Racal-Milgo Omnimode Series Modems
Omnimode 48, 96, 14.4 & 1614

■ PROFILE

Function • high-performance modems for dedicated facilities; optional network control support.

Communications/Networks • synchronous at 16.8K-/14.4K/9600/4800 bps; point-to-point or multipoint communication over unconditioned 4-wire dedicated Type 3002 facility (Omnimode 48 and 96), and D1-conditioned (Omnimode 14.4/1614); tail circuits supported via multiport option • not compatible with AT&T modems • compatible with CCITT V.24, V.28, V.27, and V.29 modems or Racal-Milgo MPS modems in existing network • supports Racal-Milgo CMS 185/2000 network control and management systems.

First Delivery • 1982 (Omnimode 48); 1983 (Omnimode 96); 1984 (Omnimode 14.4); 1985 (Omnimode 1614).

Units Delivered • undisclosed.

Comparable Systems • principal competition from AT&T Dataphone II modems; Codex 2600 Series; IBM 3800 Series modems; Infinet DMX Series modems; NCR Comten 7160 Series modems; Paradyne VHS/MPX Series modems.

Vendor • Racal-Milgo Information Systems, Inc; 1601 North Harrison Parkway, Sunrise, FL 33323 • 305-475-1601.

Canadian Headquarters • Electronetic Systems Limited; 785 Arrow Road, Weston, ON M9M 2L4 • 416-745-2999.

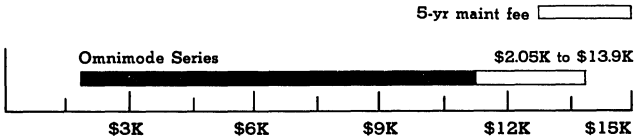
Distribution • nationwide via local Racal-Milgo direct sales offices and manufacturer's representatives • Canada via Electronetic Systems, Ontario, Vancouver, Montreal, and Ottawa • Europe, Africa, the Middle East, the Far East, and South America via Racal-Milgo Intercontinental, Inc, Miami.

GSA Schedule • listed.

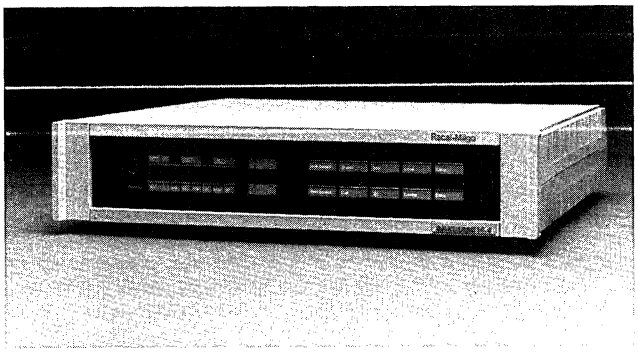
■ ANALYSIS

Racal-Milgo has significantly strengthened its marketing stance over the past year by adding 2 high-end models to its Omnimode Series of high-performance modems. In addition, pricing for existing standalone and central-site Models 48 and 96 was slashed by approximately 16 percent. Racal-Milgo has also reduced prices for remote modem control and multiport options and is no longer charging an additional cost for its eye-pattern generator feature. Furthermore, Racal-Milgo has expanded its level of analog parameter monitoring and measurement to include both interruptive and noninterruptive analog testing. The Analog Parameter Monitoring and Analog Parameter Measurement options assist users in identifying the causes of degrading line conditions. Noninterruptive monitoring and measurement examines transmit and receive level, signal quality, phase jitter, and signal-to-noise ratio. The Analog Parameter Measurement option operates on the main channel and measures

PURCHASE PRICE RANGE



RACAL-MILGO OMNIMODE SERIES PURCHASE PRICING bar graph covers price range between "small" and "large" configurations for hardware (solid bar) and for associated 5-year period maintenance (open bar) • Omnimode Series single-unit pricing ranges from standard Omnimode 48 at low end to Omnimode 1614 with 6-channel TDM multiplexer and Remote Modem Control at high end.



a variety of parameters including attenuation/delay distortion, noise with tone, frequency translation, phase jitter, amplitude jitter, gain hits, impulse noise, and phase hits. The new Omnimode 14.4 and 1614 modems extend Omnimode Series transmission speeds up to 14.4K and 16.8K bps, respectively. Both modems utilize a special modulation scheme called **Convolutional Coded Modulation (CCM)** which improves performance and reduces bit errors at higher speeds. The new modems can be configured in a network with any combination of Models 48 and 96. The new additions also support the Omnimode Remote Modem Control Option for accommodating remote-modem status monitoring and diagnostic testing.

In a similar manner to that of AT&T's Dataphone II network control system, Omnimode modems can provide several levels of diagnostics and control depending on the scope of a user's network. At the first level, Omnimode modems installed with optional Remote Modem Control allow all remote modem drops on a single line to be controlled from the master modem front panel. The next level controls all rackmounted modems and associated drops in a single equipment cabinet (up to 64 modems) from a single control panel located on the cabinet. The highest level of control is provided for all modems in the user's network from a centrally located CMS network control management system. Even under CMS management, users can still control or diagnose individual modems from a rack or from a standalone modem without CMS assistance.

□ Strengths

The Omnimode Series is an advanced family of modems that provide exceptional control and configuration ease. There are no internal straps or switch settings; all modem parameters are soft-configured from the modem's front panel.

The addition of the 2 high-end Models 14.4 and 1614 has enabled Racal-Milgo to retain a competitive position against vendors with comparable offerings such as Paradyne and Codex. The Omnimode 14.4 and 1614 also represent Racal-Milgo's first commercial offering to utilize trellis-coded or convolutional-coded modulation. An innovative forward error-correction (FEC) scheme, already employed by several major modem vendors including Codex and General DataComm, this encoding technique insures data integrity at transmission rates up to 16.8K bps. Increased immunity to line noise and other circuit impairments are decided advantages of trellis- or convolutional-coded modulation. Unlike the Codex method which trellises 5 data bits to every 4 of the original data stream, Racal-Milgo's coded modulation attaches 1 coded data bit to each transmitted data stream. A drawback of the Racal-Milgo method is that it may

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not produce as accurate a representation of the data transmitted. On the other hand, Racal-Milgo's coded modulation scheme doesn't experience the restrictive overhead encountered with other approaches.

Automatic speed adjustment to changing line conditions is another advantage of the top-of-the-line Omnimode Model 1614. This standard feature eliminates the inefficiency and inconvenience of manually changing main channel rates. As line conditions degrade, the Omnimode 1614 automatically falls back from 16.8K bps to 14.4K bps or 12K bps as required to provide the optimum transmission. Once line conditions improve, the data rate automatically increases to 16.8K bps.

The Remote Modem Control (RMC) option functions as a diagnostic secondary channel and benefits users by permitting the monitoring and control of remote modems from a central-site modem. As the user's network grows, control can be added for an entire rack or an entire network of modems from a central point. If a higher level of control malfunctions, control reverts back to the individual rack or modem level. Nonvolatile RAM memory also ensures that modem failures do not wipe out preset modem configurations.

The multiport option for the Omnimode Series eliminates the cost of extra lines and modems for users with additional terminals at a remote site. The option multiplexes as many as 4 low-speed data streams on a 4800-/9600-bps line, and as many as 6 low-speed data streams on a 14.4K-/16.8K-bps line, resulting in considerable cost savings.

The Dynamode channel allocation scheme, a standard feature when combining multiport and Remote Modem Control options, permits 3 different levels of channel priorities. This feature is useful for combining critical traffic with traffic of a less sensitive nature. Batch traffic, such as printing, is often selected for lower priority than interactive terminal traffic.

Omnimode modems of different data rates and applications are packaged in the same manner, permitting them to be combined in the same rackmount enclosure or standalone case. Users do not maintain different enclosures or learn different operating procedures, simplifying network operations and reducing costs.

☐ Limitations

Racal-Milgo no longer offers an auxiliary secondary channel for user-defined applications on its Omnimode Series. While the RMC option supports a secondary channel for passing diagnostic and network control information, there is no longer any provision for user-defined applications on Omnimode Models 96, 14.4, and 1614. This presents a limitation to users requiring a secondary channel function for building security, alarm, or other low-speed specific data applications. The Omnimode 48 still supports a tertiary channel for handling such user-defined applications. Users should also be aware that diagnostic testing is limited to loopback tests and simple line-level/quality reporting when the modems are not employed in a CMS network control environment.

The modems do not provide redundancy, except through a separate hot-spare modem. Although the calculated MTBF may be excellent, it doesn't mean failures cannot occur. This is why Racal-Milgo provides hot-spare switchover for critical applications.

The Omnimode Series still **does not support asynchronous data traffic**. Leading competitors Paradyne and Codex both offer asynchronous-to-synchronous data conversion for converting asynchronous data at the digital electrical interface to a synchronous data stream (and the converse).

In addition, planned enhancements such as data compression and an EIA RS-449 digital interface are still **not available**.

■ HARDWARE

☐ Terms & Support

Terms • available for purchase or for lease under 1-, 2-, 3-, or 5-year agreement • separate maintenance contract available for leased or purchased units • leased/purchase credit is 50 percent of lease paid out up to 80 percent of purchase • one-year warranty • quantity discounts for 10 or more purchased/leased units; discount percentage based on total dollar volume per order.

Support • installed by Racal-Milgo or by user; no installation charge with maintenance contract or lease agreement • installation charge for purchased units: $150 prime time (all models); $240, after hours (all models) • regional customer support centers located in: Southeast/Atlanta; West Coast/Los Angeles; Southwest/Richardson, TX; Midwest/Schaumburg, IL; Northeast/Freehold, NJ; use of telephone consulting service free of charge.

☐ Overview

The 4 models in the Omnimode family of high-performance modems are designed for point-to-point or multipoint network configurations at 4800-, 9600-, 14,400-, and 16,800-bps data rates, with fallback speeds for transmission over degraded communication facilities. The top-of-the-line Omnimode Model 1614 features automatic speed selection which downspeeds data transmission from 16.8K bps to 14.4 bps or 12K bps to compensate for deteriorating and upspeed transmission rates to 14.4K bps or 16.8K bps in order to achieve the best possible performance level. All modem configuration settings, diagnostics, and status information are soft-configured and viewed from the modem's front panel; no internal strap adjustments or switch settings are required. When Omnimode modems are equipped with optional Remote Modem Control (RMC), remote units can be controlled and monitored from the central modem as well. Other extra-cost options include interruptive Analog Parameter Measurement, multipoint operation and failure recovery through dial backup and hot-spare modem switching at central and remote sites.

All models are available in either a standalone version or rackmount modem card for high-density, central-site card nesting. The Omnimode CS rackmount modem enclosure consists of primary and secondary shelves supporting up to 16 Omnimode Series modem cards per shelf, without options; RMC and multiport options each occupy one card slot. Different modem models and data rates can be mixed in the same shelf. The primary shelf, one per equipment rack, contains a modem control panel similar to an Omnimode modem front panel. In a 6-foot rack containing one primary shelf and up to 3 secondary shelves, a user can select one of any Omnimode modems (up to 64 modems without options) for control or monitoring. Remote modems can also be accessed from an Omnimode CS master panel when installed with the RMC option.

The RMC option is also compatible with Racal-Milgo CMS 185 or CMS 2000 network management systems, adding a third level of control for medium-to-large network users. In a CMS-equipped network, all Omnimode modems are constantly polled over the RMC channel for status and change-of-state conditions. The modems can report their own serial numbers for inventory purposes, and provide additional analog line parameters with user-defined thresholds—functions only available under CMS control. From a single CMS operator console, users can also downline load modem strapping parameters; measure network performance; simultaneously monitor all ports on a multiport modem; perform modem diagnostics; and provide failure recovery for an entire modem-based network, including multitier configurations.

Fault isolation through diagnostic testing, conducted from the modem's front panel, includes local and remote analog/digital loopbacks and end-to-end testing in the CCITT V.54 format. An integral 511-bit pseudo-random test pattern generator and comparator displays a bit error count on the front panel during testing.

☐ Packaged Modems

Standalone or rackmount packaging available. Rackmount cards are housed in the Omnimode CS modem enclosure, which fits standard 19-inch equipment cabinets for central-site card nesting. All rackmounted Omnimode modems are controlled and monitored from a single control panel mounted in the rack.

Standalone Packaging

Omnimode 48 • standard CCITT V.27 or Racal-Milgo MPS

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48-compatible 4800-bps modem; 2400-bps fallback speed • half-/full-duplex operation on unconditioned 4-wire dedicated facilities • without options:

$82/$68 mo	$2,050 prch	$25 maint

Omnimode 96 • standard CCITT V.29 or Racal-Milgo MPS 9629-compatible 9600-bps modem; 7200-/4800-bps fallback speeds • half-/full-duplex operation on unconditioned 4-wire dedicated facilities • without options:

139/124	3,470	28

Omnimode 14.4 • standard CCITT V.24/28 14.4K-bps modem; 12K-bps fallback speed • half-/full-duplex operation on D1-conditioned, 4-wire dedicated facilities • without options:

260/211	8,000	35

Omnimode 1614 • standard 16.8K-bps modem; 14.4K-/12K-bps fallback speeds • half-/full-duplex operation on D1-conditioned, 4-wire dedicated facilities • without options:

373/270	10,000	35

Rackmount Packaging

Omnimode 48 • single-card modem equivalent to standalone Omnimode 48, without options • occupies single slot in Omnimode CS primary or secondary shelf:

$68/$57 mo	$1,700 prch	$25 maint

Omnimode 96 • single-card modem equivalent to standalone Omnimode 96, without options • occupies single slot in Omnimode CS primary or secondary shelf:

125/111	3,120	28

Omnimode 14.4 • single-card equivalent to standalone Omnimode 14.4, without options • occupies single slot in Omnimode CS primary or secondary shelf:

248/201	7,450	35

Omnimode 1614 • single-card equivalent to standalone Omnimode 1614, without options • occupies single slot in Omnimode CS primary or secondary shelf:

315/255	9,450	35

Omnimode CS • modem card enclosure consists of primary and secondary shelves; each shelf accommodates up to 16 Omnimode modems without options, 8 modems with Remote Modem Control, or 5 multiport modems with Remote Modem Control • accommodates any mixture of Omnimode modems, including different data rates and options • up to 1 primary shelf and 3 secondary shelves per 6-foot equipment cabinet; up to 64 Omnimode modems maximum without options.

Primary Shelf, Feature A • contains master front panel, similar to standalone modem front panel • allows configuration control, interface monitoring, or diagnostic testing for any selected Omnimode modem housed in either the primary shelf or in one of up to 3 cascaded secondary shelves • provides centralized control for remote Omnimode modems when installed with Remote Modem Control options • includes single power supply:

80/70	2,600	NC

Primary Shelf, Feature B • identical to Feature A but contains 2 power supplies for primary or multishelf redundancy:

105/90	3,100	NC

Secondary Shelf, Feature A • contains single power supply • can accept back-up power from primary shelf or another secondary shelf with redundant power:

75/65	1,600	NC

Secondary Shelf, Feature B • contains 2 power supplies for complete power redundancy per shelf • can provide back-up power to another secondary shelf, Feature A:

97/83	1,900	NC

Secondary Shelf, Feature C • contains single power supply • does not accept redundant power:

70/61	1,500	NC

☐ Application

Point-to-point or multipoint communication over unconditioned (Omnimode 48 and 96), and D1-conditioned (Omnimode 14.4), 4-wire dedicated Type 3002 voice channel; point-to-point communication over D1-conditioned, 4-wire dedicated Type 3002 voice channel • Omnimode 48 RTS/CTS delay selectable at 708 or 50 milliseconds, V.27 mode; 26 milliseconds, MPS 48 mode • Omnimode 96 RTS/CTS training time delay selectable at 30, 40, 50, or 253 milliseconds, V.29 mode; selectable at 30, 40, or 50 milliseconds, MPS 9601 mode. Omnimode 14.4/1614 RTS/CTS training time delay at 1.33 seconds.

☐ Operating Parameters

Synchronous half-/full-duplex transmission with selectable fallback data rates • Omnimode 48 rates at 4800 bps with half-speed fallback • Omnimode 96 rated at 9600 bps with fallback rates of 7200/4800 bps • Omnimode 14.4 rated at 14.4K bps with fallback rate of 12K bps • Omnimode 1614 rated at 16.8K bps with fallback rates of 14.4K/12K bps • 8-phase DPSK modulation, Omnimode 48 • QAM modulation with 8 phase and 2 amplitude levels, Omnimode 96 • Convolutional Coded Modulation (CCM) transmitting a 256-point eye pattern constellation at 16.8K bps, a 128-point eye pattern constellation at 14.4K bps, and a 64-point eye pattern constellation at 12K bps; Omnimode 14.4 and 1614 • automatic adaptive equalization.

Automatic Speed Selection • standard feature for Omnimode Model 1614 only • selects optimum data rate for a modem pair based on existing line quality • degrading line conditions cause automatic fallback from 16.8K bps to 14.4K bps or 12K bps • improving line conditions cause automatic transmission speed increases from 12K bps to 14.4K bps or 16.8K bps.

☐ Channel Functions

Multiport • Omnimode 48 available with optional 2-channel or 4-channel TDM multiplexer; Omnimode 96 available with optional 4-channel TDM multiplexer; Omnimode 14.4 and 1614 available with optional 4- or 6-channel TDM multiplexer • synchronous data rates at 1200, 2400, 3600, and 4800 bps for Omnimode 48; 2400, 4800, 7200, and 9600 bps for Omnimode 96; 2400, 4800, 7200, 9600, 12K, and 14.4K bps for Omnimode 14.4; and 2400, 4800, 7200, 9600, 12K, 14.4K, and 16.8K bps for Omnimode 1614 • supports dedicated or dial-up tail circuits • port data rate selections manually selected via front-panel switches and LED display or automatically for all RMC-equipped modems from a single Omnimode CS control panel or CMS network management system.

MP2 2-Channel Multiplexer • single-board Omnimode 48 option provides 3 selectable data rate port selections at 4800 bps; 2 selections at 2400-bps fallback rate • occupies designated slot in standalone Omnimode 48 or single slot in Omnimode CS primary or secondary shelves:

$23/$20 mo	$550 prch	NC maint

MP4 4-Channel Multiplexer • single-board Omnimode 48 or Omnimode 96 option provides 4 selectable data rate port selections at 4800-bps or 2400-bps fallback rate for Omnimode 48; 5 selectable data rate port selections at 9600 bps, 3 selections at 7200 bps, and 2 selections at 4800 bps for Omnimode 96 • occupies designated slot in standalone Omnimode 48/96 or single slot in Omnimode CS primary or secondary shelves:

28/24	750	NC

MP6 6-Channel Multiplexer • single-board Omnimode 14.4 or 1614 option provides 6 selectable data rate port selections at 14.4K bps for Omnimode 14.4; 7 selectable data rate port selections at 16.8K bps for Omnimode 1614 • occupies designated slot in standalone Omnimode 14.4/1614 or single slot in Omnimode CS primary or secondary shelves:

40/33	1,200	NC

Remote Modem Control (RMC) • 75-bps, FSK-modulated channel • controls remote point-to-point and multipoint modems

MO: single-unit monthly 1-/2-year lease charge; does not include maintenance. PRCH: single-unit purchase price. MAINT: monthly maintenance charge for leased or purchased equipment. NC: no charge. Prices are current as of April 1985.

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from central-site modem, including remote status and monitoring, diagnostics, and configuration control • call feature allows message communication between central and remote personnel by passing user-designated mnemonics and message codes; includes broadcast mode • available for all Omnimode models:

26/23	600	NC

Dynamode Dynamic Channel Allocation • improves link utilization for multiport-optioned models by automatically assigning only active data channels for transmission • any port can be assigned 1 of 3 selectable channel priorities • Fixed ports are assigned dedicated bandwidth at a specified data rate (first priority) • Dynamic ports are assigned available bandwidth when DTR is raised by terminal (second priority) • Variable ports are assigned unused bandwidth (third priority) • standard feature when multiport option combined with RMC option:

NC/NC	NC	NC

Tertiary Channel • low-speed, FSK-modulated, full-duplex side channel operates above Omnimode 48 primary channel • supports asynchronous data rates up to 150 bps • provides control path for user-defined applications; Omnimode 48 only • requires RMC option:

21/17	400	NC

Digital Interface • EIA RS-232C/CCITT V.24/V.28 all ports • 25-pin electrical connector.

☐ Control Functions

K10 Modem Sharing Option • allows several terminals to share modem channel port one-at-a-time • switched and monitored either locally or via CMS network control • available for CMS 4801/7201/9601 Fastran models only:

$29/$24 mo	$595 prch	NC maint

Failure Recovery • provides immediate recovery from line or modem failures • switches modems at attended or unattended sites between 4-wire dedicated line and 2 dial-up lines to restore communications interrupted by line failure/degradation • switches data terminal equipment and 4-wire dedicated line between faulty modem and hot-spare modem to restore communications interrupted by modem failure/degradation.

Model 124 Registered Manual Line Adapter • switches attended site modem between 4-wire dedicated line and 2 DDD line pairs • FCC-certified manually controlled standalone or plug-in unit • manual originate and answer.

Model 124 Standalone Unit:

15/12	260	6

Model 124 Central Site Plug-In Card:

15/12	230	3

Model 122 Registered Automatic Line Adapter • switches unattended or attended site modem between 4-wire dedicated line and 2 DDD line pairs • automatically answers calls on DDD lines • FCC-certified standalone or plug-in unit • central site/CMS control.

Model 122 Standalone Unit:

46/32	765	7

Model 122 Central Site Plug-In Card:

46/32	695	7

Model 23 Multiline Adapter • distributes analog signal from single modem to multiple remote modems via 4-wire dedicated lines or DDD line pairs • requires FCC certified registered connecting device (RCD) for each DDD connection • 4- or 8-channel configurations, standalone or rackmount; units can be cascaded for extra channels.

Model 23 4-Channel Standalone Unit:

39/29	575	9

Model 23 8-Channel Standalone Unit:

66/53	975	13

Model 68M RCD • standalone 2-wire, FCC-certified, manual Data Access Arrangement (DAA) • allows connection of Racal-Milgo and other vendor equipment to the DDD network; for non-FCC-certified devices:

6/5	100	NC

Model 68A RCD • features identical to Model 68M; automatic version:

8/8	190	NC

Dial Line Selector • central site dial backup switch accommodates up to 16 2-wire or 8 4-wire backup circuits with 1 handset • configured in 4-channel increments • point-to-point and multipoint networks • rack adapter, accommodating Dial Line Selector and associated RCDs, requires 8.75-inch vertical mounting space in standard equipment rack.

4-Channel Basic Dial Line Selector Unit:

212/170	3,945	30

Remote Modem Transfer Switch • switches analog and digital connections between primary modem and hot-spare backup modem:

73/52	1,535	12

Auto-Answer (Automatic Answer) • 2-wire, auto-answer feature with internal RCD; offered in either permissive or programmable mode • switches unattended or attended-site modem between 4-wire dedicated lines and 2-wire dial-up switched lines • available only for Omnimode Model 48 • extra-cost option:

6/5	150	NC

☐ Diagnostic & Status Indicators

Omnimode modems provide a comprehensive array of diagnostic tests and visual status information accessible from the modem front panel or an Omnimode CS master front panel. Tests are selected and status displayed through interaction with an 8-character LCD display and 12 touch-sensitive switches. With the RMC option, remote modems can be configured, monitored, and tested from a central site also; in addition, RMC provides compatibility between Omnimode modems and a Racal-Milgo CMS 185 or CMS 2000 network control and management system. Modems display unsolicited alarms of critical network failures, and a visual indication of modem and line operating conditions (status) upon touch-selection.

Loopback Tests • performs conventional digital/analog loopback tests at the local and remote modem; in addition, performs remote unattended tests per CCITT V.54 loop 2 (remote digital loop), loop 3 (local analog loop), and loop 4 (remote line side loop) • performs self-error test, self-polling test, end-to-end error test, and end-to-end polling test • when Multiport and RMC options are combined, allows one port to be looped without disturbing data on other ports:

NC/NC mo	NC prch	NC maint

Analog Parameter Monitoring (API) • measures transmit/receive levels and signal quality • adds additional measurements when used in conjunction with CMS network control and management system, including signal-to-noise ratio, phase jitter, frequency translation, and clock slew • measurements taken from user data; does not interrupt user traffic • requires Remote Modem Control (RMC) option:

NC/NC	NC	NC

Analog Parameter Measurement (AP2) • monitors and measures analog parameters; conforms closely to phone company specifications for expediting problem isolation • measures attenuation/delay distortion, noise with tone, frequency translation, signal-to-noise ratio, phase jitter, amplitude jitter, gain hits, dropouts, impulse noise, phase hits, and loss • interrupts normal data traffic • requires purchase of Remote Modem Control (RMC) option:

9/6	300	NC

Test Tone Generation • produces a 1004-Hz tone at the remote Omnimode modem for reception and testing at the central site in conjunction with user-supplied analog diagnostic equipment • interrupts normal data traffic:

NC/NC	NC	NC

Test Pattern Generation • integral 511-bit pseudo-random test pattern generator and error detector performs bit error rate tests

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during loopbacks • error count is displayed on modem front panel while tests are running:

NC/NC	NC	NC

Eye Pattern Generator • option creates eye pattern on externally connected oscilloscope; presents analog transmission conditions:

NC/NC	NC	NC

Alarms • visual and audible alarms alert users to modem failure on a remote Omnimode; terminal power failure for local or remote DTE; streaming modem caused by malfunctioning DTE; receive line fault when local/remote modem not receiving valid signal; and external alarm condition caused when customer equipment closes set of contacts • front-panel LCD display indicates location of alarm condition; multiple alarm condition indicates more than one alarm at the same time:

NC/NC	NC	NC

Status Display • modem and line conditions called up on front-panel LCD display upon operator command • provides modem speed and port configuration • receive level dBm and signal quality • interface signal monitoring • tests in progress and error counts:

NC/NC	NC	NC

• **END**

Racal-Milgo Omnimux Series
Omnimux TDM56, 4, 8, 80, 160 & 320

■ PROFILE

Function • bit-interleaved time-division multiplexer (Omnimux TDM56) • statistical multiplexers for point-to-point or multipoint network applications (Omnimux 4/8/80/160/320).

Communications/Networks • Omnimux TDM56 supports up to 8 synchronous channels; Omnimux 4/8 support up to 4/8 asynchronous channels, respectively; Omnimux 80/160/320 support up to 8/16/32 asynchronous/BSC channels, respectively • maximum aggregate channel rate of 76.8K/76.8K/153.6K/307.2K bps (Omnimux 4/8/80/160/320) • supports 1 composite link in point-to-point configurations; supports 2 composite links in multinode configurations • modified CCITT X.25 Level II link protocol.

First Delivery • 1981 (Omnimux 80/160/320); 1984 (Omnimux TDM56, Omnimux 4/8).

Systems Delivered • not available.

Comparable Systems • principal competition for Omnimux TDM56 from Gandalf OLM504 and Micom Micro 750; Omnimux 4, 8, and 80 from Codex 660; DCA 105; Gandalf PIN9106; GDC 1240/1241; Infotron Supermux 480; Micom Micro 800 and Micro 800/2; Prentice SNP-1000; Case Rixon DCX815; and Timeplex Series II Microplexer M4A/M8C • competition for Omnimux 160 and 320 from Codex 6010; DCA 120; DCC CM9100/CM9200; Gandalf PIN9103; GDC 1240/1241; Infotron Supermux 680; Micom Micro 800/2; Case Rixon DCX836; and Timeplex Series II Microplexer M24C.

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Distribution • nationwide via Racal-Milgo regional sales offices and Racal-Milgo distributors • Canada via Electronetic Systems, Downsview and Ottawa, ON; Vancouver, BC; and Montreal, PQ • worldwide through Racal-Milgo distributors.

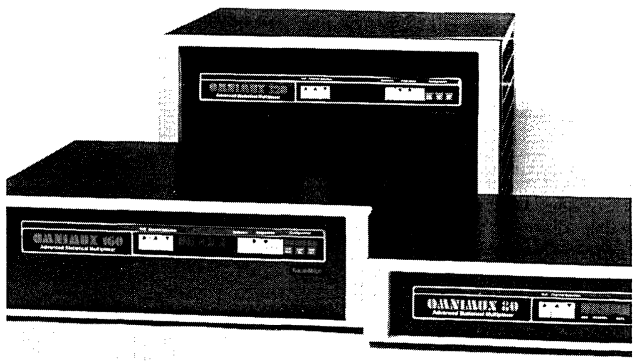
GSA Schedule • listed.

■ ANALYSIS

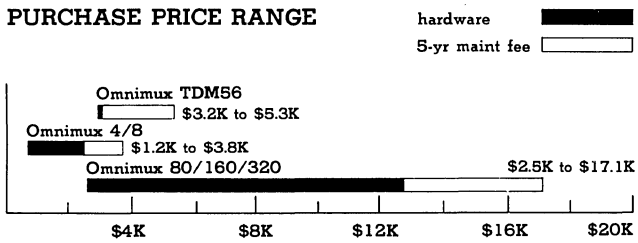
As part of an effort to reinforce its competitive positioning in the multiplexer marketplace, Racal-Milgo has formed a separate Multiplexer Division over the past year. The new organization supports the development and marketing of the expanded multiplexer product line which comprises the Omnimux family of time-division and statistical multiplexers. Since this report's last revision, 2 new members have been added to the existing statistical multiplexer line-up, a new time-division multiplexer model has been introduced, and several new options for high-end Models 80/160/320 have been released.

