Northern Telecom Displayphone

datapro ANALYSIS

UPDATE: *In May 1987, Northern Telecom announced that it discontinued manufacture of Displayphone PLUS, Displayphone PLUS Direct Connect, and Displayphone 1000. The Displayphone 220 represents the first of a family of new terminals from Northern Telecom. The Displayphone 220 will be the product of choice for the marketplace, and future enhancements will center around the Displayphone 220 product family. Maintenance and repair support for Displayphone PLUS, Displayphone PLUS Direct Connect, and Displayphone 1000 will continue from Displayphone Service Depots for a period of three years.*

Northern Telecom opened up the integrated voice/data terminal (IVDT) market with the February 1981 introduction of the first version of the Displayphone. The first commercially available device of its kind, the Displayphone integrates voice and data capabilities in a conventional telephone handset and accompanying telephony features. The Displayphone attracted a great deal of interest in the computer industry, particularly among workstation vendors. Many vendors were interested in bringing their products to executive desks; thus, the Displayphone was a factor in the emergence of a new class of equipment—the executive/professional workstation.

The Northern Telecom Displayphone 220, the newest addition to the company's Displayphone line of IVDTs, includes a nine-inch amber display screen; an integral telephone handset; a retractable/detachable keyboard; and an optional, integral 300/1200 bps modem. The unit also supports Digital VT220, VT100, and VT50 emulation.

VENDOR: Northern Telecom Inc., 640 Massman Drive, Nashville, Tennessee 37210. Telephone (800) 558-9936.
IN CANADA: Northern Telecom Ltd., 30 Norelco Drive, Weston, Ontario M9L 2X6. Telephone (416) 749-0110
MODELS: Displayphone 220 and Displayphone SL-1.
COMPETITION: AT&T, Davox, Rolm, and Inte-Com/Wang.
PRICE: Displayphone 220 is priced at $895 or $1,095 with an optional internal modem. Displayphone SL-1 is priced at $1,595.

REPORT HIGHLIGHTS: **PAGE**

The key to acceptance was to convince executives that computer-based workstations are a valuable decision-making tool, not simply a fancy machine for clerical work. Thus, adding telephony features to a compact data terminal was seen as a major step toward their acceptance in the executive suite. This acceptance, however, has been grudging at best. The companies that targeted the executive market failed to achieve significant success.

Successful integrated terminal vendors turned away from "executive row" toward the growing ranks of knowledge workers, particularly those in communications-intensive applications. Companies are learning that expanding the use of their databases, permitting access below the corporate rank to workers who are in the mainstream of company output, brings numerous benefits. There is a learning process, and a cautious approach is often best, but the practice is gaining momentum. IVDTs are proving the viability of integrating voice and data in a single workstation.

Since the Displayphone's introduction, a number of vendors have introduced IVDT products, in hopes of capturing a share in what many thought would be a lucrative market. Unfortunately, the market has not grown as these vendors had hoped. The reason for the sluggish market is not IVDT preformance; rather, it is the lack of applications for these devices, and, as mentioned previously, targeting the wrong users. Although IVDTs have proved useful in a variety of applications, users have not found a

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major application that would cause this market to explode. Until such an application is found, the IVDT market will likely continue to grow slowly.

The Displayphone is one of the most successful IVDT products. In fact, it possesses the largest installed base of any IVDT product in the market (an estimated 45 percent share by mid-1987). Of course, the Displayphone had a major head start on its competition. After initial problems with some features found on the original Displayphone, Northern Telecom enhancements made it an attractive choice. End-user comments and suggestions were major factors in the design and development of the new Displayphone 220, along with a study of the data equipment installed base to which an IVDT interfaces.

Currently, Northern Telecom offers two Displayphone models. The Displayphone 220 is the standard model in the line, for use both as a standalone unit or with a PBX. The Displayphone SL-1 is designed specifically for use with Northern Telecom's SL-1 PBX.

The Displayphone 220 continues Northern Telecom's commitment to its Open Protocol Enhanced Networks (OPEN) World strategy, which the company announced in 1982. The OPEN World concept is based on the premise that products should be compatible with other technologies and with user needs. Likewise, products should be capable of integrating with systems made by other manufacturers. The strategy certainly isn't revolutionary—it is the same strategy that local area network vendors used to bring that market to its full potential. It is a philosophy that now dominates the computer and communications industry, and in that sense Northern has certainly come in on the "ground floor." The company committed a billion dollars to research and development in the OPEN World program, so users of the Displayphone and other Northern products can preserve their investments into the future.

Standard Displayphone 220 features include a nine-inch display, a retractable/detachable keyboard with full-size keys, an integrated telephone handset, 10 soft-function keys, and a compact enclosure size. Telephony features include a built-in speaker, a telephone directory that stores up to 90 entries, and last-number redial. Two telephone lines are available—either line is used for voice calls and the second line for data calls. The Displayphone handles voice and data transmissions simultaneously.

MARKET POSITION

As mentioned previously, the Displayphone was the first commercially available product of its kind and has one of the largest installed bases of any IVDT product. The vendors that followed Northern Telecom into this market can be divided into three groups: PBX/communications vendors (a group which includes Northern), high-technology start-ups, and traditional data terminal vendors.

Of the first group, Rolm, AT&T, and InteCom/Wang have introduced IVDT products. Rolm's Cypress IVDT is the Displayphone's direct competitor; it is a compact terminal with a nine-inch display, IBM and Digital Equipment Corporation terminal compatibility, and one-button access to Rolm PhoneMail. Rolm also markets Juniper, an add-on product for the IBM PC. AT&T introduced the BCT 515 and the Personal Terminal Model 510, both of which are designed for use with the company's System 75 and System 85 PBXs. The Model 510 is the first IVDT with a touch-sensitive display.

Davox has been the most successful of start-up IVDT firms. Unlike the other members of this group, its IVDT products are aimed at the IBM 3270 replacement market.

The traditional data terminal vendors have stayed out of the IVDT market for the most part. Liberty Electronics did, however, introduce versions of its standard display terminals that include an integral modem, which attach to a standard telephone handset.

Competition in the IVDT market is fragmented. Datapro believes that PBX vendors, such as Northern Telecom, Rolm, and AT&T, will continue to dominate. The primary market for IVDT products will be as add-ons to PBXs. Until major applications for the IVDT develop, however, the market will continue to be limited.

PRODUCT EVALUATION

Northern Telecom has constantly upgraded and enhanced the Displayphone. A major source of dissatisfaction with the original Displayphone product was its "chiclet"-style keyboard. Northern has replaced that keyboard with one having full-size keys, but the overall keyboard size has not changed, and it can still be stored within the unit's base when not in use. In fact, the compact size of the Displayphone ranks as a major advantage; it occupies minimal desk space.

In its present form, the Displayphone product packs significant data and voice capabilities into a compact device. All models feature multiline support for simultaneous voice and data transmission, a 90-number telephone directory, call hold, automatic dialing, hands-free dialing, last-number redial, call forwarding, single-key logon, and an alert function that signals an incoming data call.

Also available in the line is the Displayjet, an ink jet printer designed specifically for use with the Displayphone.

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SPECIFICATIONS

MODELS: Displayphone 220 and Displayphone SL-1.
DATE ANNOUNCED: Displayphone 1000—February 1981; Displayphone PLUS—September 1984; Displayphone SL-1—February 1983; Displayphone PLUS-DC—February 1986; Displayphone 220—October 1986.
DATE OF FIRST DELIVERY: Displayphone 1000—February 1981; Displayphone SL-1—June 1983; Displayphone PLUS—October 1984; Displayphone PLUS-DC—March 1986; Displayphone 220—October 1986.
NUMBER INSTALLED TO DATE: Over 50,000.

MODELS

The newest Displayphone family of products consists of two models. These models are described briefly in the following paragraphs.

Displayphone 220—a version of the Displayphone that features full Digital Equipment Corporation VT220, VT100, and VT52 emulation. The Displayphone 220 consists of a nine-inch display, an integral handset, an integral upper keyboard, and a retractable/detachable lower keyboard. An internal 212A-type modem is optional. A conferencing unit for speakerphone use is also optional. The Displayphone 220 can be used as a standalone IVDT or in conjunction with a PBX.

Displayphone SL-1—a version of the Displayphone designed exclusively for use with Northern's SL-1 PBX. The Displayphone SL-1 combines features found on Northern's SL-1 telephone with Displayphone features and functions. The Displayphone SL-1 includes a seven-inch display, an integral handset, a speakerphone, an integral upper keyboard, and a retractable lower keyboard. Data calls can be placed at speeds from 75 to 1200 bps.

DATA FEATURES

Displayphone 220 is available with an optional internal 300/1200 bps (selectable), Hayes-compatible, 212A-type modem. The internal modem provides full-duplex operation in originate or auto answer modes and includes a provision for setting odd/even/mark/no parity. As an option, one can use an external 19.2K bps modem with the Displayphone 220.

The Displayphone SL-1 transmits digital data over an SL-1 PBX line at speeds ranging from 75 to 1200 bps. For data calls, the Displayphone SL-1 dials up the SL-1 modem pool for communications over an analog network.

For more information on the Northern Telecom SL-1 PBX, see Report TC07-674MR-101 in Volume I.

The Displayphone 220 provides two-line operation. Two modular telephone jacks (USOC RJ11) are included. The unit processes voice and data calls simultaneously. The Displayphone SL-1 operates over two voice lines and one data line (the second voice line can be assigned as DN, Dial Intercom, Group Call, Voice Call, or Private Line). The Displayphone SL-1 is used only with the Northern Telecom SL-1 PBX; the Displayphone 220 is compatible with most PBXs. An optional Keyset Adapter, for operation in a key telephone system, is available.

