purchase; volume discounts available.



the Excel line and, with the exception of DEC, are more favorably priced.

While Excel consists of 12 different models, many are variants with minor feature differences. The primary terminal is the Model 12. This unit includes all of the above standard features plus an Advanced Video Option (AVO), which provides capabilities similar to those offered with the Advanced Video feature of the DEC VT100. Such facilities as a 3168-character 24-line x 132-column (character) display capacity, underline, reverse video, character blinking, and a bidirectional auxiliary printer port are provided. Model 14 is exactly the same as Model 12, except it has a 14-inch screen versus 12 inches for Model 12. (In the Datamedia product coding scheme for Excel, the last digit in the model number includes the last digit of the diagonal size on the screen. For example, the Model 62 has a 12-inch screen; the Model 64 has 14 inches). Models 12 and 14 operate in character-only transmission mode.

Models 22 and 24 are the same as the 12/14, except that the AVO is an option. Models 32 and 34 are essentially the same as the 12/14, except AVO is not offered even as an option. Users can, however, equip the 32/34 terminals with a 24-line x 132-column display capability. The Models 32 and 34 provide keyboard-selectable emulation of the Applied Digital Data Systems (ADDS) Regent 25, Hazeltine Model 1420, Lear Siegler ADM-3A, and Datamedia Elite 1521, in addition to DEC VT52/100 compatibility.

Models 42 and 44 differ greatly from the rest of the Excel family. Both display only 1920 characters (24 lines x 80 columns) and support 96 ASCII character set (versus 128 for all other models). Both, however, provide more powerful local data editing and furnish 2 pages of display memory. The latter feature is particularly significant since it permits the terminals to store display data locally, eliminating the associated communication cost and delay in recalling data from the host. Models 42 and 44

Datamedia Excel Display Terminal Family
Models 12, 14, 22, 24, 32, 34, 42, 44, 62, 64, 72D & 74D

also include a bidirectional auxiliary printer port, a feature packaged into the AVO with other members of the family. Models 42 and 44 also operate in character/block modes.

Models 62 and 64 have the same features as Model 12 and 14, except they operate in character/block modes, are compatible with DEC VT52/131 terminals, and meet ANSI 3.64 standards. Model 72D and 74D are the same as the 62/64, except these terminals are compatible only with the Data General Dasher 100/200 and DG 6053 models.

The Excel 12 competes against the ADDS Viewpoint/90, Televideo 970, Beehive ALT-008, and DEC VT 102/131/220/240. All offer much the same edit and format facilities, support 132-column lines, and accommodate local page storage. Against the Viewpoint/90, Televideo 975, and Beehive ALT-008, the Excel 12 falls short on price and/or overall facilities. The ADDS Viewpoint/90 with optional 4K-byte page buffer and optional 132-column display costs $1,125 versus $1,410 for an Excel 12 with only a 2K-byte page buffer. In addition, the Viewpoint/90 keyboard has 16 programmable function keys and protected fields are supported. Excel 12 has only 4 programmable function keys and does not allow protected fields. The Viewpoint/90 supports both character and page (block) mode transmission, while Elite 12 operates only in character mode.

The Viewpoint/90 with its optional 4K-byte page buffer is about equivalent to the Elite 42 and 44. Those units come with a 4K-page buffer and are priced at $995 for a 12-inch screen version and $1,080 for a 14-inch screen unit. The Viewpoint/90 has a 13-inch screen plus all the aforementioned facilities and costs $1,125. The Excel 42 and 44 both operate in character or block mode as the ADDS product, and emulate a Lear Siegler ADM-31/-32. According to ADDS, the Viewpoint/90 can emulate different products as well.

The Televideo 975 at $1,495 is priced slightly higher than the Excel 12, but has more features for greater flexibility. The 975, for example, can store 3 local pages, has 16 programmable function keys, operates in character, block, or local modes, is soft-configured from the keyboard, and is ANSI 3.64 compatible.

If you don't need a 132-column line format, Televideo Models 924 and 925 offer an even better deal. Both terminals have essentially the same edit and format capabilities as the Excel 12, but offer greater page storage capacity, more programmable function keys, protected fields, and character/block mode transmission. The 924 has a 2K-byte page buffer with 3 extra pages optional, and sells for $899. The 925, priced at $995, also has a 2K-byte page buffer with an optional additional page. The page memory upgrade for the 924 and 925 costs $40.

The 924 and 925 are also the equal of the Excel 42 and 44, but are priced below the Datamedia products. The Televideo terminals, in addition, have page-memory expansion options not offered with the 42 and 44.

The Excel 22 and 24, the standard 80-column line displays in this family, compete against the Televideo 910, 910 Plus, and 914. In overall edit and format capabilities, we'd rank these terminals equal. The 910 and 910 Plus, however, have 11 programmable function keys, and the 910 Plus operates in character or block mode. The 914 has 3 programmable function keys and also operates in character or block modes. When it comes to price, there is no contest: Televideo costs about half as much. The 910 is priced at $649; the 910 Plus costs $699, and the 914 lists for $699.

The Beehive ALT-004 and -008 compete principally against the Excel 12 and its variants. Both Beehive offerings support an 80-/132-column line, feature local page storage, and operate in character or block mode. Both are ANSI 3.64 compatible and both are configured from the keyboard. The ALT-004 and -008 editing and formatting facilities are much the same, and similar to those of the Excel 12. The ALT-004 has a 2K-byte page buffer (like the Excel 12), 8 user-programmable function keys, and 16 preprogrammed function keys. Priced at $995, it is priced $415 lower than Datamedia.

The ALT-008 competes against the Excel 12 and 42 and is priced in the same ballpark at $1,495. The Beehive terminal, however, has a 32K-byte page memory (that's 16 pages of local storage) which far outstrips Datamedia's unit. In addition, the ALT-008 is offered with a 128K-byte expansion buffer which sells for $200. The ALT-008 is also DEC VT100/131 compatible, as is the Excel 12. Given the overall capabilities of the Beehive product, we'd pick it over Excel even with the $95 price difference.

Datamedia fares much better against the DEC product line, as far as editing and formatting are concerned. While several of the Excel terminals are compatible with the DEC VT52 and 100 (see Model Packages section), Datamedia's principal targets are the DEC VT100, 101, 102, and 131. Against these, Datamedia offers the Excel 12 and 62. The Excel 12 is nearly identical to the VT102 and offers more features than the VT100 and 101; the Excel 62 is slightly more powerful than the VT131. The VT102 includes a 1920-/3168-character display formatted as 24 lines x 80/132 characters. It also offers double-width/-height characters, bidirectional scrolling, split-screen operations, and smooth or jump scrolling of received data. The VT100 has the same features except it only displays 14 lines x 132 characters. The VT101 is the same as the VT100 but with local echo. The Excel 12 equals the VT102 in overall capability, but has a bidirectional auxiliary printer port, which is quite a performance boost (see Strengths). As for cost, the Excel 12 is priced lower than the VT102 ($1,410 versus $1,595), considerably less than the VT100 priced at $1,945; but considerably more than the $1,350 VT101. The VT100's higher price is due to its flexibility, as discussed under Limitations of the Excel series.

Both the Excel 62 and VT131 are variants. The 62 is based on the Excel 12 except it supports character/block mode operation versus character mode only. Likewise, the VT131 is based on the VT102 with the same operating mode difference. Thus, the principal operational difference lies with the aforementioned bidirectional port—the Elite 62 has it while the VT131 does not.

The price is also different. The Elite 62 is priced lower at $1,165 versus $1,695 for the VT131. For those requiring 14-inch screens (versus 12 inches on the standard models), Datamedia offers the Excel 14 and 64, which are functionally the same as the 12 and 62, but are slightly lower in price than the VT131.

Datamedia's edge is blunted against the new DEC VT200, an extension of the VT100 which offers top-flight performance at a competitive price. The VT220 incorporates all features of the VT100 including a 132-column x 24-line format, plus it has local echo, selective erase, 15 programmable function keys, downline loadable character sets, a multinational character set, keyboard configuration, and a nonglare screen. Its price is $1,080. The VT240 has the same features as the VT220, plus it supports bit-mapped graphics (240x800 resolution) and accommodates the Tektronix 4010/4014 graphics packages and is priced at $1,980. None of the Excel products supports high-level graphics. The third member of the VT200 family is 241. This unit is essentially a VT240 with a color monitor, and lists for $2,980. Again, Excel has nothing like it.

☐ Strengths

Principal strengths are the 132-column display line and the bidirectional printer port available on most Excel models. The 132-column line supports applications employing spreadsheets and large inventory forms which require additional screen capacity. In addition, since most printers support 132-column lines, it relieves the terminal of having to reformat 80-column lines for 132-column printers. The 132-column format also allows users to view a line as it will appear when printed.

The bidirectional port is an excellent feature. With it, the attached printer can receive data directly from the host without passing it through the display screen. Thus, the screen can be used for data entry simultaneously with printing.

Another useful feature is the smooth scrolling of received data; it allows users to slow the rate at which data is received. This, in turn, makes it easier for the operator to read.

☐ Limitations

The Excel line is no longer competitive with respect to price or performance with any of the aforementioned principal competitors except for the old VT100 family. The Excel series

Datamedia Excel Display Terminal Family
Models 12, 14, 22, 24, 32, 34, 42, 44, 62, 64, 72D & 74D

lacks sufficient local page storage to match products like Televideo's 900 series and the Beehive ALT; they are short on programmable function keys; most are character-only transmission models, and they lack a graphics facility as well.

The Excel family also has no facility to upgrade it to perform personal computer functions. DEC, on the other hand, permits this with the VT18X option for the VT100. By purchasing a VT18X Intelligent Upgrade, the customer receives a Z80 microprocessor, CP/M operating system, 64K bytes of RAM, and dual 5.25-inch diskette drives with a total of 340K bytes of storage. With such power the device can easily handle local processing, making it extremely attractive for distributed environments. In addition, any member of the VT100 series can be upgraded from the basic terminal.

■ COMMUNICATIONS FACILITIES OVERVIEW

All models operate point-to-point over switched or dedicated lines in half-/full-duplex modes at speeds of 50 bps to 19.2K bps, except Models 42 and 44 which operate at 110 to 9600 bps. Character-only mode operation is provided by Models 12, 14, 22, 24, 32, and 34; all others support character/block mode. Local echo is available. Communication interface is RS-232C, with 20-mA current loop optional, and supports XON/XOFF flow control.

■ SOFTWARE

All models are compatible with DEC VT52/100 programming standard modes, and therefore can run software written for those terminals. Certain models are also compatible with terminals manufactured by ADDS, Lear Siegler, Hazeltine, and Data General, and are run in ANSI X3.64 mode.

■ HARDWARE

□ Terms & Support

Terms • all models offered on purchase basis only • volume discounts available.

Support • all service is third party (RCA Service Company) and is available on a 7-day, 24-hour-per-day basis; service contracts quoted by Datamedia or its distributors; typical cost is $288 per year • depot service or demand service also available.

□ Overview

The Excel series consists of 12 ASCII keyboard-display terminals which share many common characteristics. As mentioned under Analysis, the family consists of two terminal types with the others being variants. The primary terminal is the Model 12, a unit capable of displaying 80-/132-column x 24-line format and providing fairly typical data editing and control. The variants are Models 14, 22, 24, 32, 34, 62, 64, 72D, and 74D, and differ principally in screen size, line/column capacity, and terminal emulation.

Excel 42 is a buffered display terminal with an 80-column x 24-line display format. This unit has a 4K-byte (2 page) local storage buffer, and permits split-screen/regional scrolling. The Excel 44 is basically the same unit, but with a 14-inch (versus 12-inch) screen.

Model Packages

Excel 12 Display Terminal • keyboard-display terminal with 12-inch screen • 1920-character at 24-line x 80-column capacity • 128 ASCII character set • double-width/-height characters • smooth/jump scrolling • split-screen with regional scrolling • RS-232C communication interface • includes Advanced Video Option consisting of 3168-character, 24-line x 132-character display capacity; underline, reverse video, blinking, and a bidirectional auxiliary printer port • 2K-byte page buffer • character-mode operation • DEC VT52/100 compatible:

$1,410 prch	$24 maint

Excel 14 Display Terminal • same as Excel 12, except has 14-inch screen:

1,495	24

Excel 22 Display Terminal • same as Excel 12, except has no Advanced Video Option:

1,120	24

Excel 24 Display Terminal • same as Excel 22, except has 14-inch screen:

1,205	24

Excel 32 Display Terminal • same as Excel 12, except does not have Advanced Video Option • also provides keyboard-selectable emulation of ADDS Regent 25, Datamedia Elite 1521, Hazeltine 1420, and Lear Siegler ADM-3A:

1,250	24

Excel 34 Display Terminal • same as Excel 32, except has 14-inch screen:

1,300	24

Excel 42 Buffered Display Terminal • keyboard-display terminal with 12-inch screen • 1920-character at 24-line x 80-character capacity • 96 ASCII character set • double-width/-height characters • smooth or jump scrolling • split-screen/region scrolling • RS-232C communication interface • bidirectional printer port • 2 pages of local buffer storage • character/block mode transmission • compatible with Lear Siegler ADM-31/32:

995	24

Excel 44 Buffered Display Terminal • same as Excel 42, except has 14-inch screen:

1,080	24

Excel 62 Display Terminal • same as Excel 12, except operator block/character mode • DEC VT52/131 and ANSI 3.64 compatible:

1,160	24

Excel 64 Display Terminal • same as Excel 62, except has 14-inch screen:

1,245	24

Excel 72D Display Terminal • same as Excel 62, except compatible only with Data General Dasher 100/200 and DG 6053:

1,395	24

Excel 74D Display Terminal • same as Excel 72D, except has a 14-inch screen:

1,480	24

□ CPU & Memory

All models, except the 42 and 44, include a single page of display memory. Models 42 and 44 contain 2 pages of memory capable of storing 2 24-line x 80-column screens of data. In addition, all models—except the 42 and 44—are configurable from the keyboard with operating parameters stored in nonvolatile RAM. The 42 and 44 are switch configured.

□ I/O & Communications

All members support point-to-point asynchronous ASCII transmission over switched or dedicated lines in half-/full-duplex modes. Operating speeds are selectable at 50 bps to 19.2K bps on all models except Models 42 and 44, which operate at 110 to 9600 bps. Standard interface is RS-232C; 20-mA current loop is optional on all models. Transmit, receive, and auxiliary printer port data rates are independent on all terminals with bidirectional printer port. Incoming data on all terminals is stored in a 64-character buffer. XON/XOFF flow-control characters are used to ensure that no data is lost due to receive-buffer overflow.

Keyboard-selectable operating parameters establish 7- or 8-bit character size; even/odd/no parity; data transmission speeds for

PRCH: purchase price. MAINT: monthly maintenance charge (see Terms & Support for details). NA: not applicable. NC: no charge. Prices effective as of June 1984. All prices are single-quantity purchase.

Datamedia Excel Display Terminal Family
Models 12, 14, 22, 24, 32, 34, 42, 44, 62, 64, 72D & 74D

terminal/printer; and answerback (except Models 42 and 44). On Models 32 and 34, users can invoke emulation of ADDS Regent 25, Hazeltine 1420, Lear Siegler ADM 3A, and Datamedia Elite 1521 directly from the keyboard.

Communications interface is RS-232C, with 20-mA current loop optional. Models equipped with a bidirectional auxiliary printer port can receive data directly from the host, bypassing the screen.

20-mA Current-Loop Interface • available for all models:

$50 prch	NA maint

☐ Disk

No disk/diskette is offered.

☐ Terminals/Workstations

Configuration • tabletop keyboard-display with modular detached typewriter-style keyboard; separate numeric key cluster • 4 programmable function keys standard on Models 12, 14, 52, and 54; 8 standard on Models 42 and 44; 12 standard on Models 22, 24, 62, 64, 72, and 74 • **2-page display buffer standard on Models 42 and 44.**

Display • tiltable 12-inch diagonal CRT (Models 12, 22, 32, 42, 52, 62, and 72D) or 14-inch diagonal CRT (Models 14, 24, 34, 44, 54, 64, and 74D) • 7x9 dot matrix • 1920 characters at 24 lines x 80 characters on all models; 3168 characters at 24 lines x 132 characters standard on Models 12, 14, 52, 62, 64, 72D, and 74D • double-width/-height characters • 128-character ASCII set on all models except 42 and 44, which have 96-character ASCII set • business graphics and line-drawing sets on all models • split-screen • bidirectional smooth/jump scrolling • underline and reverse video standard on all models • blinking and bold characters standard on all models except 22 and 24 • blanked character standard on all models except 42 and 44.

Edit & Format Feature • auto-repeat keys • cursor up, down, left, right; tab forward; tab backward (Models 42 and 44); backspace (except Models 42, 44, 72D, and 74D) • return/return line feed • bidirectional scrolling; smooth/jump scroll; no scroll all models except Models 32, 34, 72D, and 74D • underline, reverse video standard on all models • blinking and bold characters (except Models 22 and 24) • blanked character (except Models 42 and 44) • line insert/delete (except Models 12, 14, 22, and 24) • character insert/delete on Models 42, 44, 62, and 64 • erase character, line, page • protected fields on Models 42, 44, 62, and 64 • local print on all except Models 12 and 14.

Peripherals • auxiliary RS-232C interface supports printer on all models.

Advanced Video Option • provides 3168 characters at 24-line x 132-column capacity; blink, underline, reverse video; bidirectional auxiliary printer port; offered on Models 22 and 24:

$300 prch	NC maint

3168-Character Display Format • provides 24-line x 132-column display format for Models 32 and 34:

74	NA

Extended Character Set • provides 128 ASCII character set on Models 42 and 44:

55	NC

Component Video • allows video monitor to be attached to Models 22, 24, 32, 34, 62, 64, 72D, and 74D:

75	NA

Program Function Keys • provides 8 programmable function keys on Models 32 and 34:

125	NA

☐ Printers

Any printer with an RS-232C interface can be attached. Terminals with bidirectional auxiliary ports can receive data destined for the printer without first passing it through the display.

• **END**

Datapoint ARC
Baseband Local Area Network

■ PROFILE

Architecture • ARC Local Area Network • distinguished from ARC System; ARC is component of ARC system • see Figure 1.

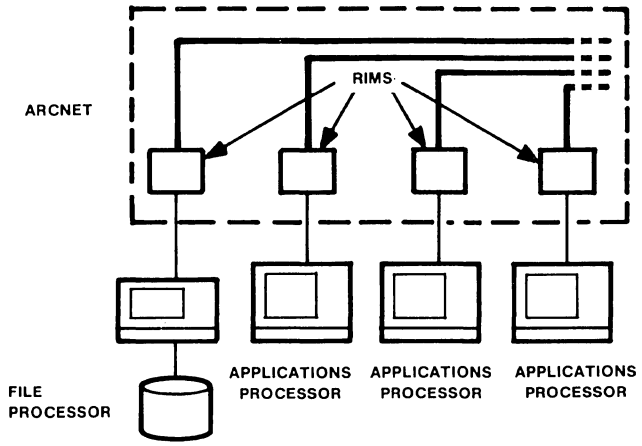
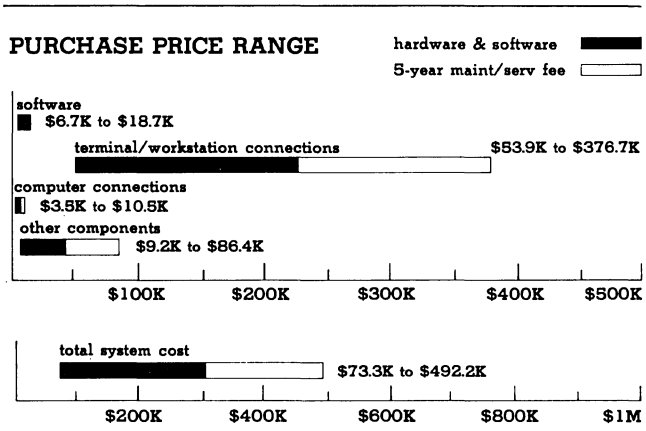


Figure 1 • ARC interconnects processors in an ARC system.



DATAPOINT ARC PURCHASE PRICING bar graph covers price range between small and large configurations for software and hardware products (solid bar) and for associated 5-year period maintenance fees (open bars) • **SMALL SYSTEM** interconnects 100 terminals (50 VISTA-PCs and 50 IBM PCs) workstations with 2 resource computers (one 3200 and one 8800); configuration includes 50 VISTA-PC ARC interfaces and software, 50 INX-PC ARC interfaces and software, 8807 RIM ARC interface for 8800, INX-32 RIM ARC interface and software, eight 9484 8-port Active Hubs, eight 9486 8-Port Expanders for 9484s, and 1200 feet of coaxial cable to interconnect hubs (assumed 200 feet apart) • **LARGE SYSTEM** interconnects 500 terminals/workstations (150 VISTA-PCs, 150 IBM PCs, 200 1560 Processors), with 4 resource computers (two 3200s and two 8800s); configuration includes 150 VISTA PC ARC interfaces and software, 150 INX-PC ARC interfaces and software, 200 RIMS for 1560s, 2 INX-32 ARC interfaces for 3200 and software, 2 RIM ARC interfaces for 8800, 39 9484 8-port Active Hubs, 39 9486 Port Expanders for 9484s, and 7800 feet of cable for interconnecting hubs, assumed to be 200 feet apart • Datapoint does not charge for most of its software for the 1560 and 8800; it does charge for 1200 and 3200 software; software maintenance is included with hardware maintenance.

Type • baseband token-passing, contention-free bus architecture • provides guaranteed delivery service with predictable channel access intervals.

Transmission Speed • 2.5M bps over cable • throughput rates dependent on length of cable, number of nodes transmitting, and length of messages • with no transmissions, 30K token passes per second; with 10 nodes transmitting 100-byte messages, throughput is 1,720 messages per second or 1.4M bps.

Cable Length • 4 miles maximum.

Applications • primarily integrated electronic office environments.

Configuration • consists of Resource Interface Modules (RIMs), coaxial junction boxes called hubs, and coaxial cable interconnecting file and application processors; hubs are either 4-port passive or 8-/16-port active junction boxes • maximum configuration includes up to 255 RIMs, up to 4 miles of cable with up to 10 hub-to-hub hops for each end-to-end transmission, and up to 2,000 (coaxial cable)/4000 (fiber optic cable) feet between active hubs.

Interface • through RIM (Resource Interface Module) and application processor.

Gateways • through application processors connected to RIMs: ARCLINK connects remote DOS/ARC systems (see Figure 2); Channel Adapter Products connect ARC processors to IBM S/370-compatible mainframes; and MULTILINK software to Burroughs, CDC, Honeywell, and IBM mainframes; and to X.25 packet-switched networks.

Support of Foreign Devices • through processors connected to RIMs: Teletype 33/35 models; EMS (Electronic Message Systems) supports Teletype, Telex, and TWX text formats for mailboxes • IBM PCs through INX-PC.

Security • physical connection of devices to ARC and location of disks can confine users to data on 1 ARC network (see Figure 3) • operating system dependent: DOS provides file write protection and private user names and code words; RMS provides assigned security levels and protection through passwords; UNOS also provides protection of file access.

Communications Management • RIM manages lower 2 levels of communications comparable to ISO model; operating system on RIM-attached processor provides upper levels of communications management.

Protocols • ARC uses Datapoint's own protocol which Datapoint has now made public • token passing, deterministic protocol for transmitting packets of data up to 253 bytes long with positive acknowledgement of receipt.

Distributed Functions • distributed control among nodes; ARC System provides File Processors and Application Processors to perform dedicated functions and allow resource sharing of files, printers, facsimile, communications, and internetwork gateways.

First Delivery • 1977.

Systems Delivered • over 6,000.

Comparable Systems • ARC is unique in a number of ways: it was the first LAN commercially available; it has more installations than any other LAN; and it was developed concurrently with the Datapoint processor hardware and software to support distributed processing • uses different protocol but is comparable to Xerox Ethernet, Ungermann-Bass Net/One, and Sytek LocalNet • uses radically different LAN philosophy and implementation hardware but provides many of the same functions offered by WangNet.

Vendor • Datapoint Corporation; 9725 Datapoint Drive, San

Datapoint ARC
Baseband Local Area Network

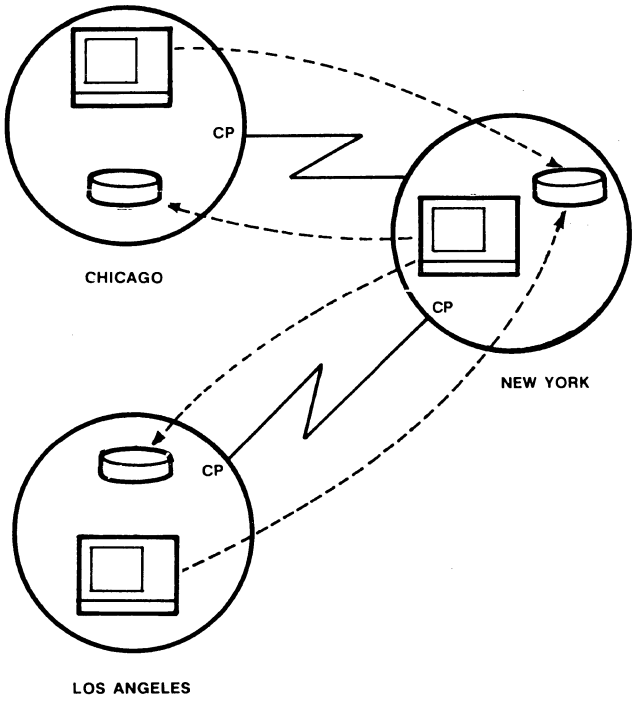


Figure 2 • remote ARC communications using ARCLINK and communications processors (CP).

Antonio, TX 78284 • 512-699-7542.

Canadian Headquarters • Datapoint Canada, Inc; 4881 Yonge Street, Suite 700, Willowdale, ON M2N 5X3 • 416-222-8005.

GSA • listed.

Distribution • through 64 domestic sales offices in the United States and subsidiaries in 14 countries with distributors throughout the world • European Regional Headquarters.

■ ANALYSIS

The ARC local area network was initially designed to allow Datapoint intelligent terminals and small business computers to supplement their processing power by operating in a distributed processing environment. In fact, Datapoint's computers were initially called "Dispersed Processing Systems." Currently, Datapoint distinguishes ARC, the LAN physical components, from ARC Systems, the collection of file and application processors interconnected through ARC.

Initially, the ARC protocol was considered proprietary and Datapoint jealously guarded its specifications from outsiders. With the increased interest in LANs in the past few years and the standards developed for LANs by the IEEE 802 Committee, Datapoint has offered ARC as a standard LAN protocol. The 802 committee did not accept the ARC protocol as an IEEE standard.

The IEEE 802 Committee has established a standard for the CSMA/CD protocol for baseband bus-centered contention-based LANs.

The token-passing protocol for bus- and ring-oriented LANs has also been standardized. ARC uses a token-passing protocol with a combined bus and star physical topology that forms a logical ring. ARC does not conform to either of the IEEE token-passing standards.

Datapoint has made its protocol public and invited outside vendors to use it without a license fee.

IBM has announced it will offer a LAN using a token-ring protocol. The IBM LAN is still over a year away. The Datapoint ARC is here today and the company has a long history of successful implementations.

A logic chip that implements the ARC protocol is available from Standard Microsystems Corporation of Hauppauge, New York. Nestar is shipping PLAN 4000 LANs (based on the ARC protocol) for interconnecting Apple II and III and IBM Personal Computers.

Wang offers a LAN using the ARC protocol. Interactive Systems/3M LAN/1 also uses the ARC protocol. Thus, the Datapoint ARC protocol is becoming a defacto standard. These companies have good reasons for selecting the ARC protocol.

The ARC protocol is clever and quite simple. It is deterministic in that each node is guaranteed an opportunity to send its message within a prescribed time frame. It supports distributed control, multiple length messages, acknowledgement of message receipt, automatic system reconfiguration if a new node is connected to the network, and guaranteed message delivery. Reconfiguration is not required when a node is removed from the network.

On its large inhouse ARC network, used for research and development, with about 175 nodes active at any time performing a wide range of applications, Datapoint has found that traffic load seldom falls below 400 messages per second during peak business hours. Less than 2 percent of the nodes send messages on the average token trip around the network. This means that the time that a node must wait to transmit a message is close to the

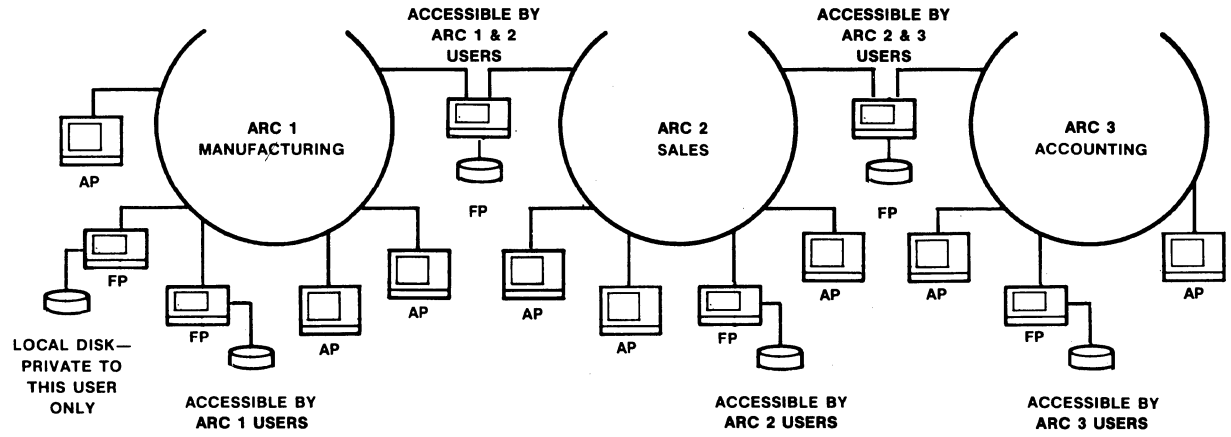


Figure 3 • security through physical disk file connection.

Datapoint ARC
Baseband Local Area Network

no-traffic value, which is 5.6 milliseconds for a 200-node network (28 microseconds x number of nodes), plus propagation delay. If only 1 node is transmitting 100-byte messages on a 10-node network, it can send 1 message every 833 microseconds (token-passing time plus message transmission time) for a throughput rate of 1200 messages per second or 960K bps. Token-passing time is defined as the total number of nodes (10) times 28 microseconds per node (10 x 28 = 280 microseconds). Message transmission time equals 113 microseconds plus 4.4 microseconds per byte (113 + 4.4 x 100 bytes = 553 microseconds).

Theoretically, a 10-node ARC with all 10 nodes transmitting 100-byte messages for each token pass, handles 172 messages per second per node for a throughput rate of 1.376M bps.

ARC implements higher-level protocols in the CP/M, UNOS, CTOS, DOS, and RMS operating systems running on the processors connected to ARC. Currently, DOS.H, RMS, the 1560 CP/M, CTOS, MS-DOS, UNOS, and PC-DOS operating systems can reside on the same ARC, but systems cannot intercommunicate between system files. Separate disks are used to store each operating system's files and when files are interchanged, DOS.H to RMS for example, the DOS.H file is converted to the RMS format and the security measures for RMS are attached.

RMS is the primary environment on ARC. The PRO-VISTA software runs under RMS. Systems on ARC communicate with UNOS (3200) systems through a UNOS-HOP program running on an RMS system. UNOS-HOP attaches the RMS workstation to UNOS. DOS is supported because it offers so many facilities for users. It is an old system and Datapoint has developed alot of software that runs under DOS.

☐ Strengths

The ARC protocol and ARC products boast extensive usage, the technology is proven, and experience has shown throughput remains high even during peak usage. The protocol is versatile and flexible. Packets can range in size from 1 byte for an acknowledgement to 260 bytes for a packet with 253 data bytes. The data field can vary from 1 to 253 bytes, thus it is appropriate for character-oriented terminals as well as for block-oriented computer file transfers.

Because control is distributed, a node failure does not disrupt other traffic on the line if the receiving node has buffer space available for a message. Data overruns are impossible, and the network is never bogged down with undeliverable data because the sending node interrogates the receiving node for buffer availability and waits for an acknowledgement from the receiving node that buffer space is available before sending the data.

Furthermore, all data packets require acknowledgement so the sending node knows if the message was received without error. System reconfiguration is automatic when a new node is added or if the token is lost. It is not required if a node is removed. A device/node can be moved anywhere on the network and retain its same address (ID).

The interface is inexpensive and is available in chip sets from Standard Microsystems. Now that Datapoint has made the protocol public and is encouraging its use by other vendors, ARC products are being offered by many vendors. Even though the 802 committee did not adopt ARC as an IEEE standard, it is still a standard that is well defined and readily available.

☐ Limitations

The number of nodes on a network is limited to 255. A second ARC is required to accommodate additional devices, and 1 processor on each network must be used for the internetwork gateway. Access to the outside world of foreign vendors is also supported through a processor connected to ARC. Datapoint's higher-level communication software, however, makes the location of the accessed file, printer, facsimile terminal, or processor transparent to the user.

■ NETWORK SUMMARY

Datapoint offers a complete family of products to construct and use ARC. Although its computers can be used as standalone systems, all are designed to function as distributed processors on ARC.

A Datapoint ARC System is a collection of up to 255 File Processors and Application Processors interconnected by ARC. The physical components of ARC include network interface units, each called a Resource Interface Module (RIM), active and passive hubs, and coaxial cable.

ARC is organized as a combined bus and star topology that forms a logical ring; the interconnecting cable, however, does not form a physical ring. Each ARC hub with its interconnected RIMs form a star configuration. Hubs are interconnected by a coaxial bus. RIM addressing forms a logical ring of up to 255 device addresses. RIM addressing is independent of physical network location and is established via jumper connections (straps) in each RIM, which can be changed in the field. Each RIM is identified by a unique address and is a discrete network node.

ARC uses a token-passing protocol for access control. The token is not passed to inactive nodes, which must "come online" to be considered as active network nodes.

All user devices interface to ARC through an Application Processor (AP) which can be an IBM or VISTA PC; disk storage is connected through a File Processor (FP). An AP accommodates up to 28 terminals and can connect foreign vendor mainframes to ARC. ARC is an integral part of Datapoint's Integrated Electronic Office Environment (IEOE); see Figure 4.

An AP or FP connects to a RIM through its I/O bus, and the RIM attaches to a hub port via coaxial cable. The address of an AP or FP is determined by its associated RIM. The physical RIM exists as

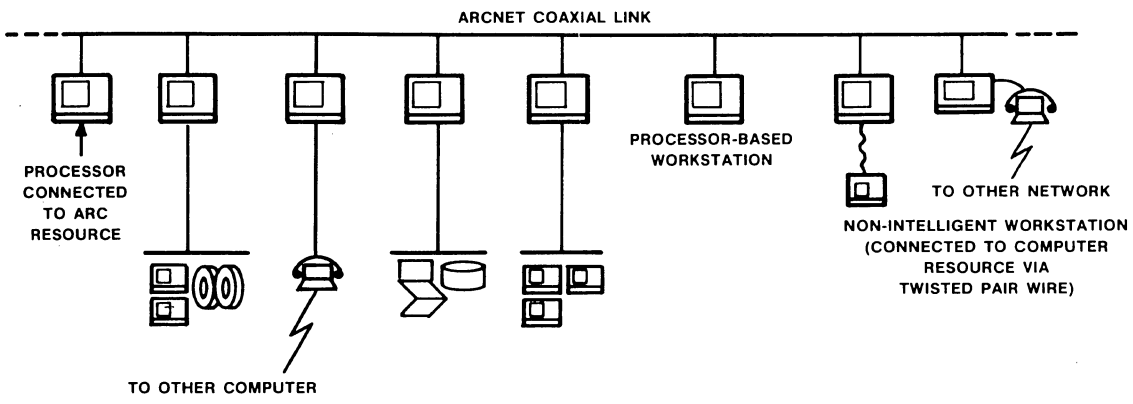


Figure 4 • ARC distribution of resources.

Datapoint ARC
Baseband Local Area Network

a standalone unit external to an AP or FP, or as an integral component of an AP or FP. A simple 2-RIM network does not require a hub; the RIMs are interconnected by coaxial cable.

A RIM is a microprocessor-based unit dedicated to monitoring and controlling data transmission through ARC. The maximum transmission rate over the ARC cable is about 2.5M bps. Each RIM contains 1K bytes of data buffering and provides error control and system reconfiguration. RIMs also support the 2 lower-level protocols that handle communication over ARC through resident firmware. Upper-level protocols that handle applications are implemented in the operating systems and application programs running on File and Application Processors, which can include any of a number of Datapoint computers or an IBM PC.

Hubs are coaxial junction boxes that interconnect colocated RIMs and other hubs via coaxial cable to support communication between any 2 network nodes (RIMs). Each hub functions as a network tap and suppresses reflection without signal loss. The distance between any 2 network hubs cannot exceed 2,000 cable feet. Also, communication between any 2 network nodes cannot be routed through more than a maximum cable distance of 4 miles; this is a limitation imposed by propagation delay.

There are 2 types of hubs: active and passive. Active hubs contain a signal amplifier, accommodate 8 RIMs via individual hub ports, and can interconnect with other hubs; see Figure 5. Maximum cable distance between any 2 colocated RIMs is 4 miles. Passive hubs do not contain an amplifier and accommodate a maximum of 4 RIMs; the maximum cable distance between any 2 colocated RIMs must not exceed 200 cable feet. Passive hubs are used to interconnect up to 4 RIMs (nodes) in a simple network; see Figure 6.

Installations that make stringing cable impractical or impossible can use Datapoint's LightLink to extend an ARC network or interconnect 2 or more ARC networks. LightLink units are designed for rooftop or window installations.

■ SOFTWARE

ARC lower-level protocols are implemented through RIM-resident firmware. Software support for ARC Systems and higher-level protocols for ARC runs on the attached File and Application Processors. Both RMS and DOS.D Operating Systems running on File and Application Processors support ARC; see Figure 7. DOS ARC is the modular software that runs under DOS to allow application processors on ARC to share a common database on a File Processor. RMS systems can be system generated to operate as shared resources on ARC. The principle difference between RMS and DOS ARC is that DOS requires a system such as DATASHARE to control and allocate system resources. RMS does not require a system manager. Control of system resources can be distributed among the RMS systems on ARC. CP/M on the 1560 also supports ARC.

With the introduction of Datapoint's new 3200 and 1200 systems as well as attachment of the IBM PC to ARC, the network now supports 4 new operating systems: UNOS (3200), CTOS, and MS-DOS (1200/Vista PC), and PC-DOS (IBM PC). The new 8400 runs under RMS.

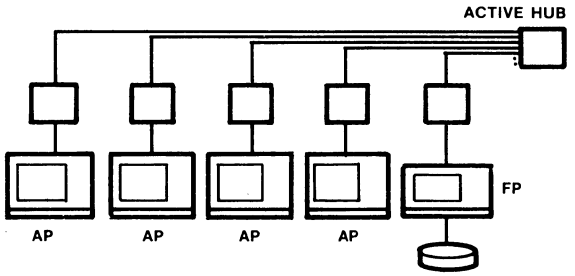


Figure 5 • active hubs amplify, condition, and distribute high-speed data signals over ARC.

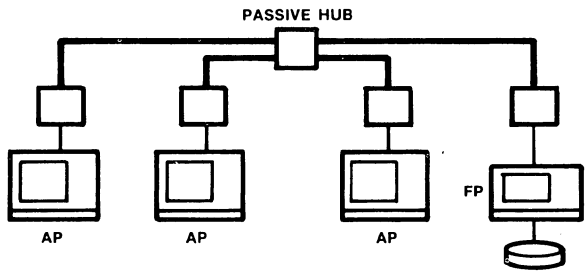


Figure 6 • passive hubs are simple, non-amplifying devices for connecting up to four processors.

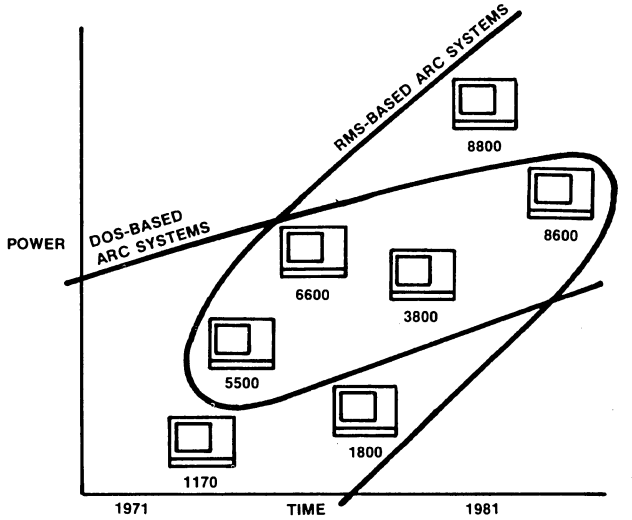


Figure 7 • ARC system software executes on a variety of hardware.

DOS ARC • runs on 6600 and 8600 file processor and supported by DOS operating systems running on any number of application processors connected to ARC • provides full set of commands to control file processor operation.

DOS ARC Boot Tape Writer (ARCBMAKE) • produces a boot tape to load DOS.D and programs in Datapoint 5500 and 6600 processor from an ARC file processor.

DOS ARC Bootstrap (ARCBOOT) • for diskette-based 1100 Series system; allows them to connect to ARC.

DOS ARC Disk Volume Maintenance (ARCID) • allows maintenance of disk volumes managed by ARC file processor.

DOS ARC Disk Volume Automatic Execution Clear (AUTOCLR) • clears automatic execution specified for a user for automatic initialization; clears volume to nonauto-execute condition.

DOS ARC Disk Volume Access (MOUNT) • utility to establish logical connection with disk volume(s) an application processor can access • volumes can reside in from 1 to 31 file processors and the location is transparent to application processor; user types in name and codeword, and ARC software will find the volume.

DOS ARC Disk Volume Write Protection (PROTVOL) • allows user to write-protect any disk volume controlled by a file

Datapoint ARC
Baseband Local Area Network

processor.

DOS ARC File Copy (ARCOPY) • bidirectional file transfer utility for use between ARC system and an alien DOS.

DOS ARC System Statistics (ARCSTAT) • provides detailed statistical data on ARC operations; can be displayed on an application processor's screen or written on disk for later printing; used to optimize ARC performance.

DOS ARC Print Request Queueing (SPOOL) • provides means to load print requests to an ARC UNSPOOL queue.

DOS ARC Print Unspooling (UNSPOOL) • allows deferred printing of standard print files located on a file processor • up to 3 local printers are supported at each site.

Utilities are available to allow RMS and DOS to coreside on ARC. Some software that runs under DOS is not available to run under RMS, thus combined DOS/RMS systems are common.

80953 ARC Software • for 1200; upward compatible, with cluster software that supports up to 1200 systems; designed to allow 1200 systems on ARC to share resources; can attach to RMS system and access RMS resources such as PRO-VISTA modules; can also access such systems as 3200 in RMS environment; easy to use • CTOS only:

$75 lcns

INX-PC Card Support • software to support IBM PCs attachment to ARC; includes DOS S/W to run on the 1590 included with INX-PC:

75

81013 INX-32 Interface • supports the INX-32 adapter; allows 3200 to operate as resource on ARC; supports high-speed file transfers over ARC with RMS systems • UNOS-HOP software also supplied to run on RMS system to allow RMS workstations to access 3200 resources:

500

Conversion Utilities • designed to facilitate transition from DOS to RMS • include GETARC, PUTARC, GETDOS, and PUTDOS; all run under RMS.

DOS ARC to RMS ARC File Transfer (GETARC) • allows user to transfer files controlled by DOS ARC File Processor to an RMS disk; does not compromise DOS ARC security.

RMS ARC to DOS ARC File Transfer (PUTARC) • allows user to transfer an RMS disk to a disk controlled by a DOS ARC File Processor.

DOS to RMS File Transfer (GETDOS) • allows user to transfer local DOS disk files to an RMS disk; DOS disk must be on a drive physically attached to RMS node running GETDOS; RMS disk can be any RMS disk resource.

RMS to DOS File Transfer (PUTDOS) • allows user to copy RMS text files to a DOS disk in DOS format.

Communications Software

Datapoint provides a family of products to allow multiple processors/workstations on ARC to share communication facilities. These include facilities for communicating with remote or local mainframes, other ARCs, remote Datapoint systems running under DATASHARE (a timesharing system), and standalone Datapoint processors. The programs run on an Application Processor (AP) on ARC; the AP is designated as a Communication Processor (CP). The new 1200 and 3200 systems Datapoint has introduced come with a number of data communication packages such as 3270 and 2780/3780 emulation.

ARCGATE Products • provide for communication between ARC and IBM mainframes; products include ACMLU, AC3271B, AP3270, DS3270, DSMLU, and WS3270.

ACMLU • IBM 3270 Emulator runs on a CP on ARC under DOS.D; uses SNA/SDLC line protocol; emulates 3274 SDLC cluster controller, 3776 SDLC batch controller or a combination 3274/3776; as 3274, supports 32 terminals or printers; as 3776, supports RJE site with card reader/punch, printer, and interactive console; as 3274/3776, supports 26 terminals or printers, and 1 RJE site with card reader/punch, printer, and interactive console.

AC3271B • same as ACMLU except it emulates IBM 3271 BSC cluster controller; also runs under DOS.D • supports up to 32 IBM 3277 terminals or IBM 328X printers, number depends on processor model; operates in multipoint configurations over 2-wire or 4-wire leased lines at up to 9600 bps.

AP3270 • designed to execute existing 3270 applications; runs under DOS.D on 1800/3800/8600 processor; emulates IBM 3277/3278 display terminal and 328X printer.

DS3270 • 3270 DATASHARE adjunct to ARCGATE 3270 software to allow Datapoint terminals to emulate basic features of IBM 3277.

WS3270 • runs on any RMS workstation that can run IEOS (Integrated Electronic Office Station) software; emulates all function keys available on 3270.

DSMLU • 3770 DATASHARE adjunct to ACMLU Batch software to allow Datapoint terminals to emulate the basic features of IBM 3776.

Local Connect Products • support channel-attached IBM S/370-compatible mainframes; require the Datapoint Channel Adapter which attaches directly to IBM mainframe byte multiplexer channel; run under the DOS.D or DOS.E operating system.

Channel Input-Output Unit Record Utility (CHIOUR) • provides emulation of up to 16 unit record devices: card readers, card punches, line printers, and 1052 system console • provides operator-controlled utility for fast data transfers between an AP on ARC and mainframe.

Datapoint Attached Support Processor (DASP) • provides for remote batch communication between mainframe and an AP on ARC; includes spooling system, scheduler, message switching system, and communication system.

Direct Channel Interface Option (DCIO) • emulates up to 16 unit record devices; paired to provide 8 input and 8 output files; a card reader, for example, is paired with a card punch or line printer • up to 8 programs on the mainframe can access DCIO concurrently, or a single program can use all 8 pairs concurrently • monitors and logs all disk file activity.

ARCLINK • provides a telephone link over a dial-up or leased line at up to 19.2K bps to a remote ARC File Processor; totally transparent to other application processors on ARC except response is slower; user simply logs on to a disk volume • runs under Datapoint 6000 Application Processor with a 9481 Communication Adapter installed.

MULTILINK • an enhancement of the DATABUS language that includes facilities for concurrent communications; allows communication between a user's DATABUS program and a variety of other computer systems using telecommunication facilities • all programs that run under DATABUS or DATASHARE interpreter will run under MULTILINK interpreter; a MULTILINK system in a network controlled by a host computer has access to its local database, to the host's database; the host can also poll and access other databases on the network, providing access to all data • run under DOS operating system; communication can be either interactive or batch; several program modules or line drivers are available to communicate with other DATASHARE systems, other vendor mainframes, and other networks: Burroughs, IBM, Sperry, Honeywell, and vendors that support TTY, as well as X.25 networks.

DOS Burroughs Newline RJE MULTILINK Interface (MLDC1000) • emulates an RJE station of large-scale Burroughs computers using Burroughs NEWLINE RJE protocol; operates over 2- or 4-wire, leased, or switched line at up to 4800 bps.

DOS DATASHARE-to-DATASHARE MULTILINK Line Driver (MLDSDS) • enables DATASHARE systems to communicate with each other within a multidrop network using standard DATABUS SEND and RECEIVE verbs.

LCNS: one-time license fee; software maintenance is generally included in hardware maintenance. Prices are current as of March 1985.

Datapoint ARC
Baseband Local Area Network

DOS Remote User MULTILINK Driver (MLRUP) • allows DATASHARE system to communicate with DASP (Datapoint Attached Support Processor) system.

DOS MULTILINK SNA Remote Batch Line Handler (MLSNA) • provides access method for DATABUS programs running under DATASHARE to transmit and receive batch data to/from a host operating in an SNA environment; emulates many functions of the IBM 3777 Multiple Logical Unit batch terminal.

DOS Burroughs MULTILINK Interface (MLTC350) • interactive support for synchronous or asynchronous communication with Burroughs mainframe.

DOS SPERRY Uniscope MULTILINK Interface (MLUN200) • external interface for DATASHARE system to communicate with Sperry mainframe using Uniscope line discipline; supports 1 to 4 DATASHARE users communicating synchronously.

DOS Honeywell VIP MULTILINK Interfaces (MLVIP) • external interface for 1 to 4 DATASHARE users to operate in a multipoint environment and communicate with mainframe supporting the Honeywell 7000 Visual Information Projection (VIP) terminals.

DOS MULTILINK X.25 LAPB Driver (MLX25B) • runs on an ARC communication processor; permits access to other processors and terminals on an X.25 packet-switching network from application processors residing on ARC; provides up to 24 logical connections simultaneously through 1 physical connection to the packet network.

DOS IBM 3741 MULTILINK Driver (ML3741) • point-to-point driver that emulates IBM 3741 in nontransparent BSC mode at speeds up to 4800 bps; 1 DATASHARE port configured to control 3741 communication.

DOS IBM 3700 MULTILINK Line Driver (ML3770) • allows MULTILINK to emulate IBM 3770 terminals on multipoint BSC line for communication at up to 9600 bps with IBM system.

DOS 1800 IBM MULTILINK Line Driver (ML377018) • for Datapoint 1800 only; emulates IBM 3770 BSC protocol for communication with an IBM system at up to 4800 bps.

DOS IBM 3780 MULTILINK Driver (ML3780) • emulates IBM 3780 terminals in point-to-point BSC environment for communication with IBM system at up to 4800 bps.

DOS IBM Channel Adapter Interface (MLCI) • provides access method for DATABUS programs running under Datashare to transmit/receive information to/from an IBM S/370 host as if it were a directly connected card reader/punch or printer.

Burroughs Poll/Select Line Handler for DBML15 (ML15TC35) • line handler for use on Datapoint 1500 processor to communicate with Burroughs system using Burroughs Standard Poll/Select protocol.

Teletypewriter Line Handler for DBML15 (ML15TTY) • line handler for Datapoint 1500 processor to communicate with system that supports USASCII teletypewriter protocol.

1500 Honeywell VIP MULTILINK Interface for DBML15 (ML15VIP) • simulates a single Honeywell VIP terminal; interfaces Datapoint 1500 DATABUS interpreter with a Honeywell VIP 7700 system.

DATAPOLL • a series of programs and a protocol designed to collect and distribute files in distributed network; supported on all Datapoint processors except 3200; runs under MS-DOS, CTOS, RMS and DOS; Datapoint provides many DATAPOLL programs for a wide variety of hardware configurations using synchronous or asynchronous communication, leased or switched lines, half- or full-duplex, at data rates up to 4800 bps • DATAPOLL Master allows communication with 1 or more unattended remote Datapoint processors running DATAPOLL Slave program; provide for disk spooling under DOS operating systems.

893 DATAPOLL • implementation of Datapoint's standard communication protocol for data transmissions between Datapoint systems; compatible with other DATAPOLL products; MS-DOS or CTOS:

$300 lcns

REMDOS (Remote DOS) • designed for centralized service and maintenance for slave sites from a master site; allows master console to operate as the slave console for debugging or updating programs; uses a Datapoint synchronous protocol.

Communication Products for 1200 • includes a number of packages for IBM environment and 1 for X.25 environment.

80889 BSC 3270 • allows 1200 to look like 3276 Cluster Controller with 3278 display stations; CTOS only:

500

80890 2780/3780 • allows 1200 to look like 2780/3780 RJE terminal; CTOS only:

300

80901 SNA-PAC • same as BSC 3270 except using SDLC protocol; CTOS only:

600

80902 X.25 Interface • certified by Telenet and Tymnet; provides up to 16 channels; supports data rates up to 9600 bps • CTOS only:

500

80987 2780/3780 Communication • for 3200; allows 3200 to look like 2780/3780 RJE terminal:

200

■ HARDWARE

The ARC hardware consists of RIMs, hubs, cables, and LightLink.

Resource Interface Modules (RIMs)

The RIM functions as the physical and logical interface between the node processor or processor-based peripheral, such as laser printer, and the rest of the network. Communication between the processor and the RIM is on a message basis.

The RIM contains 4 256-byte buffers and the arbitration logic needed to share them among the processor, RIM transmitter, and RIM receiver. The processor writes a message into a RIM buffer when it wants to send a message and assigns a buffer to the RIM receiver when it wants to receive a message.

RIMs are internal to many Datapoint processor models. Some ARC systems can interface to more than 1 ARC network so external RIMs are needed to attach a processor to multiple ARCs.

0740 INX-PC Adapter Card • to attach IBM PC to ARC; includes Datapoint 1590 processor running DOS; includes RIM • annual maintenance:

NA/NA/NA/NA mo	$695 prch	$76 maint

1241 VISTA-PC ARC Module • allows 1200 to operate as VISTA-PC with access to ARC network; includes RIM • annual maintenance:

NA/NA/NA/NA	620	57

3219 INX-32 RIM • for connection of 3200 to ARC; requires INX-32 Interface software:

115/90/80/75	2,000	14

8807 RIM Module • for 8800 only; up to 5 per 8830 and 8840 and 6 per 8860:

79/63/56/53	1,500	15

9421 ARC Interface (RIM) • additional interface for 8600; maximum of 3 per 8605 and 1 per 8602:

60/45/40/40	995	18

9483 RIM Adapter • interfaces node to ARC for 6600:

100/80/70/65	1,650	16

MO: first figure is monthly charge for short-term rental; second is for 1-year lease; third is for 2-year lease; fourth is for 3-year lease. PRCH: purchase price. MAINT: monthly charges for prime-shift maintenance within 50 miles of local service point; annual maintenance is listed for a few items. NA: not available. NC: no charge. Prices are current as of March 1985.

Datapoint ARC
Baseband Local Area Network

Hubs

Hubs are coaxial junction boxes that provide total reflection suppression without signal loss and function as ports into the network. Active hubs also provide signal amplification. Passive hubs can be used only to interconnect up to 4 RIMs (nodes) on a simple network where any 2 RIMs are no more than 200 feet apart.

9484 Active Hub • 8-port model • available as refurbished equipment:

NA/NA/NA/NA mo	$350 prch	$12 maint

9485 Passive Hub • provides 4 ports:

NA/NA/NA/NA	125	NC

9486 8-Port Expander • for 9484:

40/32/27/26	650	5

9489 8-Port Active Hub • nonexpandable:

40/33/29/27	675	8

Fiber-Optic Hub • 3-port: 2 for coaxial cable and 1 for fiber-optic cable; cable length between hubs can be 2,000 feet using coaxial cable and 4,000 feet using fiber-optic cable:

NA/NA/NA/NA	NA	NA

Cable

3460 RG62 Coaxial Cable • requires 3462 connector kit • $1.05 per foot.

3461 Coaxial Cable • 50 feet with connectors:

NA/NA/NA/NA mo	$90 prch	NC maint

3462 Connector Kits • for RG62 coaxial cables:

NA/NA/NA/NA	10	NC

LightLink

LightLink uses modulated noncoherent, infra-red light to communicate between 2 ARCs or to extend an ARC. Information is transmitted between 2 LightLink units located up to 1 mile apart at the same rate as that of the ARC cable, 2.5M bps. The LightLink units are fully weatherproofed and can operate outdoors as well as near adjacent windows for inter-building communications.

9530 LightLink TM Transceiver Pair • 2 units, 1 for each ARC; full-duplex, 2.5M-bps transmission:

$1,350/$1,100/$750/$675 mo	$14,000 prch	$195 maint

9533 LightLink TM Pedestal, Pair • 1 for each transceiver:

80/65/60/55	1,000	NC

9535 Outdoor Kit, Single • for outdoor installation; NC when ordered with 9530:

NC/NC/NC/NC	600	NC

■ SPECIFICATION

ARC uses its own token-passing protocol. The protocol specification is available from Datapoint without license fee.

Packet Format

ARC transmits 5 types of messages: Invitation-to-Transmit, Free Buffer Inquiry, Packet, Acknowledgement (ACK), and Negative Acknowledgement. See Figure 8. Messages can range from 1 to 260 bytes long.

The line idles in a no-signal condition (spacing). Each message begins with an alert burst composed of 6 unit intervals of the mark signal. A mark is a 200-nanosecond wide dipulse: a 100-nanosecond positive pulse followed by a 100-nanosecond negative pulse. The 6-unit mark is then followed by the bytes in a message. Each byte, however, is preceded by a 2-unit interval of the mark signal and a space. Thus, each byte transmitted consists of 11 bits.

Invitation-to-Transmit • consists of Alert Burst followed by 3 characters: ASCII EOT (End of Transmission) characters and 2 Destination Identification (DID) characters • used to pass token from RIM to RIM.

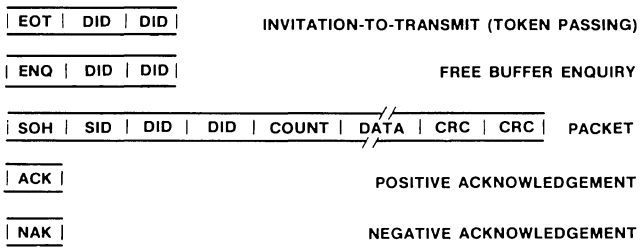


Figure 8 • packet message formats.

Free Buffer Enquiry • consists of an Alert Burst followed by 3 characters: ASCII ENQ (Enquiry) and 2 Destination Identification (DID) characters • requests a RIM to receive a packet.

Packet • consists of Alert Burst followed by ASCII SOH (Start of Header) character, 1 Source Identification (SID) character, 2 Destination Identification (DID) characters (count number of data bytes in message), 1 to 253 bytes of data, and 2 CRC (Cyclic Redundancy Check) characters • used to transmit data between RIMs.

Acknowledgement • consists of an Alert Burst followed by ASCII ACK (Acknowledgement) character • acknowledges packet reception and is a positive response to Free Buffer Enquiry.

Negative Acknowledgement • consists of an Alert Burst followed by ASCII NAK (Negative Acknowledgement) character • negative response to Free Buffer Enquiry • nonvalid data messages are not NAKed, they are merely ignored.

The RIM receiver validates all messages by checking that at least 1 mark and a space precede each character, that a proper ASCII character follows the Alert Burst (EOT, ENQ, SOH, ACK, NAK), that CRC is correct, that message contains the proper number of characters (1, 3, or 8 to 260), and that at least 9 spaces follow the last character.

Transmission Characteristics

Channel Encoding • uses a 200-nanosecond dipulse as a mark: 100-nanosecond positive pulse followed by 100-nanosecond negative pulse • a space transmits no energy thus there is virtually no intersymbol interference • all messages are preceded by an alert signal which consists of 6 marks • all bytes (characters or information) are preceded by 2 marks and a space.

Data Rate • 2.5M bps or 400 nanoseconds per bit • system throughput is a function of the number of active RIMs (nodes) on the network, the number of RIMs that have messages to pass each time the token passes, and the length of the messages transmitted (ARC protocol passes tokens only to active RIMs (nodes) ignoring propagation delay) • a simple token pass requires 28 microseconds; a message takes 113 microseconds plus 4.4 microseconds per byte of data; thus a message followed by a token pass requires 141 microseconds plus 4.4 microseconds per byte of data transmitted • total time required for a token to circulate an ARC is 28 microseconds per active RIM (for token pass) plus 113 microseconds per message (waiting to be sent) plus 4.4 microseconds per message byte • ARC requires 280 microseconds to circulate the token through a network with 10 active RIMs with **no** messages ready for transmission; 1 RIM has a 100-byte message to send each time the token is circulated, the token requires 833 microseconds to circulate through the network; this is equivalent to a throughput rate of 1200 messages per second (123,000 bytes per second or 984K bps) • if all 10 active RIMs have 100-byte messages to send each time the token is circulated, it requires 5810 microseconds to circulate the token and transmit the 10 100 byte messages; for this example, the throughput rate is 1720 messages per second, equivalent to 172,000 bytes per second or about 1.4M bps.

Carrier • generated by presence of activity on cable; idle state generates no carrier signal on line.

Topology • physical bus with star clusters around each hub; see

Datapoint ARC
Baseband Local Area Network

Figure 9; logical ring with respect to network addressing • node addresses are 1 through 255; each node initializes to address of node with next higher address; address "0" broadcasts messages to all nodes; addressing is independent of physical location on bus • each node must be able to sense all other nodes and there must be only 1 path between 2 nodes • signals must be able to pass between any 2 nodes in 31 microseconds or less, which limits physical cable length to 4 miles • distance between active hubs is limited to 2,000 feet; using coaxial cable but is extended to 4,000 feet using fiber-optic cable; end-to-end transmission can traverse up to 10 hubs.

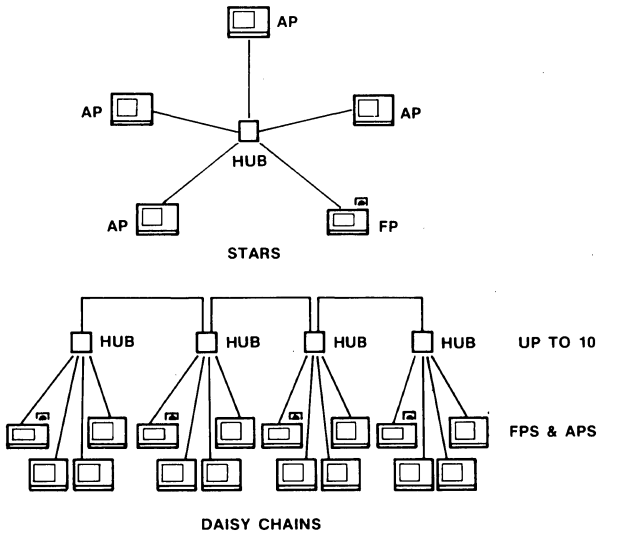


Figure 9 • ARC topology combines physical star and bus with logical ring addressing.

Control Procedures

Control procedures follow the token-passing scheme to control accesses to the channel from the up to 255 RIMs (nodes) that can be connected to the cable. Only 1 station can transmit at a time, thus before transmission, a station must determine if the channel is free. This is performed by the station by waiting until it receives an "Invitation-to-Transmit" message containing its address. This is the token-passing message.

If the addressed station has a message to transmit, it first sends an Enquiry to the station that is to receive its message, asking if it has free buffer space available. If the receiving station does have free buffer space, it replies with an "ACK" message. If it has no buffer space available, the receiving station returns a "NAK" message.

When the station that has control of the line (the token) receives an "ACK," it immediately sends its message to the appropriate station and waits for an "ACK" message, indicating the transmission was successfully received. The station then sends an Invitation-to-Transmit to the node with the next address (NID of next active node) higher than its own.

The station that has control of the line (the token) can receive a "NAK" in response to its Enquiry of the station that is to receive the message (packet) meaning the station has no free buffer space. When this happens, the sending station retains the message (packet) until the tokens next pass around the network and tries to send the packet again.

If the packet when it arrives at the receiving station is in error—fails CRC test, number of bytes in message, number of marks and spaces between characters, and so on—the receiving station ignores it. When the sending station does not receive an ACK in response to its packet, the sending station retains the packet until the token is passed around again. Then it transmits the packet again. The sending station waits up to 74 microseconds for an ACK before it passes the token to the next node.

If a station that has the token wishes to broadcast a message, it uses address "0." It does not send out an Enquiry prior to the message but simply sends the message. Each node set to receive broadcast messages write the message in its receive buffer. Broadcast messages are not ACKed.

The next address (NID) for token passing is not necessarily only 1 higher than that of the station passing the token. It is the address of the last node to which the station passed the token. If a station passing the token does not hear activity on the line within 74 microseconds after sending the Invitation-to-Transmit, the station increases its NID counter by 1 and passes the token again. This continues until the token is passed to an active node. This arrangement allows nodes to go off-line without requiring a system reconfiguration and increases line efficiency by not passing tokens to inactive nodes. This arrangement also means that nodes must explicitly register as being online. When the token is lost or a node comes online, the system must be reconfigured.

All RIMs in the system are constantly monitoring the line for activity. If any RIM sees the line idle for more than 78 microseconds, it initializes an internal reconfiguration sequence. It first sets its Network Identification (NID) counter to its own address (ID) and then begins a time-out equal to 146 microseconds x (255-ID). The RIM with the highest ID times out first and sends an Invitation-to-Transmit to itself; this activity on the line causes all other RIMs to abort their time-out sequences. The transmitting RIM waits 74 microseconds for a response to the message that it sent to itself, hears nothing, and increments its NID counter. It sends another Invitation-to-Transmit and waits. If it hears activity within the 74 microseconds, it relinquishes control of the line. If it hears no activity within the 74 microseconds, the process of incrementing its NID, transmitting, and waiting is repeated until it finally hears a response. Each RIM in the system in turn searches out the next RIM in the sequence until the system is fully configured.

When a RIM is first powered on or does not receive an Invitation-to-Transmit for 840 milliseconds, it transmits a Reconfiguration Burst. This burst consists of 8 marks and 1 space repeated 765 times; its duration is longer than any other type of transmission, and it will overlay the next Invitation-to-Transmit from the RIM currently controlling the network. The next RIM which should receive control will hear incoherent data and will not know that it should accept control of the line. The RIM transmitting the Invitation-to-Transmit will interpret the activity generated by the reconfiguration burst as a sign that the RIM to which it was attempting to pass control has indeed accepted control of the line, thus it will relinquish control of the line. At this point, no RIM has control, and the line will remain idle for 78 microseconds. The configuration sequence described in the previous paragraph will occur; only this time the new RIM will be configured into the system.

This configuration process, in which each RIM in the system detects and remembers the next active RIM, is one of the contributing factors to the ARC protocol efficiency.

Token Passing • Invitation-to-Transmit message to NID (next active node); node receiving message has token and is free to transmit.

Enquiry • before transmission, sending station insures that receiving station has buffer space to receive packet of data • receiving station returns ACK or NAK response; sending station waits for its next turn for transmission if it receives NAK.