New Omnimux Models 4 and 8 supersede the older Models 30 and 40 which are being phased out of the current line-up. The Omnimux 4 is a 4-channel nonexpandable asynchronous statistical multiplexer which is priced 33 percent lower than its Model 30 predecessor. The Omnimux 8 is a 4- or 8-channel field upgradable unit which is priced 12 percent lower than a comparable Model 40 multiplexer with 8 channels. Racal-Milgo has also unveiled a TDM multiplexer, the TDM56, which divides wideband DDS circuits into low-speed channels allowing users to economically use DDS for a variety of low to high speed devices. Another addition to the Omnimux line-up is an OEM version of the Amdahl 2211 T1 multiplexer, called Omnimux T1; see report 910-A358-2211. Noteworthy enhancements to the existing Omnimux Models 80/160/320 include a Universal Channel Card Option which essentially replaces the older 2-channel Bisync card with a 4-channel card designed to support a variety of asynchronous and synchronous protocols on a per-channel basis. The Omnimux Wideband Aggregate Link Option further enhances the Omnimux family by combining asynchronous and synchronous data paths to reduce the number of transmission links. In addition, the new CMS Compatibility Option supports supervisory control and statistical reporting functions accessed and controlled via a Racal-Milgo Communications Management Series (CMS) console.

The 6 members of the Omnimux family include a TDM multiplexer designed for operation over wideband DDS links and 5 statistical multiplexer models designed for a range of small- to medium-scale point-to-point or multipoint network applications. The Omnimux TDM56 is an 8-channel synchronous time-division multiplexer that eliminates the high cost of 2 or more dedicated lines and high-performance modems by consolidating synchronous traffic on one line. Data rates from 1200 to 32K bps are individually set for each channel and aggregate link speeds ranging from 9600 to 72K bps are supported. When connected to



PURCHASE PRICE RANGE



RACAL-MILGO OMNIMUX SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations (solid bars), and for associated 5-year period maintenance fees (open bars) • **Omnimux TDM56** bar graph covers "basic" configuration (solid bar) and associated 5-year period maintenance (open bar) • **Omnimux basic** configuration consists of 8-channel TDM multiplexer • **Omnimux 4/8 small** configuration consists of 4-channel async multiplexer; **large** of 8-channel async multiplexer • **Omimux 80/160/320 small** configuration consists of 4-channel async multiplexer; **large** of 28-channel async multiplexer with 2 composite links, supervisory control/monitor option, and integral 9600-bps modem.

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a high-speed communication facility such as AT&T's DDS, the Omnimux TDM56 operates at 56K bps and provides 52K bps of available bandwidth. It can also be cascaded with the Omnimux T1 multiplexer to effectively utilize the T1 bandwidth. All operating parameters are entered via DIP switches and remote channel parameters can be downline loaded from the local multiplexer.

The Ommnimux 4/8 are economical, more compact versions of the older Models 30 and 40. The Omnimux 4 is a low-end packaged multiplexer equipped with 4 channels. A no-frills unit, the Omnimux 4 **cannot be** upgraded to support 8 channels. The Omnimux 8, however, is a 4- or 8-channel field-expandable asynchronous statistical multiplexer. Both Omnimux 4/8 multiplexers offer economical solutions to eliminating the cost of several dedicated lines and/or dial-up facilities for remote asynchronous terminals. Typical applications include communication with asynchronous terminals and teleprinter terminals which can be directly connected or remotely connected (via tail circuits or dial-up lines to multiplexer channels).

Echoplex and flyback control are standard features. Echoplex is a simple means of error control through visual verification of transmitted data at the sending terminal. Flyback control compensates for carriage return, line feed, and form feed delays. Both features can be enabled or disabled on a per channel basis. The standard unit also supports diagnostic measures to locate and isolate channel- or link-related failures reported through status indicators on the unit's front panel. Autobaud and flow control are also standard features. Autobaud is useful for dial-up applications to accommodate remote terminals with different data rates. Flow control guards against loss of data from multiplexer buffer overflow, and from terminal conditions that slow or interrupt the flow of data, such as buffer full.

The Omnimux 80, 160, and 320 are more sophisticated units that support up to 8, 16, and 32 channels, respectively, in a wide variety of channel configurations. These devices are packaged with asynchronous or block-mode synchronous channels either separately or combined. Each model is field upgradable to its full complement of channels. Physically small, the Omnimux 80, 160, and 320 are available in both standalone and rackmount versions.

The Omnimux 80, 160, and 320 are designed for ease of use through simplified front panel controls and a digital display. Operating parameters are easily established or reviewed for the individual local and remote channels through the digital display and associated select buttons. All functions are performed through a single key depression. A stored menu displays all operating parameters, with the appropriate parameters selected when displayed. Operating flexibility is augmented through an extra-cost Supervisory Control and Monitor option which supports all operating functions and operating status from a user-supplied terminal.

The Omnimux 80, 160, and 320 provide extensive statistics reporting. Operating statistics on individual channel operation and composite link are continuously accumulated, and can be displayed at either local or remote units. Statistics reports are available at an operator terminal with the Supervisory Control and Monitor option. Individual entries are logged with time of day for detailed analysis.

Diagnostics can be performed from front panel controls on the Omnimux 80, 160, or 320 or from a channel attached operator terminal with the Supervisory Control and Monitor option. Diagnostics are comprehensive. They include local and remote channel loopback testing as well as local and remote composite link loopback to isolate failures within individual channels; within a local or remote multiplexer; within a local or remote integral modem; and within the composite link. A FOX test message can be transmitted to selected channels to verify operational integrity.

All Omnimux models are designed to facilitate easy removal and replacement of power supply, link module, channel adapters, and modem. These components are readily accessible from the front panel without disturbing cable connections. A snap-off front panel reveals horizontally mounted PC boards that plug into the unit's backplane via edge connectors. Component failures are easily resolved by swapping boards, and channel adapters can be easily added to accommodate expansion.

For the future, Racal-Milgo is planning to add several new enhancements to the Omnimux family. These include integral modems and rackmount versions for the low-end Omnimux 4 and 8; the extension of the supervisory Control and Monitor and CMS Compatibility options across the entire line; and the release of additional protocol support for the Universal Channel Card.

☐ Strengths

The addition of the Omnimux TDM56 offers users with low-speed applications the advantages of DDS by dividing DDS circuits into low-speed channels for economical data transfer. As an alternative application, the Omnimux TDM56 can be used to increase channel capacity of Racal-Milgo's Omnimux T1 by combining up to 8 low-speed channels on a single synchronous channel of the T1 multiplexer. The Omnimux TDM56's 12 selectable rate combinations provide enhanced flexibility for a range of traffic conditions.

The Omnimux 4 and 8 are cost-effective alternatives to multiple dedicated lines and modems for asynchronous terminal communication. They eliminate the cost of extra lines and modems but are not yet available with integral modems which require the user to acquire an external modem for the composite link. The basic units are equipped with echoplex and flyback control. Echoplex is useful for data verification at CRT or teleprinter terminals, while flyback control is especially useful for unbuffered teleprinter terminals to compensate for delays encountered with nonprint functions. Autobaud, a standard option, eliminates the need for dedicated lines to support remote terminals with different data rates. With autobaud, these terminals can dial-up on any channel; channel rate is automatically regulated to the transmission rate. Flow Control is advantageous for heavy traffic flow into the multiplexer channels to guard against buffer overflow with resultant loss of data. It is also beneficial to prevent loss of data at the terminal end as a result of buffer full or other conditions that interrupt data flow. The diagnostics included with the basic unit are adequate to isolate failures at any point in the system, and to determine link degradation or failure.

Configuration modularity, ease of operation, performance statistics, and comprehensive diagnostic support are the chief advantages of the Omnimux 80, 160, and 320. They are easily field upgradable to accommodate user growth. Ease of operation is achieved through menu-driven operation and display-associated touch controls. Operating parameters are easily altered to respond to changing operating requirements. Performance statistics provide the user with essential information for performance evaluation; thus, the user can tune the network for optimum performance and plan for future needs. Menu-selectable diagnostics facilitate ease of failure isolation, eliminating finger-pointing and excessive downtime.

The Omnimux 40, 80, 160, and 320 are also link compatible. These units can thus be mixed in multinode networks (up to 3 nodes) when 1 node is equipped with the dual composite link option. The dual link option is a strong user benefit, supporting applications such as higher data throughput over a point-to-point dual link; channel bypass in a 3-node network, saving the expense of redundant parallel composite links; and multinode networks, where 1 master-site mux supports 2 independent remote muxes.

The new wideband link option for the Omnimux 80, 160, and 320 provides another advantage for handling statistically multiplexed asynchronous and synchronous data at apeeds from 2.4K to 72K bps. This option allows up to 32 channels of asynchronous/synchronous data, each operating at rates up to 9600 bps, to be multiplexed over a single composite link. The wideband option allows economical usage of DDS satellite, or analog circuits and is suitable for a variety of devices including printers, facsimile terminals, minicomputers, and batch terminals.

The new Universal Channel Card greatly enhances the flexibility of the high-end Omnimux models by allowing the user to configure individual channels to handle different protocols. Earlier channel cards, such as the 2-channel Bisynch Card and

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the 4-channel Async Card **do not** support the intermixing of different protocols on a selectable per-channel basis. A technically innovative feature, the Universal Channel Card will appeal to users with multiple host installations.

☐ Limitations

The Omnimux TDM56 is a no-frills time division multiplexer which is limited by an 8-channel capacity. It is only suitable for synchronous applications requiring 8 channels or less. In addition, operating parameters for both local and remote configurations are entered via DIP switches located on the front panel. The low-cost Omnimux 4 and 8 are also restricted by this operating inconvenience which makes all 3 units unsuitable for a network control environment. However, the vendor has promised that the Supervisory Control and Monitor option currently available for the 16- and 32-channel models will be introduced for the low-end units as well. This useful option allows operating parameters to be altered from separate ASCII terminals. In addition, statistical information and diagnostic reporting can be generated from a single location which centralizes supervisory control.

At the present time, the Omnimux 4 and 8 do not support integral modems and do not provide a current loop electrical interface. Although integral modems should be available for Models 4 and 8 sometime during 1985, the lack of a current loop interface will prevent them from supporting TTY-type terminals equipped only with a current loop interface. The Omnimux 80, 160, and 320 are very attractive units, but they do have a few shortcomings. Users with a heavy concentration of synchronous terminals should consider these models' 8-channel limitation for synchronous channels as a serious restriction. This is not a restriction among some of the other leading vendor's products, such as Infotron's Supermux 680 and 790 and the Codex 6030, which allow an intermix of asynchronous and synchronous channels. The Omnimux units also do not support bit-synchronous protocols. The inability to mix synchronous and BSC synchronous channels on the same Omnimux unit eliminates applications involving both synchronous and BSC terminals, such as IBM 3270s and 3780s, at remote sites. This limitation can be partially alleviated by combining the composite link of an Omnimux unit with the BSC channels with synchronous channels on a multiport modem such as the Racal-Milgo MPS 9601, which accommodates up to 7 synchronous channels.

Although a dual composite link option is available for the high end of the series, Omnimux models **do not** support alternate routing in case of link failure; nor do they support channel routing or port contention. Users with these requirements should consider comparable multiplexers from vendors such as Timeplex, Infotron, Paradyne, or Micom.

Priority control is absent in the Omnimux models. Channel priority assignments are necessary to service channels handling critical traffic before those with noncritical traffic. Different levels of priority assignments are necessary to accommodate channels with different demands. The Omnimux units will not satisfy these user needs.

Data compression is also absent from the Omnimux models. Applications that handle volume numerics or frequently repeated characters should consider the lack of data compression as a definite limitation. Data compression significantly reduces the amount of data that need be transmitted, thereby increasing communications efficiency.

■ HARDWARE

☐ Terms & Support

Terms • the Racal-Milgo Omnimux Series multiplexers are available for purchase, or on a 1-, 2-, 3-, 4-, or 5-year lease • separate maintenance contract available for leased or purchased units • 1-year warranty for purchased units • lease/purchase credit 50 percent of lease paid out up to 80 percent of purchase • quantity discount for 6 or more purchased units.

Support • installed by Racal-Milgo or by user • installation charge is $100 for Omnimux 4; $125 for 4-channel Omnimux 8; $180 for 8-channel Omnimux 8 or 80; $220 for Omnimux 160; $290 for Omnimux 320 • maintenance performed under annual contract during prime-shift hours (8.00 AM to 5.00 PM, Monday through Friday) • maintenance priced at $18 per month for Omnimux 4; $20 per month for 4-channel Omnimux 8; $25 for 8-channel Omnimux 8 or 80; $45 per month for Omnimux 160; and $60 per month for Omnimux 320 • on-call or factory maintenance billed for time and materials plus travel expense for on-call service • nationwide Racal-Milgo service; dial-up test facilities for online testing and troubleshooting assistance via regional customer support centers at Atlanta, GA; Huntington Beach, CA; Richardson, TX; Schaumburg, IL; and Freehold, NJ.

☐ Overview

The Omnimux TDM56 time-division multiplexer and the 5 statistical multiplexer models are designed for a broad range of small- to medium-scale point-to-point network applications. The models are packaged with 4 (Omnimux 4) or 8 channels (Omnimux 8 and TDM56) or come with empty card slots supporting up to 8, 16, or 32 channels (Omnimux 80, 160, and 320) in 4- or 2-channel increments. Asynchronous and BSC synchronous channels are supported as well as SDLC channels. A 4-channel Universal Channel Card accommodates any mix of async and sync channels. Units can be ordered with only asynchronous or only BSC synchronous channels, or with combinations of asynchronous with BSC or SDLC synchronous channels. Maximum channel rate is 9600 bps; composite link rates are supported up to 19.2K bps. An integral 2400-bps, 4800-bps, or 9600-bps link modem is optional on high-end Models 80/160/320. The link protocol, modified CCITT V.25 Level II, is common to all models.

The Omnimux 80, 160, and 320 can be equipped with dual composite links designed for 1 of 3 applications. **load sharing**, **split link**, or **channel bypass** configurations.

Load sharing is a point-to-point configuration using dual composite links to achieve transmission speeds up to 19.2K bps (9600 bps per link) with fallback to 9600 bps in case of a link failure. A split link provides two 9600-bps links in a multipoint configuration, where each link connects different destinations. Channel bypass configuration connects 3 nodes using only 2 composite links; channels that communicate between 2 single-node units bypass 1 dual-node unit, eliminating parallel links.

Individual channel ports accommodate asynchronous data rates from 50 to 9600 bps, and synchronous rates from 1200 to 9600 bps. Channel parameters are selected by internal DIP switches on the Omnimux TDM56, 4, and 8. On the Omnimux 80, 160, and 320 channel parameters are established for individual local and remote units via front panel unit/channel select buttons in conjunction with a parameter select button which selects appropriate parameters from a scrolling menu. Channel parameters are downline loaded to the remote unit on all models.

Omnimux TDM56 Configuration • 8-channel standalone unit • supports synchronous channels at selectable rates to 32K bps • single composite link at synchronous rates to 72K bps.

Omnimux 4/8 Configurations • 4- or 8-channel packaged configuration standalone unit • supports asynchronous channels at selectable rates to 9600 bps; 76.8K-bps maximum aggregate channel rate • 1 composite link; synchronous rates to 9600 bps.

Omnimux 80 Configuration • 8-channel standalone unit in expandable 2- or 4-channel increments • supports 4 or 8 asynchronous or synchronous channels in 4-channel increments; 2 or 4 BSC synchronous channels • selectable channel rates to 9600 bps • 76.8K-bps maximum aggregate channel rate • 1/2 composite links; synchronous rates to 19.2K bps or up to 72K bps with wideband Aggregate Link option.

Omnimux 160 Configuration • 16-channel standalone unit in expandable 2- or 4-channel increments • supports 4 to 16 asynchronous channels in 4-channel increments; 2 to 8 BSC synchronous channels in 2-channel increments • selectable channel rates to 9600 bps • 153.6K-bps maximum aggregate channel rate • 1/2 composite links; synchronous rates to 19.2K bps or up to 72K bps with wideband Aggregate Link option.

Omnimux 320 Configuration • 32-channel standalone unit in

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expandable 2- or 4-channel increments • supports 8 to 32 asynchronous channels in 4-channel increments; 2 to 8 BSC synchronous channels in 2-channel increments • selectable channel rates to 9600 bps • 307.2K-bps maximum aggregate channel rate • 1/2 composite links; synchronous rates to 19.2K bps or up to 72K bps with wideband Aggregate Link option.

Omnimux TDM56 Synchronous Time-Division Multiplexer

Omnimux TDM56 Central Control • central control module packaged with 8-bit-interleaved synchronous channels; contains central logic, power supply, integral channel adapters, and single composite link module.

8-Channel Sync Omnimux TDM56 • multiplexer configuration with 8 synchronous channels and single composite link.

$128/$119 mo	$3,200 prch	$35 maint

Rackmount Option • mounts standalone unit in standard equipment cabinet • extra-cost option.

NA/NA	80	NA

Omnimux TDM56 Diagnostic Tests • isolates failure in local central controller, local/remote channels, local/remote composite link modules, or composite link through selectable tests • remote and local channel loopback • local composite loopback • channels in loopback mode do not interfere with active channels • standard feature.

NC/NC	NC	NC

Omnimux TDM56 Channels • central control module packaged with 8-bit-interleaved synchronous channels • half-/full-duplex switch-selectable channel rates at 1200/2400/4800/7200/8400/9600/12K/14.4K/16K/16.8K/19.2K/32K bps; sum of channel rates can equal 93 percent of link rate • passes 4 full-duplex EIA control signals (DTR/DSR, RI, RTS/CTS, DCD) • channel price included in cost of central control unit.

NC/NC	NC	NC

Omnimux TDM56 Composite Link • central control module packaged with link • 9.6K/12K/14.4K/16K/16.8K/19.2K/32K/48K/56K/64K/72K bps synchronous rates • external clock • RS-232C/CCITT V.24/V.35 electrical interface • composite link included in cost of central control module.

NC/NC	NC	NC

☐ Omnimux 4 Multiplexer

ADD & Omnimux 4 Central Control

Central control module available in nonexpandable 4-channel packaged configuration with central logic, power supply, 7K-byte RAM buffer shared by central logic and channels, integral channel adapters, and composite link module.

4-Channel Async Omnimux 4 • multiplexer configuration with 4 asynchronous channels and composite link; supports EIA control signals.

$49/$45 mo	$1,200 prch	$18 maint

Omnimux 4 Flow Control

Guards against multiplexer buffer overflow and resultant loss of data; also protects terminal equipment from loss of data resulting from various conditions that prevent a terminal from accepting data • controls data flow from terminals at selected terminal ports by lowering or raising Clear-To-Send (CTS) on RS-232C interface, or by generating XON/XOFF (CTL Q/S) control characters; compatible with DEC, Wang, and HP • flow suspension threshold at 80 percent total buffer utilization; flow resumption threshold at 60 percent • terminal equipment controls data flow from multiplexer via control characters recognized at channel port • standard feature.

NC/NC mo	NC prch	NC maint

Omnimux 4 Diagnostic Tests

Isolates failures in local central controller, local/remote channels, local/remote composite link modules, or composite link through selectable tests • remote and local channel loopback • remote and local composite loopback • channels in loopback mode do not interface with active channels • standard feature.

NC/NC mo	NC prch	NC maint

Omnimux 4 Channels

Central control module packaged with 4 asynchronous channels • half-/full-duplex switch-selectable channel rates at 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps; maximum aggregate input rate of 9600 bps per channel • 5/7/8 data bits; 1/1.5/2 stop bits; parity transparent, odd/even/no parity • passes 4 full-duplex EIA control signals (DTR/DSR, RI, RTS/CTS, DCD) • RS-232C/CCITT V.24/V.28 electrical interface.

Echoplex • loops transmission received from data terminal equipment at channel port to port output • selectable on per channel basis • provides visual data verification at remote terminal connected through tail circuit • standard feature included in package price.

NC/NC mo	NC prch	NC maint

Flyback Control • delays transmission of data to data terminal equipment following transmitted carriage return, line feed, or form feed control characters • compensates for time required for terminal to perform these control functions • selectable on per channel basis • standard feature included in package price.

NC/NC	NC	NC

Automatic Baud Recognition (Autobaud) • regulates asynchronous channel rate to that of dial-up line • selectable on per channel basis • 110/134.5/150/300/600/1200-bps rate • CR/Memorex convention • standard feature included in package price.

NC/NC	NC	NC

Hewlett-Packard (HP 3000) Option • provides statistical multiplexing for the HP 3000 ENQ/ACK asynchronous protocol • standard feature included in package price.

NC/NC	NC	NC

Wang Option • provides statistical multiplexing for the Wang 2200 computer systems using 9-bit synchronous or 11-bit asynchronous character codes for special function keys • standard feature included in package price.

NC/NC	NC	NC

Omnimux 30 Composite Link

Central control module packaged link • synchronous rates from 1200 bps to 19.2K bps • modified X.25 Level II link protocol • CRC 16 error detection • RS-232C/CCITT V.24/V.28 electrical interface • standard feature included in package price.

NC/NC mo	NC prch	NC maint

☐ Omnimux 8 Multiplexer

Omnimux 8 Central Control

Central control module available in 4- or 8-channel packaged configurations with central logic, power supply, 7K-byte RAM buffer shared by central logic and channels, integral channel adapters, composite link module.

4-Channel Async Omnimux 8 • multiplexer configuration with 4 asynchronous channels and composite link; supports EIA control signals.

$70/$64 mo	$1,700 prch	$20 maint

8-Channel Async Omnimux 40 • multiplexer configuration with 8 asynchronous channels and composite link; supports EIA control signals.

94/86	2,300	25

MO: 1-year/2-year monthly lease charge without maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for leased and purchased units. NC: no charge. NA: not available/pricing not announced to date. Prices are current as of March 1985.

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Omnimux 8 Flow Control

Guards against multiplexer buffer overflow and resultant loss of data; also protects terminal equipment from loss of data resulting from various conditions that prevent a terminal from accepting data • controls data flow from terminals at selected terminal ports by lowering or raising Clear-To-Send (CTS) on RS-232C interface, or by generating XON/XOFF (CTL Q/S or CTL R/S) control character; compatible with DEC, Wang, and HP • flow suspension threshold at 80 percent total buffer utilization; flow resumption threshold at 60 percent • terminal equipment controls data flow from multiplexer via control characters recognized at channel port • standard feature.

NC/NC mo	NC prch	NC maint

Omnimux 8 Diagnostic Tests

Isolates failures in local central controller, local/remote channels, local/remote composite link modules, or composite link through selectable tests • remote and local channel loopback • remote and local composite loopback • channels in loopback mode do not interface with active channels • standard feature included in package price.

NC/NC mo	NC prch	NC maint

Omnimux 8 Channels

Central control module packaged with 4 or 8 asynchronous channels • half-/full-duplex switch-selectable channel rates of 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps; maximum aggregate input rate of 9600 bps per channel • 5/7/8 data bits; 1/1.5/2 stop bits; parity transparent, odd/even/no parity • passes 4 full-duplex EIA control signals (DTR/DSR, RI, RTS/CTS, DCD) • RS-232C/CCITT V.24/V.28 interface.

Echoplex • loops transmission received from data terminal equipment at channel port to port output • selectable on per channel basis • provides visual data verification at remote terminal connected through tail circuit • standard feature included in package price.

NC/NC mo	NC prch	NC maint

Flyback Control • delays transmission of data to data terminal equipment following transmitted carriage return, line feed, or form feed control characters • compensates for time required for terminal to perform these control functions • selectable on per channel basis • standard feature included in package price.

NC/NC	NC	NC

Automatic Baud Recognition (Autobaud) • regulates asynchronous channel rate to that of dial-up line • selectable on per channel basis • 110/134.5/150/300/600/1200-bps rate • CR/Memorex convention • standard feature included in package price.

NC/NC	NC	NC

Hewlett-Packard (HP 3000) Option • provides statistical multiplexing for the HP 3000 ENQ/ACK asynchronous protocol • standard feature included in package price.

NC/NC	NC	NC

Wang Option • provides statistical multiplexing for the Wang 2200 computer systems using 9-bit synchronous or 11-bit asynchronous character codes for special function keys • standard feature included in package price.

NC/NC	NC	NC

Omnimux 8 Composite Link

Central control module packaged link • synchronous rates from 1200 bps to 19.2K bps • modified CCITT X.25 Level II • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 interface • standard feature included in package price.

NC/NC mo	NC prch	NC maint

☐ Omnimux Models 80, 160 & 320

Models with dual composite links can be used in load sharing, split link, or channel bypass configurations • load sharing equally divides the traffic load between 2 composite links in a point-to-point network, whereby the composite load is dynamically shared between the two links; in case of link outage, all traffic is routed over the remaining redundant link until the failure is corrected; upon recovery, normal load sharing over both composite links is automatically resumed • a split link provides 2 composite links with destinations at 2 different sites in a multinode network; channels are permanently assigned to 1 of the 2 links • channel bypass supports communication among 3 nodes using only 2 composite links, one to link each single-link remote node to a dual-link central node; eliminates parallel links • **different models in this group are link compatible.**

Omnimux 80 Central Control

Central control module consists of chassis with central logic, power supply, composite link module, and 14K-byte RAM buffer shared by central logic and channels; provides 2 slots for 4-channel or 2-channel adapters and/or optional 2400-bps, 4800-bps, or 9600-bps composite link modem • 8 channels maximum without composite link modem(s).

$137/$82 mo	$1,600 prch	$25 maint

Rackmount Option • mounts standalone unit in a standard equipment cabinet • extra-cost option.

NA/NA	25	NA

Omnimux 160 Central Control

Central control module consists of chassis with central logic, power supply, composite link module, and 20K-byte RAM buffer shared by central logic and channels; provides 4 slots for 4-channel or 2-channel adapters and/or optional 2400-bps, 4800-bps, or 9600-bps composite link modem • 16 channels maximum without composite link modem(s).

$155/$100 mo	$2,000 prch	$45 maint

Rackmount Option • mounts standalone unit in a standard equipment cabinet • extra-cost option.

NA/NA	25	NA

Omnimux 320 Central Control

Central control module consists of chassis with central logic, power supply, composite link module, and 32K-byte RAM buffer shared by central logic and channels; provides 8 slots for 4-channel or 2-channel adapters and a dedicated slot for optional 2400-bps, 4800-bps, or 9600-bps composite link modem • 32 channels maximum.

$180/$125 mo	$2,400 prch	$60 maint

Rackmount Option • mounts standalone unit in a standard equipment cabinet • extra-cost option.

NA/NA	25	NA

Flow Control—Omnimux 80, 160 & 320

Guards against multiplexer buffer overflow and resultant loss of data; also protects terminal equipment from loss of data resulting from various conditions that prevent a terminal from accepting data • controls data flow from terminals at selected terminal ports by lowering or raising Clear-To-Send (CTS) on RS-232C interface, or by generating XON/XOFF (CTL Q/S or CTL R/S) control character; compatible with DEC and HP • flow suspension threshold at 80 percent total buffer utilization; flow resumption threshold at 60 percent • terminal equipment controls data flow from multiplexer via control characters recognized at channel port • standard feature.

NC/NC mo	NC prch	NC maint

Diagnostic Tests—Omnimux 80, 160 & 320

Diagnostic tests conducted through front-panel controls on local or remote multiplexers, a user-supplied terminal supported by Supervisory Control and Monitor option • test results presented via unit's digital display or at supervisory terminal • operator selectable local or remote channel loopback for operator selected channels; local or remote composite link loopbacks • local channel loopback loops send and receive sides of selected channel interface for testing from terminal equipment; remote channel loopback loops send and receive sides from remote

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interface to verify integrity of entire system from local terminal equipment • local aggregate loopback loops input/output of composite link on local unit to verify integrity of local multiplexer via terminal equipment attaches to local channel • remote aggregate loopback loops composite link at remote unit to verify integrity of both units and transmission facility from terminal equipment on local channel • FOX message generation on selected channels verifies terminal operation • standard features included in package price.

NC/NC mo	NC prch	NC maint

Status Reporting/System Control—Omnimux 80, 160 & 320

Monitors and accumulates statistics on operating performance • digital display presents results at operator selection • includes aggregate link statistics and individual channel statistics • aggregate link statistics include total link utilization defined as percentage of available link bandwidth utilized by all channels; percentage of asynchronous and synchronous traffic utilization; and number of retransmissions • channel statistics include percentage of asynchronous and synchronous traffic utilization on a per channel basis; flow control utilization, defined as the number of flow control functions executed over a 5-minute period; and input buffer overflows, defined as the number of overflows on asynchronous channels over a 5-minute period • standard features included in package price.

NC/NC mo	NC prch	NC maint

160/320 Supervisory Control & Monitor • supports user-supplied terminal as supervisory and control terminal on designated channel • system operating parameters altered from terminal; monitor, diagnostic, and statistics reporting functions for local and remote multiplexers controlled from terminal • statistics logged with time for detailed network analysis of traffic flow • can display, transmit, and receive data flow of any channel without interference • can conduct diagnostic testing of local and remote units, and send messages to remote terminals • extra-cost option.

6/5	100	NC

CMS Compatibility Option • provides single aggregate CMS compatibility • supports functions provided in supervisor and control option • allows Omnimux control, monitoring, and statistical reporting to be accessed and controlled via CMS console • extra-cost software option.

NA/NA	200	NC

Satellite Link Option • compensates for additional transmission delays incurred with satellite links without affecting efficiency.

NC/NC	NC	NC

Channels—Omnimux 80, 160 & 320

Omnimux 80 central control module supports two 4-channel adapters (Async or Universal Channel Cards), 2 channel adapters (Bisync Cards), or combinations • Omnimux 160 central control module supports four 4-channel adapters, four 2-channel adapters, or combinations • Omnimux 320 central control module supports eight 4-channel adapters, eight 2-channel adapters, or combinations.