Displayphone 220 models include a serial RS-232C/RS-422 interface port for connection to a local computer, an external modem, a local area network, or a serial printer. Data rates are selectable up to 19.2K bps. Displayphone 220 includes ports for connection to an IBM Personal Computer and a Centronics-compatible parallel interface port for the connection of a printer, such as Northern's Displayjet.

All models provide the following data features: menu-driven setup and parameter selection, automatic or semi-automatic logon sequences, data security (three-day memory backup, extended memory backup), electronic mail, local editing, reminder messaging, and a date/time display on the screen. Video attributes available on all models include blinking field, highlight, underline, and reverse video. Displayphone users can place data calls simultaneously with voice calls; one can dial calls manually or from the directory. The Displayphone models communicate with local or remote asynchronous host computers, as well as with public data bases such as Dow Jones, CompuServe, and The Source.

The Displayphone 220 provides full Digital VT220, VT100, and VT52 emulation. It also provides for connection to an IBM PC. When used with the SL-1 System 36 Gateway, the Displayphone can emulate an IBM 5251 Model 11 display station to access IBM System/34, System/36, and System/38 host computers; it can also emulate an IBM 3270 terminal when used with the SL-1/3270 Protocol Converter.

VOICE FEATURES

Either line on the Displayphone supports voice calls; when someone picks up the handset, voice calls are automatically answered on line one. To dial manually, the user presses a line key and makes the call through the standard telephone dial pad on the upper keyboard. The dialed number appears on the upper left-hand side of the display

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screen. When the call is answered, the user lifts the handset. A caller can check numbers for errors before dialing through the predial feature.

Users can also place calls through the Displayphone's directory, which stores up to 90 entries. The user presses the **directory** key on the upper keyboard, selects the number to be called from the menu on the screen, and presses that number on the dial pad or lower keyboard. When the **line** key is pressed, Displayphone automatically dials the call. Frequently called numbers are stored in a recall list by pressing the soft-function key on the upper keyboard that signals "keep" when the number is being dialed. Through the **redial** key, also on the upper keyboard, users can automatically redial the last number called on line one or two.

Calls are put on hold manually by pressing the **hold** key; calls are held automatically through the **line** key. The loudspeaker includes an adjustable volume control, located on the upper keyboard. Calls are ended by replacing the handset or pressing the **release** key on the upper keyboard.

COMPONENTS

CRT DISPLAY UNIT: A nine-inch (diagonally measured) display screen is standard on Displayphone 220 models. Users select display formats of either 24 lines by 80 characters or 24 lines by 132 characters. A 25th line is reserved for the labeling of soft-function keys. Characters are formed using a 7-by-9 dot matrix in a 10-by-12 character field. Displayphone 220 displays characters in amber on a dark background.

A seven-inch (diagonally measured) display screen is standard on the Displayphone SL-1 models. Selectable formats of 24 lines by 40 characters or 24 lines by 80 characters are provided, with a 25th line reserved for labeling of soft-function keys. Characters are formed using a 5-by-7 dot matrix in a 7-by-10 character field. Displayphone SL-1 displays characters in white on a dark background.

All models display the 96 ASCII and 64 ANSI graphic character sets; the Displayphone 220 also displays VT100 graphic characters. Displayphone provides two separate display pages: one for data and one for telephony features.

HANDSET: An integral telephone handset is located to the left of the display screen on the Displayphone enclosure. Speaker volume control is located on the left side of the upper keyboard.

UPPER KEYBOARD: An integral upper keyboard contains 10 screen-labeled soft-function keys on the Displayphone 220, 5 screen-labeled soft-function keys on the Displayphone SL-1, a standard telephone dial pad, and the following dedicated keys:

delete—deletes numbers dialed using the predial feature; each time the key is pressed, the cursor backspaces and erases one character;

directory—displays the Directory Index; pressing the key a second time clears the screen;

enter—enters pauses ("+" on the display) when one enters numbers in the directory; during a data session, this key performs the carriage return function;

hold—places a busy line on hold.

line 2—accesses line two for placing or answering a call; line two is used to make data calls;

line 1—accesses line one for placing or answering a call;

link—transmits a switchook flash (Displayphone 220 only);

on/off—turns the screen on or off;

PF keys—provide Digital Equipment function key emulation when using the Displayphone 220 in VT220, VT100, or VT50 mode. The PF keys perform calculator functions when the Displayphone 220 is used in the calculator mode. (These keys do not appear on the Displayphone SL-1.);

redial—causes the last number dialed to be displayed in the upper left corner of the screen; pressing a free line key causes that number to be redialed;

release—releases a busy line when a call is being terminated;

screen—when a data session is in progress, the **screen** key returns to the data display after a feature is used;

services—displays the Services Index from which the various Displayphone services can be accessed; pressing the key a second time clears the screen; and

volume—increases or decreases the speaker volume on the Displayphone 220. On the Displayphone SL-1, the volume control is located behind the handset, in front of the loudspeaker grill.

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The keys on the upper keyboard are touch sensitive; Northern Telecom recommends that sharp objects (such as pens) not be used to press the keys.

LOWER KEYBOARD: Displayphone 220s come with a 62-key, full-travel, QWERTY-style keyboard, which retracts into the base of the Displayphone or is detached when not in use. Displayphone SL-1s come with a 55-key, full-travel typewriter-style keyboard, which retracts into the base of the Displayphone when not in use. The keyboard generates 128 ASCII codes. Auto repeat and two-key rollover are standard; audible key click (tactile feedback) is selectable. Keycaps are changeable to accommodate special key designations for other terminal types, such as the IBM 3278.

DISPLAYJET PRINTER: The Displayjet is an ink jet printer used with the Displayphone 220. It is a compact, portable printer that combines the printhead with an ink reservoir in a disposable unit. Characters are formed by spraying ink onto the paper through tiny holes in the printhead; noise is minimized (less than 50 dB) because the printhead never touches the paper. The Displayjet prints at a speed of 150 cps, using 11-by-12 dot matrix characters. It accommodates multiple print sizes and prints 12 languages.

PRICING

Northern Telecom Displayphone IVDTs and accessories are available for purchase or lease; discounts are available. Maintenance contracts are available on an annual installment or per-call service basis. Distribution is nationwide through Northern Telecom's direct sales force, local telephone operating companies, and authorized distributors.

A one-year warranty on parts from the day of installation is included in the purchase. Northern Telecom or an authorized distributor provides training at the time of installation.

EQUIPMENT PRICES

	Purch. Price ($)	Annual Maint. ($)
Displayphone 1000	—	100
Displayphone 220	1,095	185
Displayphone 220-DC	895	185
Displayphone SL-1	1,595	125
Keyset Adapter	35	—
Coax Adapter	925	45
3270 Keycap Kit	25	—
Displayjet Printer	495	48
Displayjet Printer Cable	50	—
Unity Conferencing Unit	165	—

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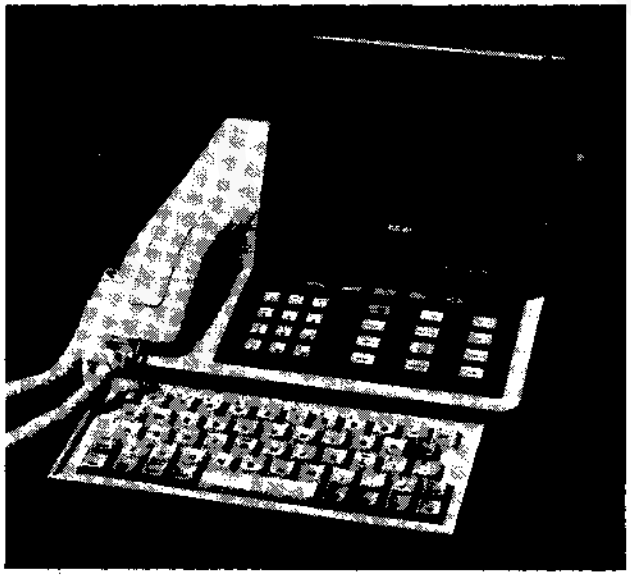
MANAGEMENT SUMMARY

Northern Telecom opened up the integrated voice/data terminal (IVDT) market with the introduction of the first version of the Displayphone in February 1981. The first commercially available device of its kind, the Displayphone integrated voice capabilities with data capabilities through the addition of a conventional telephone handset and accompanying telephony features. The Displayphone attracted a great deal of interest in the computer industry, particularly the workstation segment. Many vendors were interested in bringing their products to executive desks; thus, a new class of equipment had emerged, the executive/professional workstation.

The key to the acceptance of these devices was seen to lie in the convincing of executives that these devices could prove to be a valuable decision-making tool, not just a device designed to facilitate clerical work. Thus, the addition of the telephone. Since a great deal of today's corporate business is transacted over the telephone, the addition of telephony features to a compact data terminal was seen as a major step toward their acceptance in the executive suite. This acceptance, however, has never materialized. The companies who targeted this segment of the market, like the now-bankrupt Zaisan, have failed to achieve any significant amount of success. However, IVDTs themselves have been successful in proving the viability of the integration of voice and data in a single workstation.



The Northern Telecom Displayphone PLUS is the newest addition to the company's Displayphone line of IVDTs. The Displayphone PLUS includes a 7-inch amber display screen, integral telephone handset, retractable keyboard, and an integral 300/1200 bps modem. The unit also includes downloadable terminal emulations of several popular ASCII terminal models.

Northern Telecom's Displayphone was the first commercially available integrated voice/data terminal (IVDT) on the market. Since its inception, the Displayphone has received a number of enhancements and improvements; it is now available in four models. The Displayphone features basic voice and data features, plus electronic mail capability. Voice and data calls can be handled simultaneously by the Displayphone.