Packet Transmission • after receiving an ACK, meaning buffer space available, sending station transmits data packet • if packet received without error, receiving station returns ACK response; if packet received with error, receiving station ignores it • sending station waits for its next turn to retransmit packet.

Broadcast Transmission • skip Enquiry and transmit message with address "0" and all nodes set to receive broadcast messages write it in their buffers; never ACKed by receiving nodes.

Datapoint ARC
Baseband Local Area Network

System Reconfiguration • when token is lost new node comes online; establishes token-passing sequence for all active nodes on the network • occurs when RIM (node) has not received token for 840 milliseconds, meaning token is lost or node has just been switched online.

Transmission Medium

ARC uses low capacitance RG62 coaxial cable. Taps to cable are through ports on an active or passive hub. Connecting cables between hub and RIM that interfaces nodes to ARC can be any length up to 2,000 feet for active hubs. Small ARCs composed of 4 RIMs (nodes) can be interconnected through a passive hub; distance between RIMs limited to 200 feet. Fiber-optic cable can be used to interconnect hubs and distance between hubs can be increased to 4,000 feet.

Use

ARC is integral to Datapoint's distributed processing philosophy for its office automation products. ARC systems composed of File and Application Processors interconnected by ARC provide the higher-level protocols, and system software to implement applications. The system software makes the location of a shared resource transparent to the user; even to the extent that a resource may be remotely located on another ARC system.

• END

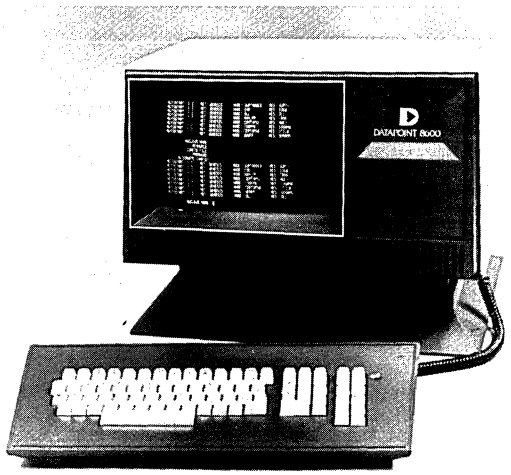
Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

■ PROFILE

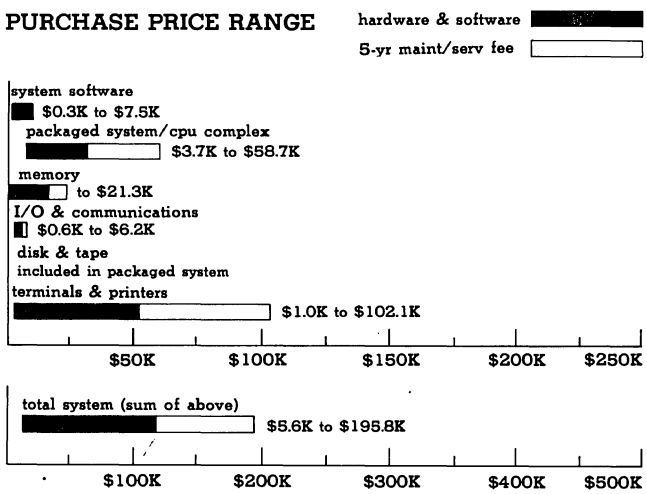
Function • operate primarily as a file or applications processor member in distributed processing systems on ARC; can also function in standalone processing environments with remote communication to mainframe systems and other ARC systems.

Architectures Supported • ARC • emulate IBM terminals for communication with IBM host and IBM unit record equipment for attachment to IBM byte multiplexer channel • emulate Burroughs, CDC, Sperry, and Teletype terminal protocols for communication with other vendors' systems • can interface to X.25 packet-switched networks • provides emulation of Datapoint 8220 for IBM PCs.

Communications • CTOS, MS-DOS, PC-DOS, UNOS, RMS, DOS ARC, and CP/M support ARC and can coreside on 1 network • ARCGATE provides interface between ARC systems and IBM mainframes; supports SDLC, emulates 3274 controller, 3776 RJE, 3271 BSC; multipoint configurations; half-/full-duplex at up to 9600 bps • ARCLINK provides telephone link at up to 19.2K bps over leased or dial-up line to remote ARC File Processor from Application Processor on ARC • MULTILINK supports Burroughs NEWLINE RJE and poll/select protocols; also supports CDC, Sperry, Honeywell, IBM, Teletype, and X.25 protocols • DATAPOLL provides for collection and distribution of files in network using synchronous/asynchronous communications at data rates up to 4800 bps • REMDOS supports centralized service and maintenance to remote systems • 1200 supports SDLC/BSC 3270, 2780/3780 RJE SDLC/BSC and X.25 under CTOS; 3200 supports 2780/3780 RJE under UNOS.



PURCHASE PRICE RANGE



DATAPOINT ARC SYSTEMS PURCHASE PRICING bar graphs cover price ranges between a small 1200 system (VISTA-PC) on ARC and a large 3200 System for hardware and software (solid bars) and for associated 5-year period maintenance fees • **SMALL SYSTEM** includes a 1211 80186 Processor with 256K-byte memory and dual 630K-byte diskette drive; optional features include a 1225 Monochrome Monitor, a 1241 VISTA-PC ARC module, a 1258 160-cps, 80-column printer, and CTOS, ARC support, and Databus Interpreter software • **LARGE SYSTEM** includes a 3250 Double Module system with 1M-byte parity memory, 12 serial ports, a parallel port, a 152M-byte disk with backup tape, 2 enclosures, and double stand; options include five 3215 1M-byte memory modes, an INX-32 RIM, a 2780/3780 adapter, 3210 and 3211 serial port modules (8 ports each), 25 8220 Ergonomic terminals, three 8230 Ergonomic terminals with printer ports, a 9258 Printer (attached to system on ARC), and three 9623 160-cps Matrix Printers; software includes UNOS operating system, UNOS Tools, C language compiler, INFORMIX database management system with MAP interface, MAP, Databus interpreter, 2780/3780 communications, INX-32 communications support for INX-32 interfaces to ARC, LEX with MAP interface, and Multiplan.

Operating Systems • DOS dual-tasking operating system runs on 1500, 4000, 6000, and 8600, and is limited to Application Processor support of 8600 systems configured in ARC networks • RMS operating system runs on 4000, 6000, 8600, and 8800, providing generalized multitasking expanded file management resource sharing, and system/network security features • industry-standard CP/M operating system runs on 1560 only; CTOS and MS-DOS run on 1200 Series, UNOS runs on 3200 only, and PC-DOS runs on IBM PCs connected to ARC.

Database Management • utilities available for file generation and manipulation • sequential, indexed-sequential, and random file access; hierarchical file structures • INFORMIX relational DBMS available on 3200.

Transaction Processing Management • through DATABUS interpreter or DATASHARE, which allows up to 24 users to access DATABUS interpreter; runs under DOS or RMS • DATAFORM provides forms generation and runtime executive for data entry applications • ARC software modules reside in the Datapoint operating systems and direct file requests to file processors or to shared resources, both on ARC; shared resources include printers, communications processors, and facsimile units as well as disk storage; RMS, DOS, UNOS, and CTOS systems can support shared resources.

Support Software • program development using DATABUS, DATASHARE (multiuser DATABUS), COBOL, RPG, and CHAIN (command language) under DOS and RMS • BASIC as standalone system • BASICPLUS, RPG PLUS, FORTRAN, SCRIBE (text processing), assembler, DATAFORM (data entry interpreter); MULTIFORM (multiuser DATAFORM) and MULTILINK (extension to DATABUS allowing concurrent communications) available under DOS • languages available for standard CP/M operating system • ARC software supports concurrent support for RMS, DOS, and CP/M on same ARC • 1200 languages include BASIC, COBOL, FORTRAN, and Pascal; 3200 supported by C language.

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

Processors • 1560 on Z80A • 6600 and 8600 based on a Datapoint 8-bit word microprocessor • 8400 based on Intel 80286, 8800 based on the Z8000, a 16-bit word microprocessor • 1200 based on Convergent Technology N-GEN • 3200 based on Charles River Data Systems Universe Systems • IBM PC, PC/XT, PC/AT.

Memory • 1560 (64K/128K bytes) • 6600 (64K/128K/256K bytes) • 8600 (128K/256K bytes) • 8400 (512K to 1M bytes), 8800 (256K to 1M bytes in 128K-byte increments) • 1200 (256K to 1M bytes) • 3200 (1M to 8M bytes).

Disk • 1560 (1.0M/1.5M/2.0M/3.0M bytes diskette and 5M/10M bytes nonremovable disk) • 6600 (20M-/40M-byte half fixed/half removable disk and 120M/180M/240M-byte storage system) • 8600 (1.0M-byte diskette, 10M-byte cartridge, and 20M- to 100M-byte nonremovable disk with 20M-byte cartridge tape for backup) • 8800 (135M/270M/540M/810M/1080M-byte nonremovable disk and 67M/134M/201M/268M-byte removable disk) • 1200 (1.2M/10M/20M bytes); 3200 (152M bytes).

Terminals/Workstations • 1560 (up to 3 and console) • 6600 (up to 24 local/remote and console) • 8400 (up to 8), 8600 (up to 12 local/2 remote, and console) • 8800 (up to 24 local/remote and console) • 1200 (single user system) • 3200 (28).

Printers • local terminal connections can be used for workstations or printers • serial character printer (35 cps, letter quality) • serial/parallel matrix printers (160 cps) • serial/parallel belt printers (230/340 lpm) • drum printers (900 lpm) • parallel band printers (300/600 lpm) • laser printer (about 1300 lpm) used as resource on ARC • 1200 supports 35-cps letter-quality printer or 1600-cps matrix printer.

First Delivery • 1560 (1982) • 6600 (1976) • 8400 (1984) • 8600 (1981) • 8800 (1981) • 1200 and 3200 (1984 by Datapoint).

Systems Delivered • over 6,000 ARC networks are installed worldwide, over 4,000 in the U.S.

Comparable Systems • Datapoint systems are unique in that they are designed for a distributed system environment although they can operate standalone; all can reside amicably and cooperatively on ARC and share resources; Burroughs B 25 also based on Convergent Technology NGEN, thus comparable to 1200 Series • 1560 comparable to Digital Equipment PDP-11/23 system, and Rainbow Personal Computer; IBM Personal Computer; Hewlett-Packard HP 125, HP 150, and HP 250; and Wang word processing and office systems • 6600 and 8600, comparable to MAI Basic Four, Four-Phase, IBM S/36 DEC PDP-11 low-end RSX-11M systems, and Wang 2200 systems • 8400 comparable to IBM S/36, 3200 comparable to VAX-11/780 • 8800 comparable to Burroughs B 900, IBM S/38, Wang VS/100, and Digital Equipment larger PDP-11 RSX-11 systems.

Vendor • Datapoint Corporation; 9725 Datapoint Drive, San Antonio, TX 78284 • 512-699-7542.

Canadian Headquarters • Datapoint Canada, Inc; 4881 Yonge Street, Suite 700, Willowdale, ON M2N 5X3 • 416-222-8005.

GSA • yes.

Distribution • nationwide through 64 direct sales and service offices; internationally subsidiaries in 14 countries and distributors throughout the world.

■ ANALYSIS

Datapoint ARC systems started out as a means to supplement the processing power of the Datapoint intelligent terminals/small business computers. They have grown into a comprehensive distributed processing environment interconnected inhouse with ARC network and communicating with remote sites through dedicated communication processors. For a time, Datapoint increased ARC systems capability for the integrated office environment at a furious pace. Rising revenues accompanied Datapoint's increased product enhancements in 1982 until it was revealed that the company had inflated earnings with early shipments of orders. Profits plummeted due to the restatement of earnings. During most of 1983, Datapoint operated in recovery mode, trying to restore confidence in the company and its products.

The company got out of the PBX business by selling its Communications Management Division to **Teknekron Industries, Inc in June 1983**.

Also, during 1983, Datapoint began to clean up its product lines and eliminated products with little differentiation one to another; it dropped the 1800, 3000, and 4000 Series, keeping only the 1560, 6600, 8600, and 8800 Series.

Unfortunately, 1984 did not bring Datapoint's problems to an end. Currently, the company is fighting an unfriendly takeover bid. Datapoint appears to be successfully defending itself, but the continued unstable situation is certainly not good for the company.

Despite its troubles, the company introduced many new products in 1984 to modernize its distributed processing line. It produced the PRO-VISTA automated office software that runs under RMS on ARC. The PRO-VISTA software provides a new user interface into ARC. Datapoint is standardizing on this user interface.

Datapoint introduced 2 new PRO-VISTA workstations to go along with the software. VISTA-PC (1200 Series) is based on the Convergent Technology N-GEN. The VISTA-84 is based on the Intel 80286 and was developed inhouse. The VISTA-PC (1200 Series) can operate standalone, as a clustered system with 5 VISTA-PCs sharing the resources of a master VISTA-PC, or as a workstation on ARC. The VISTA-84 can connect directly to ARC and supports up to 8 VISTA-82 workstations.

Datapoint also added the 3200 Series, which can operate as standalone systems or as resource processors on ARC. The 3200 Series is based on the Charles River Data Systems Universe Series. These are 32-bit Supermini processors with a performance rating in the 1 MIPS range. The 3200 Series runs under the UNOS operating systems, a UNIX look-alike, and provides the Informix relational database management system.

The 3200 Series connects to ARC through an INX-32 Adapter that allows RMS Workstations on ARC to emulate UNOS terminals. The 3200 supports up to 28 terminals. Thus, the 3200 offers a number of firsts for Datapoint: the first 32-bit processor, first 1 MIPS processor, first database management system, and first system to support as many as 28 terminals.

In addition, Datapoint has developed an INX-PC adapter to allow IBM PCs, PC/XTs, and PC/ATs to interface to ARC. The INX-PC interface includes a 1569 processor running the DOS software.

All of these additions means ARC now supports 7 operating systems including Datapoint RMS and DOS on 6000 and 8000 Series; CP/M on 1560; Convergent Technology CTOS and MS-DOS on 1200 Series; Charles River Data Systems UNOS on 3200 Series; and IBM PC-DOS on the IBM PCs.

Datapoint has brought all these systems together through developing some standard Datapoint products such as DATAPOLL and DATABUS for the 3200 and 1200 Series, by providing emulation of RMS terminals for accessing the 3200, and by providing interfaces to ARC for the 1200 and the IBM PCs.

The current product line is versatile and flexible, with a broad range of products. Although a 1-MIPS processor is not considered very powerful as a standalone unit, it is quite powerful for the distributed processing environment of ARC where any number of systems can offer resources to be shared by the workstations connected to the network.

Primarily, the reason all these systems can operate together amicably on ARC is that Datapoint has implemented its "dispersed processing" architecture in a relatively simple way. Systems are specialized and operate as application or resource processors. Furthermore, Datapoint has been operating in the dispersed processing mode for about 10 years, and the company knows how to integrate different systems together into a total environment.

□ Strengths

Datapoint's greatest strength is the company's long experience in providing a workable dispersed processing environment. The

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

new products Datapoint introduced in 1984 have modernized its offerings for today's office. The PRO-VISTA interface has been designed for the office worker; it does not require an EDP professional to use it. The 1200 is based on a workstation design that has proved very popular. The 3200 adds power, a relational database, a UNIX-like operating system, and support for up to 28 workstations.

Adding support for IBM PCs allows Datapoint customers to tie their IBM PCs together on ARC as well as to access Datapoint resources from the PC. This facility should broaden the market for Datapoint's products considerably.

No vendor in the local area network business has had more experience than Datapoint. Until the past year, however, ARC was used primarily to tie Datapoint systems together. Now, Datapoint has opened up its architecture, making it more general purpose for a multivendor environment, specifically for IBM and Datapoint.

☐ Limitations

Datapoint's greatest weakness is the uncertainty of its management. Hopefully, the situation will stabilize and allow the company to concentrate on its products and its competitors. The Datapoint product strategy in the past year has been to offer a well-rounded line for the office environment. The company needs time to continue its integration of the new products now being offered.

■ COMMUNICATIONS FACILITIES OVERVIEW

☐ Distributed Communications

An ARC system processor provides communications to support its application programs only. When connected to ARC, the processor can use the communication facilities implemented on a shared resource processor. An ARC system can have a number of communication processors that support different facilities shared by the other Processors on ARC.

Most Datapoint communication facilities can operate in both the standalone and ARC environment. All Datapoint computer systems can connect to ARC through a Resource Interface Module (RIM) or through an interface adapter that contains a RIM. The RMS operating system includes the imbedded software modules required for the system to allocate resources to users accessing the system through ARC. The CP/M operating system, which runs on the 1560 only, also has imbedded software modules for interfacing with ARC. DOS requires the addition of DOS ARC modules running on a File Processor to allow allocation of resources to systems connected to ARC.

The INX-32 adapter interfaces the 3200 Series systems to ARC. In addition, it allows RMS workstations on ARC to emulate UNOS terminals on the 3200. Thus, the 3200 can operate as a shared resource system on ARC.

The INX-PC adapter interfaces the IBM PC (including AT and XT) to ARC. The adapter plugs into the IBM PC. INX-PC includes a Datapoint 1590 processor and RIM adapter so the IBM PC can access and share ARC resources. The 1590 runs under DOS.

The 1200 Series connects to ARC through an ARC module that includes a RIM. ARC is supported by a separate software module running under CTOS. Also, the 1200 can connect to a Datapoint processor and emulate an 8220 terminal. The 8220 Emulation package runs under both CTOS and MS-DOS.

☐ Distributed Configurations

The main components of ARC systems are Application and Resource Processors with attached terminals/workstations. All processors can operate in standalone mode or can be a member of an ARC network.

Datapoint offers 7 processors for ARC configurations: 1200, 1560, 3200, 6600, 8400, 8600, and 8800. The 3200, 6600, 8600, and 8800 can function as either an Application or Resource Processor under ARC, or they can operate as standalone units. The 1560 also operates as an Application or Resource Processor on an ARC system interconnecting 1560s, or it can function in a standalone environment or as an Application Processor on ARC with other Datapoint processors.

The 1200 can also operate as an Application or Resource processor on a network of up to 6 systems: 5 can operate as application processors while another can operate as the resource processor. It can also function in standalone mode or as an Application Processor (workstation) on ARC.

In addition, IBM PC can also attach to ARC as Application Processors and access and share ARC resources.

The number of terminals/workstations that can be configured under ARC depends on the applications being run, and on whether other ARCs are being linked together. Most standalone ARCs use at least 1 Resource Processor for each 5 to 18 Application Processors. A fully loaded ARC can include 23 Resource Processors and 230 Application Processors, and an Application Processor can accommodate up to 28 terminals for a total of 6,440 terminals on a single ARC. If more terminals are required, additional ARCs can be linked locally through LightLink or remotely through gateway communications.

The smallest Datapoint system configuration can function as a workstation. Under DATASHARE, systems can support from 4 to 24 users running data-entry applications and sharing a DATABUS interpreter. Under RMS operating system, up to 24 users can share system resources in a multitasking, multiprogramming environment. Under UTOS, the 3200 can support up to 28 terminals; these terminals can access only the local resources of the 3200. The 8400 can attach up to eight 8220 terminals. Thus, an ARC system can consist of a wide variety of attached workstations/processors.

☐ Distributed Communications Utilities

Datapoint provides 4 broad classes of communication products: ARCGATE, ARCLINK, DATAPOLL, and MULTILINK. ARCGATE products allow ARC processors to communicate with a mainframe computer through terminal emulation or channel attachment. ARCLINK provides facility for processors on ARC to communicate with a remote Resource Processor on another ARC. DATAPOLL allows Datapoint processors to communicate with each other in master/slave mode for file collection and distribution. MUTLILINK is an enhancement to the DATABUS language and interpreter to provide facilities for concurrent communication with program execution. The MULTILINK modules are basically line drivers implementing various protocols for DATABUS language extensions.

■ SOFTWARE

☐ Terms & Support

Terms • most system software for the Datapoint systems is free when ordered at the same time as the processor; notable exceptions are the software packages supplied with the 1200 and 3200 systems • without a hardware order, it is available for a nominal one-time license fee, such as $1,500 for each DOS, RMS, BASICPLS, FORTRAN, or EM3270 • IEOS software is an exception; there is no charge for it at any time, whether ordered with a processor or not • a media charge is made for all supported software; monthly maintenance fee is $10 for each DOS and $20 for each RMS product • the monthly maintenance fee per software product entitles the user to all updates; updates for DOS are not automatic, the user must order them; the updates for RMS are automatic • CP/M software has an initial license fee and a media charge • Datapoint charges for the 1200 and 3200 software.

Support • for most Datapoint products, it is bundled with purchase of hardware; support contract customized to user needs; local systems engineers are backed up by software support teams at the regional and headquarters levels; fixes are made to software as quickly as possible, but no specific response times are guaranteed • 1200 maintenance is unbundled and on an annual basis.

☐ Operating Systems

Datapoint supports 7 operating systems: CTOS, UNOS, CP/M, PC-DOS, and MS-DOS on ARC in addition to the standard

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

Datapoint DOS and RMS. CTOS (Convergent Technology Operating System) that runs on the 1200 Series should not be confused with the old Datapoint CTOS that ran on the old 2200 and 5500 systems. MS-DOS also runs on the 1200 Series. UNOS (a UNIX look-alike) runs on the 3200 Series that is based on the Charles River Data Systems Universe Systems. PC-DOS runs on IBM PCs. CP/M runs only on the 1560. DOS runs on all Datapoint systems except the 8800. RMS runs on all processors except the 1560 models. REMDOS is a variation on DOS that provides remote diagnostic capability to allow for central site service and maintenance.

The Datapoint CP/M is an enhanced version of the standard CP/M operating system, and can coreside with DOS and RMS systems on ARC. Each operating system must have its own disk for file storage because the data formats differ. Software modules are currently available to convert files between RMS and DOS systems. No conversion programs are available to allow files to be transferred between CP/M and DOS or RMS systems.

DOS is basically a single-tasking operating system made up of a number of software modules which perform various functions. A second task-handling capability is optional. DOS requires another subsystem such as DATASHARE or MULTIFORM to allocate shared resources. DATASHARE, a timesharing executive that runs under DOS or RMS, allows from 4 to 24 users to share a DATABUS interpreter.

RMS is a true multitasking, multiprogramming operating system that can allocate shared resources. The limitation on the number of users is due to the physical limitations of the processor, such as memory size and number of connections for terminals. RMS also provides extensive security features to ensure program security and data integrity.

CTOS (Convergent Technology Operating System)

CTOS, the operating system for the 1200 (VISTA-PC), is a real-time multitasking system. The context manager can load up to 10 jobs at runtime and run all 10 simultaneously. The user can move from job to job while other jobs continue to execute. Multiple jobs can go down to the record level for file sharing. CTOS supports a wide range of programs. CTOS file structure is supported on ARC and CTOS files can be interchanged with UNOS and RMS files.

80999 CTOS for Disk Systems • for 1200 only:
$210 lcns

81000 CTOS for Diskette Systems • for 1200 only:
110

80880 EM 8220 • allows 1200 to emulate Datapoint 8220 terminal, which is supported by both the DOS and RMS operating environments • supported by CTOS and MS-DOS:
175

80881 Color PAC • combined package of Word Processing, Multiplan, Business Graphics, and Context Manager • runs under CTOS only:
700

80883 Cluster-PAC • supports the clustering of six 1200s with one 1200 with a hard disk operating as a master; the 1200s are daisychained together; allow sharing of disk, printer, and communication lines • runs under CTOS only:
600

80884 Word Processing • included in 80881; CTOS only:
450

80885 Multiplan • included in 80881; CTOS only:
250

80886 Business Graphics • included in 80881; CTOS only:
200

80887 Context Manager • allows up to 10 jobs to run simultaneously; CTOS only:
350

80889 BSC 3270 • allows 1200 to look like 3276 Cluster Controller with 3278 display stations; CTOS only:
500

80890 2780/3780 • allows 1200 to look like 2780/3780 RJE terminal; CTOS only:
300

80893 DATAPOLL • implementation of Datapoint's standard communication protocol for data transmissions between Datapoint systems; compatible with other Datapoll products; MS-DOS or CTOS:
300

80894 Systems-PAC • software development package; CTOS only:
700

80895 DBMS Runtime • user can integrate as DBMS in COBOL programs; CTOS only:
900

80897 Basic Compiler • CTOS only:
300

80898 COBOL Compiler • CTOS only:
900

80899 FORTRAN Compiler • CTOS only:
350

80900 Pascal Compiler • CTOS only:
300

80901 SNA-PAC • same as BSC 3270 except using SDLC protocol; CTOS only:
600

80902 X.25 Interface • certified by Telenet and Tymnet; provides up to 16 channels; supports data rate up to 9600 bps • CTOS only:
500

80905 R:Base 4000 • single user DBMS; CTOS only:
495

80906 R:Base 6000 • multiuser DBMS; for use when 1200s are clustered for resource sharing; CTOS only:
1,900

80953 ARC Software • upward-compatible with cluster software that supports 1200 clusters; designed to allow 1200 systems on ARC to share resources; can attach to RMS system and access RMS resources such as PRO-VISTA modules; can also access such systems as 3200 in RMS environment; easy to use • includes User's Guide; CTOS only:
75

MS-DOS

Standard MS-DOS operating system that runs on the 1200 Series.

80998 MS-DOS • with GW BASIC; supports some of the same programs as CTOS: 80880 EM 8220, and 80893 DATAPOLL are described under CTOS section • for 1200 only:
$65 lcns

80892 Databus for Developers • compiler with other tools for program development; compatible wtih other Datapoint Databus products; MS-DOS only:
450

80896 MS-DOS Programmers Utilities • for MS-DOS only:
75

80908 Lotus 1-2-3 • standard package for MS-DOS only:
495

80926 Databus Interpreter • compatible with other Datapoint Databus packages; for MS-DOS only:
100

LCNS: license fee (one-time charge), most software bundled in system price. Prices current as of March 1985.

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

UNOS (A UNIX look-alike)

UNOS is a multiuser, multitasking, timesharing operating system that supports Informix relational database management system in addition to RM/COBOL, C, and Databus development languages. Databus is the Datapoint Business Language. UNOS supports the 3200 in standalone mode or as a resource processor on ARC.

Support for ARC requires the INX-32 Adapter, which allows RMS terminals to emulate UNOS terminals.

80975 UNOS • for 3200 only:

$1,000 lcns

80988 UNOS Tools • for 3200 only:

500

80974 C Language Compiler • for 3200 only:

950

80976 MAP • for 3200 only:

500

80977 LEX with MAP Interface • for 3200 only:

900

80978 LEX • a full-featured word processing package; menu-driven with extensive help facilities:

750

80979 MULTIPLAN • high-performance spreadsheet:

350

80980 INFORMIX with MAP Interface • for 3200 only:

1,100

80981 INFORMIX • relational database management system:

950

80982 RM COBOL • for 3200 only:

950

80983 DATABUS • Datapoint Business Language; for 3200 only:

1,500

80987 2780/3780 Communication • for 3200 only:

200

81013 INX-32 Interface • supports the INX-32 Adapter; allows 3200 to operate as resource on ARC; supports high-speed file transfers over ARC with RMS systems • UNOS-HOP software also supplied to run on RMS system to allow RMS workstations to access 3200 resources:

500

PC-DOS

PC-DOS runs only on the IBM PCs connected to ARC.

RMS Features Versus DOS

Multitasking • RMS provides multitasking for however many users can be attached • DOS is a basic single-tasking operating system, with optional dual-tasking (shared Databus interpreter foreground) • an RMS processor can simultaneously be both a file-server (Resource Processor) and Application Processor on ARC • a DOS processor can be one or the other on ARC.

Virtual Processing Resource • RMS enables a nonintelligent 8200 terminal to appear intelligent (a processing resource) to a user • DOS cannot.

Resource Sharing • RMS provides total generalized disk and communications sharing on ARC, and printer sharing/spooling under direct user control • DOS provides limited disk/communications sharing on ARC, and spooled 3270 communications.

Operations on Files • RMS permits an operation to be applied to a generic set of files • DOS does not.

File Capacity • under RMS, the only practical limit on size/number of files is the physical disk space available • under DOS, the largest disk file is limited to 10.5M bytes, and a logical volume can contain only up to 256 files • RMS permits 10,000 files on a disk, which for practical purposes is no limit.

File Compression • RMS has space and digit compression • DOS has only space compression.

Security Features • RMS has a tree-structure of "catalogs" defining a user's area of access • user passwords and/or commands can be required for catalog and/or file-level access, at any user privilege level • standalone DOS has user-level security at the application level, but any user at the system console has total power • DOS ARC implements user passwords.

Languages/Word Processing • COBOL, CHAIN, and IEOS Word Processing are all enhanced under RMS over DOS versions.

CP/M • enhanced version of the standard CP/M operating system; Datapoint offers WordStar, SpellStar, and MailMerge to run under CP/M • requires 1500 processor; can coreside with DOS and RMS systems on ARC:

$395 lcns

Disk Operating System (DOS)

Three versions of DOS are currently offered although 7 versions are supported. DOS.A, B, and C are for Datapoint 1100 or 2200 processors no longer marketed. DOS.D runs on all ARC processors except 1560 and 8800 and supports 9370 mass storage devices, and 9374 disk cartridges. DOS.E runs on 5500 or 6600 processors and supports 9350 disk cartridges. DOS.G runs on 1800 (no longer marketed) and supports diskette drives. DOS.H runs on a 1560 processor and supports integral dual diskettes.

DOS.D • mass storage disk operating system that is essentially identical to DOS.G except that DOS.D is supported on ARC system; will operate in conjunction with two to eight 9370 series disk drives; supports the Partition Supervisor (released separately); supports up to 160M-byte (of 20M-byte cartridge) or 180M-byte (of 60M-byte disk pack) disk on 6600 systems; supports up to 40M-byte (of 10M-byte cartridge) or 100M-byte (of 20M-byte nonremovable) disk on 8600 systems (standalone), or 8600 systems without disk as ARC Applications Processor.

DOS.E • requires 5500 or 6600 processor with 48K memory and up to four 9350 cartridge disks with 4K controller • does not support ARC, otherwise similar to DOS.D.

DOS.H Diskette Operating System • included with 1560 system; entry-level operating sytem; upward compatible with DOS on larger Datapoint systems; basic interface between the operator and specific processing tasks; takes near-English requests from the operator, loads requested programs, provides peripheral control, including the management of data files created on diskettes; can process 2 tasks simultaneously • Concurrent Job Loader divides resources into a user program area (normal batch job) and a concurrent job area (specialized runs); concurrent (second) job must be designed specifically to be used as such; data entry application (Dataform or Databus) or a processing activity (Databus or DOS utility) may share resources with concurrent job • IBM 2780 emulator, the IBM 3780 emulator, or a Datapoll slave program provides communications concurrently with data entry, data inquiry, or processing; concurrent print spooler available; a function key allows the operator to check on the progress of a concurrent printing or communications task without stopping the primary task • includes over 30 utility features accessible directly from console for functions such as SORT, EDIT, BACKUP, REFORMAT, and CHAIN (links execution of program to completion of previous program) • data reliability is maintained by verifying retrieved data against a cyclic redundancy check character stored on diskette; all data written on diskette is immediately reread to verify the data stored; data file reliability is provided via system backup information and a comprehensive repair utility program to allow recovery of data files lost or damaged due to diskette media wear or power failures; system security is provided by delete or write protection, as well as via file access lockout that can restrict system operation to various subsets of diskette files • supports sequential, random, hierarchical ISAM, and key-sequential file

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

access methods • requires 4K bytes of system memory; resides on each diskette used • supports ARC.

Resource Management System (RMS)

Operating Environment • multiuser, multitasking RMS operating system supports standalone and Attached Resource Computer (ARC) network configurations; processors running under RMS and Datapoint Disk Operating System (DOS) can coexist in ARC networks; high-level-language applications can be transported from DOS to RMS configurations; processors currently supported by RMS include Datapoint 6600, 8400, 8600, and 8800 • in standalone configurations, RMS processors perform all system and applications processing; in ARC network configurations, RMS processors can be Resource or Applications Processors; Resource Processors primarily perform disk management functions; Application Processors primarily run user programs, accessing disk resources attached to other processors • up to 24 local and/or remote interactive terminals per RMS standalone or ARC Applications Processor; each interactive terminal user can access all software-supported facilities • up to 255 processors and over 6,000 interactive terminals per ARC network; multiple networks can be interconnected with full resource sharing.

Resource Management • dynamic resource management supports user/task sharing of all system components, including processors, memory, communications devices, disk storage, and peripherals; RMS locates and assigns resources to users/tasks as required; interactive terminal users can access remote files and peripherals as if they were locally attached • the RMS nucleus, a library of processor-dependent routines, allocates/deallocates resources and monitors, controls, schedules, and dispatches all system activities/tasks; RMS Nucleus functions include user-transparent I/O management; dynamic memory allocation/deallocation in 4K-byte sectors (users can optionally specify the amount of main memory to be allocated to a task); file handling; program loading and execution control; multitasking scheduling • under RMS, resources are categorized as either single- or multiple-file; single-file resources include communications devices, tape drives, terminals, and printers; disk units are the only multiple-file resources.

Program Processing • concurrent interactive and batch application processing; multitasking based on timeslicing and dynamic resource management • multitasking is defined for internal and user task levels; internal multitasking permits I/O processing to be performed concurrently with applications program processing; user multitasking permits multiple applications programs to be processed concurrently • user tasks are categorized as workstation, local, or independent tasks; a workstation task is associated with each active terminal; workstation tasks perform support functions under operator control; workstation tasks can spawn local tasks (e.g., application module); local tasks are under control of the spawning workstation task and use the same memory map, registers, and security/priority levels; workstation tasks can also spawn independent tasks (e.g., print spooling); independent tasks are totally independent of the spawning workstation task and must terminate themselves • intertask communication is via reserved areas in main memory called pipes.

Data Handling • sequential, indexed-sequential, and random file access methods supported by RMS through COBOL and DATABUS programming languages.

Communications Support • IBM 2780/3780, HASP, and Datapoint DATAPOLL emulation • interprocessor communications management in ARC network environments.

Programming Support • COBOL; Databus (COBOL-like business language); Datashare (multiuser Databus); CHAIN (job control language).

User Interface • user interface to RMS software is through VISTA-GUIDE and VISTA-VIEW • system access control is multilevel; users must know the symbolic name of a system resource to access that resource; additionally, system resources can be password-protected; up to 9 different passwords can be assigned to each resource; file access privileges can be selectively restricted by password to any combination of read/write/rename/catalog/create/delete/change; security levels (separate from passwords) are assigned to each user and each file; security levels range from 0 (limited access) to 9 (global access); a user's security level must be greater than or equal to a file's security level to permit any access to the file.

☐ **Data Management**

DOS File Management • DOS provides general file management via a library of utility programs • about 40 standard utility programs interface between user and processing tasks • file directory maintains 256 file names to classify files • provides facilities to locate, expand, compress, and access files • access methods are random, sequential, and indexed sequential (ISAM).

DOS Dataform • keyboard-/forms-oriented data entry facility • once form is created, the processor console or a datastation can be used for the data-entry function.

DOS Multiform • Dataform facility extended for use by up to 3 users: one is the processor console and the other 2 are datastations • up to 34 fields can be defined per screen format • provides 5 passes of the fields to refine specifications • each user assigned 16K bytes of virtual memory • requires processor with at least 2 disk units.

SORT • allows a file to be sorted into ascending or descending order based on any number of keys supplied by the user; the collation order can be modified if desired, and multiple levels of keys can be employed; a file may be searched and stripped to produce multiple output files from a single input file; output files are fully compatible with all other Datapoint files • requires disk-based system.

RMS Disk File Structure • disks are logically divided into files; up to 10,000 files per disk; maximum file size is dependent only on physical disk capacity • files consist of 256-byte sectors; first sector in a file contains a File Description Table used by RMS to address the file; disk space is allocated to files in clusters; a cluster is a group of physically contiguous sectors; for example, 16 sectors per cluster on 67M- and 135M-byte disk drives used with the 8800; clusters are grouped into segments; up to 32 segments per file; any number of clusters (up to physical disk capacity) per segment • Hierarchical Structure Identification (HSI) is used to group files into multilevel, hierarchical structures; HSI structures consist of any number of levels, with any number of files per level; each level is assigned a name by appending an identifier to the name of the next higher level; lowest level names cannot exceed 32 characters in length • disk volume descriptions consist of tables located at fixed addresses; Locked-Out Segment Table (LOST) points to disk segments unavailable for use; Cluster Allocation Table (CAT) is a one-to-one bit map of clusters; Hashed File Directory (HFD) describes file locations on disk; File Structure Directory (FSD) is used to locate files in an HSI structure.

Utilities are available to allow RMS and DOS to coreside on ARC. Some software that runs under DOS is not available to run under RMS, thus combined DOS/RMS systems are common. An associative Index Generator is also available to allow DOS files to be accessed using generic keys.

Conversion Utilities • designed to facilitate transition from DOS files to RMS files • include GETARC, PUTARC, GETDOS, and PUTDOS; all run under RMS.

DOS ARC to RMS ARC File Transfer (GETARC) • allows user to transfer files controlled by DOS ARC File Processor to an RMS disk; does not compromise DOS ARC security • RMS ARC to DOS ARC File Transfer (PUTARC) • allows user to transfer an RMS disk to a disk controlled by a DOS ARC File Processor.

DOS to RMS File Transfer (GETDOS) • allows user to transfer local DOS disk files to an RMS disk; DOS disk must be on a drive physically attached to RMS node running GETDOS; RMS disk can be any RMS disk resource.

RMS to DOS File Transfer (PUTDOS) • allows user to copy RMS text files to a DOS disk in DOS format.

Associative Index Generator (AIMDEX) • produces associative index required for Associative Index Method (AIM) access to disk data files • runs under DOS.

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

☐ Communications/Networks

Datapoint provides numerous software modules to handle telecommunications applications. Many of the modules can be used with standalone processors or with processors on ARC. On ARC, the communications software runs on an Applications Processor dedicated as a communication processor. Generally, the ARC boundary is transparent to the user, thus a terminal user operates as if the attached processor were standalone. The facilities provide for communicating with remote or local mainframes, other ARCs, remote Datapoint systems running under DATASHARE (a timesharing system), and standalone Datapoint processors.

The DOS ARC modular software allows Application Processors on ARC to share a common database on a File Processor. RMS systems can be system generated to operate as shared resources on ARC. The principal difference between RMS and DOS ARC is that DOS requires a system such as DATASHARE to control and allocate system resources. RMS does not require a system manager. Control of system resources can be distributed among the RMS systems on ARC.

Communications Software

DOS ARC • runs on File Processor and supported by DOS operating systems running on any number of Application Processors connected to ARC • provides full set of commands to control file processor operation.

DOS ARC Boot Tape Writer (ARCBMAKE) • produces a boot tape to load DOS.D and programs in Datapoint 6600 processors from an ARC File Processor.

DOS ARC Bootstrap (ARCBOOT) • for diskette-based old 1100 Series system; allows them to connect to ARC.

DOS ARC Disk Volume Maintenance (ARCID) • allows maintenance of disk volumes managed by ARC File Processors.

DOS ARC Disk Volume Automatic Execution Clear (AUTOCLR) • clears automatic execution specified for a user for automatic initialization; clears volume to non-auto-execute condition.

DOS ARC Disk Volume Access (MOUNT) • utility to establish logical connection with disk volume(s) an Application Processor can access • volumes can reside in from 1 to 31 File Processors and the location is transparent to Application Processor; user types in name and codeword and ARC software finds the volume.

DOS ARC Disk Volume Write Protection (PROT VOL) • allows user to write-protect any disk volume controlled by a File Processor.

DOS ARC File Copy (ARCOPY) • bidirectional file transfer utility for use between ARC system and an alien DOS.

DOS ARC System Statistics (ARCSTAT) • provides detailed statistical data on ARC operations; can be displayed on an Application Processor's screen or written on disk for later printing used to optimize ARC performance.

DOS 1800 RIM Loader (BOOT RIM) • enables 1800 system to participate in ARC system.

DOS ARC Print Request Queuing (SPOOL) • provides means to load print requests to an ARC UNSPOOL queue.

DOS ARC Print Unspooling (UNSPOOL) • allows deferred printing of standard print files located on a file processor • up to 3 local printers are supported at each site.

ARCGATE Products • provide for communication between ARC and IBM mainframes; products include ACMLU, AC3271B, AP3270, DS3270, DSMLU, and WS3270.

ACMLU • IBM 3270 Emulator runs on a CP on ARC under DOS.D; uses SNA/SDLC line protocol; emulates 3274 SDLC cluster controller, 3776 SDLC batch controller on a combination 3274/3776; as 3274, supports 32 terminals or printers; as 3776, supports RJE site with card reader/punch, printer, and interactive console; as 3274/3776, supports 26 terminals or printers and 1 RJE site with card reader/punch, printer, and interactive console.

ARCGATE 3270 • same as ACMLU except it emulates IBM 3271 BSC cluster controller; also runs under DOS.D • supports up to 32 IBM 3277 terminals or IBM 328X printers, number depends on processor model; operates in multipoint configurations over 2-wire or 4-wire leased lines as up to 96M bps.

AP3270 • designed to execute existing 3270 applications; runs under DOS.D on 1800/3800/8600 processor • emulates IBM 3277/3278 display terminal and 328X printer.

DS3270 • 3270 DATASHARE Adjunct to ARCGATE 3270 software to allow Datapoint 8200 terminals to emulate basic features of IBM 3277/3278.

WS3270 • runs on any RMS workstation that can run IEOS (Integrated Electronic Office Station) software; emulates all function keys available on 3270.

DSMLU • 3770 DATASHARE adjunct to ACMLU Batch software to allow Datapoint terminals to emulate the basic features of the IBM 3776.

Local Connect Products • support channel-attached IBM S/370-compatible mainframes; require the Datapoint Channel Adapter which attaches directly to IBM mainframe byte multiplexer channel; run under the DOS.D or DOS.E operating system.

Channel Input-Output Unit Record Utility (CHIOUR) • provides emulation of up to 16 unit record devices: card readers, card punches, line printers, and 1052 system console • provides operator-controlled utility for fast data transfers between an AP on ARC and mainframe.

Datapoint Attached Support Processor (DASP) • provides for remote batch communication between mainframe and an AP on ARC; includes spooling system, scheduler, message switching system, and communication system.

Direct Channel Interface Option (DCIO) • emulates up to 16 unit record devices; paired to provide 8 input and 8 output files; a card reader, for example, is paired with a card punch or line printer • up to 8 programs on the mainframe can access DCIO concurrently or a single program can use all 8 pairs concurrently • monitors and logs all disk file activity.

ARCLINK • provides a telephone link over a dial-up or leased line at up to 19.2K bps to a remote ARC File Processor; totally transparent to other Application Processors on ARC except response is slower; user simply logs on to a disk volume • runs under Datapoint 6000 Application Processor with a 9481 Communication Adapter installed.

MULTILINK • an enhancement of the DATABUS language that includes facilities for concurrent communications; allows communication between a user's DATABUS program and a variety of other computer systems using telecommunication facilities • all programs that run under DATABUS or DATASHARE interpreter will run under MULTILINK interpreter; a MULTILINK system in a network controlled by a host computer has access to its local database, to the host's database; the host can also poll and access other databases on the network, providing access to all data • run under DOS operating system; communication can be either interactive or batch; several program modules or line drivers are available to communicate with other Datashare systems, other vendor mainframes, and other networks: Burroughs, IBM, Sperry, Honeywell, and vendors that support TTY, as well as X.25 networks.

DOS Burroughs Newline RJE MULTILINK Interface (MLDC 1000) • emulates an RJE station of large-scale Burroughs computer using Burroughs NEWLINE RJE protocol; operates over 2- or 4-wire, leased, or switched line at up to 4800 bps.

DOS DATASHARE-to-DATASHARE MULTILINK Line Driver (MLDSDS) • enables DATASHARE systems to communicate with each other within a multidrop network using standard DATABUS SEND and RECEIVE verbs.

DOS Remote User MULTILINK Driver (MLRUP) • allows DATASHARE system to communicate with DASP (Datapoint Attached Support Processor) system.

DOS MULTILINK SNA Remote Batch Line Handler (MLSNA) • provides access method for DATABUS programs running under DATASHARE to transmit and receive batch data to/from a host

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

operating in an SNA environment; emulates many functions of the IBM 3777 Multiple Logical Unit batch terminal.

DOS Burroughs MULTILINK Interface (MLTC3500) • interactive support for synchronous or asynchronous communication with Burroughs mainframe.

DOS Sperry Uniscope MULTILINK Interface (MLUN200) • external interface for DATASHARE system to communicate with Sperry mainframe using Uniscope line discipline; supports 1 to 4 DATASHARE users communicating synchronously.

DOS Honeywell VIP MULTILINK Interfaces (MLVIP) • external interface for 1 to 4 DATASHARE users to operate in a multipoint environment and communicate with mainframe supporting the Honeywell 7000 Visual Information Projection (VIP) terminals.

DOS MULTILINK X.25 LAPB Driver (MLX25B) • runs on an ARC communication processor; permits access to other processors and terminals on an X.25 packet-switching network from Application Processors residing on ARC; provides up to 24 logical connections simultaneously through 1 physical connection to the packet network.

DOS IBM 3741 MULTILINK Driver (ML3741) • point-to-point driver that emulates IBM 3741 in nontransparent BSC mode at speeds up to 4800 bps; 1 DATASHARE port configured to control 3741 communication.

DOS IBM 3700 MULTILINK Line Driver (ML3770) • allows MULTILINK to emulate IBM 3770 terminals on multipoint BSC line for communication at up to 9600 bps with IBM system.

DOS 1800 IBM MULTILINK Line Driver (ML377018) • for Datapoint 1800 only; emulates IBM 3770 BSC protocol for communication with an IBM system at up to 4800 bps.

DOS IBM 3780 MULTILINK Driver (ML3780) • emulates IBM 3780 terminals in point-to-point BSC environment for communication with IBM system at up to 4800 bps.

DOS IBM Channel Adapter Interface (MLCI) • provides access method for DATABUS programs running under DATASHARE to transmit/receive information to/from an IBM S/370-compatible host as if it were a directly connected card reader, card punch, or printer.

Burroughs Poll/Select Line Handler for DBML15 (ML15TC35) • line handler for use on Datapoint 1500 processor to communicate with Burroughs system using Burroughs Standard Poll/Select protocol.

Teletypewriter Line Handler for DBML15 (ML15 TTY) • line handler for Datapoint 1500 processor to communicate with system that supports USASCII teletypewriter protocol.

1500 Honeywell VIP MULTILINK Interface for DBML15 (ML15 VIP) • simulates a single Honeywell VIP terminal; interfaces Datapoint 1500 DATABUS interpreter with a Honeywell VIP 7700 system.

DATAPOLL • a series of programs and a protocol designed to collect and distribute files in distributed network; supported on all Datapoint processors; runs under RMS and DOS; Datapoint provides 24 DATAPOLL programs for a wide variety of hardware configurations using synchronous or asynchronous communication, leased or switched lines, half- or full-duplex, at data rates up to 4800 bps • DATAPOLL Master allows communication with 1 or more unattended remote Datapoint processors running DATAPOLL Slave program; provide for disk spooling under DOS operating systems.

REMDOS (Remote DOS) • designed for centralized service and maintenance for slave sites from a master site; allows master console to operate as the slave console for debugging or updating programs; uses a Datapoint synchronous protocol.

Multiple Terminal Emulator (MTE) • provides capability to emulate both remote and batch terminals such as IBM 2780, 3780, 2770, and 3770, as well as IBM HASP, JES, and RES workstations; also emulates Honeywell's G-115 and CDC UT200 • can be executed under DOS, the Partition Supervisor, or CHAIN; or, except for 3770, JES, and RES, under RMS also; provides a menu display allowing the choice of emulator to be specified by a keyboard entry, as well as peripherals assignment; uses the integral communication adapter and a synchronous modem to communicate at rates up to 4800 bps • requires 60K bytes of memory.

☐ Program Development/Languages

Higher-level languages available for program development include SNAP/3 macro assembler, BASIC PLUS interpreter, DATABUS compiler, MULTILINK extension to DATABUS, DATAFORM, MULTIFORM extension to DATAFORM, FORTRAN, RPG II, and SCRIBE (text processing) under DOS only. Languages available under DOS and RMS include DATABUS (interpreter), DATASHARE extension to DATABUS to allow multiple users to access interpreter, COBOL, RPG PLUS, and CHAIN (command and job control).

SNAP/3 Macro Assembler • provides the means for a programmer to create either an absolute or relocatable object code program from a source file containing mnemonic operation codes; it includes conditional assembly and list control commands, extensive arithmetic operations, and a sorted cross-reference listing; source and object files may reside on tape or disk with a choice of local, remote, or servo printers for the output listing; a limited set of macros are built into the assembler and provide the programmer with single-line memory reference mnemonics which would otherwise require 2 or more instructions; double register load and shift count macros are also present; SNAP/3 is also supported by a library maintenance utility, a system library maintenance utility, and a linking editor for relocatable modules; SNAP/3 requires 60K bytes of memory; the linking editor and support utilities each require 16K bytes of memory.

BASICPLS • patterned after the Dartmouth BASIC language; uses an interpretive compiler to provide the Datapoint processor with an interactive compile/execute program capability • provides full screen control; data files are maintained on diskette; programs can be executed line-by-line as entered, or a program can be compiled and stored for later execution; provisions for floating-point arithmetic and 3-dimensional arrays are included • requires 60K bytes of memory.

FORTRAN • ANSI 1966 version 3.9 • provides full FORTRAN IV compatibility, except for complex numbers; supports ISAM data access; disk files are fully compatible with other languages in the Datapoint family • developed by Microsoft Corporation as a version of its FORTRAN 80.

DATAFORM • allows nonprogrammers to design forms for data entry applications; supports environments where large amounts of data need to be checked for validity during the data capture process; to use Dataform, the operator keys in the desired form on the screen and specifies the edit criteria; more than 15 edit criteria may be specified for each field including alpha, numeric, justification, and fill requirements; includes a high-level language for writing short field validation programs for applications requiring more complex verification of data that includes English sentence instructions, user-defined variables, redefined variables, IF statements, standard arithmetic functions, data manipulations, logical operators, and form interactions.

DF18SYS DATAFORM • provides a complete data entry operation producing a compatible data file ready to be transmitted or processed; files generated are compatible with other Datapoint packages.

DOS Multiterminal Data Entry • MULTIFORM allows 2 data stations to generate and use customized forms.

DOS SCRIBE • processing language and print utility used in conjunction with the general-purpose editor to provide an automatic typing and text processing system; also provides a way to create, update, and format text files; files are first created and corrected using the general-purpose editor; formatting is then done by imbedding SCRIBE commands within the text; commands allow the operator to perform operations such as carriage return, margin setting and tabstop setting; output may be directed to the CRT display screen or a printer • also used for the creation and production of computer-typed form letters and mailing labels; one file can be used for the form letter text and another for names and addresses; names inserted in the body of

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

the text are automatically sized and surrounding body copy adjusted to fit • requires 16K bytes of memory.

MS SCRIBE • Text Processor for DOS (DSCRIBE) • used to create, update, and format text files; requires 16K-byte memory; available for use with SCRIBE, a technical manual preprocessor and table-of-contents generator to aid in writing technical manuals • features include automatic chapter and section numbering and conditional print suppression; the technical manual preprocessor and table-of-contents generator run on any SCRIBE system.

MS INDEX • Manual Index Pre-Processor used in conjunction with the technical manual preprocessor and table-of-contents generator to facilitate the creation of indices for technical manuals; the manual index preprocessor runs on any SCRIBE system.

DATABUS • Datapoint Business Language; high-level, commercial language used to write programs that perform any combination of data entry and editing, file inquiry and processing, and printing tasks; virtual memory techniques permit DATABUS reentrant programs to be as large as 32K bytes with 4K bytes of resident working storage; supports random, sequential, and indexed-sequential (ISAM) operations; provides extensive human interaction via commands in simple English (such as Display, Add, etc); comments may be inserted into programs at any point to increase readability; debug trace facility permits interactive debugging • available as interpreter and compiler • DATABUS programs compiled on larger Datapoint systems can be executed on the 1560 without change and can be downline loaded into the 1560 • interpreter runs under RMS or DOS; compiler runs under DOS.

DATASHARE • multiuser version of DATABUS; provides concurrent execution of 4 to 24 user programs controlled interactively from independent local or remote terminals; runs on disk-based system; supports Datapoint 8200, Teletype 33/35, and compatible asynchronous ASCII terminals or other Datapoint processors emulating these terminals; runs under DOS and RMS • executable code is divided into 256-byte, virtual, reentrant pages; working storage area for each program reserved in real memory; supports DATABUS programs only; each program is allocated up to 64K bytes of virtual memory; supports standard Datapoint random, sequential, or indexed-sequential files; files can be shared among users • provides capability to access/update ISAM files on remote Datapoint computer acting as DATASHARE terminal • supports Associative Index Method (AIM) for file access.

DATASHARE DSGEN • 3-module program generation system for development of DATABUS data entry/checking source program under DATASHARE; user designs data entry screen format by specifying options, via prompts and menu selection, for field and edit definitions, range checks, and table lookups.

DATASHARE DSTEXT • allows DATASHARE user to invoke many of the DOS utility functions to control job flow and system functions.

DBCMPLUS • universal DATABUS Compiler for DOS systems; accepts programs written in the DATABUS language and translates them to a form that can be interpreted by the DATABUS Interpreter; results in DATABUS object programs that run on any system; can be transferred to another Datapoint processor and executed by any DATABUS or DATASHARE interpreter.

MULTILINK • extension to DATABUS language to allow concurrent communications with application execution.

ANSI 1974 COBOL Compiler • meets Level 1 specifications for the Nucleus, Table Handling, Segmentation, Random Access, and Sequential Access Modules of 1974 ANSI COBOL; Level 2 Table, Sorting, Library Facilities, name qualification, full continuation for words and literals, complete figurative constants, arithmetic expressions, and extended file options from Level 2 Nucleus, Sequential Access, and Random Access; Dynamic allocation/deallocation of diskette space is performed automatically and is transparent to the user; no modification of existing ANSI 1968 COBOL program is required to use ANSI 1974 COBOL; interactive extensions are provided that enable COBOL to function on a standalone processor; programs can display, prompt, accept, convert and reformat input data, and process transactions as they become available; programs can be compiled and executed on standalone processors or on processors on ARC system; files created by COBOL are compatible with those created by DATABUS, RPG, BASIC, FORTRAN, and the DOS utilities; COBOL can utilize the beep and click sounds, plus the processor's special features include the 1920-character screen, 5 programmable function keys, field highlighting, blinking, and the interrupt key; precompiled subprograms can be called from within an interactive COBOL program, making structured programming easier to implement; a runtime debugger and the internal SORT feature are also available for use with COBOL • RMS version provides record buffering; does not support CRT screen blinking or cassette tapes; supports multiple-reel magnetic tape files, intertask communications via "pipes," disk printer files, and large programs on the 8600 or 8800 without segmentation; RMS COBOL file support allows deleting indexed or relative records, COPY statements freely placed, RELATIVE KEY synonomous to ACTUAL KEY, and sequential access to relative records.

RPGPLUS Compiler • runs under DOS or RMS • provides enhanced RPG II facilities similar to those provided for the IBM System/3, that include handling large record sizes and indexed-sequential file processing; produces object programs that run under DOS.

RPGFILTER Program will read a non-Datapoint RPG program from the diskette and make all possible changes to that program to make it compatible with Datapoint RPGPLUS • produces a converted program and flags all incompatibilities found which cannot be resolved.

CHAIN • command file processor supports structured, recursive job-control language • supports unattended job stream execution and file processing.

☐ Office Automation

Datapoint's Integrated Electronic Office System (IEOS) consists of the Electronic Message System and Word Processing System combined with dispersed processors (such as DATASHARE) in an ARC system. Datapoint also offers an enhanced EMS Network Controller to allow IEOS users to reside on Teletype stations and TWX, and U.S. Telex networks.

The components for the integrated office are modular and flexible. The organization is the same as Datapoint uses with its dispersed processing and ARC systems; control is distributed without a host computer.

In February, 1984, Datapoint introduced its PRO-VISTA office automation software that runs in the RMS environment.

Electronic Message System (EMS) • a standalone, turnkey ARC system providing a high-speed message pick-up and delivery service in the office environment • implemented with an EMS Network Controller, office stations, and File Processor • the network controller and office stations operate as Applications Processors • office stations function as mail stops and workstations, and the controller functions as the post office • the network controller, which can handle 8 simultaneous data calls, uses a 20M-byte disk to store messages in transit • the File Processor stores and retrieves data relevant to the network as a whole • EMS uses standard ARC utilities such as the printer spooler to handle system printing • the network controller is a Datapoint 6600 Application Processor • Datapoint 1560 is the prime processor used as an office workstation • non-Datapoint terminals that are standalone devices with a controllable buffer can transmit to EMS via a communications line • provides EMS accounting reports by terminal, department, or project to user as well as to historical file • prints management reports periodically giving such data as variations in delivery speed and message length • a Telephone Directory Package provides maintenance of the EMS database.

MultiSite EMS • implemented using the LightLink for sites located within 2 miles of each other.

Enhanced EMS Network Controller • provides EMS user transparent access to Telex, TWX, and Teletype addresses • can also operate independently of IEOS and allow Telex, TWX, and

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

Teletype users to communicate with each other • performs automatic dialing, protocol conversion, automatic routing, delivery to multiple addresses and management reporting • supports up to 1,000 addresses (mailstops); transmission speeds range from 50 to 4800 bps • runs on 6600 Series Advanced Business processor with 128K bytes of memory, disk, and local printer • can be customized using variables such as polling interval per mailstop, type of mailstop (Teletype, TWX, Telex, or Datapoint workstation), company name and department, overnight time range, and protocol answer-back strings.

Word Processing System • runs on any Datapoint processor with large screen (excludes 6600) • provides Associative Index Method (AIM) for filing and retrieval by content; 95% of key strokes are from "home" position; documents displayed in printed form • standalone system that can connect to ARC system.

PRO-VISTA • a new generation of office automation products for Datapoint; provides a new interface between user and the computer network; includes both hardware and software • hardware includes the VISTA-STATION 84 (8400 System), VISTA-82 (8220 or systems emulating 8220), and VISTA-PC (1200) • software includes VISTA-WORD, VISTA-GUIDE, MULTIPLAN, VISTA-MAIL, and VISTA-VIEW • other related software includes software support for the INX-PC card and for the VISTA-PC Network Interface.

VISTA-WORD • word processing software that is integrated with other VISTA software packages to provide information sharing as well as word processing • license fee may be waived when software is licensed with Datapoint hardware:

$1,500 lcns

VISTA-GUIDE • user interface to the Datapoint RMS operating system through plain English command syntax, simple multiple choice, and fill-in-the-blank command scripts in VISTA-SCRIPT mode • user can tailor activities according to job function, security requirements, and unique requirements; HELP scripts allow system to speak the user's language • RMS provides resource sharing and networking provides for almost unlimited growth • license fee may be waived when software is licensed with Datapoint hardware:

1,500

MULTIPLAN • electronic spreadsheet that provides formulated, up-to-date information for decision making; performs labor intensive tasks; includes HELP facility for online tutorials; runs under RMS operating system 1.11 or later • license fee may be waived if licensed with Datapoint hardware:

1,500

VISTA-MAIL • electronic mail program that uses ARC to deliver messages throughout an organization; users may create and transmit their own documents as well as receive, print, store, and retrieve messages • provides HELP prompts; sender can use bulk distribution, define security measures, enclose MULTIPLAN models, and receive delivery confirmation and status:

1,500

VISTA-VIEW • provides windowing to allow user to view information for several applications simultaneously; applications can be independent of each other or information can be combined from several programs; provides up to 14 windows:

1,000

INX-PC Card Support • software to support IBM PCs attachment to ARCnet; includes DOS S/W to run on the 1590 included with INX-PC:

75

VISTA-PC Network Interface • software support for attaching VISTA-PC to ARC:

75

☐ Other Facilities

Print File Queuing Package (SPOOL) • provides means to queue jobs to ARC unspooler; includes Datashare SPOOL command that can execute from Datashare port to allow Datashare programs to queue print jobs.

Print Unspooler (UNSPOOL) • allows user to defer printing of Datapoint print file stored in a File Processor database; any ARC applications processor can submit jobs for printing.

Other DOS Utilities • other utilities provide useful programmer tools that are included with each release but must be ordered separately.

Alternate Drive DOS Boot (BOOT) • allows DOS to be booted from online disk drive; requires 16K-byte processor.

Enhanced Chaining Program Command (CHAINPLS) • improved compilation and execution capabilities of CHAIN: arithmetic computation, string manipulation, assigning default values, and access to status information.

Character Font & Keyboard Translate Table Editor (CHAREDIT) • serves as editor for CHARSET/SYS font set definition file and KEYXLATE/SYS 1800/3800 keyboard translate table definition file for DOS.

8200 International Character Set Generator (CHARLD82) • set of programs build character set file, modify configuration in character set file, and load character set to an 8200 terminal.

DOS Multiplan • Microsoft's spreadsheet simulator • runs on 8600 with 96K bytes of memory • RMS version and 1560 DOS versions available • standalone or ARC support • under RMS:

$1,500 lcns

Magnetic Tape Utility Routing (DCTAPE) • provides backup of critical disk data; users can transfer entire disk contents to 7- or 9-track tape and subsequently back to disk; DCTAPE will process files in byte-for-byte format or as text files; processed text files data can be recorded as ASCII, EBCDIC, or BCD character sets; processes both labeled and unlabeled tapes; supports ANS, IBM OS, and DOS labeling conventions; an advanced facility (user unit mechanism) is used for processing unsupported label formats and character sets.

■ HARDWARE

☐ Terms & Support

Terms • available on purchase, monthly rental (90-day minimum), and 1/2/3-year lease • multiple unit purchases discounted according to published schedule, but discounts are on a per-order, not a step-quantity basis; most non-Datapoint manufactured items are not discountable • shipping and installation extra • installation minimum is $195 in local support area, $390 in remote zone for all but terminals, communication adapters, modems, and acoustic couplers, which have minimum installation charges $95 locally and $195 in remote zones • 10% prepayment discount and full-year price protection offered on annually billed maintenance • lease and rental prices do not include maintenance • peripherals and options not leased without processor • upgrades raise prices to those for the new configuration • purchased systems cannot lease upgrades • lease upgrades require minimum 1 year, and entire system reverts to 1-year lease rates unless lease is extended 2 or more years • upgrades also incur installation charges • equipment warranty is 30 days.

Support • basic service period is any continuous 9-hour period between 7:00 AM and 6:00 PM Monday through Friday; Datapoint's holidays excluded • extended service coverage available in some locales at rates of premium • extended plans available are Alternate Shift (continuous 8-hour period between noon and 1:00 AM), 16-hour (continuous, between 7:00 AM and 1:00 AM), 24-hour, 6-day (extends basic coverage through Saturday), 7-day, and holiday • Alternate Shift, 16-hour, and 24-hour plans available on 5/6/7-day basis • premiums for, respectively, Alternate Shift, 16-hour, and 24-hour coverage are 10%, 15%, 35% (5-day); 25%, 30%, 50% (added to 15% for 6-day); and 45%, 50%, 70% (added to 35% for 7-day); holidays always 5% extra premium • normal response in nonremote zones is one-half day after call • priority response available in extended service locales for premium of 12.5% for 4-hour response, 20% for 2-hour response • customer training facilities in 5 U.S. cities offer quarterly scheduled courses • customer service facilities in 176 U.S. cities, 36 offer extended coverage • premiums for remote-zone service are 30% (76 to 125 miles), 40% (126 to 175

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

miles), 50% (176 to 225 miles), and 60% (226 or more miles) • maintenance for all systems except 1200 is on a monthly fee basis with 6% discount for prepaid annual fee; 1200 maintenance fees are charged on annual basis.

☐ Systems Overview

Currently in the Datapoint systems line are the 1200, 1560, 3200, 6600, 8400, 8600, and 8800 series.

The 1200 Series is the VISTA-PC, a professional computer series based on the N-GEN from Convergent Technology. VISTA-PC runs under CTOS (Convergent Technology Operating System) MS-DOS and operates as part of the PRO-VISTA line of office automation products. The system includes a high resolution color monitor and supports from 256K to 1M bytes of memory, dual diskettes, 10M/20M bytes of disk storage, color plotter, and printer. It can emulate a Datapoint 8220 terminal; thus, it can interface to ARC through an ARC processor running the VISTA software under the Datapoint RMS software. Up to 6 VISTA-PCs can share resources and information. The systems are daisychained together using twisted-pair cable with 1 VISTA-PC operating as the master controlling the resources to be shared.

The 1560 is a Z80A-based microcomputer operating as a standalone system; it can also function within Datapoint's ARC local network. The system runs under DOS.H and a version of industry-standard CP/M, supports 64K- or 128K-byte RAM, and includes CRT, multipurpose keyboard, communication interface, and up to 40M bytes of storage. Through RS-232C interfaces, the 1560 can support 3 additional terminals and a printer. The 1561 model includes a RIM Interface Card for operations on ARC. The Multifunction Communication Interface is an option for SDLC operations.

The Datapoint 3200 Series is based on the Charles River Data Systems Universe Series, which in turn is based on the 12M Hz Motorola 68000. The systems are supermicros with performance of about 1.25 MIPS. The 3200 runs under UNOS, a UNIX look-alike operating system. The system also supports Informix, a relational database management system, EEX word processing package, MULTIPLAN spreadsheet, Datapoint Databus, and COBOL. The 3200 Series supports 1M to 8M bytes of memory, 32M to 120M bytes of disk storage, 45M-byte streamer tape, 2780/3780 Communications Controller, Data Terminal and keyboard (8230/8232/8220), 35-/300-cps or 300/600/1000-lpm printer, and INX-32 adapter to attach to ARC. The INX 32 with its INX and RMS INX Network Services Software allows the 3200 to be a database resource on ARC.

Datapoint 6600 Series includes 4000, 6000, and 6600 models; all based on the 6600 8-bit processor. Memory features parity checking. The 6600 features low-profile design with small integral CRT and a keyboard, and 2 "Philips" cassette tape drives (unless the 6600 is a 6000 ARC). Use can be generalized; standalone or in networks using DOS or RMS. The 67M-byte disk pack units can be attached. Tape can also be configured.

The Datapoint 8400 Series provides the VISTA-Station 84 line of processors that run VISTA-WORD, VISTA-MAIL, VISTA-GUIDE, VISTA-VIEW, and MULTIPLAN. The 8400, based on the 16-bit Intel 80286, is designed to operate as an application processor on ARC. It can perform data processing as well as office automation tasks such as word processing, electronic mail, financial modeling, and windowing. A standard VISTA-VIEW user window into ARC, allows the user to manage multiple active office applications simultaneously. The 8400 can interface directly to ARC and it supports up to 8 VISTA-Station 8230 terminals. The 8400 runs under RMS.