Asynchronous half-/full-duplex or synchronous half-duplex channels • asynchronous channels packaged in 4-channel increments; menu-selectable channel rates of 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps; maximum aggregate data rate of 9600 bps per channel • 5/6/7/8 data bits; 1/1.5/2 stop bits; parity transparent, odd/even/no parity • passes 4 full-duplex EIA control signals (DTR/DSR, RI, RTS/CTS, DCD) • synchronous half-duplex channels in 2-channel increments; menu-selectable channel rates of 0.125, 0.25, 0.50, or 1.0 percent of the composite link speed • RS-232C/CCITT V.24/V.28 electrical interface.

4-Channel Async Card • includes flow control and optional autobaud, optional HP ENQ/ACK support • autobaud adjusts channel rate automatically to speed of dial-up tail circuit; 110/134.5/150/300/600/1200-bps rate; CR/Memorex convention; selectable on per channel basis • ENQ/ACK option supports Hewlett-Packard 3000 systems employing the asynchronous block-mode ENQ/ACK protocol; selectable on per channel basis.

$30/$18 mo	$875 prch	NC maint

2-Channel Bisync Card • statistically multiplexes block-oriented synchronous protocols including IBM 3270, 2780/3780; CDC User 200; Sperry Uniscope 100/200; Burroughs 771, Poll/Select and Honeywell VIP 7700; and half-duplex SDLC/SNA.

35/22	900	NC

4-Channel Universal Channel Card • statistically multiplexes synchronous/asynchronous channels; protocols supported include IBM BSC (3270/2780/3780) and half-duplex SDLC. and CR/Memorex convention • asynchronous channel rates to 9600 bps • synchronous channel rates to 19.2K bps • selectable on a per-channel basis.

38/28	975	NC

Echoplex • loops transmission received from data terminal equipment at channel port-to-port output; echos data from remote multiplexer instead of from CPU • selectable on a per-channel basis • standard feature.

NC/NC	NC	NC

Flyback Control • delays transmission of data-to-data terminal equipment following transmitted carriage return, line feed, or form feed control characters • compensates for time required for terminal to perform these control functions • selectable on per channel basis • standard feature included in package price.

NC/NC	NC	NC

Automatic Baud Recognition (Autobaud) • regulates asynchronous channel rate to that of dial-up line • selectable on per channel basis • 110/134.5/150/300/600/1200-bps rate • CR/Memorex convention • standard feature included in package price.

NC/NC	NC	NC

Hewlett-Packard (HP 3000) Option • provides statistical multiplexing for the HP 3000 ENQ/ACK asynchronous • standard feature included in package price.

NC/NC	NC	NC

Wang Option • provides statistical multiplexing for the Wang 2200 computer systems using 9-bit synchronous or 11-bit asynchronous character codes for special function keys • stndard feature included in package price.

NC/NC	NC	NC

Composite Link—Omnimux 80, 160 & 320

Central control module packaged link; can be replaced by dual aggregate option for a total of 2 composite links • synchronous rates from 1200 to 19.2K bps • modified CCITT X.25 Level II link protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface • standard feature.

NC/NC mo	NC prch	NC maint

Dual Aggregate Link Option • single card option replaces original composite link module; provides two 9600-bps synchronous composite links for load sharing, split link, or channel bypass applications • extra-cost option.

48/34	1,000	NC

Wideband Aggregate Link Option • single card option supports single composite link for statistically multiplexed synchronous and asynchronous data • supports operating speeds from 2.4K to 72K bps for DDS and analog circuits • modified CCITT X.25 Level II link protocol • CRC 16 and ARQ error detection and correction (async channels only) • RS-232C/CCITT V.24 or V.35 electrical interface • extra-cost option.

64/58	1,500	NC

Integral 2400-bps Modem • full-duplex synchronous integral modem for operation over unconditioned 4-wire dedicated Type 3002 lines • statistical equalizer • CCITT V.26 A/B compatible • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Omnimux 80 and 160 control module; Omnimux 320 provides dedicated slot for single integral modem.

45/31	900	7

Integral 4800-bps Modem • full-duplex synchronous integral modem for operation over unconditioned 4-wire dedicated Type 3002 lines • 4800-/2400-bps switchable data rates • automatic

Racal-Milgo Omnimux Series
Omnimux TDM56, 4, 8, 80, 160 & 320

adaptive equalizer • CCITT V.27 bis, MPS 48/MPS 4827 compatible • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Omnimux 80 and 160 control module; Omnimux 320 provides dedicated slot for single integral modem.

72/62	2,200	13

Integal 9600-bps Modem • full-duplex synchronous integral modem for operation over unconditioned 4-wire dedicated Type 3002 lines • 9600/7200/4800-bps switchable data rates • automatic adaptive equalizer • CCITT V.29, MPS 9601/MPS 9629 compatible • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Omnimux 80 and 160 control module; Omnimux 320 provides dedicated slot for single integral modem.

132/106	2,900	17

• **END**

Racal-Milgo Communications Management Series
CMS 185 & 2000 Network Control/Management Systems

■ PROFILE

Function • network control system (CMS 185) and network control and management reporting systems (CMS 2000).

Communications/Networks • CMS 185 supports up to 127 4-wire dedicated Type 3002 lines in 4- and 8-line increments; CMS 2000 supports 16 to 256 Type 3002 lines in 16-line increments • CMS 185 addresses up to 4,064 modems, 254 per line maximum; CMS 2000 addresses up to 10,000 modems, 254 per line maximum • accommodates Racal-Milgo CMS series, LMS series, or Omnimode series modems equipped with integral network control; accommodates Racal-Milgo LSI series modems equipped with plug-in network control • 75-bps secondary channel supports network control functions.

First Delivery • 1977 (CMS 185); 1980 (CMS 2000).

Systems Delivered • over 900 (CMS 185); over 250 (CMS 2000).

Comparable Systems • principal competition from AT&T Dataphone II Service; Codex DNCS 200, 300, and 400; General DataComm Netcon 6; IBM 3860 Series modems with NPDA software product; Infinet Series 90; and Paradyne ANALYSIS System.

Vendor • Racal-Milgo Information Systems, Inc; 1601 North Harrison Parkway, Sunrise, FL 33323 • 305-475-1601.

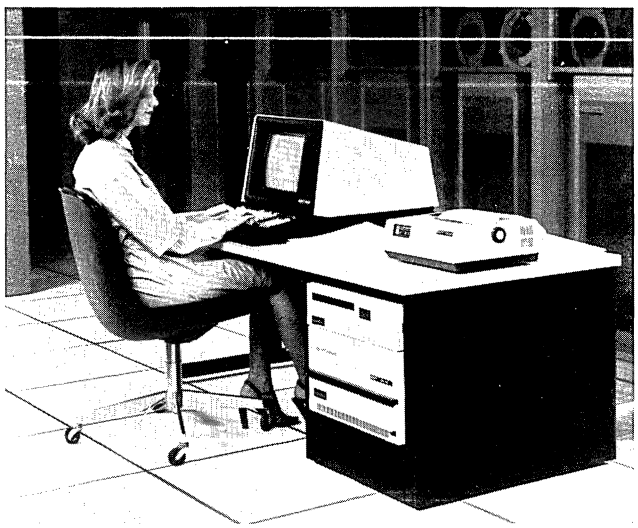
Canadian Headquarters • Electronetic Systems Limited; 785 Arrow Road, Weston, ON M9M 2L4 • 416-745-2999.

GSA Schedule • listed.

Distribution • nationwide via local Racal-Milgo direct sales offices and manufacturer's representatives • Canada via Electronetic Systems, Ontario, Vancouver, Montreal, and Ottawa • Europe, Africa, the Middle East, the Far East, and South America via Racal-Milgo Intercontinental, Inc, Miami.

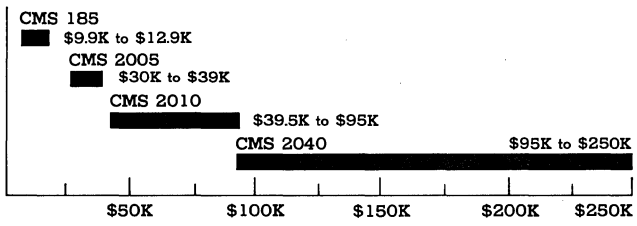
■ ANALYSIS

Over the past year, Racal-Milgo has demonstrated its commitment to the Communication Management Series by introducing a new CMS 2000 model and releasing several beneficial enhnacements for the existing line-up. The CMS 2005 is an **entry-level** CMS 2000 system designed for small- to medium-sized networks. It supports up to 2 Network Interface Processors (NIPs) and handles up to 32 secondary channels. Upgradable to the mid-range 2010, the 2005 provides the same basic diagnostic and network surveillance functions as the larger 2010 and 2040 systems.



The CMS Series enhancements include the **TCM-7 Test Control Module**, the **CMS Host-Link Option**, and the **AP-2 Line Parameter Test**. The new TCM-7 feature is a welcome addition for users with networks consisting of other vendor's modems. By employing this "wraparound" option, users can upgrade nondiagnostic modems from single or multiple vendors to a fully diagnostic network. It can be installed in single or mixed vendor networks operating at 1.2 to 16.8K bps and can be used in either point-to-point or multidrop applications. Modems equipped with TCM-7 are compatible with the CMS Series for providing central site management and initiating line testing, modem testing, dial backup, and network restoral from a single location. The addition of the AP-2 Line Parameter Test feature offers the CMS user much more comprehensive measurement of analog parameters. A comprehensive list of significant analog line parameter tests can be conducted from the central site for measuring frequency translation, phase modulation, phase jitter, amplitude jitter, c-notched noise, signal-to-noise ratio, envelope delay distortion, attenuation distortion, impulse noise, gain hits, phase hits, and drop-outs. Once selected tests are executed, the results are presented in comparison to user-defined threshold criteria. Another innovative option and significant user benefit introduced during the past year is a hardware/software module which interfaces the CMS systems with IBM mainframes. Dubbed **CMS Host-Link**, the new facility enables users to consolidate network management files with host-resident statistics. The CMS Host-Link interfaces to any IBM system supporting BSC 2780/3780 protocol over switched or dedicated lines operating at speeds up to 9600 bps. The following alarm information can be transferred from the CMS system to the IBM mainframe: unit number; site, time, date, and type of alarm; and text area for user comments and time and date of problem resolution.

PURCHASE PRICE RANGE — hardware



RACAL-MILGO CMS SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations based on typical systems as established by Racal-Milgo; actual pricing may be higher or lower • maintenance contracts for all CMS systems require special quotation • **CMS 185 small** configuration consists of an 8-line system; **large** of a 16-line system • **CMS 2005 small** configuration consists of a 16-line system; **large** of a 128-line system • **CMS 2040 small** configuration consists of a 16-line system; **large** of a 256-line system.

Racal-Milgo Communications Management Series
CMS 185 & 2000 Network Control/Management Systems

In addition, Racal-Milgo has dramatically **lowered** the price, by approximately 55 percent, of **CMS-SPAN**, its add-on network performance measurement system. Announced last year, this option collects statistics on various network response times and traffic loading conditions for up to 256 lines, and alerts network management to degrading performance conditions. It provides an analysis tool for optimizing network performance and evaluating future network expansion. CMS-SPAN is designed to complement the control and management reporting functions afforded by the basic CMS 2000 system. Furthermore, Racal-Milgo asserts that SPAN software, CMS systems software, and user data occupy no more than 10M bytes of disk space for CMS 2005, 2010, and 2040 systems, allowing ample room for future applications.

The CMS Series of network control systems comprise 4 different models that supervise dedicated networks through continuous surveillance for line or component failure or degradation; diagnostic testing to isolate failures; and remedial recovery procedures to insure network integrity and eliminate excessive downtime. These models address the requirements of small-, medium-, and large-scale data networks.

The CMS 185 is a low-end, microprocessor-based system that monitors up to 16 communication lines and up to 4,064 modems. Although the number of lines monitored can be expanded to 127 lines, the total number of modem addresses remain constant. It performs most of the same basic diagnostic functions as the larger, more sophisticated CMS systems, but is not upgradable. The CMS 2005, 2010 and 2040, on the other hand, are designed for the database-intensive requirements of medium to large networks of up to 256 communication lines. They are based on 1 of 5 Digital Equipment Corporation (DEC) minicomputers, and can be equipped with 1 to 4 operator consoles along with disk drives and tape units of varying capacity. Although the upper-end models could conceivably be configured with many hundreds of communication lines, they have a practical database limit of 10,000 modem addresses (not including alternate backup modems). Upgrading from the CMS 2005 to the CMS 2010 and from the CMS 2010 to the CMS 2040 is peripheral intensive and depends on the size and component requirements of a given system. Configurations can vary greatly from user to user, thus upgrades are subject to factory consultation and quotation.

All CMS systems accommodate point-to-point or multipoint dedicated lines, as well as IBM 3600 loop systems. Network control is accomplished through an out-of-band secondary channel implemented via Racal-Milgo modems and some switching devices. The company calls its supervisory capability "T7," or Monitor, Test, and Control option. This option is an integral component of 3 modem families: the CMS, LMS, and Omnimode series. Other Racal-Milgo MPS and LSI modems can accept an optional plug-in T7 card module. CMS networks accommodate lines with multiplexed circuits and multiple tail circuits (multitier configurations) and with the addition of the TCM-7 feature, can now communicate with other vendor modems.

CMS users have the option of addressing network modems using a technique called "digital mixing" which duplicates the T7 control signals for additional line segments at the branching-off points; e.g., at modems with built-in TDM multiplexers or at modem tail-circuit locations. CMS systems thus do not impose an arbitrary line maximum for multitier networks; in fact, there are no estimable line limitations for CMS systems at all, because it is possible to increase line capacity by employing standalone digital mixing modules (DMM) in lieu of adding additional secondary channel modules. Modems and other addressable network units are differentiated by an individual T7 number, not by a line or network location.

Although DMM's are a cost-effective way to increase line capacity, Racal-Milgo does not recommend that they be used as an integral part of network design, and for good reason. Since these devices duplicate primary control signals for multitier lines, the CMS system does not "know" which modems belong to which lines. All modems on multitier lines are treated as though they resided on only 1 line, posing an organizational problem for operators of extensive networks. The new graphics display capability does much to alleviate this problem, allowing an operator to map-out modem locations with their corresponding lines to provide a frame of reference.

A standard graphic display enables the operator to display a graphic representation of the diagnostic channel on a color CMS console. A strong user benefit, this important feature distinguishes modem drops on multitier lines from drops on the original (backbone) circuit, usually a difficult task for extremely large networks with multiplexers and tail circuits. The graphic symbol of the modem includes the device address, site identification, and modem type.

The 2000 Series is comprised entirely of DEC peripherals (except for NIPs and Color Terminals); DEC provides maintenance for its equipment, while Racal-Milgo services its hardware components and software. This arrangement could invite complications arising from composite-vendor maintenance. Racal-Milgo maintains ultimate responsibility for repairs, however, with Racal-Milgo maintenance personnel serving as the first point of contact when a problem occurs. The vendor asserts that this system works well.

For the second consecutive year, Racal-Milgo has still not provided a replacement for the System Management Option (SMO) series of software packages. SMO provided extensive networks with a comprehensive management reporting capability, including the issuing and tracking of trouble tickets; creating historical files to analyze performance data; and producing and maintaining an inventory file for installed equipment. These software packages reportedly incur system performance problems and are not being actively marketed, although they are being maintained by Racal-Milgo.

At the present time, Racal-Milgo is beta testing an **X.25 Pass-Through Capability** which will allow diagnostic channels to pass through X.25 networks via the use of customized Network Interface Processors (RXNIP, RXNIS & CXNIS). This is an important benefit to users whose analog networks interconnect to PDNs. An unattended end-to-end test feature is also in operation at beta test sites. Prescheduled, unattended diagnostic testing of individual circuits or groups of circuits during inactive business periods is a cost-effective optional benefit which can inform management of degrading or substandard communication lines, prompting corrective action often before network performance is adversely affected.

☐ Strengths

Users desiring network control can select a CMS model to fit practically any long-haul, dedicated network configuration. Alternatively, users with an existing and available PDP-11 system can purchase unbundled CMS software, using the DEC processor in a dedicated network control function.

The arrival of the new low-end CMS 2005 further extends configuration flexibility downwards and offers a viable alternative to users with small- to medium-sized networks. Channel capacity upgrades in the form of Expansion Packages which are available for CMS 2005 and 2010 systems facilitate ease of expansion and support users with growing network requirements. Although still active, the older CMS 185 is a mature but limited product that has experienced no recent improvements and will most likely be phased out in favor of the new, upgradable CMS 2005. In addition, peripherals and data storage can be tailored to fit the user's exact requirements. In addition, CMS systems at the high end allow multiple operator consoles and/or interface processors to be physically spread throughout a network, providing greater flexibility and optimum network planning.

CMS systems use the **out-of-band secondary channel approach** to monitor network performance and send control signals to remote locations. This approach is noninterfering with normal data communication activity, unlike the in-band method used by some competitors. IBM's NPDA network control product, for example, is an in-band approach that adds overhead to normal data traffic and can affect throughput.

Another advantage of CMS is the ability of T7-equipped Racal-Milgo modems to send unsolicited alarms upon detection of a self-failure or degraded condition. This ability, along with the regular polling and surveillance duties performed by the network

Racal-Milgo Communications Management Series
CMS 185 & 2000 Network Control/Management Systems

controller, assures the rapid detection and isolation of component failures and their subsequent correction by the CMS operator(s). The ability to search the network for modem serial numbers, or to search for a network modem by its own serial number, is another CMS function which gives greater network awareness to a user.

The new TCM-7 feature is a significant user benefit because it accommodates nondiagnostic, non-Racal-Milgo modems. This feature will appeal to users with purchased or leased modems that are still under lease, or to users satisfied with modem performance and vendor support provided by other manufacturers. Unlike most of its competitors, Racal-Milgo allows users to access the database potential of their host computer with the CMS Host-Link feature. The result of this IBM mainframe interface is an enhanced reporting facility which provides consolidated network management files combined with host resident statistics for a more comprehensive review of total network operation.

Another key Racal-Milgo advantage and strong user benefit, is the newly-released Analog Line Parameter Test Feature. Often, the monitoring of analog line parameters is by no means comprehensive. Competing vendors Infinet and AT&T both offer limited analog line parameter measurements. Although expensive, the AP/AP-2 Line Parameter Tests measure both threshold parameters and actual lines according to **AT&T specifications**. The user can conduct tests on all major analog parameters including frequency translation, phase jitter, phase modulation, signal-to-noise ratio, envelope delay distortion, impulse noise, and attenuation distortion. The identification and isolation of line condition problems is especially important to users since the breakup of the Bell System eliminated end-to-end service.

There are other advantages that should be considered when weighing CMS over competitive systems. The relatively inexpensive method of increasing line capacity through DMM modules can delete the need to add expensive interface processors, or significantly expand line capacity for the CMS 185. The DMM method of duplicating control signals for additional line segments also affords a tremendous range of modem addressability, keeping in mind the limitations of this technique.

The CMS-SPAN option is an effective tool for measuring network performance. It allows line utilization and response-time statistics to be collected and analyzed, and alarms the user when performance thresholds are exceeded. SPAN can be configured to monitor all lines in a CMS-controlled network, or can save costs by allowing a small number of line monitor cards to be switched between network lines. SPAN measures both network and host performance, and will monitor transmission through non-Racal-Milgo modems.

Finally, Racal-Milgo is a leading data communication vendor with a sound track record, and is a single-source vendor for much if not all equipment required for effective data (and digital voice) communication. The Omnimode Series of diagnostic modems, compatible with CMS, is an example of the firm's continuing engineering excellence. These very advanced and versatile modems are testimony that the company provides innovative solutions for datacomm users.

☐ Limitations

In common with other secondary channel network control/management systems, CMS cannot be used over all-digital transmission facilities that do not support sideband circuits; i.e., AT&T's current DATAPHONE Digital Service or any satellite facility. Hybrid or wide-area network users can only employ CMS over that portion of their networks traversing dedicated voice-grade circuits; therefore, CMS represents only a partial solution to comprehensive network management in today's interconnected world.

CMS cannot support standalone multiplexer or concentrator nodes, and must bypass these in a user's network. Older model Racal-Milgo modems do not support the Analog Parameter (AP) option, meaning they cannot report line levels or signal quality at all.

Racal-Milgo's method of duplicating control signals for multitier lines is another disadvantage for CMS users. Since the system cannot distinguish multiplexed lines or tail circuits from the original (backbone) circuit, keeping track of which modems belong to which lines is an inconvenience at the least. Users wishing to increase CMS channel capacity by installing separate DMM units in lieu of "real" secondary channels or remote NIPs should also be wary of this limitation.

Racal-Milgo's CMS-SPAN performance monitoring system is not supported by the CMS 185 or by existing CMS 1000 systems. Although it shares processor and peripherals of the primary CMS 2000 system, CMS-SPAN is still an add-on product and requires support and maintenance of a separate database. Only 2 protocols are supported at this time, IBM's BSC (3270) and SDLC; however, the unit will eventually be equipped with 8 standard protocols and can be optioned with custom protocols for individual users. In addition, CMS 185 doesn't support the new CMS Host-Link option or the AP/AP-2 Line Parameter Test feature. Furthermore, the CMS 185 cannot be upgraded to the entry-level CMS 2005. Intended as a low-end system, the 2005 is somewhat limited by the fact that it cannot support an additional operator console and does not support the Remote Operator and Remote Line Location features which are extra-cost options for the 2010 and 2040 systems.

At the present time, Racal-Milgo doesn't provide an unattended test feature. Racal-Milgo has been beta testing this feature since the last revision of this report, yet has **still** not delivered it. Automatic testing and reporting scheduled during inactive communication periods expedites the detection of existing or potential failures so that remedial action can be taken before communication activity resumes. Several of Racal-Milgo's competitors such as Infinet have benefited from this advantageous facility for spotting component or line degradation. Although not presently available, Racal-Milgo has promised that this feature will be released during 1985.

■ SOFTWARE

☐ Terms & Support

Terms • all software (firmware) for CMS 185 bundled with hardware component pricing • CMS 2000 software bundled with hardware (except for optional SPAN performance monitoring software), or sold unbundled on a customized, per-installation basis • users purchasing unbundled CMS software require a DEC PDP-11 with necessary peripherals, and must also purchase appropriate network interface processors (NIPs) and color display terminal hardware from Racal-Milgo • software for upgrades within the CMS 2000 product line available on a customized, per-installation basis • other software terms are identical to hardware; listed under HARDWARE section.

Support • bundled software supported under hardware maintenance agreement; unbundled software supported on a custom basis • see HARDWARE section for details.

☐ Operating System

The CMS 185 runs under a proprietary operating system. The CMS 2000 runs under DEC's real-time operating system, RSX-11M. In addition, CMS 2000 systems include proprietary file management software to formulate reports on network structure and components. All operating system instructions are written in assembly code. Operating Systems and Control Programs are bundled with hardware, or unbundled for use with existing customer hardware.

☐ CMS 185 Control Program

The CMS 185 Controller provides most of the line diagnostic and testing functions of CMS 2000 systems, without the extensive database/reporting features inherent in those larger systems. Furthermore, unlike the CMS 2000 systems, the CMS 185 is not menu-driven and relies instead on multifunction front-panel keys to provide operator interaction and prompting.

System Control

System control is performed by the operating system under the direction of the console operator, in 1 of 4 operating modes through multifunction keys. A 4-position, keylock mode switch provides mode selection, and prevents unauthorized or accidental operations which could result in interference to

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normal network activity and loss of data. Multifunction keys located on the unit's vertical front-panel console are color labeled to indicate functions performed for specific modes. Testing and other functions are manually initiated and are performed sequentially.

Normal Mode • allows operator to view or scan individual modem or specified modem groups' EIA interface status, or power on/off, test, or backup conditions • call-up screen display of all modems in dial-backup mode • call-up screen display of all modem alarms associated with an addressed line • print hardcopy from CRT screen on optional printer.

Interrupt Mode • enables diagnostic testing or recovery procedures which are usually interruptive of normal data communication • permits individual or automatic execution of diagnostic tests; dial backup for backbone modems and ancillary equipment; hot-spare modem switching; or report/change of CMS parameters for CMS Series and Omnimode Series modems.

Configuration Mode • allows system initialization and the addition (or changing) of lines, modems, and ancillary units to system memory • monitors all 16 lines to verify proper operation • conducts self-test of CMS 185 RAM/ROM memory • permits the transfer of direct bit-oriented commands to T7-equipped devices to request specific data from a modem or correct certain modem abnormalities; recommended only for use by Racal-Milgo field engineers.

LMS Mode • allows operator to view or scan individual or collective LMS Series modems in IBM 3600 Loop configurations • permits LMS modem diagnostic testing, loop bypass, and dial backup procedures.

Network Surveillance

Network surveillance is performed continuously at operator command in the Normal Mode, and provides a scan of an individual modem or modem groups' operating conditions. In addition, Racal-Milgo modems and switching devices send unsolicited alarms to alert the network operator about abnormal and change-of-state conditions. Alarms are triggered by EIA signal levels, power levels, streaming conditions, and LMS Series modem loss of synchronization; alarm threshold parameters are established by the user. Modems with the Analog Parameter (AP) option also support user-established alarm threshold parameters for circuit signal levels and signal quality; OMNIMODE modems report signal-to-noise and phase jitter measurements. The operator is immediately alerted to alarm conditions via an audible alarm; the abnormal conditions are displayed on the CRT screen. Network surveillance and alarm conditions are noninterfering with normal network activity.

CMS 185 Commands

CMS 185 networks equipped with CMS Series, LMS Series, and Omnimode Series modems, and other Racal-Milgo modems containing the Monitor, Test, and Control (T7) option, provide 12 specific commands to monitor and control those modems. The following commands apply to most modems, except for a few older models which do not contain Analog Parameter circuitry.

Report Serial Number • displays serial number of selected modem; displays "no response" message if modem does not exist.

Flag Serial Number • identifies line location and modem number for selected modem.

Display/Change Thresholds • changes the thresholds for transmit and receive signal alarms; can establish high or low threshold as determined by Racal-Milgo • option to squelch this function.

Display Unit Levels • displays the transmit level, receive level, or signal quality of a selected modem or each modem on a selected line.

Display Unit Alarms • displays current alarm status of selected unit.

Clear Analog Alarms • resets the Analog Parameter alarms for a suitably equipped modem or line, as stored in the system memory.

Monitor Individual Port • monitors the status of an individual port on a multiport; updated every 4 seconds until test satisfied • displays key EIA interface signals, power status, loopback status, and signal quality.

Loop Individual Port • loops an individual port of a multiport modem; normal loops are used for other modems.

Clear Port Loop • clears the previously mentioned multiport loop function.

Downspeed All Modems • downspeeds all modems on a selected line to their strapped fallback data rate.

Upspeed All Modems • upspeeds all modems on a selected line to their higher data rate; reverse of the above.

Downspeed Single Modem • downspeeds a single modem to its strapped fallback data rate.

☐ CMS 2000 Control Program

System Control

System control is performed by the operating system under the direction of the console operator(s) through keyed commands; system executes commands entered into CMS Color Terminal keyboard and interacts with operator through CMS mode formats, and through System and Function menus • System and Function menus display the function groups (listed below) and executable commands; operator enters commands and views network alarms, alerts, and messages in the CMS mode formats • all consoles operate independently, with selectable multilevel password control for system integrity • up to 4 concurrent functions can be performed for each CMS terminal on the CMS 2005/2010/2040.

System Commands • power-up/-down and initialize system • create and modify network configuration in database network map.

Diagnostic Commands • conduct individual qualitative and quantitative tests at selected sites and abort tests.

Monitor Commands • enable/disable automatic monitor mode • display alarm/alert message; alarm message reports abnormal conditions that exceed threshold values; alert message reports problem caused by system or operator action • alarm reports automatically logged on system printer as they occur.

Status Commands • display detailed status of EIA interface leads for specific device or all devices on same channel.

Remedial Commands • control dial backup; hot-spare modem switching; terminal streaming through modem disconnection/restoration; data rate fallback.

Loopback Commands • establish/break digital or analog loopback path at specified remote device.

Utility Commands • set time and date • assign user name, password, and access level • search network for modem serial number; display modem serial number • display Help list of all command functions and descriptions.

Network Surveillance

Network surveillance is performed continuously during active communication periods without interfering with network activity. Digital and analog modem and line parameters for devices specified in a polling list are monitored for alarm or status change conditions. Alarm conditions are abnormal conditions that exceed operating thresholds. The operator is immediately audibly alerted to an alarm condition, the alarm condition is entered in the Pending Work File, and logged on the system printer.

System Activity Files

Disk-resident database stores network activity information which is accessed under 5 different database functions • files created, accessed, modified, and deleted through operator console (CMS Color Terminal) • network units as represented in file contents are displayable for review, or printed in various forms under Report Generation Functions • database functions include:

Display Network, Port, Site, NIP, Channel, Unit • displays

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current network or network component status; includes overall network or individual port, Network Interface Processor (NIP), communication line, or modem with associated equipment.

Add Site, NIP, Channel, Unit • adds a previously undefined network component to the database.

Modify Site, NIP, Channel, Unit • alters network component characteristics for units already defined in the database.

Drop Site, NIP, Channel, Unit • deletes a previously defined network component from the database, plus all subsequent units in the network that are dependent on that component.

Verify Network • checks for inconsistency between the database and the actual network.

Diagnostic Tests

Diagnostic test procedures isolate and identify failures or degradation in network lines or components • specific tests of designated components and lines executed at CMS console operator command • most tests, including loopbacks and end-to-end test, are disruptive of normal data communication; testing central units disrupts communication with remote units, while testing remote units disrupts normal communication for specific tests • maximum 4 concurrent tests per CMS operator console on CMS 2005/2010/2040.

Self-Test • activates a unit's self-generated 511-bit test pattern • loops pattern through unit's own transmitter and receiver; unit counts errors and reports them every 6 seconds for duration of test • not valid for remote modem transfer switch (RMTS) units • disrupts normal data communication for modem under test and all downstream units.