MODELS: Displayphone 1000, Displayphone PLUS, Displayphone PLUS-Direct Connect, and Displayphone SL-1.
DISPLAY: All models feature a 7-inch (diagonal) screen with a 1,920-character display capacity. Characters are displayed in white on the Displayphone 1000 and Displayphone SL-1, and in amber on the Displayphone PLUS and Displayphone PLUS-DC.
KEYBOARD: A full-travel, typewriter-style keyboard is standard for the Displayphone 1000, Displayphone PLUS, and Displayphone PLUS-DC.; the Displayphone SL-1 includes a data entry-style keyboard. The keyboards are retractable and can be stored inside the terminal's base. The Displayphone models also feature an integral upper keyboard, just below the display. This keyboard includes the softkeys, dial pad, and service and feature control keys.
INTEGRATED HANDSET: An integrated handset is mounted to the left of the display. A speakerphone is located near the handset.
COMPETITION: AT&T BCT 515 and Personal Terminal Model 510; GTE XT300E ActionStation; InteCom/Wang Keystone; ITT Telecom InfoStation; Rolm Cypress; Ambi AmbiSet; and others.
PRICE: Base prices range from $995 to $1,595.

CHARACTERISTICS

MANUFACTURER: Northern Telecom Inc., 565 Marriott Drive, Nashville, TN 37210. Telephone (615) 885-3510. IN CANADA: Northern Telecom Ltd., 7350 Trans Canada Highway, Villes St. Laurent, Quebec H4T 1A4. Telephone (514) 331-9611.

MODELS: Displayphone 1000, Displayphone PLUS, Displayphone PLUS-Direct Connect, and Displayphone SL-1.

DATE ANNOUNCED: Displayphone 1000—February 1981; Displayphone PLUS—September 1984; Displayphone SL-1—February 1983; Displayphone PLUS-DC—February 1986.

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Since the introduction of the Displayphone, a number of vendors have introduced IVDT products, in hopes of capturing a share in what many thought would be a lucrative market. Unfortunately for these vendors, the market has not grown to be nearly as large as these vendors had hoped. The reason for the sluggishness of this market is not the IVDTs themselves; rather, it is the lack of applications for these devices, and, as we mentioned before, the targeting of the wrong segment of users. Although IVDTs have proven their usefulness in a variety of applications, users have yet to find that one major application that would cause this market to explode. Until this application is found, the IVDT market will likely continue its current slow rate of growth.

The Displayphone, however, has been among the most successful of the IVDT products introduced to date. In fact, it possesses the largest installed base of any IVDT product on the market (an estimated 68 percent share by the end of 1984). Of course, the Displayphone had a major headstart on its competition. However, after some initial problems with some features found on the original Displayphone, enhancements have made the product an attractive choice for potential users.

Currently, Northern Telecom offers four models of the Displayphone. The Displayphone 1000 is the standard model in the line, for use both as a standalone model or with a PABX. The Displayphone PLUS, an enhanced version of the Displayphone 1000, is a general-purpose IVDT that features emulation of standard display terminals from Digital Equipment Corporation, IBM, Data General, Applied Digital Data Systems (ADDS), Hazeltine, and TeleVideo. The Displayphone PLUS-Direct Connect is a direct-connect version of the Displayphone PLUS. The Displayphone SL-1 is designed specifically for use with Northern Telecom's SL-1 PABX.

The Displayphone PLUS continues Northern Telecom's commitment to its OPEN (Open Protocol Enhanced Networks) World strategy, a strategy that the company first announced in 1982. The OPEN World concept is based on the premise that products should be compatible with other technologies and with user needs. Likewise, products should be able to be integrated with systems made by other manufacturers. This strategy certainly isn't a revolutionary one—it is the same strategy that the local area network vendors hope to use to bring that market to its full potential. It *is* a strategy that will soon dominate the computer and communications industry, however, and in that sense Northern has certainly gotten in on the "ground floor." The company has made a billion-dollar commitment to research and development in the OPEN World program, so users of the Displayphone and other Northern products will be able to preserve their investment over time.

Features standard to all Displayphone models include a 7-inch display, retractable keyboard with full-size keys, integrated telephone handset, five soft function keys, and a compact enclosure size. Telephony features include a built-in speakerphone, a telephone directory that can store up to 90 entries, and last-number redial. Two telephone lines are

DATE OF FIRST DELIVERY: Displayphone 1000—February 1981; Displayphone PLUS—October 1984; Displayphone SL-1—June 1983; Displayphone PLUS-DC—March 1986.

NUMBER INSTALLED TO DATE: Over 30,000.

MODELS

The Displayphone family of products currently consists of three models. These models are described briefly in the following paragraphs.

Displayphone 1000—an enhanced version of the original Displayphone. The Displayphone 1000 is a standalone IVDT that includes a 7-inch display, integral handset, speakerphone, integral upper keyboard, and retractable lower keyboard. An internal 300 bps, 103-type modem is standard. The Displayphone 1000 can be used as a standalone IVDT or in conjunction with a PABX. It is compatible with the IBM 3101 and a subset of the ANSI X3.64 standard.

Displayphone PLUS—a version of the Displayphone that features four terminal configurations including full Digital Equipment Corporation VT100 and VT52 emulation, IBM 3101 cursor addressing, and ANSI X3.64 cursor addressing. A fifth cursor-addressing protocol allows the Displayphone PLUS to emulate terminals from Applied Digital Data Systems (ADDS), Data General, Hazeltine (Esprit Systems), and TeleVideo. Like the Displayphone 1000, the Displayphone PLUS consists of a 7-inch display, integral handset, speakerphone, integral upper keyboard, and retractable lower keyboard. An internal 300/1200 bps, 212A-type modem is standard. The Displayphone PLUS can be used as a standalone IVDT or in conjunction with a PABX.

Displayphone PLUS-Direct Connect—a direct-connect version of the Displayphone PLUS.

Displayphone SL-1—a version of the Displayphone designed exclusively for use with Northern's SL-1 PABX. The Displayphone SL-1 combines features found on Northern's SL-1 telephone with Displayphone features and functions. Like the other Displayphone models, the Displayphone SL-1 includes a 7-inch display, integral handset, speakerphone, integral upper keyboard, and retractable lower keyboard. Data calls can be placed at speeds from 75 to 1200 bps.

TRANSMISSION SPECIFICATIONS

The Displayphone 1000 includes an internal 300 bps (fixed), Bell 103-type modem. The internal modem provides full-duplex operation in an originate-only mode, and includes a provision for setting odd/even/mark parity. The Displayphone PLUS includes an internal 300/1200 bps (selectable), Bell 212A-type modem. The internal modem provides full-duplex operation, in originate or auto answer modes, and includes a provision for setting odd/even/mark/none parity. An external modem, with speeds up to 9600 bps, may be optionally used for both the Displayphone 1000 and Displayphone PLUS. The Displayphone SL-1 transmits digital data over a line of the SL-1 PABX, at speeds from 75 to 1200 bps. For data calls, the Displayphone SL-1 dials up the SL-1 modem pool for communications over an analog network.

The Displayphone 1000 and Displayphone PLUS provide two-line operation. Two modular telephone jacks (USOC RJ11) are included. Voice and data calls can be made simultaneously. The Displayphone SL-1 operates over two voice lines and one data line on the SL-1 (the second voice line can be assigned as DN, Dial Intercom, Group Call, Voice Call, or Private Line). The Displayphone SL-1 may be used only with the Northern Telecom SL-1 PABX; the

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available; either line can be used for voice calls, while data calls can be made on the second line. Voice and data calls can be handled simultaneously.

COMPETITIVE POSITION

As we mentioned previously, the Displayphone has one of the largest installed bases of any IVDT product on the market; at the end of 1984, it was reported to hold a 68 percent share of the entire installed base for IVDTs by the Eastern Management Group, a Parsippany, NJ-based market research firm. Introduced in 1981, the Displayphone was the first commercially available product of its kind. The vendors who have followed Northern Telecom into this market can be divided into three groups: PABX/communications vendors (a group which includes Northern), high-technology start-ups, and traditional data terminal vendors.

Of the first group, Rolm, AT&T, Mitel, GTE Communication Systems, ITT Telecom, and InteCom/Wang have introduced IVDT products. Rolm's Cypress IVDT is a direct competitor of the Displayphone; it is a compact terminal with a 9-inch display, IBM and Digital terminal compatibility, and one-button access to Rolm PhoneMail. Rolm has also introduced Cedar, and IBM Personal Computer-compatible version of the Cypress, and Juniper, an add-on product for the IBM PC. AT&T has introduced the BCT 515 and the Personal Terminal Model 510, both of which are designed for use with the company's System 75 and System 85 PABXs. The Model 510 is the first IVDT with a touch-sensitive display.

The start-ups to enter the IVDT fray included Davox, AMBI, Sydis, Cygnet, and Zaisan. Davox has been the most successful of these firms; unlike the other members of this group, its IVDT products are aimed at the IBM 3270 replacement market. Cygnet, which manufactures an add-on product similar to the Rolm Juniper, called CoSystem, has run into financial difficulties and is now selling the CoSystem on a component-by-component basis. Zaisan, a promising company at its inception, has filed for bankruptcy protection and has all but disappeared.

The traditional data terminal vendors have mostly stayed out of the IVDT market. TeleVideo and Matra have introduced personal terminals, designed for easy access to public data bases such as Dow Jones and The Source. Liberty Electronics has introduced versions of its standard display terminals that include an integral modem, and can be attached to a standard telephone handset.

As you can see, the competition in the IVDT market is fragmented. Datapro believes that this market will be dominated by the PABX vendors, such as Northern Telecom, Rolm, and AT&T, and that the primary market for IVDT products will be as add-ons to PABXs. However, until major applications are found for the IVDT, the market for these devices will continue to be a limited one.