The 8600 contains all 6600 user mode instructions in an ergonomically designed package; indeed, it appears identical to the 8220 Ergonomic 8200 Terminal. Capable of generalized usage under DOS or RMS, the 8600 line also uses an 8-bit architecture processor, but with a standard RIM chip and able to use 10M-byte cartridge disks or 20M-byte nonremovable disks.

The 8800 is a 16-bit architecture system; it requires the RMS operating system. Its memory and disk capacities, up to 1M-byte and 1G-byte, respectively, top the Datapoint line. The 8800 is also the only cabinet-housed Datapoint processor, as befits its greater performance and power.

Datapoint offers packages for IBM PCs to allow them to participate in ARC networks. The PC 8220 software package allows the IBM PC, PC/AT, and PC/XT to emulate an 8220 terminal. The Intelligent Network Executive (INX-PC) is an adapter card that fits in an expansion slot in the IBM PC, PC/XT, or PC/AT. It includes a 1590 processor that runs the DOS operating system and a RIM to interface to ARC.

The PC 8220 software allows the IBM PCs to operate as Datapoint terminals under RMS and DOS with access to the Datapoint office automation, data processing, and communication resources.

The INX-PC allows users to link the IBM PCs together via the ARC network. The PCs can operate as information access workstations with access to the Datapoint DOS, Databus, MULTIPLAN, IEOS, and EMS applications, as well as centralized network services such as file, printer, and communication servers.

☐ Packaged Systems

1200 (VISTA-PC) Systems (based on Convergent Technology N-GEN)

A basic 1200 system includes an 80186 processor with 256K bytes of memory with power supply. Memory can be expanded to 1M bytes. Disk storage can consist of 630K-byte diskettes and 10/20M bytes of Winchester disk storage. A VISTA-PC ARC module allows the 1200 to operate as a professional terminal on an ARC processor running RMS and the PRO-VISTA office automation software.

1211 System • includes 80186 processor, 256K-byte memory, dual 630K-byte diskettes, and power supply • requires 1224 Color or 1225 Monochrome Monitor; 1224 also requires 1221 Graphics Module • also requires CTOS and MS-DOS operating systems:

NA/NA/NA/NA mo	$3,195 prch	$355 maint

1212 System • includes 80186 processor, 512K-byte memory, 10M-byte Winchester disk, 630K-byte diskette, and 2 power supplies • requires 1224 Color or 1225 Monochrome Monitor; 1224 also requires 1221 Graphics Module • also requires CTOS and MS-DOS operating systems:

NA/NA/NA/NA	4,995	489

1214 System • includes 80186 processor, 256K-byte memory, and power supply • requires 1224 Color or 1225 Monochrome Monitor; 1224 also requires 1221 Graphics Module • also requires CTOS and MS-DOS Operating Systems:

NA/NA/NA/NA	2,195	192

1560 Systems

A 1560 basic system includes a self-contained 1920-character CRT, typewriter-style keyboard, communications interface, and printer interface. The Z80A microprocessor supports 12K-byte system ROM, 64K bytes of RAM expandable to 128K bytes. The integral CRT features an 80-character by 24-line format and an inverse video feature that displays dots on a character-by-character basis, program-defined 128-character font, 60-frame-per-second refresh rate (using 50 Hz power), and 5x7 matrix character generator. The keyboard has a 55-key alphanumeric group, an 11-key numeric group, and 10 programmable control keys. A removable keyboard is optional. The system provides 2 serial channels, 1 supporting either synchronous or asynchronous communications, the other providing local printer support. A Multifunction Communication Interface (MFC) providing RS-232C-compatible serial channel is optional.

1540 System • includes 1560 processor with 128K-byte memory, removable keyboard, and 10M-byte removable and

MO: first figure is monthly charge for short-term rental; second is for 1-year lease; third is for 2-year lease; fourth is for 3-year lease; does not include maintenance. PRCH: purchase price. MAINT: monthly charges for prime shift maintenance within 75 miles of local service point. NA: not available. NC: no charge. Prices current as of March 1985.

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

40M-byte fixed disk storage • maximum capacity 130M bytes of disk storage:

$1,115/$890/$790/$730 mo	$16,450 prch	$176 maint

1545 System • includes 1560 processor with 128K-byte memory, removable keyboard, and two 10M-byte removable cartridge disk drives • maximum disk capacity of 100M bytes:

1,025/820/730/675	14,950	186

1561 Application System • includes 1560 processor, 128K-byte memory with ARC Interface Card, integrated communications adapter (ICA), and removable keyboard:

245/195/170/160	3,995	59

1562 System • includes 1560 processor, 128K-byte memory, 1M-byte diskette drive, ICA, and removable keyboard:

350/280/240/230	5,750	82

1563 System • includes 1560 processor, 128K-byte memory, 2M-byte diskette drive, ICA, and removable keyboard:

400/320/275/260	6,500	92

1567 System • includes 1560 processor with 128K-byte memory, removable keyboard, 20M-byte fixed disk, and 1M-byte diskette:

625/500/425/410	8,950	141

1569 Application System • ARC Application Processor; includes 1560 processor with 128K-byte memory, ARC interface board, and removable keyboard • no options:

150/120/105/100	2,400	35

3200 Systems (Based on Charles River Data Universe Series)

A basic 3200 includes 1M-byte memory, 4 serial ports, 1M-byte diskette, and 32M-byte hard disk in enclosure on single stand. The system can be expanded to 8M bytes on some configurations, 152M bytes of hard disk storage with 45M-byte streamer tape, up to 28 communication ports, 2780/3780 communication adapter, and up to 1000-lpm printers. The 3200 can interface to ARC through the INX adapter and operate as a network resource.

3231 Single Module • includes 1M-byte memory with parity checking, 4 serial ports, 1M-byte diskette, 32M-byte hard disk, enclosure, and single stand:

$870/$695/$620/$575 mo	$15,430 prch	$96 maint

3232 Single Module • same as 3231 except with 8 additional serial ports for a total of 12 serial ports and 1 parallel port:

950/760/675/625	16,845	110

3233 Double Module • same as 3231 except 45M-byte streaming tape is included and the system includes 2 enclosures and a double stand:

1,340/1,070/955/880	23,780	168

3250 Double Module • same as 3233 but with following additions: 8 serial ports for a total of 12, 1 parallel port, and 128M-byte hard disk for a total of 152M bytes of disk storage:

2,260/1,810/1,605/1,485	40,130	310

6600 Series Systems

4650 Datashare System • based on 6600 with 128K bytes of memory, 134M-byte dual disk pack subsystem, and MCA:

$3,270/$2,615/$2,240/$2,135 mo	$42,640 prch	$483 maint

4654 ARC File Processor • based on 6600 with 128K bytes of memory, 2 60M-byte disk pack subsystems, and RIM adapter:

3,270/2,615/2,240/2,135	42,640	480

4750 Datashare System • based on 6600 with 256K bytes of memory, 134M-byte dual disk pack subsystem, and MCA:

3,375/2,700/2,315/2,205	44,080	499

4755 ARC File Processor • based on 6600 with 256K bytes of memory, 2 60M-byte disk pack subsystems, and RIM adapter:

3,375/2,700/2,315/2,205	44,080	496

6010 ARC Application Processor • based on 6600 with 64K bytes of memory and built-in RIM:

530/420/355/345	8,495	84

6020 ARC Application Processor • based on 6600 with 128K bytes of memory and built-in RIM:

585/465/395/380	9,395	92

6040 ARC Application Processor • based on 6600 with 256K bytes of memory and built-in RIM:

690/550/470/450	11,195	108

6600 System • includes 6600 processor with 128K-byte memory and cassettes:

720/575/415/375	12,200	180

6640 System • includes 6600 processor with 256K-byte memory and cassettes:

830/665/475/430	14,000	196

8400 Systems (VISTA-STATION-84)

The 8400 Systems implement the VISTA-Station-84, which can provide in conjunction with VISTA-Station-82, a powerful dual workstation configuration on ARC. The 8400 basic system includes the 80286 Processor, 512K-byte memory, ARC Interface, RS-422 serial port, and RS-232C Printer Port. It can be expanded to included 1M bytes of memory, an external 8-port MPCA for connection of 8400 to 8230 terminals, and up to 50M bytes of disk storage.

8412 Application System • includes 8400 processor, 512K-byte memory, ARC Interface, RS-422 Communications Port for 8230 or 8475, and RS-232C Printer Port:

$480/$385/$345/$315 mo	$7,500 prch	$62 maint

8440 System • includes 8412 processor plus 10M-byte Removable and 40M-byte Fixed Disk; maximum 130M-byte disk capacity:

1,390/1,115/980/930	21,450	207

8445 System • includes 8412 processor plus dual 10M-byte Removable Disks; maximum 100M-byte disk capacity:

1,395/1,115/980/930	19,950	217

8450 Systems • includes 8412 processor plus 28M-byte fixed disk and 65M-byte streaming cartridge tape:

NA/NA/NA/NA	15,500	NA

8600 Systems

8600 basic packaged systems are available as ARC Application Processors (without disk) or as systems capable of standalone operation, as RMS/ARC File Processor, or DOS/ARC Application Processor usage. They include an ergonomic CPU and keyboard, CPU with 128K bytes of memory, an integral RIM chip, and keyboard/display subsystem board with serial I/O channel for system printer.

8603 Applications System • 128K parity memory processor and 1 free slot for 128K memory expansion:

$350/$280/$250/$230 mo	$5,950 prch	$60 maint

8605 Applications System • 256K ECC memory processor and 4 free slots for interface options:

510/405/365/335	7,500	80

8627 Disk System • 8605 processor with 1M-byte diskette drive and 10M-byte fixed disk • maximum system disk capacity 40M bytes:

850/680/610/560	13,450	190

8640 Disk System • 8605 processor with 10M-byte removable cartridge disk and 40M-byte fixed disk • maximum system disk capacity 130M bytes:

1,395/1,115/980/930	21,450	225

8645 Disk System • 8605 processor with 2 10M-byte removable cartridge disk drives • maximum system disk capacity 100M bytes:

1,395/1,115/980/930	19,950	235

8660 Disk System • includes 8605 processor with parallel bus adapter and dual 60M-byte removable disks (DOS only); 180M-byte maximum disk capacity:

2,250/1,800/1,600/1,480	39,950	369

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

8800 Systems

All basic 8800 systems include CPU and 256K bytes of memory, cabinet, 8811 Peripheral Processor, and 8220 Datastation system console; 20 card slots are provided.

8830 Application System • with 256K-byte memory, 8220 console, RIM module, MCPA module, and Peripheral Processor; uses 11 card slots:

$1,475/$1,180/$1,040/$985 mo	$24,500 prch	$228 maint

8840 Data Resource System • 256K-byte memory, 8220 console, DRP, 202M-byte disk, (67M-byte removable and 137M-byte nonremovable), and Peripheral Processor; uses 12 card slots:

3,515/2,815/2,480/2,345	59,950	492

8860 Standalone System • with 256K-byte memory, 8220 console, 2 Peripheral Processors, MCPA module, 67M-byte disk-pack disk, 202M-byte disk drive with 67M-byte removable and 135M-byte nonremovable; uses 13 card slots:

3,515/2,815/2,480/2,345	59,950	530

☐ CPUs

1200 Processor & Options

1200 Processor • based on the Intel 80186 16-bit CPU; includes 256K bytes of RAM expandable to 1M bytes; supports up to 20M bytes of disk storage • provides a high-resolution color or monochrome monitor; color monitor allows graphic representation of information • provides Datapoint's VISTA interface, a user-friendly standard access facility into ARC systems • available only as part of packaged system.

1221 Graphics Module • required to provide graphics capability to color monitor:

NA/NA/NA/NA mo	$575 prch	$67 maint

1223 Power Supply • unit for expansion of 1200 system:

NA/NA/NA/NA	240	NC

1224 Color Monitor • displays text and graphics in up to 8 colors simultaneously on a high-resolution screen (720x348 pixels):

NA/NA/NA/NA	850	67

1225 Monochrome Monitor • for 1200 system:

NA/NA/NA/NA	500	48

1230 Dual 630K-Byte Diskettes • with controller, dual system, double density:

NA/NA/NA/NA	1,250	163

1231 Winchester Disk Drive with Diskette • 10M-byte disk and 630K-byte diskette and controller:

NA/NA/NA/NA	2,600	297

1232 Winchester Disk Drive • 10M-byte disk with controller:

NA/NA/NA/NA	2,300	144

1233 Winchester Extension Drive • 10M-byte drive:

NA/NA/NA/NA	1,800	105

1240 Memory Expansion Cartridge • 256K bytes:

NA/NA/NA/NA	585	NC

1241 VISTA-PC ARC Module • allows 1200 to operate as VISTA-PC with access to ARC network; includes RIM:

NA/NA/NA/NA	620	57

1560 Processor & Options

1560 Processor • provides all control functions necessary to support keyboard, CRT, communications, disks; based on Z80A-based microprocessor and instruction set; 8-bit memory word length plus parity • controls microbus which provides interface between processor and up to 10 peripherals; microbus handles block data transfer rates of 175K bytes per second with maximum block length of 256 characters; processor controls data transfer over 8 bidirectional lines via 8-bit commands, 2 command strobes, an interrupt acknowledge strobe, and interrupt request line • available only as part of system configuration.

0252 ARCNET Interface Card • factory installed:

$25/$20/$17/$15 mo	$400 prch	$4 maint

0652 ARCNET Interface Card • field installed:

25/20/17/15	500	4

0253 Multifunction Communication Card • factory installed:

37/29/24/21	580	12

0653 Multifunction Communication Card • field installed:

37/29/24/21	630	12

0525 Single Data Dual Terminal Connector • for use with 1560 MFC option:

NA/NA/NA/NA	100	NA

0601 Ergonomic Base • for 1560 Processors:

NA/NA/NA/NA	175	15

3200 Processor & Options

3200 Processor • includes single/double module with 1M-byte parity memory, 1M-byte diskette, 32M-/152M-byte hard disk in single/double enclosure and 4 serial ports or 12 serial ports with 1 parallel port; some systems include streaming tape • systems can be expanded with the following options.

3209 TP308 Ports 5 to 12 • 1 parallel port and 8 serial ports:

$90/$70/$65/$60 mo	$1,560 prch	$14 maint

3210 TP308 Ports 13 to 20 • 8 serial ports:

80/65/60/55	1,415	14

3211 TP308 Ports 21 to 28 • 8 serial ports:

80/65/60/55	1,415	14

3215 1M-Byte Parity RAM • memory increment:

170/135/120/115	3,000	21

3218 2780/3780 Adapter • requires 2780/3780 software:

150/120/110/100	2,665	11

3219 INX-32 RIM • for connection to ARC; requires INX-32 Interface software:

115/90/80/75	2,000	14

6600 Processor & Options

6600 Processor • includes CPU, CRT display, and keyboard • also 2 read-write cassette tape decks, 1 for program storage and 1 for data storage.

CPU • implemented using 8-bit word microprocessor • implements full set of instructions (excluding multiply and divide) on 8-bit operands; about 0.6 MIPS average execution rate; extends instruction set with double length (16-bit) integer multiply and divide; execution time about 60 microseconds for multiply and about 70 microseconds for divide; also implements instructions for byte string and decimal field operations up to 16 bytes long; add/subtract only arithmetic operation implemented; uses 2 sets of general-purpose registers and 2 sets of condition codes: 1 set used in Alpha mode and the other set used in Beta mode for foreground/background processing • uses base register and sector table to provide a memory management system that protects 4K-byte segments of memory with access/write enable codes and expands addressing to maximum of 256K bytes • CPUs are marketed in system configurations only.

CRT Display • integral to CPU • 7x3.5-inch screen; displays 960 characters in 12 lines, 80 characters per line; 128-character set; 5x7 dot-matrix character generation; blinking cursor, page scroll up and down, and single control line erasure; direct processor control of CRT functions.

Keyboard • integral to CPU • 55-key alphanumeric group, 11-key numeric pad, and 5 system control keys; processor controls transfer of characters and audio feedback (click); programmable attention sound (beep).

Cassette Tape Decks • 2 read-write tape decks; accept Norelco-type cassettes; 47 cpi; bidirectional; processor-controlled data transfers, direction, and rewind; capacity 130,000 characters • character transfer time 2.8 milliseconds; rewind time 40 seconds.

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

8400 Processor & Options

8400 Processor • built around the Intel 80286 microprocessor with 512K-byte memory, ARC interface, RS-422 serial port, and RS-232C printer port • can be expanded to 1M bytes of memory and 50M bytes of disk storage.

8230 Ergonomic Terminal with Printer Port • RS-422 port for 8412 only:

$130/$105/$90/$85 mo	$1,595 prch	$22 maint

8406 Microbus Interbus • for 8400 disk support:

65/50/45/45	1,100	20

8408 Memory Upgrade • for 8412, 512K-byte increment of ECC memory:

100/80/75/65	1,750	13

8409 1M-Byte Memory • for 8412; uses 1 board and 1 slot total; for field installations, new memory subsystem installed and 512K-byte memory returned to Datapoint:

215/170/150/140	3,750	13

8475 MPCA • 8-port external, connects 8400 to 8230 (RS-422):

60/45/40/40	1,000	9

0639 Connector Kit • 8412 to 8230:

NA/NA/NA/NA	25	NC

0704 Cable • 8412 to 8230, plenum rated, 6 twisted pair, $2.50 per foot:

NA/NA/NA/NA	NA	NC

8600 Processor & Options

8600 Processor • 8-bit microprocessor on 3 daughterboards (CP/RIM, CP/ALU, CP/CONTROL) interface with each other and to common bus or motherboard, and generate RIM connection to ARC system • interface to memory and devices is via other daughterboards attached to common bus • instruction set is downward compatible with the Datapoint 6600 • integral ergonomically designed CRT monitor and keyboard • 2 models; 8601 cannot attach peripherals (except printer) or communications devices (except ARC, which is built-in); 8602 can attach 1 disk subsystem and 3 Multiport Communication Adapters and 2 Multifunction Communication Adapters • Model 8601 can be upgraded to 8602 • marketed in system configurations only.

8600 Processor Options • options described below are available field or factory installed • prices shown are for field-installed options, which are higher than for factory installed • factory-installed options are available on rental/lease • installation charges also apply.

0605 PIO Interface • permits attachment of 9301 20M-byte disk with backup cartridge tape; field installed:

$75/$60/$55/$50 mo	$1,200 prch	$20 maint

0606 Microbus Interface • permits attachment of 9310 10M-byte cartridge disk and 1M-byte diskette; field installed:

75/60/55/50	1,200	20

0612 Tilt/Rotate Base • for 8600 and 8220:

NA/NA/NA/NA	100	15

0091 PIO Disk Interface • factory installed:

75/60/55/50	1,100	50

0093 Microbus Disk Interface • factory installed:

75/60/55/50	1,160	50

0655 Parallel Bus Adapter • for DOS only • field installed:

70/55/50/43	1,100	5

0139 Parallel Bus Adapter • same as 0655 but factory installed:

70/55/50/45	950	45

5202/5203/5273 Keycap Kit • for 8230 or 8600 with VISTA/VISTA and 3270/Word Processing and 3270 inscriptions:

NA/NA/NA/NA	48	NC

5279 Keycap Kit • for 8220 or 8600 universal keyboard without word processing or 3270 inscription:

NA/NA/NA/NA	46	NC

5287 Keycap Kit • for 8220 or 8600 with (029) data-entry keyboard inscriptions:

NA/NA/NA/NA	95	NC

9421 ARC Interface (RIM) • additional interface; maximum of 3 per 8605 and 1 per 8602:

60/45/40/40	995	18

8800 Processor & Options

The Datapoint 8800 uses multiple internal data/control paths to interconnect system components. A Main Bus interlinks the CPU, main memory, and 8811 Peripheral Processors. A DMA Channel supports direct main memory access by the CPU, disk, and communications devices. In addition, multiple Peripheral Control Buses are used to interface device controllers.

Separate Peripheral Control Buses are dedicated to the CPU and each 8811 Peripheral Processor. The CPU's Peripheral Control Bus connects to a System Adapter and 5500 I/O Adapter. The System Adapter is used to interface an 8200 Datastation operator console and DC 150 Cartridge Tape Drive. The 5500 I/O Adapter supports magnetic tape, printer, and punched card device attachment.

Peripheral Control Buses associated with 8811 Peripheral Processors interface all other devices, including 8806 Multiport Communications Adapters, 8809 Multifunction Communications Adapters, 8807 Resource Interface Modules (RIM), and a Disk Interface. 8806 Multiport Communications Adapters each support up to 8 interactive terminals; 8809 Multifunction Communications Adapters are used for telecommunications; 8807 Resource Interface Modules connect an 8800 system to an ARC network (see Configurations below). The Disk Interface is an 8-drive controller. Scheduling and control functions for these devices are performed by the connected 8811 Peripheral Processor.

System components described above are implemented on circuit boards that are housed in the 8800 main cabinet. A total of 20 circuit board slots are provided.

8800 Processor • 16-bit architecture; microprogrammed; interfaces with Main Bus, DMA channel, and Peripheral Control Bus; instruction set is downward-compatible with the Datapoint 6600 • 16-key pad and 16-digit alphanumeric display provided for diagnostics; 8200 Datastation is used for operator console/system control functions • requires 3 circuit board slots.

8891 8800 Disk Expansion Kit • required for drive 5:

NA/NA/NA/NA mo	$300 prch	NC maint

☐ Memory

1200 Memory • basic system includes 256K bytes expandable to 1M bytes using 256K-byte cartridges; see 1200 Processor and Options section.

1560 Memory • 128K bytes of RAM memory is included in 1560 packaged system; organized in 9-bit words (8 data and parity); total 12K ROM is used for initialization, tasking, communications, debug program, keyboard/display handlers, initial program boat from disk/diskette; 630-nanosecond memory cycle time; 300-nanosecond access time.

4000 & 6000 Memory • normally integrated into CPU and not available in optional modules except as indicated below • 248K bytes maximum • byte parity • 600-nanosecond cycle time.

0507 Memory Expansion Kit • expands a 6020 Application Processor or 6600 system from 128K bytes to 256K bytes of user memory:

$105/$85/$75/$70 mo	$1,800 prch	NA maint

0535 Memory Expansion Kit • expands 6000 and 6600 systems from 64K to 128K bytes:

55/45/40/35	900	NA

0536 Memory Expansion Kit • expands a 6010 or 6600 system Application Processor from 64K bytes to 256K bytes of user

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

memory:

160/130/115/105	2,700	NA

8400 Memory • processor includes 512K-byte ECC memory expandable to 1M bytes using 512K-byte increment or substituting 1M-byte board for 512K-byte board • see 8400 Processor and Options section.

8600 Memory • 256K, 512K, 768K, or 1M bytes on 1 or 2 boards • byte parity • 750-nanosecond read/write cycle, 300-nanosecond access time, 250-nanosecond refresh at 2-millisecond intervals.

0602 Memory Expansion • field-installed 128K-byte parity memory for 8600:

85/65/60/55	1,600	12

0656 ECC Memory Upgrade • field-installed 512K-byte ECC memory for 8605, 8627, 8634, 8640, and 8645; replaces 256K-byte memory board:

120/95/85/90	2,800	20

0661 ECC Memory Upgrade • 512K-byte upgrade for 8605; maximum 2 memory board per processor:

120/95/85/80	2,800	13

0102 Memory Expansion • same as 0602 but factory installed:

85/65/60/55	1,200	12

0141 Memory Expansion • same as 0656 but factory installed:

120/95/85/80	1,800	10

8800 Memory • 256K to 1M bytes in 128K-byte increments; multiple-bit error checking and correction; 16-bit word length • DMA channel permits CPU, Disk Interface, and Resource Interface Module (RIM) to directly access main memory • 256K-byte minimum memory configuration includes memory controller and requires 3 circuit board slots.

8801 Memory Expansion • 128K-byte memory increment • requires 1 circuit board slot; up to 6 per processor:

94/75/67/63	1,400	12

☐ I/O

1200 I/O • supports dual diskettes, 630K-byte, 10M-byte Winchester drive and controller, 10M-byte disk extension, ARC module, plotter, and printer.

1560 I/O • microbus handles block data transfers on 8 bidirectional lines at data rates 175K bytes per second with maximum block lengths at 256; provides interface between processors and up to 10 peripheral devices, such as printers, disks, diskettes.

3200 I/O • single module supports 4/12 serial ports, 1M-byte diskette, 32M-byte disk, 4 serial ports, and 1 parallel port; double module adds 120M-byte disk and 45M-byte streamer tape in second module; both systems support up to 28 ports added in 8-port increments, 2780/3780 adapters, printer (35 cps to 1000-lpm model), and 1 NX-32 module for connection to ARC.

6600 I/O • high-speed bus, 1.7M bytes per second • byte-parity checked/generated on all I/O • interfaces to Datapoint disks and to IBM System 360/370 byte-multiplexer channel.

8400 I/O • includes 1 serial port for connection of 8230 or an 8475 8-port MPCA for connection of 8230 terminals and one RS-232C printer port; supports up to 50M bytes of disk storage.

8600 I/O • keyboard/display subsystem board interfaces/controls CRT monitor and console keyboard; also provides attachment for system printer • either Microbus Interface or Peripheral Interface board, packaged with system or available to 8602 control/interface, respectively, cartridge disk/diskette or nonremovable disk/backup tape.

8800 I/O • noncommunications I/O interface units for the Datapoint 8800 include the integral System Adapter, the 5500 I/O Adapter, and a disk interface (included with a disk subsystem).

System Adapter • supports 8200 Datastation operator console and DC 150 Cartridge Tape Drive • included in packaged systems.

5500 I/O Adapter • supports up to 4 magnetic tape, printer, and/or punched card peripherals • included in packaged systems.

☐ Communications

1200 Communications

The 1200 system includes 2 RS-232C ports that can be used to connect modems for data communication links or printer. Data rates on RS-232C ports are up to 19.2K bps. The IBM 2780/3780 and BSC 3270 emulation consists entirely of software. The Datapoint 8220 terminal emulation also consists entirely of software.

The 1200 can also connect to the ARC through the VISTA-PC ARC module, which is supported by the VISTA-PC ARC software.

The 1200 system can also run the Datapoint DATAPOLL software for communication with other remote Datapoint systems.

1560 Communications

Two channels are included with each system. First channel supports synchronous or asynchronous, full- or half-duplex communications under program definition and control. Character codes can also be defined under program control, with ASCII or EBCDIC typical. Data rates are programmable from 50 to 9600 bps asynchronous. An external clock can be used for synchronous operation; typically used for communications with a host system. The second channel is typically used for basic local printer support under processor control. It may also be used as a second communications channel.

The communications module is self-contained within the basic unit and allows for communication under several disciplines. The module is fully buffered with a 128-character buffer on transmit as well as receive, providing automatic testing of received line signal detector and clear-to-send and Cyclical Redundancy Check (CRC) error checking on both transmit and receive when needed; on transmit the CRC bytes are automatically inserted in the data block.

A 4-port Multiport Communications Adapter (MPCA) is incorporated in the controller of a 9320 Cartridge Disk Subsystem, which can be used with the 1560.

3200 Communications

The 3200 system can support from 4 to 12 serial ports on single module systems and from 4 to 28 serial ports on double module systems. Both systems can support 1 parallel port.

The 3200 also supports the INX-32 RIM board for connection to ARC. The INX-32 in conjunction with the INX-32 Interface software allows the 3200 to operate as a resource computer on ARC.

See 3200 Processor and Options section for the listing of the individual communication modules.

6600 Communications

For the 6600-based systems, Datapoint supplies 4 hardware/software channel adapter products: Direct Channel Interface Option (DCIO), Multilink Channel Interface (MLCI), Datapoint Attached Support Processor (DASP), and Channel Input/Output Unit Record Utility (CHIOUR). Using the DCIO facility, the IBM mainframe interfaces to an ARC system through a Series 6600 processor. The IBM mainframe perceives ARC as 8 pairs of unit record devices performing input/output operations. The ARC system perceives the IBM mainframe as another Applications Processor.

The MLCI facility allows a Datashare system, which can be an applications processor in an ARC system, to interface with the IBM mainframe in either an interactive or medium-speed batch mode. Like DCIO, MLCI emulates IBM Unit record equipment.

The DASP facility was designed to provide remote batch communications to an IBM mainframe without teleprocessing facilities. DASP looks like peripherals to the IBM mainframe. DASP can receive/transmit data to/from 4 remote sites simultaneously, read, print, and punch records from the byte

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

multiplexer channel, and handle alternate console communications.

The CHIOUR directly emulates up to 16 IBM unit record devices.

9426 Channel Adapter, Freestanding • provides interface between Datapoint 6600 I/O bus and the IBM-compatible mainframe byte multiplexer channel:

$413/$330/$290/$275 mo	$7,800 prch	$75 maint

9427 Channel Adapter, Console • same as 9426 except available in console:

413/330/290/275	7,800	75

Datapoint provides both asynchronous and synchronous communications facilities for 6600-based systems.

9462 Multiport Asynchronous Communications Interface • provides 8 ports to connect devices directly or via modems and telephone lines from remote locations; supports full-duplex transmission at up to 300 bps with 202-type modem or up to 9600 bps with RS-232C modem or device; provides auto-dial/-answer • maximum of 3 per 6600 system • tabletop or wall mounting • connects to I/O bus • available as refurbished equipment only:

NA/NA/NA/NA	350	19

9481 Multifunction Communications Adapter • transfers large amounts of data at high speeds • operates in full-duplex mode compatible with SDLC protocol, in half-duplex mode compatible with BSC or in program-controlled half-duplex mode for general synchronous operations • contains 63-byte transmit and receive buffers • operates at up to 40,800 bps • supports auto-call devices • provides comprehensive error checking including VRC, LRCC, polynomial cycle redundancy character generation/checking • compatible with RS-232C or CCITT V.24 synchronous modems • a chassis; requires mounting • available as refurbished equipment only:

NA/NA/NA/NA	1,000	30

8400 Communications

The 8400 includes an RS-232C communications interface to a local serial printer and an RS-232C or RS-422 serial communication interface to a terminal, data communication line, or an 8475 MPCA 8-port external adapter. The RS-422 port can connect the 8230 terminal (VISTA Station-82).

8600 Communications

0603 Multiport Communications Adapter • supports up to 4 local and/or remote interactive terminals • full-duplex transmission at up to 19,200 bps using RS-232C modem/terminal • maximum of 3 0103s per 8602 processor • field installed:

$50/$35/$33/$30 mo	$1,200 prch	$9 maint

0103 MPCA • same as 0603 except factory installed:

50/35/33/30	1,000	9

0604 Multifunction Communications Adapter • single-line communications controller • operates in full-duplex mode with separate reverse channel using Bisync, SDLC, HDLC, ADCCP, or GENSYNCH protocols • asynchronous operation as well • RS-366 and RS-366A auto-call compatible • RS-232C or RS-422/423 compatible • speeds up to 56K bps • maximum of 2 per 8602 processor • field installed:

75/60/55/50	1,800	18

0104 MFCA • same as 0604 except factory installed:

75/60/55/50	1,500	18

8800 Communications

8806 Multiport Communications Adapter • supports up to 8 local and/or remote interactive terminals • full-duplex transmission at up to 9600 bps using RS-232C modem/terminal or up to 300 bps using AT&T 202-type modem; auto-dial/-answer • maximum of 3 8806s per standalone or ARC Application Processor system • uses 1 slot:

$105/$84/$74/$70 mo	$2,000 prch	$18 maint

8807 RIM Modules • 1 card, up to 5 per 8830 and 8840 and 6 per 8860:

79/63/56/53	1,500	15

8809 Multifunction Communications Adapter • single-line communications controller • operates in full-duplex mode using SDLC, in half-duplex mode using BSC, or in program-controlled half-duplex mode for general synchronous operations; up to 40,800 bps; supports RS-232C and CCITT V.24 modems • maximum of 3 8809s per system • uses 1 slot:

131/105/93/86	2,500	18

8811 Peripheral Processor • provides scheduling and control functions for 8806 Multiport Communications Adapters, 8801 Resource Interface Modules, and 8809 Multifunction Communications Adapters • any number of the above devices (within system constraints) can be attached to an 8811 Peripheral Control Bus; system I/O throughput can be increased by using multiple 8811s • uses 1 slot • up to 4 per processor:

126/101/89/84	1,000	35

General Communications Devices

9400 Asynchronous Communications Adapters • single-line, available as indicated below • 110 to 2400 bps • mounts on desktop or wall, connects to modem and to I/O bus • nonself-powered.

9400 Asynchronous Adapter • with EIA interface:

$48/$38/$34/$32 mo	$910 prch	$17 maint

9401 Asynchronous Adapter • with 103-compatible modem:

79/63/56/53	1,500	21

9402 Asynchronous Adapter • with 202-compatible modem:

79/63/56/53	1,500	21

9404 Synchronous Communications Adapter • single-line • 110 to 2400 bps • mounts on desktop or wall, connects to modem and to I/O bus:

48/38/34/32	910	17

9481 Multifunction Communications Adapter (MFCA) • for synchronous communication • also available as refurbished product:

103/82/72/68	1,950	30

Refurbished Adapter:

NA/NA/NA/NA	1,000	30

0572 Upgrade Kit • for 9481 mode prior to 2/81; enables 9481 to run with RMS:

NA/NA/NA/NA	NA	NA

9455 Multiple Communications Adapter Housing • chassis providing 4 card slots for printed-circuit boards that are versions of 9400 series single-line communications adapters listed above:

121/97/85/81	2,300	32

9451 Option Adapter Card • equivalent to 9400; uses 1 slot:

38/30/26/25	710	17

9452 Option Adapter Card • equivalent to 9401; uses 2 slots:

69/55/48/46	1,300	17

9453 Option Adapter Card • equivalent to 9402; uses 2 slots:

69/55/48/46	1,300	17

9456 Option Adapter Card • equivalent to 9404; uses 2 slots:

41/33/29/28	790	17

Modems & Data Access Arrangements

9478 Datashare Modem • with Internal Data Access Arrangement (DAA) • split-speed modem; 1200/150 bps:

$53/$42/$37/$35 mo	$995 prch	$23 maint

9479 Datashare Originate-Mode Modem • with Internal DAA • split-speed modem; 1200/150 bps:

53/42/37/35	995	22

9445 DAA • does not have auto-dial/-answer:

8/7/6/5	175	2

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

9446 DAA • includes auto-dial/-answer:

14/10/9/8	250	3

Local Area Network Communications

Connection of Datapoint devices to the Datapoint ARCNET is via the Resource Interface Module (RIM), which is either standard or optional for the package, as follows. Datapoint also offers an interface to ARC for the IBM PC. It is called the INX-PC and allows IBM PCs, XTs, and ATs to access ARC DOS resources. The INX-PC includes a 1590 processor that allows the IBM PC to operate as a corporate access workstation in an RMS ARC environment.

1200 Series • connects to ARC through an ARC module or it can emulate 8220 terminal and connect to ARC through an ARC 6000 or 8000 processor.

1560 Systems • RIM is included with 1561 system package.

3200 Series • connects to ARC through Intelligent Network Executive (INX-32), which includes RIM.

4000 Series • RIM is included in 4000 ARC packages.

6000 Series • RIM is included in 6000 ARC packages.

8400 Series • ARC interface included in basic packaged system.

8600 Series • a RIM chip is standard.

8800 Series • a RIM card (1-slot) is optional; up to 6 can be used; 8830 and 8840 systems include 1 RIM card.

8807 RIM Module • for 8800 series:

$79/$63/$56/$53 mo	$1,500 prch	$15 maint

IBM PC, PC/XT & PC/AT • through Intelligent Network Executive (INX)-PC adapter card that fits into slot in PC; includes a 1590 processor and RIM to interface to ARC; Datapoint calls this a "door" into ARC.

0740 INX-PC Adapter Card • includes installation guide; requires INX-PC software:

NA/NA/NA/NA	695	76

80954 PC8220 • includes keyboard overlay, software, and User's Guide to a look like allow PC to Datapoint 8220 terminal:

NA/NA/NA/NA	175	NC

ARC System Components

9483 RIM Adapter • basic RIM adapter module; for 6600:

$100/$80/$70/$65 mo	$1,650 prch	$16 maint

9484 8-Port Active Hub • available as refurbished equipment:

NA/NA/NA/NA	350	12

9485 Passive Hub • 16 ports:

NA/NA/NA/NA	125	NC

9486 8-Port Expander • for 9484:

40/32/27/26	650	5

9489 8-Port Active Hub • nonexpandable:

40/33/29/27	675	8

3460 RG62 Coaxial Cable • plenum rated; per foot:

NA/NA/NA/NA	105	NC

3461 50-Foot Coaxial Cable • with connectors; plenum rated:

NA/NA/NA/NA	90	NC

3462 Connector Kit • for 3460:

NA/NA/NA/NA	10	NC

LightLink • a self-contained bidirectional system that permits transmission of data in full-duplex mode between 2 ARC systems up to 1 mile apart at 2.5M bps • interfaces directly to the interprocessor bus • designed for installation on a rooftop or adjacent to an exterior window • uses modulated infrared light • requires no changes to ARC hardware or software • includes microprocessor-controlled transmitter and receiver at each end • looks to each ARC system like an extension of the interprocessor bus • includes a multiplexed subchannel for audio and low-speed data for installation.

9530 LightLink • transceiver pair:

1,350/1,100/750/675	14,000	195

9533 Pedestals • pair, for 9530:

80/65/60/55	1,000	NC

9535 Outdoor Kit • for 9530; single; NC when ordered with 9530:

NA/NA/NA/NA	600	NC

☐ Disk

Disk Drives for 1200

The 1200 supports dual 630K-byte diskettes with controller and 10M-byte Winchester Disk Drive with Controller plus one 10M-byte extension drive for maximum of 20M bytes of Winchester disk storage.

Disk Drives for 1560

1402 Diskette Expansion Module • for 1560 • adds pair of 0.5M-byte diskette drives to existing system • single-sided • 256 bytes per sector; 26 sectors per track; 77 tracks per diskette • 10-millisecond track-stepping seek plus 50-millisecond settling • 83-millisecond average rotational latency • attaches to Microbus:

$188/$150/$125/$120 mo	$3,000 prch	$42 maint

1403 Diskette Extension Module • for 1560 • adds a pair of 1M-byte diskette drives in housing • double-sided • same specifications as 1402 except there are 52 sectors per (2-track) cylinder:

256/205/175/165	4,150	49

1404 Diskette Extension Module • for 1560 • same as 1403, but only 1 drive:

188/150/125/120	3,000	42

931X Winchester Disk Drives • 5.25-inch drive with either 10M or 20M bytes of data storage • drives provide 256 bytes per sector, 48 sectors per track • rotational speed for the drive is 3600 rpm; rotational delay is 8.33 milliseconds • average head positioning time is 85 milliseconds • attaches to Microbus.

9315 Winchester Disk Drive • provides 10M bytes of data storage on one platter and 1M-byte diskette:

525/420/365/330	5,495	90

9316 Winchester Disk Drive • provides 10M bytes of data storage on 2 platters for 1560 or 862X:

225/180/150/135	3,250	55

9317 Winchester Disk Drive • 20M-byte Winchester drive and 1M-byte diskette:

525/420/365/330	7,495	100

9324 Dual Removable Cartridge Disk • 10M bytes per cartridge; to upgrade 1561 to 1545 or 8605 to 8645 • requires Microbus Interface:

1,025/820/710/640	12,500	135

9325 Removable Cartridge Disk & Fixed Disk • 10M bytes removable and 40M bytes fixed; used to upgrade 1561 to 1540 and 8605 to 8640 • requires Microbus Interface:

1,240/990/860/775	14,150	125

9326 40M-Byte Extension Disk Module • for 154X and 864X systems; includes cabinet and cable:

470/375/335/315	7,600	75

9327 80M-Byte Extension Disk Module • for 154X and 864X systems; includes two 40M-byte fixed disks in cabinet:

790/630/555/525	12,700	120

0600 40M-Byte Fixed Disk Extension Unit • upgrades 9326 disk to 9327:

NA/NA/NA/NA	6,500	45

Disk Drives for the 3200

The 3200 includes a 32M-byte hard disk and 1M-byte in single

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

module systems and 32M-/152M-byte disk with streaming backup tape.

3224 120/160 Disk Upgrade • upgrades 3233 Double Module system with 32M-byte disk to 3250 Double Module with 152M-byte disk:

$925/$740/$660/$610 mo	$16,430 prch	NA maint

3235 Single Module to Double Module • upgrades 3231 Single Module to 3233 Double Module system; adds 120M bytes of disk storage plus streaming tape:

1,445/1,155/1,025/950	25,615	NA

3236 Single Module to Double Module Upgrade • adds streaming tape; upgrades 3231 Single Module to 3233 Double Module System:

430/345/305/285	7,630	NA

Disk Drives for the 6600

939X Disk Pack Drives • storage module type drive • employs 3 platter top loading pack with 5 data surfaces and 1 servo surface • 256 bytes per sector, 64 sectors per track, 16,384 bytes per track, 785 tracks per surface (384 tracks per inch) • 5 tracks per cylinder, 785 cylinders, and 81,920 bytes per cylinder • total formatted capacity is 60,211,200 bytes • rotational speed is 3600 rpm; rotational delay is 8.33 milliseconds • average head positioning time is 30 milliseconds; maximum is 55 milliseconds • data transfer rate is 1.209M bytes per second from the buffer • basic configuration consists of console table-mounted intelligent controller with 10K buffer and 2 drives mounted in standalone pedestal cabinet.

9390 Disk Pack Subsystem • consists of two 67M-byte drives and controller:

$2,695/$2,155/$1,845/$1,760 mo	$35,160 prch	$284 maint

9391 Add-On Drive • consists of 67M-byte drive in a pedestal cabinet • requires 9390:

975/780/670/640	15,950	112

Disk Drives for the 8400

All of the 8400 systems except the 8412 include integral disk drives. Extension disks are available to add storage to the maximum allowable capacity:

9325 40M-Byte Extension Disk • all fixed:

$470/$375/$335/$315 mo	$7,600 prch	$75 maint

9327 80M-Byte Extension Disk • dual 40M-byte fixed disks:

790/630/555/525	12,700	120

Disk Drives for the 8600

931X • see Disk Drives for 1560 section for details.

930X Fixed Disk with Cartridge Tape Backup • basic subsystem includes 20M-byte fixed disk, 20M-byte removable cartridge tape for backup, and controller; up to 4 20M-byte add-on fixed drives can be configured with the controller • fixed disk has 256 bytes per sector, 24 data sectors per track (plus 3 spares), 6144 bytes per track, 549 data tracks per surface plus 1 diagnostic track • fixed disk has 3 platters, 6 data surfaces with 6 tracks per cylinder and 549 cylinders per drive • total drive capacity is 20.24M bytes • rotational speed is 5520 rpm; rotational delay is 5.435 milliseconds • track to track, average, and maximum head positioning times are respectively 15, 75, and 100 milliseconds; maximum start time is 20 milliseconds • data transfer rate is 725,250M bytes per second • cartridge backup is 9-track; tape speed is 60 lps; recording density is 5208 bpi • record size is 6144 bytes • tape data transfer rate is approximately 39,064 bytes per second.

9301 Disk Tape Subsystem • 20M-byte disk and 20M-byte cartridge tape; to upgrade 8605 to 8634:

$1,245/$995/$865/$780 mo	$17,850 prch	$150 maint

9302 Add-On Fixed Disk Drives • provides two 20M-byte drives in a cabinet plus 2 logic cards for installation in 9301 cabinet:

1,220/975/850/765	17,500	135

9303 Add-On Fixed Disk Drive • provides one 20M-byte drive in a cabinet plus 1 logic card for installation in 9301 cabinet:

700/555/485/435	9,995	70

9304 Add-On Fixed Disk Drive • provides one 20M-byte drive for installation in 9303 cabinet plus 1 logic card for the 9301 cabinet:

555/445/385/345	7,950	65

Disk Drives for the 8800

Disk devices for 8800 standalone and Data Resource Processor system configurations include an 8-drive Disk Interface, 67M-byte/135M-byte removable/fixed-disk drive, and 135M-byte fixed-disk drive. Minimum configurations include the Disk Interface, and 1 removable/fixed-disk drive. Up to 6 additional disk drives are optional for a maximum disk storage capacity of 1080M bytes.

Disk Interface • controller supports one 67M-byte/135M-byte removable/fixed-disk drive and up to six 135M-byte fixed-disk drives • performs multiple-sector read/write operations; detects up to 10-bit errors; interfaces with DMA channel.

93XX Fixed/Removable Disk Drives • 67M-byte removable specifications include 6220-bpi inner track bit density, 384-track-per-inch track density, 315 bytes per sector, 64 sectors per track, 16,384 bytes per track, 67,420,160 bytes per pack (formatted) and 5 tracks per cylinder • 135M-byte fixed specifications include 6038-bpi inner track bit density, 680-track-per-inch track density, 305 bytes per sector for 65 sectors plus 335 bytes for last sector, 64 sectors per track plus 2 spares, 16,384 bytes per track, 134,840,320 bytes per pack (formatted), and 10 tracks per cylinder • specifications common to both fixed and removable disks include rotational speed of 3600 rpm, rotation delay of 8.33 milliseconds, average head positioning time of 30 milliseconds and maximum head positioning time of 55 milliseconds • all drives attach to an integrated disk interface mounted in the 8800 chassis.

9331 Single Disk Drive • 135M-byte fixed-disk drive; includes cabinet space for 9333 Expansion Drive:

$894/$715/$630/$595 mo	$17,000 prch	$100 maint

9332 Dual Disk Drive • two 135M-byte fixed-disk drives:

1,675/1,340/1,185/1,120	31,950	200

9333 Expansion Drive • 135M-byte fixed-disk drive • requires 9331 Single Disk Drive:

844/675/595/560	16,000	100

9390 Storage Module • dual 120M-byte disk with controller; available as refurbished equipment only:

NA/NA/NA/NA	16,000	284

9391 Disk Extension • 67M-byte for 9390:

975/780/670/640	15,950	112

9392 Disk Extension • 67M-byte for use with 9391 to upgrade 9393:

925/740/635/600	15,050	112

9393 Disk Extension • dual 67M-byte extension drive:

1,835/1,470/1,260/1,200	24,000	224

9395 Dual Disk Drive • 67M-byte removable-disk and 135M-byte fixed-disk drives with cabinet:

1,675/1,340/1,185/1,120	31,950	210

☐ Tape

Tape cassette drives are integral to the Datapoint "small-screen" 6600-based systems. The only other tapes available are the 20M-byte backup cartridge tape on the 8600 systems and industry-standard 0.5-inch, 9-track tapes available to 6600 and 8800 systems. The 8800 systems also incorporate a DC150-type cartridge tape drive.

8600 Tape

8600 Tape • 20M-byte cartridge integral to 9301 Disk/Tape, dedicated to backup • 20M-byte backup/restore in under 15 minutes • 256 data bytes per record; 24 records per group; 366 groups per track; 9 serial tracks • controller has some specific

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

backup-oriented commands (e.g., Start At Selected Disk Cylinder).

8800 & 6600 Tape

Magnetic tape devices for 6600 and 8800 configurations include a standard cartridge tape drive and can add 3 open-reel drives. Each drive includes an integrated controller. Tape configurations subject to interface availability on the 5500 I/O Adapter on the 8800 or on the 6600 I/O bus.

DC 150 Cartridge Tape Drive • used for loading programs • 500K-byte cartridge capacity; 30 ips for read/write; 90 ips for search • included in 8800 packaged systems; integrated controller attaches to System Adapter.

9586 Open-Reel Tape • 9-track; 800/1600 bpi; 25 ips; 10.5-inch reel; read-after-write • integrated controller attaches to 5500 I/O Adapter on 8800 or to 6600 I/O bus:

$1,288/$1,030/$880/$840 mo	$20,975 prch	$185 maint

☐ Terminals/Workstations

8220 Ergonomic Terminal • 24-line by 80-character, 12-inch display terminal; optionally detached, typewriter-like keyboard includes numeric and function keypads • serial interface provided for printer attachment • 150 to 9600 bps, operator-selectable; attaches to System Adapter for use as operator console; attaches to Multiport Communications Adapter for use as local/remote workstation • advanced ergonomic design, based on European studies • amber phosphor; detached keyboard; optional tilt/swivel base:

$80/$65/$55/$50 mo	$1,395 prch	$18 maint

8230 Ergonomic Terminal • with printer port; RS-422 port for 8412 processor only:

130/105/90/85	1,595	22

0612 Tilt/Rotate Base • for 8220 and 86XX:

NA/NA/NA/NA	100	NC

☐ Printers

9611 Serial Impact • same as 1261; for all systems via serial interface • 35-cps formed character letter quality • 96 characters • 132/158/198 columns at 10/12/15-pitch (132 is default; IEOS supports up to 140) • includes serial interface/controller:

$165/$150/$130/$125 mo	$2,795 prch	$36 maint

0087 Tractor Assembly • for 9611:

NA/NA/NA/NA	400	NC

0245 Cut Sheet Feeder:

106/85/76/72	2,055	19

0640 Cut-Sheet Feeder Interface Kit • for 9611 printer:

NA/NA/NA/NA	350	NC

962X Matrix Printer • serial interface at up to 9600 bps for attachment to any system, or parallel attachment to 6600/8800 • 160 cps; bidirectional • 96-character set; 132 columns • 10 cpi; 6/8 lpi.

9623 Multi-Mode Matrix Printer • includes all necessary cabling and hardware:

200/160/140/133	3,495	53

0061 Expanded Print Option • for 962X:

NA/NA/NA/NA	200	NC

0247 Dual Bin Cut-Sheet Feeder • portrait mode only; manual slot for envelope:

115/90/80/75	1,995	23

0501 Mechanical VFU • vertical format unit for 160-cps printer:

7/5/4/4	100	NC

0763 Font Extension Board • for 9623 printer:

NA/NA/NA/NA	395	6

0764 Tractor • for 9623 printer:

NA/NA/NA/NA	400	NC

9603 Printer Stand • 160-cps and 45-cps printers:

NA/NA/NA/NA	150	NC

9628 Matrix Printer • 80 columns, 160 cps:

85/70/60/50	995	20

0240 Roll Paper Holder • for 9628:

NA/NA/NA/NA	50	NC

0241 Paper Tractor • for 9628:

NA/NA/NA/NA	70	NC

Belt Printer • serial interface version for 1560 or 8220 terminal attachment, or parallel interface for 6600/8800.

9214 Belt Printer • 230/340 lpm; 96-/64-character set; 132 print positions; 6 lpi • tractor feed; 1.75- to 16.75-inch wide, 1- to 6-part forms; cartridge-enclosed ribbon • status lamps for fault conditions • parallel interface/controller:

530/425/380/345	8,500	135

9297 Belt Printer • serial version of 9214:

530/425/380/345	8,500	135

9213 Belt Option • 64-character belt for 9214/9297 to yield 340 lpm; installation fee only:

NA/NA/NA/NA	NC	NA

9216 Paper Tray • for 9214/9297:

NA/NA/NA/NA	40	NC

0593 Parallel-to-Serial Conversion Kit & Cable • 9214 to 9297:

NA/NA/NA/NA	800	NA

0594 Serial-to-Parallel Conversion Kit & Cable • 9297 to 9214:

NA/NA/NA/NA	625	NA

925X Band Printers • parallel interface/controller for attachment to 6600/8800 • 132 columns • 10 cpi; 15 cpi optional on 300-lpm version • 6/8 lpi switch-selectable • single-channel vertical forms control • 3- to 16-inch wide, 3- to 14-inch long forms • includes pedestal.

9257 Band Printer • 300 lpm at 64 characters, 10 cpi:

530/425/380/345	8,500	105

0204 Band • 64 characters at compressed 15 cpi; for 9257 • 132 columns:

NA/NA/NA/NA	400	NC

0205 Band • 96 characters at 10 cpi; for 9257 • yields 220 lpm:

NA/NA/NA/NA	400	NC

9258 Band Printer • 600 lpm at 64 characters; 10 cpi:

720/575/510/465	11,950	142

0226 Band • 96 characters at 10 cpi; for 9258 • yields 440 lpm:

NA/NA/NA/NA	400	NC

9284 Paper Receptacle • for 925X:

NA/NA/NA/NA	80	NC

0140 Serial Option • for 9257 or 9258; factory installed:

NA/NA/NA/NA	NC	NA

0202 Acoustic Cabinet • for 925X • factory installation only • limits form length to 13 inches:

85/65/55/50	1,650	9

0513 Parallel-to-Serial Upgrade • for 9257 or 9258; field installed:

NA/NA/NA/NA	800	NA

9660 Laser Printer • printing subsystem that interfaces directly to ARC; includes interface processor, text video processor, control processor and memory, and associated ARC processor with workstation • interface processor accepts commands from the users on the ARC network, routes and formats incoming text, and directs the operation of the text video and control processors • text video processor expands and buffers high-speed data; control processor manages the printing and paper operations; associated ARC processor running under RMS functions as unspooler, controls what information is sent to the 9660, and provides status

Datapoint ARC Systems
1200, 1560, 3200, 6600, 8400, 8600 & 8800 Series

and direct control of 9660 • memory ranges from 128K to 512K bytes • high-quality printer with 480x240 pixels per square inch; printing speed is 20 surfaces per minute or about 1300 lpm; graphics or multiple type faces can be used; up to 32 different character sets can be used per page • provides 5 input drawers which hold 500 pages each and 10 output bins; up to 7 output bins can be added; output can be directed to any bin • status of 9660 is available to all workstations on ARC network • use charge for volume over 10,000 surfaces per month at $0.026 per surface is added to maintenance fee.

9660 Laser Printer • includes 1 output module, paper tray, and accessory cabinet:

3,020/2,415/2,165/1,980	**47,500**	**420**

9662 Output Module • for 9660; maximum of 3 additional per printer:

280/223/200/185	**6,000**	**40**

80708 Paper Trays • for 9660; set of 5:

NA/NA/NA/NA	**125**	**NC**

• END

Datastream Terminal Controllers
Models 774, 776 & 874

■ PROFILE

Function • emulates IBM 3271/3274/3276 remote controllers and 3178/3278/3287 terminals and printers • substitutes ASCII terminals/printers/personal computers for emulated IBM units • performs terminal management and control, polling, data concentration, and network control.

Packaging • standalone, tabletop units attaching 3 or 7 (Model 776), 7, 11, 15, or 23 (Model 774), or 7, 11, or 15 (Model 874) terminals/printers • 874 accommodates up to 15 additional keyboard send-receive (KSR) terminals.

Communications/Networks • Model 776 supports single BSC high-speed link at 9600 bps; Model 774 supports 1 or 2 BSC high-speed links each at 9600 bps • dual links transmit/receive simultaneously, and allow users to switch between them via keyboard command • attaches to IBM 27XX and 37XX communication processors; used with S/360, S/370, 30XX, and 43XX processors • RS-232C DTE and DTE interface.

First Delivery • 1983.

Systems Delivered • undisclosed.

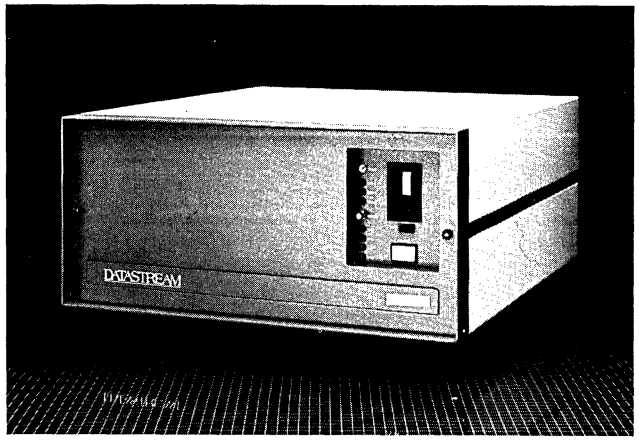
Comparable Systems • Black Box A/S-3, CCI 8274C, DRA Hydra II, ICOT 35X/36X, Infotron VTS 35X/36X, Innovative Electronics MC80/600/602, Kaufman Data 870/872, Local Data DataLynx3274, Micom Micro 7400, Protocol Computers 1071/171/71B, Renex RT74, Thomas Engineering MZ-80, etc.

Vendor • Datastream Communications Inc; 2520 Mission College Boulevard, Santa Clara, CA 95050 • 408-986-8022.

Distribution • direct sales and distributors throughout the U.S.

■ ANALYSIS

The Datastream family consists of remote cluster controllers that emulate the control facilities of the IBM 3271/3274/3276 control units, the display and editing facilities of the IBM 3178/3278 keyboard-display units, and the printing facilities of the IBM 3287 serial printer. The Datastream controllers **do not** attach IBM peripherals; instead, they substitute low-cost ASCII terminals and printers for the more expensive IBM units. For users that prefer a single vendor relationship, Datastream offers its own IBM 3178 and 3278 replacement terminals called the 178 and 878, respectively. The 878 emulates 3278 Models 2, 3, 4, and 5 plus the DEC VT100. Both terminals also have 3270-type (layout) keyboards. All Datastream controllers also accommodate personal computers, allowing them to operate as 3178/3278 terminals.



While the Datastream controllers are logically similar to the aforementioned IBM units, there are some differences. Model 874, an SNA/SDLC-like controller, supports up to 15 attached CRTs, serial printers and/or keyboard send-receive (KSR) terminals. In addition, the 874 permits printer/KSR's to be attached to the display units auxiliary RS-232C interface and directly addressed by the host. Thus a fully configured 874 accommodates 30 terminals/printers, 2 less than an IBM 3270.

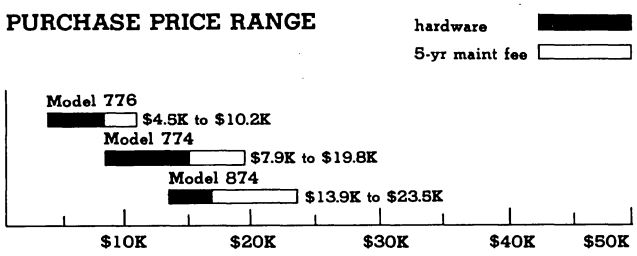
The 874 also supports up to 44 concurrent logical sessions. Individual users can declare multiple sessions and switch between them without logging off.

Dual link support and dial-in are strong features of the Datastream controllers that are not found on IBM controllers. Models 774 and 874 support up to 2 independent high-speed links to the host. All Datastream controllers support dial-in connections from remote terminals. These are significant advantages discussed under **Strengths**.

Products like Datastream are marketed as low-cost alternatives to the more expensive IBM products. The cluster controllers are priced lower than comparable IBM units, and the ASCII terminals are priced one-third to one-quarter as much as an IBM keyboard-display unit. For example, IBM's low-cost 3178, priced at $1,660, could be replaced by a host of $500 terminals. If you opt for the Datastream 178, it will cost $975, but this terminal comes with a 3178-like keyboard. The ASCII printers available are also priced below the IBM 3287.

With price and performance superiority, one questions why products like Datastream's haven't dominated the IBM 3270 marketplace. There are a number of reasons, such as user unawareness of the alternative products and the security associated with the IBM umbrella. Another reason, however, is **efficiency**. Any product that emulates another and/or performs protocol conversion, has built-in overhead in both time and resources in order to accomplish the conversion. The Datastream controllers emulate the IBM 3178 and 3278, causing the ASCII terminals to "appear as and behave as" the emulated IBM units with respect to data presentation, edit, and control facilities. The controllers also convert ASCII character and the datastream to a 3178/3278 format. In addition to ASCII display terminals, all

PURCHASE PRICE RANGE



DATASTREAM 77X & 87X SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations (solid bars) and for associated 5-year maintenance fees (open bars) ● Model 776 **small** configuration is 776-00 with 4 ports; **large** configuration is 776-01 with 8 ports ● Model 774 **small** is 774-00 with 8 ports; **large** is 774-03 with 24 ports ● Model 874 **small** is 874-00 with 8 ports; **large** is 874-02 with 16 ports ● all prices are single quantity purchase.

Datastream Terminal Controllers
Models 774, 776 & 874

Datastream controllers allow low-cost keyboard-printer to be substituted for IBM 3178 and 3278 printers.

To emulate the operating characteristics, the controllers employ PROM-resident tables that convert ASCII keyboard commands to IBM 3178/3278 commands. Since the ASCII keyboard probably does not have the edit and control keys corresponding to those of the 3178 and 3278, a predetermined set of keystrokes is required to enter a 3270 command. Most controllers like Datastream's require 2 or 3 keystrokes to enter a command generated by a **single keystroke** on a 3178 or 3278 keyboard. This is one of the weaknesses of products like Datastream's, unless the ASCII terminal has a 3270-like keyboard.

The actual keyboard command emulation is fairly rapid, since firmware executes the process. The inefficiency is at the operator level. Someone familiar with an IBM keyboard must learn a completely new keyboard arrangement and keying pattern, which reduces productivity and increases possibility of keying errors. Even after the operator becomes proficient, the time required to enter multiple keystrokes reduces productivity. Another limiting factor is that some of these replacement products do not emulate the more sophisticated features of the 3270. For example, a "Read Modified data only" operating is not always supported, nor is the full complement of program function keys. Datastream claims that all 3178/3278 and 3270 controller functions are supported by its controllers.

In summary, products like the Datastream controllers do offer a low-cost alternative to IBM and, in many cases, provide useful features not available on the 3270. Multiple keying requirements for ASCII terminals, however, will cut throughput efficiency. Whether the tradeoff justifies the cost requires careful study. Of course, you can eliminate the multiple-keystroke problem by using Datastream 178 and 878 terminals.

☐ Strengths

Aside from cost, the Datastream controllers are user-flexible units that offer a number of attractive operational facilities, some of which are not available on comparable IBM controllers. For example, remote terminal dial-in, whereby a remotely located terminal employs the DDD to access the controller, is standard on all versions of the Datastream products. In addition, the 774 and 874 support 2 independent high-speed links and can be equipped with redundant control logic and power supplies.

The dual-link facility is a no-cost option on the 774 and 874, and allows the cluster controller to directly communicate with 2 independent hosts or 2 separate ports on the same front-end processor. But the dual links must use the same protocol (BSC or SDLC). Both links of the dual communication facility support concurrent communication and users can switch from one link to another via a single keyboard command. There is no logging on or off as is the case with some products. Users can even put a session on hold, switch links to perform another function or retrieve data, and switch back to the on-hold session.

The remote terminal dial-in facility is not unique to Datastream (other "protocol" converters have it as well) but it does not exist on the 3270. Remote dial-in allows users to configure specific controller ports to recognize the data transmission rate and character format of a remote terminal dialing into the controller, and establish a session for it. For organizations with remote users requiring only occasional host-processor services, the dial-in facility is a low-cost solution. Without it, the remote site would need its own cluster controller or emulation of it.

The redundant control logic and power supply facilities guarantees that a failure in the primary units will not affect system operation. While this facility is certainly attractive, switchover to the redundant components is **not automatic**. Users must manually switch ribbon cables, an inconvenience that diminishes the overall attractiveness of this facility.

☐ Limitations

The Datastream controllers are strictly **remote** controllers that communicate with the 27XX or 37XX communication processors. Local host connection to the byte or block multiplexers or selector channel on the host processor is **unsupported**. Since the 774 and 874 each have a dual-link facility, a beneficial enhancement would be the use of using one for direct local connection. Lee Data Corporation provides this operating flexibility with its Models 321 and 421, and we understand that it has been very successful. Of course, there's nothing to stop you from making a local connection via a modem to the communication processor, provided you have one.

Protocol inflexibility is another limitation of the 774 and 874. Each link of dual link controller must employ the same protocol. Users would substantially benefit from mixing BSC and SNA/SDLC protocols for greater utility and flexibility. ICOT provides such flexibility with its VTS 35X and 36X controllers.

While control logic and power supply redundancy is cited as a strength, we must fault it for not providing automatic switchover. Manually switching a ribbon cable is certainly not difficult, but it does take time and deprive users of the cluster's services while the correction is changed. Automatic switchover would make this enhancement much more attractive, justifying its implementation.

■ SOFTWARE

☐ Terms & Support

Terms • firmware bundled with basic system price.

Support • bundled with hardware.

■ HARDWARE

☐ Terms & Support

Terms • offered on purchase basis only • $500 installation charge per site.

Support • on-site support available • 120-day warranty.

☐ Overview

The Datastream family consists of 3 primary clustered-terminal controllers that emulate the IBM 3271/3274/3276 (Model 776) and 3274 (Models 774 and 874) remote controllers with attached IBM 3178/3278 terminals and 3287 printers. The Datastream controllers accommodate up to 30 asynchronous ASCII terminals and printers to be substituted for IBM devices, and emulate their display and print characteristics and edit/format/control functions. The Model 874 supports up to 15 CRTs, but allows a KSR terminal to be attached to each ASCII terminal's auxiliary RS-232C interface, increasing the terminal capacity to 30 devices.

Models 774 and 874 can be configured with up to 2 independent links for communicating with separate host processors, or different ports on an IBM 27XX or 37XX communications processor (front end). Both links must use the same protocol, either BSC (Model 774) or SNA/SDLC (Model 874).

While the controllers are delivered with the necessary firmware to execute emulation, the user must configure the operating parameters for each ASCII port. From a keyboard, a user enters the line speed, word format, indicator, line type, and authorized user ID for each port. Selectable line speeds are 50/75/110/150/200/300/600/1200/1800/2000/2400/3600/4800/7200/9600 bps; the auto-baud (auto-speed) detection facility can be specified if the access terminal connects to the controller via a remote communication facility. The word format indicates the number of active bits, parity, and stop bits. This too, can be automatically detected for dial-in terminals. The line type indicates local (direct attachment), leased line, or auto-answer. Receive-only printers can be assigned to auto-answer ports as long as they are not part of a hunt group (rotary). All of the configuration parameters are retained in RAM and backed up on tape. This allows the system to be easily rebooted during start or restart operations.

The receive-only printer definition defines the line count, line length, and page length and width. XON is employed for flow-control.

Model 776 controller is offered in 4- or 8-port versions and accommodates 3 or 7 terminals/printers; a port is used for the high-speed link. Models 774 and 874 are offered in submodels that only differ in the number of ports provided: 8, 12, 16, and 24 ports on the 774; 8, 12, and 16 ports on the 874. These controllers

Datastream Terminal Controllers
Models 774, 776 & 874

also use a port for the high-speed link, displaying a single terminal or printer in each configuration. If the dual-link option is employed, it uses an additional port displacing a second terminal or printer.