End-to-End Test • instructs a remote unit and associated central unit to generate internal test patterns, which are sent to each other and compared • units count errors and report them every 6 seconds for duration of test; reports actual bit-error rates • not valid for RMTS units or LMS Series modems • disrupts normal data communication.

Analog Loopbacks • local and remote analog loopbacks loop data (local) or test pattern (remote) at the analog side of the unit(s) under test; only the remote test checks for errors, reported every 6 seconds for test duration • analog loopbacks not valid for RMTS units or LMS Series modems • disrupts normal data communication for units involved.

DTE Loopbacks • local and remote digital loopbacks loop data (local) or test pattern (remote) at the digital side of the unit(s) under test; only the remote test checks for errors, reported every 6 seconds for test duration • digital loopbacks not valid for RMTS units or LMS Series modems • disrupts normal data communication.

Powerfail Test • sends a tone to an upstream unit, testing that unit's ability to report a downstream unit's power failure • if no alarm is detected, system displays an error message specifying why the power failure cannot be detected from the upstream unit • not available for RMTS units or LMS Series modems • nondisruptive of normal data communications.

LMS Series Modem Diagnostics • specific tests for LMS Series modems include Line Test, Wrap Unit Test, Wrap Loop Test, Simulate RLF, and Verify LMS Loop • Line Test sends test pattern to all LMS modems in an IBM 3600 loop; error counters displayed for each modem • Wrap Unit Test loops an LMS modem transmit and receive circuits, and IBM transmit and receive circuits • Wrap Loop test checks LMS and IBM transmit and receive circuits like the Wrap Unit test, and also tests the associated terminal subloop • Simulate RLF (Receive Line Failure) test squelches upstream modem's primary transmitter, testing downstream unit's ability to detect and report a receive line fault condition • Verify LMS tests integrity of an LMS loop using dial-backup lines, and displays results; LMS central unit must have 2 DDD backup lines • all LMS diagnostic tests disrupt normal data communication except Verify LMS.

Line Parameter Test Facility (AP/AP-2) • provides 2 types of analog parameter measurements: threshold parameters; and actual line testing according to AT&T System Technical Reference, Publication 41009 • facility allows network manager to measure various line parameters from central site including Frequency Translation, Phase Modulation, Phase Jitter, Amplitude Jitter, C-Notched Noise (noise with tone), Signal-to-Noise Ratio, Envelope Delay Distortion, Attenuation Distortion, Impulse Noise, Gain Hits, Phase Hits, Dropouts, and Loss • once menu-selected tests are executed, results are reported in comparison with user-defined threshold criteria • individual and group tests can be initiated; results can be displayed in tabular and color graphic format • requires no additional hardware or operator assistance at remote sites:

$19,500 lcns

Remedial Recovery

Remedial recovery procedures restore communication interrupted by line outages or degradation, modem failure, or terminal or modem streaming conditions until faulty condition is corrected • recovery procedures conducted by console operator through keyed commands • dial backup and hot-spare modem switching restore communication interrupted by line outage or by modem failure • terminal or modem streaming, a prolonged or continuous Request-To-Send (RTS) or modem carrier signal, prevents use of multipoint line by other multidropped terminals; communication restored by disabling modem until condition is corrected.

Dial Backup • switches modem at remote attended or unattended site between 4-wire dedicated line and 2 dial-up lines to restore communication interrupted by line failure or degradation • CMS 800 or automatic line adapter answers call automatically on DDD line pairs; switches modem from dedicated to dial-up lines • under console operator command, dial backup unit switches from dial-up lines to dedicated line without terminating (hanging up) DDD call unless dedicated line is restored • dial backup for LMS Series modems is performed for all modems in a loop; the secondary channel is initially switched to dial backup, and is switched back to dedicated lines, before primary channel, upon line restoration.

Hot-Spare Modem Switching • remote modem transfer switch (RMTS) or CMS 800 switches data terminal equipment and 4-wire dedicated line between faulty modem and hot-spare (backup) modem under console operator command; restores communication interrupted by modem failure or degradation.

Modem Fallback/Reconfiguration • switches CMS Series and Omnimode Series modem data rate to fallback rate to compensate for line degradation; reconfigures subchannel and main channel rates of multichannel (multiport) modem • procedures executed under CMS console operator command; older Racal-Milgo modems with plug-in T-7 diagnostics may require manual fallback procedures with attended remote sites.

Streaming Recovery • disables streaming modem by squelching primary data channel; procedure executed by console operator; some models are automatically squelched • operator restores disabled modem once streaming condition is corrected • not valid for RMTS units or LMS Series modems.

☐ Management Reports

A limited management reporting facility is standard for all CMS 2000 Series systems. Reports on network structure, network problems, and equipment operator status are printed at operator command during normal network hours, or saved on file for later printing. These reports provide a more comprehensive look at the network/database than is possible on the operator display screen.

Channel Structure Report • provides a formatted representation of 1 or all communication channels and its/their associated units.

Help Report • provides hardcopy of all Help Texts, or a selected Help Text, prompts network operators on CMS functions and commands.

Network Equipment Report • lists all or selected communication channels and their associated sites, NIPs, ports, and units (modems and switches) • includes channel and unit operator status.

LCNS: one-time software license fee.

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NIP Status Report • generates an overview of a selected Network Interface Processor (NIP), and ports, and the associated channels and operator status.

Significant Event Report • generates a chronological listing of significant events by date, type, or channel • users can print this report exactly as it appears on the Significant Event Log, or print selected alarms and messages.

Pending Work File Report • provides a hardcopy report of alarm entries, with user comments if desired.

Site Report • lists all units at a specified site and their associated NIPs, channels, and operating status • includes site comments.

☐ Performance Measurement & Reporting

Network performance monitoring and measurement is conducted by the Systems Performance Analyzer (SPAN) option available for the CMS 2005, CMS 2010, and CMS 2040. SPAN polls main-channel data on a regular, noninterfering basis according to a user-defined schedule, collecting network statistics for incorporation into reports or bar charts and alerting users immediately to degrading network conditions. A relational database contains trending data and user-defined alarm thresholds; parameters are menu-driven, with single-keystroke control of most functions/subfunctions and a Help file for user assistance. All operator interaction is conducted through the standard CMS system color console. SPAN itself consists of both software and hardware elements (see HARDWARE); SPAN software, however, runs on standard CMS system equipment. The software is available for a one-time license fee; a detailed description follows pricing:

$2,250 lcns

Database

A database describing the user network is built and maintained with a record for each of up to 256 communication lines. Each line is associated with a user-defined 12-character ASCII name and a 64-character entry of free-text describing the line. Data rate, protocol, response-time alarm thresholds, prepoll time (if required), and other line identification information are also defined. Users maintain a cross-reference table to associate each line with a specific SPAN card within a group of such cards; a new group of lines can be selected for monitoring via matrix switching. When all lines are defined, parameters are downline loaded to SPAN cards. Individual lines can then be monitored or altered through the system console.

Performance Data

Two general sets of information about line performance are available for both trending analysis and alarm reporting. **Line Utilization** collects statistics on the number of characters inbound/outbound, transmission errors, number of transactions per each device or controller, and the effective data rate of the line. Transaction search ID codes can trap on a transaction ID of up to 8 characters, pinpointing problems to transaction types. **Response Time** statistics relate to time delay in the host, total response times, and maximum response times for a given period.

SPAN Alarms

An Alarm List on disk file stores up to 999 SPAN alarms as they are polled from the SPAN cards. Alarm entries include NAKs (negative acknowledgements) and transactions over threshold. These are buffered in the SPAN cards and polled as a background operation while operator activity is idle. Users can sort and display alarms either on screen or on hardcopy; alarm items can be purged selectively.

Trending/Graphical Analysis

To study long-term system performance, users schedule background analysis by establishing a 7-day/24-hour calendar for automatic trending. The trender only trends on user-selected lines; trend periods can range from 1 hour to 7 days. At the end of a trend period, entries are uploaded from SPAN cards to the database with maximum storage for 4096 entries. Entries can be sorted and displayed or printed for comparison. Users can generate the following statistical/graphical reports on the CMS color console.

Response Time Histogram • bar chart provides number of transactions falling into response-time categories by percentage • shows percentage of total transactions with 2 percent resolution; shows overall response for individual line components.

Statistics for Utilization • presents detailed utilization statistics for selected lines using the general field of monitor display • displays Line, Cluster, Device, and Transaction levels.

Trend Analysis • bar chart displays trending database statistics for cross-comparison • user-selected display criteria include Line, Cluster, Device IDs, and time ranges • generates 2 reports —response time report and line utilization report—providing different statistics from the trending database.

☐ Program Development/Languages

Racal-Milgo does not presently provide high-level compilers for the CMS Series. Applications are written in assembly code. CMS 2000 systems could foreseeably support user programming in a future release.

■ HARDWARE

☐ Terms & Support

Terms • available for purchase or for lease under 1-, 2-, 3-, 4-, or 5-year agreement • separate maintenance contract available for leased or purchased units • lease/purchase credit is 50% of lease paid out to 80% of purchase • 1-year warranty on purchased components.

Support • installed by Racal-Milgo; installation charges vary according to processor model and peripherals supported • 4 service plans: Standard Maintenance/Extended Warranty/Per-Call/Factory Repair • Standard Maintenance billed at a fixed rate for all calls performed within the scope of a maintenance agreement; includes parts and labor • Extended Warranty billed at a fixed rate plus handling charges for repairs; includes parts • users with existing DEC equipment who purchase unbundled CMS software and other CMS components can continue receiving maintenance through Digital Equipment Corporation; Racal-Milgo will service software and any hardware which it manufactures; other custom maintenance programs available • Critical Maintenance option provides guaranteed 4-hour response time to a service call • regional customer support centers located in: Southeast/Atlanta; West Coast/Los Angeles; Southwest/Richardson, TX; Midwest/Schaumburg, IL; Northeast/Freehold, NJ; use of telephone consulting service free of charge.

☐ Overview

The CMS Series of network management and control systems all supervise network performance through network surveillance, diagnostic testing, and remedial failure recovery. They operate in conjunction with Racal-Milgo's T7 diagnostic feature, an inherent component of the company's CMS, LMS Series, and Omnimode Series modems and available as a plug-in component for other Racal-Milgo modems. Supervision is performed through a narrowband secondary channel attached to the primary communication channel; the network is continuously monitored for abnormal conditions according to user-defined alarm thresholds, and users can establish special scan routines for the network or network segments.

Monitored parameters include digital modem characteristics and, for newer Racal-Milgo modems, analog line levels. In addition, Milgo modems are self-monitoring and send unsolicited alarms to the CMS central site upon detection of an internal failure. Visual and audible alarms alert the network operator of the failure, and a record of the condition is automatically logged on the system log printer (an optional feature for the CMS 185). CMS 2000 users can also display or print reports covering network structure, problems, or equivalent operating status.

Diagnostic testing is manually performed from the CMS operator console, in real-time, for specific lines or modems. Individual tests such as loopbacks, self-tests, and bit-error rate tests can pinpoint line or modem degradations or failures. Most diagnostic tests interfere with normal network data traffic, but do not affect scheduled network (passive) monitoring on the secondary

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channel. Up to 4 tests can be conducted simultaneously for the CMS 2005 and CMS 2010, and up to 4 tests can be conducted simultaneously for each CMS operator console attached to a CMS 2040 system.

Remedial recovery initiated at the operator console(s) immediately restores communication interrupted by line outage/degradation, modem failure, or a streaming terminal or modem. The console operator can disable a streaming modem, or modem with a streaming terminal, on a multipoint line (some modem models are automatically squelched); switch to a hot-spare modem at a remote site to recover from modem failure; select a lower (fallback) data rate to compensate for line degradation; or switch a remote site modem from dedicated line to dial backup to recover from a line outage.

A significant feature of the CMS Series is the ability to request serial numbers from modems at specific network addresses. Operators can collect serial numbers from the entire network or from individual addresses; conversely, modem line and location numbers can be collected for a specified serial number. Serial number reporting is an aid for inventory and other cross-reference functions.

Another feature of CMS 1000/2000 Series systems is the ability to remotely locate NIPs and operator consoles from the CPU as well as from each other. A specific 2000-based system, therefore, can itself function as a distributed system with sub-sites located in optimal network locations. One operator console, however, must remain with the central-site CPU and retains master status of the network. A multilevel password protection scheme provides security from unauthorized entry into the system. Distributed CMS systems require a pair of 4800-bps modems for each remote NIP or operator console, plus a Racal-Milgo error correction unit.

CMS 185 Configuration • central-site system includes a diagnostic console with integrated CRT screen and multifunction keys, and an optional system printer • provides 4/8/12/16 secondary channels, or up to 127 secondary channels with limited control • supports Racal-Milgo CMS or Omnimode modems, or other Racal-Milgo modems with plug-in T7 option • each secondary channel supports multiple individual 4-wire dedicated Type 3002 lines in multiplexed, multipoint, and tail circuit arrangements with a maximum of 254 modem drops per secondary channel.

CMS 2000 Configuration • consists of 3 models: CMS 2005, CMS 2010, and CMS 2040 • CMS 2005 consists of CPU with 512K bytes of main memory (expandable); an operator console; 1 to 2 NIPs supporting 16 to 32 secondary channels; a 28M-byte rigid disk drive; and 1 or 2 system printers • CMS 2010 consists of CPU with 512K bytes of main memory (expandable); 1 or 2 operator consoles; 1 to 8 NIPs supporting 16 to 128 secondary channels; 2 rigid disk drives; and 1 or 2 system printers • CMS 2040 consists of CPU with 1M bytes of main memory (expandable); 1 to 4 operator consoles; 1 or 2 121M-byte disk drives and 1 10.4M-byte removable disk drive; an optional magnetic tape unit; and 3 or 4 system printers • secondary channel support same as for CMS 185.

☐ CMS 185 Network Control System

CMS 185 Central Site Control

System consists of a controller with integral operator control panel (Network Diagnostic Controller) and optional system printer • Network Diagnostic Controller creates secondary channels, performs modem polling, transmits diagnostic/control commands, and receives network status and alarms from individual modems • controller supports 4 to 16 secondary channels in 4-channel increments via individual modem ports • each secondary channel port connects to a central site modem and shares the bandwidth of a voice-grade communication path with the modem's primary data channel; communication path can consist of multiple individual 4-wire Type 3002 dedicated circuits in multiplexed/tail circuit configurations • Digital Mixing Module (DMM) extends line capacity beyond 16-line limit of Network Diagnostic Controller; extends each secondary channel port by 8 ports for maximum of 127 secondary-channel ports • channel addressing supports 254 maximum modem addresses per port/line for a maximum of 4,064 modem addresses per 16 secondary channels (254x16) • addressing scheme altered to 254 maximum modem addresses per 8 DMM ports/lines with addition of each DMM • Network Diagnostic Controller and optional DMMs link Racal-Milgo CMS and Omnimode Series modems via standard circuitry; links Racal-Milgo LSI, MPS, and LMS Series modems via add-in T7 secondary channel diagnostic/control card • T7 feature (integral to CMS, LMS, and Omnimode modems) monitors modem and line parameters, and executes diagnostic and control commands via a 75-bps secondary channel on communication link • optional TCM-7 feature provides wraparound capability for upgrading nondiagnostic modems from single or multiple vendors to a fully diagnostic network; supports all T7 diagnostic and control commands.

CMS 185 Network Diagnostic Controller • basic standalone or rackmount controller contains integral network control logic, 4K-byte RAM memory, numeric keypad, 23 multifunction keys, and 9-inch CRT screen • supports up to 4 secondary channels with upgrades to 8/12/16 channels • each secondary channel supports maximum of 254 drops (modem addresses) • CRT displays different screen formats according to user function keys; not menu selectable • system security via keylock mode switch prevents unauthorized interruption of normal communication activity • supports optional printer for system hardcopy • standalone desktop unit or rackmount unit for standard 19-inch equipment rack:

$9,900 (4 chans) to $12,900 (16 chans) prch

CMS 185 Printer • optional 120-cps dot-matrix printer with serial interface card • automatically logs fault alarms; prints network modem status and activity log upon operator command • extra-cost option:

2,835

Serial Interface Card • plug-in module provides connection for user-supplied serial printer • extra-cost option:

250

EXCD-1 Line Expansion Card • 4-line to 8-line upgrade:

1,220

EXCD-2 Line Expansion Card • 4-line to 12-line upgrade:

2,440

EXCD-3 Line Expansion Card • 4-line to 16-line upgrade:

3,660

EXCD-4 Line Expansion Card • 8-line to 12-line upgrade:

1,220

EXCD-5 Line Expansion Card • 8-line to 16-line upgrade:

2,440

EXCD-6 Line Expansion Card • 12-line to 16-line upgrade:

1,220

Digital Mixing Module (DMM) #90 • standalone or rackmount unit installed at central site CMS 185 extends line capacity beyond 16-line maximum • supports up to 8 additional lines on each CMS 185 secondary channel by duplicating CMS control signals • transparent to CMS 185 controller, which operates as though it still had only 16 lines • modems on multiple DMM lines share addresses of single secondary channel and are addressed as if they were all on the same line • up to 16 DMM units per CMS 185 maximum, for a system total of 127 physical lines; 16 logical lines • 1 DMM 90 required at central site for each expanded secondary channel.

DMM 90 • standalone unit provides up to 8 additional communication lines from 1 CMS 185 secondary channel:

660

CS DMM 90 • PC card version of DMM 90 for central site card nest • fits Type 7 shelf assembly cage:

615

PRCH: purchase price. NA: pricing not available. NC: no charge. Prices current as of March 1985.

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Type 7 Shelf Assembly Cage, Feature A • accommodates up to 16 CS DMM 90 cards • includes common power supply • fits standard 19-inch equipment cabinet or Racal-Milgo H4 Tabletop Enclosure:

760

Type 7 Shelf Assembly Cage, Feature B • identical to Feature A, but includes dual redundant power supply • fits standard 19-inch equipment cabinet:

950

H4 Tabletop Enclosure • accommodates Type 7 card cage, Feature A only:

902

CMS 185 Remote Site Control

Network control functions at intermediate and remote sites implemented for Racal-Milgo CMS Series, LMS Series, and Omnimode Series modems; and for Racal-Milgo LSI Series and the MPS 14.4 models with plug-in PC board • secondary channel supports network control functions • PC board/modem control card resides in standalone modem enclosure.

LSI Series T7 Control Card • plug-in card contains CMS secondary channel and circuitry for Racal-Milgo 1200-bps CS 1200 Mk II modem or 2400-bps CS 24 LSI Mk II modem • 1 card required per modem:

$600 prch

MPS 14.4 T7 Control Card • plug-in card contains CMS secondary channel and circuitry for Racal-Milgo 14.4K-bps modem • 1 card required per modem:

900

TCM-7 Test Control Module • add-on module provides CMS secondary channel and circuitry for nondiagnostic, other-vendor primary or spare modems operating at 1200 bps to 16K bps in either point-to-point or multidrop configurations • diagnostic tests on central and remote modems include modem self-test, line loopback, end-to-end error test, DTE loopback, and 1004 Hz tone generator • following nonsolicited alarms are generated: modem power failure, main channel streaming, receive line failure, customer generated alarm, dedicated line not restored, DTE power failure, transmit line level, and receive line level • 1 test module required per modem:

850

☐ CMS 2000 Network Control Systems

The CMS 2000 systems are minicomputer based and include 1 to 4 operator consoles, 1 or 2 rigid disk units, 1 to 3 system printers, and 1 to 16 Network Interface Processors (NIP) • each NIP links up to 16 central-site modems (1 per NIP port) with the minicomputer via individual secondary channels • NIP creates secondary channels, performs modem polling, transmits diagnostic/control commands, and receives network status and alarms • NIP links Racal-Milgo CMS, LMS, and Omnimode Series modems via standard modem circuitry; links Racal-Milgo LSI and MPS Series modems via add-in T7 secondary channel diagnostic/control card • T7 feature (integral to CMS and Omnimode modems) monitors modem and line parameters, and executes diagnostic and control commands via a 75-bps secondary channel on communication link.

2005/2010 Upgrade • expansion package upgrades 2005 to 2010 capacity with a maximum of 128 channels • extra-cost option:

$3,900 prch

3605 Host-Link Option • the CMS Host-Link Option is an add-on hardware/software system available for CMS 2005, CMS 2010, and CMS 2040 systems • it appears as a 2780/3780 terminal to an IBM 3705 and communicates with IBM 370 and 303X series processors operating under DOS/POWER, OS/HASP, VS1/RES, SVS or VMS with JES2 and JES3 • this option consolidates network management files with host resident statistics for enhanced performance monitoring and network evaluation • Host-Link operates on data from the Pending Work File and contains the following alarm information: unit number, channel name, site ID, time of alarm, date of alarm, PWF entry number, alarm type, user comments (free text area), time problem closed, date problem closed, and user-assigned problem ID (4 characters) • all data is converted to an IBM-compatible EBCDIC format when transmitted • an IBM Job Control Language (JCL) file created on CMS system is automatically appended to the front of alarm file each time a transfer occurs • each CMS Host-Link occupies a 9600-bps switched or dedicated line port on specific IBM host system:

8,200

CMS 2005 Central Site Control • Kernel system consists of DEC Micro/PDP-11 CPU with 512K bytes of main memory (expandable); a CMS Color Terminal keyboard-display; a Network Interface Processor (NIP) supporting up to 16 secondary channels; a 28M-byte rigid disk unit; and a 180-cps log printer • supports up to 2 NIPs (3703) with a maximum of 32 secondary channels • supports multiplexed or tail-circuit environments; each secondary channel supports 1 communication path which can be composed of multiple 4-wire Type 3002 circuits • supports optional 180-cps log printer (3203); optional 180-cps screen image printer (3205); optional 180-cps report printer (3204) • typical system price range:

$30,000 (16 chans) to $39,000 (32 chans) prch

CMS 2010 Central Site Control

Kernel system consists of DEC PDP-11/23-PLUS CPU with 512K bytes of main memory (expandable); a CMS Color Terminal keyboard-display; a Network Interface Processor (NIP) supporting up to 16 secondary channels; 2 10.4M-byte rigid disk units; and a 180-cps log printer • supports up to 8 NIPs (3703) with a maximum of 128 secondary channels • supports multiplexed or tail-circuit environments; each secondary channel supports 1 communication path which can be composed of multiple 4-wire Type 3002 circuits • supports 1 additional (optional) CMS Color Terminal (3101); optional 180-cps log printer (3203); optional 180-cps report printer (3204); up to 7 optional remote line location modules (3704); and 1 optional remote operator location feature (3103) • typical system price range:

$39,500 (16 chans) to $95,000 (128 chans) prch

2010/2040 Upgrade • expansion package upgrades 2010 to 2040 capacity with a maximum of 256 channels • extra-cost option:

21,350

CMS 2040 Central Site Control

Kernel system consists of DEC PDP-11/44 CPU with 512K bytes of main memory (expandable); a CMS Color Terminal keyboard-display; a Network Interface Processor (NIP) supporting up to 16 secondary channels; a 121M-byte RA80 disk unit; a 30-cps log printer; and a 180-cps system report printer • supports up to 16 NIPs (3703) with a maximum of 256 secondary channels • supports multiplexed or tail-circuit environments; each secondary channel supports 1 communication path which can be composed of multiple 4-wire Type 3002 circuits • up to 254 modem addresses per channel, 10,000 system maximum • supports up to 3 additional (optional) CMS Color Terminals (3101); optional 180-cps log printer (3203); optional 180-cps screen image printer (3205); up to 1 additional 121M-byte disk drive for a system maximum of 2; up to 15 optional remote line location modules (3704); and up to 3 optional remote operator location features (3103) • optional magnetic tape unit Model 2 (3402) for system backup • kernel system includes standalone enclosures for CPU, expansion chassis, and disk units; typical system price range:

$95,000 (16 chans) to $250,000 (256 chans) prch

CMS 2000 Central Site Control—System Components

3101 CMS Color Terminal • operator console contains 8-color CRT screen and functional keyboard • console screen displays 3,120 characters in 39 lines by 80 characters; 3 different screen formats provide operator interaction • CMS Mode Screen Format displays system information including terminal/customer identification, priority level, alarms and alerts, pending messages, time and date, system function and status, and command input line • System Menu Format lists the 7 function groups for operator selection; network reports, analog parameters, network restoral,

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network configuration, network test, network control, and system menu • Function Menu Format lists executable functions for each function group; functions activated and messages displayed in CMS Mode Format • 103-key detachable keyboard includes special function keys and numeric keypad; menu selection via color-coded keys • system security via password protection • 1 standard CMS Color Terminal only, CMS 2005; 1 standard CMS Color Terminal and up to 2 optional, CMS 2010; 1 standard and up to 4 optional, CMS 2040:

$8,000 prch

3103 Remote Operator Location Feature • standalone unit provides interface for remote connection of optional CMS color terminal; 1 terminal must be located at central site • requires user-provided 4-wire dedicated communication line and 4800-bps modem pair • 1 required per remote location • extra-cost option:

3,400

3201 Log Printer • 30-cps KSR printer terminal prints significant events, including alarm and alert messages, as they occur • standard equipment with CMS 2040 kernel system; can be replaced with optional 3203 180-cps printer:

NC

3203 Optional Log Printer • 180-cps KSR printer can replace 3201 or 3202 log printer • extra-cost option:

3,150

3204 System Report Printer • 180-cps KSR printer terminal prints reports on network structure, network problems, and equipment operating status upon operator command • standard feature CMS 2040; can be replaced with 3209 300-lpm line printer • extra-cost option for CMS 2005 and 2010:

3,150

3205 Optional Screen Image Printer • 180-cps KSR printer terminal prints CRT screen display upon operator command • extra-cost option for CMS 2040 only:

3,150

CMS 2040 Disk Drive • 121M-byte RA80 Winchester disk unit for database storage; 1 included in kernel CMS 2040 system • up to 1 additional disk unit (2 maximum) per system:

16,995

3402 Optional Magnetic Tape Unit Model 2 • 9-track 1600-bpi tape unit for archival storage, system backup, or data transfer to a host computer • extra-cost option for CMS 2040 only:

16,200

3703 Network Interface Processor (NIP) • rackmountable unit provides logic for 16 secondary (T7) channels • local or remote operation from CMS processor • original installation includes rackmount chassis; additional NIPs require 3701 or 3702 network expansion chassis • remote operation requires 3704 remote line location feature plus user-supplied modem pair • up to 2 NIPs per CMS 2005; up to 8 NIPs per CMS 2010; up to 16 NIPs per CMS 2040:

3,900

3702 Network Expansion Chassis Model 2 • rackmountable enclosure accommodates up to 2 NIPs • fits standard 19-inch equipment cabinet • extra-cost option:

1,194

3701 Network Expansion Chassis Model 8 • rackmountable enclosure accommodates up to 8 NIPs • fits standard 19-inch equipment cabinet • extra-cost option:

4,725

3704 Remote Line Location Module • standalone unit provides interface for remote connection of NIPs • requires user-provided 4-wire dedicated communication line and 4800-bps modem pair • 1 required per remote location • extra-cost option for CMS 2010 and 2040 models:

3,769

Digital Mixing Module #90 (DMM 90) • standalone or rackmount unit installed at central site CMS system provides additional line capacity without adding additional NIPs • supports up to 8 additional lines for 1 CMS secondary channel by duplicating the CMS control signals • transparent to CMS controller, which operates as though it still had only 1 line per channel • modems on DMM lines must be addressed as if they were all on 1 line • 1 DMM 90 required at central site for each expanded secondary channel.

DMM #90 • standalone unit provides up to 8 additional communications lines from 1 CMS 185 secondary channel:

660

CS DMM 90 • PC card version of DMM 90 for central site card nesting • fits Type 7 shelf assembly cage:

615

Type 7 Shelf Assembly Cage, Feature A • accommodates up to 16 CS DMM 90 cards • includes common power supply • fits standard 19-inch equipment Cabinet or Racal-Milgo H4 Tabletop Enclosure:

760

Type 7 Shelf Assembly Cage, Feature B • identical to Feature A, but includes dual redundant power supply • fits standard 19-inch equipment cabinet:

950

H4 Tabletop Enclosure • accommodates Type 7 card cage, Feature A only:

902

CMS 2000 Remote Site Control

Network control functions at intermediate and remote sites implemented for Racal-Milgo CMS and LMS Series and Omnimode Series modems; and for Racal-Milgo LSI Series and MPS Series modems with plug-in PC board • secondary channel supports network control functions • PC board/modem control card resides in standalone modem enclosure.

LSI Series T7 Control Card • plug-in card contains CMS secondary channel and circuitry for Racal-Milgo 1200-bps CS 1200 Mk II modem or 2400-bps CS 24 LSI Mk II modem • single card required per modem:

$600 prch

MPS 14.4 T7 Control Card • plug-in card contains CMS secondary channel and circuitry for Racal-Milgo 14.4K-bps modem • single card required per modem:

900

TCM-7 Test Control Module • add-on wraparound module provides CMS secondary channel and circuitry for nondiagnostic, other-vendor primary or spare modems operating at 1200 bps to 16K bps in either point-to-point or multidrop configurations • diagnostic tests on central and remote modems include modem self-test, line loopback, end-to-end error test, DTE loopback, and 1004 Hz tone generator • following nonsolicited alarms are generated: modem power failure, main channel streaming, receive line failure, customer generated alarm, dedicated line not restored, DTE power failure, transmit line level, and receive line level • single test module required per modem:

850

☐ CMS 185/2000 Remedial Recovery

Provides immediate recovery from line or modem failures, or from terminal streaming condition; central and remote site units provide automatic dial backup, hot-spare modem switching, and modem sharing by groups of terminals • CMS central site control.