ADVANTAGES AND RESTRICTIONS

Since its introduction, the Displayphone has been constantly upgraded and enhanced by Northern Telecom. One

Displayphone 1000 and Displayphone PLUS are compatible with most PABXs. An optional Keyset Adapter, for operation in a key telephone system, is available.

All Displayphone models also include an RS-232-C (serial) I/O port for connection to an asynchronous host computer, with selectable data rates from 75 to 9600 bps; and a parallel I/O port for the connection of a printer (like the Northern Telecom Displayjet).

For more information on the Northern Telecom SL-1 PABX, see Report TC07-674MR-101 in Volume 1.

DATA FEATURES

All models provide the following data features: menu-driven set-up and parameter selection; automatic or semiautomatic logon sequences; data security (3-day memory backup, extended memory backup); electronic mail; local editing; reminder messaging; and a date/time display on the screen. Video attributes available on all models include blinking field, highlight, underline, and reverse video. Data calls may be placed at the same time as voice calls; data calls can be manually dialed, or made from the directory. The Displayphone models can communicate with local or remote asynchronous host computers, as well as with public data bases such as Dow Jones, CompuServe, and The Source.

The Displayphone 1000 is compatible with the IBM 3101 ASCII display terminal, and with a subset of the ANSI X3.64 standard for command code sequences. The Displayphone PLUS provides full Digital VT100 and VT52 emulation, IBM 3101 emulation, and ANSI X3.64 standard compatibility. It also provides for downloadable terminal profiles of popular ASCII terminals manufactured by Applied Digital Data Systems (ADDS), Data General, Hazeltine, and TeleVideo. Northern has also introduced the Coax Adapter (for use with the Displayphone 1000 and Displayphone PLUS), which enables a Displayphone to be connected to a coaxial port on an IBM 3270 control unit, thus emulating an IBM 3278 Model 2 display station. The Displayphone SL-1, when used with the SL-1 System 36 Gateway, can emulate an IBM 5251 Model 11 display station to access IBM System/34, System/36, and System/38 host computers; it can also emulate an IBM 3270 terminal when used with the SL-1/3270 Protocol Converter.

VOICE FEATURES

Voice calls can be answered on either line of the Displayphone; when the handset is picked up, voice calls will automatically be answered on line 1. For handsfree operation, the user presses the line key (on the upper keyboard) which is flashing; the call will then come across over the speakerphone. To dial a call manually, the user presses a line key and makes the call using the standard telephone dial pad on the upper keyboard. The number being dialed appears on the upper left hand side of the display screen. When the call is answered, the user can lift the handset or talk handsfree using the speakerphone. Numbers to be dialed can be checked for errors beforehand using the predial feature. Calls can also be placed using the Displayphone's directory (which stores up to 90 entries). The user presses the directory key on the upper keyboard, then selects the number to be called from the menu on the screen and presses that number on the dial pad. When the line key is pressed, Displayphone will automatically dial the call. Frequently called numbers can be stored in a recall list; this can be done by pressing the soft function key (on the upper keyboard) that signals "keep" when the number is being dialed. The redial key (on the upper keyboard) allows the user to automatically redial the last number called on line 1 or 2.

Northern Telecom Displayphone

of the chief areas of dissatisfaction with the original Displayphone product was its "chiclet" style keyboard. That keyboard has been replaced by one with full-size keys; the overall keyboard size, however, has not changed. The keyboard can still be stored within the unit's base when not in use. In fact, the compact size of the Displayphone ranks as a major advantage; it occupies minimal space on the desk.

Also since its introduction, additional versions of the Displayphone have been introduced. The Displayphone 1000 is the original version in its enhanced form; the company has also added the Displayphone SL-1, designed specifically for use with the company's SL-1 PABX, and the Displayphone PLUS, which provides enhanced data capabilities via its emulation of several popular ASCII terminals. Also new to the line is the Displayjet, an ink-jet printer designed specifically for use with the Displayphone.

In its present form, the Displayphone family of products packs significant data and voice capabilities into a compact device. All models feature: multiline support for simultaneous voice and data transmission; a 90-number telephone directory; call hold; automatic dialing; hands-free dialing; last number redial; call forwarding; a speakerphone; an internal modem; single-key logon; and an alert function that signals an incoming data call.

USER REACTION

During the months of February and March 1986, Datapro, in conjunction with *Data Communications* magazine, conducted the 1986 LAN/Terminal Users Survey. Questionnaires were mailed by Datapro to 15,000 subscribers of *Data Communications*, asking them to report on their experiences with local area networks, display terminals, integrated voice/data terminals, and conversion systems. At the time this report was being written, a total of nine users of the Northern Telecom Displayphone had responded to the survey. The respondents had a combined total of 378 units installed; the largest user had 150 units, while two of the users had only one Displayphone each. These users were asked to rate the Displayphone with regard to six specific categories. Their ratings are summarized in the following table.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	1	6	2	0	2.9
Data capabilities	1	5	3	0	2.8
Voice capabilities	3	5	1	0	3.2
Hardware reliability	4	1	3	0	3.1
Mfr.'s maint. service/ technical support	3	3	1	1	3.0
Overall performance	1	7	0	1	2.9

*Weighted Average based on a scale of 4.0 for Excellent.

The users were asked to identify the factor which *most* influenced their decision to buy a Displayphone. Three users cited the features and/or functionality of the unit, while three others stated that the deciding factor was its low price. One user cited both of the above-mentioned reasons, while another did not give a reason. The remaining user

Calls can be put on hold manually (by pressing the hold key) or automatically (by using the unused line key). Users can switch between manual and handsfree, on the same call, by using the mute handsfree key on the upper keyboard. The loudspeaker includes an adjustable volume control, located behind the handset. Calls can be terminated by replacing the handset, or pressing the release key on the upper keyboard.

COMPONENTS

CRT DISPLAY UNIT: A 7-inch (diagonally measured) display screen is standard on all Displayphone models. Users can select display formats of 24 lines by 40 characters or 24 lines by 80 characters. A 25th line is reserved for the labeling of soft function keys. Characters are formed using a 5-by-7 dot matrix in a 7-by-10 character field. Characters are displayed in white on a dark background on the Displayphone 1000 and Displayphone SL-1, and in amber on a dark background on the Displayphone PLUS and Displayphone PLUS-DC. All models can display the 96 ASCII and 64 ANSI graphic character sets; the Displayphone PLUS can also display VT100 graphic characters.

Displayphone provides two separate display pages; one for data, and one for telephony features.

HANDSET/SPEAKERPHONE: An integral telephone handset and internal speakerphone are located to the left of the display screen on the Displayphone enclosure. Speakerphone volume control is located behind the handset, in front of the loudspeaker grill.

UPPER KEYBOARD: An integral upper keyboard contains five screen-labeled soft function keys, a standard telephone dial pad, and the following dedicated keys:

screen—when a data session is in progress, the screen key is used to return to the data display after a feature is used;

redial—the redial key causes the last number dialed to be displayed in the upper left corner of the screen; pressing a free line key causes that number to be redialed;

delete—the delete key is used to delete numbers dialed using the predial feature; each time the key is pressed, the cursor backspaces and erases one character;

enter—the enter key is used to enter pauses ("+" on the display) when entering numbers in the directory; during a data session, this key performs the carriage return function;

services—the services key is used to display the Services Index from which the various Displayphone services can be accessed; pressing the key a second time clears the screen;

directory—the directory key is used to display the Directory Index; pressing the key a second time clears the screen;

release—the release key is used to release a busy line when a call is being terminated;

on/off—the on/off key turns the screen on or off;

line 2—the line 2 key is used to access line 2 for placing or answering a call; line 2 can be used to make data calls;

line 1—the line 1 key is used to access line 1 for placing or answering a call; and

hold—the hold key is used to place a busy line on hold.

The keys on the upper keyboard are touch-sensitive; Northern Telecom recommends that sharp objects (such as pens) not be used to press the keys.

Northern Telecom Displayphone

had one Displayphone on an evaluation basis. When asked whether or not they would recommend the Displayphone to other users, eight of the respondents answered that they would, while only one (the user with the evaluation unit) stated that he would not. □

LOWER KEYBOARD: A 55-key full-travel, typewriter-style keyboard is included with all models. The keyboard can be retracted into the base of the Displayphone when not in use. The keyboard generates 128 ASCII codes. Auto-repeat and two-key rollover is standard; audible key click (tactile feedback) is selectable. Horizontal key spacing is 0.75 inches (19 mm). Keycaps can be changed to accommodate special key designations for other terminal types, such as the IBM 3278.

DISPLAYJET PRINTER: The Displayjet is an ink-jet printer for use with the Displayphone 1000 and Displayphone PLUS. It is a compact, portable printer that combines the printhead with an ink reservoir in a disposable unit. Characters are formed by spraying ink onto the paper through tiny holes in the printhead; noise is minimized (less than 50 db) because the printhead never touches the paper. The Displayjet prints at a speed of 150 cps, using 11-by-12 dot matrix characters. It can accommodate multiple print sizes, and prints 12 languages.

PRICING

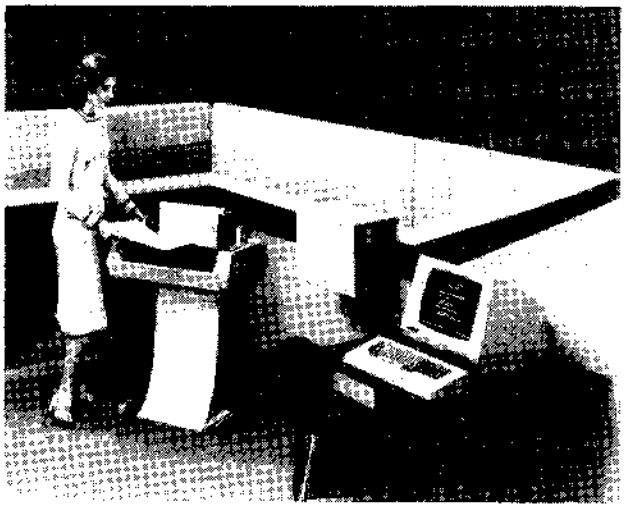
Northern Telecom Displayphone IVDTs and accessories are available for purchase or lease; discounts are available. Maintenance contracts are available on an annual installment or per-call service basis. Distribution is nationwide via the Northern Telecom direct sales force and authorized distributors.