The actual total number of concurrent sessions supported by each controller is determined by the capacity of its terminal transmit/receive buffer and the number of characters displayed on each terminal's screen. The maximum capacity of the 776 is 14K bytes while that of the 774 is up to 46K bytes (see Converters/Emulators). The IBM 3178 and 3278-2 terminals are emulated; both display 1920 characters plus a status line. The 874, however, contains 512K bytes of RAM transmit/receive buffer, more than enough to handle the 44 logical sessions initiated by the keyboard-printer terminals and 3178/3278 terminals Models 2 through 5. Total buffer capacity is available to **both** links, not to each link; therefore, buffer capacity allocated to a link displaces that available to the second link.

As mentioned, the 776 can be equipped with a BSC link while the 774 and 874 support 2 links. The 774 supports only BSC protocol on each link and 874 supports SNA/SDLC. Protocols cannot be mixed on the same unit, as is the case with some competitive products (see Limitations).

As can be seen, the Datastream controllers offer some facilities not available with the IBM 3270 (e.g., dual host links and remote terminal dial-in). In addition, the Datastream controllers also allow the user to switch between high-speed link sessions without logging on and off, and to establish a concurrent second session on the same or different host. The 774 and 874 can also be ordered with redundant control logic and power supplies, neither of which is available on the 3270. As another safeguard, the 874 will hold sessions at a port should a line failure occur.

☐ Converters/Emulators

Model 774-00 • tabletop, remote cluster controller supports any combination of up to 7 ASCII terminals and printers • emulates IBM 3274C models with attached 3178/3278 Model 2 terminals and 3287 printers • RS-232C interface • remote dial-in with ABR/character recognition • 14K-byte RAM terminal buffer • single high-speed trunk • 9600 bps, BSC; second BSC trunk no-cost option:

$7,900 prch	$80 maint

Model 774-01 • same as 774-00 except supports 11 terminals/printers and has 22K-byte RAM terminal buffer:

10,500	80

Model 774-02 • same as 774-00 except supports 15 terminals/printers and has 30K-byte RAM terminal buffer:

13,000	80

Model 774-03 • same as 774-00 except supports 23 terminals/printers and has 46K-byte RAM terminal buffer:

15,000	80

Model 776-00 • tabletop, remote cluster controller supports any combination of up to 3 ASCII terminals and printers • emulates IBM 3271/3274/3276 with attached 3178/3278 Model 2 terminals and/or 3287 printers • RS-232C interface • remote dial-in with ABR/character recognition • 6K-byte RAM terminal buffer • single high-speed trunk, 9600 bps, BSC:

4,500	53

Model 776-01 • same as 776-00 except supports 7 terminals/printers and has 14K-byte RAM terminal buffer:

7,000	53

Model 874-00 • tabletop, remote cluster controller supports any combination of up to 7 ASCII terminals and printers • emulates 3274C models with attached 3278 Models 2 through 5 terminals and 3287 printers • RS-232C interface • remote dial-in with ABR/character recognition • 512K-byte RAM terminal buffer • single high-speed trunk, 19.2K bps, SNA/SDLC; second SNA/SDLC trunk no-cost option:

10,950	110

874-01 • same as 874-00 except supports 11 terminals/printers:

13,950	110

874-02 • same as 874-00 except supports 15 terminals/printers:

16,950	110

Models 774 and 874 Expansion Modules

774-00 4-Port Expansion Module • expands Model 774 from 8 to 12 ports:

$4,250 prch	NA maint

774-00 8-Port Expansion Module • expands Model 774 from 8 to 16 ports:

6,500	NA

774-00 16-Port Expansion Module • expands Model 774 from 8 to 24 ports:

9,100	NA

774-01 4-Port Expansion Module • expands Model 774-01 from 12 to 16 ports:

4,250	NA

774-01 12-Port Expansion Module • expands Model 774-01 from 12 to 24 ports:

7,800	NA

774-02 8-Port Expansion Module • expands Model 774-02 from 16 to 24 ports:

6,500	NA

874-00 4-Port Expansion Module • expands Model 874-00 from 8 to 12 ports:

4,700	NA

874-00 8-Port Expansion Module • expands Model 874-00 from 8 to 16 ports:

6,750	NA

874-01 4-Port Expansion Module • expands Model 874-01 from 12 to 16 ports:

4,700	NA

774/874 Redundant Control Module • provides redundant control logic and power supply to Models 774 and 874 controllers:

6,000	NA

☐ Terminals/Printers

The Datastream controllers are delivered with emulation firmware that allows the most commonly available asynchronous ASCII terminals and printers to be substituted for IBM 3178/3278. Among the terminals mentioned by the vendor are the DEC VT 100/52, all ADDS Regent and Viewpoint modes, all Beehive, Datamedia, Delta Data, Anderson Jacobson, LSI, Hewlett-Packard, Televideo, etc. In addition, they also accept most of the personal computers commercially available (e.g., IBM and Apple). Each controller is delivered with the firmware for 15 different user-specified ASCII terminals. (This allows users to mix terminal types). Datastream also offers its own terminals that emulate the 3178 and 3278. Called Models 178 and 878, they provide the display and control features of the IBM terminals and also have IBM-compatible keyboards. The latter provided the same layout features of the keyboards used with the 3178/3278 and thus obviates the multiple keying operations necessary when ASCII keyboards are emulating 3270 units.

The controllers also accommodate any serial ASCII printer, including receive-only or keyboard send/receive models. The printers operate as host-addressable units—shared or unshared—and can be used for local copy printing. Datastream does require that the printers support XON/XOFF controls.

178 Display Station • emulates IBM 3178/3278 Model 2 • 12-inch diagonal screen; tilt and swivel • low-profile keyboard with 24 unshifted program function keys, unshifted CLEAR key, operator-selectable 10-key numeric pad, 2 ALT keys • supports

PRCH: single-unit purchase price. MAINT: monthly maintenance charge. NC: no charge. NA: not available. All prices are current as of November 1984.

Datastream Terminal Controllers
Models 774, 776 & 874

all display, edit and control features • also emulates DEC VT 100:

$975 prch	$11 maint

878-15 Display Station • emulates IBM 3278 Models 2 through 5 • 14-inch diagonal screen; tilt and swivel • low-profile keyboard with same features as 178 keyboard • supports all display, edit, and control features • also emulates DEC VT 100 80-/132-column formats; ANSI 3.64 emulation:

1,800	22

☐ Communications

The Model 776 emulates the IBM 3271/3274 "C" models and the 3276, all under BSC protocol. Models 774 and 874 emulate the 3274 "C" models, with the 774 operating under BSC and the 874 under SNA/SDLC. The 776 supports a single link to the host processor, and both the 774 and 874 support up to 2 separate host links. The controller attaches ASCII terminals/printers via an RS-232C interface. For CRT-attached printers and/or KSR's, the interface is also RS-232C.

The terminals can be directly attached via twisted-wire pairs to any of the controllers, up to the limit of the interface (50 feet). For greater distances, a limited-distance modem is recommended. All controllers also support remote terminal dial-in whereby a leased line or the DDD can be used to access the controllers. All support auto-baud recognition (ABR) and character format recognition, allowing the controller to automatically "set up" to handle incoming data. The top transmit speed for a remote terminal is 9600 bps; for locally attached devices, the top speed is also 9600 bps. All controllers also provide local and remote flow control (XON/XOFF) to ensure that transmit/receive buffer capacity is not exceeded, causing data to be lost.

The controllers communicate with IBM S/360, S/370, 303X, and 43XX processors via 27XX or 37XX front-end processors, or integrated adapters on the S/370 Models 115, 125, 135, or 138 and the 4331. Communications are point-to-point under BSC (Models 774 and 776) and SNA/SDLC (Model 874). Models 774 and 874 support a second high-speed link. Top link transmit speeds are 9600 bps for BSC and 19.2K bps for SNA/SDLC. The dual-link units operate simultaneously and allow users to switch between them via a keyboard command.

774 Optional BSC Trunk • microprocessor-controlled optional high-speed trunk for 774 controllers • concentrates the outputs of up to 23 terminals • BSC protocol; 9600 bps:

NC prch	NA maint

874 Optional SDLC Trunk • microprocessor-controlled optional high-speed trunk for 874 controllers • concentrates the outputs of 30 terminals • SNA/SDLC protocol; 19.2K bps:

NC	NA

• **END**

Datatel DCP 9100
T1 Voice/Data Multiplexer

■ PROFILE

Function • bit- or byte-interleaved TDM designed for T1 carrier facilities • point-to-point applications; downline loading of remote multiplexers • handles asynchronous/synchronous data and voice channels • composite link rate is 1.544M bps.

Communications/Networks • supports synchronous data channels of 300 to 19.2K bps and synchronous channels from 600 to 1024K bps; channel interfaces are RS-232C, CCITT V.35, MIL-Std-188-114, AT&T 301/303 • voice channels handled by PCM at 64K bps or CVSD at 16K or 32K bps; 4-wire E&M signaling • single composite link (trunk) • point-to-point applications • cascaded channel multiplexers.

First Delivery • February 1983.

Systems Delivered • over 100 pairs.

Comparable Systems • Amdahl Model 2211, Avanti Ultra Mux, Bayly Omniplexer, Codex 6240, DCA Netlink, General DataComm Megamux Plus, Infotron T Mux, Paradyne DCX-T1, and Timeplex Link/1.

Vendor • Datatel Incorporated; Cherry Hill Industrial Center, Cherry Hill, NJ 08003 • 609-424-4451.

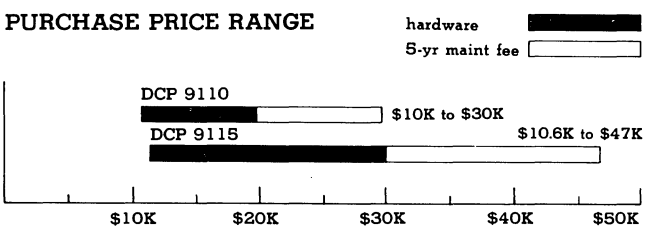
Distribution • nationwide through direct sales and manufacturers representatives.

■ ANALYSIS

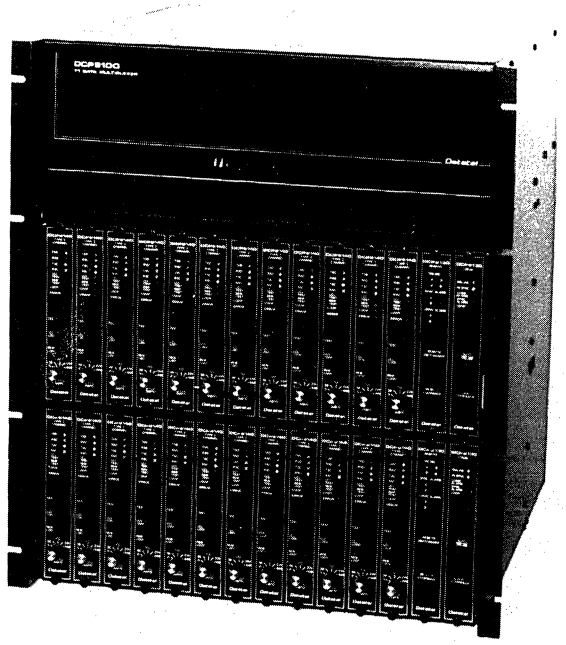
The Datatel DCP 9100 is a specialized time-division multiplexer designed specifically to combine a wide range of asynchronous and synchronous data and voice channels on a single broadband link referred to as a T1 carrier.

The T1 carrier service has been used by the telephone company since the early 1960's to carry digitized voice and data. Until early 1983, however, T1 was unavailable as a tariffed service to private users; those who required it had to subscribe to independent carriers, or had to install their own microwave links. Users can now order the service under AT&T's Accunet T1.5 service or similar offerings from MCI, RCA, etc.

PURCHASE PRICE RANGE



DATATEL DCP 9100 PURCHASE PRICING bar graphs cover price range between "small" and "large" configurations for hardware (solid bars) and projected associated 5-year maintenance (open bars) • **DCP 9110 small** configuration consists of an equipment nest, common logic and power supply, 4 DCP 9140 synchronous channel cards, 2 DCP 9146 voice channel cards, and 6 DCP 9142 synchronous channel cards; • **large** configuration consists of equipment nest, redundant control logic and power supplies, 8 DCP 9140, 4 DCP 9146, and 12 DCP 9142 channel cards • **DCP 9115 small** configuration consists of an equipment nest, common logic, and power supply, 4 DCP 9140, 2 DCP 9146, and 6 DCP 9142 channel cards; **large** configuration consists of equipment nest with redundant control logic & power supplies, DCP 9116 expansion nest, 10 DCP 9146, 8 DCP 9178, 10 DCP 9140, and 6 DCP 9174 synchronous channel cards • maintenance charges based on 1 percent of purchase price/month over 60 months • all prices single-quantity purchase.



T1 offers the end user a high-volume communication facility at low cost. For example, a single 1.544M-bps link can support up to 24 64K-bps channels and the transmission quality of the service is also superior. AT&T guarantees a point-to-point, full-duplex link with an error rate of no more than 1 bit in 1 million over a 1 day period.

The T1 bandwidth is ideal for combining a large number of communication links (paths) such as may be the requirements of office automation. For example, such applications and digital voice, requires 32K to 64K bps, mainframe-to-mainframe file transfers need at least 64K bps, and compressed video requires a minimum of 450K bps. A T1 multiplexer can accommodate these requirements.

The DCP 9100 first appeared last year and was a competent—but limited—product. For example, it could only handle synchronous data directly, with asynchronous inputs relegated to submultiplexers or the "clock in at 4 times the data rate" trick; it had no voice facility; it accommodated only 48 input channels; and it was strictly a hardware-configured box. Those drawbacks have now been eliminated, but others remain (see Limitations).

Datatel significantly increased the range and flexibility of its synchronous cards. Last year's offerings consisted of 2 cards, a single-channel card supporting data rates to 448K bps and a dual-channel card with rates to 19.2K bps. Six additional synchronous cards have recently been added that offer a wider range of data rates. Especially significant is the DCP 9170, a single-channel card with 12 selectable data rates from 56K bps to 1024K bps. This range should cover the gamit of high-speed data requirements most users will have, including file transfer between mainframes. Another noteworthy channel card is the DCP 9174.

Datatel DCP 9100
T1 Voice/Data Multiplexer

This is also a single-channel card and operates at speeds of 56K and 772K bps, **but** it can support DDS tail circuits **without frequency locking** the multiplexer to the DDS network, which is a strong advantage (see Strengths).

Datatel now markets the DCP 9100 in 2 different versions: the DCP 9110 which is nothing more than last year's old "hard-configured" unit that accepts the new data and voice cards; and the DCP 9115, an extremely advanced multiplexer that can be configured and controlled from a terminal, supports the extended frame format (Fe) that will be mandatory for connection to the Accunet T1.5 service after January 1, 1985, and is frame-compatible with AT&T D4 channel banks. The latter will be employed as part of AT&T's proposed Digital Access and Crossconnect Service (DACS) slated for release sometime next year. With DACS, T1 users will be able to specify and control the switching of any of the 24 64K-bps channels comprising a T1 link to any other T1 channel controlled by the DACS unit. This amounts to a form of **drop-and-insert** using AT&T facilities. For more information on DACS, (see Strengths).

Another feature of DCP 9115 is that it accommodates a 24-channel slot expansion nest for growth. Called the DCP 9116, this nest has its own power supply and driver logic but relies on the 9115 for message frame and T1 interface services. Much to Datatel's credit, it does permit owners of the old DCP 9110 to upgrade to a 9115 by simply changing control logic cards.

The voice-channel facility, also new this year, is conventional. Users have a choice between a single-channel PCM unit operating at 64K bps, or a dual-channel unit employing CVSD at 32K bps. Datatel insiders indicate that a voice card employing adaptive differential pulse code modulation (ADPCM) is under development.

With the enhancements to the DCP 9100, Datatel has positioned the product to be truly competitive with the likes of the Amdahl 2211, Avanti Ultra Mux, Codex 6240, General DataComm Megamux Plus, DCA's Netlink, Scitec's BSPT 1, and Timeplex's Link/1. (Tellabs also has announced a similar product, but we've yet to see it.) These products are all software (terminal) configured and controlled, provide a voice facility, are equipped with extensive synchronous data handling facilities, and with the exception of DCA and Scitec, meet the DS1 framing format required for direct connection to the Accunet T1.5 service. Amdahl, Datatel, DCA, and General DataComm also offer deliverable asynchronous data cards.

As for futures, every vendor listed plus Coastcom and Bayly Engineering claim to have or are about to announce the extended frame format which becomes a must next year for connection to Accunet T1.5, and it's a safe bet that all will offer D4 framing in one form or another, matching Coastcom and Datatel who offer it today. Infotron (TMUX) and Paradyne (DCX-T1) both OEM their products from Datatel, and should receive all of the DCP 9100 enhancements. Infotron, however, is working on its own T1 product design, so it may not offer the same facilities in the future.

With all technical features being equal, the purchase decision comes down to price and support. Datatel currently offers one of the lowest priced products on the market, and it has come a long way to expand its service. Last year, all Datatel had was depot and third-party service. Now it offers its own field service. Still, one has to consider how really important on-site service would be with a box as simple as this one. Any problem could be solved by merely changing a card or two.

☐ Strengths

Both versions of the DCP 9100 have common strengths that make the product extremely attractive. For example, the central logic and power supplies can be backed up with redundant facilities; the testing and diagnostic facilities are strong; dynamic clock tracking is supported; and both are offered with a wide range of data and voice channel cards.

The testing facilities are designed to pinpoint failures or degradation and are easy to use. Each channel has its own random test pattern generator which allows independent concurrent testing of 1 or more channels. The integral test data generator obviates the need for an external test-data source—generally an extra-cost test generator. The ability to isolate channel tests means that the user can perform an extended test on 1 or more channels without interfering with other channels.

The techniques for conducting loopback tests are sound. Datatel employs relay-actuated loopbacks (as opposed to logic control). Loopback testing begins at the EIA side of the DTE and tests all components through to the EIA side of the DTE at the remote location. This loopback test procedure tests all components including the link driver. With some logic-controlled tests, that vital component is overlooked.

The DCP 9100 message train format conforms to the specifications established by AT&T for T1 service. Under that specification, any 24-bit interval must have at least 3 "ones" and no more than 15 consecutive "zeros" to maintain carrier timing alignment. If a multiplexer conforms, to this specification 99.4 percent of the bandwidth is available for data; but if it does not conform, the phone company requires the use of AT&T Model 306 modem to establish compatibility. Besides the extra cost of the modem, the 306 reduces available bandwidth by 12.5 percent. This is equivalent to 1.34M bps using 306 versus 1.53M bps for a multiplexer that conforms.

The Dynamic Clock Tracking (DCT) facility operates with all channels receiving external clocking, and eliminates the limitations and restrictions of frequency-locked T1 systems. Each channel can dynamically adjust its timing to match that of the channel input; thus loss of clock will not be catastrophic as is the case with frequency-locked systems. There are 2 immediate benefits to DCT. First, overflow/underflow conditions that can occur when input data rates deviate from clocked rates, **cannot occur** because the multiplexer **automatically compensates** for the difference. DCT, incidentally, allows Datatel to employ very small elastic buffers on its channel cards.

The second major DCT benefit is realized when DDS tail circuits are employed. DDS, of course, requires the user to lock on its clock. Without a facility like DCT, the entire multiplexer generally locks onto DDS and thus cannot accept clock sources from other channels—such as microwave links. In addition, DDS locking eliminates dial-in applications, since the 2-wire connection cannot handle the full-duplex exchanges required by DDS unless very sophisticated modems are used. For DDS applications, Datatel offers the DCP 9174 data card, which supports DDS tail circuits without frequency-locking the entire multiplexer.

The DCP 9115—or more accurately the control logic set associated with that product—offers such advanced capabilities as terminal-controlled test and configuration, extended frame format (Fe), D4 frame compatibility, and channel expansion nests. Under terminal control, users employ a menu to configure channel operating parameters; perform tests and diagnostics on a per channel level and system load basis; display system statistics; view primary and secondary configurations; and display link parameters. For organizations that prefer a nonterminal-controlled system, Datatel allows the control terminal to be locked out and all configurations and tests initiated at the channel card level via rotary switches and pushbuttons mounted on the card's bezel. Users could employ this lockout, for example, if they wished to conduct an on-going test on a particular channel affecting operation of the others.

Field-upgradability is another DCP 9100 strong point. Users may convert from a hardware-configured DCP 9110 to a more sophisticated 9115 by merely exchanging the 2 control logic boards and adding a third board, which provides the terminal-controlled functions. The DCP 9116 expansion nest, used primarily to provide an additional 24 channel slots to the 9115, can be converted to a 9115 itself by merely swapping its control logic driver cards for 9115 control logic. An added benefit of this swap is that it provides an **additional** separate T1 link facility at the user's site.

The final DCP 9115 strength is its compatibility with AT&T D4 channel banks, a unit which will provide the switching services associated with AT&T's **Digital Access and Crossconnect System** (DACS) projected for 1985. DACS is a terminal-controlled system that allows the redistribution (switching) of individual DSO 64K-bps channels among T1 systems at a digital level. From a simple ASCII terminal, a user can direct a DACS

Datatel DCP 9100
T1 Voice/Data Multiplexer

controller to switch individual channels within a T1 stream to another T1 stream associated with the same DACS controller.

The DACS controller (AT&T calls it a "terminal") terminates up to 128 DS1 signals, one of which is used for control. The remaining 127 DS1 terminations (3,048 64K-bps channels) can be used for crossconnections. Since 2 DSO channel terminations are required for a crossconnect, the DACS controller provides a maximum of 1,524 DSO crossconnections. DS1 signals to and from DACS are provided via DSX-1.

DACS is compatible with DS1 formats found in D1D, D2, D3, and D4 channel banks, and is end-to-end compatible with general trade channel banks meeting the requirements of PUB 43801. For a T1 multiplexer to be DACS compatible, its channels must be 64K-bps wide and its DS1 format must consist of 24 8-bit words and 1 superframe bit for a total of 193 bits per frame. (A superframe is made up to 12 frames, and each superframe bit is time-shared to identify both channel framing and signal framing.) A T1 multiplexer that does not employ 8-bit words and 64K-bps channels, therefore, shouldn't be DACS compatible. The Datatel DCP 9100 does meet these specifications.

☐ Limitations

While the DCP 9100 has made giant strides over the past year, it still has a few limitations that could hinder users not participating in DACS facilities. These problems stem from the way channels are subslated, and the lack of a true drop-and-insert capability.

The DCP 9100's method for handling channel and link data wastes the available bandwidth. In parceling out slots within the available 1.544M-bps bandwidth, the DCP 9100 employs the following scheme: 56K-bps channels are assigned 1 time slot; 112-, 224-, or 448K-bps channels receive 2, 4, or 8 slots, respectively; 19.2K-bps channels and below are serviced 2 to a slot. What this means is that the smallest slot amounts to 2 9600-bps subslots. Any data rate lower than 9600 bps is still assigned that portion of the subslot regardless of its actual bandwidth requirement. For example, a 300-bps terminal wastes 9300 bps; 2 300-bps terminals waste 18,600 bps. It could be argued that such waste is trivial with 1.544M bps available. However, when considering that many users might want to interface digital voice (32K- to 64K-bps bandwidth), front-end processors (around 64K-bps bandwidth), and even video (at least 700K bps with current technology) such waste is a severe limitation. The Catch-22 to this situation for Datatel is that if it alters its subsloting scheme, it is no longer DACS compatible. By not altering it, Datatel stands to lose potential customers.

Drop-and-insert is useful in environments where many end points are involved that pick up and drop data. Organizations such as large banks and companies with large regional centers are typical candidates for this type of operating environment. Of the multiplexers on the market that actually work, only Bayly's Omniplexer and Coastcom's D/I Mux support this service.

The final major limitation is the DCP 9100 is restricted to a single link rate of 1.544M bps. While this is the data rate associated with T1 facilities within North America and Japan, it is not applicable to foreign countries that employ a link rate of 2.048M bps. Datatel does not offer channel facilities needed for foreign T1 links either. For local networks, some users may find the 1.544M-bps link rate too high. Datatel could benefit and further increase its market opportunities by correcting this single speed limitation.

■ HARDWARE

☐ Terms & Support

Terms • standard components and options are available for purchase only • annual dollar-volume purchase discounts are available • $500 installation charge per unit.

Support • all components carry a 1-year guarantee • out-of-warranty, on-call, and fixed-price service plans available • out-of-service plan charges $75 for microprocessor board repair and $35 for other board repairs; user pays shipping charges to Cherry Hill, NJ • on-call service plan provides Datatel field service engineer to customer premises; $50 per hour travel to and from site plus $50 per hour on-site to maximum of $200 service charge • fixed-price service plan provides on-site service between 9:00 AM and 5:00 PM Monday through Friday (except holidays) • for fixed price; normal response time is under 8 business hours.

☐ Overview

The DCP 9100 is a bit- or byte-interleaved time-division multiplexer, designed primarily for point-to-point communications over AT&T's Accunet T1.5 services or facilities, such as those available from MCI, RCA, etc. It can also be interfaced to private microwave facilities, such as GE's Gemlink. Cascaded multiplexers are supported and the unit can be configured as a multimode network. Drop-and-insert facilities are not currently available, but are under development.

The DCP 9100 offers channel cards that handle asynchronous and synchronous data and voice. The latter are available in versions employing Pulse Code Modulation (PCM), and requires a 64K-bps channel for each voice channel; or the user can order a Continuously Variable Slope Delta (CVSD) mode that requires only 16K or 32K bps per channel. With the CVSD card, 2 voice channels can share a 64K-bps channel.

The data-handling channel cards are either single- or dual-channel units (see channels). Of particular note is the new DCP 9170, a synchronous card capable of handling data rates to 1024K bps; and the DCP 9178, a dual-channel asynchronous card with data rate ranges of 300 to 19.2K bps. Both are very recent additions, and remove some of the data restriction limitations noted when DCP 9100 was first reviewed last year. Support for synchronous rates to 1024K bps is a valuable asset since it efficiently accommodates operations such as file-to-file transfers and digitized video.

The DCP 9100 is offered on 2 different versions: DCP 9110 and DCP 9115. Both units provide the same number of channel slots (24), and can be equipped with redundant central control logic and power supplies. The 9110, however, is configured via rotary switches on each channel card's bezel and provides a DS1 unframed format message frame. The 9115, on the other hand, gives the user the option of configuring the multiplexer from the aforementioned rotary switches or from a central control console, which can be a simple ASCII terminal. When under terminal control, the rotary switches are locked out and all system configuring, testing, and monitoring are conducted from the terminal. System configuration setups and testing are under menu control and commands are in English.

While the standard multiplexer provides slots for 24 data/voice channels, users of the DCP 9115 can double this capacity by adding the DCP 9116 expansion nest. The 9116 contains its own power supply and driver logic cards, but is linked to the 9115 for message framing and T1 link interfacing. Depending on whether single- or dual-channel data/voice cards are employed, a full-blown DCP 9115 can range from 48 to 96 data channels or 46 voice channels.

Users should note that the DCP 9110 is not a dead-end product. Owners of the DCP 9110 can **upgrade** their existing units to a DCP 9115 by merely swapping the common logic cards and adding a third card that provides the terminal control functions.

For those concerned with system integrity, Datatel offers redundant power supplies and common logic for the DCP 9110, 9115, and 9116. The common logic and power supplies operate as hot spares, and automatically take over if a primary component fails. The redundant power supply, incidentally, operates in tandom with the primary; this arrangement generally increases the life of both units dramatically.

☐ DCP 9100 Multiplexer

The DCP 9100 is offered in 2 different versions, old and new. The older DCP 9110 equipment nest and logic is a "hardware" configured unit that supports the unframed DS1 format employed with Accunet T1.5. The new DCP 9115 can be configured by hardware or via a terminal, and meets the new DS1 extended frame format that is scheduled to become mandatory for interfacing with Accunet T1.5 as of **January 1, 1985**. The DCP 9115 frame format is also D4 compatible, allowing it to switch through D4 channel banks. D4 framing is also the standard required by AT&T communications for use with the Digital Access

Datatel DCP 9100
T1 Voice/Data Multiplexer

and Crossconnect Service proposed for 1985 (see Strengths).

DCP 9110 Equipment Nest • chassis, common logic, power supply, and 24 channel-adapter card slots • accommodates up to 24 data-channel cards or 23 voice-channel cards; voice/data cards can be intermixed • common logic requires 2 card slots and handles multiplexing/demultiplexing over single high-speed composite link; monitors local/remote logic functions; initiates local/remote system loopback operations; detects in-sync/out-of-sync condition; indicates logic alarms; permits manual or automatic switchover to redundant logic; stores channel configurations in RAM; downline loads configurations to remote unit • supports unframed DS1 format • includes CBE 9108 cable:

$3,200 prch

DCP 9115 Equipment Nest • same as DCP 9100 except it supports AT&T extended frame format (Fe), is AT&T D4 compatible, and provides supervisory terminal control • includes CBE 9108 cable:

3,800

DCP 9116 Expansion Nest • power supply, 2 control logic driver cards, 24 channel card slots, and CBE 9136 cable for connection to DCP 9115:

3,200

Central Control—Common Components

DCP 9120 Backup Load-Sharing Power Supply • provides redundant power source for DCP 9110, 9115, and 9116 • diode-coupled to primary power supply and operates in tandem with it:

$800 prch

DCP 9122 Load-Sharing Power Supply • provides 48 VDC for voice applications:

500

DCP 9130 Backup Common Logic • provides redundant central logic for DCP 9110 • occupies 2 card slots in equipment nest • link speed is 1.544M bps:

700

DCP 9135 Backup Common Logic: 9115 & 9116 • provides redundant central logic for DCP 9115 and 9116, plus central console port and logic • occupies 3 card slots • includes CBE 9135:

1,500

DCP 9160 Audible Alarm & Remote Backup Power Monitor • monitors remote-unit power supply for any variations in threshold voltages; provides visual/audible alarms if remote supply or supplies malfunction:

500

DCP 9010 Standalone Cabinet • standalone enclosure for rackmounting single equipment nest • measures 25(W) x 30(H) x 26(D) inches:

1,200

DCP 9015 Standalone Cabinet • standalone enclosure for rackmounting 3 equipment nests • measures 25(W) x 79(H) x 26(D) inches:

1,800

Channels

The DCP 9100 handles asynchronous and synchronous data, and voice channels directly. In addition, users can employ separate external multiplexers to allow multiple terminals to share a single channel. This form of "submultiplexing" effectively increases the total number of terminals handled by DCP 9100.

Datatel offers 7 synchronous channel cards (called channel adapters), an asynchronous channel card, and 2 voice channels to handle a wide variety of channel speeds and applications. The synchronous channel cards differ in the number of channels provided per card, the range of selectable speeds, and the interface. The asynchronous card accommodates 2 data channels, and handles a data rate range from 300 to 19.2K bps.

All data, except the DCP 9172, can have channel-parameter set either directly at the card via rotary switches or via an ASCII control terminal. The DCP 9172 operates only under terminal control. System tests (local/remote loopbacks) and diagnostics are also under terminal control or at the card level. To aid card-level tests, Datatel provided a separate 511-bit pseudo-random test pattern generator on each card to allow channel testing on an individual level. For terminal-initiated tests, users have the capability of testing each channel individually or all channels simultaneously.

All data channels can be configured as DTE or DCE, which allows them to generate or receive clock signals. The DCP 9140 and 9141 have 8 bits of elastic storage, while all other synchronous channels have 16 bits. Generally, this range of elastic buffer is too small for high-speed channels. However, Datatel compensates for this with its Dynamic Clock Tracking facility (see Strengths).

The data-channel card indicators consist of LEDs showing transmit/receive data activity, clock signals, and local/remote test results. This same information can also be displayed on the control terminal.

Two voice-handling cards are offered. One employs Pulse Code Modulation (PCM) at 64K bps and provides the logic to handle a single channel. The other employs Continuously Variable Slope Delta (CVSD) quantization, and accommodates 2 separate voice channels. Data rates can be selected as 16K or 32K bps under the CVSD scheme. (The CVSD voice channel can also be used for data inputs interfaced via a modem. Top data rate is 2400 bps.) Both voice cards are 4-wire units and employ E&M signaling. Up to **46** voice channels can be handled by the DCP 9100.

DCP 9140 Synchronous Channel Adapter • provides channel logic for single synchronous data channel • half-/full-duplex modes • channel data rates of 56/112/224/448K bps • plus or minus 8 bits of elastic storage • CCITT V.35 interface:

$320 prch

DCP 9141 Synchronous Channel Adapter • same as DCP 9140, except supports channel data rates of 56/112/224K bps; RS-232C interface:

320

DCP 9142 Synchronous Channel Adapter • provides channel logic for 2 synchronous data channels • half-/full-duplex modes • channel data rates of 300/600/1200/2400/4800/7200/9600/14,400/19,200 bps; independent data rates each channel • passes up to 4 full-duplex control signals • RS-232C interface:

650

DCP 9144 Voice Channel Adapter: PCM • provides channel logic for single voice input • PCM quantization at 64K bps • 4-wire 600 ohm interface; E&M signaling • requires CBE 9111 cable • compatible with AT&T D4 channel banks:

400

DCP 9146 Voice Channel Adapter: CVSD • provides channel logic for 2 voice inputs • CVSD quantization at 16K or 32K bps • 4-wire 600 ohm interface; E&M signaling • requires 2 CBE 9111 cables:

800

DCP 9170 Synchronous Channel Adapter • provides channel logic for single data channel • half-/full-duplex modes • channel data rates of 56/64/112/128/224/256/384/448/512/768/896/1024K bps • plus or minus 16 bits of elastic storage • 4 control signals optional • CCITT V.35 interface:

375

DCP 9171 Synchronous Channel Adapter • same as DCP 9170, except it supports channel data rates of 56/64/112/128/224/256K bps • RS-232C interface:

375

DCP 9172 Synchronous Channel Adapter • same as DCP 9142 except all configuration, tests, and controls are under terminal control only • RS-232C interface:

700

PRCH: purchase price. Prices are single-quantity purchase and are current as of December 1984.

Datatel DCP 9100
T1 Voice/Data Multiplexer

DCP 9174 Synchronous Channel Adapter • provides channel logic for single synchronous data channel • half-/full-duplex modes • channel data rates of 56 and 772K bps • plus or minus 16 bits of elastic storage • passes single control signal • supports DDS tail circuit with frequency locking DCP 9100 to DDS network • CCITT V.35 interface:

475

DCP 9175 Synchronous Channel Adapter • same as DCP 9174, except has RS-422 interface:

475

DCP 9178 Asynchronous Channel Adapter • provides channel logic for 2 asynchronous data channels • half-/full-duplex modes • channel data rates of 300/600/1200/2400/4800/7200/9600/14400/19200 bps; channels can operate at different speeds o DTE/DCE interface o passes 4 control signals per channel • RS-232C interface:

700

Cables & Connectors

DCP 9152 CCITT V.35 Interface Module • converts 25-pin connector to female 34-pin connector:

$90 prch

DCP 9153 Connector Extender • 25-pin male to 25-pin female extender:

75

CBE 9102 Cable • 25-pin male to 34-pin female DCE V.35; 1-foot long • used with DCP 9140:

75

CBE 9103 Cable • 25-pin male to 34-pin female DTE V.35; 1-foot long • used with DCP 9140:

75

CBE 9104 Cable • 25-pin male to 25-pin female DCE EIA; 15-feet long • used with DCP 9142:

80

CBE 9105 Cable • 25-pin male to 25-pin male DTE EIA; 15-feet long • used with DCP 9142:

80

CBE 9106 Cable • 25-pin female DCE EIA; 15-feet long • used with DCP 9141:

80

CBE 9107 Cable • 25-pin male to 25-pin male DTE EIA; 15-feet long:

80

CBE 9108 Cable • 25-pin male to 15-pin male 551A interface; provided at no charge with DCP 9110:

75

CBE 9109 Cable • 25-pin male to 5-position terminal strip used with GE's GEMLINK microwave system; 15-feet long:

75

CBE 9110 Cable • DS1 interface cable with bezel • included with DCP 9110:

90

CBE 9111 Cable • 25-pin male to 8-conductor solid wire; 15-feet long • required with DCP 9144 and DCP 9146:

80

CBE 9112 Cable • 24-pin male to 24-conductor solid wire; 25-feet long • required with DCP 9146:

90

Composite Link

The DCP 9100 supports a single composite link at 1.544M bps only. No lower/higher speeds are available. The link between the multiplexer and communications facility is established through the common logic cards.

• **END**

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

■ PROFILE

Function • remote cluster, IBM 3274-compatible display terminal system employed in inquiry/update, data entry, and program development • local processing via Personal Computer option • emulation of asynchronous ASCII terminals for communication with ASCII hosts.

Architectures Supported • used with IBM S/360, S/370, 3030, 3081, and 4300 processors, and with 3790 Communications Systems • S/370 and 4300 function under SNA/SDLC architecture • S/360, S/370, and 4300 operate under BSC • remote attach by nonswitched private or switched dial-line communications facilities in BSC/SDLC at rates up to 19.2K bps for BSC and 56K bps for SDLC • asynchronous ASCII/TTY communications at speeds up to 19.2K bps.

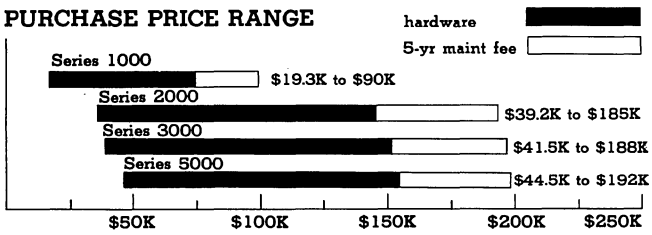
Communications • CICS/VS under ACF/VTAM, ACT/VTAME, ACF/TCAM for OS/VS and DOS/VS • IMS/VS under BTAM and ACF/VTAM • single line • 19.2K bps for BSC and 56K bps for SDLC protocols; 19.2K bps asynchronous • half-/full-duplex • ASCII/EBCDIC code • point-to-point/multipoint • RS-232C interface.

Operating System • service through host processor under DOS, DOS/VS, DOS/VSE, OS, OS/VS, VM/370.

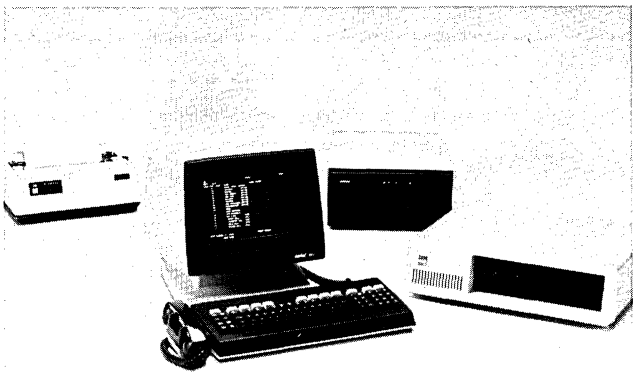
Database Management • none; only in association with host IMS/VS and CICS/VS facilities.

Transaction Processing • primarily through CICS or IMS which acts as terminal-oriented transaction monitor with file processing facilities • supports send/receive batch and inquiry tasks.

PURCHASE PRICE RANGE



DAVOX INFORMATION DISPLAY SYSTEM PURCHASE PRICING bar graph covers price ranges between "small" and "large" configurations for hardware (solid bars) and for associated 5-year maintenance fees (open bars) • **small Series 1000** consists of basic cluster controller with 5 Model 811 keyboard-display workstations, 2 system printer adapters, and ANSI X3.41 emulation software; **large** system consists of basic Series 1000 controller plus 2 Expansion Controllers, 10 Model 811 and 10 Model 1921 keyboard-display workstations, 4 system printer adapters, 10 personal computer interfaces, and ANSI X3.64 emulation software • **small Series 2000** consists of basic cluster controller with 5 Model 2911 color keyboard-display workstations, 2 system printer adapters, and ANSI X3.64 emulation software; **large** system consists of basic Series 2000 controller plus 2 Expansion Controllers, 10 Model 2911 and 10 Model 3911 color keyboard-display workstations, 4 system printer adapters, 10 personal computer interfaces, and ANSI X3.64 emulation software • **small Series 3000** consists of basic Series 2000 controller, 1 Series 3000 controller, plus the same workstations, printer adapters and ANSI software emulation as shown for small Series 2000; **large** configuration consists of basic Series 2000 controller, 1 Series 3000 controller, plus the same Expansion Controllers, workstations, printer adapters, personal computer interfaces and ANSI software emulation as shown for large Series 2000 • **small Series 5000** consists of Series 5000 controller plus the same workstations, printer adapters, and ANSI software emulation as shown for small Series 2000; **large** configuration consists of Series 5000 controller plus the same Expansion Controllers, workstation, printer adapters, personal computer interfaces, and ANSI software emulation as for large Series 2000 • **NOTE:** prices do not include printers or maintenance prices for screen print, personal computer interfaces, system printer adapters, and X3.41/X3.64 emulation software; therefore, overall system prices would be considerably higher.



Support Software • supported by and employs software and program facilities of host processor • no local independent (from host) off-line programming/processing capabilities except when Personal Computer is employed • system diagnostics checks DTE and DCE.

Processor • 8-bit microprocessor on controllers; 16-bit on PC's.

Terminals/Workstations • up to 32 CRTs and printers per cluster; or up to 24 personal computers per cluster.

First Delivery • 1982.

Systems Delivered • 4,500 terminals.

Comparable Systems • emulates IBM 3274 Models 21C, 31C, 41C, 51C, and 61C • other competitive systems include ITT Courier 270 and 9000 Series, Lee Data 300 and 400 Series, Memorex 2070, MDS 9000 and Hero, NCR 7950, Telex 270, and others.

Vendor • Davox Communications; 4 Federal Street, Billerica, MA 01821 • 617-667-4455.

Canadian Headquarters • none.

Distribution • direct through Davox sales offices and selected major OEMs.

GSA Schedule • unlisted.

■ ANALYSIS

The Davox product line is a replacement for the IBM 3270 Information Display System, and offers facilities comparable to the 3274C series of controllers with 3178, 3278, 3279 terminals, 3287 printers, and IBM Personal Computers attached. Davox, however, uses a different architectural approach. Instead of producing a separate controller for each 3274 model emulated, Davox produces a single controller that emulates the 3274 Models 21C, 31C, 41C, 51C, and 61C by merely changing software. To move from a 41C to a 61C, for example, the user need only swap diskette-resident control programs. Moving from a smaller controller to a larger might also require some additional RAM memory.

Davox's approach to system expansion is also quite different. The

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

basic controllers, called Series 1000 and 2000, contain terminal adapters that accommodate 8 workstation/printers. To add additional terminals, users needn't purchase additional adapters—they buy Expansion Controllers. That device is a modified controller, and therefore, has the software/hardware needed to control attached workstations/printers. Each Expansion Controller accommodates 7 such peripherals, and up to 8 controllers can be configured, bringing the total number of workstations/printers to 56. However, **only 32 are addressable.**

Each Expansion Controller connects to a central Series 1000 or 2000 called the Master Controller. That unit handles the interface between all controllers and the host processor. The only difference between these 2 controller types is that the Master Controller's control program contains the software for interfacing the "slaved" controllers and the host processor. Thus to switch modes, users need only **swap diskettes** and interface cables to convert an Expansion Controller to a Master. In fact, Davox recommends this procedure to **guarantee** continued system operation should the Master Controller fail.

In addition to the 1000 and 2000, Davox offers 2 other controllers which are not standalone units. One, the Series 3000 asynchronous controller, is really a modem pool-sharing unit that connects to the DCE side of a multilink version of the Series 1000 or 2000 and provides 8 independent asynchronous data links. The 3000 can only be used with Davox terminals operating in asynchronous mode and routes terminal outputs to destinations designated by the 1000 or 2000. Up to 4 Series 3000 controllers can be attached to a Series 1000 or 2000 controller, providing 32 independent data links for locally attached or remote asynchronous hosts.

The other dependent controller, Series 5000, is actually a hybrid consisting of a dual-link Series 2000 controller and a communication handler called the Model 3200 Secondary controller. The sole intent of the 5000 is to provide a **dual-host** addressing capability for remote IBM hosts. With the 5000, users configure the Master Controller (a Series 2000) in the same manner as a Series 2000 and designate those terminal outputs to be transmitted to different destinations. The 3200 conencts to the DCE side of the 2000 and provides a separate data path for terminals attached to the 2000. Thus, the normal data path from the 2000 plus the independent link from the 3200 provides the dual-host facility Datavox has sorely needed.

Davox offers 10 different workstations (terminals), 6 of which emulate the IBM 3178 and 3278-2 and 4 provide IBM 3279-S2B services. All accommodate a serial printer, and all except 2 (Models 811 and 821) can attach to an IBM Personal Computer.

There are 2 principal differences among the terminals: (1) some can emulate ANSI X3.41 while others support ANSI X3.64 protocols; (2) three have integral telephone handsets and a 10-button keypad for **analog** voice communication. Telephones use their own twisted wire pairs and connect to the DDD network via a USOC RJ11C module jack.

The vendor's approach to terminal emulation is also different. Rather than incorporating the protocol-conversion chips in the controller, Davox employs a software approach whereby the user loads the emulator from the system diskette into the workstation's RAM. Two benefits are derived from this technique. First, the user can switch processing modes without requiring controller services; second, it allows the terminal to operate as a standalone in ASCII mode. In addition, by loading the emulator from the diskette, customers can use the same emulation software to service all workstations attached to the controller. This could prove to be a substantial savings.

Davox recommends that workstations emulating the ANSI or ASCII TTY protocols and not employing Series 3000 services, access remote host processors via the DDD network. The required modem connects to the terminal via the RS-232C port provided for printer attachment. For those who require communication and printer capability, Davox offers a port-sharing interface.

The vendor offers 2 schemes for attaching the IBM Personal Computer. The first taps to coaxial cable between the workstation and controller. The second allows the PC to attach directly to terminal adapter on the cluster controller, where it can be shared by all attached workstations. The major benefit to this approach is the savings realized from purchasing a limited number of PCs. On the negative side, users can't conveniently take full advantage of PC services since they may not be able to load their own diskettes whenever they choose. In addition, users probably will not let diskettes containing sensitive data out of their sight. Both objections can be overcome with use of the XT.

Another facility worth mentioning is DavoxNet. The name itself is misleading since it conjures up the idea of local area networks. DavoxNet is actually a facility whereby 4-wire twisted-pair telephone lines connect workstations to the cluster controller. The rationale for using this versus coaxial cable is that the telephone lines are cheaper and may already be in place, eliminating installation costs. Everyone, by now, knows of the expense involved in "pulling" coaxial cable to workstation locations. Note that twisted-pair conductors can guarantee signal integrity up to 2,000 feet, while coaxial cable supports connections up to 5,000 feet.

In summary, the Davox line provides the same services offered by comparably equipped IBM 3270 systems plus some additional benefits like smart buttons, protocol emulators, asynchronous terminal handling, and dual-host. They do not, however, manufacture printers, allowing users to choose their own. For installations requiring IBM 3287 capabilities, Davox offers the System Printer Adapter, which allows a serial printer to emulate the IBM device. This same interface, incidentally, allows attachment of printers with capabilities up to 600 lpm.

☐ Strengths

Since last year's evaluation, Davox increased the strength of its overall product line with the addition of a dual-host addressing facility, plus the capability to access multiple asynchronous hosts. Added to the existing terminal emulation facilities, the architecture employed to configure the system, and the "smart" buttons gives the Davox products extensive operating flexibility and makes them very attractive to prospective users.

The dual-host addressing facility, implemented through the new Series 5000 controller, allows 2 independent remote IBM hosts to be accessed simultaneously from a single location.

There are 2 major advantages associated with a multihost addressing facility. First and most obvious, users can interact with independent host simultaneously, making use of their processing power and databases. This speeds overall processing, simplifies distributed processing architectures, and reduces the load on the host, particularly if it is used for switching operations. As an example of the latter, take the case where a Davox user in Philadelphia wishes to access a host in New York, but is connected to a host in Chicago. With a single-host addressing scheme, traffic flow in both directions would have to pass through Chicago. Aside from tying up the host, this arrangement also runs up communication costs. The dual link elminates the need to pass through Chicago.

The multiple asynchronous host addressing facility is part of the new Series 3000, and allows users of the Series 1000 or 2000 controller and attached **Davox** terminals operating under asynchronous emulation to access 8 independent local and/or remote hosts simultaneously. Users can also maintain communication links with IBM hosts via the normal facilities of the 1000 or 2000 while the 3000 is handling asynchronous chores. The facilities of the 3000, coupled with Davox's terminal emulation facilities, is a strong advantage for organizations with multivendor host applications. Instead of requiring separate terminals and separate communication facilities, Davox users can employ a single terminal for both IBM and asynchronous communication, and direct everything through the 1000 or 2000 controllers.

The Series 3000, as mentioned, is a modem pool-sharing device, allowing terminals to **contend** for a modem on a first-come basis. This further saves the customer the expense of dedicating a modem per terminal. However, remember that contention can also cause delays when all available modems are occupied. Users who need asynchronous facilities, but do not want to use the Series 3000, interface a modem with the RS-232C port on each terminal. The link can be dedicated or dial-up.

The architecture employed by Davox, whereby individual 8-port

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

cluster controllers connect to a central Master Controller, is certainly one of the strengths of this system. What users get with these "slaved" controllers (Expansion Controllers) is a combination local cluster controller and workstation multiplexer which furnishes all of the services needed by the attached terminals and allows them to be located up to 10,000 feet from the Master Controller. To attain this distance with competitive products, an extra-cost terminal multiplexer must be used.

The ability to switch a controller from an Expansion unit to a Master Controller by only changing system diskette is a definite advantage. Should the control logic fail in the Master unit, users can be back online in minutes with the Davox system. With competitive products, users or vendor technical personnel must locate the failed boards and replace them. This often is a time-consuming operation.

Another outstanding benefit is realized from the "smart buttons" implemented on each keyboard. These buttons can be programmed from the terminal to generate strings of code or commands used to perform certain functions. Operations such as terminal log-on/-off, communication mode switching (3270 to asynchronous), telephone number selection from a host-resident directory and auto-dial, etc. All can be assigned to smart buttons. Since the associated functions can be modified from the keyboard, users can implement new operations without having to replace PROMs, as is the case with hard-configured terminals.

The terminal emulation facilities and the way they are emulated are also notable. By supporting ANSI X3.41, X3.64, and ASCII TTY protocols, Davox permits its terminals to interface with most of the popular minicomputers on the market. The X3.41 protocol, for example, is the same one used by DEC's VT52, while X3.64 is employed by their VT100. By loading the protocol emulation software into the terminal's RAM, Davox permits it to operate in a communication environment independent from the cluster controller. Since the terminal operating in this manner can access any host via the DDD network, it is not restricted to only the host processor attached to the cluster controller. This degree of flexibility and autonomy can be expensive in communication costs and facilities, however.

The ability to attach a serial matrix printer directly to the workstation is extremely useful. Users can transfer data directly from the screen for local printing with no cluster controller/host interaction, and there are no printing delays as is the case when terminals must contend for cluster-attached printers.

The final major strength of this system is the facility for attaching personal computers either to individual workstations for their exclusive use, or to the cluster controller for shared use. Either way, users can perform local processing with no host-processor facilities required. While personal computers were unique to a 3270 environment last year, it is no longer the case. IBM, Lee Data, Harris, Telex, and ITT Courier offer it also.

☐ Limitations

The limitations of this product line are much the same as those inherent with similar IBM components: no local processing unless PCs are used; no remote terminal dial-in; no data compression; and no print spooler. Davox, unlike IBM, has no data encryption. Davox terminals are also restricted with respect to display formatting by comparison to IBM and Lee Data models.

The Davox terminals emulate the IBM 3178, 3278-2, and 3279-S2B, each of which display only 80-columns. In contrast both IBM and Lee Data provide units that display 132-columns, making those terminals well-suited for spreadsheet applications as well as direct printing of 132-column lines. Both the IBM 3180 Model 1 and Lee Data 1214 provide these extended display formats, plus multiple column formnats of 24, 32, or 43 lines (the old Lee Data 1220 and 1221 also provide these multiple display formats).

Davox does not offer anything equivalent to the IBM 3270 PC or Lee Data Series 70. Both support multiwindowing plus fairly good graphics (both IBM PC and 3279-S3G).

Davox has yet to implement a remote terminal dial-in facility. This feature would allow a terminal to connect to a controller by dialing in over the public switched network, and avail itself of the same service offered to collocated terminals. IBM also does not support this facility.

When you have up to 32 devices operating online, as Davox permits, you want every bit of the available bandwidth to count. A data compression capability provides such a service by eliminating unnecessary data such as zeros, blanks, and redundant characters. Davox should consider this facility.

Print spooling is a technique whereby information bound for a relatively slow device like a printer is placed on an auxiliary device (usually a disk). This allows the printer to operate at its normal speed and suffer its normal problems without effecting the overall data communication function. Davox has no spooler and it could certainly benefit from one. So could IBM, Lee Data, Telex, and ITT Courier for that matter.

■ COMMUNICATIONS FACILITY OVERVIEW

☐ Distributed Communications

The Davox controllers communicate in a point-to-point or multipoint arrangement over switched or leased lines at speeds up to 9600 bps (56K bps optional) half-/full-duplex under BSC, SDLC, or ASCII protocols. The clustered workstations can emulate asynchronous ASCII terminals and communicate directly with the host via the DDD network at speeds up to 9600 bps. Both EBCDIC and ASCII character sets are supported.

Communications control rests with the IBM host-terminal access methods supported. For the IBM S/360, 370, 3030, 3081, and 4300, these include BTAM, BTAM-ES, TCAM, ACF/TCAM, VTAM, ACF/VTAM, ACF/VTAME, and EXTM. For a description of these access methods, see the IBM 3270 analysis report **950-I048-3270**.

☐ Distributed Configurations

The product line consists of 4 cluster controllers, 3 of which emulate the IBM 3274 Models 21C, 31C, 41C, 51C, or 61C, and the fourth handles asynchronous communications. Ten workstations are also provided, emulating the IBM 3178, 3278-2, and 3279-S2B. Each workstation can attach an IBM personal computer and also emulate an asynchronous ASCII terminal. Each workstation can also attach its own serial printer to provide printing services independent of the cluster controller.

The Series 1000 and 2000 controllers resemble an IBM 3274-51C, and attaches up to 8 workstations/printers. To accommodate larger configurations, Davox employs a fan-out approach whereby a single controller is designated as a Master Controller with up to 8 "slaved" controllers—called Expansion Controllers—attached to it. The Expansion Controller is actually a modified Series 1000 or 2000, and contains the hardware/software needed to control up to 7 attached workstation/printers. Thus a fully-configured system consists of a Master Controller, 8 Expansion Controllers, and 56 workstations/printers. The architectural restrictions the IBM 3270, however, allows for only 32 devices to be recognized. Therefore, the remaining 24 Davox devices are used as spares or for personal computer attachment.

The Series 3000 is an asynchronous controller which allow Davox terminals to interface with asynchronous hosts. The 3000 attaches to the DCE side of a multilink version of a 1000 or 2000 controller and provides 8 RS-232C interfaced independent links. Up to 4 Series 3000's can be attached to a 1000 or 2000, providing asynchronous links. The 3000 attaches no terminals directly. Rather, users interface their Davox terminals to the 1000 or 2000.

The Series 5000 is not a single physical unit, but a hybrid consisting of a dual-link Series 2000 controller and a Model 3200 Secondary Controller. The terminals handled and the configuration techniques for the 5000 are the same as the 2000; the Model 3200 does not accommodate terminals, but accepts a multiplexed channel stream from the 2000 (see Controllers section for details). The 5000 configuration provides multihost support through independent links, one each from the 2000 and the 3200, which can communicate with different host processors.

The personal computer utilized is IBM's Models 5150 or XT, and is offered with its full complement of hardware. The personal

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

computers can be attached between the controller and workstation, or connected to a channel on the Master Controller and/or Expansion Controller, thus allowing it to be shared among all workstations. In the latter case, control of the personal computer is through using the workstation. The personal computer can also share the cluster printers.

Davox offers no printers of its own design, but does provide interfaces to attach serial/parallel devices to the cluster controller. In addition, an RS-232C port on each workstation accommodates a serial printer for exclusive use.

☐ Distributed Utilities

The vendor supplies a utility which allows the user to configure the system software from the workstation's keyboard to meet operational requirements. Users may also employ the following IBM utilities furnished for its 3270: Display Exception Monitoring; Device Independent Display Operator Console Support (DIDOCS); Network Problem Determination Application; Status Display Support; and the Interactive Instruction Set. All of these utilities are described in report **950-I048-3270**.

■ SOFTWARE

The entire system operates under control of the host processor's software. In standalone mode, the workstations generate and respond to coded sequences per ANSI standards X3.41-1974, X3.64-1977, and ASCII TTY as employed by many popular terminals. Davox also provides a screen-print routine which prints data displayed on a workstation on the attached terminal printer, and an auto-dial facility which permits a remote terminal to read a host-resident telephone directory and select a number to be auto-dialed.

SWVT-01 X3.41 Emulation • allows workstation to emulate a terminal operating under ANSI X3.41 standards; up to 32 workstations supported by single emulation program:

$23/$19 mo	$595 prch	NA maint

SWVT-02 X3.64 Emulation • allows workstation to emulate a terminal operating under ANSI X3.64 standards; up to 32 workstations supported by single emulation program:

58/48	1,495	NA

SWTT-01 TTY Emulation • allows workstation to emulate ASCII TTY terminals; up to 32 workstations supported by single emulator program:

16/13	395	NA

SWPR-01 Screen Print • allows data displayed on workstation screen to be printed on workstation-attached printer • supports up to 32 terminals:

16/13	400	NA

SWHS-01 High-Speed Controller Communications • allows Series 1000/2000 to communicate in SNA/SDLC at speeds to 56K bps • RS-232C or CCITT V.35 interface:

27/23	700	NA

SWPC-03 PC/Host File Transfer • enables files of data or programs to be transferred between IBM PC and IBM mainframe • runs under VM/CMS or TSO • includes status reporting, PC printing, PC hold, PC clear, and PC personal ID:

31/26	800	NA

SWPC-04 PC/Host File Transfer, Second Controller • used for subsequent Master Controllers at site equipped with SWPC-03 installed:

24/19	600	NA

SWPC-03 PC File Server Software • allows user to define IBM PC-XT on Series 2000 to operate as shared resource disk for other PC's:

27/23	800	NA

SWSD-01 Telephone Cursor Dialing • allows workstation telephone to auto-dial phone numbers from host database; operates in 3270 mode only:

16/13	400	NA

SWSD-02 Telephone Screen Display • allows telephone number displayed in a specific field location on-screen or in a specific row and column to be defined as a Smart Button for single-button dialing:

24/19	600	NA

SWHE-01 Directory Help • allows user to temporarily exit Directory screen to view prompts:

NC/NC	NC	NC

SWAD-01 Smart Button Administrative Software • allows a Davox workstation to remotely define Smart Button functions for any designated workstations • allows user to write programs that dynamically change Smart Button functions to meet applications:

33/27	850	NA

☐ Operating System

IBM S/360, S/370, 3030, 3081 & 4300 Processors

The Davox system operates under IBM OS, DOS, OS/VS1, OS/VS2(SVS), OS/VS2 (MVS, MVS/SE, MVS/SP), DOS/VS, DOS/VSE, and VM/370 (VM, VME, VM/BSE, VM/SP) in conjunction with other systems software and programs.

IBM TSO (Time Sharing Option) • provides for time-shared option under all OS/DOS or communication OS/DOS facilities.

☐ Database Management

IBM S/360, S/370, 3030, 3081 & 4300 Processors

The product line may employ any of the following IBM software: Advanced Text Management System II; Airline Control Program; Customer Information Control System/VS; Information Management System/VS; Data Language/1 (DL/1); and Storage and Information Retrieval Storage. These database managers are described in report **950-I048-3270**.

☐ Communications/Networks

IBM S/360, S/370, 3030, 3081 & 4300 Processors

As previously mentioned, the Davox Series 1000 controllers run under BTAM, BTAM-ES, TCAM, ACF/TCAM, VTAM, ACF/VTAM, and ACF/VTAME. In addition, the system may also make use of IBM's Conversational Monitor System; Display Information System; Generalized Information System; Structured Information Facility; and Virtual Storage Personal Computing. See report **950-I048-3270** for a description of these packages.

☐ Application Development Aids

Davox offers no application development aids; users, however, may employ IBM's Processors Disclose Mode; Script; Visual Data Entry Online routines; and the Graphical Data Display Manager and Presentation Graphics Feature.

☐ Other Facilities

IBM S/360, S/370, 3030, 3081 & 4300 Processors

Again, Davox users may employ any of the following IBM facilities: Display Exception Monitoring; Device Independent Display Operator Console Support; Network Problem Determination Application; and Interactive Instruction system. These are also described in report **950-I048-3270**.

■ HARDWARE

☐ Terms & Support

Terms • all products are available for purchase or lease; quantity purchase discounts are available • lease terms are available for 2, 3, and 4 years and do not include maintenance.

MO: monthly 2-year/3-year lease charges not including maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for on-site service of purchased units. NA: not available/applicable. NC: no charge. Prices current as of March 1985.

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

Support • service offered on a depot-repair or replacement-module basis • maintenance prices shown in this report are the fees charged for **replacement module service**, which are about 60 percent higher than depot service • on-call service available from CDC.

☐ Packaged Components/Overview

The Davox Information Display System consists of 4 cluster controllers and 10 keyboard-display units that emulate the IBM 3270 Information Display System. The systems emulate the characteristics and features of an IBM 3274 cluster controller with attached 3178, 3278 Model 2 and 3279-S2B display stations. In addition, both the cluster controller and keyboard-display units can attach the IBM Personal Computer to provide local processing facilities.

The Series 1000 and 2000 Controllers are protean devices that emulate 3274 Models 21C, 31C, 41C, 51C, or 61C. Its characteristics resemble a 3274-51C and support up to 8 workstations/printers. Unlike its IBM counterpart, however, the Davox units also accommodates an IBM Personal Computer directly on its I/O ports, sharing it among all workstations.

The Series 3000 asynchronous controller operates in conjunction with the multilink versions of the Series 1000 and 2000 controllers to provide independent data paths to asychronous hosts. The 3000 attaches to the DCE side of the controller and routes the terminal outputs to one of 8 independent data paths. Up to 4 Series 3000's can be attached to a 1000 or 2000, providing a total of 32 independent paths.

Series 5000 is a hybrid unit consisting of a dual-link Series 2000 controller and a Model 3200 Secondary Controller. The 5000 provides the same emulation and terminal-handling facilities as the 2000, but employs the 3200 to provide a dual-host communication facility. The architecture of the Series 5000 is explained under Controllers section.

Davox employs a fan-out approach to expand beyond an 8-device configuration. A single Model 1000 or 2000 controls up to 8 slaved controllers, each of which controls 7 workstations/printers. These subordinate controllers, called Expansion Controllers, are actually Model 1000s or 2000s with software designating them as expansion units. All 8 controllers are connected locally to another Model 1000 or 2000 designated by software as the Master Controller. The combination of 8 controllers with associated workstation/printers allows users to build configurations with up to 56 devices. Since the 3270 environment allows up to 32 devices, the remaining 24 are used for spares or for personal computer attachment.

The Expansion Controllers are subordinated in the Master unit only as far as interaction with the host processor is concerned. Their internal logic and software are identical to the Master, and they provide all of the usual services for the attached devices. In fact, an Expansion Controller can be converted to a Master unit by merely swapping controller diskettes.

Models 1000 and 2000 are remote controllers supporting BSC and SNA/SDLC protocols. They also support asynchronous ASCII communication. Both controllers support a single high-speed link to the host processor, and transmit data at speeds up to 9600 bps (standard) or 56K bps (optional). Multiple high-speed versions are used with the Series 3000 and 5000 configurations.

Series 3000 provides 8 RS-232C ports for interfacing Davox terminals connected to a 1000 or 2000 controller to asynchronous hosts. Up to 4 Series 3000s can be attached to a controller, providing a total of 32 independent asynchronous data links running at 19.2K bps each.

Series 5000 supports the same protocols and data transmission speeds as the Series 2000, but allows a separate communication link to be established by the Model 3200 connected to the second link of the Series 2000. That unit operates at 9600 bps or 56K bps (optional).

Six workstations (terminal-keyboards) Models 811, 821, 911, 921, 1911, and 1921, emulate the IBM 3178/3278-2, and attach a serial printer. Models 2911, 2921, 3911, and 3921 emulate the IBM 3279-S2B and also attach a serial printer. All terminals except the 3911 and 3921 attach to the controller via RG62W coaxial cable. Models 3911 and 3921, on the otherhand, use a twisted-pair facility called Davox Net to interface with the Series 2000. This same Davox Net can be used by the 1911 and 1921 for connection to the Series 1000 in lieu of the RG62W. Models 911, 921, 1911, 1921, 2911, 2921, 3911, and 3921 can also attach an IBM Personal Computer via an RS-232C interface. In addition, all terminals can emulate asynchronous ASCII terminals. Davox offers ANSI X3.41, X3.64, or ASCII TTY protocol software retained on the controller's diskette and loaded into the terminal's RAM during system initializing. Users switch from 3270 to asynchronous mode by depressing a single key on the keyboard.

In asynchronous mode, the terminals operate as standalone units and can access a host computer directly via the DDD network. The DCE interface is an RS-232C port normally reserved for serial printer attachment. For users who wish to perform remote data transmission and local printing, Davox provides a port-sharing device that attaches both the modem and printer.

A somewhat unusual facility offered by Davox is the 8 Smart Buttons on all keyboards. Essentially, these are soft-programmable keys which can be configured to generate strings of characters, commands, even touch-tones to initiate functions normally requiring multiple keystrokes. Such functions as log-on/-off, communication mode switching, and screen format changing can be initiated via a single keystroke. The function associated with a Smart Button can be defined at the keyboard, or changed by the host-processor or another terminal designated as the administrative terminal.

While Davox does not offer a terminal multiplexer as such, concentration can be achieved by employing an Expansion Controller. While this might be a case of overkill, it's the only alternative outside of buying an Ungermann-Bass, Fibronics, etc, multiplexer.

Davox does not produce its own printers. It does, however, OEM Centronics and provide them as part of a package.