Dial Line Selector (DLS) • central site dial backup switch accommodates up to sixteen 2-wire or eight 4-wire backup circuits with 1 handset • expandable in 4-channel increments • point-to-point and multipoint networks • requires FCC-certified RCD unit per channel • rack adapter accommodates Dial Line Selector and associated RCDs; requires 8.75-inch vertical mounting space in standard equipment cabinet • following prices are approximate.

4-Channel DLS:

$3,937 prch

Racal-Milgo Communications Management Series
CMS 185 & 2000 Network Control/Management Systems

8-Channel DLS:
5,315

12-Channel DLS:
6,692

16-Channel DLS:
8,165

Model 122 Registered Automatic Line Adapter (RALA) • switches unattended or attended remote-site modem between 4-wire dedicated line and 2 DDD line pairs • automatically answers calls on DDD lines • FCC-certified standalone or plug-in card unit.

Model 122 Standalone Unit:
765

Model CS 122 PC Card • up to 16 CS 122 cards can be housed in a Type 7 Shelf assembly:
695

Model 23 Multiline Adapter • switches modems between 4-wire dedicated line and 2 DDD line pairs for multipoint networks • requires FCC-certified Registered Connecting Device (RCD) • 4- and 8-channel configurations, standalone or rackmount; units can be cascaded for extra channels • standalone only.

Model 23 4-Channel Unit:
575

Model 23 8-Channel Unit:
975

CMS 700 Remote Dial System (RDS) • FCC-registered unit switches modems between 4-wire dedicated line and 2 DDD line pairs for multipoint networks; can place up to 31 calls to back up a multipoint line • remote control from CMS controller; downline loads telephone numbers to remote CMS 700, which dials over the DDD network to establish backup • operates from any remote modem at critical network points • standalone only.

CMS 700 Control Card • dial backup logic for up to 31 calls on a multipoint line:
1,290

CMS 700 Dial Access Card • required for each DDD line pair:
560

CMS 700 Transition Board • required for every 4 DDD lines:
100

Model 68M RCD • standalone 2-wire, FCC-certified manual Data Access Arrangement (DAA) • requires telephone handset • connects Racal-Milgo and other vendor equipment to the DDD network; for non-FCC certified devices:
100

Model 68A RCD • features identical to Model 68M; automatic version:
190

Remote Modem Transfer Switch (RMTS) MK II • standalone unit switches analog and digital connections between primary modem and hot-spare standby modem:
1,535

RMTS Rackmount Kit:
71

Analog Mixing Module 42 (AMM 42) • an analog bridge (analog port sharing device) for remote modems in multiport dial backup operations; alternatively, can service 2 point-to-point lines • strap option allows 4 remote modems on a multidrop line to contend for 1 dial-up channel • control bit option allows CMS operator to turn the individual AMM 42 ports on or off; single CMS modem can control up to 3 AMM 42s • unlimited cascading of AM 42s is possible without the control bit option installed; dedicated cascade in/cascade out port provides unlimited cascading without reducing available channels.

AMM 42 • standalone 2 (1x4) unit:
NA

CS AMM 42 • card version for central-site nesting; requires Type 7 shelf assembly, accommodating up to 16 CS AMM 42s:
NA

CMS Control Bit Option • provides remote control from a CMS 185/1000/2000 system:
NA

CMS 800 Switch • multifunction A/B or 1xN switch provides EIA and VF interface switching, plus modem sharing, from the same physical unit • temporarily bypasses faulty network devices; permits backup communication for 16 primary devices from a single standby spare; restores repaired devices back to the network • placement at either central or remote network locations, or both • occupies unique T7 address; appears as modem to CMS central unit • composed of 16-slot Type 9 card cage and 4 basic types of PC cards, some with and some without transition boards • the following pricing is meant only as a guideline; customer configuration requires proposal from Racal-Milgo Systems Engineering.

CMS 801 Control Card & Transition Board • control logic card; receives and decodes switching control commands • 1 required per switch; occupies 1 slot in Type 9 card cage:
1,000

CMS 801B • same as CMS 801 but contains DMM circuitry for duplicating CMS control signals:
1,200

CMS 802 EIA Switch Card • switches any equipment with EIA interface such as modems, terminals, or CPU ports • requires 1 or more transition boards providing A/B or 1xN switching:
250

1x2 EIA Transition Board • provides only 2 options for switching A and B • requires 2 slots in a Type 9 card cage:
150

1x4 EIA Transition Board • provides 4 switching options • multiple cards can be cascaded to provide up to 16 switching options • requires 4 slots in a Type 9 card cage:
350

1x5 EIA Transition Board • central site version of 1x4 board; provides additional connectors to eliminate Y cables • requires 5 slots in a Type 9 card cage:
350

CMS 803 VF Switch Card & Transition Board • switches telephone lines and the voice frequency (VF) interfaces of network communications equipment • strappable for two 1x4 or one 1x8 paths • can be cascaded to provide 1xN switching • requires 2 slots in a Type 9 card cage:
500

CMS 804A-1 MSD Switch Card & Transition Board • allows 4 terminals to share 1 modem port • 2 MSD switches can be cascaded to allow 7 terminals to share 1 modem port (eighth position used for cable connection):
650

CMS 804A-2 MSD Switch Card • same as 804A-1 but contains DMM circuitry for duplicating CMS control signals:
650

Type 9 Card Cage • rackmount card nest has a total of 16 slots; occupies 10.5 inches of vertical rack space • more than 1 cage may be required to accommodate a 1xN switch • fits standard equipment cabinet:
950

☐ CMS-SPAN Network Performance System Configuration

The CMS System Performance Analyzer (CMS-SPAN or SPAN) is an add-on software/hardware system available for CMS 2010 and CMS 2040 systems. The hardware consists of line cards located at the user central site or remotely located over a 4800-bps asynchronous channel; each SPAN card attaches to and monitors a main communication channel on a noninterruptive basis. SPAN cards are housed in a chassis linked with CMS controllers; SPAN software (see SOFTWARE) takes

Racal-Milgo Communications Management Series
CMS 185 & 2000 Network Control/Management Systems

advantage of central-site hardware, including the processor, disk space, and system color console (a second color console can be dedicated to SPAN). SPAN cards can be physically interfaced with main channels in 1 of 3 ways: through a test position on an EIA patch panel; through a CMS 800 switch; or through a modem line interface. A limited number of SPAN cards can also be grouped into user-defined units and electrically switched between network lines.

SPAN Card • monitors one primary communication channel • supports IBM 3270 BSC or SDLC protocol, soft-selectable; will support 6 additional protocols supplied in the future by Racal-Milgo or custom programmed • 32K-byte battery-backed RAM buffer stores line configuration, and stores user 7-day calendar parameters until purged to main disk file; stores calendar parameters for up to 42 days (up to 1024 devices per line) • up to 32 cards per CMS 2005; up to 128 cards per CMS 2010; up to 256 cards per CMS 2040 • occupies slot in the Omnimode central site chassis:

$1,600 prch

Omnimode CS Secondary Chassis • standard modem chassis used for housing SPAN cards • contains 16 slots • fits standard 19-inch equipment cabinet, up to 4 chassis per 6-foot cabinet:

1,600

o END

Racal-Vadic Modems
VA212, VA300, VA1200, 2400PA, VA2400, VA3400, VA4000 & VA4840 Series

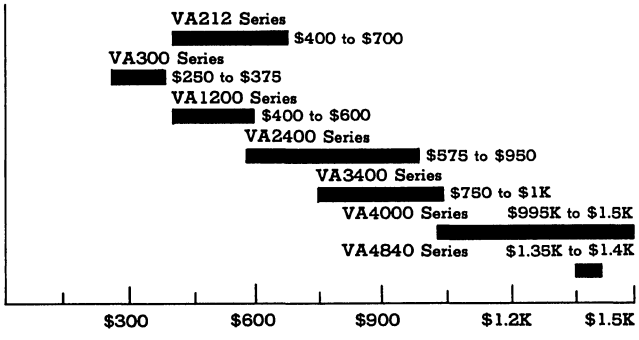
■ PROFILE

Function • low- and medium-speed, AT&T-compatible and non-AT&T-compatible modems.

Communications/Networks • 300-bps AT&T 103-/113-compatible for the DDD network; point-to-point or multipoint over unconditioned 2-wire dedicated Type 3002 facility • synchronous 2400-bps AT&T 201-compatible for the DDD network; point-to-point or multipoint over unconditioned 2- or 4-wire dedicated Type 3002 facility • asynchronous 300-/1200-bps or synchronous 1200-bps AT&T 103-/113-, AT&T 202-, AT&T 212A-, and/or Vadic 3400-compatible for the DDD network; point-to-point or multipoint over unconditioned 2-wire dedicated Type 3002 facility • asynchronous 300/1200/2400-bps or synchronous 1200-/2400-bps AT&T 103-/113-, 212-, VA 3400-, and CCITT V.22 bis-compatible for the DDD network; point-to-point over unconditioned 2-wire dedicated Type 3002 facility • synchronous 4800-bps AT&T 208A/B-compatible for the DDD network; point-to-point or multipoint over unconditioned 2- or 4-wire dedicated Type 3002 facility.

First Delivery • 1973 (3400); 1976 (VA2430); 1977 (VA355, VA2440/VA2445, VA3455/VA34X7); 1978 (VA1250/VA1255); 1979 (VA1251/VA1252); 1980 (VA103 Modemphone, VA3413, VA3450); 1981 (VA315, VA1244/VA1245, VA2450/VA2455, VA3212, VA3481); 1982 (VA4840); 1983 (VA212/VA212PAR/VA212LC, VA4400); 1984 (2400PA); 1985 (VA4224).

PURCHASE PRICE RANGE hardware



RACAL-VADIC MODEM PURCHASE PRICING bar graphs cover ranges between "small" and "large" configurations; maintenance contracts usually provided by vendor reps or stocking distributors • **VA212 small** configuration consists of 300-/1200-bps AT&T 212A-compatible VA212LC modem; **large** of 300-/1200-bps AT&T 212A-compatible VA212PA modem • **VA300 small** configuration consists of 0- to 300-bps AT&T 103-compatible VA103MA modemphone; **large** of VA315 or VA355 modem • **VA1200 small** configuration consists of 1200-bps AT&T 202-compatible VA1244 modem; **large** of VA1251 modem with auto-dial option • **VA2400 small** configuration consists of 2400-bps AT&T 201-compatible VA2440 modem; **large** of VA2450 modem with auto-dial option • **VA3400 small** configuration consists of 300-/1200-bps modem; **large** of 300-/1200-bps VA3400 and AT&T 212A-compatible modem with auto-dial option • **VA4000 Series small** configuration consists of 300/1200/2400-bps VA4224 modem; **large** of VA4401 modem with auto-dial option • **VA4840 small** configuration consists of 4800-bps AT&T 208A/B-compatible modem; **large** of 4800-bps AT&T 208A/B-compatible modem with auto-dial option.

Racal-Vadic's VA1200 Series are point-to-point and multipoint AT&T 202-compatible modems with fixed 2400-bps or 2400-/1200-bps data rates.

Units Delivered • 101,000+ for VA300 Series • 128,000+ for VA1200 Series • 120,000+ for VA2400 Series • 300,000+ for VA3400 Series.

Comparable Systems • principal competition from Anderson Jacobson AJ1233, AJ1234, AJ1235, AJ1256, AJ1259; AT&T 103, 108, 113, 201, 202, and 212A; Concord Data CDS 224; General DataComm 103A3/J/J-L, 113BR2/C/D, 201C/C-M/-7R, 202S Type 21, 202S/T/9D/9R, 212A, and 2400 ASM; Hayes Smartmodem; Paradyne LSI 2400/A/C; Penril 300/1200, 1800 DED, 2400 LSI, 8201; Prentice P103/P113, P201C, P212A/C, P202A/T; Racal-Milgo CMS12, CMS24; Rixon T103J, T108, T113C, T212A, TA201C, T202S/T, R212A, R2424; Universal Data Systems 103LP/JLP/-1/-2, 103J, 113D, 212A, 201B/C, 202LP/S/D/T; and Ventel MD212 models.

Vendor • Racal-Vadic Inc; 1525 McCarthy Boulevard, Milpitas, CA 90503 • 408-946-2227.

Canadian Distribution • Canadian General Electric; 396 Atwell Drive, Rexdale, ON M9W 5C3 • 416-675-7500.

Distribution • nationwide via local Racal-Vadic representatives/distributors; international sales via individual (foreign) state agencies.

GSA Schedule • listed.

■ ANALYSIS

Over the past year, Racal-Vadic has consolidated its line of low- and medium-speed modems, dropping older Models VA1245, VA1252, VA1255, VA2455, VA3212, and VA3413 from the lineup. Racal-Vadic also eliminated the Error Controller unit that provided end-to-end error control by inserting a CRC-16 check character into the data stream. Racal-Vadic has indicated, however, that a new Error Controller based upon Microcom's

Racal-Vadic Modems

VA212, VA300, VA1200, 2400PA, VA2400, VA3400, VA4000 & VA4840 Series

MNP networking protocol is being prepared for release in the near future. Additions to the line-up include the VA4224 and the 2400PA modems. The 4224 is a full-duplex, triple-modem card that features automatic selection of tone and pulse dialing, call progress reporting, last number redialing, and tandem and blind dialing capabilities. The 2400PA is also a triple modem that operates at 300/1200/2400 bps and includes a built-in Modem Manager for remote modem control, diagnostics, and configuration capabilities. Pricing remained relatively stable for most of the Racal-Vadic product line with an approximate 20 percent price reduction affecting only Models VA212LC and VA3451.

In addition, Racal-Vadic has recently introduced its Multiple Data Set (MDS) II system which is designed for local or remote modem management in a dial-up network. Unlike previously available systems, the MDS-II chassis will accommodate any combination of up to 32 modems, within a standard 19-inch rack. Another unique feature is the MDS-II System Controller that performs comprehensive central-site supervision and monitoring functions for a dial-up network. According to a Racal-Vadic spokesperson, the new MDS-II system offers significant user benefits by enabling users to download options, monitor performance, gather usage statistics, and conduct diagnostic tests on any portion of a network from a single central location.

The MDS-II family comprises the VA1690 chassis, VA990 control card, VA2190 power supply card, VA4491E triple modem, and VA9000 System Controller. The VA1690 is a front-loading, rackmountable chassis with 16 slots for modem cards (2 modem cards fit in 1 slot), 1 slot for the chassis control card, and 1 additional slot for future products. The chassis front panel contains status indicators, EIA indicators, a 2-line x 16-character LCD, and a keypad. The keypad and display present alarm messages and modem and call status while enabling the operator to enter operational commands, configure the modems, and perform diagnostic testing. The MDS-II unit can also accommodate a second VA2190 power supply card to provide load sharing. Load sharing will improve the mean time between failure and decrease system downtime and maintenance requirements.

At the present time, the new VA4491E is the only modem card that can be used with the MDS-II unit. According to Racal-Vadic, it will not be economically feasible to offer an upgrade provision for existing modem cards; instead, a new line of rackmountable modems will be produced that are designed for use with this latest Racal-Vadic product offering.

Although the lack of sufficient information on the MDS-II system prohibits us from presenting detailed system specifications, we were able to obtain pricing information.

The MDS-II VA1690 chassis, equipped with a VA990 control card and 2 VA2190 power supplies, will be priced at $3,260. The VA4491E modem will be available for $1,095. Furthermore, the VA9000 System Controller, consisting of an interface board for an IBM PC or compatible system along with proprietary software, will be priced at $3,500.

Racal-Vadic modems focus on the AT&T market for low- to medium-speed communication requirements. Four families of AT&T-compatible modems support data rates up to 300 bps, 1800 bps, and 2400 bps and provide compatibility with AT&T 103/113, 201, 202, 212A, and 208A/B modems. User benefits are increased operating flexibility, ease of use, end-to-end AT&T compatibility, and significant cost reductions below equivalent AT&T models. Modems are available for dial-up use on the DDD network as well as for point-to-point and multipoint dedicated applications. Standalone and rackmount packaging satisfies remote and central-site applications. Cabinets and card nests are available for central-site installations.

Racal-Vadic is not just another "me-too" vendor that produces Chinese copies of AT&T modems. The company is an innovator that designs its products to satisfy user needs. Prime examples of Racal-Vadic's innovative approach are its triple modems, the quad modem, and its Modemphone. Racal-Vadic was the first to introduce a full-duplex 1200-bps modem for use on the DDD network 2-wire dedicated line. This split-band modem was introduced in 1973; it wasn't until 1976 that AT&T introduced its own split-band full-duplex modem for 1200 bps over a 2-wire facility, the 212A.

Racal-Vadic's dual and triple modems give users the flexibility to communicate at 300 bps or 1200 bps in full-duplex to serve different applications, eliminating the cost for 2 modems, extra cables, and a switch. Compatibility with AT&T's 103/113 and 212A allows these modems to communicate with other users' AT&T modems. Racal-Vadic modems are FCC registered and can be directly connected to the DDD network. Racal-Vadic's Modemphone is an example of innovative packaging that combines an AT&T 103-/113-compatible modem with a standard rotary dial or touch tone telephone. The 300-bps full-duplex modem is concealed in the phone, eliminating the need for a separate modem and associated cables.

Racal-Vadic also markets the 1200PC and 2400PC Maxwell family of personal computer modems comprising 4 models encompassing AT&T 103 and 212A modem standards. Models 1200PC and 2400PC are plug-in cards for IBM PC/XT personal computers, while Models 1200V and 2400V are standalone, desktop versions. Packaged with integral communication software, the units will allow their users a choice between Hayes-compatible or Vadic-proprietary communication protocols with automatic detection. Dialing options will include manual or automatic operation, automatic pulse or tone dialing, and call progress monitoring. Racal-Vadic's communication software can provide hardcopy reports such as numbers dialed, number of times a number has been dialed, and number of completed calls. Desktop models feature terminal-controlled dialing, and Model 1200V will feature full diagnostics for both local and remote inspection.

Racal-Vadic supports its modems through 5 nationwide service centers, and is extending maintenance service to individual representatives and distributors who will provide on-site or shop service. The availability and cost of leasing and maintenance contracts vary among distributors.

☐ Strengths

Racal-Vadic offers solutions to user needs unsatisfied by AT&T. It offers users extensive operating flexibility to meet the requirements for a broad base of applications and still retains compatibility with AT&T modems for unrestricted communication with AT&T modem users. Substantially reduced prices below those of AT&T-equivalent models produce considerable user savings, especially for large orders. The modems are highly reliable, technically sophisticated units that have been widely accepted by users. Their success in the market is manifested by the existence of competitive modems with Vadic compatibility.

Racal-Vadic offers an extensive array of AT&T-compatible, low- and medium-speed modems that provide users with additional operating flexibility. The Tandem Dialing feature included in Models 2400PA, VA4224, and VA212 benefits users by allowing the modem to automatically dial through a PBX system or to utilize special carriers such as MCI and GTE Sprint. Also, the call progress monitoring feature provided on Models 2400PA and VA4224 supports the added benefit of unattended operation.

The 2400PA built-in Modem Manager is a unique feature aimed at corporations with scattered multiple users. Although it is not supported by other modem products at this time, Racal-Vadic intends to incorporate it into future releases. The Modem Manager extends user control over remote modems by supporting reconfiguration and line diagnostic capabilities.

☐ Limitations

Racal-Vadic limits its market to the low- to medium-speed, AT&T-compatible segment. Medium- to high-speed modems are available from parent company Racal-Milgo. There are no obvious serious limitations in the Racal-Vadic product line.

Racal-Vadic's withdrawal of Models VA1245, VA1252, VA1255, VA2445, and VA2455 from the market represented the discontinuation of a reverse channel feature. According to Racal-Vadic, declining market demand for models supporting a reverse channel led to the demise of these models. Users still requiring a reverse channel for supervisory control or user-defined applications should be aware that Racal-Vadic doesn't plan to offer reverse or secondary channel provisions. The

Racal-Vadic Modems

VA212, VA300, VA1200, 2400PA, VA2400, VA3400, VA4000 & VA4840 Series

initial specifications surrounding the new MDS-II system will attract users with new installations because of its high-density packaging and centralized network control capabilities. However, the new VA1690 chassis cannot accommodate existing Racal-Vadic modem cards, which presents a forced upward migration path to current users. These users will not look kindly on Racal-Vadic, has decided not to protect its investment.

■ HARDWARE

☐ Terms & Support

Terms • large quantity purchase directly through Racal-Vadic; end-user small quantity purchase or lease only through Racal-Vadic representative/distributors • modem repair available from vendor or representative/distributor; • 1-year warranty on all models • quantity discounts for 10 or more purchased units.

Support • all models installed by user • modems under warranty repaired free of charge; out-of-warranty repair incurs a one-time equipment charge with faulty modem sent to the nearest Racal-Vadic Customer Service Department, or repaired under arrangement with local representative/distributor • Customer Service Departments providing factory repair and free dial-up diagnostics located in Sunnyvale, CA; Oakbrook Terrace, IL; Wakefield, MA; Lanham, MD; and Arlington, TX • sales and service provided by over 15 stocking distributor/representatives in over 30 locations.

☐ Overview

The 7 series of Racal-Vadic modems meet a wide variety of user requirements for low- to medium-speed data communication. Models in the VA212, VA300, VA1200, VA2400, and VA4000 Series and Model 2400PA are compatible with their AT&T 212, 103/113, 202, 201, and 208A/B counterparts, respectively, but offer significant advantages in cost and features. Full-duplex 2400-bps models also conform to the CCITT V.22 bis standard. They are packaged in a variety of standalone or rackmount configurations. The VA3400 Series is comprised of dual 212A-/103-compatible and triple 3400/212A/103-compatible models. They are also packaged in rackmount or standalone versions. Racal-Vadic offers an optional automatic auto-dialer and standard auto-answer feature for popular models; all modems within the family include models for leased-line applications as well as direct-connect modems for the DDD network.

VA212 Series • direct-connect AT&T 103-/212A-compatible modems with data rates up to 300 bps and 1200 bps.

VA300 Series • point-to-point and multipoint AT&T 103-/113-compatible modems with data rates up to 300 bps.

VA1200 Series • point-to-point and multipoint AT&T 202-compatible modems with fixed 1200- or 1800-bps data rates.

VA2400 Series • point-to-point and multipoint AT&T 201-compatible modems with fixed 2400-bps or 2400-/1200-bps data rates.

VA3400 Series • point-to-point and multipoint Vadic 3400-, AT&T 212A-, and AT&T 103-compatible modems with data rates up to 300 bps and 1200 bps.

VA2400PA & VA4000 Series • point-to-point and multipoint Vadic 3400, AT&T 103-compatible, AT&T 212A-compatible, and CCITT V.22 bis-compatible modems with data rates up to 300 bps and fixed rates at 1200 and 2400 bps.

VA4840 Series • point-to-point and multipoint AT&T 208A/B-compatible modems with fixed 4800-bps data rate.

☐ Packaged Modems

All Racal-Vadic modems are available in a standalone version; excluding the VA4224 and the VA212PAR • card modems can be mounted in a dual- or quad-mount standalone enclosure, or in a multiple-modem card nest for central-site rackmounting • VA103 Modemphones are packaged inside rotary or tone dial telephones with an RS-232C interface • central-site card nest (VA1680/VA1681 Multiple Data Set Chassis) fits standard 19-inch equipment cabinets.

VA212 Series AT&T 212-Compatible Modems

VA212PA • standard AT&T 103-/212A-compatible standalone modem 300/1200 bps over DDD direct connection; originate and answer mode with integral automatic dialer:

$695 prch	$85 maint

VA212LC • standard AT&T 103-/212A-compatible standalone modem; 300/1200 bps over DDD direct connection; manual originate and automatic answer mode:

395	85

VA212PAR • standard AT&T 103-/212A-compatible modem card; 300-/1200-bps operation over DDD direct connection; manual/automatic originate and answer mode:

595	85

VA300 Series AT&T 103-/113-Compatible Modems

VA103 MA Modemphone • standard DDD direct-connect 300-bps modem with rotary dial telephone and manual originate and answer mode:

$250 prch	$75 maint

VA103 AA Modemphone • same as VA103 MA except with automatic answer mode:

330	75

VA103 MB Modemphone • same as VA103 MA except with tone dial telephone:

300	75

VA103 AB Modemphone • same as VA103 MB except with automatic answer mode:

380	75

VA315 • standard 2-wire or DDD direct-connect 300-bps modem card with manual originate and answer mode • fits VA1601/VA1604 standalone enclosure or VA1680 Multiple Data Set Chassis:

375	75

VA355 • standard 2-wire or DDD direct-connect 300-bps standalone modem with manual originate and answer mode:

375	75

VA1200 Series AT&T 202-Compatible Modems

VA1244 • standard 2-wire or 4-wire dedicated or DDD direct-connect 1200-bps modem card; accommodates VA811 automatic calling unit • fits VA1601/VA1604 standalone enclosure or VA1680/VA1681 Multiple Data Set Chassis:

$400 prch	$75 maint

VA1250 • standard DDD direct-connect 1200-bps standalone modem:

425	75

VA1251 • standard 2- or 4-wire 1800-bps standalone modem:

425	75

VA2400 Series AT&T 201-Compatible Modems

VA2440 • standard 2-wire or 4-wire dedicated or DDD direct-connect 2400-bps modem card • fits VA1601/VA1604 or VA1680/VA1681 enclosures:

$575 prch	$85 maint

VA2450 • standard 2- or 4-wire dedicated or DDD direct-connect 2400-bps standalone modem:

725	85

VA3400 Series AT&T 103-/212A-Compatible Modems

VA3467 • standard AT&T 103-/212A- and VA3400-compatible answer-only modem on dual PC cards; 300/1200 bps over DDD

PRCH: single-unit purchase price. MAINT: one-time charge for out-of-warranty factory repair. NA: not available. NC: no charge. Prices are current as of June 1985.

Racal-Vadic Modems

VA212, VA300, VA1200, 2400PA, VA2400, VA3400, VA4000 & VA4840 Series

direct connection • fits VA1601/VA1604 standalone enclosure or VA1680 Multiple Data Set Chassis:

$750 prch	$85 maint

VA3451 • standard AT&T 103-/212A- and VA3400-compatible standalone modem; DDD direct-connect with originate and answer mode with or without integral automatic dialer:

725	85

VA3481 • standard AT&T 103-/212A- and VA3400-compatible modem on dual PC cards; DDD direct-connect with manual originate and answer mode • fits VA1601/VA1604 standalone enclosure or VA1680 Multiple Data Set Chassis:

950	85

VA4000 Series & 2400PA AT&T 103-/212A-Compatible & CCITT V.22 bis-Compatible Modems

2400PA • standard 2-wire dedicated or DDD direct-connect 300/1200/2400-bps full-duplex modem • tandem dialing feature and call-progress monitoring • provides storage for up to 15 phone numbers, I.D. names, or logon sequences of up to 60 characters each • integral Modem Manager supports remote modem control, configuration, and diagnostic functions • integral memory editor provides editing functions for correcting phone numbers or lengthy logon sequences:

$995 prch	NA maint

VA4224 • standard 2-wire dedicated or DDD direct-connect 300/1200/2400-bps full-duplex modem card • auto-dialing accomplished through serial port, manually through telephone, or through Multiline Automatic Calling System (MACS), which provides single dialing port for up to 15 modems • automatic selection of tone or pulse dialing, call progress reporting, last number redialing, and tandem and blind dialing • fits 1680/1681 Multiple Data Set Chassis:

925	NA

VA4401 • standard 2-wire dedicated or DDD direct-connect 300-, 1200-, and 2400-bps full-duplex modem on dual PC cards • manual/automatic originate, automatic answer • compatible with VA3400 Series modems • fits VA1604 standalone enclosure or VA1681 Multiple Data Set Chassis Only:

1,425	150

VA4840 Series AT&T 208A/B-Compatible Modems

VA4840 • standard 2- or 4-wire dedicated or DDD direct-connect 4800-bps modem on dual PC cards • manual originate/answer or manual originate/automatic answer • fits VA1604 standalone enclosure or VA1681 Multiple Data Set Chassis only:

$1,350 prch	$125 maint

Modem Enclosures

VA1601U Remote Standalone Cabinet • 2-channel standalone enclosure with power supply; holds 2 card modems or 1 dual-card modem:

$175 prch	$50 maint

VA1604 Remote Standalone Cabinet • 4-channel standalone enclosure with power supply; holds 4 single-card modems or 2 dual-card modems, any type:

250	50

VA1680 Multiple Data Set Chassis • 16-slot card nest; accommodates combinations of single- or dual-card modems, excluding VA4800 Series modems • includes integral power supply; accommodates VA2082 power supply for redundancy; UL approved • occupies 7.5 inches of vertical rack space:

725	50

VA1681 Multiple Data Set Chassis • 16-slot card nest accommodates dual-card VA4800 Series modems • includes integral power supply; accommodates VA2085 power supply; UL approved • occupies 10 inches of vertical rack space:

950	50

VA2082 • power supply provides backup redundancy for VA1680 chassis:

200	75

VA2085 • power supply for VA1681 chassis:

380	75

☐ Application

VA212 Series

VA212, VA212LC & VA212PAR • designed for operation over the DDD network.

VA300 Series

VA103 • designed for operation over the DDD network.

VA315 & VA355 • point-to-point and multipoint communications over unconditioned 2-wire dedicated Type 3002 voice channel, or operation over the DDD network.

VA1200 Series

VA1250 & VA1255 • designed for operation over the DDD network.

VA1244 • point-to-point and multipoint communication over unconditioned 2-wire or 4-wire dedicated Type 3002 voice channel, or over the DDD network.

VA1251 • point-to-point and multipoint communication over unconditioned 2- and 4-wire dedicated Type 3002 voice channel, or over the DDD network.

VA2400 Series

VA2440 • point-to-point and multipoint communication over unconditioned 2-wire dedicated Type 3002 voice channel, or over the DDD network.

VA2450 • point-to-point or multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel, or over the DDD network.

VA3400 Series

VA3467, VA3451 & VA3481 • designed for operation over the DDD network.