A 90-day warranty on parts from the day of installation is included. Training is provided by the distributor at the time of installation; equipment is installed by Northern Telecom and authorized distributors.

EQUIPMENT PRICES

	Purchase Price ($)	Monthly Maint. ($)
Displayphone 1000	995	100
Displayphone PLUS	1,395	125
Displayphone PLUS-DC	1,095	125
Displayphone SL-1	1,595	125
Keyset Adapter	35	—
Coax Adapter	925	45
3270 Keycap Kit	25	—
Displayjet Printer	495	48
Displayjet Printer Cable	50	— ■

Northern Telecom Systems Corp. 290 Display System



This basic Model 296 configuration consists of the controller (mounted on the wall panel), a 1920-character display, a 78-key typewriter-style keyboard with a 12-key Program Function Key cluster, and a Sprinter impact matrix printer.

Plug-for-plug replacements for components of IBM's 3270 Information Display System.

The 290 System supports up to 16 1920-character display stations or 66, 120, or 180 cps printers in any combination in local environments and in remote environments operating under BSC or SDLC line disciplines.

A Model 296 remote mini-cluster with 2 display stations and a 66-cps printer leases for $227 per month, including maintenance, on a three-year lease.

A Model 291 remote cluster of 15 display stations and a 66-cps printer leases for $912 per month, including maintenance, on a three-year lease.

MANAGEMENT SUMMARY

Northern Telecom Systems Corporation was founded in 1978 by its parent company, Northern Telecom Limited, from the merger of two of its acquisitions, Data 100 Corporation and Sycor, Inc. The new company, under whose name the product lines of both Sycor and Data 100, including the 290 Display System, are now being marketed, has sales representatives in 50 U.S. cities and more than 50 countries abroad and provides service from 136 official service cities.

A microprocessor-based display terminal, the NTSC 290 Display System is designed as a direct replacement for the IBM 3270 in a remote or local environment. Operationally, 290 System components can act as plug-for-plug replacements for first generation IBM 3270 equipment; no changes in host hardware or software are required. Models 290 and 296 can replace IBM 3271-2 (BSC) or -12 (SDLC) remote cluster controllers; Model 292, the 3272-2 local cluster controller; and Model 297, the 3277-2 display station. But *price-wise*, the 290 System competes directly against IBM's second generation 3270 components. Northern Telecom's pricing provides substantial monthly savings compared to IBM's monthly rental prices and two-year leases. Monthly savings are increased under NTSC's 3-year lease plan. For purchased equipment, NTSC's quantity-one prices are well below IBM's, and quantity discounts are available.

The 290 System is available in three configurations: a remote cluster that can consist of up to 16 display stations and printers; a local cluster that can also include up to 16 devices; and a remote mini-cluster limited to 8 devices, of which up to 5 can be printers. NTSC rationale for limiting its maximum cluster size to ➢

CHARACTERISTICS

VENDOR: Northern Telecom Systems Corporation, Computer Systems Group, P.O. Box 1222, Minneapolis, Minnesota 55440. Telephone (612) 932-8000.

DATE OF ANNOUNCEMENT: September 1977.

DATE OF FIRST DELIVERY: December 1977.

NUMBER DELIVERED TO DATE: Information not available.

SERVICED BY: Northern Telecom Systems Corp., Customer Service Group.

MODELS

The Northern Telecom 290 Display System is a microprocessor-based alphanumeric display terminal designed as a replacement for the IBM 3270 Information Display System in a local or remote environment.

The 290 System is available in the following configurations:

- **Model 291 — a remote cluster terminal.**
- **Model 292 — a local cluster terminal subsystem.**
- **Model 296 — a remote mini-cluster terminal.**

The Model 291 Remote Cluster Control Unit and Model 292 Local Cluster Control Unit can each accommodate up to 16 devices including any combination of Model 297 Display Stations and 66-cps, 120-cps, and 180-cps Sprinter printers.

The basic controller model is equipped with one display adapter which accommodates one or two displays. Up to seven additional device adapters including any mix of display and printer adapters can be installed to accommodate up to 16 devices. The configuration must include at least one Model 297 Display Station. A cassette tape drive within the controller is used to load the cassette-based operating system and system diagnostics. The cassette drive is accessible to the operator. ➤

Northern Telecom Systems Corp.
290 Display System

half that of IBM's is two-fold. One is that it is price/performance competitive. Secondly, it provides system redundancy; i.e., an inoperative controller disables only 16 stations instead of 32 as with the IBM 3270.

The 290 System features a 15-inch display screen (compared with IBM's 14-inch screen) but is currently limited to a 1920-character display capacity. Northern Telecom offers six keyboard styles comparable with those offered by IBM, except for the number of program function keys, which NTSC limits to 12 instead of the 24 available from IBM on two of its keyboards.

Northern Telecom provides three printer models with its 290 System: NTSC's second-generation matrix printers are available with rated speeds of 66, 120, and 180 cps and with a characters set of 64 or 96 characters. All models operate bi-directionally via microprocessor control. By comparison, IBM's matrix printers are rated at 66, 80, and 120 cps and are available with a 94 character set. But IBM also offers line printers that are rated at 120 lpm to 300 lpm with a 64-character set.

Terminal control is performed by software or firmware. NTSC's operating system is loaded from cassette tape (Models 291 and 292) or stored in ROM (Model 296). User-accessible parameters built into the control logic provide system flexibility in reconfiguring a terminal. Diagnostics, also loaded from cassette or stored in ROM, pin-point failures while the terminal is switched off line.

Transmission parameters are comparable with those of the IBM 3270. BSC or SDLC protocol is available and Northern Telecom offers its own modem for operation at 2400 bps.

In summary, the Northern Telecom 290 offers the IBM 3270 market an IBM replacement at substantially lower cost. Based on its proven image under the Sycor name as a prominent independent vendor of IBM replacement and data-entry display terminals, the NTSC 290 warrants serious consideration by the potential user.

Northern Telecom is currently unable to provide Datapro with the names of any users of the Northern Telecom 290 Display System; subsequently, the User Reaction section does not appear in this report.□

The 291 and 292 controllers contain dual microprocessors; one is subordinate to the other to maintain control. The master processor performs communications and cassette tape-related functions, as well as controlling the subordinate processor, which performs keyboard, display, and printer functions. Each microprocessor is equipped with 12K bytes of dedicated memory, but shares the remainder of memory. Maximum memory capacity is 64K bytes; 2K bytes are assigned to each display station or printer buffer storage, leaving 8K bytes to be shared by both processors for data interchange and for the operating program.

The Model 296 Mini-Cluster Controller consists of one display station and can accommodate up to 7 additional devices including Model 297 Display Stations and 66-cps, 120-cps, and 180-cps Sprinter printers. The 296 Controller contains a single microprocessor with 41K bytes of ROM and up to 40K bytes of RAM. The 41K-byte ROM contains basic instructions (12K bytes), diagnostics (12K bytes), 1K bytes for language translation tables, 8K bytes for communications functions, 4K bytes for configuration parameters, and 4K bytes for options such as the light pen and badge reader. Communications buffers, tables, and other data areas are assigned 8K bytes of RAM total; 2K-bytes of RAM are assigned to each display station or printer as buffer storage. No cassette drive is provided; all operating instructions, diagnostics, and other functions are stored only in ROM.

The Model 297 Display Station can accommodate any of six keyboard styles, a light pen, and a badge reader.

TRANSMISSION SPECIFICATIONS

Transmission is synchronous in the half- or full-duplex mode at transmission rates from 1200 to 9600 bits/second. BSC or SDLC protocol can be specified, as well as ASCII or EBCDIC transmission code. Transmission at 1200 bps is internally clocked. All other speeds require clocking by an external modem. The terminals are equipped with an RS-232C interface. Northern Telecom provides one modem: the 2923-1 for 2400 bps operation over leased lines.

DEVICE CONTROL

The 290 System operates under control of the program stored at the remote computer and provides complete compatibility with the addressing sequence, command code structure, and BSC or SDLC line discipline employed by the IBM 3270 Information Display System. The 290 responds to and executes the full repertoire of IBM 3270 commands via microprocessor control and a NTSC 290 operating system loaded from cassette tape (Models 291 and 292) or stored in ROM (Model 296).

Operator controls are provided for cursor control, editing, and program functions.

Cursor controls position the cursor up, down, left, or right, step-by-step or repetitively if the key is held depressed. The cursor can also be backspaced one character position, moved to the beginning of the next line or beginning of the next unprotected data field, tab to the beginning of the next unprotected data field, and backtab to the beginning of the previous unprotected data field.

Edit controls permit data to be inserted in or deleted from text, character by character. Following data is automatically expanded or contracted.