☐ Controllers

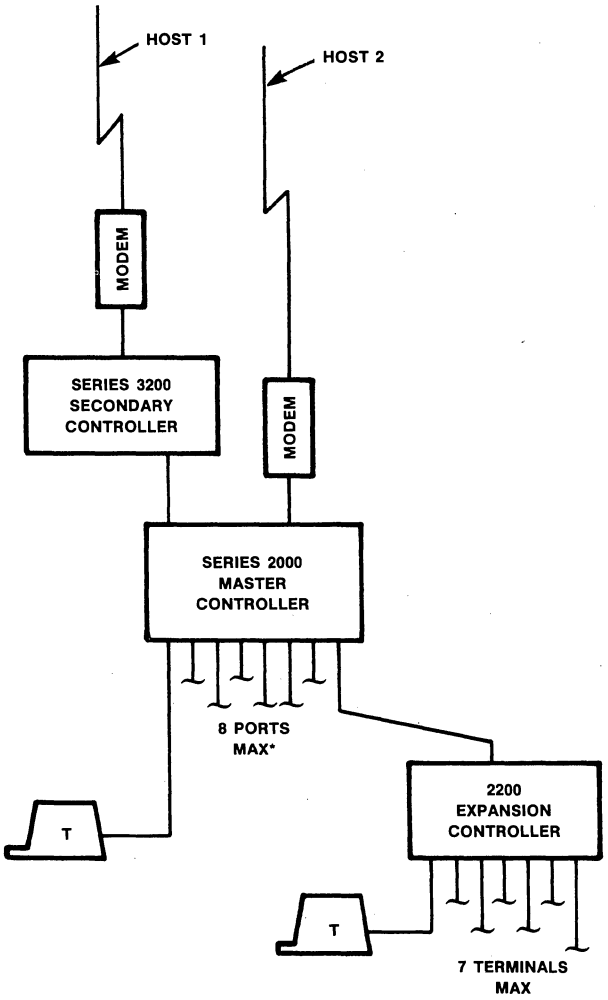
Davox offers 4 cluster controllers, 3 of which emulate the IBM 3274 "C" models while the fourth handles asynchronous communication. The latter unit, the Series 3000, is a modem pooling device that handles Davox workstations on a contention basis.

The 3270 lookalikes consist of the Series 1000, 2000, and 5000. All emulate the 3274-21C, 31C, 41C, 51C, and 61C controllers and all can be configured with up to 32 ports for attaching display terminals, printers, and/or personal computers. Series 1000 and 2000 are basically identical as far as the number of terminals handled and communication facilities provided. The Series 2000 comes with more standard RAM, more diskette storage, plus the ability to interface Davox's new Series 29XX and 39XX color terminals—both IBM 3279-S2B replacements.

The Series 5000 is a "hybrid" system which combines the basic facilities of a dual-link Series 2000 with a Series 3200 Secondary Controller to attain a **dual** independent host-addressable system. This is Davox's response to the demand for dual-host links and, while it's better than no facility at all, it would be simpler if only one controller was needed. A fully configured Series 5000 provides **identical services** and **facilities** as the Series 2000. The Series 3200 **cannot** directly interface terminals, but accepts the multiplexed terminal data stream from output port zero of the Series 2000. **(See Figure 1)**. Terminals assigned to hosts 1 or 2 are defined by the user and stored in the Series 2000 controller; the 3200 controller contains 128K bytes of RAM and diagnostic ROM that allows loading of operating system software from the 2000.

Davox employs a fan-out approach to handle configurations above 8 devices. A single Series 1000 or 2000 controller designated as the Master Controller, can accommodate up to 8 attached "slaved" controllers, called Expansion Controllers. Since each Expansion Controller attaches up to 7 devices, a configuration can consist of 56 workstation/printers/personal computers. In a 3270 environment, however, **only 32 devices are recognized**. Therefore, the remaining 24 can be used as

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems



*any mix of terminals, printers, and Expansion Controllers up to 56 terminals/printers.

Figure 1 • Series 5000 configuration.

spares or for personal computer attachment.

The ability to attach a personal computer directly to a controller I/O port allows that device to be shared among all workstations. In addition to handling local processing, the personal computer can also interact with the host and pass files. The personal computer, of course, cannot interact independently with the host (the BSC/SDLC protocols won't recognize it) but must be under control of a workstation.

As a point of reference, the Series 1000 and 2000 controllers are similar to the IBM 3274-51C. Like that unit, they also employ a diskette to hold configuration tables, emulation software, diagnostic software, telephone directory, etc. The Master Controller is basically a Series 1000 or 2000 with a diskette designating it as the Master unit. To make any other controller in the group the Master unit, the user need only swap the diskettes and change the cable interfaces. With such interchangeability, Davox offers a form of redundancy (actually backup) whereby a failure of the Master Controller will only cause processing interruptions long enough to switch boxes.

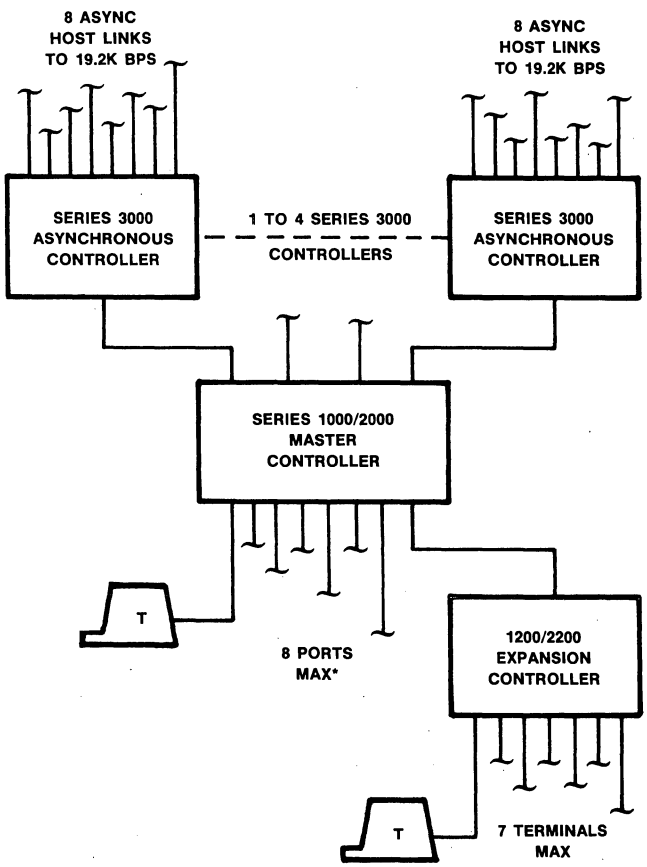
Both controllers employ an 8-bit microprocessor for central processing. This unit controls internal communication between station adapters and data/message transfers between controllers and/or the host. A separate 8-bit microprocessor controls the diskette.

Series 3000 is listed as a controller, but it's actually a modem pool-management device that works in conjunction with a 4-link version of the Series 1000 or 2000 controller. As shown in **Figure 2**, the 3000 attaches to the DCE side of the controller and routes the outputs of the terminals attached to the 1000 or 2000 to targeted host sites at speeds to 19.2K bps for each link. Each 3000 contains 8 RS-232C link interfaces, and up to 4 Series 3000's can be attached to a single controller.

The 3000 does not poll the terminals. Rather, terminals contend for service by raising a control signal such as RTS. Users are informed of the availability of a modem via a message on the screen. With modem sharing, customers can service a large number of users without the expense of separate dedicated modems or lines to the host (see Strengths).

The Series 3000, like the 5000, has no configuration or routing tables. Instead it relies on the master controller for this information. Users can change end-host destination addresses directly from the keyboard, further adding to the flexibility of the 3000 and 5000.

CL02-01 Series 1000 Master Controller • tabletop unit supports 8 workstations/printers or Expansion Controllers • 8-bit microprocessors; 64K bytes of RAM (expandable to 128K) for emulation and communications; 4K bytes of ROM for diagnostics and loading • 160KB single-sided integrated diskette for cluster



*any mix of terminals, printers, and Expansion Controllers up to 56 terminals/printers.

Figure 2 • Series 3000 configuration.

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

controller software; double-sided diskettes are optional • port zero switchable for Master/Expansion function • communicates with S/360, 370, 303X, and 4300 processors at speeds up to 9600 bps or at 56K bps (optional) • RG62A/U Coax DTE interface; RS-232C DCE interface • SNA/SDLC or BSC:

$150/$123 mo	$3,880 prch	$23 maint

CL06-01 Series 2000 Master Controller • tabletop unit supports 8 workstations/printers or Expansion Controllers • 8-bit microprocessors; 128K bytes of RAM for emulation and communications; 8K bytes of ROM for diagnostics and loading • 640KB double-sided, double-density diskette for cluster controller software • port zero switchable for Master/Expansion function • communicates with S/360, 370, 303X, and 4300 processors at speeds up to 9600 bps or at 56K bps (optional) • RG62A/U Coax DTE interface; RS-232C DCE interface • SNA/SDLC, BSC, or asynchronous ASCII:

210/173	5,950	33

CL09-01 Series 3000 Asynchronous Controller • tabletop controller containing 8 RS-232C ports and 2 coaxial ports • attached to asynchronous hosts directly or via modem; interfaces with Series 1000 or 2000 controllers via coax connection:

89/73	2,295	13

CL06-XX Series 3200 Secondary Controller • contains 64K bytes of RAM and 8K bytes of ROM • attaches to Series 2000 (CL06-01); provides single high-speed link:

222/183	5,770	33

CL07-01 Series 5000 Dual-Host Controller • dual tabletop controllers consisting of a Series 2000 Dual-Link Master Controller and a Model 3200 Secondary Host Controller linked together at port zero • supports 8 workstations/printers or Expansion Controllers via Series 2000 facilities • 1 independently-targeted link from Series 2000 and Model 3200 each running at 9600 bps (or at 56K bps optional) • RG62A/U coax DTE interface; RS-232C DCE interface • SNA/SDLC, BSC, or ASCII:

432/355	11,225	62

CL02-02 1200 Expansion Controller • provides 7-port expansion for CL02-01 (Series 1000) or CL06-01 (Series 2000) Master Controller • contains 64K bytes of RAM, directory, and directory backup diskettes • also provides redundancy for CL02-01:

116/95	2,995	27

CL04-01 2200 Diskless Expansion Controller • provides 7-port expansion for CL06-01 (Series 2000) Master Controller • contains 64K bytes of RAM:

106/87	2,745	24

Speed Option • allows controller to transmit data at 56K bps • operates only under SNA/SDLC:

NA/NA	700	NA

☐ I/O Channels

The controllers communicate with the host processor via switched or dedicated facilities to host channel-connected control units/adapters • communication facilities connect to the S/360, S/370, 3030, and 4300 processors via the 2701 Data Adapter Unit, 2703 Transmission Control, and 3704/3705/3725 communication controllers. On the S/370 Models 115, 125, 135, and 138, connection is via an Integrated Communications Adapter; the Communications Adapter is used on the 4331.

Display stations/printers attach directly to the cluster controller via coaxial cable. Models 1911, 1921, 3911, and 3921 can use 4-wire twisted-pair telephone wire in lieu of coaxial cable. Each display station can attach a serial printer via an RS-232C port. Display stations/printers can be located up to 5,000 feet from the cluster controller with coaxial cable; and 2,000 feet with twisted pair.

To increase the distance between the display stations/printers up to 10,000 feet with coaxial cable and 4,000 feet with twisted pairs, Davox offers an Expansion Controller which accommodates up to 7 devices and multiplexes their message streams on a single line to the cluster controller. The Expansion Controller, based on Davox's Model 1000 and 2000 controllers, can provide the same basic services (e.g., configuration control, diagnostics, etc). It is not a "passive" device like a terminal multiplexer. Up to 8 Expansion Controllers can connect to the cluster controller.

As mentioned under Workstations/Terminals, those terminals emulating asynchronous devices can operate in standalone fashion when communicating with the host. The data communication interface is an RS-232C port furnished for an attached printer. Users wishing to interface a printer along with remote communication may do so with an optional Communications Port Splitter.

CL02-02 Expansion Controller • connects up to 7 workstations/printers; provides single composite link (coax or 4-wire twisted pair) to cluster controller • interfaces personal computers for shared use by attached terminals:

$116/$95 mo	$2,995 prch	$27 maint

Communications Port Splitter • equips workstation for both remote communication with host and local (at the workstation) printing • attaches to RS-232C port on workstation:

NA/NA	395	1

CA01-02 Davox Net IBM PC Attachment • attaches PC to Model 191, 1921, 3911, and 3921 terminals for dedicated (to terminal) use • attaches to Model 911, 921, 2911, and 2921 controllers for shared use:

54/44	1,390	NA

CA01-01 IBM Personal Computer Attachment • attaches PC to workstation, expansion controller, or cluster controller:

46/38	1,195	5

DN01-01 Controller Interface • 8-port device converts twisted-pair signal format into coaxial cable signal format for presentation to cluster controller, and the converse:

29/24	895	NA

PR01-01 System Printer Adapter • adapter with serial port allowing serial printer to emulate an IBM 3287 • accommodates printers at speeds up to 600 lpm:

74/60	1,900	NA

☐ Communications

The Series 1000, 2000, and 500 remote controllers support BSC and SNA/SDLC protocols. In addition, they can also emulate prominent ASCII terminals including the DEC VT52/100. The remote controller communicates with the host via half-/full-duplex data transmission over point-to-point or multipoint switched or dedicated facilities at speeds up to 19.2K bps or 56K bps (optional). An RS-232C interface connects the cluster controller to the modem. Series 3000 operates in asynchronous mode at speeds to 19.2K bps.

Terminals operating in standalone asynchronous mode employ the DDD network to interact with the host processor. Transmission speeds are typically 75/110/134.5/150/300/600/1200 bps, but some models also support 9600 bps. Interface is RS-232C.

☐ Diskette

A single-drive 5.25-inch diskette unit is integrated into the cluster controller to store configuration tables, emulation, and utility software. Users can modify the contents of the diskette from the terminal keyboard and create duplicate copies. The diskette cannot be used for other functions, such as local storage for housing applications.

The Series 1000 diskette is a single-sided, dual-density 5.25-inch unit with 48 tracks per inch and a capacity of 160K bytes. Series 2000 employs a 5.25-inch unit that is double-sided, double-density, has 96 tracks per inch, and holds 640K bytes.

MO: monthly 2-year/3-year lease charges not including maintenance. PRCH: single-quantity, purchase price. MAINT: monthly maintenance charge for on-site service or purchased units. NA: not available/applicable. NC: no charge. Prices current as of March 1985.

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

☐ Workstations/Terminals

Davox provides 10 workstations/terminals, 6 of which are monochrome and 4 are 7-color displays. All are equipped with keyboards similar to the IBM 4627.

The monochrome versions consist of the Models 811, 821, 911, 921, 1911, and 1921. All emulate the IBM 3278-2, and are equipped with an RS-232C interface which can be used to attach a serial printer or except for the 811 and 821 an IBM Pesonal Computer. Color terminal Models 2911, 2921, 3911, 3921 are used with the Series 2000 and 5000 controllers. The new terminals emulate the IBM 3279-S2B and also can attach a serial printer on the IBM PC.

All terminals can emulate asynchronous ASCII terminals Models 821, 921, 1921, 2921, and 3921 contain a telephone handset and a 10-button keypad for analog voice communication. Digitized voice is not supported. All Davox terminals are delivered with a tilt and swivel base which can be swiveled 100 degrees and tilted 20 degrees.

Aside from the integral telephone facilities, there are no differences among models with respect to the character display characteristics, edit and format facilities, and keyboard functions. Differences include asynchronous terminal emulation, personal computer support and the manner of connection to the cluster controller.

Monochrome terminals emulate the IBM 3178 and 3278-2, and each can switch from 3270-mode operation to personal computer or asynchronous mode by single-key depression. For the 811 and 821, Davox offers either ANSI X3.41 or ASCII TTY protocol emulation. The X3.41, incidentally, is the same protocol used with the DEC VT52, making the Davox terminal acceptable to all hosts supporting that terminal. Emulation software is loaded into the terminal RAM at power-up time.

All other terminals are available with ANSI X3.41, X3.64, or ASCII TTY protocol emulation. The X3.64 is the protocol used by the DEC VT100. If you're planning to interface with IBM and asynchronous hosts, order the X3.64 emulation facility. With it, you get X3.41 facilities, allowing your terminal to emulate both the VT52 and VT100.

All Davox terminals except Models 3911 and 3921 attach to the controller at distances up to 5,000 feet via standard RG62U coaxial cable terminated with BNC connectors. In addition, Models 1911 and 1921 can also use existing 4-wire twisted-pair telephone wiring in lieu of coaxial cable. Models 3911 and 3921 can only be used with twisted pairs.

Davox calls twisted-pair communication DavoxNet, and requires the use of a special interface called DN01-01. This unit is an 8-port device on the cluster controller that converts the twisted-pair signals to coaxial compatibility and vice versa. The advantage to twisted-pair wiring is that the telephone wires may already be in place, saving the user the expense of buying and pulling coaxial cable. With twisted-pair, devices can be located 2,000 feet from the controller.

The integral telephone facility is merely a convenience feature. **It does** not digitize voice, and employs its own twisted-pair wiring.

Termination to the telephone network is via an RJ11C module jack. However, the services it offers are notable. Manual, auto-dial, and repertory speed dialing are furnished. Up to 85 entries with 48 characters per entry are permitted, and speed dialing can be by name or 1-character speed number. Entries can even be chained. The auto-dial feature will also handle MCI and Sprint dialing sequences. In addition, the telephone permits automatic dialing of host-resident telephone directories.

When used in conjunction with the keyboard Smart Buttons, the telephone facility can also be used to handle PBX function codes. These **Smart Buttons** (8 on each keyboard) are dual function and unique to Davox equipment. The Smart Buttons simplify complex operations. For example, a user can program a button to perform all of the sequences and code/command generation to change a screen format, or automatically log-on/-off the system. It can also be used to switch the terminal from 3270 mode to asynchronous operation. Each button can store commands and character strings (up to 100 characters each), and can even send touch-tone signals. The functions associated with each Smart Button are defined by the user via the keyboard, and are stored on the system diskette. Functions can also be changed from an Administrative terminal or by the host processor. The Administrative terminal is normally connected to the cluster controller, but any terminal can be designated as such.

The Smart Buttons can be programmed to send data or respond to control signals or data sequences which control the flow of data. For example, users can specify that certain operators will only initiate when a specific character string is received from the host.

While Davox now offers multihost accessing at the cluster controller level, it also provides it with its terminals. Each terminal is equipped with an RS-232C port which can be used for connecting a printer **or** as a communication interface (DTE). Users can switch from an attached terminal (3270 mode) to a standalone asynchronous mode via a Smart Button, and once in that mode employ the DDD network to make connection to another host. This is an extremely flexible and clever feature but, as we mentioned under Analysis, it does run up communication costs. Should the user wish to have the communication facility **and** local printer, Davox offers a Communications Port Splitter that allows both devices to share the RS-232C port—but **not** concurrently.

For those wishing local processing capability, Davox will furnish the IBM Personal Computer. Offered in the 5150 and XT models, it interfaces with all Davox terminals except Models 811 and 821 and supports file transfers. Davox also permits the PC to be attached to the cluster controller, making it available to all terminals on a shared basis. The PC can be ordered in any configuration with any options offered by IBM.

811 Multi-Mode Terminal

Configuration • cluster display employed with Davox Series 1000 controllers • modular detached typewriter-style EBCDIC keyboard • tilt and swivel base • attaches serial printer • emulates 3278-2 • ANSI X3.41 and ASCII TTY emulation optional.

Display • 12-inch diagonal • 9x12 dot matrix • 1920-character, 24-line x 80-character format; 25th status line • 96 EBCDIC/ASCII-B character sets • blink and nonblink block or underline cursor • P31 green; antiglare screen.

Edit & Format Features • cursor up, down, left, right, home • forward and back tab • character insert/delete • protected/nonprotected fields (3278 mode only); normal/high-intensity fields • n-key rollover; typematic keys • erase to EOF; clear input.

Communications • via cluster controller in 3270 mode • point-to-point communication with host in asynchronous mode; RS-232C interface; 75/110/134.5/150/300/600/1200 bps.

Peripherals • attaches serial printers for direct screen contents printing • uses cluster printers via controller • attaches IBM PC.

DS03-01 Series 811 Terminal • 1920-character display; 96-key EBCDIC keyboard (see keyboards for particulars):

$70/$57 mo	$1,795 prch	$11 maint

Amber Screen • provides amber display background for CRT:

3/3	75	NA

821 Professional Desk Set

Configuration • cluster display employed with Davox Series 1000 controllers • modular detached typewriter-style EBCDIC keyboard • tilt and swivel base • attaches serial printer • includes telephone handset, 10-button keypad, manual or auto-dial • emulates 3278-2 • ANSI X3.41 and ASCII TTY emulation optional.

Display • same as Model 811.

Edit & Format Features • same as Model 811.

Communications • via cluster controller in 3270 mode • point-to-point communication with host in asynchronous mode; RS-232C interface; 75/110/134.5/150/300/600/1200 bps • telephone employs 4-wire USOC RJ11C module jack.

Peripherals • same as Model 811.

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

DS01-01 Series 821 Terminal • 1920-character display; 99-key EBCDIC keyboard; telephone handset with 10-button keypad:

$77/$63 mo	$1,995 prch	$12 maint

Amber Screen • provides amber display background for CRT:

3/3	74	NA

911 Maxi-Mode Terminal

Configuration • cluster display employed with Davox Series 1000 controllers modular detached typewriter-style EBCDIC keyboard • tilt and swivel base • attaches serial printer and IBM Personal Computer • emulates 3278-2 • ANSI X3.41, X3.64, and ASCII TTY emulation optional.

Display • same as Model 811.

Edit & Format Features • cursor up, down, left, right, home • forward and back tab • character insert/delete • reverse video, field, blink, underline, normal/bright intensity in any combination of fields (ANSI 3.64/PC modes) • normal/high intensity, nondisplayable protected/unprotected fields (3270 mode) • n-key rollover; typematic keys • erase to EOF; clear input.

Communications • same as Model 811, except 9600-bps asynchronous.

Peripherals • attaches serial printer for direct screen contents printing • uses cluster printers via controller • attaches IBM PC.

DS04-01 Series 911 Terminal • 1920-character display; 96-key EBCDIC keyboard:

$77/$63 mo	$1,980 prch	$11 maint

Amber Screen • provides amber display background for CRT:

3/3	75	NA

CA01-01 IBM Personal Computer Attachment • available in IBM 5150 and XT models • full configurations and options available • connects to DS04-01; requires CA01-01 adapter • PC price quoted:

NA/NA	NA	NA

921 Professional PC Desk Set

Configuration • cluster display employed with Davox Series 1000 controllers • modular detached typewriter-style EBCDIC keyboard • tilt and swivel base • attaches serial printer and IBM Personal Computer • includes telephone handset, 10-button keypad, manual or auto-dial • emulates 3278-2 • ANSI X3.41, 3.64, and ASCII TTY emulation (optional).

Display • same as Model 911.

Edit & Format Features • same as Model 911.

Communications • via cluster controllers in 3270 mode • point-to-point communication with host in asynchronous mode; RS-232C interface; 75 bps to 9600 bps • telephone employs 4-wire USOC RJ11C module jack.

Peripherals • same as Model 911.

DS02-01 Series 921 Terminal • 1920-character display; 99-key EBCDIC keyboard; telephone handset with 10-button keypad:

$84/$69 mo	$2,180 prch	$13 maint

Amber Screen • provides amber display background for CRT:

3/3	75	NA

CA01-01 IBM Personal Computer Attachment • available in IBM 5150 and XT models • full configurations and options available • connects to DS02-01; requires EA01-01 adapter • PC price quoted:

NA/NA	NA	NA

1911 Professional PC Desk Set

Configuration • cluster display employed with Davox Series 1000 controllers • modular detached typewriter-style EBCDIC keyboard • tilt and swivel base • attaches serial printer and IBM Personal Computer • emulates 3278-2 • ANSI X3.41, X3.64, and ASCII TTY emulation (optional).

Display • same as Model 811.

Edit & Format Features • cursor up, down, left, right, home • forward and back tab • character insert/delete • reverse video, blink, underline, normal/bright intensity in any combination up to 8 fields (PC mode) • normal/high-intensity, nondisplayable protected/unprotected fields (3270 mode) • n-key rollover; typematic keys • erase to EOF; clear input.

Communications • via cluster controller in 3270 mode • point-to-point communication with host in asynchronous mode; RS-232C interface; 75/110/134.5/150/300/600/1200/9600 bps • attaches to controller via twisted-pair or coaxial cable.

Peripherals • attaches serial printer for direct screen contents printing • uses cluster printers via controller • attaches IBM PC.

DS08-01 Series 1911 Terminal • 1920-character display; 96-key EBCDIC keyboard:

$84/$69 mo	$2,175 prch	$11 maint

Amber Screen • provides amber display background for CRT:

3/3	75	NA

CA01-01 IBM Personal Computer Attachment • available in IBM 5150 and XT models • full configurations and options available • connects to DS08-01; requires CA01-01 adapter • PC price quoted:

NA/NA	NA	NA

1921 Professional PC Desk Set

Configuration • cluster display employed with Davox Series 1000 controllers • modular detached typewriter-style EBCDIC keyboard • tilt and swivel base • attaches serial printer and IBM Personal Computer • includes telephone handset, 10-button keypad, manual or auto-dial • emulates 3278-2 • ANSI X3.41, X3.64, and ASCII TTY emulation (optional).

Display • same as Model 1911.

Edit & Format Features • same as Model 1911.

Communications • via cluster controller in 3270 mode • point-to-point communication with host in asynchronous mode; RS-232C interface; 75/110/134.5/150/300/600/1200/9600 bps • attaches to controller via twisted-pair or coaxial cable • telephone employes 4-wire USOC RJ11C module jack.

Peripherals • same as Model 1911.

DS06-01 Series 1921 Terminal • 1920-character display; 99-key EBCDIC keyboard; telephone handset with 10-button keypad:

$92/$75 mo	$2,375 prch	$13 maint

Amber Screen • provides amber display background for CRT:

3/3	75	NA

CA01-01 IBM Personal Computer Attachment • available in IBM 5150 and XT models • full configurations and options available • connects to DS06-01; requires CA01-01 adapter • PC price quoted:

NA/NA	NA	NA

29XX Professional Color Workstation Configuration • cluster display employed with Davox Series 2000 and 3000 controllers • modular detached typewriter-style keyboard comparable to IBM 4627 • tilt and swivel base • attaches serial printer and IBM Personal Computer • emulates IBM 3279-S2B • ANSI X3.41, X3.62, and ASCII TTY emulation optional.

Display • 12-inch diagonal • 9x12 dot matrix • 1920-character, 24-lines x 80-characters (column) format; 25th status line • 22-character APL/Text character set including 94-character EBCDIC set • blink and nonblink block or underline cursor • 7-color support (green, red, blue, yellow, white, turquoise, and pink).

Edit & Format Features • cursor up, down, left, right, home • character insert/delete • forward and back tab • field attributes consist of normal display, blank, blink, protected, nonprotected, underline, reverse video for IBM, ANSI 3.62 or PC support • n-key rollover, typematic keys.

Davox Information Display Systems
Series 1000, 2000, 3000 & 5000 Systems

Communications • terminal attaches to Series 2000 controller via RG62U coaxial cable terminated by BNC-type connectors; communication with host via cluster controller in 3270 mode • asynchronous communication via auxiliary RS-232C interface at speeds of 75/110/134.5/150/300/600/1200/9600/19,200 bps over dedicated line or public switched network • telephone employs 4-wire USOC RJ11C module jack.

Peripherals • attaches serial printer for direct screen contents printing • user cluster printers via controller • attaches IBM PC.

DS10-01 Model 2911 Professional Color Workstation • all 29XX features:

$216/$177 mo	$5,600 prch	$26 maint

DS09-01 Model 2921 Professional Color Workstation • all 29XX features plus telephone handset with 10-button keypad:

220/180	5,700	27

39XX Professional Color Workstation Configuration • cluster display employed with Davox Series 2000 and 3000 controllers; attaches to controller via Davox Net • modular detached typewriter-style keyboard comparable to IBM 4627 • tilt and swivel base • attaches serial printer and IBM Personal Computer • emulates IBM 3279-S2B • ANSI X3.41, X3.64, and ASCII TTY emulation optional.

Display • same as 29XX.

Edit & Format Features • same as 2911.

DS12-01 Model 3911 Professional Color Workstation • all 39XX features:

228/187	5,912	28

DS11-01 Model 3921 Professional Color Workstation • all features of 39XX plus telephone handset with 10-button keypad:

232/190	6,015	28

☐ Keyboards

The 2 keyboards included with the Davox terminals are basically IBM 4627 layouts with some modifications to accommodate the 8 Smart Buttons and 3 telephone control keys. The Smart Buttons, included with all keyboards, allow the user to define and associate character sequences and commands which can be activated by depressing the associated key. Smart Buttons can be used, for example, to define screen layouts which can be called from the host by depressing the appropriate key. Working with a host telephone directory, a Smart Button can be programmed to search for, retrieve, and auto-dial telephone numbers, or switch from 3270 to asynchronous mode operation. The telephone control keys, supplied with the keyboards for Models 821, 921, 1921, 2921, and 3921 handle such functions as hold and redial. Also included with each keyboard is a Directory Key which allows retrieval and display of locally held (at the cluster controller) or host-held telephone directory.

The keyboards employ a typewriter layout with the F and J home keys being deep dished. The keyboards contain a 12-key calculator keypad and 24 programmable functions. The latter are all shift-activated alternate functions associated with other keys. On the Model 821, 921, 1921, 2921, and 3921 terminal keyboards, the calculator keypad also serves as the telephone keypad.

96-Key Keyboard • 96-key EBCDIC keyboard with typewriter layout • 46 alphanumeric data keys, 26 control keys, 12-key calculator keypad with 12 alternate programmable functions, 8 Smart Buttons, and a Directory key:

NC/NC mo	NC prch	NC maint

99-Key Keyboard • same as 96-key version; except includes 3 telephone control keys:

NC/NC	NC	NC

☐ Printers

Printers can be attached directly to each terminal for its exclusive use, or to the cluster controller for shared use with all terminals. Standard printer interface is serial RS-232C.

While Davox manufactures no printers, it does OEM from Centronics and Diablo. Customers can order any model of the Centronix 150 and 350 Series or attach any comparable printer. For customer wishing to emulate IBM 3287 printer functions, Davox will supply a printer adapter and serial port to handle this. The adapter, according to the vendor, allows any printer to emulate the 3287. The adapter also accommodates printers running at speeds up to 600 lpm.

PR01-01 System Printer Adapter • adapter and serial port allowing serial printer to emulate IBM 3287 • accommodates printers at speeds up to 600 lpm:

$74/$60 mo	$1,900 prch	NA maint

• END

DCA Irma Family Emulators

Irma, Irmaline, Irmalette, Irmacom, Irmakey/3270, Irmaprint, Irmalink DBX/CICS & Irmalink FT/TSO

■ PROFILE

Function • emulates IBM 3278/3279 terminals (Irma, Irmaline and Irmalette); 3271/3274/3275/3276 controllers plus 3277/3278/3279 terminals and 3284/3286/3288/3289 printers (Irmacom); 3287 printer (Irmaprint); and 3270/personal computer keyboard (Irmakey/3270) • interfaces with IBM 3270 controller and/or performs data communication • file transfer services (Irmalink DBX/CICS and FT/TSO).

Packaging • printed circuit card (Irma and Irmalette); standalone tabletop unit (Irmaline and Irmaprint) • diskette-resident software (Irmacom and Irmalink).

Communications/Networks • Irma, Irmaline, Irmalette, and Irmaprint rely on IBM 3270 controllers for communication services • Irmacom attaches to IBM System 370, 30XX, 4300, 8100, and 3790 over point-to-point and multipoint lines at 9600 bps, half-/full-duplex, SNA/SDLC or BSC • RS-232C interface.

First Delivery • 1982.

Systems Delivered • over 85,000 Irma boards; others not disclosed.

Comparable Systems • ABM Computer Systems SC-Series, AST Research AST-PCOX/SNA/BSC/3780/5251, Avatar PA100 and PA100 Turbo, CXI Inc CXI 3278/3279, Forte Data Systems FORTEPJ/3270-PC, Micro-Integration Coax/Micro/BIS Family, Pathway Design PC Path, Persyst Products Coax/3278 and PC/3270/3780/HASP, Techland Systems Bluelynx Series, and Winterhalter Datatalker/Coax, 3270/3780/2780.

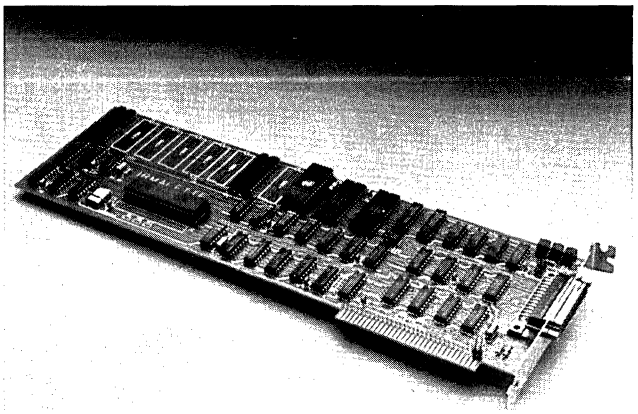
Vendor • Digital Communications Associates (DCA); 303 Technology Park, Norcross, GA 30092 • 404-448-1400.

Distribution • through DCA and independent distributors and retailers both nationally and internationally.

■ ANALYSIS

The Irma family of products fall into the general category of "protocol" converters designed to allow normally incompatible terminals to communicate with IBM mainframes. Like so many products in this growing marketplace, the Irma units emulate the facilities and features of the IBM 3270.

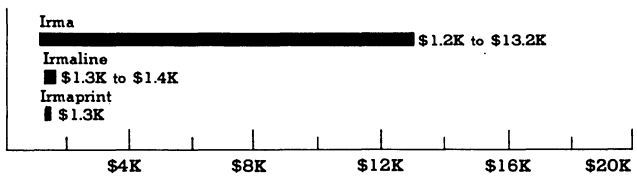
The Irma line, however, is different because it offers more than emulation. While many of the so-called protocol converters are designed to link asynchronous devices such as ASCII terminals/printers and personal computers to IBM mainframes, Irma goes much further by supporting file transfers. That's the **real strength** of the product line. It also offers an interface for user-written applications.



The Irma product itself first appeared in August 1982. Designed and marketed by Decision Support Inc (later acquired by DCA), Irma is a printed circuit board that plugs into an IBM PC, PC/XT, or compatible personal computer, causing it to emulate an IBM 3278/3279 terminal. Communication services are provided by a locally attached IBM 3274/3276. In addition to providing the terminal emulation services, Irma also supports file transfer uploads and downloads between the terminal or personal computer and an IBM mainframe running the Time Sharing Option (TSO). While that scheme for transferring files is the easiest to use (for nonprogrammers) and requires few host processing resources, it tends to be slow and somewhat limited. To alleviate this shortcoming, DCA introduced a faster application called FT/TSO, which operates as a mainframe file transfer utility and does not suffer the delays associated with screen-transfer acknowledgment from the host, as is the case with TSO (see Strengths).

A limitation of Irma is its inability to handle communication. In short, the personal computer cannot be located remotely from the 3274/3276. To eliminate this restriction DCA offers the Irmaline and Irmalette products. Irmaline is a standalone "box" that functions like so many other "protocol" converters on the market, in that it allows asynchronous ASCII terminals and personal computers to be used to replace (or in place of) the IBM 3278. Irmaline performs the necessary terminal emulation and connects directly to a 3274/3276 or Integral Terminal controller with Type A adapters. Irmaline contains 2 DTE ports: (1) a coaxial interface for attaching an IBM 3278 in native passthrough mode, and (2) an RS-232C interface which is used to connect a local or remote asynchronous terminal such as the DEC VT100, LSI ADM-3A, IBM 3101, and Data General D200 (or look-alikes). To configure the RS-232C port for dial-up terminals, users employ a 3278 terminal and an Irmaline menu.

PURCHASE PRICE RANGE hardware ■



DCA IRMA LINE PURCHASE PRICING • bar graph covers price ranges between "small" and "large" configurations for hardware products (solid bar) • small Irma board consists of basic unit emulation IBM 3278/3279 terminals and supporting MVS/RMS TSO file transfer; large system adds DBX/CICS file transfer software • small Irmaline consists of dual-port IBM 3278/3279 emulator; large system adds Irmalette board • small/large Irmaprint consists of a single port IBM 3287 emulator which attaches asynchronous ASCII printers. All prices single quantity purchase; maintenance is negotiable.

DCA Irma Family Emulators

Irma, Irmaline, Irmalette, Irmacom, Irmakey/3270, Irmaprint, Irmalink DBX/CICS & Irmalink FT/TSO

Irmalette is a printed circuit card that plugs into a personal computer equipped with an Irma board. Irmalette merely provides an asynchronous communication link with Irmaline; while the Irma board supports file transfers and 3278 emulation.

The Irmaline/Irmalette combination has its limitations. Translation delays are encountered as data passes through Irmaline and the 3274/3276 on the way to and from the host. Also, many users either do not need to transfer files or require support for transferring large quantities of data. DCA's answer to both problems is Irmacom, a hardware/software combination that provides 3271/3275/3274/3276/3277/3278/3287/3289 emulation in the Irmacom/3270 package; and Irmacom/3770 and Irmacom RJE, both designed to emulate IBM RJE terminals.

Irmacom/3270 consists of a printed circuit board that plugs into a personal computer and disk-resident emulation software which is loaded into the personal computer's RAM and runs as an application under PC-DOS and MS-DOS. The SNA/SDLC version of Irmacom/3270 emulates the remote 3274 or 3276 controllers, the 3278 terminal, and 3287 or 3289 printers. Users can attach parallel or serial ASCII printers to the personal computer and operate them in LU1 or LU3 modes. The BSC version emulates the remote 3271 or 3275 controllers, 3277 terminal, and 3284, 3286, or 3288 printers. Again, serial or parallel ASCII printers can be substituted for IBM products.

Irmacom/3770 lets the personal computer emulate the IBM 3770 RJE workstation, and allows a serial or parallel ASCII printer to emulate the workstation's printer. Either ASCII or EBCDIC transmission is supported, and both text and binary files are transmitted. The DCA product supports multiple selectable devices and job files and is fully compatible with the SNA 3770 standard. The latter provides the possibility of communicating with non-IBM computers which support SNA 3770 RJE communication.

Irmacom/RJE provides IBM 2780/3780 RJE workstation emulation and also allows serial or parallel printers to act as a workstation printer. The emulator supports RJE console and operator-selectable output devices (printers and disks) and handles both text and binary data. Irmacom/RJE allows users to create command macro files, a very useful facility for unattended operation. The emulator is fully compatible with IBM's 2780/3780 RJE standards, thus allowing communication with non-IBM mainframes supporting 2780/3780 RJE communication.

The remaining products in the Irma family are Irmaprint and Irmakey/3270. Irmaprint is a standalone unit that attaches to a 3274/3276 or Integral Terminal controller and allows an asynchronous printer to be used in place of an IBM 3287. Aside from providing the printer emulation services, Irmaprint performs character substitution of ASCII characters with no EBCDIC equivalents (e.g., escape characters).

Irmakey/3270 is a 126-key keyboard used in place of the personal computer's. The intent of this product is to provide both a 3278 and personal computer layout that will allow operators to invoke features of both terminals with a minimum of keystrokes and retraining. In fact, the user can completely redefine the keyboard, change the location of a key, and selectively program any key to produce the equivalent of a series of keystroke sequences. All facilities should dramatically increase operator efficiency by reducing mistakes associated with keying data on a nonstandard keyboard, and by eliminating multiple keystrokes to perform a normally single-key operation.

In summary, the Irma product line is really nothing special if you only need emulation services. In fact, products from Black Box, Datastream, ICOT, Infotron, Local Data, Micom, and Innovative Electronics, to name a few, can do the same job and support multiple terminals/printers (see Survey report 737 for details). Most of those products are standalone boxes, however, which require space on an already crowded disk. In addition, some of them support the file transfer facilities of Irma. Keep in mind that sophisticated file transfer capabilities, such as those offered with Irmalink DBX/CICS, are **not** for the **novice**. They require knowledge of database organization (file, record, and field organizations), normally the turf of a systems programmer or database administrator. For those who can live with less power and flexibility, the TSO and FT/TSO file handling software is much easier to use.

☐ Strengths

The strength of the Irma family varies with the product. The Irma board itself provides a standalone, card-level emulation of the IBM 3278/3279 terminal, light pen support, and VM/CMS or MVS/TSO file transfer operations for $1,195. The key here is the file transfer. Being able to upload and download files between the host mainframe and personal computer adds a degree of processing power and flexibility well-suited to distributed processing. In addition, using a file transfer utility is substantially faster than having an operator enter data from the terminal. This is especially true where a volume of data must be transmitted. The TSO employed by the Irma board is fairly simple for non-data processing professionals to learn and puts few burdens on the host mainframe resources. TSO is slow, however, and does not work directly with IMS or CICS (see Limitations).

The Irmalink FT/TSO and DBX/CICS file transfer applications are substantially faster and more efficient. Both are mainframe file transfer programs and are not hobbled by the screen transfer delays encountered by the native TSO editor. Here, the personal computer must wait for a mainframe response after every screen of data. FT/TSO reduces these delays.

Another problem with native TSO is that it cannot talk to IMS or CICS unless a programmer builds a bridge (or link) through CMS (Conversational Monitor System) or TSO. With the DBX/CICS package, users can take full advantage of CICS communication and file management facilities—very sophisticated features for a personal computer indeed.

The Irmalette board, which provides the communication link between a remote personal computer and Irmaline, also performs another unusual service—error-correction of asynchronous data. This service is not part of the asynchronous protocol per se, and normally requires an external device like an error-correcting interface box, modem, or statistical multiplexer.

The Irmacom/3770 and RJE packages bring batch-transfer support to the personal computer which, as mentioned earlier, is ideal for volume data transfers. Both handle text and binary data files and transmit data in compressed form, further adding to the overall communication efficiency. The Irmacom/RJE also files data to be sent to printer or disks, and operates in an unattended environment.

☐ Limitations

The limitations of Irma products, like their strengths, vary with the product. For example, the standard TSO file transfer shipped with the Irma board interfaces with the TSO link editor. That utility reads data a line at a time and responds back to the personal computer regarding the acceptability of data. For interactive applications, this isn't a real problem, but for file transfers it's too slow. The new FT/TSO bypasses the link editor and substantially increases the overall transfer speed between uploaded/downloaded files.

Both the MVS/CMS TSO and FT/TSO also cannot communicate with the IMS and CIMS software at the host unless a user-written application code forms a bridge, which generally requires the expertise of a highly skilled applications programmer.

The Irma board itself does not support the concurrent transfer of files and personal computer operation. Thus, during a file transfer the machine cannot be used for local processing. In all fairness to DCA, we know of no product in Irma's class that allows such concurrent operation. We are merely pointing this out in the event that such an operation is planned.

Another Irma limitation is the lack of a multiwindow facility (a la IBM 3270 PC). Such a facility is extremely useful in program development and data comparison, and also eliminates the screen erase switching operations required when changing operations. DCA recognizes this limitation and will shortly introduce windowing with DFT Irma.

DCA Irma Family Emulators

Irma, Irmaline, Irmalette, Irmacom, Irmakey/3270, Irmaprint, Irmalink DBX/CICS & Irmalink FT/TSO

■ SOFTWARE

☐ Terms & Support

Terms • software utilities offered on a purchase-only basis with discounts negotiated • firmware bundled into price of component.

Support • maintenance provided by DCA or end-seller personnel • telephone consulting offered by DCA.

☐ Utilities

DCA offers several utilities covering component emulation and file transfer. The emulation utilities are a combination of hardware/software designed to work directly with an IBM PC, PC/XT, and compatible personal computers, and emulate the IBM 3271, 3274, 3275, and 3276 controllers, and the 2780/3780/3770 RJE workstations (see Converters/Emulators for a description).

The file transfer facilities consist of TSO, FT/TSO, and DBX/CICS. The file transfer utilities are intended for use with the IBM personal computer, but require that the device have an Irma board to provide the IBM 3270 emulation services. In addition, the host processor must also contain DCA-supplied interface software to handle Irmalink file transfer operations such as opening host-resident files.

The TSO file transfer scheme is the standard method employed by Irma. Under TSO the mainframe is instructed to transfer files via command list instructions that invoke procedures within IBM's Time Sharing Option (TSO) software. This scheme, however, can be slowed by screen image transfers (see Limitations).

The Irmalink FT/TSO file transfer application speeds file transfers. FT/TSO supports mainframes running under MVS/TSO and PCs running under PC-DOS 2.0 and MS-DOS 2.0 or higher releases. Users invoke file transfers by entering the source and destination filenames followed by the depression of a function key. FT/TSO assigns the transfer definition, which contains the file's record format, code table, and transfer mode. Both text and binary files are handled.

The Irmalink DBX/CICS file transfer application also runs under PC-DOS and MS-DOS and permits the transfer of files between the host mainframe running CICS and the microcomputer. The DBX/CICS record definition allows users to designate the fields to be extracted from a file on the mainframe for transfer to the personal computer. Using this function, the user can create a single mainframe file consisting of only selected fields. System security facilities allow the data processing manager or database administrator to control user access to file data and the operations performed on it.

Irmalink DBX/CICS • diskette-resident software application running on IBM PC, PC/XT, and compatible products with Irma board and PC-DOS or MS-DOS 2.0 operating systems • interfaces with IBM mainframes running under DOS/VSE with CICS, MVS with CICS or OS/VS1 with CICS; requires Irmalink DBX/CICS interface software at host • field types supported include alpha, alpha left and right justified, zoned numeric, zoned numeric left and right justified, and packed decimal • micro file formats include BASIC, DIF, PRN, CSV, and record • VSAM Entry Sequence, VSAM Key Sequence, and Transient Data Sets supported • user-definable access restrictions to each function • supports field selection from multiple files to create new file • allows selection of files/records for transfer; multiple record formats from single mainframe file:

$11,995 prch	NA maint

Irmalink FT/TSO • diskette-resident software application running on IBM PC, PC/XT, and compatible products with PC-DOS or MS-DOS 2.0 operating systems • interfaces with IBM mainframes running MVS/TSO communication software • PC requires Irma board • supports sequential and partitioned data sets with fixed and variable formats; transfers text and binary files • file transfers initiated by entering source and destination filenames • data transferred in compressed format:

50	NA

■ HARDWARE

☐ Terms & Support

Terms • offered on a purchase basis only • discounts negotiated.

Support • maintenance provided by DCA or end-seller personnel • telephone consulting offered by DCA.

☐ Overview

The Irma product line consists of a family of products primarily designed to allow IBM PC, PC/XT, and compatible products to communicate with IBM mainframes in an interactive or batch environment. Other Irma products are also offered which allow asynchronous ASCII terminals and printers to replace high-priced IBM units.

The major application of the Irma line is the emulation of IBM 3270 components. Users can choose an emulator for IBM 3271/3272/3274/3276 controllers, 3277/3278/3279 terminals, and 3284/3286/3288/3289 printers. Emulators are also offered which make the personal computer appear to be an IBM 2780/3780 or 3770 RJE terminal. In addition to emulation, the Irma family also supports file transfers between host and personal computer. To increase the overall efficiency of that operation, DCA offers 2 file transfer packages called FT/TSO and DBX/CICS.

The Irma board—the mainstay of the line—fits into any available card slot on an IBM PC, PC/XT, or compatible product, and allows it to operate as both a standalone personal computer and an IBM 3278 or 3279 terminal. Users switch modes from the keyboard. The Irma board allows the PC to connect to a coax port on an IBM 3274, 3276, or Integrated Terminal controller with Type A adapters. In addition to emulating the 3278/3279, Irma permits file transfers (although not very efficiently, as mentioned under Limitations) or it can be used with the FT/TSO and DBX/CICS software.

Irmaline is a standalone terminal emulator which directly connects to an IBM 3274/3276. Irmaline accommodates a personal computer or asynchronous ASCII terminal, and emulates an IBM 3278-2 through -4 and 3279 terminals. Irmaline accommodates a single terminal at a time, and that device can be either directly connected to it via a coax port or RS-232C port, or access Irmaline via a dial-up telephone connection and the RS-232C port. A set of menus allows the user to set the RS-232C port parameters. Irmaline supports such common terminals as the DEC VT100, IBM 3101, LSI ADM-3A, Data General D200 (or look-alike) and non-IBM personal computers. The latter, however, must support emulation of the aforementioned ASCII terminals. Irmaline has 2 coax ports, one connects the unit to the 3274/3276 controller, while the other is a passthrough port. The passthrough port accommodates IBM PC or PC/XT (or compatible) with an Irma board installed or an IBM 3278/3279. Priority is given to the RS-232C port when it is active.

Irmalette is a printed circuit board that fits into any available slot on an IBM PC, PC/XT or compatible product, and provides Irma services to remotely located terminals. Irmalette is an intelligent asynchronous communication board which connects to Irmaline's RS-232C port. Communication with Irmaline and the mainframe is maintained independently of the personal computer, allowing the PC to operate independently. With Irmalette, Irma-like file transfers can be initiated between the remote terminal and host. To maintain security, Irmalette accepts the user password needed to access Irmaline and passes it directly. Irmalette also has an error-correction facility which detects and corrects errors occurring between Irmaline and Irmalette.

Irmaprint, the only other self-contained unit in the product line, attaches to an IBM 3274/3276 or Integral Terminal controller and allows any asynchronous ASCII printer to emulate an IBM

PRCH: single-quantity purchase price. NA MAINT: not applicable. Suggested domestic prices shown; international prices vary. Prices current as of January 1985.

DCA Irma Family Emulators

Irma, Irmaline, Irmalette, Irmacom, Irmakey/3270, Irmaprint, Irmalink DBX/CICS & Irmalink FT/TSO

3287 or display-only terminal. Irmaprint operates in both SNA/SDLC and BSC networks and supports LU1 and LU3 print streams. A printer connects to Irmaprint via an RS-232C interface or a Centronics parallel port.

DCA also offers several hardware and software products which allow a personal computer to emulate IBM 3270, 2780/3780, and 3770 controllers and workstations. The Irmacom 3270, for example, consists of a synchronous communication board and emulation software which makes the personal computer appear to be a 3274 or 3276 controller in an SNA environment, or a 3271 or 3275 in BSC. Terminals emulated are the 3277 or 3278; printers emulated are the 3287 or 3289 in LU1 or LU3 modes. Emulation software is loaded from a diskette into the personal computer's RAM and runs as an application under DOS and MS-DOS 2.0.

For RJE applications, users can employ Irmacom/RJE and Irmacom/3770. Both use a synchronous communication card to establish connection to the host, and diskette-loaded emulation software that runs DOS and MS-DOS 2.0. Irmacom/3770 emulates the IBM 3770 RJE workstation and accommodates an attached printer. Irmacom/RJE provides IBM 2780/3780 RJE workstation emulation and also accommodates a printer.

For file transfers users can employ the limited support built into the Irma board, or for greater operating efficiency and flexibility, use the Irmaline DBX/CICS or FT/TSO programs. Both are loaded into the personal computer's RAM and handle the uploading and downloading of files between the terminal and host. To employ either of these file transfer applications, the host processor must also have DBX/CICS or FT/TSO interfacing routines appended to the CICS and TSO monitor software. DCA provided these routines as part of the file transfer application.

The final product in the Irma line is the Irmakey/3270, a keyboard which combines the functions of IBM 3278 and PC keyboards and operates in 3278 or PC modes. The 126-key unit attaches to the personal computer via a 7-foot coiled cord and includes software to completely redefine the keyboard. For example, physical key locations can be "changed" and keys can be programmed to produce the equivalent of a series of keystrokes. Keyboard definitions can be temporary or saved on diskette and recalled to suit the application.

☐ Converters/Emulators

Irma PC Interface • printed circuit card plugs into IBM PC, PC/XT, or compatible products • emulates IBM 3278-2, -3, -4 and 3279-2A, -2B, -3G (4-and 7-color) terminals; APL/Text keyboards • coaxial (direct) interface to IBM 3274/3276 or Integral Terminal controller with Type A adapters; BSC or SNA/SDLC • file transfer under VM/CMS or MVS/TSO • light pen support:

$1,195 prch NA maint

Irmaline Terminal Emulator • tabletop standalone terminal emulator; attaches asynchronous ASCII terminals or personal computers • emulates IBM 3278-2, -3, -4, or 3279-2A, -3B, -3G (4- and 7-color) terminals • accommodates single locally attached or remote dial-in terminal; RS-232C DTE interface; coaxial passthrough port to attach personal computer equipped with Irma board • emulator directly attaches to IBM 3274/3276 or Integral Terminal controllers with Type A adapters via coaxial cable; BSC or SNA/SDLC • dual 8X305 microprocessors handle 3270 coaxial protocol and RS-232C protocol independently • accepts 110- to 9600-bps rates from attached terminals:

1,295 NA

Irmalette Remote Terminal Interface • asynchronous communication printed-circuit card; plugs into IBM PC, PC/XT, or compatible personal computers • handles remote terminal interface to Irmaline controller • contains Irma file transfer utilities for VM/CMS and MVS/TSO; interfaces with Irma facilities contained in Irmaline; permits uploading/downloading of binary data • automatic error detection and correction • RS-232C DTE interface; 110- to 9600-bps data transfer rate:

395 NA

Irmaline/Irmalette • Irmaline with integral Irmalette interface • used for attaching a remote personal computer to local IBM controller • handles file transfers under VM/CMS and MVS/TSO:

1,395 NA

Irmaprint Printer Emulator • tabletop standalone printer controller supports single ASCII printer • emulates IBM 3287-1 or -2 printer; contains 3440 character buffer • attaches to IBM 3274/3276 or Integral Terminal controller with Type A adapters; supports LU1 and LU3 print streams • software-selectable HEX translator mode for ASCII characters with no EBCDIC equivalent • RS-232C or Centronics parallel DTE interface; 45- to 38,400-bps asynchronous transmission speed:

1,295 NA

Irmakey/3270 Keyboard • 126-key keyboard replacement for personal computer keyboard • provides IBM 3278 and PC key placements • 24 PF keys in addition to normal 10 personal computer function keys • user-definable key functions:

329 NA

Irmacom/3270 Emulator • printed circuit card and software for emulating IBM 3270 controllers and terminals • printed circuit card plugs into IBM PC, PC/XT, or compatible products and handles communication functions • software loads as an application under DOS and MS-DOS 2.0; emulates IBM 3274 or 3276; terminal emulation of 3277/3278 (480/960/1920 characters) and 3287/3289 printers • supports data-entry and typewriter-style keyboards with user-definable keys and key sequences • supports 24 PF keys and PA 1-3 plus CLEAR functions • supports single or parallel printer attachment in LU1 or LU3 modes; optional light pen support • remotely attaches to IBM System/370, 30XX, 4300, 8100, and 3790 over point-to-point and multipoint lines at 9600 bps half-/full-duplex • SNA/SDLC • RS-232C interface • ASCII or EBCDIC codes:

895 NA

Irmacom/3270B Emulator • same as Irmacom/3270, except emulates IBM 3271 or 3275 controllers, 3277 terminal and 3284, 3286, or 3288 printers • employs BSC protocol:

895 NA

Irmacom/RJE Emulation • printed circuit card and software for emulating IBM 2780/3780 RJE workstations • printed circuit card plugs into IBM PC, PC/XT, or compatible products and handles communication functions • software loads as an application under DOS and MS-DOS 2.0 • supports concurrent interleaved display station and printer operations; follows IBM's model of BSC layering • supports command macro file feature for unattended operation, printer forms control, operator-selectable I/O devices (printer, disk), RJE support and data compression/decompression (3780 only) • BSC protocol • host interface and communication support same as Irmacom/3270:

895 NA

Irmacom/3770 Emulator • same as Irmacom/RJE except emulates IBM 3770 RJE workstation • supports concurrent interleaved display station and printer operations, multiple selectable devices, multiple job files, online trace and error logging, and data compression (from host only) • parallel or serial printer interface • SNA/SDLC protocol • all other communication facilities same as Irmacom/3270:

895 NA

Irmacom/3770B • same as Irmacom/3770, except runs under BSC protocol:

895 NA

☐ Terminals/Printers

With the exception of Irmaline and Irmaprint, all Irma products are designed to interface IBM PC, PC/XT, and compatible products with IBM mainframes or host processor. To accomplish this, the Irma product emulates IBM 3277, 3278, 3279 terminals;

PRCH: single-quantity purchase price. NA MAINT: not applicable. Suggested domestic prices shown; international prices vary. Prices current as of January 1985.

DCA Irma Family Emulators

Irma, Irmaline, Irmalette, Irmacom, Irmakey/3270, Irmaprint, Irmalink DBX/CICS & Irmalink FT/TSO

3284, 3286, 3288, and 3289 printers; 3271, 3274, 3275, and 3276 controllers; or 2780/3780/3770 workstations.

The Irmaline product interfaces with such asynchronous ASCII terminals as the DEC VT100, IBM 3101, LSI ADM-3A, and Data General D200 (and compatible products) and personal computers supporting the **same** asynchronous communication protocols as the aforementioned terminals. All other terminals and personal computers are **incompatible**. Irmaline performs the necessary emulation to make the asynchronous terminals appear to be IBM 3278 or 3279 units when addressed by the IBM 3274/3276 controller.

Irmaprint attaches any ASCII printer with an RS-232C or (optionally) a Centronics parallel interface. Users can also attach a display-only monitor in lieu of a printer. Irmaprint connects to a 3274/3276 controller or Integrated Terminal controller and emulates the IBM 3287-1 and -2 printer running under LU3 and 3270 modes. LU1 is supported by some printers. Irmaprint converts HEX representations of ASCII codes to actual ASCII data streams, a feature essential to users with ASCII devices that generate ASCII characters that do not have equivalents in the IBM character set. The attached terminals are configured via an Irmalink menu from an IBM 3278 or 3279 terminal. Configurations (e.g., data transmission rate, parity, handshaking protocol) are stored in nonvolatile RAM.

☐ Communications

With the exception of the Irmacom family of emulators, the Irma products rely on the IBM 3274/3276 controllers for communication services. Those controllers attach to the IBM System/370, 30XX, 4300, 8100, and 3790 processors over point-to-point and multipoint lines at 9600 bps, half-/full-duplex, SNA/SDLC. Locally attached controllers transfer data at 56K bps.

The Irmaline emulator attaches asynchronous ASCII terminals and personal computers operating at data rates of 110 to 9600 bps, full-duplex. The Irmaprint emulator allows asynchronous ASCII terminals to replace IBM 3287-1 and -2 models, and handles data rates between 45 to 38,400 bps. The Irmalette board, which provides the data interface between the personal computer and Irmaline, handles asynchronous transmission at data rates from 110 to 9600 bps.

The Irmacom product line, consisting of products that emulate the IBM 3271/3274/3275/3276 controllers and 2780/3780/3770 workstations, interface directly with the host and transmit data at 9600 bps, half-/full-duplex. Depending on the controller, SNA/SDLC or BSC protocols are supported.

• END

DCA Netlink
Series I & II T1 Multiplexer

■ PROFILE

Function • bit-interleaved TDM designed for T1 carrier facilities • point-to-point applications; downline loading of remote multiplexer • handles asynchronous/synchronous data and digitized voice • composite link speeds from 50 bps to 1.544M bps or 2.048M bps • drop-and-insert.

Communications/Networks • supports synchronous data inputs from 50 bps to 256K bps • digitized voice employs continuously variable Slope Delta (CVSD) modulation with 9.6K-, 16K-, 32K-, or 64K-bps scan • composite link interfaces consist of DS1, RS-449, RS-232C, RS-422, RS-423, and CCITT V.35; channel interfaces are RS-232C, RS-422, RS-423, and CCITT V.35 • single composite link (trunk) • point-to-point applications • cascaded multiplexer handled on data input.

First Delivery • 1983.

Systems Delivered • unknown.

Comparable Systems • Amdahl Model 2211, Avanti Ultra Mux, Bayly Omniplexer, Coastcom D/I Mux, Codex 6240, Datatel DCP 9100, General Data Comm Megamux, Infotron T Mux, Paradyne DCX-T1, Timeplex Link/1, and Scitec BSPT1.

Vendor • Digital Communications Associates, Inc; 303 Technology Park, Norcross, GA 30092 • 404-448-1400.

Distribution • through direct sales and manufacturer's representatives worldwide.

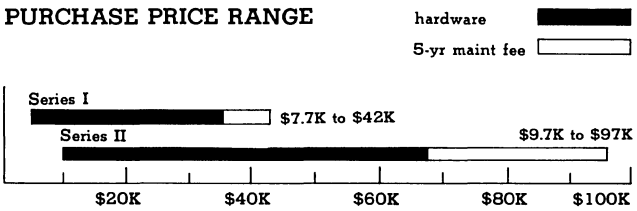
■ ANALYSIS

The DCA T1 multiplexer is a specialized time-division multiplexer designed specifically to combine a wide range of asynchronous and synchronous data paths on a single broadband link referred to as a T1 carrier.

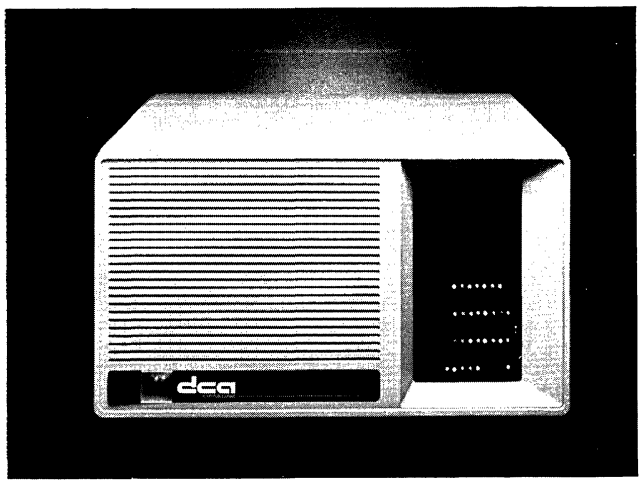
The T1 carrier service has been used by the telephone company since the early 1960s to carry digitized voice and data. Until early 1983, however, T1 was unavailable as a tariffed service to private users. Those who required it had to subscribe to independent carriers or had to install their own microwave links. Users can now order the service under AT&T Communications Accunet T1.5 Service.

T1 offers the end user a high-volume communication facility at low cost. For example, a single 1.544M-bps link can support up to 24 64K-bps channels, and the transmission quality of the service is also superior. AT&T guarantees a point-to-point, full-duplex link with an error rate of no more than 1 bit in 1 million over a 1-day period.

PURCHASE PRICE RANGE



DCA NETLINK PURCHASE PRICING bar graph covers price range between "small" and "large" configurations for hardware (solid bars) and associated 5-year maintenance (open bars) • **small** Series I consists of a 3-slot card frame with power supply, control logic, 1 data module and 1 voice module; **large** configuration consists of a 12-slot card frame with power supply and control logic, redundant power supply and control logic, 6 data and 6 voice modules • **small** Series II consists of a 3-slot card frame with power supply and control logic, 1 data and 1 voice module; **large** configuration consists of 12-slot card frame with power supply and control logic, redundant control logic and power supply, a 12-slot expansion frame with power supply, 12 data and 12 voice modules. All prices single quantity purchase; no maintenance prices available for voice card, so actual price will be slightly higher.



The T1 bandwidth is ideal for combining a large number of communication links (paths) and is suitable to applications such as office automation. For example, digital voice requires 32K to 64K bps, mainframe-to-mainframe file transfers need 64K bps, and compressed video must have at least 450K bps. A T1 multiplexer can accommodate all of these requirements.

The DCA T1 Mux was designed by Scitec Corp of Middletown, RI, which markets its product under the name BSPTI multiplexer. DCA manufactures its own version, and supports it through on-site service or remotely via remote diagnostics (see Terms & Support).

Netlink is now available in 2 version, Series I and II. Both offer the same basic T1 multiplexer services, but the Series II is the more powerful and flexible of the two. For example, the Series II supports the D4 extended frame format required for connection to the ACCUNET T1.5 service; it supports drop-and-insert; it has a time-of-day reconfiguration facility; it supports asymmetric (i.e., independent transmit and receive clocks) channels; it supports an optional redundant T1 modem and trunk with automatic switchover; and it passes high-speed EIA control signals. All of these facilities are strong advantages for Netlink, as discussed under Strengths. The user should note that the Series I does **not** support the **D4 extended frame format**, which excludes it from use on ACCUNET T1.5, relegating it to use on private facilities. While it presents no technical problems, it does reduce the product's flexibility. Much to DCA's credit, it allows a Series I to upgrade to Series II by merely changing control logic.

The multiplexer employs extremely simple packaging. The control logic module consists of a single card which handles multiplexing/demultiplexing, monitors and initiates system tests, monitors system alarms, stores configurations, gathers statistics, and establishes the trunk link. Systems such as the Amdahl 2211 require several cards to perform the same functions. The 2 channel card types offered, one for data and the other for voice, provide 4 I/O ports per card. This, too, is quite a departure from

DCA Netlink
Series I & II T1 Multiplexer

most of the competition, which provides only 2 channels per card. Such compact packaging means more channels accommodated in a smaller space, and results in a smaller system overall.

The synchronous channel card handles half-/full-duplex data at rates of 50 bps to the trunk speed, and passes TxD, RxD, RxC, TxC, RTS, CTS, DSR, DTR, CD, RI, and BO control signals. Each channel also has a 64-bit elastic buffer. We would like to see that about 100 percent higher, especially if the channel will be used to handle multidropped or dial-up terminals, and differences in clock rates are anticipated.

The voice channel employs Continuously Variable Slope Delta (CVSD) modulation for converting analog voice to digitized form. CVSD divides the 4-Hz voice into 8-bit words with each bit sampled 32,000 times a second. Only the direction of change (delta) in the slope between the current and previous sampling is transmitted. As a result, a CVSD channel only requires 32K bps to produce the digitized voice output. The other popular digitizing technique Pulse Code Modulation (PCM), needs 64K bps. Data Decisions heard the DCA voice channel at 16K, 32K, and 64K bps, and was very much impressed. Toll-quality reproduction was produced at 32K and 64K, and the 16K was quite intelligible—albeit a little raspy. We did not hear it at 9.6K bps.

The DCA T1 Mux has no asynchronous data card, a drawback discussed further under Limitations. Asynchronous data must be interfaced through a submultiplexer, or a synchronous channel can be used provided the sampling rate is 4 times the clock rate.

For ease of use, the multiplexer is first rate. Functions dialing with configuring, testing, monitoring, and controlling the system are handled through a supervisory terminal, and all operations are menu driven and in simple English. No complex symbols or procedures are used. DCA also permits the supervisory terminal (any asynchronous ASCII CRT) to be remotely located from the multiplexer and connect through the DDD network. Remote terminals, however, cannot initiate diagnostic and test procedures.

There is little question that given the price and performance facilities, the Series II is the product of choice in the Netlink family. The redundant T1 modem and trunk facility, coupled with the available redundant control logic and power supplies, pretty much guarantees operational integrity. Its D4 framing, available now, makes it acceptable to ACCUNET, and the drop-and-insert facility increases its utility.