VA4000 Series & 2400PA

2400PA • point-to-point communication over 2-wire unconditioned dedicated Type 3002 voice channel, or over the DDD network.

VA4224 • point-to-point communication over unconditioned 2-wire dedicated Type 3002 voice channel, or over the DDD network.

VA4401 • point-to-point communication over unconditioned 2-wire dedicated Type 3002 voice channel, or over the DDD network.

VA4840 Series

VA4840 • point-to-point or multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel, or over the DDD network • training time (CTS) delay at 50 or 150 milliseconds (switched carrier); turnaround delay optionally 150 milliseconds including CXR (carrier detect) ON timing.

☐ Operating Parameters

VA212 Series

VA212 • asynchronous full-duplex at 0 to 300 bps, AT&T 103 mode; FSK modulation • asynchronous full-duplex at 1170 to 1212 bps or synchronous full-duplex at 1200 bps, AT&T 212A mode; PSK modulation.

VA212LC • asynchronous full-duplex at 0 to 300 bps, AT&T 103 mode; FSK modulation • asynchronous full-duplex at 1170 to 1219 bps, AT&T 212A mode; PSK modulation.

VA212PAR • asynchronous full-duplex at 0 to 300 bps, AT&T 103 mode; FSK modulation • asynchronous full-duplex at 1170 to 1212 bps or synchronous at full-duplex at 1200 bps, AT&T 212A mode; PSK modulation.

Racal-Vadic Modems

VA212, VA300, VA1200, 2400PA, VA2400, VA3400, VA4000 & VA4840 Series

VA300 Series

All Models • asynchronous full-duplex at 0 to 300 bps • FSK modulation.

VA1200 Series

VA1251 • asynchronous half-/full-duplex at 0 to 1200 bps • FSK modulation.

VA1244, VA1245 & VA1250 • asynchronous half-duplex at 0 to 1200 bps • FSK modulation.

VA2400 Series

VA2440 & VA2445 • synchronous half-duplex at 2400/1200 bps • DPSK modulation • 2-level compromise (statistical) equalization.

VA2450 • synchronous half-/full-duplex at 2400 bps • DPSK modulation • 2-level compromise (statistical) equalization.

VA3400 Series

VA3451, VA3467 & VA3481 • asynchronous full-duplex at 0 to 300 bps, AT&T 103 mode; FSK modulation • asynchronous full-duplex at 1182 to 1212 bps or synchronous full-duplex at 1200 bps, AT&T 212A mode; QAM modulation • asynchronous full-duplex at 300 or 1200 bps, or synchronous full-duplex at 1200 bps, VA3400 mode; QAM modulation • 2-level compromise (statistical) equalization.

VA4000 Series & 2400PA AT&T 103-/212A-Compatible & CCITT V.22 bis-Compatible Modems

2400PA • asynchronous full-duplex at 0 to 300 bps, AT&T 103 mode, FSK modulation • asynchronous or synchronous full-duplex at 1200 bps, AT&T 212A mode; QAM modulation • asynchronous or synchronous full-duplex at 2400 bps, CCITT V.22 bis mode; 16-level PSK (QAM) modulation • combined automatic adaptive and fixed compromise equalization.

VA4224 • asynchronous full-duplex at 0 to 300 bps, AT&T 103 mode, FSK modulation • asynchronous at 1170 to 1219 bps or synchronous full-duplex at 1200 bps, AT&T 212A mode; 4-level PSK (QAM) modulation • asynchronous full-duplex at 2340 to 2424 bps or synchronous at 2400 bps, CCITT V.22 bis mode; 16-level PSK (QAM) modulation • automatic adaptive equalization.

VA4401 • asynchronous full-duplex at 0 to 300 bps, AT&T 103 mode; FSK modulation • asynchronous or synchronous full-duplex at 1200 bps, AT&T 212A mode; QAM modulation • asynchronous full-duplex at 300 or 1200 bps or synchronous at 1200 bps, VA3400 mode; QAM modulation • asynchronous or synchronous full-duplex at 2400 bps, CCITT V.22 bis mode; 16-level PSK (QAM) modulation • combined automatic adaptive and compromise equalization.

VA4840 Series

VA4840 • synchronous half-duplex at 4800 bps; DPSK modulation • automatic adaptive equalization.

☐ Channel Functions

Local Copy • models VA315, VA355, VA1244, VA1250/VA1255, VA1251, VA2440, VA1250, and VA3413 include integral local copy option; echoes data back to DTE for local printout • standard feature included in package price:

NC prch	NC maint

Digital Interface • EIA RS-232C on all ports • 25-pin electrical connector.

☐ Control Functions

FCC-Registered Modems • all Racal-Vadic modems specified for the DDD network are FCC registered for direct connection under FCC Rules Part 68; does not require separate Data Access Arrangement (DAA) • requires RJ41S/RJ45S data jacks or RJ11C standard telephone jack • standard feature included in modem pricing:

NC prch	NC maint

Alternate Voice/Data • all direct-connect modems for the DDD network can be equipped for alternate voice/data communication by attaching TelCo telephone, Data Phone, or Vadic VA870 Series Telephones; VA103 Modemphone includes integral handset for voice communication and integral voice/data switch • leased-line modems not designed for voice communication.

VA871A Rotary Dial Telephone • includes integral voice/data switch for use with manual/automatic originate/answer modems without a voice/data switch:

70	50

VA871B • same as VA871A except includes tone dial instead of rotary dial:

120	50

VA872A Rotary Dial Telephone • without voice/data switch for use with manual/automatic originate/answer modems with integral voice/data switch:

50	50

VA872B • same as VA872A except includes tone dial instead of rotary dial:

75	50

VA865 Modem Expander • dual-card unit allows up to 5 terminals to share 1 modem, one at a time • manually switched • for dedicated multipoint networks only:

260	75

Automatic Mode Adaptation • VA3400 Series modems with dual and triple mode compatibility (VA3400, AT&T 212, AT&T 103) and designed for central-site operation; can recognize calling modems and automatically adjust to the correct mode • transparency to modem type precludes operator intervention • standard feature on models VA3467/VA3481:

NC	NC

Autoanswer (Automatic Answer) • models in the VA1200 and VA2400 Series, and the VA103AA/AB Modemphone, VA315, VA212, VA212LC, VA212PAR, VA3467, VA4400, and VA4840 include integral automatic answer function • standard equipment:

NC	NC

VA212 Auto-dial • VA212 modem includes an integral auto-dialer; stores up to 15 telephone numbers of up to 31 digits each, pulse or tone dial • redials the last number dialed via operator keystroke input or modem front-panel button • numbers can be entered, changed, or dialed from an operator terminal, modem front-panel keypad, or other peripheral equipment • accommodates linked addresses, dialing subsequent numbers if the first number fails • standard feature:

NC	NC

VA811 Multimode Automatic Calling Unit • single card-compatible replacement for AT&T 801 and Racal-Vadic VA3400/801/821 ACUs • provides automatic dialing for CPU originated calls on single- or multiline systems using pulse or tone dialing over the DDD or TWX networks • addresses up to 60 single-card Racal-Vadic modems from 1 computer port • requires computer port with RS-366 interface • requires slot in VA1601, VA1604, VA1680, or VA1681 chassis; each chassis in a multiple chassis/cascaded configuration requires 1 VA811; up to 4 chassis per equipment rack:

600	75

VA831 RS-232C Adapter • single card RS-232C to RS-366 converter for CPUs with RS-232C interface; requires 1 slot in VA1680 chassis; only 1 converter required per each 2 to 4 chassis cascaded configuration:

500	75

Satellite Delay • integral switch-selectable option inserts 275-millisecond delay, at end of answer tone, to inhibit RTS; enables activation of TelCo echo suppressors for use in satellite links or ground distances greater than 500 miles • standard feature on models VA1244 and VA2450 only:

NC	NC

Racal-Vadic Modems

VA212, VA300, VA1200, 2400PA, VA2400, VA3400, VA4000 & VA4840 Series

New Sync • integral switch-selectable option permits rapid resynchronization of incoming calls in 4-wire leased line communication; activated at master-site modem, and required when intervals between incoming calls are 10 milliseconds or less • standard feature on model 2450 only:

NC	NC

Clock Slaved Timing • integral switch-selectable option on synchronous full-duplex models locks received clock signal in phase with outgoing signal; slaves modem tail circuit timing to that of high-speed modem or multiplexer • standard feature on models VA2450, VA2455, and the 3400 Series:

NC	NC

Automatic Disconnects • Racal-Vadic direct-connect modems designed for the DDD network contain integral switch-selectable timers that automatically disconnect a call, at predetermined time intervals, when remote end fails to answer a call or a loss of carrier occurs • standard feature on VA300 Series models, VA1244, VA1250, VA2400 Series, and 3400 Series:

NC	NC

Standard Option Mode • integral strap-selectable option on microprocessor-based models programs modem for factory-specified "standard configuration," disabling all other strap and switch options • ease-of-use feature for end users with standard configuration requirements; any deviation to the standard configuration dictates all 30 to 40 straps and switches (depending on model) to be manually set • standard feature on models VA315, VA1244, VA1245, VA2450, and VA3400 Series modems:

NC	NC

☐ Diagnostic & Status Indicators

Loopback diagnostics isolate failures in local or remote modems, dedicated line, or data terminal equipment (DTE), depending on model • manual control of diagnostics through modem front panel, or terminal console (via EIA control pin #25) • visual indication of operating conditions; visual warning of abnormal conditions • VA103 Modemphone does not support loopback diagnostics.

Loopback Tests • local analog and local/remote digital loopback, all full-duplex models; half-duplex models run local analog loopback only:

NC prch	NC maint

Test Pattern Generation • integral bit-pattern generator and error detector performs bit error rate tests • microprocessor-based models generate an uppercase "U" pattern for end-to-end or internal self tests; other models, including the VA103 Modemphone, VA355, VA1250, and VA2440, generate a simple start/stop pattern for internal self-test only:

NC	NC

Status Indicators • test mode; circuit quality; EIA interface signal activity • VA103 Modemphone indicates carrier on/off only.

• END

RCA Americom
Domestic Satellite Service

■ PROFILE

Function • voice-grade and wideband, switched and dedicated channel, carrier network services.

Facilities • analog and digital, satellite, microwave, and landline network comprising RCA-owned operating center earth stations as well as earth stations at customer sites • terrestrial channels extend access to major metropolitan areas.

Services • switched and leased network services for teleprinter, data, facsimile, and voice transmission • specialized Government communication services • television and radio program transmissions • transponder services.

Access • direct from customer locations via on-site earth stations • access to network via RCA operating centers in 11 major cities serving over 350 communities in their location distribution areas • service extensions provide access to more than 130 other locations.

First Available • 1973.

Number of Users • over 700 customers; 10,000 private users.

Comparable Services • American Satellite and Satellite Business Systems for on-site dedicated channel services; GTE Telenet for switched data channels; AT&T Communications DDD and GTE SPRINT for switched voice services.

Vendor • RCA American Communications; Four Research Way, Princeton, NJ 08540-6684 • 609-987-4000.

■ ANALYSIS

RCA Americom offers point-to-point voice-grade channels to domestic users on a full-period (7 days per week) basis. It also offers a point-to-point 56K-bps wideband digital service called 56 Plus, which is available on a 1-year minimum basis. The channels are suitable for voice, data facsimile, and various wideband applications.

Besides dedicated voice-grade channels, RCA offers metered-use switched lines. In many instances, where the voice/data traffic pattern might suggest otherwise, the switched service can be economically justified. Satellite transmission is, to some extent, distance insensitive—the user, in reality, is paying for transponder capacity, not mileage; and for relatively high-volume and long-haul traffic in excess of 500 miles, it can prove financially attractive compared with a terrestrial alternative. According to RCA, a user can save anywhere up to 40 percent with no capital investment, no change in equipment, and no trade-off in reliability. One RCA satellite user, handling 12,500 information requests each week from customer service centers located 2,000 miles away, reported a cost saving of 50 percent.

RCA Americom currently is supported through 11 operating centers located in major East Coast and West Coast cities, Cincinnati, and Texas. Connection between customer site located outside local distribution areas, and an operating center is supported by other common carrier facilities provided through RCA Americom or by the customer. City-pair voice-grade channels are available for as little as $622 or $722 per month under annual or monthly commitments, respectively, plus a $100 per month local distribution charge at each end.

RCA Americom offers its 56 Plus service as an alternative to AT&T's 56K-byte DDS service. This service is available between RCA operating centers and can include local channels to customer premises.

RCA Americom was a pioneer in domestic communication services. In 1973, the company started serving customers using leased channels on the Canadian Telestat Anik II satellite. In 1975, RCA launched its own SATCOM I, and SATCOM II went into orbit in 1976. Second generation RCA satellites launched in late 1982 feature improvements providing a 50 percent increase in voice/data capacity, reduced ground investment for 2-for-1 video reception, and an expected in-orbit life of 10 years. They are also compatible with existing in-orbit SATCOM satellites and terrestrial facilities. Satellites for the Americom communication network are designed and built by the RCA Astro-Electronics organization.

The SATCOM spacecraft feature several technological innovations that together provide improved performance and communication capacity compared with conventional satellites. A very significant RCA development involved a technique for doubling satellite capacity to 24 channels (transponders), a remarkable increase from the 12 that previously could be put into orbit by available Delta-class launch vehicles. The technique employed is called polarization diversity and frequency interleaving. The groups of 12 active transponders are served by cross-polarized antennae; one antenna accommodates vertically polarized frequency transponders, the other accommodates horizontally polarized transponders. Each transponder is currently capable of handling approximately 2,900 voice-grade channels.

RCA Americom is superbly positioned to be a leading purveyor of satellite communication services in the 1980s. Its technological resources, particularly in spacecraft design and nonterrestrial communication, are probably second to none. Through a series of shrewd strategic moves, the company has developed a network of ground-based operating centers which provide satellite capacity to major metropolitan areas within the United States.

The user most likely to be attracted to RCA Americom data services, given contemporary rate structures will have a concentrated high-volume traffic flow between 3 or more sites located at least 500 miles apart.

RCA Leased Voice-Grade Channel Minimum Usage Costs

Configuration • single leased voice-grade channel • customer stations (2) located in Atlanta and Chicago, respectively • Type I fixed-term service (12 months) • no special extension facilities, line conditioning, or other options.

Minimum Start-Up Costs • $100 total • consists of $50 each for installation of local channels in Atlanta and in Chicago.

Minimum Monthly Operating Costs • $721 per month total • $752 per month city-pair access charge reduced an additional 35 percent by Type I discount; $50 per month for 2 operating center terminations reduced an additional 35 percent by Type I discount; $200 per month for 2 local channels.

□ Strengths

The strengths of the RCA Americom domestic satellite service are impressive. It is an exerienced service, having pioneered in satellite communications back in the early 1970s, and it is buttressed by the vast and renowned RCA communication and spacecraft technology resources. Americom is well established

RCA Americom
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TABLE 1: RCA Domestic Satellite Private Leased Channel Rates Under Month-To-Month Commitment

	ATLANTA	BOSTON	CHICAGO	CLEVELAND	DALLAS	HONOLULU	HOUSTON	LOS ANGELES	MIAMI	NEW YORK	PHILADELPHIA	SAN ANTONIO	SAN FRANCISCO	SEATTLE	WASHINGTON D.C.	WILMINGTON
ATLANTA	—	1092.50	965.00	752.50	965.00	1427.50	965.00	1177.50	965.00	965.00	965.00	1092.50	1177.50	1177.50	—	—
BOSTON	1092.50	—	1092.50	880.00	1177.50	1597.50	1177.50	1347.50	1177.50	—	—	1347.50	1347.50	1347.50	—	—
CHICAGO	965.00	1092.50	—	752.50	965.00	1427.50	965.00	965.00	965.00	965.00	965.00	1092.50	965.00	965.00	965.00	965.00
CLEVELAND	752.50	880.00	752.50	—	965.00	1427.50	965.00	1177.50	965.00	752.50	—	1092.50	1177.50	1177.50	752.50	—
DALLAS	965.00	1197.50	965.00	965.00	—	1427.50	—	965.00	965.00	965.00	965.00	—	965.00	965.00	965.00	965.00
HONOLULU	1427.50	1597.50	1427.50	1427.50	1427.50	—	1427.50	1427.50	1427.50	1427.50	1427.50	1597.50	1427.50	1427.50	1427.50	1427.50
HOUSTON	965.00	1177.50	965.00	965.00	—	1427.50	—	965.00	965.00	965.00	965.00	—	965.00	965.00	965.00	965.00
LOS ANGELES	1177.50	1347.50	965.00	1177.50	965.00	1427.50	965.00	—	1177.50	1177.50	1177.50	1177.50	—	965.00	1177.50	1177.50
MIAMI	965.00	1177.50	965.00	965.00	965.00	1427.50	965.00	1177.50	—	965.00	965.00	1092.50	1177.50	1177.50	965.00	965.00
NEW YORK	965.00	—	965.00	752.50	965.00	1427.50	965.00	1177.50	965.00	—	—	1177.50	1177.50	1177.50	—	—
PHILADELPHIA	965.00	—	965.00	—	965.00	1427.50	965.00	1177.50	965.00	—	—	1177.50	1177.50	1177.50	—	—
SAN ANTONIO	1092.50	1347.50	1092.50	1092.50	—	1597.50	—	1177.50	1092.50	1177.50	1177.50	—	1177.50	1177.50	1347.50	1347.50
SAN FRANCISCO	1177.50	1347.50	965.00	1177.50	965.00	1427.50	965.00	—	1177.50	1177.50	1177.50	1177.50	—	965.00	1177.50	1177.50
SEATTLE	1177.50	1347.50	965.00	1177.50	965.00	1427.50	965.00	965.00	1177.50	1177.50	1177.50	1177.50	965.00	—	1177.50	1177.50
WASHINGTON D.C.	—	—	965.00	752.50	965.00	1427.50	965.00	1177.50	965.00	—	—	1347.50	1177.50	1177.50	—	—
WILMINGTON	—	—	965.00	—	965.00	1427.50	965.00	1177.50	965.00	—	—	1347.50	1177.50	1177.50	—	—

with over 700 customers and thousands of on-site earth stations located throughout the United States.

RCA Americom links customer data, voice, and television channels through operating centers which serve every major city in the continental U.S and Honolulu, HI.

The Americom service has an extraordinarily wide geographic reach. Local and extension channels provide access to over 480 communities with little or no capital investment and no need to secure zoning variances or permits from regulatory agencies. Very high-volume users can elect to install on-site earth stations which furnish a level of independence from terrestrial common carrier facilities and open a gateway to future service enhancements such as: electronic mail, facsimile, and teleconferencing.

It should be noted that satellite transmission is inherently high quality. The intrinsic weather and electrical disturbances which plague earth-bound communications are virtually nonexistent on the satellite path; bit error rates of 1 in 10 million or better are routinely achievable.

☐ Limitations

The economic and technical factors that make satellite communication attractive to large users (high-volume long-haul transmission over satellite links) also inhibit its use by other classes of users. Organizations with small facilities dispersed over a wide geographic area might not find satellite communication appealing; the cost to link each site via long stretches of extension channels to an RCA operating center might prove prohibitive.

Propagation delay can sometimes be a problem with satellite data transmission; the round-trip delay to a satellite, 22,300 miles out in space over the equator, is about 540 milliseconds. This delay increases response time and decreases throughput if error-control procedures based upon a receiver acknowledgement are employed. RCA does offer a device called a satellite delay manager (SDLM) which can improve efficiency in many of these cases. The SDLM acts as a data and response anticipation buffer between the terminal and the modem.

■ NETWORK

☐ Terms & Conditions

Billing Criteria • customers pay for leased voice-grade services based on factors associated with city-pair access, local and extension channels, and operating center terminations • 56K-bps wideband digital data service charges based upon monthly rental of RCA channel and local common carrier extension facilities.

Billing Conditions • leased voice-grade service is full-duplex, 2-point, 7 days per week, 24 hours per day; minimum billing period is 1 month, payable in advance • for fixed-term leased voice-grade service, customer must specify city-pairs and number of channels required over term • discounts offered for leased voice grade service contingent on lease period and channels utilized • private line switched service available on 2-point, 7-day-per-week, 24-hour-per-day basis; minimum period of 1 month • joint use arrangements permitted for all services; customer responsible for allocation of joint use service • proportionate billing for fractional charges incurred when service start or stop does not coincide with monthly billing period.

Other Conditions • right reserved to limit or discontinue services due to conditions beyond control of RCA • RCA assumes no liability for damage or unauthorized use of customer facilities or

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TABLE 2: RCA Domestic Satellite Private Leased Channel Rates Under Annual Commitment

	ATLANTA	BOSTON	CHICAGO	CLEVELAND	DALLAS	HONOLULU	HOUSTON	LOS ANGELES	MIAMI	NEW YORK	PHILADELPHIA	SAN ANTONIO	SAN FRANCISCO	SEATTLE	WASHINGTON D.C.	WILMINGTON
ATLANTA	—	882.50	785.00	622.50	785.00	1197.50	785.00	947.50	785.00	785.00	785.00	882.50	947.50	947.50	—	—
BOSTON	882.50	—	882.50	720.00	947.50	1327.50	947.50	1077.50	947.50	—	—	1077.50	1077.50	1077.50	—	—
CHICAGO	785.00	882.50	—	622.50	785.00	1197.50	785.00	785.00	785.00	785.00	785.00	882.50	785.00	785.00	785.00	785.00
CLEVELAND	622.50	720.00	622.50	—	785.00	1197.50	785.00	947.50	785.00	622.50	—	882.50	947.50	947.50	622.50	—
DALLAS	785.00	947.50	785.00	785.00	—	1197.50	—	785.00	785.00	785.00	785.00	—	785.00	785.00	785.00	785.00
HONOLULU	1197.50	1327.50	1197.50	1197.50	1197.50	—	1197.50	1197.50	1197.50	1197.50	1197.50	1327.50	1197.50	1197.50	1197.50	1197.50
HOUSTON	785.00	947.50	785.00	785.00	—	1197.50	—	785.00	785.00	785.00	785.00	—	785.00	785.00	785.00	785.00
LOS ANGELES	947.50	1077.50	785.00	947.50	785.00	1197.50	785.00	—	947.50	947.50	947.50	947.50	—	785.00	947.50	947.50
MIAMI	785.00	947.50	785.00	785.00	785.00	1197.50	785.00	947.50	—	785.00	785.00	882.50	947.50	947.50	785.00	785.00
NEW YORK	785.00	—	785.00	622.50	785.00	1197.50	785.00	947.50	785.00	—	—	947.50	947.50	947.50	—	—
PHILADELPHIA	785.00	—	785.00	—	785.00	1197.50	785.00	947.50	785.00	—	—	947.50	947.50	947.50	—	—
SAN ANTONIO	882.50	1077.50	882.50	882.50	—	1327.50	—	947.50	882.50	947.50	947.50	—	947.50	947.50	1077.50	1077.50
SAN FRANCISCO	947.50	1077.50	785.00	947.50	785.00	1197.50	785.00	—	947.50	947.50	947.50	947.50	—	785.00	947.50	947.50
SEATTLE	947.50	1077.50	785.00	947.50	785.00	1197.50	785.00	785.00	947.50	947.50	947.50	947.50	785.00	—	947.50	947.50
WASHINGTON D.C.	—	—	785.00	622.50	785.00	1197.50	785.00	947.50	785.00	—	—	1077.50	947.50	947.50	—	—
WILMINGTON	—	—	785.00	—	785.00	1197.50	785.00	947.50	785.00	—	—	1077.50	947.50	947.50	—	—

for communication or security breaches resulting from customer use of RCA services • customer shall ensure presence of trained technician at transmitter location when transmissions are sent from customer earth station • sharing arrangements for switched voice private line cannot be configured as MTS or WATS equivalents.

☐ Overview

RCA American Communications, Inc (Americom), provides a broad range of commercial and government satellite services in the United States. These services offer an alternative to terrestrial communication links for voice, data, facsimile, audio, and television transmission. RCA Americom connects major U.S. business centers with a network of RCA earth stations. The major earth stations, known as operating centers, are equipped to simultaneously transmit and receive traffic to meet the needs of government, industry, and the media. The system is expandable, and if required, RCA is prepared to construct and operate additional transmit/receive and receive-only earth stations. Major cities serviced by RCA Americom network now include Atlanta, Boston, Chicago, Cleveland, Dallas, Honolulu, Houston, Los Angeles, Miami, New York, Philadelphia, San Antonio, San Francisco, Seattle, Washington, DC, and Wilmington, Delaware. As part of its commercial communication services, RCA Americom provides other common carriers with lines to connect the operating and switching centers of these carriers. RCA Americom and MCI announced an agreement whereby MCI leases voice-grade circuits for its Execunet service.

The roster of customers for RCA satellite services includes banking, insurance, and securities companies; utilities, energy producers, and equipment manufacturers; as well as distributors, hotel and retail chains, food processors, chemical refiners, computer firms, and freight shippers. Access to the service is fairly widespread throughout the United States; local and extension channels provide entry from more than 480 communities.

Under the leased channel service, RCA furnishes channels between operating centers utilizing a satellite in space for the direct transmission and reception of voice and/or data services. The leased channel, which has transmission characteristics equivalent to those of a voice-grade circuit within a frequency bandwidth of approximately 300 to 3000 Hz, is offered for full-duplex operation on a 2-point basis, with service for 7 days per week, 24 hours per day. Local distribution area channels, and extension channels connect the leased channels to the customer's station. The monthly rate for this service is principally based on a monthly access charge per channel, which can vary with the operating center city-pair involved. Other rate elements to be considered include channel termination charges, the substantial RCA discount structure, and charges for local/extension channels, alternate use and line conditioning.

Another major RCA Americom offering is a private line switched service which permits communication between stations on a customer's leased channel network by dialing through RCA provided voice-grade facilities. The switched service is available on a 2-point basis, 7 days per week, 24 hours per day, for a minimum period of 1 month. Customer stations may be arranged for voice, data, or facsimile applications and may be connected to standard telephone instruments, computer terminals, private branch exchanges, CO centrex or the central office end of a Foreign Exchange or WATS channel. RCA provides or arranges with other common carriers to provide the requisite channel facilities connecting the customer's station and the RCA operating center. Charges for the private line switched service

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comprise facility charges to connect a customer station to a switch at the operating center, monthly termination charges, and a monthly usage charge per switch channel based on average monthly satellite usage per switched channel. No usage charges apply for traffic exchanged between stations connected to the same operating center.

A somewhat specialized RCA Americom is the Digital Data Service, also known as the 56 Plus Service. It is a high-speed, 56K-bit-per-second data transmission offering, via satellite, typically using dedicated earth stations at customer sites, although accessing can also be arranged via terrestrial common carriers and RCA operating centers located near major metropolitan areas. This service is available on a full-duplex, 2-point basis, 7 days a week, 24 hours per day for digitized voice, data, high-speed data, video, facsimile, and other forms of telecommunication singly or in any combination. The service can be expanded through additional 56K-bps circuits.

☐ Traffic Charges

Private Line Switched Service Traffic Charges

Monthly usage charge per switched channel based on average monthly satellite usage, which is determined by dividing total number of minutes originated on satellite for all customer access channels by total number of customer access channels on network. A $150 recurring charge applies to each switch connection exempt from special access surcharge; $175 per month for local channels subject to special access surcharge at RCA operating center. In addition, a $60 monthly charge applies to each channel switch termination at RCA operating center.

Less Than or Equal to 1,320 Minutes • average monthly satellite usage; basic monthly charge multiplied by number of customer access channels:

$265 mo

Greater Than 1,320 Minutes • average monthly satellite usage; basic monthly charge is $265 • per month plus $0.09 per minute for all minutes above 1,320.

☐ Access Charges

Leased Voice-Grade Channel Access Charges

A basic monthly charge per channel is applied for leased voice-grade channels between various RCA operating center city-pair combinations. See Table 1 for channels leased under a month-to-month commitment; Table 2 for channels leased under an annual commitment. A monthly local channel charge is also levied for operating center/customer station channels within the local distribution area of an RCA operating center. Service can be extended to other communities with extension charges based upon the charges imposed by the common carrier(s) from which RCA has arranged to obtain extension channels. Channel termination, alternate usage, and channel conditioning charges are also applicable. RCA applies a discount schedule to the city-pair monthly channel charges contingent on the service terms.

City-Pair Service Discounts

City-Pair Monthly Service Discount • 15 percent discount for 1-month minimum service.

City-Pair Type I Fixed-Term Service Discount • 35 percent discount for 12-month minimum service.

City-Pair Type II Fixed-Term Service Discount • 40 percent discount for 24-month and 150-channel minimum service.

City-Pair Type III Fixed-Term Service Discount • 45 percent discount for 36-month and 240-channel minimum service.

Local & Extension Channel Charges

Local Channel Charges • monthly charge plus installation for each local voice-grade channel between an RCA operating center and a customer station located within the local distribution area of the operating center • charge includes a standard telephone instrument when required:

$50 instal **$150 mo**

Extension Channel Charges • if RCA arranges to obtain extended voice-grade channels for customer stations not located within local distribution areas for Atlanta, Boston, New York, Camden, NJ, Chicago, Honolulu, Houston, Dallas, Los Angeles, San Francisco, Seattle, and Miami, a charge will be imposed by the common carrier from which RCA has arranged to obtain such channels.

Leased Channel Charges For Other Common Carriers

Groups of voice-grade channels are available under Types A, B, and C Services on a distributed basis from the RCA operating center.