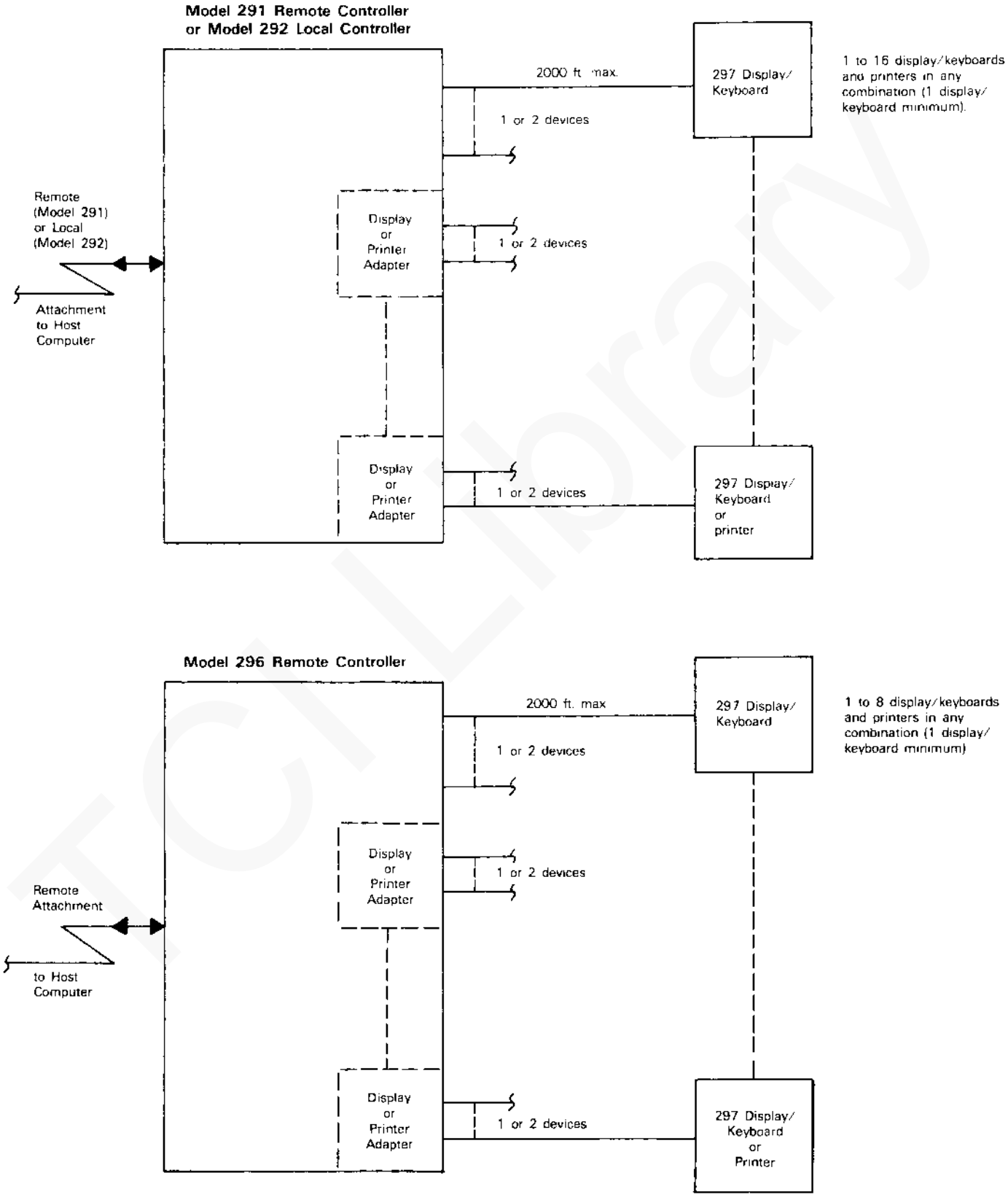
Program Function keys are used to initiate program functions or identify data that can be transmitted with an accompanying program function code.

Character Addressing permits a message to be written beginning at any screen location. Addressing can be interspersed with data throughout a message received from the computer. Character Addressing also permits the selective modification of attribute control codes.

Program control by data field provides a flexible formatting capability. A field, identified by an attribute control code (nondisplayed) in the initial character position, can process any one of several characteristics. The attribute control code can specify a protected or unprotected field (for fixed format operation), beam intensity or brightness (off, normal, or bright), alphanumeric or numeric (automatic shift) input, auto lock or skip, tab stop, or light pen selection. NTSC 290 field attribute codes are identical with those of the IBM 3270 and control all the same field characteristics, except for lack of reverse video.

Northern Telecom Systems Corp.
290 Display System

Configuration



Northern Telecom Systems Corp.
290 Display System

Null supression is a standard feature. Blank (null) characters are not transmitted for increased communications efficiency.

A light pen is available as an option. Any one of several alphanumeric or numeric fields of fixed or variable format can be selected by the pen, which transmits the address of the selected entry to the computer to initiate the programmed function.

The Status Line, an additional line at the bottom of the screen, replaces the system status indicator lamp employed by IBM on its 3270.

Diagnostic testing is automatically performed on power-up and system initialization. Off-line diagnostics can also be operator identified to the operator via a displayed message.

COMPONENTS

CRT DISPLAY UNIT: A 15-inch (measured diagonally) CRT with a 1920-character display capacity. The display arrangement is 24 lines of 80 characters each. An additional bottom line displays terminal status. The character set contains 64 or 96 (no-cost option) displayable symbols including upper and lower (optional) case alphabetics. Each character is formed within a 7-by-9 dot matrix for upper case characters or a 7-by-12 dot matrix for lower case characters. Data is displayed in green. Highlighting and security features include dual intensity and blanking, respectively.

KEYBOARD: Six detachable keyboard models include:

- Model 2930—a 66-key, typewriter-style keyboard with ASCII or EBCDIC code.
- Model 2931—a 66-key, data entry style keyboard with ASCII or EBCDIC code.
- Model 2932—a 66-key, keypunch keyboard with ASCII or EBCDIC code.
- Model 2933—a 78-key, typewriter-style keyboard with a 12-key Program Function keypad with ASCII or EBCDIC code.
- Model 2934—a 78-key, operator console keyboard with a 12-key Program Function keypad with EBCDIC code only.
- Model 2935—a 78-key, typewriter-style keyboard with a 12-key dual-function keypad. The dual-function keys operate as a numeric pad or program function keys. The numeric keys operate in lower case, while Program Functions are initiated in upper case. It is available with ASCII or EBCDIC code.

PRINTER: The Sprinter printer is a bi-directional, microprocessor-controlled, impact matrix printer equipped with 132 print positions and is available with one of three rated speeds: 66 cps, 120 cps, or 180 cps. The printer is equipped with a 64 character set of upper case ASCII or EBCDIC symbols; a 96 character set of upper and lower case ASCII or EBCDIC symbols is optional. Horizontal spacing is 10 characters/inch; an option provides either switch or program controlled spacing at 10 or 16.5 cps. Vertical spacing is 6 lines/inch. An optional switch selects spacing at 6 or 8 lpi. Automatic double line feed is a standard switchable feature. The standard printer is equipped with an adjustable tractor feed with or without a tear bar. The printer accommodates multipart continuous forms from 4 to 15 inches wide. An optional front feed mechanism can be ordered to allow precut forms to be used on the Sprinter.

Vertical tabs and form feed are program controlled. Vertical slewing is automatic at 50 lpm on detection of blank lines. A firmware option on 180-cps printers provides automatic horizontal slewing at 350 cps over blank fields. A monitored, out-of-paper switch does not halt printing until the bottom of the form is reached (an average of an extra 14 lines). The printer also features a pre-computed default margin (132nd clear position) and default form length according to the user's average form.

Printer control keys establish forms parameters such as length, left margin, and vertical tabs.

PRICING

The Northern Telecom 290 System is available for purchase or on a one-year, two-year, or three-year lease. A separate maintenance contract is available for leased or purchased equipment. Quantity discounts are available on purchased equipment. Installation is priced at $100 per site. The investment tax credit is passed on to the customer for purchased equipment; however, the transfer of the ITC is negotiable for leased equipment.

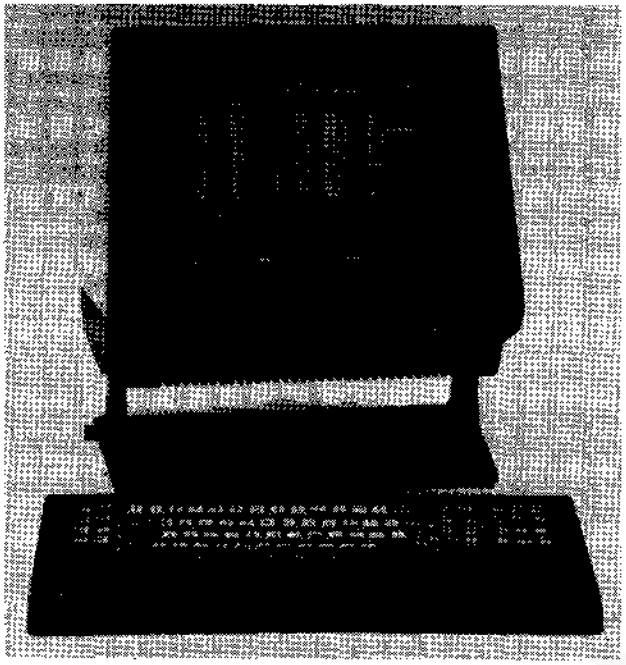
Northern Telecom provides its own maintenance service from 136 official service cities joined by a centralized dispatch system.

Customer training consists of three days at the factory or a customer training center plus on-site programmed instruction. Training centers are located in New York City; Washington, D.C.; Chicago; Dallas; and San Francisco.