☐ Strengths

The principal strengths of both Series are redundant power supplies and control logic; bandwidth contention; an outstanding voice channel; a redundant T1 modem (CSU); overall ease of use. In addition, the Series II can be fitted with a redundant T1 trunk and CSU; it supports D4 framing, drop-and-insert configurations, an asymmetric channel operation, and can be configured with alternate configurations that can be automatically "switched over" at a predefined time of day. The redundancy option guarantees that a failure in the power supply or control logic controlling a chassis will not interrupt service. While such redundancy is beneficial, it is not unusual. All T1 Mux competitors offer this facility. The redundant T1 link is currently supported by Amdahl, although several other manufacturers have announced it.

The **bandwidth contention** facility allows the operator to assign specific channels to contend for composite link bandwidth on an as-available basis. The contention method contrasts with assigning a fixed portion to each user, which is the case with conventional TDM assignments. Under the contention scheme, a terminal signals for access by raising a control signal such as RTS. If bandwidth is available, the multiplexer issues the equivalent of CTS, and transmission commences. If the requesting terminal has a speed below the available time slot, the multiplexer reframes the output automatically. Don't confuse bandwidth contention with the overbooking scheme employed by statistical multiplexers. Those units have buffers to accommodate the "bidding" terminals while this multiplexer does not. If a terminal is denied access, it cannot transmit and must wait. The advantage of contention is that **more** terminals can be accommodated than the channels could normally support. The vendor is gambling that statistically, not all terminals will be transmitting all of the time and statistically, he should be correct.

As mentioned under the Analysis section, the voice quality is excellent, and because of CVSD, up to 4 voice channels can be digitized at 16K bps each in a 64K-bps channel slot.

The supervisory terminal control facilities are very well thought out. We know because we tried it. Menus are provided for supervisor mode, configuration mode, diagnostic mode, and statistics reporting. Each menu contains a submenu for functions, and the user is prompted all the way through. Everything is in simple English, and is very easy to understand.

The facility to establish predefined configurations that are switched over depending on the time of day is ideal for unattended sites. The auto-switchover feature also allows users to schedule jobs with extensive bandwidth requirements for slack periods often found after regular operating hours.

The D4 framing, called DS1 extended frame formats Fe, calls for a predefined bit pattern to be inserted in every 143rd bit position of the message frame (this corresponds to 24 8-bit words that make up a message frame built around 24 64K bps channels as employed by ACCUNET T1.5 service). AT&T Communication uses this pattern for test and diagnostic purposes.

The drop-and-insert facility, offered only with the Series II, allows users to designate specific channels to be "dropped" at a predefined location, and specific channels, to be inserted into the data stream along predefined intermediate locations between the source and destination. The DCA approach to drop-and-insert requires the intermediate site Netlink to contain 2 sets of control logic and twice the number of channels as the sending Netlink. This double multiplexer is required because the Netlink demuxs the entire T1 composite link bandwidth and routes each received channel to a channel **cabled to it** at the intermediate Netlink. This procedure allows channels designated for dropping to be easily picked off. At the same time, data to be inserted can utilize the vacant slot of the dropped channel in the composite bandwidth. After the drop-and-insert operation, all channels are multiplexed and the new composite is forwarded to the ultimate destination.

While this channel cabling change might seem rigid (and it is with a hardware-controlled mux), this is not the case with netlink. Users can employ the supervisory console to route channels to other channel locations within the intermediate mux. The use of cables provides an added benefit to troubleshooting. With multiplexers that employ only software to perform the demuxing and channel dropping, troubleshooting must be done at the composite level. Cabled channels, on the other hand, can be dealt with individually.

Series II also supports asymmetric channel operation whereby independent transmit and receive clocks are employed with each channel. Such clocking allows different data rates to be employed on the transmit and receive side, and serves to compensate for satellite wobble and the resulting Dappler effect, as well as long phase delays (also found with satellites). The different data rates are also useful in applications where short answerbacks are employed in response to data transmissions.

Other useful features shared by Series I and II are the channel bypass facility and stored system configurations. With the bypass, the operator channel(s) which can access the trunk without first being multiplexed. The advantage to this is that with framing overhead appended, more of the bandwidth is available for data. Bypass is ideal for situations where large data transfers, such as CPU-to-CPU file transfers or database updates, are concerned.

The stored configuration facility, not to be confused with the aforementioned time-of-day facility, allows the user to establish and store up to 10 different system configurations, which can be activated from the keyboard. While it is not automatic, it's faster than keying in everything. It's much like speed dialing.

☐ Limitations

The principal limitations of both the Series I and II are the packaging techniques, and the inability to interface with AT&T Communications Digital Access and Crossconnect Service (DACS). The latter limitation is only important to users that intend

DCA Netlink
Series I & II T1 Multiplexer

to employ this service, and in no way affects the overall operation of either mux.

The packaging scheme employed is—to be euphemistic—dated. Each chassis (card rack) requires its own power supply. In contrast, most DCA competitors employ a single power supply and logic set to service all channels. The disadvantage with the DCA approach is that it adds bulk, and could run up the cost to users who stock spares.

Another somewhat dated design concerns the DCE interface on each channel card. DCA permanently mounts them and requires the users to screw-attach them to the backplane. To remove a card means unscrewing 2 screws and removing cables. Most vendors have made it easier for users to interchange channel cards by permanently mounting the connectors on the backplane, which allows card removal and insertion without cable disconnection and reconnection.

Netlink is not compatible with the AT&T D4 channel banks, a unit which will provide the switching services associated with AT&T's **Digital Access and Crossconnect System** (DACS) projected for 1985. DACS is a terminal-controlled system that allows the redistribution (switching) of individual DS0 64K bps channels among T1 systems at a digital level. From a simple ASCII terminal, a user can direct a DACS controller to switch individual channels within a T1 stream to another T1 stream associated with the same DACS controller.

The DACS controller (AT&T calls it a "terminal") terminates up to 128 DS1 signals, one of which is used for control. The remaining 127 DS1 terminations (3,048 64K-bps channels) can be used for crossconnections. Since 2 DS0 channel terminations are required for a crossconnect, the DACS controller provides a maximum of 1.524 DS0 crossconnections. DS1 signals to and from DACS are provided via DSX-1.

DACS is compatible with DS1 formats found in D1D, D2, D3, and D4 channel banks, and is end-to-end compatible with general trade channel banks meeting the requirements of PUB 43801. For a T1 multiplexer to be DACS compatible, its channels must be 64K bps wide and its DS1 format must consist of 24 8-bit words and 1 superframe bit for a total of 193 bits per frame. (A superframe is made up to 12 frames, and each superframe bit is timeshared to identify both channel framing and signal framing.) A T1 multiplexer that does not employ 8-bit words and 64K bps channels, therefore, shouldn't be DACS compatible. Netlink does not meet these specifications, but DCA states that DACS compatibility is under development.

■ HARDWARE

☐ Terms & Support

Terms • standard components and options available for purchase or lease; leases available on 12/24/36/48/60-month contract.

Support • all components carry a 90-day guarantee • vendor offers on-site support/maintenance conducted by their personnel, a user may subscribe to an online service called Customer Diagnostic Service Center for remote diagnostics; the latter service is priced about one-third to one-half less • service figures in this report are for on-site support • units on rental include maintenance.

☐ Overview

The DCA T1 Mux is a bit-interleaved time-division multiplexer designed for point-to-point communication over T1 carrier facilities. Cascaded multiplexers are supported, and the unit can be configured as a multinode network. Drop-and-insert applications are **supported**.

The multiplexer handles synchronous data and digitized voice directly; asynchronous inputs, currently, must be interfaced via a submultiplexing device such as a TDM or statistical multiplexer, synchronous channel cards can be employed by oversampling the input (see channels). The vendor states that an asynchronous channel card is under development. The voice channel employs the Continuously Variable Slope Delta modulation technique, and produces digitized voice outputs at speed of 9.6K, 16K, 32K, or 64K bps.

The synchronous channel cards are quad-channel units, with each channel capable of handling data rates from 50 bps to the trunk speed. A 64K-bit buffer is provided for each channel. Channel interfaces include RS-232C, with RS-422, RS-423, and CCITT V.35.

The Netlink is one of the most compact and easy to use products of its type. The control functions (e.g., multiplexing/demultiplexing, test procedures, alarm monitoring, statistics gathering, etc) are contained on a single card, and each channel card has 4 I/O ports. The system is totally configured and monitored from a supervisory terminal; no switches or jumper cables are involved in establishing operating parameters.

The basic multiplexer is a chassis (card frame) with 3, 8, or 12 I/O channel slots. The basic channel-handling capacity is extended by adding expansion nests (enclosures), each containing a power supply and 3, 8, or 12 channel slots. A total of 128 channels can be configured. Redundant power supplies, control logic, and T1 modems are available as options. With the new Series II, users can also configure a redundant trunk that automatically switches in should the primary fail.

The packaging technique for handling the DCE interfaces is somewhat dated and inconvenient. All cards are delivered with the I/O interfaces permanently mounted in rear of each card, which must be screw-attached to the backplane. More modern packaging permanently mounts the I/O interface on the backplane for ease of cable changes and card removal. The DCA T1 Mux currently supports a single composite link (trunk) that runs at 50 bps to 1.544M bps or 2.048M bps.

The Series II message frame meets the bit density required by the extended frame format specifications employed by ACCUNET T1.5 service. The Series II also supports drop-and-insert applications (see Strengths), and can be configured with a redundant T1 trunk that automatically switches in should the primary fail. Trunk speeds are 50 bps to 1.544M bps or 2.048M bps.

☐ DCA Netlink Multiplexers

The Netlink multiplexers are available in 2 versions, Series I and Series II. Both offer the same primary T1 multiplexer services including the same number of channels (128 data and voice), bit-interleaved multiplexing over a point-to-point link, dynamic bandwidth contention for voice and/or data, terminal-controlled system configuration and control, optional redundant control logic and power supplies, and an optional internal T1 modem. The Series II, however, offers more powerful and flexible features such as drop-and-insert, D4 framing compatibility, time-of-day reconfiguration, optional redundant T1 modems and trunk support with automatic switchover, high-speed EIA control signal passing, and asymmetric channel operation. The Series II also has an alarm port for output of major and minor alarm conditions. The D4 framing meets the extended frame format scheme mandatory after **January 1, 1985** for interfacing with AT&T's ACCUNET T1.5 service.

Both the Series I and II models employ an ASCII supervisor terminal to configure and control the multiplexer. (No DIP switches or jumper cables are involved, as far as the user is concerned.) All operations are handled by menu-driven prompts in simple English. The supervisory port can be accessed locally through a direct connection or remotely through a modem to prevent unauthorized access, supervisor access is guarded by up to 3 levels of user-defined passwords.

Each channel can be configured according to speed, EIA control, class and channel enable (see Channels for explanation of these parameters). The user can also display each channel's configuration. The global configuration—that is, those parameters that affect the composite link (trunk) operation and determine the system frame structure—are also established from the terminal. Such parameters as line transmit/receive speed, supervisor link speed, maximum allowable active contending channels, bypass channel number, sync character size, and installed system channels are entered through the terminal.

The supervisory terminal is also used for initiating system tests/diagnostics, and for displaying global statistics. Tests include local/remote channel loopback, local/remote line

DCA Netlink
Series I & II T1 Multiplexer

loopback, local/remote test message (e.g., fox message), and channel reset. The latter is used to initialize individual channel bit buffers. While all of these tests are software initiated, the local/remote line loopback also tests the driver module. In many cases, a hardware loopback is needed to test that component. DCA also allows a remote terminal to perform supervisory functions. However, diagnostics **cannot** be initiated.

The statistics gathered and displayed provide a supervisor message count and out-of-sync count. Individual channel EIA interface signal states can be displayed, and the monitor provides an alarm indication of trunk failure or other alarm conditions.

When not being employed for monitoring or control, the supervisory terminal can be used for exchanging messages with another supervisor terminal. The supervisory port is full-duplex, asynchronous, and handles any data rate from 50 bps to 19.2K bps. The standard interface is an RS-232C, and it recognizes XON/XOFF controls. The optional RS-423 interface supports TxD and RxD.

The multiplexer can also store up to 10 preprogrammed configurations. Each is called directly from the terminal. Automatic reconfiguration based on time-of-day can be done on the Series II.

Netlink Series I & II Central Control

NLS 1-3 Series I Basic System • basic card frame with control logic, power supply, composite link module, and RS-232C composite link (trunk) interface • contains 3 I/O channel slots:

$160/$140 mo	$3,995 prch	$52 maint

NLS 1-8 Series I Basic System • same as NLS 1-3, except contains 8 I/O channel slots:

200/175	5,195	65

NET 1-12 Series I Basic System • same as NLS 1-3, except contains 12 I/O channel slots:

240/210	5,995	78

NLS 2-3 Series II Basic System • basic card frame with control logic handling D4 framing, drop-and-insert asymmetric channel operation, time-of-day reconfiguration; power supply, alarm port, X.22 support, and RS-232C composite link (trunk) interface • contains 3 I/O channel slots:

212/185	5,295	69

NLS 2-8 Series II Basic System • same as NLS 2-3, except it contains 8 I/O channel slots:

260/227	6,495	85

NET 2-12 Series II Basic System • same as NLS 2-3, except contains 12 I/O channel slots:

292/255	7,295	95

Netlink Series I & II Expansion Modules

EN3 Expansion Enclosure • tabletop enclosure with 3 I/O channel slots • includes power supply but no composite link module or interface • expands basic Series I/II chassis to accommodate additional channels to 128 channel maximum:

$84/$74 mo	$2,100 prch	$20 maint

EN8 Expansion Enclosure • tabletop enclosure with 8 I/O channel slots • includes power supply but no composite link module or interface • expands basic Series I/II chassis to accommodate additional channels to 128 channel maximum:

130/114	3,250	28

NETEN12 Enclosure • tabletop enclosure with 12 I/O channel slots • includes power supply but no composite link module or interface • expands basic Series I/II chassis to accommodate additional channels to 128 channel maximum:

NA/NA	4,095	NA

☐ Central Logic Spares

NLSLM-1 Control Logic, Series I • spare common logic module multiplexes/demultiplexes; monitors and initiates system tests; monitor system alarms; stores system configurations in RAM; downline loads configurations to remote unit; gathers system statistics, etc • 50 bps to 1.544M bps or 2.048M bps • occupies single card slot:

$76/$66 mo	$1,995 prch	$26 maint

NETLM-3 Control Logic, Series II • spare common logic module • same features as NLSLM-1, except supports D4 framing, drop-and-insert, time-of-day reconfiguration, T1 modem and trunk line redundancy, asymmetric channel operation, etc (see NLS 2-3) • 50 bps to 1.544M bps or 2048M bps • occupies single card slot:

132/115	3,295	43

Series I & II Redundancy

NET RL-3 Redundant Logic Switching Module, Series I or II • provides redundant control logic for Series I NLSLM-1 or Series II NETLM-3 • automatic switchover • used with 12 I/O channel units:

$76/$66 mo	$1,895 prch	$25 maint

NETRS-3 Redundant Logic Switching Module & Modem, Series I or II • same as NETRL-3, except includes a T1 link modem:

100/87	2,495	33

NETRD-3 Redundant Logic Switching Module & Dual Modems, Series I or II • same as NETRS-3, except includes a redundant T1 link modem with automatic switchover:

144/126	3,595	47

NLSRL-1 Redundant Logic Switching Module, Series I or II • same as NETRL-3, except used with 3 and 8 I/O channel units:

76/66	1,895	25

NLSRS-1 Redundant Logic Switching Module & Modem, Series I or II • same as NETRS-3, except used with 3 and 8 I/O channel units:

100/87	2,495	33

NLSRD-1 Redundant Logic Switching Module & Dual Modems, Series I or II • same as NETRD-3, except used with 3 and 8 I/O channel units:

144/126	3,595	47

NETRPS Redundant Power Supply • redundant power supply provides the AC and DC voltages needed to power a 12 I/O channel slot unit • automatically switches over should primary fail:

40/35	995	13

Series I & II Interface Options

NETIM-V35 • CCITT V.35 electrical and physical trunk or channel interface:

NA/NA mo	$50 prch	NC maint

NETIM-232 • RS-232C electrical and physical trunk or channel interface:

NA/NA	50	NC

NETIM-422 • RS-422 electrical and physical trunk or channel interface:

NA/NA	50	NC

NETIM-423 • RS-423 electrical and physical trunk or channel interface:

NA/NA	50	NC

NETIM-449 • RS-449 electrical and physical trunk or channel interface:

NA/NA	50	NC

MO: monthly charge for 1-/3-year lease including maintenance. PRCH: purchase price for single quantity units. MAINT: monthly maintenance charge for onsite service; lesser cost remote maintenance available (see Support). NC: no charge. NA: not available. Prices are current as of December 1984.

DCA Netlink
Series I & II T1 Multiplexer

Netlink Series I & II Channels

DCA channel cards accommodate synchronous data and voice inputs. Up to 128 channels can be accommodated. An asynchronous data channel card is currently not available. To handle asynchronous data, the vendor recommends the use of a TDM or statistical multiplexer which produces a single synchronous connection to a T1 multiplexer channel, or asynchronous data can be input to a synchronous data channel provided the sampling rate is 4 times the channel clock rate.

Synchronous data channel cards contain 4 channels each, and handle data rates of 50 bps to the trunk speed. The channel interfaces are RS-232C, RS-422, RS-423, and CCITT V.35. All channel cards are shipped with the interface connectors mounted, and must be screw-attached to the backplane.

Voice channel cards each contain 4 channels and handle digitized voice at scan rates producing 9.6K, 16K-, 32K-, or 64K-bps output. Voice encoding is accomplished via Continuously Variable Slope Delta (CVSD) technique. The voice channel employs 4-wire E&M signaling.

All channels are configured from the supervisory terminal. The user can establish the channel speed, EIA control signals, channel class, and channel enable. The channel class consists of normal operation or bandwidth contention. With the former, the channel is allocated a fixed portion of the aggregate bandwidth. With the latter, 2 or more channels can contend for bandwidth. Channels contend by raising the RTS (Request-To-Send) control signal; the multiplexer enables the channel by issuing a CTS (Clear-To-Send). Channels which cannot be serviced due to lack of bandwidth, gain access as time slots become available. Access is granted based on the terminal's speed.

Class enable determines whether a channel is or is not multiplexed. When not, channel output is placed on the trunk without framing and thus it carries no supervisory overhead information. This facility, called bypassing, is intended for transferring large amounts of data (such as found with CPU-to-CPU file transfers, database updates, etc) where the application needs as much bandwidth as possible.

NETDM-X Quad Data Module • provides 4 synchronous data channels • half-/full-duplex modes • data rates of 50 bps to trunk speed • 64-bit elastic buffer per channel • TxD, RxD, RxC, TxC, RTS, CTS, DSR, DTR, CD, RI, BO control signals with RS-422, RS-423, and V.35 interfaces • channel can be configured to interface with DCE equipment • RS-232C interface is standard:

NA/NA mo	$1,595 prch	$21 maint

NETDM-3 Quad Data Module, Asymmetric • same as NETDM-X, except provides independent transmit and receive clocks to allow different data rates • offered with Series II Netlink only:

NA/NA	2,195	30

NETVM-3 Voice Channel Module • provides 4 voice channels • employs CVSD encoding to produce 9.6K-, 16K-, 32K-, or 64K-bps output • 4-wire 600 ohm interface; -24 dBm to +22 dBm I/O adjustable in 2 dBm increments • Type I or V E&M lead:

NA/NA	2,195	NA

Netlink Series I & II Composite Link

The Netlink supports a single composite link (trunk) established through the control logic module. A redundant composite link which automatically switches over is optional on the Series II. Users can select any synchronous speed from 50 bps to 1.544M bps or 2048M bps. Available interfaces include RS-232C, RS-422, RS-423, CCITT V.35, DS-1, and G.703. The latter is employed on international models of Netlink. Series II message frame confroms to the D4 extended frame format required for attachment to AT&T Communication ACCUNET T1.5 service. Prices for the RS and CCITT interfaces are contained under central control—common components. No price is available for the G.703.

DS-1 Interface • interface for connection to ACCUNET T1.5 service:

NA/NA mo	$50 prch	NC maint

• END

DCA Network Processors
Systems 335, 355 & 375

■ PROFILE

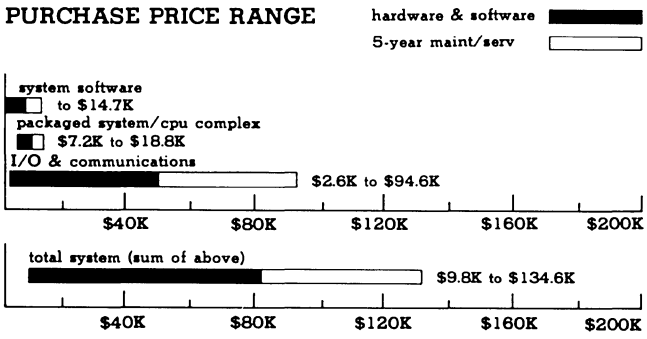
Function • bus-centered, firmware-based processors provide master switching, communication control/management, and point-to-point, multipoint, and multilink statistical multiplexing in medium-to-large-scale dedicated networks • support interactive-, batch-, and block-mode applications • control routing, host-selection, and port contention • can operate as master network processors controlling complete network • 355 can operate as front-end processor for DECsystem 10.

Associated Systems/Networks • DCA Series 100 and 200 multiplexers, INA/X.25 PAD, and 325 NetSwitch • use bit-serial interfaces for compatibility with any host; optional protocol conversion module allows terminal user to access any host on network; uses first-come-first-serve contention scheme • DCA INA (Integrated Network Architecture) • gateway through X.25 interface to public packet-switched networks (Uninet, Telenet, Tymnet, and Datapac); thus to host computers supporting X.25 protocol.

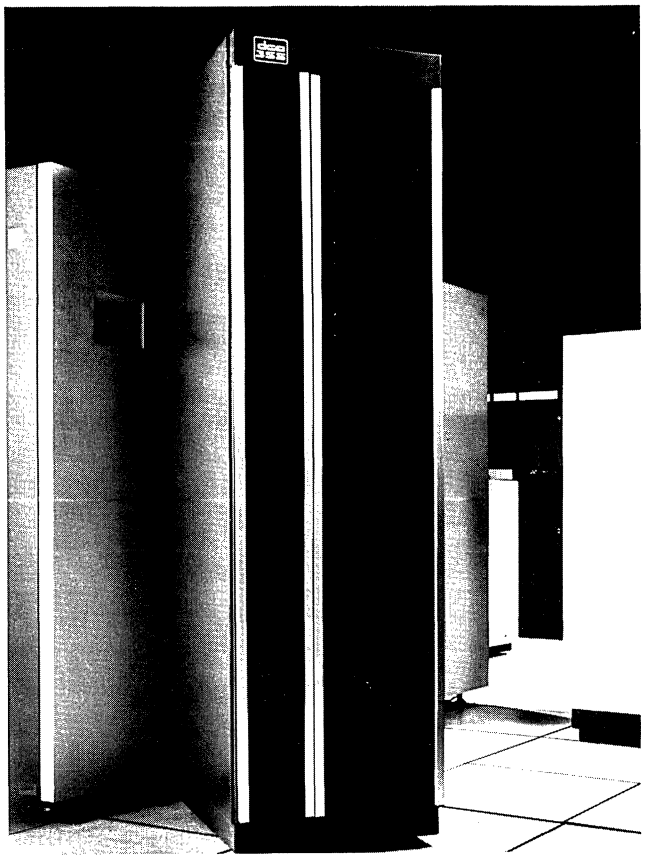
Communications • support up to 4/2 (335), 44/22 (355), or 114/57 (375) synchronous trunk lines at 9600-/19.2K-bps data rate per trunk • supports interactive asynchronous terminals/devices at data rates from 50 to 9600 bps over 42 (335)/126 (355 and 375) ports • multipoint configurations support up to 16 terminal clusters over single line • handles 1 or 2 X.25 data streams through X.25 Level 3 gateway interface per card.

Operating System • no operating system; firmware-based system run by general-purpose processing modules (PMs) • individual programs are loaded into RAM of each PM to provide both internal/external communication/network management functions • advanced software package provides macro command language for network operator control • allows network operator to manage entire network from single location: routing, port contention, host selection, and multidrop multiplexer.

PURCHASE PRICE RANGE



DCA SYSTEM 335/355 NETWORK PROCESSOR PURCHASE PRICING • bar graphs illustrate price ranges for small to large systems • solid bars reflect software/hardware purchase prices; open bars reflect 5-year service/maintenance charges • **SMALL SYSTEM** is based on System 335 master processor, supports up to 42 ports and 4 trunks; includes 2 64K-byte processing modules (PM), bus controller module, ASTRA card file with built-in tape drive, bus control module, and modem eliminator testing system in 4-foot metal enclosure; options include 14 ports and 2 trunks • **LARGE SYSTEM** is based on System 355 master processor, supports up to 126 ports and 44 trunks; includes a basic package composed of card cage assembly with 1 64K-byte PM, bus controller module, cartridge load subsystem, and 6.5-foot rack; options added include 9 64K PMs, 70 AS modules to support 10 ports, 30 trunks, and X.25 link and fan (required for systems supporting more than 4 card-cage assemblies); software includes Network Design System, Advanced Software Package, and X.25 Interface package.



Languages/Program Development • not user-programmable; console macro facility to execute user commands • diskette program load subsystem stores program or configuration information; user-specified parameters for vendor-supplied software • Network Design System (NDS) allows user to create or to change network configurations at any time on-site.

Processor • supervisory processing module (PM) supports 64K-byte memory; additional 64K-byte PMs available for extended configurations and for X.25 support • System 335 can be upgraded to 355 by adding a few modules • System 375 is an enhanced version of System 355.

First Delivery • October 1980 (DCA System 355); 1983 (System 335); April 1984 (System 375).

Systems Delivered • about 450.

Comparable Systems • Codex 6030, 6040, and 6050 Intelligent Network Processors • Infotron's Supermux Series statistical multiplexers.

Vendor • Digital Communications Associates, Inc; 303 Technology Park, Atlanta/Norcross, GA 30092 • 404-448-1400.

Distribution • in the U.S. through DCA sales representatives; worldwide through international distributors.

DCA Network Processors
Systems 335, 355 & 375

■ ANALYSIS

DCA's first product was a front-end processor for Digital Equipment's DECsystem-10. Later, DECsystem-10 support was extended to include networking. In 1974, DCA delivered its first commercial, standalone multiplexer that could interface to multiple host processors.

Currently, DCA offers an integrated line of networking products that are collectively used to configure private Integrated Network Architecture (INA) networks. These include the System 105, 110, 120 (replaces 115), and System 125 microprocessor-based entry-level statistical multiplexers that support from 2 to 32 ports, System 205 Unibus interface statistical multiplexer that emulates up to 16 DEC DZ11s to provide up to 128 user ports; System 207 Unibus Interface Network Processor that emulates up to 16 DMF 32s to provide up to 128 user ports; System 335, 355, and 375 microprocessor-based network processors. Products that work in conjunction with the Series 300 Network Processors include the INA/ATC Asynchronous Terminal Controller, INA/BTS Binary Synchronous Communications Transport System, Network Control Concentrator (NCC), Network Design System (NDS), and Network Management System (NMS). DCA also produces the 325 NetSwitch which was primarily designed to control terminal access to multiple hosts in the education environment. In addition, DCA's INA/X.25 PAD is offered as a special version of the 110 and 120 multiplexers and includes integral CCITT X.3 PAD with X.25 Level 3 link facility.

DCA also offers Netlink, a high-speed TDM, and Series 900, a complete line of modems. Finally, DCA offers a complete line of personal computer-to-mainframe interface products, known as the IRMA family.

Of the DCA products, Systems 335, 355, and 375 are the most flexible and versatile, and central products to implement INA networks. System 335 is an entry-level system that can operate as a master network processor for small networks or as a subsidiary processor to a larger System 355. Both systems can function as point-to-point, multipoint, multilink, statistical multiplexers; master switch/nodal processors; front-end controllers for terminal access to multiple hosts and gateways to X.25 networks. The systems provide network management and control. Features include routing, port contention, host selection and multiplexing. Both systems also include a console port for operator network control; a printer port can provide network status reports for network analysis.

The larger System 355 supports up to 44 trunk lines and 126 ports. Transmission speed of trunk lines is 19.2K bps. Transmission speeds for lines connected to ports can be up to 9600 bps. Aggregate throughput is up to 400K bps per system. The System 335 is limited to 4 (9600 bps) or 2 (19.2K bps) trunks and 42 ports.

The System 375 is an enhanced version of the 355. It uses the same backplane and supports the same number of I/O slots (64). It can implement the same number of I/O ports, but it can support up to 114 trunks. Trunk speed is also increased to 56K/72K bps.

DCA uses the Digital Data Communication Message Protocol (DDCMP) for data transmission over its trunk lines. DCA has found DDCMP to be an efficient and flexible protocol. Generally, users of DCA networks are most impressed with response time rather than overall throughput.

DCA also offers an X.25 Level 3 gateway to networks for communication between a packet-mode host that supports X.25 protocols and a packet-switched public data network (PDN) such as Telenet or Tymnet. In addition, DCA offers INA/X.25 PAD that uses the X.25 protocol to interface to a host computer or to an X.25 packet-switched network.

The DCA System 355 can also function as a front end for the DECsystem-10, replacing the older System 250, which is now obsolete.

The DCA System 335/355/375 is implemented with multiple microprocessors that provide link and trunk control with a supervisory processing module (PM) for overall system control. Additional PMs are added for X.25 gateways and other features. PMs support 64K bytes of RAM memory loaded from cartridge tape included in each system. PMs can also be downline loaded from the diskette on another system.

The DCA is not user programmable. The user specifies network parameters and DCA supplies the diskettes loaded with the appropriate programs. The user, however, can use the Network Design System (NDS) to develop or reconfigure a system on-site.

The System 335/355/375 modular architecture allows flexible configuration and expansion; processing modules (PMs) can be added and individually programmed to suit specific communications functions. System 335/355/375 are compatible with all DCA 100 and 200 Series multiplexing/processors, and field upgrades are a matter of adding modules: Supervisory PM, card file adapter module, and bus controller module. Upgrading from a System 335 to 355 and 355 to 375 is also a simple case of adding modules.

☐ Ease of Use Features

System 335/355/375 console command and software menus provide the network manager with information for reconfiguring a module, isolating network faults, and helping terminal users in difficulty; the console printout summarizes network status for management control. System loading is automatic at power-up and built-in diagnostics are performed on hardware components. The network manager or a maintenance engineer can dial-up each processor for monitoring all operational and diagnostic information from either a customer's network management center or DCA's CDSC (Central Diagnostic Service Center) in Atlanta. The Network Design System (NDS) allows a system to be reconfigured on-site at any time.

☐ Modes of Operation

System 335/355/375 can act as a master switcher to resolve port contention from multiple terminals to multiple hosts for cable-connected, dial-up, and leased-line ports. It can be configured to support point-to-point statistical multiplexing where a host computer supports multiple devices over a single telephone line. It provides a multipoint statistical multiplexing environment that supports up to 16 clusters of remote terminals (or 16 drops) from a single line; in this case, the system polls the buffers in the slave multiplexer (a DCA 105 or 120) to permit sequential transfer of data over a single telephone line. It can support a full-function multinode data communication environment that requires extensive network management capabilities. Using INA architecture, it can create subnetworks to select and control terminal access to host facilities (subnetting), and provide routing, switching, trunk handling and port contention. In addition to the Series 100-based clusters, the System 335/355/375 can also support an INA-/X.25-based cluster of 32 devices. The systems also support the 325 NetSwitch, which itself can handle port contention for up to 1376 local or remote terminals. DCA has added a DECsystem-10 interface option to allow it to perform as a front-end processor for a DECsystem-10.

☐ Strengths

The DCA System 335, 355, and 375 are flexible network processor systems that provide a wide range of facilities. Systems can range from a small network processor handling port contention for a small number of terminals to 1 or more hosts to a large system connected to 114 or more trunk lines and 126 communication ports. A system is easily expanded with plug-in modules. Also, DCA Systems 105 and 120 can be upgraded to the large DCA System 355 when its facilities are needed.

The DCA Systems provide the advantages of statistical multiplexers in general: reduction in number of lines needed, better utilization of available bandwidth, and faster response times. The DCA Systems can interface to X.25 public packet-switched networks and connect to all hosts that support X.25 networks. The DCA INA network is largely transparent to the user.

☐ Limitations

DCA offers no software to interface to any operating system of mainframe computers. The software handles only the data communication environment.

DCA Network Processors
Systems 335, 355 & 375

■ SOFTWARE

☐ Terms & Support

Terms • software/firmware available for a nominal one-time license fee or by leasing at a fixed monthly rate • leasing includes updates and telephone service.

Support • software/firmware support service is available primarily through telephone diagnostic service; includes all software updates.

☐ Operating System

System 335, 355, and 375 are firmware-based systems run by general-purpose processing modules (PMs) to provide both external and internal system controls and communication functions. Each PM includes a 64K-byte RAM that is loaded with a particular operational program. Supervisory PMs provide external communication interface/controls while other PMs such as port modules, card-file adapter modules, and bus controller modules provide internode trunk functions and/or protocol conversion. At power-up, each PM module performs a self-check before loading a program from the bus controller module (CK) EPROM. Once the information is written in the PM RAM memory, the PM executes system diagnostics. Finally, configuration information is distributed to all PMs and the system begins normal operations. Program initiation requires 3 to 5 minutes, depending on system size.

Each PM contains a kernel (operating system) which allocates microprocessor time and storage, operates the real-time clock, and performs other utility functions; it controls physical pathways for interaction between handlers that surround the kernel. The kernel is surrounded with handlers that perform major communication functions; each handler performs 1 function. Handlers are provided to act as node supervisor, trunk line driver, TT-protocol network-port driver, node host, console handler, and program load subsystem handler. When one handler cannot provide the throughput required, a second copy of the handler is placed in another PM and the job divided between the 2 handlers.

The node supervisor is a special handler to mediate the interactions between all other handlers in system; it loads node with program and configuration information at startup; resolves deadlocks; creates switched virtual circuits during normal operations.

The trunk line driver controls internode trunks; it drives 1 or 2 trunk links in point-to-point or multipoint configuration and implements error control on trunks using industry-standard DDCMP (Digital Data Communication Message Protocol). It participates in indirect routing to host (character routing actually depends on configuration programming) by building a 32-bit transaction which consists of character, CBUS (internal bus) destination address, and some overhead information. The trunk line driver sends PIR (program interrupt request) out to ABUS, which in turn sends PIR to CBUS via adapter module, which turns PIR over to bus controller for final destination to designated AS port module for transmission.

The TT-protocol network-port driver controls ASTRA-AS port modules; it connects local host/terminal ports to System 335/355/375 bus (CBUS). The node host handler interfaces to network ports to create switched virtual circuits and implements host/destination selection.

The console and log-port (CL) handler gathers statistics and provides facilities so the operator can alter port configuration and copy program files using Program-Load Subsystem. The program load subsystem handler drives diskette program load device in response to commands from the node supervisor and console handler.

The Network Design System (NDS) is an optional facility that allows the user to reconfigure a dynamic network on-site.

S35-NC Initial System Configuration • applies only to customers doing self-installation:

NA mo	$995 lcns	NA serv

S35-CNC Preparation • to alter an existing configuration:

NA	600	NA

S35-ADV Version 3.00 Advanced Software Package • software release providing system enhancements with such features as a console macro facility that allows network operator to associate complex software commands with simple operator-defined words; downline file loading that permits network operator to copy tape file from tape drive on one node to tape drive on any other system node; log port that provides optional data stream of system messages and repeated statistical reports; per-port testing that allows operator to selectively loopback and test individual ports both on System 335/355/375 and on its slaves; loading speedup that cuts program loading time by 50%; supervisory processing module relocation allows expanded system configuration with more card files; European data format; and series of network management and status query commands • requires 64K-byte processing module:

55	1,500	20

S30-ADVX Additional Licenses • per copy price:

35	150	20

Network Design System (NDS) • implemented as 3 code modules residing on the tape cartridge and run as part of the online System 335/355/375; gives user complete control of his configurations and more flexibility in operation of a dynamic network:

237	4,995	42

S35-NDSV Network Design System for VAX • same as S35-NDS except supplied on 9-track, 1600-bpi magnetic tape:

237	4,995	42

S35-NDSVA Additional NSD • for customers who have already purchased S35-NDS; same as S35-NDSV:

35	150	42

☐ Program Development/Languages

The system does not support user programming. The user specifies configuration requirements and DCA supplies program modules on diskette. The mass storage device accommodates 2 diskettes with total of 720K bytes for stored-program/configuration information; the microprocessor within the program-load subsystem interacts with 64K-byte Supervisory PM to transfer information into the system.

☐ Communications/Networks

All communication is under control of handlers in a processing module (PM). The trunk line driver controls the traffic over the inter-node trunks. The TT-protocol network-port driver controls traffic to/from local/remote terminals connected to the system. The node host handler controls access to the host processors.

Optional modules can be added to interface to X.25 public data networks.

☐ Other Facilities

X.25 Gateway Interface • allows INA private networks to interface to public packet-switched networks • INA network can communicate with host computer supporting X.25 standard; interconnects through point-to-point, synchronous, full-duplex link • supports all 3 levels of X.25 standard • provides X.3 Packet Assembler/Disassembler (PAD), which allows asynchronous terminals to access X.25 link • also allows System 335/355 to act as PAD that "packetizes" terminal data and transmits it to public-switched network hosts.

S30-X25 Initial Software License Agreement for X.25 Gateway • interfaces to run any number of X.25 links in a single System 335/355 node • supports Autonet, Telenet, Tymnet, Uninet, Datapac (Canada), PSS (United Kingdom), and Transpac (France);

MO: monthly license charge; includes telephone service. LCNS: license fee. SERV: monthly telephone service charge. NA: not applicable. Prices current as of November 1984.

DCA Network Processors
Systems 335, 355 & 375

requires standard 64K-byte PM:

$180 mo	$4,495 lcns	NA serv

S30-A25 Additional X.25 Gateway Interface • same as above but for additional systems in a network running any number of X.25 protocol links:

20	495	NA

■ HARDWARE

☐ Terms & Support

Terms • available under monthly lease under 1- to 5-year plans for a minimum noncancellable 12-month period • leasing plan provides conversion-to-purchase option with 50% credit of monthly lease paid up to date of purchase • purchase price includes a variety of discount plans; shipping charges are in addition to equipment costs; a 30-day payment is required for discount allowances.

Support • maintenance is unbundled (lease prices quoted in this report include monthly maintenance cost); maintenance coverage is offered within 50 miles of nearest DCA field service office; there are additional graduated charges per month for maintenance beyond the 50-mile area • the installation charge for System 335/355 is $500 per unit, and $200 per Processor Module, $100 per Expansion Card File, $600 reconfiguration per node (S35-CNC), $100 for Floppy Switch; all other installation charges are $75 per hour, 4-hour minimum • DCA offers 3 types of maintenance plans • Demand Service is for customers with no DCA contract or for service outside contract hours; service is provided by DCA employees or third party; the charge is $75 per hour plus expenses and material for portal-to-portal, Monday through Friday during 9:00 AM through 5:30 PM business hours; $100 per hour plus expenses and material for service performed outside business day/hours and holidays • the Central Diagnostic Service Center (CDSC) maintenance contract is available for a monthly service charge; it provides unlimited network troubleshooting/consultation service from DCA's Atlanta test center during business days/hours as well as unlimited factory repair (not including shipping costs); Network troubleshooting/consultation from DCA Atlanta center is accomplished through the operator console; telephone charges incurred by DCA will not be billed to customer: DCA recommends that CDSC contract customers purchase spare modules for their equipment to facilitate speedy repair of malfunctioning equipment • the On-Call (OC) maintenance contract also requires a single monthly fee and provides troubleshooting/consultation from CDSC in Atlanta during business hours; on-site repair at module level is done by DCA-approved third party; customer must pay shipping charges for modules repaired at DCA plant • 7-day, 24-hour service is available on individual basis • training for potential System operators is optional; formal classroom instruction can be arranged at either DCA facilities or at the customer site.

☐ System Overview

DCA System 3X5 Network Processor

The DCA System 335 performs nearly all the functions of the larger DCA System 355; the difference between the 2 models is essentially in amount of data traffic and trunk links each can support. The DCA 335 supports 42 ports and 4 trunks; the DCA 355 supports 126 ports and up to 44 trunk lines. The 375 is an enhanced version of the 355. It supports the NCF-HP high power card file assembly, which extends trunk capacity to 114. Also, trunk speed is increased to 56K/76K bps. Trunk speed on 335 is limited to 19.2K bps.

A standard System 335/355/375 contains 1 or more rackmountable card file assemblies (9 slots) with integral power supply and motherboard, 1 or more 64K-byte processing modules (PMs), 1 bus controller module, and 1 rackmountable diskette program loading subsystem. Depending on configuration expansion and requirements, card file adapter module(s), dual-port serializer module(s), and system bus (CBUS) cable assembly can be optionally added. Users have a choice of either a 4-foot or 6.5-foot freestanding rack enclosure. The motherboard of the card file contains port connectors, module connectors, and inter-card file cable connectors; it provides a functional card-file bus (ABUS) to allow modules to communicate down the card file to the card file adapter. Communication between card files is by a functional system bus (CBUS); and interfacing to each card file's bus (ABUS) is accomplished with a card file adapter module, which transfers data between buses. The first (lowest) card file contains the bus controller module, which combines functions of the CBUS controller and a card file adapter; it controls up to 3 (335)/8 (355) card files. The Program Load Subsystem is placed below the first card file.

A maximum System 335 unit contains 3 card files (daisy-chained) that provide a total of 24 slots for communication modules; the slots can support either user equipment (2 ports per slot) or multiplexed trunk lines (1 or 2 per slot), providing a maximum 42-port configuration that supports 4 trunks.

A maximum System 355 or 375 unit contains 8 card files (daisy-chained) that provide a total of 64 slots for communication modules; the slots can support either user equipment (2 ports per slot) or multiplexed trunk lines (1 or 2 per slot), providing a maximum 128-port configuration that supports up to 44 (355) or 114 (375) trunk lines.

The maximum System 375 unit can support up to 114 trunks operating at 9600 bps. Maximum data rate is 56K/72K bps. The number of trunks supported decreases as the data rate increases. The system supports up to 57 trunks at 19.2K bps and up to 28 trunks at 56K/72K bps. Port capacity is 126, the same as for the 355.

A basic master network System 335 processor package (335-201) includes 2 64K-byte processing modules (3PM-335), the 300-1FDB single-drive diskette card file, a 3CK-001 bus control module, and the ASTRA-MEEP modem eliminator and echo plug • the 3PM-335 processing modules are designed for 335 model only; the System 355 cannot use 3PM-335 modules, but System 335 can use the same modules as the System 355 (3PM-003); DCA provides a trade-in policy for upgrades as follows: 1 year or less, 80% of list price; up to 2 years, 60% of list price; from 2 to 4 years, 30% of list price • package includes 1 basic network configuration and license for basic operating system.

335-201 Master Network Processor • with 64K-byte PM but no enclosure:

$272/$238/$170 mo	$6,795 prch	$476/$1,070 maint

335-200 Master Network Processor • with 64K-byte PM and 3-foot metal enclosure:

288/252/180	7,195	504/1,133

A basic master network System 355 processor package (355-111) includes a 3PM-003 64K-byte PM, a bus controller module (3CK-001), 1 NCF-60 card file assembly, a diskette program loading subsystem with cable (3PL-058) and ASTRA-MEEP modem eliminator and echo plug; it includes license for basic operating software (S35-NC) • the package includes no cabinet, port modules, adapter modules, or port cables.

355-111 Master Network Processor • basic system:

400/350/250	9,995	700/1,500

355-112 Master Network Processor • includes 355-111 plus freestanding rack enclosure 4 feet high with fan assembly:

440/385/275	10,995	770/1,500

355-113 Master Network Processor • includes 355-111 plus freestanding rack enclosure 6.5 feet high with fan assembly:

452/395/282	11,295	791/1,500

MO: first figure is monthly charge for lease under 1-year plan; second figure is monthly lease charge under 2-year plan; third figure is for 5-year plan; lease cost quoted includes calculated monthly service. PRCH: single-unit purchase price. MAINT: annual service charge: first figure is for CDSC service; second figure is for OC service. NA: not applicable. Prices effective as of November 1984.

DCA Network Processors
Systems 335, 355 & 375

355-201 Master Network Processor • includes 3PM-003 64K-byte PM, 3CK-001 bus controller module, 300-2FDB dual-diskette drive card file and ASTRA-MEEP modem eliminator and echo plug; includes S35-NC basic operating software, 2 trunk line cables, but no enclosure:

400/350/250	9,995	700/1,574

355-202 Master Network Processor • includes 355-201 plus 300-SE5 freestanding rack enclosure, 4 feet high with fan assembly:

440/385/275	10,995	770/1,732

355-203 Master Network Processor • includes 355-201 plus 300-SE9 freestanding rack enclosure 6.5 feet high with fan assembly:

452/395/282	11,295	791/1,779

The basic 375 includes a 300-2FDB dual-diskette card file, NCF-200 high-powered card file that can drive 8 PMs or 16 trunks, 2 3PM-003 64K-byte PM modules, 3CK-001 bus controller module, 3AD-001 card file adapter module, and ASTRA-MEEP modem eliminator and echo plug. The system includes the S35-NC basic operating software.

375-101 Master Network Processor • basic unit with 2 trunk link cables; does not include port modules, adapter modules, port cables, or enclosure:

700/595/425	16,995	1,190/2,677

375-102 Master Network Processor • includes 375-101 plus 300-SE9 freestanding rack enclosure 6.5 feet high with fan assembly:

732/640/457	18,295	1,281/2,881

☐ CPU & Memory

Each system contains 1 or more PM processing modules (general-purpose communication processors) each supporting 64K-byte memory capacity. Each PM circuit board is a Z80A microprocessor with volatile random-access memory (RAM) and 2 ports for serial I/O. The RAM on each card is loaded with a particular operational program for 1 or more communication functions in the system. In addition, PMs contain a buffered interface to the card file ABUS; they can communicate with 2 DB25 trunk-line port connectors. Five programs share the PM's memory and processing power to allow initial user contact with system, establish virtual circuits, run diskettes, run the console, and run ASTRA-AS ports. A single PM provides an aggregate throughput of 19.2K-bps on its 2-port connection. One Supervisory 64K-byte PM is included in the base price of the system.

Memory

3PM-003 Processing Module • 64K-byte processing module; for System 335, 355, or 375; also provides the interface for connecting up to 2 trunk lines to system:

$140/$123/$88 mo	$3,500 prch	$245/$559 maint

☐ I/O Channels

The DCA 335/355 supports a console, printer, tape cartridge, and diskette drives as I/O devices. The customer supplies the console and printer. The console/printer can be any ASCII asynchronous device. DCA supplies the tape cartridge subsystem and diskette drives.

☐ Communications

The bus-centered System 335/355/375 network processor supports up to 4 (335)/44 (355)/114 (375) trunk lines that provide an aggregate transmission rate up to 400K bps per system. Both can support many half-/full-duplex asynchronous, bit-serial, character- or block-mode terminals/devices; printers, card readers, facsimile devices, plotters, line printers, or graphic terminals; DCA Series 100 and 200 Network Processors; as well as any host computer with communication interface (Amdahl, IBM, CDC, DEC, Honeywell, Hewlett-Packard, and so on) can reside on an INA network. Terminals and devices connect through 42 (335)/126 (355 or 375) ports at data rates from 50 to 9600 bps; up to 128 355 or 375 model host ports are supported. Trunk transmission data rate is up to 19.2K bps for 335 and 355, but number of trunks supported is reduced to 2 (335)/22 (355) at that data rate. Data transmission rate is up to 56K/72K bps on 375 but number of trunks is reduced as trunk speed increases: 114 at 9600 bps; 57 at 19.2K bps; and 19 at 56K/72K bps.

All systems can connect to a 2-channel Synchronous Channel Option (SCO) to allow remote synchronous terminals such as IBM 3270 or 3780 to share a single telephone line with asynchronous devices. The X.25 Gateway Interface option allows direct connection of asynchronous terminals to packet-switched computers supporting X.25 protocol and to public packet-switched networks such as Telenet, Tymnet, and Datapac. All 3 levels of X.25 are supported. In addition, the systems can be cabled into the DCA 325 NetSwitch (which supports up to 1376 local and remote multiplexed ports) for full-scale networking. The NetSwitch is primarily used in education environment, connecting many terminals to 1 or more hosts. Also, the system communicates with DCA 205 and 250 processors: the 205 statistical multiplexer interfaces remote terminals to a DEC Unibus host, such as DEC's PDP-11 and VAX-11 computers. The 250 (becoming obsolete) front ends DECsystem-10 computers. The FEP-10 interface option supercedes the 250 system; it allows the System 355 to front end DECsystem-10s.

The System 335/355/375 systems operate in 4 basic communication configurations. First, they can operate as a master switcher to provide port contention (first-come-first-serve basis) control and switching functions for local cable-connected and dial-up terminals and line printers communicating with a number of host computers; second, they support a point-to-point statistical multiplexer environment where many terminal devices are connected to a host computer over a single communication line. Data is formatted within the System 335/355/375 (bit-parallel) multiplexer, transferred over a communication line using DDMP protocol, then is demultiplexed by another multiplexer (DCA 120) at remote end. Third, in multipoint statistical multiplexing environment they can support up to 16 clusters of remote terminals (16 drops off single line). The master network processor in the system polls buffers in slave multiplexers (120s) and allows sequential transfer of data over a single communication line. Fourth, in a full-function multinode data communication environment, the System 335/355/375 assumes network management functions such as alternate routing, switching, backup, multiple trunk handling and host-computer contention resolution for up to 126 ports.

Ports connect to DCA 335/355/375 through ASTRA communication subsystems, which are used in most DCA products. The ASTRA subsystem is manufactured in its entirety by DCA. It is a general-purpose, bus-oriented, character serializer or line-adapter and includes the dual network or port module. Asynchronous ports connect through the ASTRA-AS2 port module.

Synchronous trunks connect to the system through the 3PM-003, which supports 2 9600-bps trunks or 1 19.2K-bps trunk.

System 335/355/375 systems provide interface compatibility with half-/full-duplex asynchronous, bit-serial, character-mode or block-mode terminals and host computers. They support passive interface RS-232C and 20-mA current-loop interfaces; RS-449 and active interfaces on user equipment are accommodated with an external adapter. Interface protocols include ring-asserted, DTR-asserted, or character-oriented protocols. ASCII (any parity), Correspondence-code, EBCDIC, and Baudot character sets are available for network messages and host-selection strings. Modem connections are in full- or half-duplex asynchronous, with or without reverse channel for dial-up or leased lines supporting data rates up to 19.2K bps.

ASTRA-AS2 Port Module • dual-port serializer provides gateway for local bit-serial data entering or leaving the system; converts serial input data into parallel data (required within the system) and translates parallel data into serial form for output; interfaces into system through ABUS (motherboard) • 2 ports per module; up to 8 modules per 1 file card • optionally available to suit configuration requirements • one port required for console:

$13/$11/$8 mo	$325 prch	$21/$42 maint

3AD-001 Card File Adapter Module • provides interface for

DCA Network Processors
Systems 335, 355 & 375

transferring data between the card file bus (ABUS) and System 335/355/375 internal bus (CBUS) • optionally available for system expansion requirements:

12/11/8	300	110/248

3CK-001 Bus Controller Module • combines the tasks of CBUS controller and card file adapter modules • controls up to 8 card files • occupies first (lowest) card file • basic System 335/355 package includes 1 Bus Controller Module • others are optionally available as required:

30/26/19	750	245/552

ISC-001 Synchronous Channel Option (SCO) • 2-channel, bit-interleaved, synchronous time-division multiplexer that allows synchronous terminals such as remote IBM 3270 or 3780 to share single communication line with asynchronous terminals • can be programmed to divide data streams between 2 channels (A and B); operates in full-duplex mode at up to 9600 bps • 8 LED indicators are included for troubleshooting; 2 operational status indicators; compatible with all DCA units; plugs into a standard DCA ASTRA card file slot; includes SCO-001, SCO-AD, and SCO-AGX cables:

20/18/13	500	110/280

Network Card File Assemblies

NCF-60 60-Watt Card File Assembly • includes NCF-E card cage, NPS-60 power supply subassembly, NMB-001 motherboard module, and ASTRA-IC1 CBUS cable:

$71/$62/$44 mo	$1,765 prch	$124/$278 maint

NCF-D60 60-Watt Card File Assembly • same as NCF-60 plus 3AD-001 adapter module:

83/72/52	2,065	145/325

NCF-100 100-Watt Card File Assembly • same as NCF-60 but with NPS-100 power supply subassembly instead of NPS-60:

100/87/62	2,495	175/393

NCF-D100 100-Watt Card File Assembly • same as NCF-100 plus 3AD-001 adapter module:

112/98/70	2,725	196/440

NCF-HP High Power Card File Assembly • same as NCF-60 but with CF-HP high power supply subassembly instead of NPS-60; for 375 only:

120/105/75	2,995	210/472

NCF-HP High Power Card File Assembly • same as NCF-HP plus 3AD-001 adapter module; for 375 only:

132/115/82	3,295	231/519

Diskette Drive Card File Assemblies

300-2FDB Dual-Diskette Drive Card File Assembly • includes NCF-E card cage, 3PL-2FD disk drive subassembly, NMB-001 motherboard module, and ASTRA-1C1 CBUS cable:

$198/$173/$124 mo	$4,950 prch	$347/$780 maint

300-2FDN Dual-Diskette Drive Card File Assembly With No Backplane • same as 300-2FDB without NMB-001:

150/131/94	3,750	263/591

300-1FDB Single-Diskette Drive Card File Assembly • includes NCF-E card cage, 3PL-IFD disk drive subassembly, NMB-001 motherboard module, and ASTRA-IC1 CBUS cable:

186/163/116	4,650	326/732

300-1FDN Single-Diskette Drive Card File Assembly • same as 300-1FDB except with no backplane (NMB-001 motherboard):

138/121/86	3,450	242/543

3PL-DSK Blank 5.25-inch Diskette • formatted:

4/4/3	10	NA/NA

Cables

ASTRA-ICI • 18-inch CBUS interconnect cable:

$1/$1/$1 mo	$30 prch	NA/NA maint

CT0203 • 25-foot CT trunk-link modem cable:

2/2/1	55	NA/NA

CAXXXX • 25-foot CA-series asynchronous cable:

2/1/1	40	NA/NA

• END

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

■ PROFILE

Architecture • Digital Network Architecture (DNA) announced in 1975, implemented with DECnet products including Digital Data Communications Message Protocol (DDCMP) • DECnet Phase I products limited primarily to real-time data acquisition and control applications running under RSX-11 (PDP-11) and TOPS-10 (DECsystem-10) • DECnet Phase II products provide for general interconnection of PDP-11, DECsystem-20, and VAX-11; also provides for connection to foreign networks • DECnet Phase III products add auto-answer, network management, network command terminal, multipoint line support, and adaptive routing; implemented for VAX VMS, PDP-11 RT-11, IAS, RSTS/E, RSX-11/S, RSX-11/M, RSX-11/M-PLUS, and DECsystem-20 TOPS-20 systems • DECnet Phase IV incorporates Ethernet Local Area Network (LAN) into DNA, increases number of nodes to 63,000; compatible with Phase III nodes; Phase III and Phase IV nodes can reside on same network; see Figure 1 • implemented on VAX VMS first, followed by PDP-11, RSX-11 systems, PRO 300 Professional Computer, and DECsystem-20.

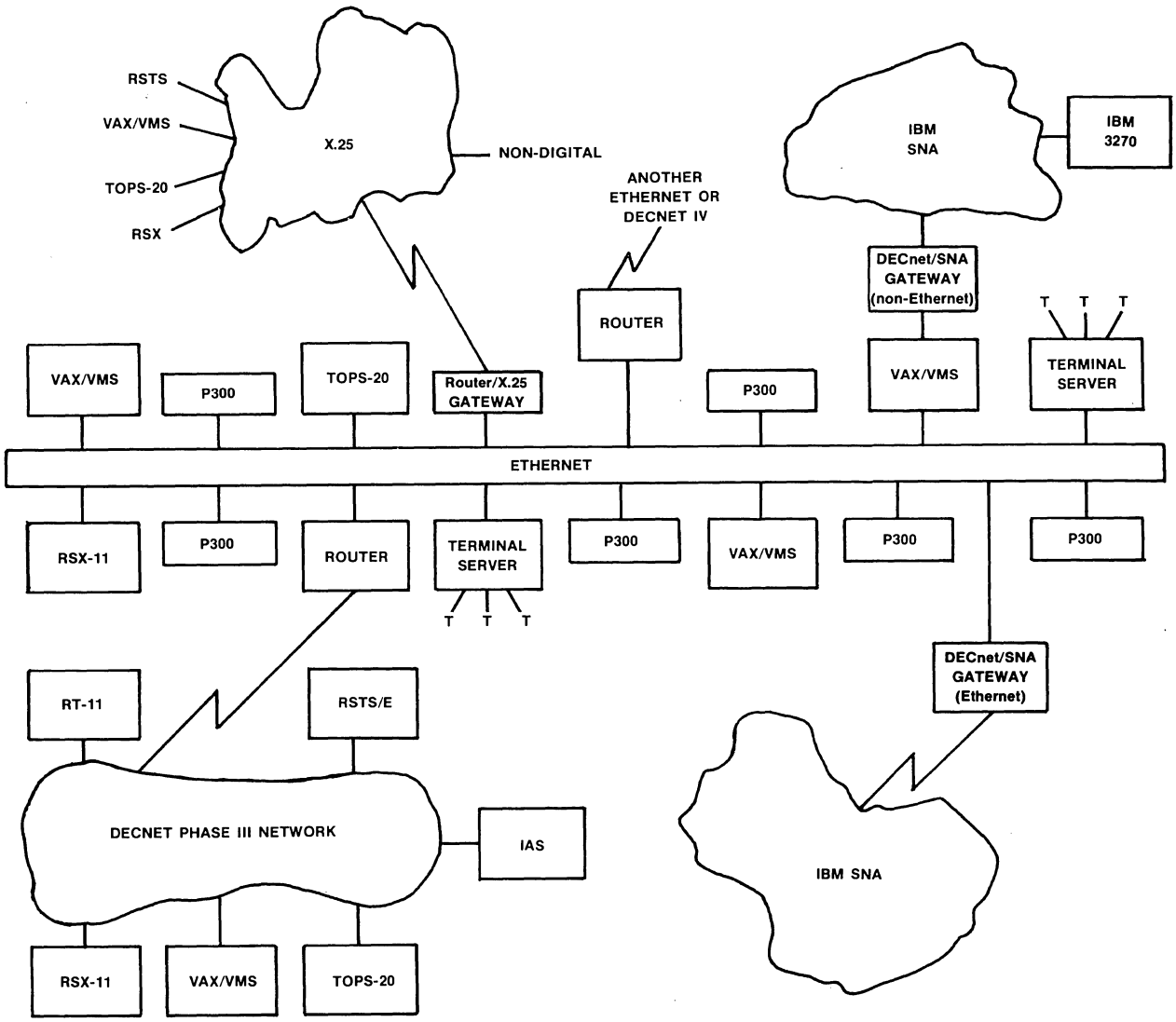


Figure 1 • multinetwork configuration incorporating Ethernet/DECnet IV products.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

Network Configuration Summary • DECnet Phase IV allows up to 63,000 nodes per network; any number can be routing nodes • path end-to-end can include up to 63 hops • DECnet Phase III allows up to 255 nodes per network; 120 can be routing nodes; the remainder must be end nodes; Phase III allows up to 31 hops where 1 hop equals a node-to-node communication • Phase II nodes can reside on Phase III network but must be located adjacent to Phase III node; Phase II nodes can route only to an adjacent node • Phase IV nodes initially implemented on VAX VMS and PDP-11 RSX-11 UNIBUS-based and Q-BUS-based systems in 1983-1984 and on PRO 300 P/OS systems in 1984; later, it will be added to DECsystem-20 TOPS-20 systems • PDP-11 RSX-11/S and RT-11 systems can function only as end nodes.

Network Management • modular and distributed; resides in the Network Management layer at each node; user-level programs and terminals can access and control DECnet network through discrete calls and commands; event logger modules reside in each network layer • OBSERVER running at RSX-11 or RSX-11M-PLUS node is network management service; monitors operational status of any DECnet node and line, collects performance data, and generates network reports.

Job/Batch Processing Management • managed by facilities of system residing at each node • user gains access to facilities through Command File Transfers, and/or Data File Transfers and Task-to-Task Communications.

Transaction Processing Management • managed by facilities of system residing at each node • user gains access to facilities through Network Command Terminal, Phase III, Network Virtual Terminal (Phase IV) Remote Resource Access, and Task-to-Task Communications.

Database Management • VAX-11 DBMS with VAX-11 DATATRIEVE for data manipulation and VAX-11 Common Data Dictionary • DBMS-11 with Data Manipulation Language (DML) for PDP-11 RSX-11/M and RSX-11/M-PLUS systems • DBMS-10/DBMS-20 for DECsystem-10/-20.

Gateways to Other Networks • PSI (Packet-Switching Network Interface) X.25 for VAX-11 and PDP-11 RSX-11 systems provide for interconnection to packet-switching networks in Canada and France for PDP-11, and in United Kingdom (PSS), France (Transpac), Germany (Datex-P), and U.S. (Telenet and Tymnet) for VAX-11 • Internet products provide interactive and batch communication with SNA through IBM hosts; IBM 2780/3780/HASP terminal emulators for RJE data exchanges; IBM 3271 protocol emulator for point-to-point and multidrop BSC communications • Sperry hosts through UN1004 Terminal Emulator • CDC hosts through MUX 200 emulator • DECnet/SNA Gateway available for VAX/VMS, micro/VAX, RSX-11M, and RSX-11M-PLUS, see Figure 2; includes Gateway, Gateway Management, 3270 Terminal Emulator, Remote Job Entry, Distributed Host Command Facility (DHCF), a DISOSS document exchange facility, 3287 Printer Emulation, and program-to-program communications • DECnet Router/X.25 Gateway links systems on Ethernet LAN to other DECnet nodes on Ethernet nets or other systems through public packet-switched network.

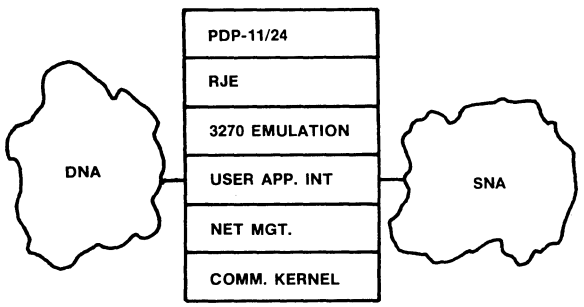


Figure 2 • DECnet/SNA Gateway network-to-network product.

Support of Foreign Terminals • Bisync Teletype Dataspeed 4541, IBM 3270 terminals, Honeywell SPD 315, memorix 1371, Lee Data 310/320, and Carterfone 6270/6274 using VAX BTS (BSC Terminal Support) software.

Security • user sets up security standards and access control rules; user implements them with Digital products • primary products are optional access control in the Session Control layer, and exchange of passwords between end-to-end facilities • other security provided by Operating systems and database management systems, especially VAX-11 DBMS Version 2.

Announced • 1975 (80 DECnet DNA); 1976 (DECnet DNA Phase I); 1978 (DECnet DNA Phase II); 1979 (DECnet DNA Phase III); 1982 (DECnet DNA Phase IV) on VAX/VMS under DECnet VAX V.3.1.

First Delivery • 1975.

Systems Delivered • over 30,000 nodes; 20,000 DECnet nodes and 10,000 Internet nodes.

Comparable Systems • IBM SNA (System Network Architecture), Honeywell DSA (Distributed System Architecture), Sperry DCA (Distributed Communications Architecture), Hewlett-Packard DSN (Distributed System Network), and other systems based on OSI (Open System Interconnection) • for limited applications, Prime Computer PrimeNet, Tandem Expand, and Data General Xodiac • most similar to Hewlett-Packard DSN in philosophy and simplicity of network access.

Vendor • Digital Equipment Corporation (DEC); 146 Main Street, Maynard, MA 01754 • 617-897-5111.

■ ANALYSIS

Digital Equipment has been at the forefront of network development since the early 1970s. Digital's minicomputers were relatively low in power in comparison to mainframes, and Digital used multiple systems to perform various aspects of many applications. The very origin of minicomputers is founded on the fact that many jobs that can be done very well by computers do not require the enormous power of mainframes.

Distributed processing grew out of the minicomputer vendor/user philosophy of providing/using the amount of processing power needed to do a job and no more (at least not much more). Minicomputers proved that processing can be dispersed, with users having computers on-site rather than centralized remotely. Distributed processing works efficiently, however, only if the on-site computers can communicate with each other for applications that span multiple sites, as well as with centralized mainframe computers.

Digital recognized early the importance of establishing a formal networking scheme to allow all of its computers to reside compatibly on networks. DECnet has been implemented on all DEC operating systems and CPUs. Phases were introduced to stage sets of new functions every 2 or 3 years. Future DECnet development will focus on VMS, RSX, MS-DOS, ULTRIX, and TOPS-20 operating systems, but Digital will continue to provide compatibility with RSTS/E, RT-11, and TOPS-10 operating systems. DNA has been implemented in DECnet Phase I, Phase II, Phase III, and Phase IV.

Digital has been on this steady, measured course for the past 9 years. The PDP-8 is no longer a DECnet product. Major emphasis is on the PDP-11 and VAX-11; most emphasis is on VAX/VMS operating system.

RSX-11/M-PLUS is an upward extension of RSX-11/M and RSX-11/S; RT-11 is a subset. The IAS operating system has a different origin; it is an extension of the older RSX-11D operating system. The RSTS/E operating system is totally different from RSX or IAS. VAX-11 has 2 operating systems, VAX/VMS and Ultrix, but only the VAX/VMS is a DECnet product, today.

DECsystem-10 and -20 are secondary DECnet products. DECnet Phase I was implemented under TOPS-10, and DECnet Phase III was implemented in 1982; DECnet Phase II was skipped for TOPS-10. DECnet Phase I, II, and III were implemented under TOPS-20, and Phase IV is planned for 1985 timeframe.