Type A Service • monthly per-channel charge, payable in advance, for leased voice-grade channels furnished between the RCA operating centers located in Atlanta, Camden, NJ, Chicago, Dallas, Houston, New York, Los Angeles, San Francisco, Miami, and Seattle:

$600 mo

Honolulu Type A Service • monthly per-channel charge, payable in advance, for leased voice-grade channels furnished between the RCA operating centers in Atlanta, Camden, NJ, Chicago, Dallas, Houston, New York, Los Angeles, San Francisco, Miami, and Seattle to Honolulu, HI:

850

Type B Service • fixed monthly per-channel charge, payable in advance, for leased voice-grade channels furnished between the RCA operating centers and the cities listed under Type A Service:

470

Honolulu Type B Service • fixed monthly per-channel charge, payable in advance, for leased voice-grade channels furnished between the RCA operating center in Honolulu and the cities listed under Honolulu Type A Service:

720

Type C Service • fixed per-channel monthly charge, payable in advance, for multiple leased voice-grade channels furnished between RCA operating centers and the cities listed under Type A Service.

Initial 2,000 Channels:

470

Channels 2,000 to 5,000 Mastergroup-to-Mastergroup Connection:

300

Channels 2,000 to 5,000 Mastergroup-to-Supergroup Connection:

310

Channels 2,000 to 5,000 Supergroup-to-Supergroup Connection:

320

Honolulu Type C Service • fixed per-channel monthly charge, payable in advance, for multiple voice-grade channels furnished between the RCA operating center in Honolulu, HI and the cities listed under Type A Service.

Initial 2,000 Channels:

720

Channels 2,000 to 5,000 Mastergroup-to-Mastergroup Connection:

550

Channels 2,000 to 5,000 Mastergroup-to-Supergroup Connection:

560

Channels 2,000 to 5,000 Supergroup-to-Supergroup Connection:

570

INSTAL: installation charge associated with specific network service. MO: monthly charge associated with specific network service. Prices effective as of July 1, 1984; pricing current as of January 1985.

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Supergroup/Mastergroup Channel Interconnect Discounts

Type B Service Supergroup Interconnect Discounts • monthly discount on per-channel-end basis for interconnect on company's premises on supergroup basis.

1,000-Channel Minimum: $30 mo

2,000-Channel Minimum: 35

Type B Service Mastergroup Interconnect Discounts • monthly discount on per-channel-end basis for interconnect on company's premises on mastergroup basis.

1,000-Channel Minimum: 38

2,000-Channel Minimum: 45

Type C Service Supergroup Interconnect Discount • monthly discount on per-channel-end basis for interconnect on company's premises on supergroup basis of all channels or portion thereof.

2,000-Channel Minimum: 35

Type C Service Mastergroup Interconnect Discount • monthly discount on per-channel-end basis for interconnect on company's premises on mastergroup basis of all channels or portion thereof.

2,000-Channel Minimum: 45

Operating Center

Termination Charges • monthly termination charge for each leased voice-grade channel terminating at an RCA operating center • city-pair discount rates also apply in the case of leased channel termination: $25 mo

Alternate Use Charges • monthly charge per customer station when a leased voice-grade channel is arranged for alternate voice/data or voice/facsimile use: 20

Conditioning Charges • on request, conditioning will be furnished at the charges established by the common carrier(s) from which RCA orders such service.

Private Line Switched Service Access Charges

When RCA arranges to obtain facilities which connect customer's station to the switch located at RCA operating center, the charge to the customer will be the charge imposed by the common carrier(s) from which RCA has arranged to obtain channels.

Switch Termination Charges • monthly charge plus installation for each channel terminating into a switch located at an RCA operating center: $100 instal $60 mo

56 Plus Service • supports digital transmissions at 56K bps and above, between RCA operating centers or earth stations • full-duplex, point-to-point • available on a 7-day-per-week, 24-hour-per-day basis; minimum 1-year service; service automatically extended for additional 12-month term unless cancelled.

56K-bps Wideband Digital Data Access Charges Between Major RCA Operating Centers • monthly charge per 56K-bps channel between RCA operating centers within the contiguous United States • if required, RCA will provide, or will arrange with other common carriers, to provide requisite channel facilities connecting customer station with RCA operating center or earth station facility: 5,400

Local or Extended 56K-bps Channel Facilities • when RCA arranges to obtain local or extended channel facilities from RCA operating centers or earth station facilities to customer's station in connection with 56K-bps digital data service, charge to customer will be charges imposed by common carrier(s) from which RCA has arranged to obtain such channels.

☐ Access

Locations

RCA provides a leased channel connection service for various communities within the local distribution access areas of its operating centers. For service outside these areas, RCA will provide extension channel access to specified communities arranged via other common carriers (OCCs).

Local Distribution Access Areas

Atlanta Area • Atlanta, Austell, Chamblee, College Park, Decatur, Doraville, Douglasville, East Point, Fairburn, Forest Park, Hapeville, Lithonia, Marietta, Mountain View, Norcross, Pamola, Powder Springs, Roswell, Smyrna, Stone Mountain, Tucker, Union City, Woodstock.

Boston Area • Acton, Andover, Arlington, Bedford, Bellerica, Belmont, Beverly, Boston, Braintree, Brockton, Brookline, Burlington, Cambridge, Chelsea, Chelmsford, Cohasset, Concord, Danvers, Dedham, Framingham, Hingham, Hudson, Lawrence, Lexington, Lowell, Lynn, Marlborough, Maynard, Medford, Milton, Natick, Newtown, North Reading, Norwood, Peabody, Quincy, Randolph, Revere, Rockland, Salem, Sangus, South Boston, Staughton, Sudburg, Waltham, Waburn, Wakefield, Watertown, Wayland, Wellesley, Weymouth, Winchester.

Chicago Area • Addison, Arlington Heights, Bedford, Bellwood, Bensenville, Berwyn, Blue Island, Brookfield, Calumet City, Chicago, Chicago Heights, Chicago-Newcastle, Chicago-O'Hare, Cicero, Deerfield, Des Plaines, Downers Grove, Elk Grove, Elmhurst, Evanston, Forest, Franklin Park, Glencoe, Glen Ellyn, Glenview, Gurnie, Half Day, Harvey, Highland Park, Hinsdale, Hoffman Estates, Homewood, Itasca, La Grange, Lake Forest, Lansing, Lemont, Lombard, Long Grove, Maywood, Mokene, Naperville, Northbrook, North Chicago, Oak Brook, Oak Lawn, Oak Park, Orland, Palatine, Palos Park, Park Ridge, Riverdale, River Grove, Riverside, Rolling Meadow, Roselle, Schaumberg, Schiller Park, Skokie, Summit, Thornton, Tinley Park, Waukeegan, West Chicago, Western Springs, Wheaton, Wheeling, Willow Springs, Wilmette, Winfield, Winnetka.

Cleveland Area • Akron, Amherst, Aurora, Avon, Avon Lake, Bainbridge, Bedford, Berea, Brecksville, Burton, Chagrin Falls, Chardon, Chester Land, Columbia Station, East Claridon, Elyria, Gate Mills, Grafton, Hillcrest, Hinckley, Independence, Kirtland, Leroy, Lorain, Mentor, Montrose, Newbury, North Eaton, Northfield, North Royalton, Olmstead Falls, Painesville, Richfield, Russell, Strongsville, Terrace, Trinity, Twinsburg, Victory, Wickliffe, Willoughby.

Dallas/Fort Worth Area • Addison, Aledo, Arlington, Belair, Benbrook, Burleson, Carrollton, Cedar Hill, Crowley, Dallas, Dallas/Fort Worth, Danieldale, DeSoto, Duncanville, Eagle Mountain La., Edgecliff, Euless, Farmers Branch, Ft. Worth, Garland, Grand Prairie, Grapevine, Hasket, Hutchins, Irving, Kennedale, Lake Worth, Lancaster, Lawson, Lewisville, Mansfield, Midlothian, Mesquite, North Mesquite, North Richland Hills, Plano, Renner, Richardson, Roanoke, Rockwall, Rowlett, Rylie, Saginaw, Seagoville, Silver Creek, Sunnyvale, Waxahachie, Wedgewood, Westland, Wheatland, White Settlement.

Honolulu Area • All exchanges on Island of Oahu.

Houston Area • Airline, Aldine, Alief, Alvin, Apollo, Bammel, Barker, Blue Ridge, Buffalo, Channelview, Deer Park, Ellington, Friendswood, Humble-South Humble, Houston, Kinwood, Kingwood, Lake Houston, Langham Creek, La Porte, Manvel, Nassau Bay, Pearland, Richmond-Rosenberg, Satsuma, Seabrook, Sheldon, Spring, Stafford, Sugerland, Westfield, West Houston.

Los Angeles Area • Agoura, Alhambra, Anaheim, Arcadia, Beverly Hills, Brea, Buena Park, Burbank, Canoga Park, Carson, Chatsworth, City of Commerce, City of Industry, Compton, Costa Mesa, Covina, Culver City, Downey, El Monte, El Segundo, Encino, Fullerton, Gardena, Glendale, Hawthorne, Huntington

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Beach, Inglewood, Irvine, La Crescenta, La Mirada, La Palma, Lomita, Long Beach, Los Angeles, Malibu, Monrovia, Montebello, Newport Beach, North Hollywood, North Ridge, Norwalk, Orange, Pasadena, Redondo Beach, Reseda, San Fernando, San Gabriel, San Pedro, Santa Ana, Santa Monica, Sierra Madre, Signal Hills, Sunland-Tujunga, Sun Valley, Tolluca Lake, Torrance, Tustin, Van Nuys, West Los Angeles, Westchester, Whittier, Wilmington.

Miami Area • Coconut Grove, Coral Gables, Ft. Lauderdale, Hallandale, Hialeah, Hollywood, Kendall, Margate, Miami, North Bay Village, North Dade, North Miami Beach, Opa Locka, Perrine, Plantation, Pompano Beach, Tamarac.

New York Area • Bedford Hills, Bronx, Brooklyn, College Point, Garden City, Hicksville, Jericho, Lake Success, Long Island City, Manhattan, Nassau, New Rochelle, New York City, Queens, Staten Island, Westbury, Westchester.

Philadelphia Area • PA: Ambler, Ardmore, Bala Cynwyd, Berwyn, Bethayres, Bristol, Broomall, Bryn Mawr, Chester Springs, Churchville, Clifton Heights, Collegeville, Conshohocken, Darby, Eddington, Flourtown, Hatboro, Havertown, Jenkintown, King of Prussia, Langhorne, Levittown, Malvern, Media, Norristown, Paoli, Phoenixville, Philadelphia, Swarthmore, Trevose, Upper Darby, Valley Forge, Warrington, Wayne, West Chester, Willow Grove • NJ: Beaver Brook, Bellmawr, Burlington, Camden, Cherry Hill, Chester, Chester Heights, Collingswood, Florence, Gloucester, Haddonfield, Haddon Heights, Merchantville, Moorestown, Mount Laurel, Pennsauken, Pitman, Riverton, Swedesboro, Willingboro, Woodbury.

San Antonio Area • Austin, Buena Vista, Castroville, Devine, Elmendorf, Floresville, Fratt, Helotes, LaCoste, Lackland, Leon Springs, LaVernia, Lytle, Marion, New Braunfels, Poth, Pleasonton, Poteet, St. Hedwig, Seguin, Somerset, Stockdale, Sutherland Springs, Universal City.

San Francisco Area • Alameda, Albany, Alcatraz, Angel Island, Atherton, Baden, Benecia, Berkeley, Brisbane, Burlingame, Campbell, Colma, Concord, Corte Madera, Daly City, Danville, Dublin, East Bay, Emeryville, Fort Baker, Fort Mason, Fort McDowell, Fort Miley, Fort Scott, Hayward, Hillsborough, Kensington, Larkspur, Lomita Park, Los Altos, Menlo Park, Millbrae, Millbrae Highlands, Mountain View, Oakland, Palo Alto, Piedmont, Redwood City, Richmond, Rinole, San Bruno, San Carlos, San Francisco, San Jose, San Leandro, San Mateo, San Rafael, Sausalito, South San Francisco, Stanford, Sunnyvale, Tanforan, Treasure Island, Walnut Creek.

Seattle Area • Auburn, Bellevue, Black Diamond, Bothell, Bremerton, Brennon, Burien, Carnation, Cedar Falls, Chico, Clinton, Crosby, Duvall, Edmonds, Everett, Fall City, Halls Lake, Hartsten, Holly, Issaquah, Kent, Keyboard, Kingston, Kirkland, Lake Stevens, Lakewood Center, Langley, Long Branch, Lowell, Lynnwood, Marysville, Monroe, Mt. Lake Terrace, Mukilteo, Parkland, Port Gamble, Poulsbo, Preston, Puyallup, Ravensdale, Redmond, Renton, Seabeck, Seattle, Silverdale, Snohomish, Snoqualmie, South Point, South Whidbey, Steilacoom, Sumner, Tacoma, Winslow.

Washington, DC Area • MD: Berwyn, Bethesda, Bowie, Capitol Heights, Clinton, Glenndale, Hyattsville, Kensington, Layhill, Marlboro, Oxon Hill, Rockville, Silver Spring • VA: Alexandria, Daleview, Elmwood, Fairfax, Falls Church, McLean, Oxford, Vienna, and Washington DC.

Wilmington, DE Area • DE: Bear, Delaware City, Hockessin, Holly Oak, Newark, New Castle, Wilmington • PA: Avondale, Kennett Square, Landenberg, Mendenhall.

Extension Channel Access Areas

When RCA arranges to obtain extended voice channels to a customer premise which is not located in the local distribution area for Atlanta, GA, Boston, MA, New York, NY, Camden, NJ, Chicago, IL, Honolulu, HI, Houston, TX, Dallas, TX, Los Angeles, CA, San Francisco, CA, Seattle, WA, and Miami FL, the charge to the customer stations located in the cities listed below will be the charge imposed by the common carrier(s) from which RCA has arranged to obtain such channels. These charges will include all termination liabilities and all other charges imposed by the common carrier(s) from which the extension channels are leased.

Alabama • Huntsville.

Arkansas • Little Rock.

Arizona • Kingman, Phoenix, Scottsdale.

California • Bakersfield, Camarillo, Fresno, Garden Grove, Haywood, Hercules, Laguna Beach, La Jolla, Larkspur, Menlo Park, Milpitas, Ontario, Palm Springs, Pittsburgh, San Diego, San Jose, Santa Rosa, Upland.

Connecticut • Greenwich, Norwalk, Stamford.

Florida • West Palm Beach.

Georgia • Athens, Milledgeville.

Illinois • Effingham, Elgin, Fox Lake, North Aurora, Rockford, South Beloit.

Indiana • Indianapolis.

Iowa • Marshalltown.

Kansas • Lenexa.

Louisiana • New Orleans.

Maryland • Baltimore, Gaithersburg, Sparrows Point.

Massachusetts • Leominster, West Bridgewater.

Michigan • Detroit, Jackson, Kalamazoo, Midland.

Missouri • Kansas City, St. Louis.

New Jersey • Atlantic City, Bloomfield, Carlstadt, Cranford, East Rutherford, Edison, Elizabeth, Elmwood Park, Englewood Cliffs, Fairfield, Hancocks Bridge, Iselin, Lakewood, Mays Landing, Millville, Montvale, Moonachie, Newark, Parsippany, Passaic, Perth Amboy, Port Elizabeth, Princeton, Rahway, Rockleigh, Short Hills, South Brunswick, South Plainfield, Teterboro, Union City, Wayne, Weehawken, Wood Ridge.

New York • Elmsford, Hartsdale, Hauppauge, Kerhonkson, Melville, Roslyn, Spring Valley, Tarrytown, White Plains.

Oklahoma • Broken Arrow, Pryor, Tulsa.

Oregon • Portland.

Pennsylvania • Pittsburgh, Radnor, Rochester, Trexlertown, Williamsport, York.

Texas • Athens, Austin, Freeport, Garland, Lone Star, San Antonio.

Tennessee • Memphis.

Wisconsin • Appleton, Madison, Midland, Milwaukee, Oconomowoc.

☐ Other Services

Off-Shore & Remote Channel Services

Off-shore and remote channel services are furnished by RCA between its operating center in Houston, Texas and customer-provided facilities located on drilling rigs operating on the outer continental shelf adjacent to the contiguous United States or remote land locations. Services provide half-duplex voice-grade channels for transmission and reception of voice and/or data on a 7-day week, 24-hour day basis. Minimum period for which this service is available is 1 month.

Off-Shore:	$2,400 mo
Remote Channels:	3,000

Government Services

Specialized services for the United States Government include: video services for the American Forces Radio and Television Service and for NASA, wideband data networks for NASA, Department of Defense, and for the LANDSAT/TIROS programs,

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and voice networks for the General Services Administration and for the Voice of America.

Video/Audio Services

A rapidly growing network of receive-only earth stations, owned and operated by cable television systems, functions in conjunction with the RCA satellite service. An estimated 2,000 to 2,500 cable television systems receive from one to several channels of daily programming from pay TV, independent stations, news, sports, and religious broadcasters via RCA satellite.

• END

RCA Cylix
Satellite Communication Network Services

■ PROFILE

Function • value-added, medium-speed, satellite packet-switching network services.

Facilities • combination leased-line and satellite network consisting of RCA Cylix-owned remote sites connected via high-speed satellite links through a central switching site located in Memphis, TN • direct terrestrial connections between remote sites for medium-to-high volume usage.

Services • data/message nonvoice transmission • user terminal-access speeds of 4800 or 9600 bps; host access to 9600 bps • protocol conversion • end-to-end network management services.

Access • users connect to remote sites using multipoint or point-to-point dedicated leased lines • direct lines to remote station can be installed where user is located near that remote station • 35 remote earth stations currently located nationwide.

First Available • terrestrial network in 1976; satellite network in 1981.

Number of Users • 228 contracted customers; 3180 drops.

Comparable Services • Tymnet and Telenet value-added, packet-switched services for lower speed users; SBS network services for data-private networks; private leased-line networks.

Vendor • RCA Cylix Communications Network; 800 Ridge Lake Boulevard, Memphis, TN 38119 • 901-761-1177.

Canada • RCA Cylix Communications Network; 1631 N.W. Professional Plaza, Suite 203, Columbus, OH 43220 • 614-454-3523.

RCA Cylix Network Minimum Usage Costs

Configuration • 1 remote terminal communicating with user host computer; traffic volume totaling 1 million characters.

Minimum Start-Up Costs • $1,425 total • consists of $425 for 1-time remote terminal installation charge ($425 per remote location), and $1,000 for 1-time host installation charge.

Minimum Monthly Operating Costs • $1,765 total • consists of $450 for terminal access charge ($450 per remote location); $1,300 for host access charge; and $15 for traffic charge.

■ ANALYSIS

RCA Cylix is an un-regulated data network designed for transaction-oriented processing, and is also the **only** packet-switching satellite network serving users **throughout** the continental United States. Network connections are primarily terminal-to-host, supporting medium-speed data transmission at 4800 or 9600 bps. Although the vendor cannot guarantee typical response times for the Cylix network, some users report excellent figures; response times are a function of user application, time-of-day, and other factors.

Originally, RCA Cylix was a private network developed by Data Communications Corporation (DCC) in 1971, that consisted of approximately 65,000 miles of leased lines. After the FCC's Resale and Shared Use decision in 1976, which allowed companies to share private networks to reduce communication costs, RCA Cylix became a separate entity offering network services to the general business community. In 1979, the RCA Cylix network began to upgrade from a totally terrestrial network to include satellite transmission facilities. This strategy was implemented to offset the high cost of leased lines to expand network capacity. Transponder facility is leased on RCA Americom's Satcom satellite with backup provisions on another Satcom satellite. As transponder requirements increase, Cylix will be able to increase transponder space on both satellites.

On August 9, 1982, the Board of Directors of RCA Corporation approved the acquisition of Cylix Communications Network, Inc by RCA Communications Inc, a wholly owned subsidiary of RCA. This acquisition was approved by the FCC, and on October 1, 1982, the company became RCA Cylix Communications Network, Inc. The network allows RCA to offer value-added data transmission services to its already extensive satellite communication facilities. The value-added RCA Cylix Communications Network is an alternative for businesses confronted with the high cost alternative of building and maintaining a private network.

☐ Strengths

The RCA Cylix network is designed to provide cost-effective, reliable, medium-speed data transmission services over dedicated lines by employing satellite communication techniques for internode connection. RCA Cylix provides a solution to business with locations in diverse geographical areas. Another plus for the use of satellite connections is that high transmission speeds are attainable with low error rates. Over satellite links, Cylix transmits data as error-free as the state of the art makes technically possible.

A major advantage of the RCA Cylix service is the high emphasis placed on supplying full-time reliable end-to-end service. This service is achieved by employing a well trained staff of specialists and utilizing sophisticated network equipment. The Network Control staff of RCA Cylix (which operates 24 hours a day, 7 days a week at the central control site) provides diagnostics for each of the network's critical components and manages all network facilities. Each network component from the Very Smart Modem (VSM), a diagnostic modem, located at the customer site to the facilities of central control is designed to provide uninterruptable service. The VSM uses a sideband channel that constantly monitors the associated multipoint or point-to-point local loop, allowing immediate isolation of circuit and connection problems while not interfering with concurrent data transmission. Each remote earth site contains uninterruptable power systems, duplicated communication equipment, and 2 antennas. One of these antennas points at a backup satellite. The RCA Cylix central site also contains duplicates of all critical components, including the Network Control System which gathers usage statistics from each network component while monitoring the status of network equipment and communication lines.

Other advantages for Cylix users include distance-insensitive pricing and an almost unique support for the Burroughs Poll/Select protocol. Since the network is not publicly accessible like other packet-switched networks, it is immune to "hackers" and most other would-be saboteurs. For IBM BSC users, Cylix simulates BSC control signals at the modem ends—called **channel spoofing**—so users do not experience unusual delays over the satellite link. The vendor also installs all access lines, modems, and other equipment, relieving the user of this burden.

All of these state-of-the-art features add up to a reliable and user-oriented service that represents an economical alternative to private networking. RCA Cylix also offers a free network cost

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analysis for helping clients evaluate future or existing network expenses.

☐ Limitations

Although the RCA Cylix network employs satellite communication techniques, there are several advantages of other satellite communication facilities that are not available due to the characteristics of the RCA Cylix network. The fact that Cylix users do not have antennae on the premises means that the very high bandwidths or bit rates that are possible with satellite communication are not available to them.

Cylix currently does not offer any data encryption options. If data security is a critical issue, the user is encouraged to perform his own data encryption prior to presentation to the network.

Cylix is not publicly accessible for dial-up equipment, meaning all user devices must be hard-wired to the network—a disadvantage for some users. Because of qualities inherent to packet switching, RCA Cylix cannot be used for voice or video traffic either.

Furthermore, the medium-volume service provided by Cylix is most suited to transaction-processing environments. Users with high-volume transmission requirements, such as might be encountered in remote batch environments, could incur excessive traffic charges. Therefore, this type of user should make a thorough analysis to determine if RCA Cylix is cost effective for the number, frequency, and size of messages transmitted.

■ NETWORK

☐ Terms & Conditions

Billing Criteria • customers pay for RCA Cylix services based on factors associated with the number of drops they have on the network, the number of characters transmitted each month, and the flow rate characteristics of the lines • there are no charges for mileage for any RCA Cylix services • for host-to-remote connections, a flat fee per month according to line speed is charged • for host-to-host connections, a flat fee is charged for line speed and basic character limit plus a surcharge for each 1-million character increment over basic allowable limits • access lines, modems, and station termination are included within RCA Cylix fees.

Billing Conditions • minimum 1-month service • 30-day advanced notice required for termination • RCA Cylix can amend its price schedule on 30-day written notice • access to local leased lines arranged by RCA Cylix • no high-usage discounts available • discounts available for volume usage for night/weekend usage.

☐ Overview

The RCA Cylix network operates as a hierarchial star network using a combination of leased and satellite facilities to provide end-to-end network management services. Basically, a permanent virtual circuit between the user terminal and the user host computer is implemented. Leased telephone lines, providing multipoint connection for terminals and point-to-point connection for hosts, are used to access the nearest remote earth station from a user site. Service over leased lines is available at 4800 bps or 9600 bps. Once a message at a network node arrives from a user terminal, it may proceed over 1 of 2 paths. If the message is intended for a host processor attached to a remote node, then a line concentrator combines the message with others to create a 56K-bps data stream which is directed to the satellite.

After the message is broadcasted from the satellite, it is received at the central site in Memphis where line controllers route each message back over the satellite link to the remote node nearest the final destination. From there the message travels over leased lines to the user's site for the host computer to process. The majority of traffic travels over a satellite communication link which uses single-channel-per-carrier (SCPC) multiple access to provide more than 260 56K-bps digital paths.

Data integrity and reliability are accomplished through full redundancy and comprehensive online monitoring of all equipment. Each Cylix remote site consists of a communication processing node and its associated satellite communication equipment. This equipment includes two 4.6-meter earth station antennas, 8- and 16-bit microprocessors that perform line monitoring and traffic coordination, an uninterruptable power system, and ambient controls. The Cylix central site is an underground structure protected against virtually any natural disaster. This facility maintains complex backup power systems and duplicate controls for critical heating, ventilation, and air conditioning. Dual 10-meter antennas provide satellite connection to remote sites, and a third antenna is available for emergencies. An array of switching computers, interconnected through high-speed data channels, route the incoming messages via the satellite to their intended destination. Also located at the central facility is a Network Control System that provides communication, control, and monitoring to the rest of the network. This computer appears as another remote node to the switching systems, and is also fully duplicated for use in case of equipment failure. As with any quality network service, RCA Cylix employs advanced diagnostic facilities to insure fast fault isolation and quick recovery from the faults.

A key feature of the network is the Very Smart Modem (VSM) also referred to as diagnostic modem. The VSM provides asynchronous diagnostics and protocol conversion.

Currently, Cylix is one of the few major network vendors offering IBM 3270 SDLC support. Other protocols supported include 3270 binary synchronous, Burroughs Poll/Select CCITT X.25, and an internal proprietary protocol for handling mini-based systems.

☐ Traffic Charges

RCA Cylix traffic charges are based on the total monthly volume of data, in increments of one million characters, transmitted to and from all remote user terminals to the host computer. Character charges do not include retransmission or network control characters, and are subject to 2 different rates depending on time of day and day of week. The prime interval is defined as 6:00 AM to 8:00 PM Central Standard Time, Monday through Friday; other periods are in the nonprime interval. Fractions of one million characters are charged at fractions of the monthly traffic charge.

Prime Interval • charge per month per million characters:

$15 M char

Nonprime Interval • charge per month per million characters:

7.5

☐ Access Charges

RCA Cylix charges monthly access fees for both host computer connections and remote customer locations (drops) on the network. The host access charge includes a 9600-bps leased line to an earth station, modem, and station termination. The remote terminal access charge includes a 9600-bps leased line (users can transmit at 4800 bps), modem(s), and station termination, and is based on the number of customer locations. A Cylix remote location is a drop with a single station termination and modem. A one-time installation charge also applies for both host and remote locations.

Host Service • installation plus monthly charge:

$1,000 instal	$1,300 mo

Remote Terminal Service • charge per remote terminal location with discounts for number of locations over 9 and over 49 • a remote terminal location can be comprised of a communication controller with more than one attached terminal; users only pay an ID charge per each discrete terminal.

1 to 9 Installed Terminal Locations • installation plus monthly charge per remote location:

425	450

INSTAL: installation charge associated with specific network service. M CHAR: charge per million characters transmitted. MO: monthly charge associated with specific network service. NA: not applicable/not available. Prices current as of March 1985.

RCA Cylix
Satellite Communication Network Services

10 to 49 Installed Terminal Locations • installation plus monthly charge per remote location:

425	425

50+ Installed Terminal Locations • installation plus monthly charge per remote location:

425	370

☐ Optional Network Service Features/Miscellaneous Charges

Spare VSM Modem • installation plus monthly access charge:

NA instal	$120 mo

Diverse Host Routing • customers with 2 or more hosts at one location can route their access lines to different Cylix nodes, in the event of node failure • installation charge quoted only; monthly access charge quoted by the vendor on request:

1,000	NA

Dial-Backup • charge to provide dial-backup to the Cylix earth station in case of leased-line failure for host and remote locations • installation plus monthly charge.

Host Location:

325	200

Remote Location:

250	60

Remote Terminal Relocation • charge to move user terminals, either within the same premises or outside the premises of original location.

Inside Relocation • installation charge only:

265	NA

Outside Relocation • installation charge only:

425	NA

☐ Access

Locations

There are currently 36 RCA Cylix earth stations that are accessed by user terminals via multipoint leased lines or by user host computers via point-to-point lines. There are no distance limitations or qualifications between customer sites and earth stations. The earth stations, also known as remote stations, are located as follows:

Alabama • Birmingham.
Arizona • Phoenix.
California • San Diego; San Francisco; Los Angeles.
Connecticut • Hartford.
Florida • Orlando; Miami.
Georgia • Atlanta.
Illinois • Chicago.
Indiana • Indianapolis.
Maryland • Germantown.
Massachusetts • Boston.
Michigan • Detroit.
Minnesota • Minneapolis.
Missouri • Kansas City; St. Louis.
Nebraska • Omaha.
New Jersey • Piscataway.
New York • Albany; Buffalo; New York City.
North Carolina • Winston-Salem.
Ohio • Cincinnati; Cleveland.
Oklahoma • Oklahoma City.
Pennsylvania • Philadelphia; Pittsburgh.
South Carolina • Columbia.
Tennessee • Memphis; Nashville.
Texas • Dallas; Houston; San Antonio.
Washington • Seattle.
Wisconsin • Milwaukee.

• END

Ricoh Facsimile Terminals
Transceiver Models R-120, R-3300 & R-5000

■ PROFILE

Function • high-performance digital transceivers; 2 models suitable for half-tone transmission.

Type • tabletop units; R-120 is portable.

CCITT Compatibility • Groups 1, 2, and 3 standard on R-120; Group 3 standard on R-3300 and R-5000; Groups 1 and 2 optional on R-3300; Group 2 optional on R-5000.

Maximum Scanning Width • 8.5 inches on R-120 and R-3300; 11 inches on R-5000.