	Monthly Charge* Three-Year Lease	Purchase	Monthly Maint.
Sample Configurations			
Model 291 Remote Cluster Controller Configuration; includes 15 1920 character display stations and one 66-cps Sprinter printer	$912	$50,200	$240
Model 292 Local Cluster Controller Configuration; includes 15 1920-character display stations and one 66-cps Sprinter printer	974	53,878	275
Model 296 Remote Mini-Cluster Configuration; includes two 1920-character display stations and one 66-cps Sprinter printer	227	12,560	83

*Includes maintenance.■

Northern Telecom 290 Display System



The Northern Telecom 298 Display Station is available in four screen formats, ranging from 1920- to 3564-character capacities. The display screen measures 15 inches (diagonally), and is tiltable. Six keyboard styles are available, each of which is detachable. The 298 offers IBM 3278 emulation.

Plug-compatible replacements for IBM's second generation 3270 components.

The 298 Display Station is a replacement for the IBM 3278 Display Station, and is available in four screen capacities ranging from 1920 to 3564 characters. The 298 contains a 15-inch (diagonal) display screen with a tilt adjustment, and features a choice of detachable keyboards. Four controllers are available for use with the 298, providing support for from 8 to 32 devices. Northern Telecom also provides three types of printers for use in the 290 system. Both BSC and SNA/SDLC protocol compatibility are supported by the 290 configurations.

Purchase prices for the 298 Display Station range from $1,870 to $2,330. Controllers range in price from $3,200 to $8,995. One-, two-, and three-year lease plans are also available.

MANAGEMENT SUMMARY

Northern Telecom's 290 product line was introduced in September 1977 by Sycor Inc., which was acquired by Northern Telecom in 1978. The 290 products are designed as plug-compatible replacements for components of the IBM 3270 Information Display System. Northern Telecom's first generation of components corresponded to IBM's first generation, and included the 291, 296, and 292 controllers, and the 297 display. The Northern Telecom products were designed to replace the IBM 3271-2 (BSC), 3271-12 (SDLC), and 3272-2 controllers and the 3277-2 display station, respectively.

The second generation of components was introduced in September 1980 and included the 294 controller and the 298 display. Northern Telecom has gradually de-emphasized sales of the first generation products, while adding enhancements and features to the 298 display and to the 296 and 294 controller models.

Control units currently offered include: the 296C, a firmware-driven remote controller which provides support for up to eight devices (displays and/or printers); the 294-51C, a diskette-driven remote unit which supports up to 12 devices; 294C, a cassette-driven remote controller which supports up to 32 devices; and the 294-1B, a local channel, 32-device control unit. The four Northern Telecom controllers are designed as functional replacements for the ➢

CHARACTERISTICS

VENDOR: Northern Telecom Inc., Electronic Office Systems, P.O. Box 1222, Minneapolis, MN 55440. Telephone (612) 932-8000.

DATE OF ANNOUNCEMENT: September 1980 (current models).

DATE OF FIRST DELIVERY: January 1981.

NUMBER DELIVERED TO DATE: 3,000 display units (U.S.); approximately 14,000 display units (worldwide).

SERVICED BY: Northern Telecom Inc.

CONFIGURATION

The 290 Display System features four display control units which support the 298 display. The control units are:

- **296C—a remote control unit which supports up to eight devices.**
- **294-51C—a remote control unit which supports up to 12 devices.**
- **294C—a remote control unit which supports up to 32 devices.**
- **294-1B—a local channel control unit which supports up to 32 devices.**

The 298 display is available in four formats which can emulate the IBM 3278 Models 2, 3, 4, and 5. The displays can be configured with any one of five keyboard styles. Three types of printers are available: a matrix printer, a line printer, and a letter quality printer. ➢

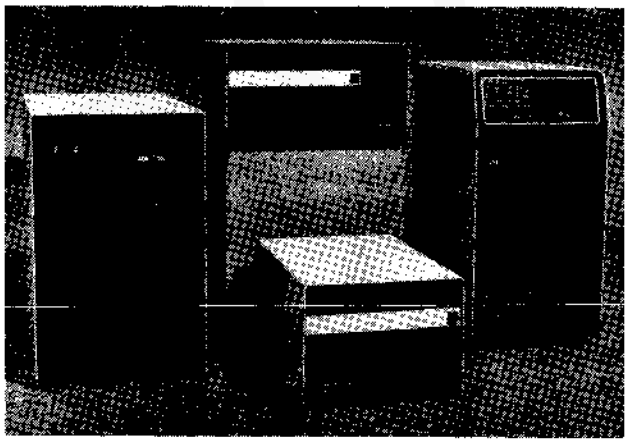
Northern Telecom 290 Display System

IBM 3276, 3274-51C, 3274-1C, and 3274-1B, respectively. The remote control units contain self-diagnostics, both BSC and SNA/SDLC protocol compatibility, and system memory at no additional charge. The local channel model contains self-diagnostics, communications protocol, and system memory at no additional charge. The Northern Telecom controllers can accommodate any mix of Northern Telecom 290 System peripherals; they do not accommodate the corresponding IBM peripherals.

The 298 Display Station is a microprocessor-based terminal that acts as a functional replacement for an IBM 3278 display station. It features a 15-inch (diagonally measured) display screen; the display itself is mounted on a pedestal base and contains a tilt adjustment. The 298 is available in four screen formats: 24 lines by 80 columns (1920 characters); 32 by 80 (2560 characters); 43 by 80 (3440 characters); and 27 by 132 (3564 characters). Each display includes a separate status line on the bottom of the screen. Each character is formed within a 7-by-12 dot matrix for the 1920- and 2560-character formats, and within a 7-by-9 dot matrix for the 3440- and 3564-character formats, with true character descenders on lower case letters. The Northern Telecom 298 can be attached to any Northern Telecom 290 controller; it can not be attached to an IBM controller.

Keyboards for the 298 display are available in either typewriter, data entry, or data entry/keypunch layouts with 75 or 87 keys. EBCDIC or ASCII transmission codes are available. All keyboards are detached, and connected to the monitor via a four-foot cable.

Northern Telecom offers three types of printers for use with the 290 system: a matrix impact printer available in speeds of 72, 144, or 180 cps; a 300-lpm line printer; and a 40-cps letter quality printer. Printers as well as displays attach to the control unit via coax cabling at distances up to 5000 feet.



Northern Telecom provides a total of four control units for use with the 290 Display System. Remote units are: the 296C, which provides support for eight devices; the 294-51C, which supports up to 12 devices; and the 294C, which supports up to 32 devices. The local channel unit, the 294-1B, provides support for up to 32 devices.

TRANSMISSION SPECIFICATIONS

The remote control units support IBM-compatible data communications using a BSC or SNA/SDLC protocol at line speeds from 1200 bps to 9600 bps. The control units can use either ASCII or EBCDIC transmission codes. Transmission at 1200 bps is internally clocked. All other speeds require clocking by external modem. Data is transferred in half- or full-duplex modes in a multipoint network over leased or switched communication lines. The local channel controller transmits data via a selector, byte multiplexer, or block multiplexer channel, operating in either byte or burst mode. All peripherals are connected via standard RS-232-C interfaces.

DEVICE CONTROL

The 290 system operates under the control of the program stored at the remote computer and provides complete compatibility with the addressing sequence, command code structure, and BSC or SDLC line protocol employed by the IBM 3270 Information Display System. The 290 responds to and executes the full range of IBM 3270 commands via microprocessor control and the 290 operating system.

Operator controls are provided for cursor control, editing, and program functions.

Cursor controls position the cursor up, down, left, or right, one position at a time or repetitively if the key is held depressed. The cursor can also be backspaced one character position, moved to the beginning of the next line or the next unprotected data field, tabbed to the beginning of the next unprotected data field, and backtabbed to the beginning of the previous unprotected data field.

Edit controls permit data to be inserted in or deleted from text, character-by-character. Following data is automatically expanded or contracted.

Program Function keys are used to initiate program functions or identify data that can be transmitted with an accompanying program function code.

Character Addressing permits a message to be written beginning at any screen location. Addressing can be interspersed with data throughout a message received from the host computer. Character Addressing also permits the selective modification of attribute control codes.

Program control by data field provides a flexible formatting capability. A field, identified by an attribute control code (nondisplayed) in the initial character position, can process any one of several characteristics. The attribute control code can specify a protected or unprotected field (for fixed format operation), beam intensity or brightness (off, normal, or bright), alphanumeric or numeric (automatic shift) input, auto lock or skip, tab stop, or light pen selection. The 290 field attribute codes are identical with those of the IBM 3270 and control all the same field characteristics, except that the 290 lacks support of reverse video.

Null suppression is a standard feature. Blank (null) characters are not transmitted, for increased communications efficiency.