DECnet IV is also implemented on the PC300 Series of personal computers running under the P/OS operating system.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

Initial emphasis with DNA was on the interconnection of Digital computers. Digital developed DDCMP (Digital Data Communication Message Protocol) data link protocol before ISO settled on HDLC, and IBM on SDLC. DDCMP is a byte-oriented protocol, and, at the time it was developed, a byte-oriented protocol appeared to have advantages over bit-oriented protocols. Other vendors, however, went to bit-oriented data link protocols. DDCMP was an integral part of DNA until DECnet IV, which incorporates Ethernet and X.25, as well as DDCMP as DNA's 2 lowest-level protocols. Ethernet uses a packet protocol that will be used for local area networks. DDCMP and X.25 are used as global communication protocols. The X.25 gateway allows X.25 to be the dominant global protocol, while DDCMP will be used for compatibility with older networks, Phase III primarily.

DDCMP was never integral to DNA, which was designed to be data-link independent. Thus, using X.25 or Ethernet protocols does not affect the upper-level protocols in DNA. Likewise, introduction of HDLC as a replacement for DDCMP protocol would not affect the upper layers. Digital has had an ongoing Packetnet Program to develop interfaces between its computers and all publicly available packet networks. Also, the Internet program interfaces various Digital computer systems to other vendors' networks.

With the DECnet IV announcement, Digital took a major turn in its evolution of DNA. Not only did Digital adopt Ethernet as its LAN, but Digital also used it to centralize many support modules into dedicated systems.

Digital will centralize communication functions into servers on Ethernet: terminal servers, DECnet/SNA Gateway, DECnet/X.25 gateway, and Router to interconnect DECnet IV and DECnet III networks. This centralization of communications support in servers reduces the communications processing load on hosts, making more system resources available for applications processing. This was certainly a step in the right direction for Digital. Once a system can interface to Ethernet, it can use the server modules to extend its participation in networking locally and globally.

The older system products that interconnect with IBM SNA networks through 2780/3780, HASP, and 3270 in SNA as well as BSC, can still perform system-to-IBM host communication. The PSI X.25 interface products can also continue to run as system-to-network products.

DECnet Phase III offers Task-to-Task Communication, File Transfers, Remote Resource Access, Network Command Terminals, and Network Management, and supports point-to-point and multipoint links. DECnet Phase IV includes all the features of Phase III, adds virtual terminal support, increases number of nodes to 63,000, finally commits Digital to Ethernet as its Local Area Network (LAN), and incorporates Ethernet into DNA. Many Ethernet products are now available; subsequent products are planned for delivery at intervals up through 1985.

☐ Modes of Operation

DNA networks are highly distributed with each node operating as an independent system, related to other systems only through the network functions/interfaces provided by the DECnet software. DNA networks can range from 2 to 63,000 nodes. Almost any node implemented by a PDP-11 or VAX-11 computer can communicate with an IBM host through terminal emulation facilities. DECnet VAX 3.1 and later versions support the DECnet/SNA Gateway for interconnection of the 2 networks. File Transfer facility allows any system to operate as an RJE terminal to any system as long as file structures are consistent.

When all the Ethernet servers are implemented (SNA and X.25 gateways, routers, and terminal servers), all of Digital's computers that can interface to Ethernet and support DECnet IV can use them.

☐ Ease-of-Use Features

Digital Command Language (DCL) is the same across all product lines, thus users need to learn only 1 language.

With the Network Command Terminal facility software, a local user can log onto a remote system running under the same operating system as the user, and access the remote system's resources as if the user's terminal was locally attached.

DECnet IV extends the Command Terminal facilities of DECnet III into a virtual terminal, which will allow any remote terminal on any DECnet IV system to operate as a local terminal to any other DECnet IV system on a DNA network.

Digital also offers the ALL-IN-1 menu for use in all application environments. In addition, its VAX Information Architecture provides facilities to simplify development of large, complex, interactive database applications.

☐ Strengths

Digital has consistently followed the policy of gradually improving and expanding its product lines. Digital learned early to limit the number of systems that will implement DNA fully to delimit software development efforts. Digital has selected the PDP-11 RSX-11/M and VAX-11 VMS as the highest-priority systems, and the primary DNA products for full implementation.

PRO 300 is perhaps next in priority, followed by RT-11, PDP-11 IAS, and RSTS/E systems, DECsystem-20 TOPS-20, and finally the DECsystem-10 TOPS-10. The PDP-8 can operate as a terminal to a PDP-11 RSX DECnet product. DECnet IV further delimits the software development effort by putting gateway software in 1 system and by placing various functions in dedicated "server" systems.

DNA is a truly layered architecture, so changes can be made to improve any layer without affecting other layers. As standards are developed, Digital can adopt them without undue trauma. The whole networking field is in a state of rapid development. In this environment, developing a flexible network architecture is the only sensible route to follow.

Digital's emphasis on PDP-11 and VAX-11 for DECnet product development makes sense; they are the most popular minicomputer and superminicomputer systems on the market today. Digital adopted Ethernet as its local area network (LAN) and is now delivering Ethernet products.

DNA facilities are simple and easy to use in comparison with IBM SNA. The Network Command Terminal and its extension to the Virtual Terminal make remote resources as easy to use as local resources. Digital offers functional facilities rather than individual software modules for particular applications.

Digital is committed to implementing OSI products once it is adopted as an international standard.

☐ Limitations

Digital Data Communications Message Protocol (DDCMP) is used only by Digital to connect its computers together. In DECnet IV, DDCMP becomes only 1 of the 3 data link protocols supported. With its vigorous support of X.25, Digital continues to move toward the rest of the industry.

■ ARCHITECTURE SUMMARY

Digital developed DNA to connect all of its computer systems together in a distributed processing environment. DNA was developed at the same time as IBM's SNA, which was designed for host-controlled network environments. DNA networks require at least 2 PDP-11, RSX-11, or VAX-11 systems.

DNA and DECnet are not synonomous. DNA is the architecture; DECnet is the name for the set of products designed to implement DNA. DECnet DNA products are divided into Phase I, II, III, and IV categories. Different DECnet products implement different aspects of DNA. Not only do DECnet DNA Phase I, II, III, and IV products differ from each other, but DECnet products within a phase also differ. For example, all DECnet Phase III products do not implement all Phase III features. Each phase has been designed to offer increased capability while providing backward compatibility to the preceding phase.

DECnet Phase I products were primarily limited to real-time data acquisition and control. They provided Program-to-Program Communications and File Transfer between separate PDP-11 computer systems running under RSX-11M.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

DECnet Phase II extended facilities to include Remote File Access between all of Digital's major operating systems and processors supported network management and provided for point-to-point communications.

Phase II networks can perform only adjacent node (1 hop) routing, thus a Phase II node that needs to communicate with a node that is 2 hops away on a communications link will require a second line.

Phase II networks were limited to about 10 nodes.

DECnet Phase III added Network Command Terminals for homogeneous systems Down-Line Loading, and Record Access to network facilities. It supports Adaptive Routing, adds multipoint links in addition to point-to-point communications, and interfaces to X.25 packet-switching networks. The number of nodes was increased to 255.

DECnet Phase IV includes all facilities of Phase III, adds support for Ethernet Local Area Networks (LANs), increases number of nodes to 63,000, via hierarchical routing, includes Virtual Terminals, provides independent support for communication servers, and implements SNA Gateway. Phase III and Phase IV nodes can reside on the same DNA network.

Phase IV DECnet includes DECnet VAX, DECnet 11M, DECnet 11M-PLUS, DECnet-11S, DECnet 20, and PRO/DECnet. Two packages support Phase IV. One is a full-function package for VAX/VMS, RSX-11M, RSX-11M-PLUS, RSX-11S, and TOPS-20. The other is an end-node package for all the same systems except TOPS-20; it is also available for the Professional 300. The end-node package is designed for Ethernet-based Phase IV networks. The end node has all the same features as the full-function node, except it cannot do routing. DECnet Phase IV was initially implemented on the VAX-11 VMS; next it was implemented on the PDP-11 RSX-11 systems; DECnet/VAX 3.1 that supports Phase IV; DECnet/RSX-11 and PRO 300 D/OS are available now. By 1985, Phase IV DECnet will be supported on DECsystem-20.

Digital will continue to support Phase III packaging for TOPS-10, RT (end node only), IAS, and RSTS/E operating systems.

Task-to-Task Communication is the basis for all program-to-program communications. This facility allows a program at one node to request execution of program/task at another node. Program development and program testing illustrate how it works. A program that will run on an RSX-11/S node can be developed on a RSX-11/M, RSX-11/M-PLUS, or IAS host system, and tested with remote data and hardware on the RSX-11/S. The program can be downline loaded on the RSX-11/S satellite. During program execution, the RSX-11/S system can checkpoint its tasks to the host system.

File Transfer facility allows the transfer of files between any 2 nodes that support the DECnet file structure, or between 2 nodes with the same file structure. Using this facility instead of Task-to-Task Communication, the program at the local node retrieves a remote file and executes the task locally. Whether the user chooses to perform the task locally or remotely depends on the amount of data that needs to be transferred. Generally, it is more efficient to execute programs on the data at the node where the data is stored.

Remote Resource Access allows computers at different nodes to share common resources such as network/resource files, line printers, video terminals, graphic plotters, and application programs. Remote Resource Access combined with File Transfer and Task-to-Task Communication facilities allows a program at one node to retrieve a file from another node and print it out locally.

Network Command Terminal is a software product that allows a terminal connected to a system supporting it at one node to gain direct logical access to a system or application program at another node. The terminal has interactive access to the remote program. The Network Command Terminal connects the terminal to the operating system on another node, making the terminal service provided by the operating system to local terminals available to the remote terminal.

In the Phase III implementation, the terminal and the applications programs must be at nodes where the computers are running under the same operating system.

Virtual Terminal extends Command Terminal facility in user application layer to allow a terminal on any DECnet IV system to operate as a local terminal on any other DECnet IV system. Facilities available through virtual terminal will include base-level services such as Command Language (CL); other services will be added, such as editing and file access; facilities will be added in a step fashion. Virtual terminal function will be added to systems with the DECnet IV implementation.

Network Management software allows users to monitor the message traffic between nodes on the network. If retransmissions are excessive between nodes, the software can logically isolate a line from the network for testing; the routing software will route traffic around the line as if it had failed. Once the problem with the line has been corrected, it can be added back into the network.

Adaptive Routing algorithm routes messages through the network according to a least-cost calculation for end-to-end transmission. A cost factor associated with the line connection between 2 nodes is used for the calculation. If a line in the least-cost route goes down, the next least-cost route is selected. The amount of traffic on a line does not affect the algorithm. Network Management software controls the adaptive routing, and the network manager must change the network parameters if a line becomes overloaded.

Router Server functions as a front end for any system that wants to off-load the routing function of DECnet IV and concentrate it in a dedicated system. For example, systems such as VAX-11 VMS can either implement routing as part of its DECnet IV software or off-load it to the router server. Other systems with no routing capacity can use the server as the router. The DECnet Router Server can handle up to 8 remote lines running DDCMP (Digital Data Communications Message Protocol) at 56K bps or 1 line at 500K bps.

Multipoint Link support allows multiple nodes to share a common communications line. The multipoint configurations always conform to a master-slave hierarchy. The master always controls the access to the common line by continually polling the slaves in sequence. When a slave has data to transmit, it can do so when it is polled. If another node has data to transmit to a slave node, it must do so through the master node. Also, slave nodes can only communicate with each other through the master node.

DECnet III and IV nodes also support System Generation, Network Parameter Modification/Tuning, Event Logging, Node/Line Statistics gathering, Loopback Testing, and Online Reconfiguration. Certain network nodes, such as RSX-11/M nodes, support other functions. DECnet III nodes also support auto-answer, half-/full-duplex, synchronous/asynchronous communications, and local coaxial cable, local 20-mA, remote EIA, remote V.35/DDS, or RS-232/-423 communications interfaces.

DECnet-RT Phase III supports all Phase III facilities except Network Command Terminals. RT-11 nodes can only be end nodes, entering data into network or receiving data from it. In addition, RT-11 nodes support Network Job Spawning, Terminal-to-Terminal Communications, and Command File Submission.

Network Job Spawning allows the RT-11 system to continue network activity unattended. When the network notifies the Network Job Spawner of a connect request, it passes control to the requested job.

Terminal-to-Terminal Communications are implemented with the Talk (TLK) utility. The remote terminals can be on any node in the network that supports TLK. The Network Job Spawner can activate TLK.

A subset of DECnet-RT supports a low-overhead direct line interface (DLX) to an RSX-11/M node in addition to the DECnet network link. Part of the time, the RT-11 system can use DLX communications with system. At other times, it could use the DECnet network link for communications with other nodes.

DECnet-RT supports only 1 DECnet link. The DECnet-RT software contains a preconfigured package (NETGEN) which will suit

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

many applications. It includes menu-driven software for special tailoring.

DECnet-11/S Phase IV supports all Phase IV facilities except File Transfer, but 11S nodes can only be end nodes.

Like DECnet-RT Phase III, it supports Terminal-to-Terminal Communications and the DLX interface for low-overhead transmissions. In addition, DECnet-11S Phase III provides Host Support for generating and downline loading an RSX-11/S system from a DECnet-11/M, DECnet-11/M-PLUS, DECnet-IAS, or DECnet-VAX host.

DECnet-11/M and DECnet-11/M-PLUS Phase IV support all DECnet Phase IV facilities. Thus, RSX-11/M systems can be either routing or end nodes on a DNA network. In addition, RSX-11/M and 11/M-PLUS systems can generate programs for remote RSX-11/S systems and downline load them. DECnet-11/M and 11/M-PLUS Phase III also support the DLX interface for communication with small RSX-11/M, RSX-11/S, and RT-11 systems.

DECnet/E Phase III supports all Phase III facilities. Thus, RSTS/E systems can operate either as routing or end nodes on a DNA network.

DECnet-IAS Phase III supports all Phase III facilities except multipoint communications. Thus, IAS systems can be either routing or end nodes on a DNA network. Currently, IAS systems will not support a multidrop line connected to RT-11 or RSX-11/S systems. In addition, DECnet IAS Phase III provides host support for developing programs for the RSX-11/S and downline loading them for execution.

DECnet-VAX Phase IV supports all Phase IV facilities except multipoint communications. Thus, VAX-11 systems can be either routing or end nodes on a DNA network. Currently, VAX-11 supports a multidrop line connected to RT-11 or RSX-11/S systems. In addition, DECnet-VAX Phase IV provides host support for DECnet-11/S for developing programs on the VAX-11 and downline loading them to the RSX-11/S system.

DECnet Phase IV supports all Phase III features and adds virtual terminal support, increases routing and addressing facilities for 63,000 nodes, support for SNA and X.25 Gateways, communication and router servers, and Ethernet LAN. Implementation will vary in virtual terminal support depending on application.

Systems that implement DECnet Phase II can operate only as end nodes on Phase III networks because Phase II nodes can route communications only to adjacent nodes.

PDP-11 RSX-11/M, RSX-11/M-PLUS, IAS, and RSTS/E systems, VAX/VMS systems, and DECsystem-20 TOPS-20 systems can function as routing nodes. PDP-11 RSX-11/S and RT-11 systems can function only as end nodes.

■ DISTRIBUTED SYSTEM MANAGEMENT

Distributed networks are set up to allow the sharing of data processing, peripherals, and data resources. The sharing is done through 3 data processing functions—sessions, jobs, and transactions.

For Sessions, a terminal or applications program captures the use of the network for a query or conversation. When completed, the terminal or program retires from the network. Primary DECnet products for session control are TLK utility for Terminal-to-Terminal Communications, Network Command Terminal (Phase III), and Network Virtual Terminal (Phase IV) for making a remote terminal appear local to a remote system.

For Jobs, the File Transfer, Remote Resource Access, and Command File Submission facilities allow batch jobs to be run at remote sites.

For Transactions, processing can be handled through Task-to-Task Communication facilities combined with Remote Resource Access, Network Command Terminal Phase III, or Network Virtual Terminal (Phase IV).

Digital has now brought a number of the VAX's information processing products under what it calls its "Information Management Architecture." These products include VAX-11 Terminal Data Management Systems (TDMS) for terminal screen formatting, VAX-11 Data Base Management System (DBMS) and/or VAX-11 Resource Management System (RMS) for data management, VAX-11 DATATRIEVE for queries and reporting, VAX-11 Common Data Dictionary to store definitions used by all the products, and VAX-11 Application Control and Management System (ACMS) to develop and control interactive commercial and industrial applications. All these products also work with Digital's ALL-IN-1 menu system for office automation and data processing.

☐ Network Management

Digital is working on an overall program to manage the network. The first Network Services Management Program is the OBSERVER, a package that monitors the status of all nodes and lines in a DECnet network. It collects performance and usage information on all components. A report generator processes the collected data and produces a summary report of node and link-level traffic, error rates, and availability. OBSERVER uses the network management facilities available at each node for its operation.

A network manager at a terminal on a node running OBSERVER can call up real-time displays of the status at any node or line in the network as well as network statistics. OBSERVER runs under the RSX-11/M or RSX-11/M-PLUS with DECnet software on a PDP-11.

Network Management facilities are modular so a user can implement some or all of its modules. It can be centralized or distributed. The Network Control Program (NCP) utility is located in the user layer to allow network users and programs to gain access to network management information. NCP uses a set of standard commands that are included in each DECnet implementation for communication with network management modules.

Network Management modules are located in each level to monitor and perform test operations. Significant events occurring at the lower levels are maintained in local queues which can be processed within the Event Logger, and then transmitted to a specified console, file, or monitor output for use by network manager.

Network Management allows a system manager to downline load an unattended remote system; to change or examine network parameters; to examine network counters and events to determine how network is working; to test links at both the physical and logical link levels; and to set and display status of all nodes and lines.

☐ Session Management

Session control is at the point where DECnet is integrated with the operating system running on the computer system implementing a node. It maps node names to node addresses, identifies end users, activates or creates processes to fulfill connect request, and validates incoming connect requests. Validation is system dependent.

☐ Host Access Methods

The network application layer contains commonly used modules to access data and provide services for users. The Data Access Protocol (DAP) allows users to access or transfer files independently of the I/O structure of host system. DAP is implemented through cooperating modules between user process on local node and a server process at the remote node.

Host access function supplied through Network Virtual Terminal (NVT), X.25 Gateway, and DECnet/SNA Gateway. NVT requires host terminal servers for interactive processing or application execution. X.25 Gateway requires peer-to-peer cooperating systems at terminal and host sites. DECnet/SNA Gateway uses IBM host access methods while access routines emulates DECnet/SNA logical unit 0, 1, 2, 3, or 6.2.

☐ Message Management

Distributed throughout network in the routing nodes. The Session Control layer translates destination name into node, and passes

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

request to End Communication layer to establish the logical link between the remote nodes, segments and reassembles data if necessary, and provides error and flow control. Flow control is based on buffer space available for storing received data.

The End Communication layer then passes it on to the Routing layer, which assigns the logical link to specific physical links. Routing is based solely on least cost for use of the links. Routing layer includes no pacing algorithms. The Network Manager changes parameters after monitoring network status.

☐ Interactive Processing Management

The major interactive processing facility is through the Network Command Terminal (Phase III) or Network Virtual Terminal (Phase IV) interface. Currently, NCT allows access to a remote system only from a terminal on a system running under the same operating system as the remote node. Eventually, the Network Virtual Terminal Interface will be universal among all of Digital computers. This facility gives the user the same terminal support as for local terminals.

☐ Job/Batch Processing Management

The File Transfer and Command File Transmission facilities are the main ways to submit RJE jobs for execution using the batch processing facilities at a remote site.

☐ Transaction Processing Management

Transactions can be performed at remote sites through the Remote Resource Access facility combined with Task-to-Task Communications. DECnet provides Remote File Access facilities including an interactive Network File Transfer utility and Network File Access Routines (NFARs), FORTRAN callable. The NFARs become part of the user's program. Record Management System (RMS) files are becoming the standard file organization for Digital's operating systems. DECnet/VMS uses RMS to generate and transmit Data Access Protocol (DAP) messages over logical links.

The VAX-11 Application Control and Management System (ACMS) is the sixth major component of Digital's VAX information architecture; ACMS interacts with the other 5 components to manage online applications with many users accessing large databases. The VAX-11 ACMS is a general-purpose transaction processing product set to develop and control interactive applications. It is a fourth-generation language facility that provides a consistent, menu-driven operator interface for application execution; it ensures database integrity and minimizes use of system resources.

The VAX-11 Terminal Data Management System (TDMS) works with other components of Digital's VAX Information Architecture to simplify the management of terminal-intensive applications while improving performance. TDMS includes a menu-based Screen Editor, nonprocedural programming facility called "REQUEST," and Record Definitions. Datatrieve works with TDMS to perform database query and display.

☐ Database Management

Database Management is under control of the operating system at a node.

DBMS-11 • an implementation meeting CODASYL 1973 and 1975 Database Language Specifications for the PDP-11 • includes a Data Description Language (DDL), Data Manipulation Language (DML), and Database Control System (DCS) • DBMS-11 runs under RSX-11/M or RSX-11/M-PLUS.

Record Management System (RMS)-11K • a keyed access records management system that runs under RSX-11/M • an extension of RSM-11K for business applications called DMS-500 runs under RSTS/E on the PDP-11.

DATATRIEVE • an interactive query, report, and data access/maintenance system supports sequential, indexed, or relative files • runs under RSX-11/M, RSX-11/M-PLUS, and RSTS/E on the PDP-11.

INDENT • an interactive data entry and forms management system runs under RSTS/E.

VAX-11 DBMS • Digital calls it a "CODASYL-compliant" database management system; runs on the VAX-11; Version 2 provides a security schema in addition to the database schema, application subschema, and storage schema of Version 1 • security schema controls users access to data manipulation language verbs to modify and read records; subschemas also protect commands that change security environment; Version 2 also allows protection of Database Operator Utility (DBO) commands through a Command Authorization List (CAL) • VAX-11 DATATRIEVE provides a high-level data manipulation facility for use with DBMS • VAX-11 Common Data Dictionary holds the internal data definitions; it supports hierarchical security scheme based on access control lists to prevent access to or modification of database schema definitions.

VAX RMS • provides a Records Management System, which is packaged with the VAX/VMS operating system for users who are not ready for a database management system.

DBMS-10/DBMS-20 • based on CODASYL 1971 Specifications; includes Data Definition Language (DDL), Data Manipulation Language (DML), and Database Control System (DBCS) • runs under TOPS-10/TOPS-20 operating system.

☐ Gateways to Other Networks

Digital has several Gateway products to interface DNA networks to X.25 networks and to interface DNA networks to IBM SNA networks.

The X.25 Gateway is designed to make the CCITT X.25 Packet Level interface available to any user program residing in any system on a DNA network. The Gateway communicates with the DECnet system that is the DTE (Data Terminal Equipment) on the X.25 network over a DECnet logical link. The Gateway is implemented with X.25 Gateway access, X.25 Gateway Server, X.25 Packet Level, and X.25 Frame Level Modules. The X.25 Server Module resides in the local DECnet system using the X.25 network. A cooperating program is required in the remote foreign node on the X.25 network.

Digital has 2 other sets of products that provide Gateways to other networks—Packet Switching Network Interface (PSI) and Internet products. PSI products are provided for both the PDP-11 RSX-11 and VAX/VMS systems. Internet products that interface to IBM hosts and SNA networks are provided for virtually all of Digital's computers.

Digital also provides terminal emulation for connection to Sperry and CDC hosts.

☐ DECnet/SNA Program Background & Product Set

For almost 15 years, Digital has successfully sold products and services to accommodate the "complementary computing" concept for its customers who require Digital/IBM networking capabilities. Products that allowed batch access from Digital systems to IBM mainframes using BSC protocols were first implemented for PDP-8s. The first "distributed processors" were used either in a standalone environment or as front-end processors to the DECSystem mainframe product line. Later, products for PDP-11 and VAX systems were released and by the end of the 70's, Digital offered IBM access across all its product lines in addition to its third generation of peer-to-peer networking products.

Since 1980, Digital has announced and delivered products that support communications between the IBM SNA environment and the Digital DNA environment. The most significant product was the DECnet/SNA Gateway program which was launched in 1982. Since then, there have been enhancements for both VAX/VMS, MicroVAX/MicroVMS, and PDP-11 asystems in accessing the IBM environment through the DECnet/SNA Gateway.

Many Digital customers have realized the potential and power in linking 2 networking environments through the DECnet/SNA Gateway rather than simply using a "protocol emulation" of specific IBM products. One typical gateway use is a Digital terminal user needing access to applications and files on an IBM host system. Access can be provided by the 3270 Terminal Emulator (3270 TE) and Remote Job Entry (RJE) access software.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

Certain custom applications require program development on both the Digital and IBM systems and hence, the Application program Interface (AI) can be used.

Since the DECnet/SNA Gateway's introduction, Digital has realized users continue to need more sophisticated functions and more "reverse gateway" turnkey functions. IBM terminal users require access to applications and information at remote VAX systems. Additionally, document exchange or electronic mail became a necessity between the 2 networking environments.

For years, the focus for the ultimate source and destination of central databases and large computing resources has been in an IBM host-based computing facility. Today, however, there is also an increased need for accommodating access for the IBM users into the Digital environment. To achieve this access without 2 terminals on the IBM 3270 user's desk, Digital announced new products in October 1984.

☐ DECnet/SNA Gateway Product Set

The DECnet/SNA Gateway product set allows users to share information between suitably configured VAX/VMS, MicroVAX/MicroVMS, RSX-11M and RSX-11M-PLUS systems in a DECnet environment and IBM systems in a Systems Network Architecture (SNA) environment. Users on 1 or more Digital systems can simultaneously access IBM application programs or other system resources, act as a 3270 display station, transfer data between VAX/VMS or RSX file subsystems and IBM batch subsystems acting as an RJE workstation. Concurrently, 3270 display users within an SNA network can remotely log into suitably configured VAX/VMS systems, receive print data destined for 3287 class printers, and implement distributed application programs that run between Digital and IBM systems.

The DECnet/SNA Gateway family includes 2 variants of the Gateway system itself and a variety of Access Routine layered software for each supported operating system.

The **DECnet/SNA Gateway** is part of both the DECnet and the SNA networks. Architecturally, it is a **DECnet Phase IV node** to DECnet and a **Physical Unit Type 2** node to SNA. DECnet network can include multiple DECnet/SNA Gateways. The non-Ethernet-based DECnet/SNA Gateway (DX24) is a freestanding software/hardware package that can be configured as a part of a wide area DECnet network (WAN). It can be geographically colocated with Digital or IBM systems.

The Ethernet-based DECnet/SNA Gateway (DECSA) connects directly to a DECnet-based Ethernet Local Area Network (E-LAN), providing SNA connectivity to any Phase IV DECnet system physically connected to the E-LAN and to DECnet systems that are logically connected to the E-LAN Logical connections can be through either the DECnet Router communications server or through DECnet systems that support host routing. The software that is used within the Ethernet-based DECnet/SNA Gateway must be ordered in addition to the appropriate Ethernet Communications Server (DECSA) hardware configuration.

Digital systems wishing access to the SNA environment must be configured with the appropriate Gateway Access Routine software. DX24 Gateway supports up to 2 SNA communications lines at speeds of 9.6K bps. DECSA Gateway will support 2 9600 bps or 2 56K lines to the SNA network. Both local and remote connections are supported from either Gateway into the IBM/SNA network.

The DX24 Gateway software is loaded directly into the system via floppy diskettes from disk drives that are part of the standard DX24 configuration. At least 1 VAX/VMS or RSX system must be adjacent to the DX24 Gateway to provide host (Gateway Management) services. Software for the E-LAN based Gateway is loaded from an RSX or VAX/VMS host also on the E-LAN. See Figure 3.

DECnet/SNA DX24 Gateway • software only.

DECnet/SNA E-LAN Gateway • software only.

For VAX/11:

$2,000 lcns

For 8600:

3,000

☐ DECnet/SNA Gateway Access Routines

Each Digital system that communicates with an SNA network requires layered software products (Access Routines) requests to provide the end-user, turnkey function. The Access Routines run as VMS processes or RSX task images, and in conjunction with the DECnet/SNA Gateway, do 3270 Terminal Emulation, Remote Job Entry, and the like. DECnet is used as the reliable, error-free transport mechanism between the various Digital systems in the DECnet network and the Gateway itself.

Access Routines are available for VAX/VMS, MicroVAX/MicroVMS, or RSX systems today. Digital has made a statement of direction to provide Access Routines for the TOPS-20 operating system environment for its DECSystem-20 user community.

Access Routines differ in their "end-user" function and the system on which they run. There are 19 different Access Routines available now: 3270 Terminal Emulation, RJE, and Application Program Interface for VMS, MicroVMS, and RSX systems; DISOSS Document Exchange Facility and 3287 Printer Emulation for VMS and MicroVMS systems; and Distributed Host Command Facility for VMS only.

Gateway management includes normal DECnet network management tools for controlling, monitoring, and trouble-shooting the Gateway itself. The VAX/VMS or RSX system manager at one of the nodes attached to the DX24 Gateway or at a designated host node on the E-LAN for the DECSA version and can manage the gateway.

Gateway Management Routines • allow a VAX/VMS or RSX operator to configure, bootstrap, restart, or initialize a Gateway • operator can access event loggers and error counters, a wide range of fault isolation tools (such as an SDLC frame level loopback) to verify communication facilities, and a trace capability for the SNA lines to help debug application programs, as well as identify system problems at the Physical Unit (PU) level, SDLC level, or session level • a "snapshot" monitoring utility is provided to display on a Digital host-controlled VT100 terminal the status of the Gateway's buffer availability, the number of SNA sessions currently in progress, and other information that pertains to both the DECnet and SNA network.

For VAX-11:

$450 lcns

For 8600:

675

3270 Terminal Emulator (TE) • allows the user of a VT100 (or other Digital terminal or personal computer in VT100 emulation mode) on a suitably configured VAX/VMS, MicroVAX/MicroVMS, or RSX system to interact with programs on an IBM system which were written for 3270 display stations • translation tables on the respective systems convert RSX or VAX/VMS ASCII terminal input to a subset of IBM multinational EBCDIC code for transfer thru the Gateway; can be modified to fit nonstandard character sets • supports emulation of IBM 3274 model 1C controller and IBM 3278 model 1 or 2 display station • can be used with most IBM applications, except those applications written using features not supported by the emulator (3279 Color Features) must be modified • readily callable HELP facility provides information on keys with altered 3270-oriented functions; much of the same status information as on an actual 3270 display is reported on a special status line which may be overlayed on the VT100's 24th line.

For VAX-11:

1,000

For 8600:

1,500

Remote Job Entry (RJE) Access Routine • allows a VAX/VMS, MicroVAX/MicroVMS, or RSX system within a DECnet network to function as an SNA/RJE workstation or group of workstations that can transmit batch jobs to an IBM host and receive job output

LCNS: one-time license fee. NA: not available.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

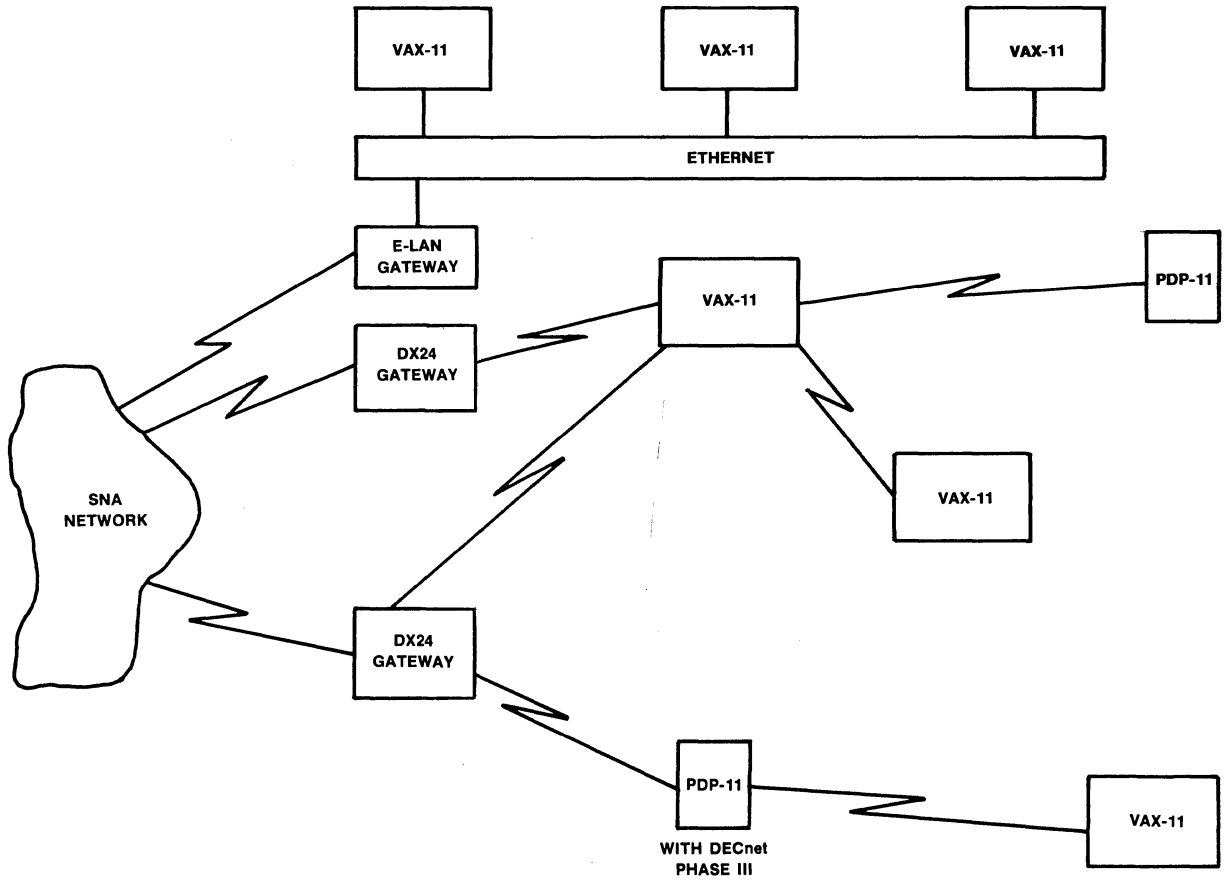


Figure 3 • network topology using DECnet/SNA gateway (DX24 & E-LAN).

• workstation users submit jobs to VAX/VMS or RSX system batch queues; the workstation transmits the queued jobs to the IBM host over the input streams associated with a queue; the IBM host returns job output to a workstation over various output streams; each IBM output stream will have a VMS or RSX directory assigned to it; job output may be directed to some system on the DECnet network other than the initiating system • VMS or RSX users with the required privilege can issue a set of restricted commands to manage the workstation; these commands allow the user to initialize and control the workstation, and to communicate interactively with the IBM batch subsystem.

For VAX-11:

1,000

For 8600:

1,500

Application Interface (AI) • enables a user-written application in a DECnet-VAX or DECnet-RSX node to exchange messages with a cooperating application in an IBM host; exists in the VAX/VMS system as a shareable image, and in the RSX system as a device driver • functionally, similar to the DECnet task-to-tast capability; interface is very general and allows most features of the SNA Session Layer to be accessed by the cooperating applications; provides VMS and RSX users with mechanisms for acessing IBM systems from applications programs; particularly useful for applications that require facilities other than RJE and 3270 Terminal Emulation such as support for Logical Unit Type O for communicating with IMS/VS or CICS/VS host-based applications • provides applications with access to the SNA functions performed by the Gateway • SNA Path Control functions, Data Link Control functions, and upper-level functions • application must provide the remaining SNA functions it requires • Logical Unit (LU) Presentation Services, Date Flow Control functions, and Transmission Control functions.

For VAX-11:

1,500

For 8600:

2,250

DISOSS Document Exchange Facility (DDXF) • allows its users within a DECnet network participate bidirectional in an IBM office systems network; the IBM office network is the vehicle for document library and distribution services in an IBM Systems Network Architecture (SNA) networking environment • users can access both document distribution and library services as provided by the IBM host supported Distributed Office Support System/370 (DISOSS/370) program product; communicates with the DISOSS/370 host system using the SNA Advanced Program to Program Communication (APPC) facility (also referred to as Logical Unit (LU) Type 6.2) and the Document Interchange Architecture/Document Content Architecture (DIA/DCA) protocols • accepts both final-form-text and revisable-form-text documents; transform routines are provided for final-form-text documents only.

For VAX-11/7XX:

1,500

For MicroVAX:

750

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

DECnet/SNA VMS Distributed Host Command Facility (DHCF) • allows a suitably configured VAX/VMS system within a DECnet network to be accessed from IBM host-controlled 327X terminals in a Systems Network Architecture (SNA) networking environment; the IBM system gains access to VAX/VMS systems through the DECnet/SNA Gateway • vehicle for supporting this or "reverse terminal" access from IBM to Digital systems is the IBM host-based program product called the Host Command Facility (HCF); IBM user can log into remote VAX/VMS systems, read or send VMS mail, perform some file editing, allocate VMS systems resources, and execute VMS commands like any other VMS user on a hard copy terminal; DHCF also allows the 3270 terminal operator at the central site, the Network Control Center, to access the maintenance, service, and control functions of the remote system for problem determination, problem isolation, and remote system control • extends to the IBM 3270 user some of the bidirectional capabilities that Digital VT100 users have had for some number of years; allows a single IBM 3270 terminal to access both networks (SNA and DNA).

For VAX-11:

1,000

DECnet/SNA Printer Emulator (PrE) • allows suitably configured VMS or MicroVMS systems within a DECnet network to receive printable data from IBM host-based applications; these applications will originally have been developed to produce output for an IBM 3287 printer when operating in system mode while connected to an IBM 3274 cluster control unit in a Systems Network Architecture (SNA) environment • data transfer is one way in nature from IBM host to the emulated printer • the PrE Access Routine software will allow VAX/VMS users to direct the received output to any valid VMS device, be printed via the VMS print symbiont, or spooled to a disk file.

For VAX-11/7XX:

1,000

For MicroVAX:

200

☐ DECnet Router/X.25 Gateway

The DECnet Router/X.25 Gateway connects DECnet nodes on an Ethernet to DECnet nodes on an X.25 packet-switched data network (PSDN) using the Data Link Mapping (DLM) capability of the Gateway software. In addition to performing all the functions of the DECnet Router, the DECnet Router/X.25 Gateway also gives systems on Ethernet with VAX X.25/X.29 Extension Package (XEP) access to the facilities offered by the PSDN.

The VAX X.25/X.29 Extension Package allows remote terminals to access the host VAX on Ethernet by "dialing in" through the network PAD (Packet Assembler/Disassembler). Locally connected terminals can access other systems connected to the PSDN by "dialing out" via the host VAX PAD provided by the XEP. Software routines allow access to the protocol level of X.25 traffic, allowing the VAX user to design utility software for task-to-task communication between the VAX and other vendors' systems.

The DECnet Router/X.25 Gateway supports the following public data networks: Datapac (Canada), Transpac (France), Datex-P (Germany), PSS (United Kingdom), Telenet (United States), Tymnet (United States), and Telepac (Switzerland).

For VAX-11:

$2,660 lcns

☐ PSI Products

PSI (Packet-Switching Network Interface) X.25 for VAX, PDP-11 RSX-11 and RSX-11M-PLUS, and DECSystem-20 systems provide for interconnection to Packet-Switched Data Networks (PSDNs), currently supported PSDNs by country and product are as shown in Figure 4.

RSX-11 PSI/M & RSX-11 PSI/M-PLUS • allows a suitably configured RSX-11M and RSX-11 PSI/M-PLUS systems to connect to Packet Switching Data Networks (PSDNs) conforming to the CCITT recommendation X.25 (June 1980); access to RSX-11 PSI/M and RSX-M PSI/M-PLUS is supported for RSX-11M and RSX-11M-PLUS user programs written in MACRO-11, FORTRAN IV, and FORTRAN-77; supports task-to-task and remote terminal communications via the network • allows use of DECnet facilities over PSDNs, as well as private leased lines or switched telephone networks • product supports EIA-RS-232C/CCITT V.28 at the hardware level, the symmetric LAPB variant of the X.25 frame level protocol, and the X.25 packet level protocol over point-to-point, 4-wire, synchronous, full-duplex lines • for intertask communication, application programs use RSX-11M executive calls to set up and break connections with the network, to send and receive data, and to issue control and synchronization requests • offers communications over both Permanent and Switched Virtual Circuits (PVCs and SVCs) • supports access from remote terminals according to the CCITT recommendations X.3, X.28, and X.29 (1978 and 1980); terminals are supported in "Remote X.29 Terminal" mode in which code conversions between ASCII and the actual code used by the terminal are performed by the network • a Network Control Program and Configuration File Editor are provided for the control of the operation of the X.25 software, includes loading and unloading.

For RSX-11/M:

$3,000 lcns

For RSX-11/M-PLUS:

3,000

VAX PSI & PSI Access • allows suitably configured VAX/VMS systems to connect to and/or access Packet Switching Data Networks (PSDNs), both private and public, conforming to the CCITT Recommendation X.25 (June 1980) • VAX PSI consists of 2 options: full-function VAX PSI and VAX PSI Access; both enable process-to-process and terminal communications between a VAX and remote data terminal equipment (DTE) in a PSDN supporting the X.25 protocol; only the full-function VAX PSI supports direct physical connection to the PSDN • both options support access for VAX/VMS user programs written in VAX MACRO and native

Country	PSDN	RSX-11 PSI/M	RSX-11 PSI/M-PLUS	TOPS-20 PSI	VAX PSI
Canada	Datapac	yes	yes	no	yes
France	Transpac	yes	yes	yes	yes
Germany	Datex-P	yes	yes	yes	yes
Holland	DN1	no	no	no	yes
Switzerland	Telepac	yes	yes	no	yes
United Kingdom	PSS	yes	yes	yes	yes
United States	Telenet	yes	yes	yes	yes
United States	Tymnet	yes	yes	yes	yes
United States	UNINET	no	no	no	yes
Belgium	DCS	no	no	no	yes

Figure 4 • X.25 Packet-Switching Network Interfaces available for DNA.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

mode high-level languages such as VAX FORTRAN; programs executing in PDP-11 compatibility mode high-level languages cannot use VAX PSI or PSI Access • full-function VAX PSI can be configured for either multihost or native mode operation; multihost mode allows a VAX PSI system to act as a gateway to a PSDN, supporting access to the network by other local or remote with VAX PSI configured in multihost mode, other VAXs in the DECnet network can take full advantage of the facilities available through or from the X.25 PSDN by installing VAX PSI Access • VAX PSI and PSI Access allow the use of DECnet/VAX facilities over X.25 circuits in addition to DECnet's support for private leased lines or switched telephone networks; a DECnet/VAX license is required to communicate with other DECnet nodes over X.25 • supports EIA-RS-232C/CCITT V.28 and CCITT V.35 at the hardware level, the symmetric LAPB variant of the X.25 frame level protocol, and the X.25 packet level protocol.

VAX PSI • 1 required per network for VAX-11:

3,300

PSI Access • required on each VAX on the network:

2,250

TOPS-20 PSI Gateway • enables a suitably configured TOPS-20 system in a DECnet Phase III network to connect to Packet Switching Data Networks (PSDNs) which conform to CCITT Recommendation X.25 (June 1980) • TOPS-20 PSI Gateway is a DECnet Phase III product • consists of TOPS-20 and front-end components; resides partly in the central processor and partly in a dedicated communications front end, the DN20/DN20F • includes MACRO-20 and FORTRAN-20 interfaces that enable application programs to use the CCITT X.25 Packet Level Functions • setting up and breaking connections, transmitting and receiving data, sending and receiving messages, and resetting virtual circuits • allows remote asynchronous terminals connected to a Packet Assembly Disassembly (PAD) facility to connect to a TOPS-20 system • provides same network management interface as DECnet-20; supports EIA-RS-232C/CCITT V.28 over point-to-point, 4-wire, synchronous, full-duplex lines at transmission rates up to 9600 bps:

NA

IBM 2780/3780 Protocol Emulators (PEs) • provide Remote Job Entry (RJE) emulators to exchange data between Digital computer and an IBM host • turnkey packages to run with standard IBM software at host • support output spooling, auto-answer, unattended operation, and code conversions • HASP emulator provides remote console and multiple I/O streams support • IBM 2780 emulator runs under all DECnet operating systems including P/M and P/OS except RSX-11/S; IBM 3780 emulator runs under all DECnet operating systems except IAS and RSX-11/S; IBM RJE/HASP runs under RSX-11/M, RSX-11/M-PLUS, IAS, and TOPS-20 • communicate with IBM host using BSC protocol.

For VAX-11:

4,620

For 8600:

6,930

For RSX-11/M:

3,800

RSX-11M/SNA Protocol Emulator (PE) • for communication between RSX-11/M system and an IBM host running on an SNA network; allows simultaneous batch and interactive communications on the same line; appears to the IBM host as an IBM programmable cluster controller • supports up to 4 lines and up to 61 SNA sessions; can connect to multipoint line with other IBM SNA devices • performs same functions as SNA layers up to and including parts of the Presentation layer • provides 3 program access modes: Emulator Control (EC) supports subset of IBM Type 1 interactive session of 3790 cluster controller; Extended Emulator Control (XEC) is almost equivalent to Type 2 interactive session of 3790 cluster controller; Application Control (AC) provides direct access to SNA protocol • runs only on PDP-11 under RSX-11/M control:

5,500

3271 Protocol Emulator (PE) • provides interactive, program-to-program link between programs running on a Digital computer and an IBM host; appears to IBM host as an IBM BSC cluster controller; can connect to same line as other IBM 3271 controllers • allows multiple Digital application programs to use same communications line; also provides multiline support for up to 6 lines which can connect to 6 IBM hosts, or 6 lines can connect to 1 IBM host • runs under all operating systems except RSX-11/S, TOPS-10, and TOPS-20.

For VAX-11/7XX:

5,500

For 8600:

8,250

For RSX-11M:

3,800

For RSX-11M-PLUS:

3,800

UN1004 Emulator • emulates the UN1004 terminal for communication with Sperry host; supported by RSX-11/M and RSTS/E.

For RSX-11M:

3,000

For RSX-11M-PLUS:

3,000

VAX-11 NTR • allows communication with Sperry 1100 host using Sperry NRT protocol.

For VAX-11/7XX:

6,100

MUX200 Emulator • communicates with CDC host as a MUX200 device; supported by VAX/VMS, RSX-11/M, and IAS.

For RSX-11M:

4,550

For RSX-11M-PLUS:

4,550

☐ Support for Foreign Terminals

Digital provides VAX Bisync Terminal Support (BTS) for bisync block mode terminals and permits Teletype Dataspeed 4541 and IBM 3270 terminals to interface to DECnet through a VAX-11. The BTS software can operate in Command Terminal or in Pass-through mode. In Pass-through mode, the VAX is transparent and the terminal appears to be connected directly to the IBM host front-end processor or communications adapter. In Command Terminal mode, the terminal can access and use any of the VAX utilities that run in **line** mode, such as ALL-IN-1 menu software, DECmail, and file management system (FMS). The IBM 3271-type cluster controller interfaces to the KMS-11 programmable front-end controller. The KMS-11 contains the IBM 3271 microcode.

■ SECURITY

☐ System Security

In general, system security depends on management establishing standards for security and access control rules, and assigning someone to enforce rules.

System Security • primary network product is the Session Control module that performs system-dependent validation checks • Session Control can perform validation, or user-programmable validation routines can be used • Session Control messages requesting connection to a remote user also contain a Password • the user can validate or reject request • other security measures provided by operating systems when user logs onto a system.

Data Security • provided by file access control rules under database management system or file management system.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

■ PHYSICAL NETWORK

DNA networks consist of routing nodes and end nodes. End nodes can initiate and receive communications from other nodes but cannot operate as intermediate nodes that can route data to other nodes in the network.

Routing nodes can be implemented using VAX-11/VMS, PDP-11 RSX-11/M, RSX-11/M-PLUS, IAS, RSTS/E, and DECsystem-20 TOPS-20 systems; end nodes can be implemented by PDP-11 RT-11 and RSX-11/S systems. Also, all systems that implement DECnet Phase II can operate as end nodes. Further, the DECsystem-10 can connect to an RSX-11/M Phase II node.

☐ Session Control

The Session Control module receives an incoming connect request. It maps the node name to a node address and determines if the network contains an end user corresponding to the one specified. Session control either activates or generates processes to handle the connect request. Using control information, which is a system parameter, Session Control validates the request.

Session Control maintains 2 databases: 1 for node-to-name mapping, and the other for the states of Session Control and optional default connection timers.

When Session Control receives the request for connection, it looks at the connect message to determine source and destination, end-user names, and access control information; validates access control information; identifies, creates, or activates destination end user; maps source code address or channel number to node name; delivers connect request to end user; and optionally starts an incoming timer. If timer runs out before end user responds, Session Control rejects connect request.

Once logical link is established, requests to send and receive data or to disconnect or abort link are passed on to Network Services in End Communications layer.

Session control also monitors a logical link to detect probable disconnection of link between nodes and to detect failure of Network Services to deliver transmitted data in a timely manner.

☐ Network Control

Network control is through network user who can be designated as network manager. The Network Manager uses the Network Control Program (NCP) utility in the user layer to access network status monitors at lower layers and to change network parameters. NCP provides a standard set of commands that are included in all DECnet implementations. Specifically, NCP allows the manager to change parameters, to gather information, to downline load, to up-line dump, to test line and network, and to zero counters.

Parameters include line, node, or logging options.

Line Parameters include such things as its state (on, off service, cleared), identification (Digital's line devices), adjacent node (node at other end of line), cost for (least-cost routing), controller, duplex (full/half), or normal timer (milliseconds before reply received from remote stations).

Node Parameters include such things as address, name, state (on, off, shut down, restricted, reachable, unreachable), identification (operating system and version), service password, CPU, host (for services), line, type (routing, nonrouting, Phase II), counters, buffers, and many more.

Logging Parameters include such things as logging sink type (console, file, monitor), state (off, on, hold), name, node address (where sink is located), and sink-type events.

☐ Network Analysis

Network analysis performed by network manager using Network Control Program (NCP) utility.

☐ Network Problem & Change Management

Digital provides the network manager with tools to manage network problems through Network Control Program (NCP) utility.

☐ Protocols

Digital has added levels to its DNA protocols over time. Phases I and II include 4 layers, while Phase III includes 8 layers. Initially, DECnet included the Data Access Protocol (DAP) in the Network Application layer, Network Services Protocol (NSP) in the Logical layer, Digital Data Communications Message Protocol (DDCMP) in the Data Link layer, and the Hardware Interface in the Physical Link layer.

Phase III adds a User layer and Network Management layer, adds the Loopback Mirror Protocol to DAP in the Network Application layer, divides NSP into Session Control layer and Network Services layer, and adds Transport layer in the Logical layer. The Data and Physical Link layers are unchanged from Phases I, II to Phase III.

DECnet Phase IV evolves DNA further. Network Services layer is changed to End Communications layer, and Transport layer is changed to Routing layer. New protocols are added to the Network Application layer: Network Virtual Terminal (an extension of the Command Terminal), X.25 Gateway access, and SNA Gateway access protocols. The Data Link layer now supports X.25 and Ethernet, in addition to DDCMP.

Phase IV nodes are either full-routing (full function) or nonrouting (end) nodes. Both types can receive or send packets from/to any other Phase IV nodes. Full-routing nodes, however, can also route packet through to other nodes. Phase IV nodes are compatible with Phase III nodes. Phase IV nodes can handle larger networks (63,000 nodes) than Phase III nodes (255 nodes), thus, a Phase III node cannot communicate with or be on a path to a node outside its address range.

Digital is committed to making DNA compatible with the Open Systems Interconnection (OSI) standard once it has been formally adapted. DNA has 8 layers that implement the 7-layer OSI model as illustrated in Figure 5. The OSI model includes Network Management in the Applications Layer.

User Layer • an application program running under an operating system on one of the nodal processors; the user defines the protocol • only DNA-defined module is Network Control Program (NCP), which is a Network Management utility to give network managers access to the lower levels; NCP has standard set of commands used by all DNA implementations.

Network Management Layer • modules with direct access to each lower level to provide user access/control of network parameters and counters • also allows user to downline load, upline dump, and test facilities.

Network Applications Layer • provides generic services to User layer; contains user and DNA modules, which execute independently and simultaneously • DNA protocols at this level are Data Access Protocol (DAP), Loopback Mirror Protocol (LMP) Network Virtual Terminal, X.25 Network Access, and SNA Gateway access protocols • DAP permits remote file access and file transfer without regard to I/O structure of system being

<table>
<tr><th>OSI LAYERS</th><th>DNA LAYERS</th><th colspan="3">DNA LAYER FUNCTIONS</th></tr>
<tr><td rowspan="2">APPLICATION</td><td>USER</td><td colspan="3" rowspan="3">FILE TRANSFER • REMOTE RESOURCE ACCESS • DOWN-LINE LOADING • REMOTE COMMAND FILE SUBMISSION • VIRTUAL TERMINALS</td></tr>
<tr><td>NETWORK MANAGEMENT</td></tr>
<tr><td>PRESENTATION</td><td>NETWORK APPLICATION</td></tr>
<tr><td>SESSION</td><td>SESSION CONTROL</td><td colspan="3" rowspan="2">TASK—TO—TASK</td></tr>
<tr><td>TRANSPORT</td><td>END COMMUNICATIONS</td></tr>
<tr><td>NETWORK</td><td>ROUTING</td><td colspan="3">ADAPTIVE ROUTING</td></tr>
<tr><td>DATA LINK</td><td>DATA LINK</td><td rowspan="2">DDCMP POINT-TO-POINT MULTIPOINT</td><td rowspan="2">X.25</td><td rowspan="2">ETHER-NET</td></tr>
<tr><td>PHYSICAL</td><td>PHYSICAL LINK</td></tr>
</table>

Figure 5 • DNA layers as compared with OSI layers.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

accessed • LMP defines message used between Network Management Loopback Access Routines to test logical links and Loopback Mirror • Network Virtual Terminal extends Command Terminal facilities to different computer systems • X.25 Gateway access and SNA Gateway access facilities are network-to-network.

Session Control Layer • defines system-dependent aspects for setting up logical link (virtual circuit) for 2-way communication; system-dependent, process-to-process communication • maps node names to node addresses, identifies end users, activates or sometimes creates processes, and controls access through validation functions.

End Communications Layer • previously Network Services layer • provides system-independent, process-to-process (end-to-end) communication service (logical link) for users no matter where they are on the network; modules control data flow and end-to-end error conditions; segments and reassembles user messages.

Routing Layer • previously called Transport layer • message delivery service; accepts packets of user data and routes them through the network, each to its destination; selects host (least-cost) route if alternate paths available • provides Datagram Service, defined as service that delivers messages on best-effort basis • amount of traffic on channel does not affect routing algorithms • routes messages to any other Phase III or Phase IV node, or to adjacent Phase II node • Phase III limited to 255-node network and 31 hops • Phase IV nodes limited to 63,000-node network and 63 hops; hop is 1 node-to-node path.

Data Link Layer • creates a communication path between adjacent nodes on the network; uses Digital Data Communications Module Protocol (DDCMP), X.25, or Ethernet for transmission • Maintenance Operations Protocol (MOP) used to maintain a remote, possibly unattended system • DDCMP is byte oriented and unlike bit-oriented protocols like SDLC and HDLC, and character-oriented protocols, such as binary synchronous; determines end of frame/message by receiver counting the number of bytes received and comparing count with the number the sender specifies within message; bit-oriented protocols determine end-of-frame by receiver looking for and recognizing an end-of-frame bit pattern; binary synchronous protocols use special characters to signal beginning or end of frame • Ethernet is specification developed by Digital, Intel, and Xerox • X.25 conforms to levels 2 and 3 of OSI model • see Figure 6 for Ethernet Packet Protocol and Ethernet configuration.

Physical Link Layer • undefined by DNA; uses industry-standard electrical signal specifications such as EIA RS-232C or CCITT V.24 interface standards; DNA defines only its Network Management interface, counters and events; modules monitor channel signals, clock channels, accept interrupts from hardware, and inform Data Link layer when transmission is complete; include parts of the device driver for each communications device, as well as the hardware itself • local cable, Ethernet coaxial cable, or telephone lines.

■ EQUIPMENT SUMMARY

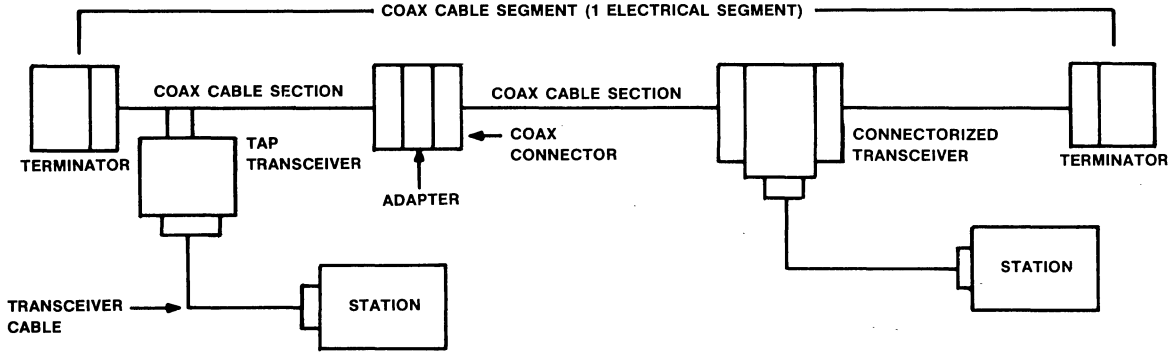
☐ Host Computers

Digital does not use centralized host computers on its DNA networks. Processing is completely distributed.

☐ Communications Processors

Digital does not use communications processors in the same way as the mainframe vendors do to control nodes on a network or as front ends to their computer systems; only the DECsystems-10 and -20 support front-end processors. Digital uses

ETHERNET CONFIGURATION



FRAME FORMAT

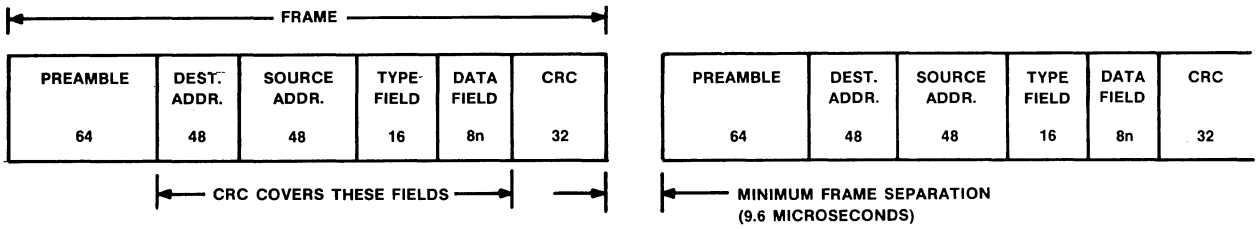


Figure 6 • the Digital Ethernet scheme.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

microprocessor-based single- and multiple-line controllers, which perform line control but not network control functions.

DN20 Universal Communications Front-End Processor • used as front end to both DECsystem-10 and -20; supports either DECnet or IBM communications on 1 front end; maximum aggregate throughput is 1.2M bps • implemented with PDP-11/34A processor • under DECnet-10 and TOPS-10 software, DN20 supports up to 12 synchronous lines, 128 asynchronous lines, or combinations of both synchronous and asynchronous lines; line speeds can be 2.4K to 56K bps; for IBM communications, DN20 emulates IBM 2780/3780 terminal and supports 6 BSC lines • under DECnet-20 and TOPS-20 software, DN20 supports synchronous communications: 8 low-speed lines (2.4K to 19.2K bps), 4 high-speed lines (19.2K to 56K bps), 2 very high-speed lines (56K to 1M bps), or combination of all 3 speeds; asynchronous communications must be handled by other controllers; for IBM communications under TOPS-20, DN20 supports BSC communications at 2.4K to 19.2K bps; maximum aggregate throughput is 40K bps; running IBM 2780/3780 terminal emulation, supports 6 BSC lines; running both IBM 2780/3780 and HASP workstation emulation, supports 4 BSC lines for 2780/3780 and 2 BSC lines for HASP workstation.

DN200 Remote Stations • operate as remote job entry stations; connect to DN20 over synchronous communications line; supports line printer and card reader • up to 4 DN200s supported per system under TOPS-20 • up to 36 DN200s supported under TOPS-10.

DH11 Series Multiline Asynchronous Multiplexers (16 Lines) • for connection of UNIBUS systems to EIA/CCITT local/remote terminals • half-/full-duplex with programmable rates and formats and EIA/CCITT interfaces; with/without modem control • supports split-speed transmit and receive rates • RS-232C or 20-mA interface optional.

DL11 Series Single-Line Asynchronous Interfaces • for local and remote interconnection of UNIBUS systems to terminals • half-/full-duplex, EIA/CCITT RS-232C or 20-mA current-loop interface; with line clock and cable or modem control; 50 to 9600 bps; compatible with AT&T 103, 113, or 202 modems.

DLVE1 Asynchronous Interface • EIA RS-232C, single-line interface for LSI-11 bus systems; transfer data under program control at data rates from 50K to 19.2K bps; split transmit and receive speeds.

DLVJ1 Asynchronous Interface • to connect up to 4 asynchronous devices to LSI-11 bus system; 4 independent serial line interfaces can be configured for EIA RS-232C, RS-422, or RS-423 interfaces, jumper-selectable line speeds from 150K to 38.4K bps, 7 or 8 data bits, and 1 or 2 stop bits • supports DLVK1-H converter from EIA to 20-mA interface.

DMC11 Single-Line Synchronous Interface • employed for high-speed interconnection on local/remote links for UNIBUS systems • full-duplex, DDCMP protocol microprocessor supporting NPR I/O • 19.2K bps half-/full-duplex with EIA/CCITT interface or 56K bps with CCITT V.35/DDS interface, and modem control for synchronous switched/private line • 56K/250K/500K/1M bps with modem and local link.

DMF32 Communications Controller • an intelligent VAX UNIBUS controller for a combination of I/O devices including 8 full-duplex, asynchronous communication lines, 1 synchronous communication line, and 1 line printer interface or general-purpose parallel I/O port • asynchronous multiplexer portion is a DZ11-A, enhanced to reduce interrupt overhead and add functionality; each line can be programmed to run in either interrupt or DMA mode at data rates up to 19.2K bps; split data rate and full-modem control for 2 lines, but other 6 lines are for local terminal connection only • synchronous line with full-modem control is DMA device that supports DDCMP, SDLC, and HDLC framed messages; generates and checks CRC; and transfers messages to host memory through DMA; DECnet VAX supports DDCMP protocol of DMF32 • line printer DMA controller's enhanced LP11 controller and will control LP11 and LP32 series printers • both line printer controller and parallel I/O port can be physically attached, but a hardware switch selects the active one.

DMP11 Communications Controller (DECnet Interface) • microprocessor-based, multipoint or point-to-point DDCMP communication controller for UNIBUS systems; performs polling and handles network communication for up to 32 tributaries at rates up to 1M bps over cable up to 1,000 feet in length; data rate reduced to 56K bps if cable length extends to 18,000 feet; DDCMP implemented in ROM • supports full- or half-duplex operation • can also communicate over common carrier facilities at rates up to 19.2K bps via RS-232C interface and 56K bps via RS-423A interface • DECnet supports only up to 56K bps • software compatible with DDCMP 3.1 and 4.0.

DMR11 Single-Line Synchronous (DECnet) Interface • high-performance DDCMP microprocessor and line unit module; provides connection to another DMR11, DMV11, DMP11, or other DDCMP microprocessor, using cable or common carrier facilities; half- or full-duplex; available in following communications standards; EIA RS-232C at up to 19.2K bps; EIA RS-423/CCITT V.24 at up to 56K bps; local coaxial version at 56K bps at 46,000 feet to 1M bps at 6,000 feet; and CCITT V.35/DDS at speeds up to 1M bps; • provides point-to-point link between UNIBUS computers; software-compatible DDCMP 3.1 or 4.0 • DECnet support limited to 56K bps.

DMV11 Communications Controller • microprocessor-based communications controller for LSI-11 Bus systems; performs polling for up to 12 tributaries and handles network communications • can communicate with DMC11, DUP11, DPV11, DMR11, DMP11, and DMV11 in same point-to-point mode • in multipoint configuration, can communicate with DMP11s or DMV11s • supports EIA RS-232 operation at 56K bps and EIA RS-232C, CCITT V.24, or CCITT V.28 operation at 19.2K bps.

DPV11 Synchronous Line Interface • single-line, program controlled, double-buffered interface between LSI-11 Bus and serial synchronous line; can handle bit-oriented (SDLC, HDLC, ADCCP) and byte-oriented (DDCMP and BSC) protocols; handles all DDCMP protocol processing, offloading central processor compatible with EIA RS-232 and EIA RS-449, CCITT V.28 interface standards and EIA RS-422 and 423 electrical standards; half-/full-duplex operation at up to 56K-bps transmission speeds with full-modem control over switched or unswitched lines.

DUP11 Single-Line Synchronous Interfaces • with modem control; half-/full-duplex; for UNIBUS systems • transmits at 9600 bps, 8-bit DDCMP/BSC or bit-oriented SDLC/HDLC, ADCCP; compatible with AT&T-type 200 modems • normally used for RJE applications.

DUV11/DPV11 Single-Line Synchronous Interfaces • for LSI-11 Bus systems • half-/full-duplex, EIA/CCITT interface at up to 9600 bps (DUV11) or 56K bps (DPV11).

DV11 Multiline Synchronous/Asynchronous Interfaces • for up to 16 lines with modem control; communications preprocessor used on PDP-11/24, 11/34A, 11/44, and 11/70 Series • supports rates up to 9600 bps, half-/full-duplex, EIA/CCITT interfaces, NPR I/O, table-driven character processing, and CRC calculation; programmable speeds and formats on per-line basis.

DZ11 Asynchronous Multiplexer (8/16 Lines) • for connection of UNIBUS systems to up to 16 local or remote terminals • programmable speeds up to 9600 bps with local EIA/20-mA current-loop terminals, up to 300 bps using Bell 103 or 113 modems, or up to 1200 bps using Bell 212 modems • formats on a per-line basis; provides control for up to 16 local asynchronous terminal devices or 16 half- or full-duplex lines; includes 64-character input buffer; includes parity generation/check on data.

DZ32 Asynchronous Line Multiplexer • microprocessor-controlled interface to connect 8/16 terminals or communications lines to a VAX-11 computer system • provides modem control, split-speed data rates for transmit and receive lines, and selection of data rates, and character lengths • operates with devices conforming to EIA RS-232C and CCITT V.24 and V.28 • data rates program-selectable from 50 to 9600 bps; standard distance between DZ32 and local terminals is 50 feet; shielded cables can extend maximum distance to 5,000 feet.

DZV11 Asynchronous Multiplexer (4 Lines) • for connection

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

of LSI-11 Bus system to up to 4 asynchronous terminals or lines; programmable speeds (up to 9600 bps) and formats on a per-line basis; provides data set control for AT&T 103 or 113 modems or equivalent.

KCT-32 Communications Controller • front end for UNIBUS systems; supports 2 synchronous or asynchronous lines; includes T-11 chip set so it can be programmed to implement any desired protocol, such as SDLC or X.25.

KMS11 Auxiliary Communications Controller • front end for UNIBUS systems to off-load communications functions for transmitting and receiving data on up to 8 synchronous communication lines; current applications use Digital PSI package and full X.25 link package for connection to X.25 packet-switched network • supports 8 synchronous, full-duplex lines concurrently at data rates up to 56K bps (4 lines) and 19.2K bps (8 lines); with PSI software, supports 9600-bps data rate for 2 lines • microcoded to off-load link and packet-level functions from host • electrical interfaces are RS-232C and MIL-188-144 (unbalanced).

KMS11-P Communication Interface • high-performance single-line synchronous controller to link VAX computers to X.25 packet-switched networks; supports data rates to 64K bps • accommodates RS-232C, V.35, RS-423, and RS-433 interfaces.

KMV11 Programmable Communications Interface • a single-line synchronous/asynchronous interface for LSI-11 Bus systems; supports half-/full-duplex DMA data transfers in point-to-point or multipoint configuration; includes DCT11 microprocessor with 32K bytes of RAM allowing soft-loading of microcode that processes protocol • supports EIA RS-232C or CCITT V.28 for operation at 19.2K bps, EIA RS-449/-442A or CCITT V.11 for operation at 64K bps, and EIA RS-449/-423A or CCITT V.10 for operation at up to 19.2K bps • can handle bit- or byte-oriented protocol • RSX-11M/M-PLUS supports HDLC/SDLC frame-level communication.

☐ Distributed Processors

This listing includes Digital's base-level computers. Configurations built around base systems can also connect to DNA networks. These include Digital's laboratory configurations and Datasystems designed for commercial applications. Systems must run under the operating systems that implement DECnet.

The PDP-11 has included a long line of 16-bit processors since it was first introduced in 1970. Of these systems, only the Micro/PDP-11, PDP-11/23-PLUS, PDP-11/24, and PDP-11/44 are currently marketed. The Professional 325 and 350 Personal Computers are based on the PDP-11/23-PLUS microprocessor and the Professional Operating System (P/OS) is based on RSX-11/M-PLUS. Further, Digital spokesmen have stated that the Professional PCs will be developed as full-fledged DECnet products.

The VAX-11 Series uses a 32-bit processor, and it has expanded into a broad computer line ranging from the MicroVAX I to the dual processor VAX-11/782.

The DECmate II Personal Computer is based on the 12-bit PDP-8 architecture. The Rainbow 100 Personal Computer is based on the Zilog Z80A/Intel 8088 8-and 16-bit processors. These systems are not DECnet products.

LSI-11/73 OEM Board Computer • based on the J-11 microprocessor with performance about equal to that of the PDP-11/44 or about 0.4 MIPS • compatible with all PDP-11 operating systems • includes 8K-byte cache memory and can address up to 4M bytes of memory • includes Qbus I/O interface.

Micro/PDP-11 Computer System • based on the LSI-11/23-PLUS CPU, thus has same performance, memory capacity, and other features as PDP-11/23-PLUS computer systems; implements LSI-11 Bus, not the UNIBUS • physical addressing of up to 4M-byte memory available in 256K- and 512K-byte increments • performance is roughly half that of the PDP-11/44 or about 0.2 MIPS in relationship to VAX-11 systems • runs commercial as well as floating-point instruction sets; provides 2 asynchronous EIA/CCITT interfaces, 1 for console terminal and 1 for expansion; options include asynchronous 4-line adapter for total of 6 lines, DECnet interfaces (RS-232, V.35, RS-423/-449), synchronous interface (9600 or 56K bps), parallel interface, 1 0.8M-byte floppy disk subsystem, and 10M-byte Winchester disk drive • RSX-11/M-PLUS system can operate as DECnet node.

Professional 325 & 350 Personal Computers • based on PDP-11/23 processor chips with 256K bytes of memory, display, 800K-byte dual diskette drives, and P/OS operating system; color video monitor and 5M- or 10M-byte disk (350 model only) optional • P/OS is a subset of RSX-11/M; P/OS Version 2.0 runs on Professional Series with hard disk • planned inclusion in DECnet Phase IV in 1984/1985 time frame • other operating systems Digital now offers for the Professional include: PRO/V7M a true UNIX system, RT-11 V5.1 single-user real-time operating system, and UCSD p-System, Version IV-1, which runs as an application under P/OS • Whitesmiths, Ltd offers IDRIS operating system and Venturcom offers VENIX • supports Real-Time Interface (RTI) module that supports 4 I/O ports: IEEE-488, 2 EIA RS-232C-/423-compatible asynchronous ports at user-selectable data rates of 50 to 9600 bpi, and bidirectional parallel I/O port with 16 data lines and 8 control lines • supports Computing Terminal Interconnect (CTI) bus to allow end users and OEMs to design options for the Professional.

PDP-11/23-PLUS Microcomputer System • based on the LSI-11/23-PLUS microprocessor; an enhanced version of the PDP-11/23; addresses 4M bytes of memory; supports commercial instruction set and floating-point options; can run RT-11, RSX-11/M, RSX-11/M PLUS, and RSTS/E V7.1 timesharing software and COBOL-81 • implements LSI-11 Bus, not UNIBUS • supports up to 4 10.4M-byte removable-cartridge disk drives, and single diskette subsystem with 2 0.5M-byte drives • options include DECnet interfaces (EIA RS-232/RS-423), synchronous interface (9600- or 56K-bps data rate) single-line or 4-line EIA interface/multiplexer, and single or 4 16-line parallel interfaces.

PDP-11/23S Computer System • packaged version of the 11/23-PLUS CPU in 3.5-inch, rackmountable box, including 64K-byte RAM or 32K-byte nonvolatile CMOS memory, 8-slot dual LSI-11 backplane, 23 serial lines, boot, and diagnostics • options include floating-point chip, commercial instruction set chip, 16-/64-bit parallel I/O, serial-line interface with modem control, 4-line serial I/O with EIA interface or 4-line buffered multiplexer.

PDP-11/24 Computer Systems • multifunction minicomputer system geared to OEM applications, first delivery March 1981 • entry-level system to the PDP-11 UNIBUS models featuring MOS/LSI technology with parity MOS memory ranging from 128K to 4M bytes; implements standard and extended PDP-11 instruction sets, commercial and floating-point instruction sets optional; has same performance as Micro/PDP-11 system, about 0.2 MIPS; maximum DMA rate is 5M bytes per second • supports 1M-byte diskette subsystem, up to 456M bytes of disk storage, and magnetic tape subsystems • runs under RT-11, RSX-11, and RSTS/E operating systems, and supports DECnet and Internet software.

PDP-11/44 Computer System • 16-bit word processor with 8K bytes of cache memory; implements standard and extended PDP-11 instruction sets, commercial and floating-point instruction sets optional; processor operates in 3 modes: kernel, supervisor, and user • implements UNIBUS and 22-bit addressing; maximum DMA rate is 1.8M bytes per second; uses Error Checking Correcting (ECC) MOS memory, 4M-byte maximum capacity; runs under RT-11, RSX-11/M, RSX-11/S, RSX-11/M-PLUS, RSTS/E, or IAS • performance 0.4 MIPS.

MicroVAX I Computer System • 2-board microcomputer implementing a subset of the VAX-11 architecture with performance rating of about 0.35 MIPS; it was designed primarily for machine and process control and single-user or small multiuser business and scientific computer applications • a major difference between the MicroVAX I and VAX-11 is that MicroVAX I implements a Qbus I/O structure rather than UNIBUS I/O structure of VAX-11; the MicroVMS Operating System is a specially packaged modular version of VMS to support the Qbus-based MicroVAX I; optional MicroVMS modules handle special functions, such as networking, program development, and multiuser authorization and accounting • Digital is developing the ULTRIX operating system based on the

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

University of California at Berkeley VM UNIX • MicroVAX retains the full virtual addressing memory management of VAX-11 with addressing of over 48 bytes, 16 32-bit general registers, 32 hardware and software interrupt priority levels, and all native mode instructions; certain instructions (decimal mathematics, some string instruction, and the D and H floating-point instructions) that are hardware-assisted in VAX-11 systems and are implemented in software on MicroVAX • VAXElan software is a subsystem of VMS for development of memory-resident real-time control and distributed computing applications; completed applications can be downline loaded to MicroVAX I as well as VAX-11/750 and VAX-11/730 systems.

VAX-11/725 System • specially packaged VAX-11/730 processor the size of a 2-drawer filing cabinet for open office locations; 1 package available with 1M bytes of memory, 2 tape cartridge drives (for IPL, diagnostics, and alternate load device), Winchester disk subsystem with 26M-byte fixed disk and 26M-byte removable cartridge and VMS software; second package adds 1M-byte memory for 2M-byte total and DMF32 communications interface; third package adds floating-point accelerator, DEUNA Ethernet Adapter, and DECnet software • supports up to 8 users.

VAX-11/730 Computer System • entry-level VAX-11 system with performance of about 0.30 MIPS, or 30 percent that of the VAX-11/780 • cannot support the MASSBUS available on other VAX-11 systems; uses integrated disk controller (IDC) to connect R80 disk drive with up to 3 RL02 drives for a disk capacity of 150M bytes; also UNIBUS interface can connect up to 8 RK11/RK07 drives for capacity of 228M bytes • memory capacity ranges from 1M to 5M bytes of MOS error checking and correcting memory • runs under VMS Version 3, which supports all VAX-11 systems including the VAX-11/782 dual-processor configuration and supports all VAX-11 software • includes as standard components CPU with data path module, writable control store, memory controller, 1M-byte memory, clocks, console subsystem, UNIBUS adapter, integrated disk controller (IDC), and DMF32 communication controller that supports 8 asynchronous lines • options include the Floating-Point Accelerator (FPA) and up to 4 additional 1M-byte memory modules • can function as full DECnet III and DECnet IV nodal processor • can support maximum of 24 asynchronous lines through 2 additional DMF32R or 1 DMF32 and 1 8-line DZ11/DZ32.

VAX-11/750 Computer System • middle-level VAX-11 system with performance of 0.6 MIPS, about 60% of the VAX-11/780 • uses LSI bipolar gate array technology, with chips custom designed and built by DEC, 488 logic gates per chip; features 8M-byte ECC MOS memory capacity with virtual addressing to 4.3 billion bytes, 4K-byte cache memory, cartridge tape for software update, diagnostics or auxiliary data storage; integral I/O bandwidth is 5M bytes per second; 2 UNIBUS interfaces with 1.5M bytes per second data rate each; and up to 3 MASSBUS adapters; options include 1K words (80-bit) writable control store and battery backup • supports all VAX-11 software: VAX/VMS, "C" compiler, COBOL, DATATRIEVE, RMS, FMS, DECnet-VAX, FORTRAN, PL/1, BASIC, Pascal, CORAL-66, BLISS-32, Macro, and all PDP-11 languages (in PDP-11 emulation mode) • performance about 20% greater than PDP-11/70 • can function as full DECnet III and DECnet IV nodal processor • supports up to 64 asynchronous lines per UNIBUS interface; 32 in mainframe cabinet • lines added through DZ11s, DZ32s, and DMF32s.

VAX-11/780 Computer System • original VAX-11 system first delivered in 1978 with performance of about 1 MIPS, about twice that of the PDP-11/70; 32-bit word CPU with 3 cache buffers—1 for memory, 1 for address translations, and 1 for instruction lookahead; upward compatible with PDP-11 when running in PDP-11 compatibility mode • central bus architecture with maximum aggregate system data rate of 13.3M bytes per second; memory ranges from 1M to 32M bytes • supports up to 12M bytes of memory with shared memory in multiprocessor configurations and high-speed data channel for user real-time devices; supports 4 optional UNIBUS and 4 optional MASSBUS I/O channels; maximum transfer rate per device is 2M bytes per second and maximum aggregate I/O rate for all MASSBUS adapter channels is 5M bytes per second • runs under VAX/VMS operating system • implements DECnet Phases II, III, and IV • can be configured with up to 96 asynchronous lines per UNIBUS interface; 48 in mainframe cabinet • lines added through DZ11s, DZ32s, and DMF32s.

VAX-11/782 Computer System • attached processor system with performance about 1.8 MIPS or 1.8 times the performance of the VAX-11/780; includes 2 tightly coupled VAX-11/780 processors that share up to 8M bytes of memory, 124M bytes of disk storage, 8-line asynchronous multiplexer, 2 DECwriter III console terminals, and VAX/VMS Version 3 operating system • supports same languages, peripherals, and DECnet products as VAX-11/780; thus, can function as full DECnet III or IV nodal processor • runs under single copy of VMS for both processors • supports up to 96 asynchronous lines per UNIBUS on system and up to 4 UNIBUS adapters per system • lines added through DZ11s, DZ32s, and DMF32s.

VAX-11/785 CPU • 32-bit, microprogrammed, bus-centered architecture • uses high-speed Schottky circuitry; MSI integrated circuits implementation • 16 32-bit registers • executes VAX instruction set in native mode; DEC PDP-11 nonprivileged instructions in compatibility mode • 32K-byte cache memory • high-precision programmable real-time clock • time-of-year clock with battery backup • 8K 99-bit words of control storage; 1K words reserved for UCS • optional floating-point accelerator • instruction microcode implemented in RAM instead of ROM • 2M- to 32M-byte memory; 36M-byte memory when 4M-byte multiport add-on memory included • 4.3G-byte logical address space • quad-UNIBUS and quad-MASSBUS adapters • up to 96 terminals in use concurrently; actual maximum of 384 • performance estimated at 1.5 MIPS.

VAX 8600 CPU • 32-bit, microprogrammed, bus-centered architecture • uses Emitter Coupled Logic (ECL) gate array circuit technology • 16 32-bit registers • executes VAX instruction set in native mode; DEC PDP-11 nonpriviledged instructions in compatability mode • 16K-byte write-back cache memory • 4-stage pipeline for execution, decoding, addressing, and fetching of instructions • high-speed internal buffers including 8-byte lookahead instruction buffer • floating-point accelerator • 80-nanosecond CPU cycle time • dedicated CPU to memory bus • separate Synchronous Backplane Interconnect I/O bus • 32 priority-interrupt levels support UNIBUS, DR780, and MASSBUS interfaces • 8K-byte control store using 86-bit words • 12M- to 32M-byte memory • 4.3G-byte logical address space; 2G-byte user program space • up to 2 SBI bus adapters • up to 160G bytes of online storage • up to 512 terminals plus potential for more through DECnet/Ethernet LAN • performance is estimated at 4.5 MIPS.

VAXcluster • composed of 2 to 16 loosely coupled VAX-11/750, VAX-11/780, VAX-11/782, and VAX 8600 systems (nodes); each system in the cluster runs under its own copy of the VAX/VMS operating system; all systems connect to the Star Coupler (SC008), a passive hub that provides a dual computer interconnect path along with electrical isolation between the processor nodes • operates outwardly as single large and powerful system offers high availability.

DECsystem-10 Computer System • no longer marketed; multiuser, multiprogramming system used primarily for timesharing applications; 36-bit word system that supports up to 4M words of memory; runs under TOPS-10 operating system • performance range up to 1.2 MIPS for uniprocessor configurations; dual-processor configurations that run under a single copy of the OS are also available for higher performance • currently consists of Model 1090 and 1091 • each processor supports up to 3 DN20 front-end processors • supports DECnet Phase I; planned support for DECnet Phase III, skipping Phase II.

DECsystem-20 Computer System • multiuser, multiprogramming system used primarily for timesharing applications; 36-bit word system that supports from 1M to 8M bytes of memory; runs under TOPS-20 operating system; DECsystem 2020 can also run under TOPS-10 operating system • currently consists of 3 actively marketed models: 2020, 2040, and 2060; 2060 uses the same hardware as the DECsystem-1091 model; uniprocessor performance of 2060 is up to about 1 MIPS: maximum aggregate data transfer rate is 7M bytes per second • supports up to 2 DN20

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

Universal Front-end Processors for synchronous communications: one can be used for DECnet-20 communications and the other for IBM communications; asynchronous communications are through the DC20-AA interface; 2020 supports MASSBUS and UNIBUS adapters, thus the DZ11 asynchronous line multiplexers can attach to the 2020 • 2020/2040/2060 can attach 2/4/6 synchronous and 32/64/128 asynchronous lines, respectively; data rates are up to 1M bps for synchronous communication and 9600 bps for asynchronous communication • performance ratings of the DECsystem 2020 and 2040 models are about 0.45 MIPS (2020) and 0.83 MIPS (2040) • provides 2780/3780 RJE and HASP workstation emulation; RJE requires DN200 Remote Front-End configuration of DN20 • supports DECnet Phase I, II, and III; support for DECnet Phase IV planned by 1985.

☐ Local Networks

Digital currently provides 4 local network facilities—DECdataway, CMR Network System, Ethernet, and PCL11 Parallel communications link.

Digital has network products under development for compliance with the IEEE 802.3 committee standard on CSMA/CD LAN. Some of the products are now in Beta test and will be announced in early 1985. Compliance with the 802.3 standard is an important part of Digital's LAN strategy and products will be offered to support it fully under DNA.

DECdataway • hardware/software system to implement Digital's local networking scheme to link PDP-11 and VAX-11 computers with distributed intelligent subsystems (DIS); it was designed for industrial applications to implement Unified Plant Management concept • PDP-11 or VAX-11 system acts as the DECdataway controller which can communicate with up to 31 DIS units, 63 device addresses, at 56K bps in synchronous mode over multidrop, shielded, twisted-pair cable up to 15,000 feet long; communication is in block mode • DIS units are PDP-11/23-based systems running RSX-11/S software, downline loaded from the PDP-11 or VAX-11 host; each host can support up to 4 DECdataways, and a VAX-11 host can currently operate as a node on a DNA network; DIS units can interface to real-time sensors and instruments, robots or numerical control machines, or terminals • interfaces at both the host and remote DIS are microprocessor based to relieve them of routine tasks • 2 types of remote DIS units, based on the LSI-11/23 microcomputer, are available: DPM50 DECdataway I/O Subsystem and the DPM23 Programmable DECdataway subsystem • 2 DIS units differ in the mounting chassis (DPM50 fits in NEMA-12 enclosure while DPM23 handles more peripherals), amount of memory (64K to 128K bytes on DPM50 and 256K bytes on DPM23), and I/O (DPM50 includes I/O subsystem with computer in 1 chassis and control for process I/O module is standard while it is separate option on DPM23) • DYT01 DECdataway Serial Interface, also microprocessor based, is a single-line interface to connect serial asynchronous devices to DECdataway: 20-mA, EIA, or ASCII devices such as video display and hard-copy terminals, programmable numerical controllers, intelligent instruments, test equipment, and Digital's RT700 Bar Code Reader; supports 50 to 9600 bps, 5- to 8-bit characters, and 132-byte buffer • DECdataway network software, common to both the DPM50 and DPM23, allows users to run applications programs; both are programmable using PDP-11 macro assembler and FORTRAN with ISA standard call extensions for I/O; standard features provide downline loading of remote DIS systems from hosts, interactive program-to-program communication (up to 32 logical task-to-task connections) between host and DIS, online diagnostics, and automatic rebooting in case of failure • hosts can be PDP-11/34, 11/44, or 11/70 systems running under RSX-11/M or RSX-11/M-PLUS, or VAX-11/750 or 11/780 running under VMS operating system; when the host is an RSX-11/M-PLUS system, a screen management system (FMS/DPM-PLUS) can run on the DPM23 to operate as a front end to VT100 terminals connected to the DPM23; provides an easy-to-use interface between terminal users and the application program.

CMR Network Subsystem • microprocessor-based distributed I/O system to link LSI-11 and PDP-11 systems to industrial and commercial equipment through up to 64 ports; each port has switch selectable data rate of 300 to 9600 bps • made up of CMR11 (PDP-11) or CMV11 (LSI-11) host controllers and CMR01 remote units; each host controller provides 4 communication ports and a computer can support up to 16 host controllers; each host controller can support up to 16 remote units using limited-distance modems or 63 remote units using EIA modems • remote unit receives, decodes, error-checks, and processes requests from the host; each remote unit can attach up to 16 I/O modules that can be A/D converters, analog I/O modules, digital I/O modules or pulse accumulators • designed for low-cost interconnection of devices for security access system distributed process monitoring, and energy management.

Baseband Ethernet • full incorporation of Ethernet into DNA global architecture; DECnet IV uses Ethernet protocols as 2 lowest levels of DNA protocols • Ethernet products announced for 3-year period from 1982 to 1985 include physical channel hardware, communication controllers for most of Digital's computers, communication servers, and software support under DECnet IV • physical channel hardware and communication controllers for PDP-11 and VAX-11 were developed first • Standard Ethernet TEFLON-coated Coaxial Cable in various lengths for building Ethernet LANs with Digital components was available year end 1982 • other products are available to connect Unibus- and Qbus-based systems to Ethernet.

H4000 Transceiver • provides physical and electrical connection to Ethernet cable; uses nonintrusive tapping device (alligator-type clamp) to allow adding or removing transceivers from cable while it is operating; includes triple redundant guard circuit to prevent device failure from degrading network usage, and loopback testing to isolate failed units • first delivery 1982 • price is $300 for single unit and $200 in 500-unit quantities.

Transceiver Cables • shielded 4-wire twisted pair, coated with polyvinyl chloride (PVC) or TEFLON.

Remote Repeater • incorporates fiber optics to connect 500-meter segments of Ethernet coaxial cable to allow physically longer Ethernet cables • requires 2 repeater units that incorporate a fiber optics interface board and the fiber optics cable up to 1,000 meters long.

Broadband Ethernet • implements Ethernet communications in Broadband Local Area Networks (LANs); products are offered to extend Digital's Ethernet communications capabilities from baseband to broadband LANs for customers who are committed to broadband cabling for their local area networks • includes Broadband Ethernet Transceivers (DECOM)—for both single and dual cable broadband network cabling schemes; Broadband Ethernet Frequency Translator (DEFTR)—for use with DECOM broadband transceivers in single cable networks, located at the network "headend," to translate Ethernet signals from transmit to receive frequencies • broadband network cabling system consists of the same cable and components used by the cable television (CATV) industry • an extension of what Digital has done with Ethernet on baseband; provides the same capabilities for baseband and broadband local networks—a high speed (10 megabits/second), peer-to-peer communications link between computers and other intelligent devices for file transfers and high-resolution graphics displays, and for transmitting text, electronic mail, and facsimile data • both Ethernets use same DECnet Phase IV Software, for VMS, RSX, and P/OS operating systems • same Ethernet controllers: DEUNA, DEQNA, DECNA • same Communications Servers (DECSA): DECnet Router Server, DECnet Router/X.25 Gateway, DECnet/SNA Gateway, Terminal Server • same Local network Interconnect (DELNI) • same Transceiver Cable from the transceivers to the Ethernet controller, DELNI, Terminal and Communications Servers • same capabilities and performance: 10 megabits/second data rate, CSMA/CD protocol, up to 1,024 nodes • see Figure 7.

Broadband Ethernet Transceiver (DECOM) • provides physical and electrical interface to the broadband coaxial cable; transmits signals onto the coaxial cable, receives signals from the cable, and detects any message collisions that may occur • single unit price is $4,250.

Single Cable Broadband Ethernet Transceiver (DECOM-BA/BB) • transmits in the frequency band of 54 to 72 megahertz (MHz) and receives at 210.25 to 228.25 MHz; requires a

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

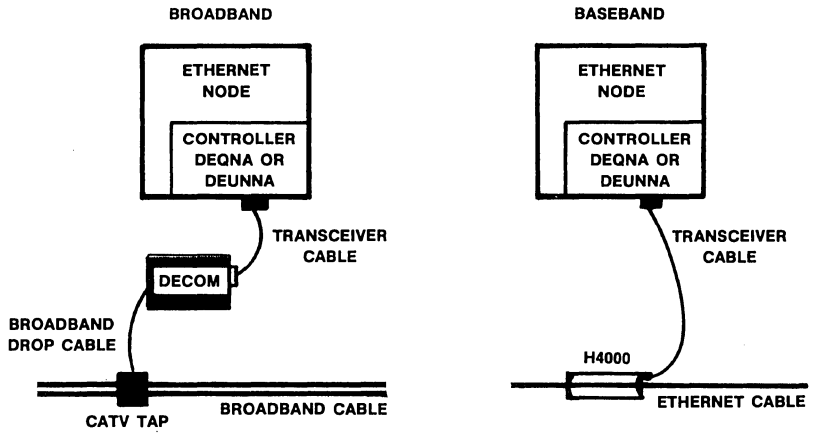


Figure 7 • Digital Baseband/Broadband Ethernet.

Frequency Translator (DEFTR) at the network headend to convert the Broadband Ethernet signals from their transmit to their receive frequencies • 1 DEFTR is required per network; see Figure 8 • price of DEFTR is $4,500.

Dual Cable Broadband Ethernet Transceiver (DECOM-AA/AB) • transmits and receives the Ethernet signals at the same frequencies, in the band from 54 to 72 MHz; does not require a Frequency Translator (DEFTR) at the network headend; has 2 connection points so it can send on 1 cable and receive on the other in Dual Cable broadband networks • see Figure 8.

DEUNA Communications Controller • interface between Ethernet transceiver and UNIBUS system • microprocessor-based; includes 32K-byte buffer area for receiving/transmitting data and separate DMA controller to move data into computer system memory; provides address recognition and data link functions for its attached Ethernet node, such as synchronization, proper channel access, and retransmission attempts when collisions occur; provides diagnostics and loopback testing • purchase price is $3,500.

DELNI • a multiplexer that can operate in Ethernet or standalone mode • in Ethernet mode, it can connect up to 8 stations to an H4000 transceiver on Ethernet • in standalone mode, it can interconnect up to 8 UNIBUS systems (VAX-11 and PDP-11) with 1 unit; multiple DELNI units can be interconnected in 2-tier configurations to interconnect up to 64 UNIBUS systems without using a LAN; end-to-end cable distance between systems is limited to 200 meters • purchase price is $995 • requires the DEUNA communications controller to connect VAX-11 and PDP-11 systems to DELNI; requires DEQNA to connect Q-bus devices to DELNI; requires H4000 transceiver to connect to Ethernet.

DEQNA Communications Controller • interfaces Digital's entire line of Qbus-based microcomputers (including MicroVAX and LSI-11/73) to Ethernet local area networks (LANs); connects to cable through Digital's H4000 transceiver; can also connect to cable through Digital's DELNI, which can connect up to 8 DEQNA or DEUNA interfaces to the H4000 • provides data link layer and some physical functions in line with latest Ethernet specification • operates with DECnet Phase IV software at 10M-bps data rate; can be downline loaded for startup in unattended mode; includes 4K-byte FIFO buffer and DMA interface for high-performance packet transmission and reception • can perform self-test on power-up and will not attempt to transmit to Ethernet if test fails; loopback tests can isolate problems between DEQNA and transceiver; remote loopback tests can be initiated fron a different host on the network to verify its operation • purchase price is $1,150.

Other Communications Controllers • planned for DECsystem-20 with early 1985 availability.

Communications Servers • include X.25 and SNA Gateways, DECnet routers, and terminal servers • these concentrate facilities in single system rather than distributing facilities across all systems • available to all systems connected to same Ethernet local area network • other servers such as line printer servers will be developed as needed.

DECnet Router/X.25 Gateway • allows DECnet nodes on Ethernet LANs to communicate over X.25 public packet-switched networks to DECnet nodes on other Ethernet LANs; see

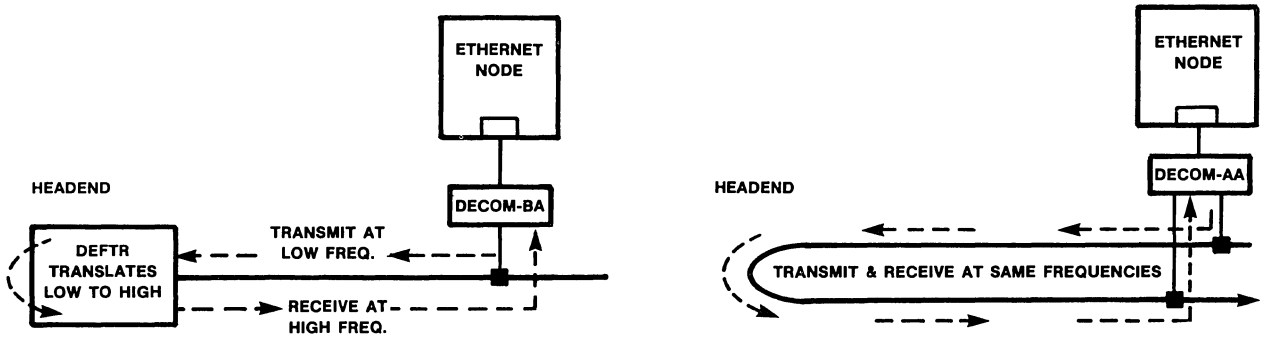


Figure 8 • Single or Dual Cable Broadband Ethernet.

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

description under Gateways to Other Networks section.

DECnet Router (DECnet Router Server) • enables Phase III networks to access resources of an Ethernet LAN, allows Phase III networks to link to Phase IV networks, and allows interconnection of different Phase IV DECnet networks • networks can be coupled locally or remotely with up to 8 56K-bps synchronous lines or 1 500K-bps line.

DECnet/SNA Gateway • complementary DECnet/SNA Gateway described under "Gateways to Other Networks" section • provides same features as DECnet/SNA Gateway without a VAX-11 acting as controller; currently allows up to 7 VAX-11 systems on Ethernet access to IBM SNA network through up to 2 communication links • performs gateway management, RJE, 3270 terminal emulation, and program-to-program communications; VAX-11, MicroVAX, RSX-11M, and RSX-11M-PLUS systems must implement SNA Gateway access routines • eventually will be upgraded into a general-purpose gateway to provide access to SNA by all systems interfaces to Ethernet.

IEEE Bus Interface • interfaces UNIBUS systems to IEEE bus complying with IEEE Std 488-1973; allows easy connection to test and measurement instrumentation.

PCL11 Parallel Communications Link • multi-CPU link for up to 16 UNIBUS systems; hardware protocol with CRC and word parity checking; time division multiplexed bus with adjustable time slicing; maximum length is 300 feet; maximum throughput 1M bytes per second • computers connected to bus, not daisychained, through PCL-11B interface, which represents a node on the bus; any node can be master mode but only one is designated as master on the bus • for failsafe operation or higher throughput, dual or triple buses can link computers together • only RSX-11/M operating system provides device driver for PCL11.

☐ Cluster Controllers

Digital announced its intention to develop a terminal server to interface clusters of terminals to Ethernet. Details of its implementation have not yet been released.

Other DECsystems can be used as cluster controllers, such as PDP-11 RT-11 systems. The ones listed here are those designed specifically for that purpose. The DEC mux terminal concentrator operates as a multiplexer rather than controller.

11C03 Graphics Terminal Interface • subsystem built around PDP-11/03 processor to link up to 8 serial graphics terminals to VAX-11/780 using Direct Memory Access (DMA) facilities; designed for computer-aided design (CAD) applications; supports any graphics display that conforms to RS-232 or RS-422/-423 interface standards; terminals can be located up to 4,000 feet from 11C03 and can transmit data at up to 128K bps • available in 2 models for 115 VAC 60-Hz and 240 VAC 50-Hz operation.

SB11 OEM Microsystem Series • LSI-11/2-based controller systems for technical applications; include 32K bytes of memory, 2 serial line ports, and real-time clock; run under memory-resident version of RT-11 operating system called MRRT-11 specifically developed for SB11 • can be downline loaded from a host RT-11 system, which can support up to 8 SB11s running MRRT-11 • can be loaded from TU58-VA, a dual-drive DECtape II Cassette subsystem, designed as storage option for SB11 • available in 4 models:

SB11-AA • basic configuration.

SB11-DA • preconfigured to support 10 serial lines.

SB11-EA • preconfigured to support 7 serial lines, including 1 with modem control.

SB11-FA • preconfigured to support IEEE 488 instrumentation bus plus 3 serial lines, including 1 with modem control.

☐ Terminals

Digital provides 2 basic lines of computer terminals: VT display terminals and LA DECwriter keyboard/printing terminals. The VAX station graphics terminal is also listed.

LA12 Correspondent • portable interactive terminal that prints hard copy at 150 cps; includes keyboard; data rate of 50 to 9600 bps.

LA120 DECwriter III Printing Terminal • freestanding; typewriter-style keyboard with dot-matrix printer; half-/full-duplex asynchronous communication at 50 to 9600 bps; dot-matrix printer speed of 180 cps; ASCII character set; standard EIA/CCITT interface.

VT100 Video Terminal Series • many members with dumb and intelligent models as well as general- and special-purpose features all based on the central 12-inch diagonal display module with cable-attached modular keyboard; models vary in number of characters displayed; 96-character ASCII set; RS-232C/CCITT V.24/V.28 or 20-mA current-loop interface • designed for operation at 19.2K-bps transmission rate.

VT100 Video Display Terminal • keyboard-display terminal with 1920-character, 24-line by 80-character and 1848-character, 14-line by 132-character capacity; 96-character ASCII set; RS-232C/CCITT V.24/V.28 interface • now replaced by VT220.

VT101 Video Display Terminal • same features as VT100 with local echo capability, but less expandable and powerful than VT100 • meant to be low-cost version.

VT102 Video Display Terminal • same features as VT101 with advanced video feature (3168-character, 24-line by 132-character capacity; underline, reverse video, bold, blinking attributes; custom character sets), and local printer RS-232C interface • also available in RT102 ruggedized version • can also be configured as an APL terminal.

VT125 Business Graphics Terminal • implements ReGIS (Remote Graphics Instruction Set); operates as a complete terminal package or as an option to VT100 or VT105 terminals; displays pictures and shapes, plotted lines, character/pie charts, point-plot graphs, and continuous data plots • incorporates microprocessor with 8K bytes of user memory so it can execute ReGIS instructions locally; BASIC, COBOL, FORTRAN, and DIBOL programs can incorporate ReGIS commands; pictorial/graphic data can be stored as ASCII text.

VT131 Video Display Terminal • less powerful and expandable than VT100; includes CRT, printer port, 5 full- and half-duplex protocols, and full-modem control; user can select block mode or character operation from keyboard; designed to implement some options of VT100 as standard features but at less cost.

VT180 Personal Computing Terminal • VT100 with Z80 microprocessor, 64K-byte RAM memory, 360K-byte mini-diskette storage unit; can run CP/M operating system • marketed as a personal computer.

VT220 Video Display Terminal • text-only terminal replacement of VT100; includes all the VT100 functionality plus choice of amber, white, or green phosphorous 12-inch monitor which turns off power to monitor if unused for 30 minutes or more; provides 15 programmable function keys, downline loadable character set, and cursor-controlled set-up menu • purchase price is 33 percent less than VT100 • provides a 68-Hz refresh rate and nonglare 12-inch screen.

VT240 Business Graphics Terminal • a VT125 replacement; provides all of the VT220 text features as well as 800x240 bit-mapped graphics; uses Digital's T-11 microprocessor for I/O handling, Intel 8025 for integrating graphics and text, and NEC graphics controller chip • Supports Digital's Remote Graphics Instruction Set Tektronix 4010/4014 Graphics protocols; includes a bidirectional printer port • purchase price is 42 percent less than VT125 • modem board is optional to provide communications at 300 to 1200 bps.

VT241 Color Graphics Terminal • provides all the features of the VT240 plus 4 displayable colors out of a total palette of 16; supports an auxiliary color monitor or camera.

GIGI (General Imaging Generator & Interpreter) • graphics terminal designed specifically for the education market; applications include computer programming, problem solving, instruction simulation, computer science, and business graphics • includes integral ReGIS (remote graphics instruction set),

Digital Equipment DECnet DNA
Digital Network Architecture & DECnet Products

multiple character sets, local intelligence (a BASIC read-only memory implementation), 9-level color and shading support, and a set of application software packages; it can interface to a graphics tablet or printer such as DECwriter IV Graphics Printer • supported by RSTS/E, VAX/VMS, and TOPS-20 operating systems.

VS11 Color Graphics System • high-performance, 16-color and monochrome raster graphics system with graphics instruction set, switch-selectable resolution and intensity • includes image processor, image memory, synchronous generator and joystick • requires VAX/VMS system and VS11-VAX driver.

VAXstation 100 • high-performance, high-resolution graphics workstation; includes 19-inch landscape monitor, keyboard, 3-button mouse, graphics processor, and UNIBUS interface • text writing speed is up to 30,000 cps; full-screen write from VAX memory in 1 second; software provides for screen management, windowing/viewports, parallel processes, display drivers, and terminal emulation of VT100 and TEK 4014.

☐ Support Equipment

Modems

DF02 Direct Connect Modem • freestanding, full-duplex modem for asynchronous data communications at 0- to 300-bps rate; FCC approved for direct connection to telephone lines through RJ11C modular jack • can be used to originate and answer calls manually or automatically • compatible with all Digital devices that support EIA RS-232C interface and offer Public Switched Telephone Network (PSTN) modem control; also compatible with integral modem in the LA36 DECwriter II • available with Automatic Calling Unit (ACU) • can store 16 digits for dialing/redialing.

DF03 Dual-Speed Modem • freestanding, full-duplex, synchronous/asynchronous modem that operates at 0 to 300 bps, or 1200 bps asynchronously or synchronously • compatible with Digital modems that support EIA RS-232C or RS-423A interface and offer Public Switched Telephone Network (PSTN) modem control; also compatible with AT&T 212A; approved by FCC for direct connection to PSTN with standard voice jack • features manual originate, manual answer, and automatic answer mode • available in 2 models: DF03-AC provides an automatic originate (auto-call) mode with 16-digit storage for dialing; the DF03-AA model does not • DF 100 multiple-modem enclosure can house up to 12 modems at one site; DF03RA and RC are single-card modem modules that plug directly into the DF100.

Multiplexers

Digital supplies multiplexers as multiple-line computer interfaces covered in Communications Processors section. In addition, Digital provides the DEC mux to connect 8 terminals to a VAX through 1 single, synchronous full-duplex line and a DFM Series of statistical multiplexers.

DECmux Terminal Concentrator • statistical multiplexer that connects up to 8 terminals to 1 4800- to 9600-bps full-duplex link • requires DZ11-compatible interface (DZS11-EA) at host and VT1XX-EB 8-channel multiplexer at terminal site • route-through feature allows terminals to be divided into 2 clusters of 4 terminals each.

DFMXX Statistical Multiplexer Series • intelligent communication processor that multiplexes 4/8/12/16 channels onto a single line; half the channels can be synchronous; supports 9600-bps input on up to 16 channels for aggregate throughput of 153.6K bps; provides statistical multiplexing, intelligent interfacing, channel switching with contention, and network management/control.

Network Control Systems

Digital's approach to network control is through facilities provided for a network manager to control the network through NCP utility.

• END

Digital Equipment VT100/VT200 Video Display Terminals

Models VT100, VT101, VT102, VT125, VT131, VT220, VT240 & VT241

■ PROFILE

Function • general-purpose, nonprogrammable, interactive keyboard display ASCII terminal • X3.64 and DEC VT52 compatible (all models); DEC VT100 compatible (DEC VT200 Series) • business graphics, vector graphics (DEC VT240 and VT241) • multicolor display (DEC VT200).

Architectures Supported • any architecture supporting asynchronous ASCII protocol • local/remote attachment to DEC hosts.

Communications • full-duplex, asynchronous, 50 to 19.2K bps, point-to-point, character/block mode transmission • RS-232C or 20-mA loop interfaces.

Database Management • none; only in association with host facilities.

Transaction Processing Management • none; only in association with host facilities.

Support Software • none; only in association with host facilities.

Processor • display-oriented control and communications logic.

Terminals/Workstations • single keyboard 1920-/3168-character display with auxiliary port for local printer.

First Delivery • 1978 (DEC VT100 Series); 1983 (DEC VT200 Series).

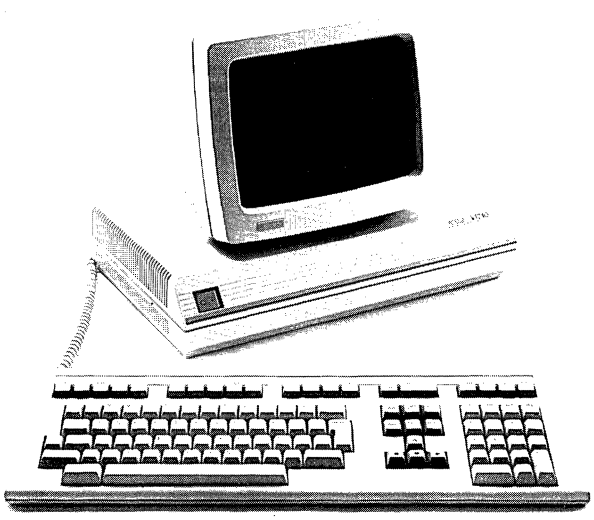
Systems Delivered • 650,000 (DEC VT100 Series); 93,000 (DEC VT200 Series).

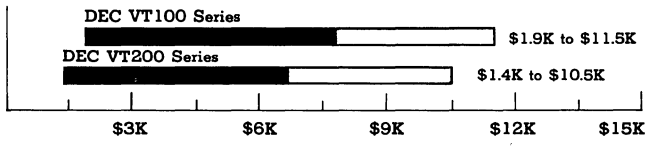
Comparable Systems • competitive with number of general-purpose ASCII display terminals; most notable are ADDS Regent 60, Esprit 1400/1500, Lear Siegler ADM, Beehive DM, IBM 3101.

Vendor • Digital Equipment Corporation; 146 Main Street, Maynard, MA 01754 • 617-897-5111.

■ ANALYSIS

The DEC VT200 family of ASCII display terminals represents the eventual successor to the DEC VT100 Series which has enjoyed a lengthy and prosperous career as an acknowledged industry standard. Although superseded by the new and improved VT200 Series, the VT100 has by no means been officially laid to rest. At the present time, this immensely popular display terminal is still being actively manufactured and marketed and has undergone some changes over the past year. Most notably, DEC has dropped the VT180 Personal Computing Terminal and the VT18X intelligent upgrade from the line-up. However, the market saturation of personal computers with VT100 emulation capabilities considerably lessens the desirability of an intelligent upgrade feature. In addition, DEC has lowered the price of VT102/131 terminals by approximately 7 percent. Maintenance pricing has increased on selected models by approximately 15 percent.





DEC VT100/VT200 SERIES PURCHASE PRICING bar graph covers price ranges between "small" and "large" configurations for hardware and software products (solid bar) and for associated maintenance fees (open bar) • **SMALL VT100** consists of VT100 keyboard-display terminal • **LARGE VT100** consists of VT125 with standard ReGIS graphics capability, advanced video feature for 24-line display, and word processing keyboard plus LA210 Letterprinter • **SMALL VT200** consists of VT220 keyboard-display terminal • **LARGE VT200** consists of VT241 terminal with standard RGB color monitor, ReGIS and Tektronix graphics support, integral modem-/auto-dialer, and LA210 Letterprinter.

The DEC VT200 Series extends VT100 capabilities with the addition of enhanced display features, improved ergonomic design, and graphics/color options. The 3 members of the VT200 line, Models VT220, VT240, and VT241, feature a modular design and a variety of user benefits including a plain language set-up menu; multinational, line-drawing, and downline loadable character set support; 15 programmable function keys; a Selective Erase feature; a CRT Saver feature; and an integral modem-/auto-dialer option. The low-end VT220 consists of a 2-piece unit incorporating a 12-inch monitor and detachable typewriter-style keyboard. The VT240 comprises a 12-inch monochrome monitor, typewriter-style keyboard, and systems box which houses power supply and logic. The high-end VT241 embodies a 13-inch RGB color monitor, typewriter-style keyboard, and systems box which contains power supply and video/graphics logic.

Ergonomic design considerations have resulted in the compact,

Digital Equipment VT100/VT200 Video Display Terminals
Models VT100, VT101, VT102, VT125, VT131, VT220, VT240 & VT241

sleeker design of the VT200 Series. The terminals employ wedge-shaped, nonglare screen monitors with a built-in tilt/swivel function and a choice of white, green, or amber phosphors. Character brightness and screen contrast are individually adjustable and a 60-image-per-second refresh rate reduces perception of flicker. The low-profile, detachable keyboard is available in both multiple language and word processing versions. A standard CRT Saver feature prevents image burn-in on an unattended terminal. A Local Echo feature is also standard on all VT200 terminals.

In an effort to facilitate operational ease of use, VT200 terminals utilize a plain-language set-up menu. Unlike previous set-up modes found on older VT100 systems, the plain-language set-up menu enables VT200 users to choose operating parameters from a menu display. Seven cursor-driven set-up screens are provided to define such parameters as keyboard type, data rate, key click, auto-wrap, cursor style, margin bell, parity, printer speed, and answer-back message.

Full bit-map graphics generation in both ReGIS and Tektronix 4010/4014 mode is standard on both VT240/241 terminals. Lines, text, circles, and curves can be produced using ReGIS (Remote Graphics Instruction Set) commands, and frequently used picture components can be stored in memory as macrograph subroutines. Designated attributes provide additional emphasis for assigning intensity; shading figures with patterns or charaters; overlay, replace, complement, and erase writing modes; variable-height and width characters; variable spacing and writing direction; and italics. Forthcoming VT240/241 graphics enhancements to be released during the first quarter of 1985 include a second Tektronix 4010/4014 emulation mode designed for handling aligned characters, a Polygon fill feature for defining and shading specified regions, and a Rotated Print feature for producing graphs in landscape mode.

Next to the ubiquitous PDP-8/-11 series of minicomputers, the VT100 terminal is probably one of the most successful products introduced by DEC. First introduced in 1978, the terminal series boasts an installed base of over 650,000.

The VT100 is in many ways a conventional ASCII terminal. It operates in a point-to-point asynchronous communication environment with adequate, but not extraordinary, editing capabilities. The display terminal does, however, provide some novel features to justify its large installed base. They include 132- as well as 80-character line display length, operating parameter configuration from the keyboard, and self-test mode. The 132-character line capability is standard for 14-line display formats; an Advanced Video option, standard on some models, offers enhanced 24-line display of 132-character line pages. Benefits gained from this feature are the display of a typical computer printout line as it would appear in line print copy, and the printing of VT100 input without reformatting.

Self-test mode automatically tests the status of the terminal when power is activated or on keyboard command. The self-test program checks nonvolatile memory, internal memory, and keyboard. Error conditions that may be encountered involve "fatal" errors which render the terminal inoperative, or "nonfatal" errors which display an error condition character but allow continued terminal operation at reduced capability.

☐ Strengths

The VT200 Series builds upon the VT100's capabilities to offer greater levels of operating flexibility and performance at a lower price. In addition to several unique features found only on VT200 terminals, this new line incorporates, as **standard** items, many VT100 Series options. For instance, VT200 Series users benefit from the following standard features: 132-character by 24-line displays, selectable local echo, multinational character set support, plain-language set-up menu, 15 programmable function keys, and local printer port. In contrast, the 132-character line display is only standard on VT102 and VT103; the 24-line display is standard on VT102 and VT125; local echo is unavailable on VT100 and VT125; and **no** multinational character support or plain-language set-up menu is available on **any** VT100 Series terminals. Furthermore, the VT100 is limited by offering only 4 programmable function keys and by the lack of a printer port on VT100 and VT101.

The addition of a graphics capability on the VT240 and VT241 is a significant asset. The DEC VT125 comes equipped with ReGIS but cannot support Tektronix 4010/4014 protocols; both are standard with VT240/241 terminals. The inclusion of color on the high-end VT241 is designed to improve operator productivity by selectively highlighting displayed information for easy identification of different information fields. Operator comfort was given a high priority in the design of VT200 terminals which feature standard nonglare screens, tilt/swivel monitors, and low-profile keyboards.

The bidirectional printer port available on VT240 and VT241 terminals is an important performance enhancement. This auxiliary printer port allows the host to directly transmit data to the printer without interfering with terminal activity. A composite video output available on all VT200 terminals accommodates an auxiliary monitor to support applications involving group presentations. Finally, the VT240/241 integral modem/auto-dialer option increases operating flexibility by enabling the operator to dial a host computer directly from the keyboard.

The VT200 Series are cost-effective replacements for the older VT100 Series. However, because of its vast popularity, the firmly established VT100 will retain a healthly after-market value, particularly for OEMs who customize the original product. And, unlike its successor, the VT100 product line can be field-upgraded to meet changing user requirements.

The aforementioned 132-character display, keyboard establishment of operating parameters and self-test mode are significant strengths. An additional attractive feature which should appeal to "slow" readers not schooled in speed-reading is the VT100/VT200 smooth scroll. This allows users to specify the speed at which lines appear on the display screen vis-a-vis the standard way of displaying lines as fast as they are received. With smooth scroll, a maximum of 6 lines per second can be added to the screen.

☐ Limitations

The VT200 models are limited by the lack of block mode transmission and local editing, both standard features on the VT131. At the present time, the VT220 does not support any graphics facility and no ReGIS or Tektronix upgrade is provided. In addition, the VT220 does not support a bidirectional printer port or the integral modem-/auto-dialer option, both of which are offered on VT240/241 terminals. Furthermore, the different component designs of the VT220 and VT240/241 prevents field-upgrading which has been an appealing factor to existing VT100 users with changing requirements.

Members of the VT100 family may be configured with a local attached printer which can print data forwarded from the host. Such data slated for printout is first displayed on the screen. Thus, the terminal is inoperative for keyboarding during printout. This is not a problem for members of the VT100 family that lack block mode capability, but a hindrance for the VT131 which could be accepting keyboard data during a print run if a screen bypass facility was implemented.

■ COMMUNICATIONS FACILITIES OVERVIEW

All models operate point-to-point at speeds ranging from 50 bps to 19.2K bps. Full-duplex operation is supported by the VT100/101/125/220/240/241; half-/full-duplex with the VT102/131. Modem controls are offered on VT102/131/220/240/241.

Character-only transmission is supported by all models except the 131, which operates in either character or block mode. Local echo is available on all terminals except the Model 125. Standard interface is RS-232C; a 20-mA current loop interface is optional.

■ SOFTWARE

The VT100 Series follows both ANSI and VT52 programming standard modes. In ANSI mode, the terminal generates and responds to coded sequences per ANSI standards X3.41-1974 and X3.64-1979. In VT52 mode, the terminal can run DEC software written for its VT52 video terminal.

Digital Equipment VT100/VT200 Video Display Terminals
Models VT100, VT101, VT102, VT125, VT131, VT220, VT240 & VT241

The DEC VT200 Series follows ANSI, VT100, and VT52 programming standard modes. In ANSI mode, the terminals generate and respond to coded sequences per ANSI standards X3.32-1973; X3.41-1977; and X3.64-1979. In addition, the terminals generate and respond to coded sequences per ISO Draft International Standards 646-1977; 2022.2; and 6429.2. In VT52 mode, the terminals can run software written for DEC VT52 terminals. This mode restricts all data generated to 7-bit, ASCII, UK, or special graphics characters. In VT100 mode, the terminals can run existing software for the VT100 terminal family. VT100 mode restricts data generated to 7-bit, ASCII, national replacement characters (NRC), or special graphics characters.

Furthermore, VT125, VT240, and VT241 terminals support ReGIS and Tektronix 4010/4014 graphics software. ReGIS (Remote Graphics Instruction Set) is a graphics descriptor language that can be used with BASIC; COBOL, FORTRAN, or Pascal to generate lines, circles, text, and curves. ReGIS capabilities can be extended with additional DEC graphics software including DECslide and DECgraph. In Tektronix 4010/4014 mode, VT240 and VT241 terminals support DEC and non-DEC graphics software available for both DEC and non-DEC systems including Tektronix's Plot-10 software. This mode enables VT240 and VT241 terminals to use a 640x240 pixel array and handle a 12-bit addressing scheme for a 4096x3072 array.

☐ Operating System

No operating system is supported. Firmware controls keyboard-display functions, data communication, and printing activities.

■ HARDWARE

☐ Terms & Support

Terms • purchase basis with separate monthly maintenance charge • full payout lease, conditional sales, OEM unit and OEM dollar volume plans also available.

Support • DEC Service and Basic Service Agreement plans for 8:00 AM to 5:00 PM, Monday through Friday support; extensions provide for coverage on 12-, 16-, or 24-hour, weekday, holiday, or weekend basis; DEC Service provides support within 4 hours of user request and continuous effort until system is operational; Basic Service provides priority response to user requests for remedial service during contract hours • OEM and Terminal service plans also available.

☐ Overview

The DEC VT100/VT200 Terminal Series consists of 8 general-purpose ASCII keyboard display terminals. All terminal models operate at speeds up to 19.2K bps, and contain an RS-232C or 20-mA current loop interface.

Each VT100 member consists of a 12-inch diagonal CRT display module and cable-attached modular keyboard. Differences relate to enhanced display capacity (3168 versus 1920 characters), block mode operation, and local echo. The VT125 terminal supports the ReGIS function also found on both VT240 and VT241 terminals. Basically, a VT100 unit with the addition of ReGIS (Remote Graphics Instruction Set), the VT125, runs under BASIC, COBOL, FORTRAN, or Pascal to generate vectors and curves.

Model VT220 comprises a 12-inch adjustable CRT display module with nonglare screen and detachable low-profile keyboard. Model VT240 is a 3-piece unit consisting of a monochrome tilt/swivel monitor (with nonglare screen and choice of white, green, or amber phosphors), detachable low-profile keyboard, and systems box containing power supply and terminal logic. Model VT241 includes a 13-inch RGB color monitor with nonglare screen, detachable low-profile keyboard, and systems box containing power supply and video/graphics logic.

All VT200 models feature 80- or 132-column x 24-line display format, plain-language set-up menu for feature selection in English, French, or German; nonvolatile memory storage of feature settings; CRT Saver feature; Selective Erase feature; and VT102 software compatibility. The CRT Saver feature clears the monitor screen if keyboard activity or input from a host computer has ceased for more than 30 minutes. No data is lost and the monitor is reactivated once input is initiated. The Selective Erase feature erases selected character positions without erasing the entire screen. This function is particularly suited for applications that require data to be inserted into form entries. After a single form entry is completed and the data is sent to the host, the Selective Erase feature can be invoked to clear the form for the next data entry sequence. In addition, 15 of the 20 function keys can be programmed to accommodate special user functions. The downline loadable character loads up to 94 characters into the terminal from the host and handles the design of special characters for specific applications. All VT200 models support 16 different language keyboards, 8 of which are available in customized word processing applications.

Models VT240 and VT241 build upon these capabilities with the addition of bit-map graphics generation in both ReGIS and Tektronix 4010/4014 emulation mode. Both high-end models support an integral modem with auto-answer/auto-dial functions. The top-of-the-line VT241 also supports 2 graphics planes to achieve 4 colors out of a palette of 64.

The entire VT100 family is very flexible and can be easily upgraded to meet changing requirements. For example, the "bread-and-butter" VT100 out of the box provides conventional display, edit, and format features. By adding an advanced video option, the display format expands to 14 lines x 132 characters. By adding graphics or word processing kits, the unit can be expanded to support those functions.

For rugged environments, DEC offers special versions of the VT100 and 102. Called the RT100/102, they are equipped with an industrial enclosure and a membrane keyboard.

Most of the VT100 family terminals, along with the VT220, will support an RS-232C serial printer port. The printer port, available for VT240 and VT241 terminals' is a bidirectional RS-232C interface. When used as an input interface, this port allows data from the attached device to be sent directly to the host. This enables the port to handle non-DEC devices such as mice, digitizers, and wands. When a printer is attached, local print functions can be initiated without host intervention.

For users preferring to purchase printers directly from DEC, the following are available: DECwriter III, Letterprinter 210, LQP02 and LQP03 Letter-Quality Printers, and Personal Printer.

Model Packages

VT100 Video Display Terminal • keyboard-display terminal with 1920-character 24-line x 80-character, and 1848-character 14-line x 132-character capacity • 94-character ASCII set; 32-character special line-drawing graphics set; double-width/double-size characters • bidirectional vertical scrolling; smooth or jump (incremental) scroll; split screen operation • RS-232C/CCITT V.24/V.28 interface:

$1,945 prch	$18 maint

RT100 Video Display Terminal • same as VT100 but with ruggedized case and flat membrane mylar keyboard:

4,300	35

VT101 Video Display Terminal • same feature as VT100 but with local echo:

1,350	15

VT102 Video Display Terminal • same features as VT101 with advanced video feature (3168-character 24-line x 132-character capacity; underline, reverse video, bold, blinking attributes; custom character sets), and local printer RS-232C interface:

1,595	22

RT102 Video Display Terminal • same as VT100 but with ruggedized case and flat membrane mylar keyboard:

4,300	35

PRCH: purchase price. MAINT: monthly maintenance charge. NA: not available/applicable. NC: no charge. Prices current as of January 1985.

Digital Equipment VT100/VT200 Video Display Terminals
Models VT100, VT101, VT102, VT125, VT131, VT220, VT240 & VT241

VT125-AA Video Display Terminal • same overall feature of VT100 but with graphics capability • executes DEC's ReGIS (Remote Graphics Instruction Set); works with BASIC, COBOL, FORTRAN, or Pascal; produces bit-map graphics and generates vectors and curves • 768x240 pixel graphic resolution • serial printer port • color output optional:

3,800	32

VT125-WA Video Display Terminal • same features as VT125-AA but with advanced video feature and word processing keyboard:

3,995	38

VT131 Video Display Terminal • same features as VT102 with block mode transmission:

1,695	25

VT220 Video Display Terminal • keyboard-display terminal with 1920-character 24-lines x 80- or 132-characters • 94-character ASCII set; 32-character special line-drawing graphics set; multinational character set support; multiple language keyboards and word processing keyboards available • double-width/double-size characters; normal or reverse video, blinking, underline, bold attributes; plain-language set-up menu in English, German, or French; bidirectional vertical scrolling; smooth or jump (incremental) scroll; split screen operation • CRT Saver feature; Selective Erase feature • local echo selectable; composite video output for auxiliary monitors; serial printer port; universal power supply • RS-232C, RS-243/CCITT V.24 interface:

1,395	9

VT240 Video Display Terminal • same overall features as VT220 with the addition of graphics capability • executes ReGIS (Remote Graphics Instruction Set) or Tektronix 4010/4014 graphics protocols • 800x240 pixel graphic resolution; 2 graphics planes to achieve 4 shades of grey; optional integral 300/1200 bps modem with auto-answer/auto-dial capability:

2,195	16

VT241 Video Display Terminal • same overall features as VT240 but with a 13-inch RGB color monitor • 2 graphics planes included to achieve 4 colors out of a palette of 64:

3,195	26

☐ CPU & Memory

The standard VT100/VT200 Series terminals have conventional logic, buffer memory, and ROM to support interactive terminal operations.

☐ I/O & Communications

All members of the VT100/VT200 Video Display Terminal Series support point-to-point asynchronous full-duplex ASCII communications at switch-selectable rates of 50/75/110/150/200/300/600/1200/1800/2000/2400/3600/4800/9600/19.2K bps. Data transmission occurs over standard RS-232C interface for VT100 Series and occurs over standard RS-232C and RS-423 interface for VT200 Series. 20-mA loop interface is optional for VT100 Series, standard for VT200 Series. Transmission may occur at one speed independent of reception speed. Incoming data is stored in a 64-character buffer for first-in/first-out (FIFO) processing, with the host or network flagged for stop/start transmission in relation to space available in the buffer.

Keyboard setup also provides for establishing 7- or 8-bit character size; for even/odd/none parity; for XON/XOFF control codes; auto-answerback message; DEC VT52 compatible/ANSI mode operation (VT100 Series); and DEC VT52/VT100 compatible/ANSI mode operation (VT200 Series). Character/block mode transmission is also selectable on the VT131; other models transmit in character-only mode.

VT1XX-AA Interface • 20-mA loop interface for VT100 Series terminals • active/passive mode operation:

$140 prch	$4 maint

VT1XX-CA Interface • converts RS-232C interface to 20-mA current loop interface • includes BC05F-15 cable • operates with VT100/101/102/125/131:

140	4

BC03M-25 Null Modem Cable • 25-foot local connect cable:

70	NC

BC03M-A0 Null Modem Cable • 100-foot local connect cable:

140	NC

BC03M-B5 Null Modem Cable • 250-foot local connect cable:

200	NC

BC03M-E0 Null Modem Cable • 500-foot local connect cable:

340	NC

BC03N-L0 Null Modem Cable • 1,000-foot local connect cable:

680	NC

VT1XX-AC Printer Interface • local RS-232C printer interface for VT100 Series • standard on VT102 and VT103:

350	7

VT1XX-CA Floppy Disk Interface • interfaces additional RX-180 mini-diskette drive to VT100 equipped with VT18X Intelligent Upgrade and VT180:

140	4

☐ Disk

No disk/diskette is supported.

☐ Terminals/Workstations

VT100 Configuration • tabletop keyboard-display with modular keyboard; 83-key typewriter-style keyboard with separate numeric key cluster and 4 program function keys.

VT200 Configuration • tabletop keyboard display with modular low-profile keyboard; 105-key typewriter-style keyboard with separate numeric key cluster and 20 function keys, 15 of which are programmable (DEC VT220) • tabletop keyboard display with modular low-profile keyboard and systems box containing power supply and logic; 105-key typewriter-style keyboard with separate numeric key cluster and 20 function keys, 15 of which are programmable (DEC VT240/241) • the different language keyboards, 8 of which are available in special word processing configurations (DEC VT200 Series).

Display • 12-inch diagonal (VT100 Series); tilt/swivel 12-inch diagonal (VT220,VT240); tilt/swivel 13-inch diagonal (VT241) • 7x9 matrix • selectable 1920-character capacity at 24 lines x 80 characters or 1848-character capacity at 14 lines x 132 characters (VT100 and VT101); 1920-character capacity at 24 lines x 80 characters or 132 characters (VT200 Series); 3168-characters at 24 lines x 132 characters (VT102 and VT131) • double-width/double-size characters (all models) • 94 ASCII set (VT100, VT101, and VT200 Series); 127-character ASCII set (VT102 and VT131) • 32-character special line graphics (all models) • CRT Saver feature (standard on all VT200 models) • selectable blinking block/underline cursor, reverse video, split screen.

Edit & Format Features • auto-repeat keys • cursor up, down, left, right, home; tab (all models); backtab and auto-tab (VT102 and VT131); backspace; selectable wraparound, return/return-line feed (all models) • bidirectional scroll, smooth or jump scrolling (all models) • cursor address read-write (all models) • erase to EOL/EOS, BOL/BOS; clear (all models) • character and line insert/delete, clear unprotected field (VT102 and VT131) • protected fields (VT131) • video attributes include selectable combination of blinking, bold, underlining, and normal or reverse video (VT200 Series and VT102 and VT131) • send/print line/message/screen (VT102 and VT131).

Peripherals • auxiliary RS-232C interface supports printer on all VT100 Series models • bidirectional RS-232C interface supports local print functions without host intervention on VT240/241 models.

VT24X-AA Integral Modem-/Auto-Dialer • consists of circuit board installed inside VT240/241 system box and allows user to dial through to a host computer directly from the keyboard or

Digital Equipment VT100/VT200 Video Display Terminals
Models VT100, VT101, VT102, VT125, VT131, VT220, VT240 & VT241

select from 1 of 2 telephone numbers stored in nonvolatile memory:

$495 prch	$6 maint

VT1XX-AB Advanced Video • provides 3168-character at 24-line x 132-character capability; user-programmable 127 ASCII set; blink, intensity, underline, reverse video attributes • standard on VT102 and VT131:

140	4

VT1XX-CB Graphics Upgrade Kit • converts VT100 to VT125 graphics functionality • 768x240 pixels; produces bit-map graphics and generates vectors and curves • executes ReGIS:

1,800	11

VT1XXCE Word Processing Upgrade Kit • converts VT100/125 and VT200 Series to word processing functionality • keyboard compatibility with DECword/DP and DECmail electronic mail system:

395	NA

VT1XX-SA Tilt/Swivel Base Assembly • provides upward tilt of 15 degrees, downward tilt of 7.5 degrees, and 180-degree swivel • usable with entire VT100 family:

89	NA

VT1XXFX Antiglare Panel • reduces glare on all screens of VT100 family • available in gray, green, and bronze:

60	NA

☐ Printer

DEC offers a host of printers which attach to the terminal through an RS-232C serial interface, and may receive data either directly from the host or from the terminal. Typical of the printers available are the LA120 DECwriter III, LQP02 letter-quality printer, and the LA50 personal letter printer.

LA120 DECwriter III • KSR • 1K/4K buffer • typewriter-type keyboard with numeric keypad • 180 cps 7x7 matrix impact • 96 ASCII; APL character sets • 132 columns at 10 cpi; 174 columns at 13.2 cpi; 217 columns at 16.5 cpi; 66 columns at 5 cpi; 80 columns at 6 cpi; 88 columns at 6.6 cpi; and 108 columns at 8.25 cpi • 2/3/4/6/8/12 lpi • 15-inch tractor platen • horizontal tab • vertical format control • bidirectional print • 50 to 9600 bps • half-/full-duplex • ASCII code • RS-232C or 20-mA current loop interface • odd/even/none parity • answerback:

$2,420 prch	$32 maint

LQP02 Letter-Quality Printer • RO • 256-character buffer • 32 cps full-character daisy-wheel • 96 ASCII character set • 10/12/15 cpi 14.87-inch friction platen • variable pitch lines/characters • interchangeable character fonts • 75 to 9600 bps • ASCII code • odd/even/mark/space parity:

2,800	29

LA50 Personal Printer • RO • 2K-character buffer • 50/100 cps 7x9/18x9 matrix impact • 128 ASCII character set • 40 to 132 columns at 10/12/16/5 cpi plus expanded • 8.5-inch tractor platen • 123x72 graphics • programmable TOF, tabs, margins • 110 to 4800 bps • ASCII code • odd/even/mark/space parity:

850	14

LA210 Letterprinter • RO • 2K-character buffer • 40/80/240 cps, 7x9/33x18/33x9 matrix impact • 15-inch tractor platen • prints in 10 languages plus VT100 line-drawing characters • equipped with Courier 10 font with over 30 optional font cartridges • 50 to 9600 bps • ASCII code • odd/even/mark/space parity • RS-232C interface:

1,595	28

LQP03 Letter-Quality Printer • RO • 256-character buffer • 25 cps Shannon text at 10 cpi/34 cps triple-A text at 12 cpi • daisy-wheel • ASCII and multinational character set • variable pitch/lines/characters • interchangeable character fonts • 110 to 9600 bps • odd/even/mark/space parity:

1,395	23

• **END**