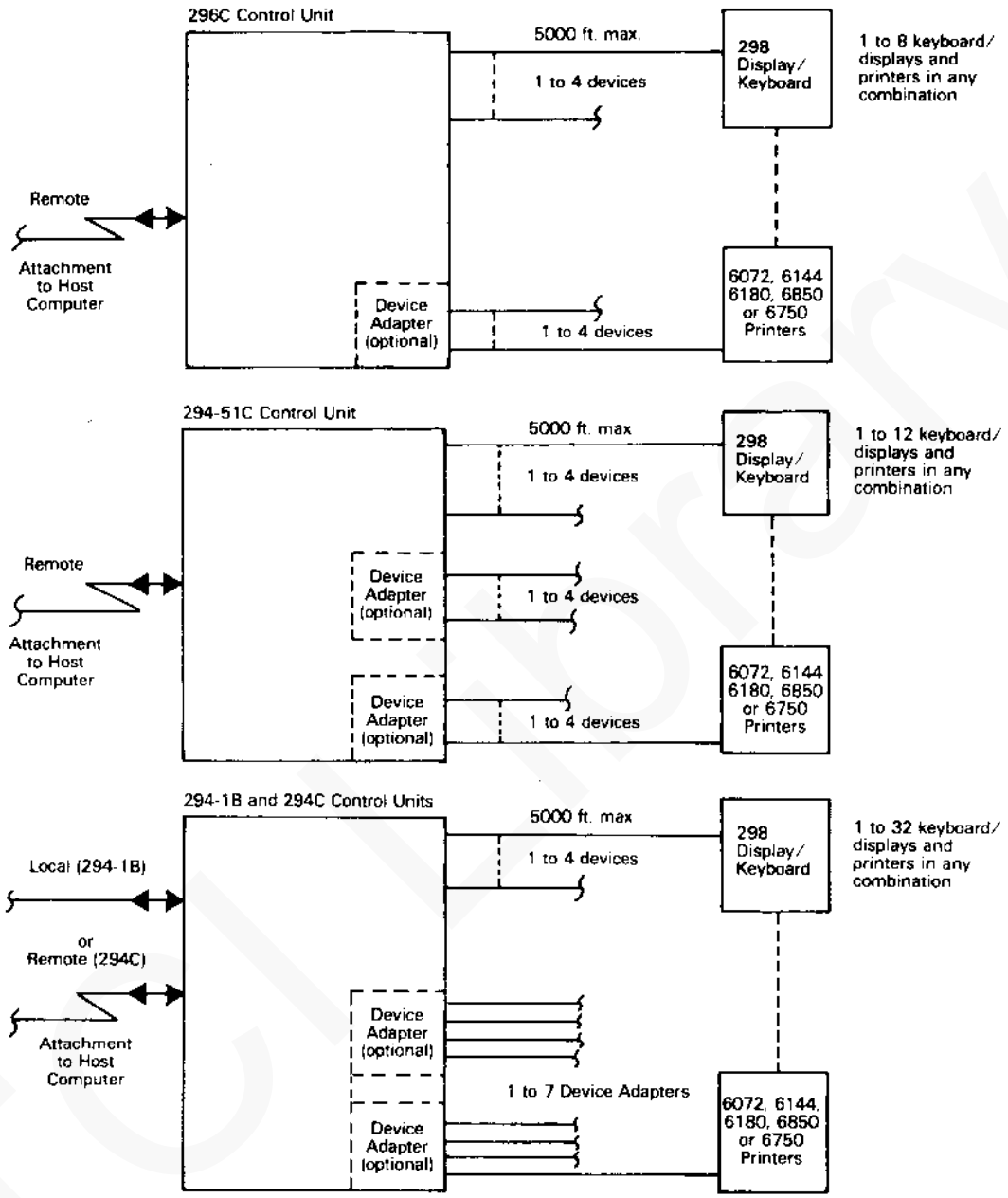
Diagnostic testing is automatically performed on power-up and system initialization. Off-line diagnostics can also be operator-identified to the operator via a displayed message.

COMPONENTS

296C CONTROL UNIT: Functional replacement for IBM 3276, with support for up to eight devices. Devices can be any combination of 298-2, -3, or -4 displays, or any of the three types of printers provided by Northern Telecom. The

Northern Telecom 290 Display System

Configurations



Northern Telecom markets the 290 product line from over 40 sales offices in the U.S. and 90 sales offices worldwide. Service is provided from over 125 offices in the U.S. and 200 offices worldwide.

USER REACTION

In July 1982, Datapro conducted telephone interviews with 10 users of the Northern Telecom 290 Display System. These users represented an installed base of 252 displays; the largest user reported on a system containing 100 terminals, while the smallest user had only one terminal on a test basis. The majority of the displays reported on were 298s; only two users reported that they were using the older 297 models. Likewise, the majority of the users were utilizing the 294 controller. The ratings

operating system, configurator program, and diagnostic program reside in firmware.

294-51C CONTROL UNIT: Functional replacement for the IBM 3274-51C, with support for up to 12 devices. Devices can be any combination of 298-2, -3, -4, and -5 displays, or any of the three Northern Telecom printer types. A diskette drive unit is housed in the controller for the system software.

294C CONTROL UNIT: Functional replacement for the IBM 3274-1C, with support for up to 32 devices. Devices can be any combination of 298-2, -3, -4, and -5 displays, or any of the three Northern Telecom printer types. A cassette tape drive is housed in the control unit for system software.

All of the above remote control units support BSC and SNA/SDLC protocols, which can be switch-selected by the operator. SNA/SDLC protocol compatibility is provided at

Northern Telecom 290 Display System

given to the 290 system by these users are summarized in the following chart.

	Excellent	Good	Fair	Poor	WA*
Overall performance	4	5	1	0	3.3
Ease of operation	3	6	1	0	3.2
Display clarity	4	4	2	0	3.2
Keyboard feel & usability	2	7	1	0	3.1
Hardware reliability	2	4	4	0	2.8
Maintenance service	5	4	1	0	3.4
Technical support	4	3	1	0	3.4

*Weighted Average based on a scale of 4.0 for Excellent.

The largest user, with 100 terminals (both 297s and 298s) installed, was an east coast educational institution. The user stated that she liked the Northern Telecom 298 terminals more than the IBM 3278, which she had previously used. She added that the college was in the process of installing additional 298s.

Another user interviewed was a financial institution in the southeast. The company had recently expanded due to a merger and was in the process of opening new branches. The user said that she had originally installed the 298s on a trial basis, looking to replace existing IBM equipment with less costly alternatives. She stated that the company was "very satisfied" with Northern Telecom and was planning on placing additional units in the new branches.

A midwest manufacturing company representative stated that his company currently was replacing old Sycor terminals with the newer 298s, and would eventually have a network of about 200 terminals. He added that the most attractive feature of the Northern Telecom equipment was its price/performance ratio. An east coast manufacturer echoed this response, stating that "the price is right" on the Northern Telecom terminal system. Two other users, a manufacturing firm and a consulting firm (both located on the east coast), stated that they felt that Northern Telecom's maintenance service was the system's strong point. Both users cited instances where problems with the equipment were rectified the next day.

Finally, an east coast insurance company stated that the main reason for his company's purchase of the 290 System terminals was the short lead time for delivery, as compared to IBM. He mentioned some initial software problems with the NTI equipment, which were eventually taken care of. He added, however, that the company maintained an "IBM shop" and would continue to do so.□

no additional cost. All required system memory is also provided at no additional cost. The basic remote control units include one device adapter, which supports four devices.

294-1B CONTROL UNIT: A local channel control unit. The 294-1B acts as a functional replacement for the IBM 3274-1B, and supports up to 32 devices. Devices can be any combination of 298-2, -3, -4, and -5 displays, or any of the Northern Telecom three printer types.

298 DISPLAY STATION: A 15-inch (diagonally measured) CRT available in four screen formats. The NT 298 can act as a functional replacement for the IBM 3278-2, -3, -4, and -5 display terminals, and can be attached to any Northern Telecom 290 System controller. The 298 does not attach to the equivalent IBM controller. The 298-2 has a 1920-character screen capacity (24 lines of 80 characters); the 298-3 has a 2560-character screen capacity (32 lines of 80 characters); the 298-4 has a 3440-character screen capacity (43 lines of 80 characters); the 298-5 has a 3564-character screen capacity (27 lines of 132 characters). An operator status line of 80 or 132 characters is displayed at the bottom of the screen.

Each character is formed within a 7-by-12 dot matrix for the 298-2 and -3 displays, and within a 7-by-9 dot matrix for the 298-4 and -5 displays, which allows true character descenders. Displays can be ordered with upper case only, or upper/lower case characters. Displays can be attached up to 5000 feet from the control unit via an RS-232-C coaxial cable. All displays include a display pedestal, on which the display screen may be tilted for operator comfort. Light pen and badge reader options are available on all displays except the 298-5.

298 KEYBOARDS: Keyboards are available featuring typewriter, data entry, or data entry with keypunch layouts, and containing 75 or 87 keys. ASCII or EBCDIC codes are available. All keyboards are detachable. Keyboard options include security keylock, single button clear, inverted dial function keypad, and switched Program Function keys.

6072/6144/6180 SPRINTER PRINTER: The Sprinter printer is a bidirectional impact matrix printer with 132 print positions. It is available in three speeds: 72 cps, 144 cps, and 180 cps. The printer is equipped with a 96-character set of upper and lower case ASCII and EBCDIC symbols. Options include: tear bar tractor feed; compressed print, which provides six or eight lines per vertical inch and/or 10 or 16.5 characters per inch; and audible alarm, which signals a paper out condition.

6850 STRIDER PRINTER: The Strider printer is a 300-lpm belt-type line printer. The Strider prints six or eight lines of 132 characters per vertical inch. Upper case or upper/lower case belts are available. The Strider attaches to the 290 system by using an external coax peripheral adapter.

6750 STRIKER PRINTER: The Striker is a bidirectional letter quality printer which prints at a speed of 40 cps. The Striker can be ordered with one of three paper feed mechanisms: the standard friction platen feed, tractor feed, or single sheet feeder. The Striker attaches to the 290 system by using an external coax peripheral adapter.

All printers can be attached up to 5000 feet from the control unit.

PRICING

Northern Telecom's 290 system components are available for purchase or on a one-, two-, or three-year lease. Non-standard contract lengths are also available. Northern Telecom also offers internal financing on purchased equipment at competitive interest rates. Purchase quantity discounts are available. A separate maintenance contract is available for leased or purchased equipment. There are no installation charges.

Northern Telecom provided Datapro with the following purchase prices for the major products in the 290 line. For more detailed pricing, as well as lease pricing, contact Northern Telecom.

Northern Telecom 290 Display System

	Purchase Price
296C Control Unit	$3,200
294-51C Control Unit	4,250
294C Control Unit	6,925
294-1B Control Unit	8,995
298-2 Display	1,870
298-3 Display	1,990
298-4 Display	2,120
298-5 Display	2,330
Keyboards	NC
6072 Printer	3,200
6750 Printer	7,700
6850 Printer	4,310 ■