Feeder • auto-feed, 30-document capacity on R-120 and R-5000; 50 documents on R-3300.

Image Resolution • 200x100 lpi standard; 200x200 lpi fine on all models.

Half-Tone Support • 8 shades of gray on R-120; 4 shades on R-3300; none on R-5000.

Communications • dedicated line or DDD; transmit/receive speeds to 9600 bps • 9600/7200/4800/2400-bps integral modem on R-5000 and R-120; 4800-/2400-bps integral modem on R-3300 • all modems auto-fallback with DAA • 9600/7200 bps optional on R-3300.

First Delivery • 1982 (R-3300), 1983 (R-5000), 1984 (R-120).

Units Installed • not available.

Comparable Systems • competitive with all like general-purpose Group 2 and 3 transceivers, especially Burroughs dex family, Mitsubishi FA 585, EMT 2000/2200/9136/9140/9160/9600, Pitney Bowes 8900, NEC 1, 2, 3, Panafax UF family, and Teleautograph Omnifax series.

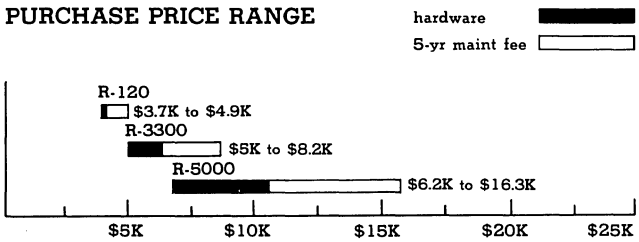
Vendor • Ricoh Corporation; 5 Dedrick Place, West Caldwell, NJ 07006 • 201-882-2000.

Distribution • marketed by Ricoh both nationally and internationally • in Canada by Rapifax of Canada, Ltd, Ottawa.

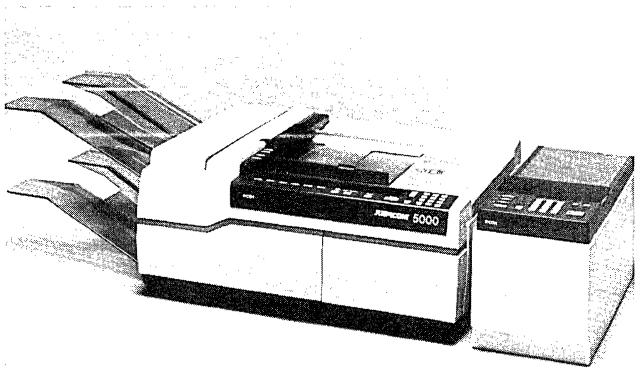
■ ANALYSIS

Ricoh (nee Rapicom) has long enjoyed the position of being an industry innovator, as well as one of the leading suppliers. It was among the first vendors to offer CCITT compatibility, eliminating the terminal incompatibility problem that showed the overall utility of facsimile as a medium for transferring documents between companies; it was also one of the few companies to provide half-tone transmission facilities for ordinary office

PURCHASE PRICE RANGE



RICOH FACSIMILE TERMINALS PURCHASE PRICING bar graph covers range between individual family members • hardware costs denoted by solid bar; associated 5-year maintenance by open bar • **R-120** offers no options • **R-3300** is basic unit plus CCITT Group 1 and 2 compatibility • **R-5000** is basic unit plus SAF-PAK and CCITT Group 2 compatibility.



equipment; with the introduction of the R-5000 with SAF-PAK, it was the first vendor to offer a tabletop transceiver with local document storage and forwarding.

Within the past 4 years, however, Ricoh's position has been erased by aggressive organizations like Burroughs, NEC, Panafax, Pitney Bowes, and Teleautograph. These companies are now offering gear quite similar to Ricoh's line, and a few have even better capabilities. Products from all of the aforementioned (except Pitney Bowes), for example, incorporate a dynamic scan-rate facility that automatically adjusts the scanner from standard to fine, and the converse to adjust to the print size of the scanned document. As mentioned under Strengths, this can significantly improve the overall document transmission time.

The Ricoh product line has been trimmed from 14 modules to 3 high-performance transceivers. All are CCITT Group 3 compatible and employ modified Huffman encoding to further improve data transmission efficiency. Groups 1 and 2 compatibility are also available to accommodate analog facsimile transceivers.

Cutting the product line to 3 has in no way injured Ricoh's competitive position. The products are nicely positioned in performance and price, and offer most of the facsimile facilities users need in the low-, middle-, and high-price ranges.

Its latest product, the R-120, is a low-cost portable unit with capabilities matching the most expensive floor models. For example, it is Group 1, 2, and 3 compatible; has a 30-document auto-feeder; handles half-tone with 8 shades of gray; has a 200x200/100-lpi scan resolution; and has a built-in 9600-bps stepdown modem. Priced at $3,750, it's an amazing buy.

The R-3300 is a 2-year old product targeted at the middle range of price/performance. While its capabilities are impressive, they are actually no better (and in some cases inferior) to the R-120. For example, the R-3300 does not support half-tone transmission, Groups 1 and 2 compatibility are optional, and its built-in modem is a 4800-/2400-bps unit. The R-3300, however, does have a document auto-reduction facility indirectly. Type B (10.1-inch) documents are reduced to Type A (8.5 inches). Whether that facility is strong enough or popular enough to justify a $2,250 price difference ($6,000 versus $3,750) for comparably equipped units remains to be seen.

The R-5000 at the top-of-the-line, is a very sophisticated unit. In fact, it was the "product to beat" in this marketplace as little as a

Ricoh Facsimile Terminals
Transceiver Models R-120, R-3300 & R-5000

year ago. As mentioned under Limitations, it has been surpassed at least as far as store-and-forward document handling is concerned. The basic R-5000 package features an auto-dialer, which stores up to 100 16-digit telephone numbers, a polling capability that can be programmed for immediate or deferred delivery of documents (plus it functions in an immediate turnaround mode), both modified Huffman and modified READ compression, and both reduction and enlargement of input documents.

The SAF-PAK options add local page storage to the R-5000. With SAF-PAK, the contents of up to 30 8.5x11-inch pages can be retained in memory and delivered to 100 locations in the network. SAF-PAK also provides a store-and-forward facility, whereby pages from remote R-5000 transceivers without SAF-PAKs can be stored at location with this option, and later routed to 10 other R-5000 transceivers.

SAF-PAK is a viable alternative for those who cannot or do not want to employ a host computer for page storage and routing. But for those that do, Ricoh offers Intelligent I, an option to its R-3300, which routes messages through a host computer. This enhancement is apparently Ricoh's response to IBM's new Scanmaster Model 8815 (see report 950-I048-8815), which permits that facsimile transceiver to be used for document store-and-forward applications. IBM's approach, however, allows multiple-destination addresses to be transmitted at one time; only 1 address is permitted by Intelligent I. This enhancement also provides an RS-232C communication port, which handles asynchronnous and synchronous transmission. Connection to a statistical multiplexer is also permitted. Through Firmware, Intelligent I also allows the facsimile transceiver to appear to be a computer peripheral, and also allows it to receive printer-type data. Thus, it is possible to use R-3300 to receive stored data which normally would require a separate printer to reproduce.

In our analysis of the R-5000 SAF-PAK limitations, we note factors which might make the product unattractive to some users for store-and-forward document handling applications. Please keep in mind that the points discussed will more than likely be relevant to those organizations with sophisticated page storage and routing applications. Also keep in mind that the R-5000 has proven to be a very popular product, and that users are quite satisfied with it as well as with the vendor.

☐ Strengths

The principal strengths of Ricoh's products are scan resolution, document handling, and CCITT compatibility. Options such as auto-dial, polling, and reporting are also extremely attractive to users that benefit from these features. But the principal strengths of the Ricoh family are augmented by the **SAF-PAK** and **Intelligent I** options, which considerably benefit Ricoh users with a need for document distribution.

SAF-PAK, as mentioned, stores up to 30 documents locally, and routes them to 100 different transceivers. This distribution feature, which does not require the use of a computer, is unique, and a real benefit to small users, because it eliminates the time and expense associated with manual distribution. SAF-PAK's store-and-forward facility allows the small user to enjoy large-system facilities.

SAF-PAK stores documents in compressed format, with white space removed and redundant character compressed. Thus the actual document storage capacity is not simply 30 pages, but the equivalent space needed to hold 30 (or optionally 60) compressed pages.

Overall, the new R-5000 is an extremely attractive tabletop transceiver. Auto-reduction/-enlargement, modified Huffman and modified READ, and integral 100 phone number auto-dialer are features one would expect to find on larger, more expensive transceivers.

The Intelligent I option, discussed in detail within this report, is a valuable and flexible piece of firmware/hardware. The unit allows Ricoh's low-priced R-3300 transceiver to be used in sophisticated environments where interaction with a host processor is desirable, and furnishes modified asynchronous, HDLC, and IBM BSC 2780/3780 protocols. Thus, the transceivers can interface with a multiplicity of mainframes. The transceiver-host interface is supported by Ricoh's Fax Device Handler software, relieving the user of the need to develop his own program.

The ability to poll and be polled is another strength. With the R-3300 and R-120, users can transmit documents to like terminals and them immediately poll them for documents to be transmitted. This saves an additional telephone call, and reduces the handshaking time needed to establish terminal connections.

☐ Limitations

The major limitations of the Ricoh line are its lack of automatic-scan-resolution adjustment and the way it assembles pages in its store-and-forward SAF-PAK document-handling option. There are also some problems with the way the SAF-PAK manages the RAM employed for storing pages.

According to SAF-PAK specifications, documents can be sent to 100 different locations. While this is certainly impressive, the disadvantage is that all locations receive all pages in storage. This undoubtedly leads to unnecessary transmission of pages, since every location won't be interested in everything sent, and it can use up RAM in the receiving SAF-PAK.

Ricoh alleviates this situation somewhat by segmenting RAM, allowing users to establish up to 10 destination groups, assign specific pages to each destination group. Each group is assigned a telephone number which is auto-dialed to transmit the pages. This method is adequate provided there is sufficient storage to retain the pages. SAF-PAK can accommodate 30 compressed pages as standard, with 30 more optional. Given the almost certainty that some pages will have to be stored redundantly if they are members of different destination groups, even 60 pages may not be enough.

There are 2 ways around this problem. First, increase the storage capacity by using either more RAM or by going to auxiliary devices like a Winchester disk (Pitney Bowes, Panafax, and NEC do). Second, develop a scheme whereby stored pages are indexed and can be selectively retrieved for placement into groups for transmission. In fairness to Ricoh, this technique is not currently available from any of its competitors. However, such a facility would be invaluable to large users with extensive facsimile applications who does not want to employ an expansion system like IBM's Scanmaster to do the job.

The RAM management scheme itself has a serious drawback; it cannot anticipate and warn the user that its storage limits are being approached. Thus, entered documents have no guarantee that sufficient space will be available to hold them. When the RAM limit is reached, the system informs the user and erases the last entered page if it is incomplete.

The SAF-PAK option cannot receive and store pages from remote R-120 and R-3300 for forwarding to other facsimile under R-5000 control. Pages can be sent to the R-5000's SAF-PAK, but only for its immediate (onsite) users.

The method that Ricoh uses to back up RAM in the event of a power failure is not totally failsafe. In place of batteries, Ricoh employs an external universal power source which supplies enough power to retain RAM contents for 1 hour. After that, the contents are lost, but a printout is generated, specifying that messages for destination addresses have been lost. The pages themselves are **not** copied. While the universal power source should be sufficient where power is restored within an hour, it is not adequate for extensive power outages; therefore, batteries would be a considerably **better** choice.

We asked Ricoh why RAM was chosen over diskette or disk storage, given the aforementioned limitations and potential problems. Ricoh stated that the principal reason for using RAM was reliability. Its RAM board has a proported 4-year MTBF, and requires no maintenance and/or adjustments as a disk requires. Good point! We wonder, however, how many users would rather have sophisticated facilities to meet their needs at the cost of minimal disk periodic maintenance.

The final limitation of the Ricoh family is its lack of an automatic-scan-resolution adjustment. Under the current scheme of operation, the user sets the resolution to accommodate the **overall quality** of the document. Since fine scans take longer to

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accomplish and transmit, users might be tempted to compromise, thus producing an output of varying quality. An auto-scan adjustment would eliminate the need to compromise the resolution quality. Until recently, auto-scan adjustment was **not available on any** transceiver. It is now offered on the Burroughs dex 6300, NEC Model 2, and Teleautograph Omnifax 99.

■ HARDWARE

☐ Terms & Support

Terms • all Ricoh terminals and accessories are available for purchase, or under 1-year or 3-year lease; 1-year and 3-year leases are identical in terms and include maintenance • all terminals/accessories are also offered on a 90-day trial basis • a trade-in plan is also available.

Support o the vendor supports its product line through local offices • maintenance is bundled into the rental or leased units, and priced separately for purchased items.

☐ Overview

The Ricoh product line consists of 3 transceivers, all of which are CCITT Group 2 and 3 compatible. In addition, the newly announced R-120 is also compatible with CCITT Group 1 machines operating with North American 6-minute FM standards. The Ricoh units, consisting of the R-120, R-3300, and R-5000, all feature automatic document feeders; employ a 200x100/200-lpi scan; have built-in modems with DAAs for connection to the DDD; and can be polled. The R-120 and R-5000 also support half-tone transmissions, and the R-5000 can be used for store and forward document transmission via an option called SAF-PAK.

The entire family operates over dedicated lines or the commercial dial network. Each terminal also contains an integral modem and DAA. Top transmission speed is 9600 bps (19.2K bps with Intelligent I option), and standard Group 3 data compression is employed. Terminal polling is supported by all.

The R-120, introduced July 1984, is an extremely powerful portable unit. (It weighs about 30 pounds, so portability may be a matter of interpretation.) Features include a 30-document auto-feeder, half-tone transmission with 8 shades of gray, auto-polling/auto-dial, turnaround polling, confidential transmission via a 4-digit protect code, transmit/remote terminal identification, error detection, and the aforementioned scan image resolution and CCITT compatibility. The error-detection facilities identify abnormal conditions such as phone failures or remote machine malfunctions, and indicates them via an LED panel display, Transaction Conformation Report, and an error report.

The Transaction Conformation Report is available on a demand basis or is automatically generated after completion of 35 transactions. The report contains vital control information on each transmitted and received batch, which includes date and time of completed transaction, the transmitting and receiving terminal's address or ID, notification of transmission failure, and total number of documents sent. A separate error report is printed if an error occurs during transmission, and shows the page number where the failure occurred. Another report, called Transmit Terminal Identification, logs the time, date, transmitting terminal location, and page number on each page received.

Secure polling employs a preprogrammed 4-digit code and is used to poll (request) documents from a similarly coded remote location. Documents placed in the R-120's auto-feeder can be polled and transmitted to an authorized facsimile unit. Turnaround polling allows the polled R-120 to immediately request documents targeted for it, thus minimizing line charges and obviating the need to place a second call.

The R-3300's facilities are quite similar to those of the R-120. It also has a 30-document auto-feed mechanism, although a 50-document feeder can be ordered. The scan image resolution is the same, and it can be fitted with Group 1 and 2 compatibility options. Data transmission speeds are 4800/2400 bps via a built-in modem with DAA. The unit also has auto-answer/disconnect and auto-polling, with auto-dialer option. The R-3300 supports the same transmit and remote terminal identification facilities as the R-120. The R-3300 differs in 2 important ways: first, it provides an auto-reduction whereby Type B documents are reduced to Type A size; and second, it can accommodate the Intelligent I option to allow direct communication with hosts operating under asynchronous, synchronous, BSC, and HDLC protocols.

The Intelligent I provides EIA RS-232C/V.24 and RS-449 ports, which permit a transceiver to connect to a communication network either directly or through a statistical multiplexer. Data transmission in both compressed and uncompressed form conforms to CCITT Group 3 standards. Data encryption is also furnished.

Ricoh provides a number of firmware options that allow Intelligent I-equipped transceivers to intercommunicate using modified HDLC and asynchronous protocols. In addition, options allow either transceiver to connect to a DEC PDP-11 running under the RSX-11M operating system, and appear to be a facsimile/computer peripheral. Communication via BSC 2780/3780 protocols is optional for IBM users. Ricoh provides its Fax Device Handler package to interface a transceiver with a host processor. This software resides at the host end, and supports receiving and transmitting facsimile data in local and remote environments, plus communication supervisory interface and data management.

Intelligent I's message or document routing, is handled by entering the destination address, message header, etc, via the keypad. Alphanumeric values of 0 through 9 and A through F are entered, as well as hexadecimal values for additional character representations. Intelligent I is menu-driven with data displayed on an 80-character liquid crystal display. All entered data can be stored locally, eliminating rekeying data. When used in conjunction with a host processor's data storage and retrieval facilities, the routing data can be used for store-and-forward applications.

A somewhat "different" service provided by Intelligent I supports the reception of ASCII- and EBCDIC-character coded file data for facsimile printer applications. The system permits simulated printer vertical format control, carriage control, and print font selection. The fonts can be selected from the menu or from the host computer using a task command.

The R-5000 is the more powerful of the trio, and the more expensive. The unit has everything the R-3300 has, plus modified Huffman and modified READ data compression, a 100 16-digit auto-dial unit, and a document store-and-forward facility called SAF-PAK.

SAF-PAK consists of a box that attaches to the R-5000 with enough random access memory (RAM) to store the equivalent of 30 8.5x11-inch paper, with an optional additional 30-page equivalent. The SAF-PAK option allows an R-5000 to send all pages stored to 100 other locations within the network, or pages can be stored in groups and sent to designated locations identified by telephone numbers. Some 40 different telephone numbers divided among 10 group lists that are accessed by a 3-digit code are provided. If the receiving R-5000 is also equipped with a SAF-PAK, received documents can be stored in memory for later retrieval. Confidential documents retained in memory are not released until the proper 4-digit code is entered to guard against unauthorized access. Multiple copies of a stored does designation instructions to SAF-PAK. Up to 10 destination stations can be addressed.

SAF-PAK generates a number of useful reports, including: memory list, transmission report, transmission failure list, power failure report, transfer station report, transfer station report local, file change report, transmission waiting file list, and group list. The file change report pertains to data stored in memory for send-later or poll transmission that has been changed.

The R-5000 without SAF-PAK provides a number of document transmission services and system reports. For example, with the Transmit Terminal Identification Page Count facility, the unit can be programmed to indicate the total number of pages in batch, and then imprint the page number of each received document. Transmit and receive counters display and print out the receive-transmit identification character for each document received or transmitted. Reports generated include: transaction conformation report, diagnostic report, error report, transfer

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request report, and shorthand number list.

R-120 Digital Transceiver

Tabletop unit measuring 16.7 (W) x 11.7 (D) x 5.4 (H) inches; 30 lbs • input document: 6 to 10.1 x 4.1 to 23.4 inches; auto-feed 30-document capacity • output document roll-fed, 8.5 inches x length of original • flat-bed, CCD scanning • switch-selectable, 200x100-/200-lpi resolution • transmission speed 8.5x11-inch document at 4800/9600 bps, respectively: 32/20 seconds at 200x100 lpi; 51/34 seconds at 200/200 lpi • no reduction/enlargement • 8.5-inch maximum scanning width • electrothermal recorder/paper; 328-foot roll • Group 3 data compression • CCITT Group 1, 2, 3 compatibility standard; Group 1 6-minute FM • 8 shades of gray half-tone support • integral 9600/7200/4800/2400-bps auto-fallback modem with DAA • auto-answer/disconnect • auto-dialer; auto-polling • transmit and remote terminal identification; transaction confirmation report • voice coordination:

$140/$125 mo	$3,750 prch	$17 maint

Model R-3300 Digital Transceiver

Tabletop unit measuring 18.1x15.8x9.8 inches; 60 lbs • input document: 4.3 to 8.5x4.7 to 21.7 inches; auto-feed 30-document capacity • output document: roll-fed 8.5 inches x length of original; 328-foot roll • flat-bed, CCD scanning • switch-selectable, 200x100-/200-lpi resolution • transmission speed 8.5x11-inch document at 4800/9600 bps, respectively: 45/30 seconds at 200x100 lpi; 90/50 seconds at 200x200 lpi • auto-reduction Type B (10.1-inch) to Type A (8.5-inch) documents • 8.5-inch maximum scanning width • electrothermal recorder/paper • CCITT Group 3 compatibility standard; Group 2 optional • Group 3 data compression • no half-tone support • integral 4800-/2400-bps auto-fallback modem with DAA; auto-answer/disconnect • auto-dialer optional; auto-polling • transmit and remote terminal identification • voice coordination; transmit confirmation report:

$187/$184 mo	$5,000 prch	$31 maint

CCITT Group 1 & 2 Compatibility • supports communication with analog facsimile terminals conforming to CCITT Group 1 (FM analog transmit/record speeds of 6 minutes per page standard and 4 minutes optional); CCITT Group 2 (AM analog transmit/record speed of 3 minutes per page):

30/30	1,000	6

Model R-5000 Digital Transceiver

Tabletop unit measuring 7.25 (W) x 18.1 (D) x 8.8 (H) inches; 17.6 lbs • input document: 7.2- to 11.7x3.5 x 47.2-inch manual feed; up to 30 pages measuring 7.2- to 11.7x5.04 to 14.3-inch auto-feed • output document: roll-fed 8.5 inches x length of original • document reduction/enlargement; reduces to 8.5 inches wide; enlarges 2 times original • switch-selectable, 200x120-/200-lpi resolution • flat-bed CCD scanning • transmission at 9600 bps for 8.5x11-inch document is 15 seconds at 200x100 lpi and 28 seconds at 200x200 lpi • 11-inch maximum scanning width • electrothermal recorder/paper; 328-foot roll • modified Huffman, modified READ, and high-speed Data Constructor/Reconstructor (Rapafax proprietary) data compression; CCITT Group 3 compatibility; Group 2 optional • contrast control to select between dark, normal, and light original documents • 4 shades of gray, half-tone support • integral 9600/7200/4800/2400-bps auto-fallback modem; auto-answer/-disconnect; auto-dialer/-redialer with 100 16-digit numbers • transmit terminal identification; transmit/receive counter • control reports • poll immediate/later/turnaround:

$225/$205 mo	$6,200 prch	$77 maint

SAF-PAK • provides storage for 30 8.5x11-inch pages standard; up to 60 pages optional • sequentially broadcasts memory-stored pages up to 100 separate locations • produces network utilization and management reports:

NA/120	4,550	NA

MO: 1-year/3-year monthly lease charge including maintenance. PRCH: purchase price. MAINT: monthly maintenance fee for purchased units. NA: not available/applicable. Prices are single-quantity purchase, effective as of November 1984.

☐ Communications

All terminals operate over the dial network (DDD) or dedicated lines at speeds up to 9600 bps. All terminals are equipped with integral modems and auto-answer/-disconnect facilities. Auto-dialing is standard on R-5000 and R-120; optional on R-3300.

An EIA RS-232C interface provides connection to an external modem for use at lower data rates over the DDD network. A DAA equivalent to AT&T Models 1001B or 1000D is also provided and required for connecting an uncertified modem to the DDD network.

Polling is permitted on all models. Polling can be simple or turnaround on all models, plus deferred on Model R-5000. The latter transceiver can poll up to 100 terminals via its auto-dial facilities, and can receive, store, and transmit up to 30 pages to 10 target terminals through the SAF-PAK option. Polling is supported only under Group 3 operation.

The Intelligent I option offered with the R-3300 transceivers provides an EIA RS-232C/CCITT V.24 port which handles synchronous data rates to 80K bps with external clocking and 19.2K bps with internal clocking. Asynchronous data rates up to 19.2K bps are also supported via RS-232 interface and up to 56K bps via an RS-449 interface. Protocols supported include modified asynchronous, HDLC, and BSC. An application package is offered to those with DEC PDP-11 systems running under RSX-11M operating systems who want to use Intelligent I as a facsimile computer peripheral.

The modified asynchronous and HDLC protocols are for interconnecting Intelligent I transceivers. Applications that require connection to host processors under task command control/or supervisory command control are supported by Ricoh's Fax Device Handler (or a like user-written program). BSC 2780/3780 protocol and ASCII/EBCDIC code supported in point-to-point/multipoint arrangements at speeds of 1200, 2400, 4800, 7200, 9600, and 19.2K bps. Variable line block sizes are selectable at 400, 512, 1024, 2048, and 4096 bytes.

Intelligent I Option • communication facility for interfacing R-3300 transceivers with identically equipped transceivers; IBM hosts supporting BSC 2780/3780 protocol; host supporting asynchronous and HDLC protocols:

$60/$60 mo	$1,500 prch	NA maint

Programmable Auto-Dialer • stores up to 30 telephone numbers preprogrammed auto-send or polls up to 15 select stations sequentially; manual override for stations not programmed • 12-hour real-time clock, memory recall display, call duration timer, redial • offered for R-3300:

15/15	435	5

• END

Satellite Business Systems (SBS) Communication Services

CNS, SNS & Skyline WATS, FX, LD & Toll-Free Services

■ PROFILE

Function • interstate voice-grade, digital, and wideband, switched and dedicated channel, carrier network services for voice, data, and image transmission.

Facilities • digital satellite-based network consisting of customer-site and SBS-owned earth stations • terrestrial extension channels extend access from major metropolitan areas.

Services • private network services for data, voice, and image transmission (Communication Network Services and Skyline Network Services) • switched-voice service (Skyline WATS/FX/LD/Toll-Free services) akin to AT&T DDD, WATS, and FX.

Access • direct from Communication Network Services (CNS) customer locations via on-site earth stations • limited access to network via SBS Service Points in 23 major metropolitan areas • customer earth station sites include interfaces, concentration, and switching equipment to terminate telephone and data devices • switched-voice Skyline services accessible throughout contiguous 48 states, U.S. Virgin Islands, and Puerto Rico.

First Available • 1981.

Number Users • undisclosed.

Comparable Services • American Satellite Corp on-site dedicated-channel services; GTE Telenet for switched data channels; AT&T Communications DDD/WATS/FX, MCI metered-use services, and GTE SPRINT for switched-voice services.

Vendor • Satellite Business Systems; 8283 Greensboro Drive, McLean, VA 22102 • 703-442-5000.

Canadian Headquarters • none.

SBS CNS Network Minimum Usage Costs

Configuration • 3 CNS Network Access Center (NAC) customer-site earth stations • 6 224K-bps Full-Time Transmission Units (FTU) providing 1344K-bps throughput capacity • no special extension facilities, service points or other options • excludes on-site moving, rigging, and emplacement costs.

Minimum Start-Up Costs • $62,100 total • consists of $34,500 for shipment of NAC earth stations; $21,600 for installation of analog CAU interfaces, and $6,000 for installation of switched digital CAU interfaces.

Minimum Monthly Operating Costs • $96,540 per month total • consists of $15,300 per month for satellite FTU transmission capacity; $53,550 per month for earth station NACs; $19,440 per month for analog CAUs.

■ ANALYSIS

SBS offers a broad spectrum of general and specialized communication services for voice, data, and image transmission focused on multifaceted business communication needs, as well as those of residential customers. Its large and growing network encompasses 4 orbiting satellites, over 100 earth stations, digital switching facilities, and terrestrial links consisting of telephone lines, microwave, and fiber-optic transmission facilities. SBS services include switched, digital, integrated private networks for large geographically dispersed companies that accommodate computer communication, video teleconferencing and telephony, long-distance telephone service for business and residential customers; digital channels for international communication; Ku-band satellite transponder capacity for customer-specified applications; and specialized telecommunication services for the real estate industry.

Communications Network Service (CNS), a private network service for large companies with geographically distant locations, uses dedicated earth stations at principal customer locations and associated terrestrial facilities for the transmission of voice, data, document distribution, and teleconferencing. CNS had been offered as CNS-A (a proprietary network) and CNS-B (a shared network). Over the past year, SBS replaced CNS-B with Skyline Network Services (SNS), a modification of CNS-B. SNS is a virtual private network service for large customers whose traffic is not as heavy as CNS customers. It provides the same all digital transmission facilities of CNS, but shares earth station facilities for large capacity at a lower cost.

Over the past year, SBS has added or revised a number of new services, including Skyline WATS/FX, Skyline Long Distance, Skyline Toll-Free, and others. Skyline WATS, an alternative to AT&T Communication WATS, replaces Message Service I (MS-I) and offers interstate and intrastate (in authorized states) communication for medium- to high-volume, long-distance telephone users with monthly bills exceeding $3K. The service is available only to customers in or near the 20 (and growing) large U.S. cities in which SBS switching centers reside. However, calls can terminate anywhere in the contiguous U.S., Puerto Rico, the U.S. Virgin Islands, and to most of Canada (at special rates). Charges are based on customer location, call destination, calling volume (minutes per month), and rate period (business/nonbusiness hours).

Skyline FX is an option that can be integrated into Skyline WATS as a low-cost alternative to traditional foreign exchange service. It offers bulk calling between SBS switching-center cities (currently 20) on a nonusage-sensitive basis.

Skyline Long Distance replaces Skyline Service as a low-cost, long-distance telephone service akin to AT&T Communications' DDD service. Available from 70 U.S. cities through SBS switching centers in 20 major cities, the service is an economical alternative to DDD for low- to medium-volume business users, as well as residential customers.

Skyline Toll-Free, an alternative to AT&T Communications 800 Service, is available for call origination or termination in over 200 U.S. cities. The service offers customers a 20-percent saving over AT&T Communications 800 Service. Skyline Call Home, a variation of Toll-Free, allows long-distance calls to a single number and is intended for callers temporarily away from the office or home.

SBS has also added Interlink International Services which provide wideband channels for advanced services to a number of overseas countries, including Canada, Belgium, France, Hong Kong, Italy Mexico, the Netherlands, Switzerland, and the United Kingdom, plus others under negotiation; and SBS Data Service, a circuit-switched, high-speed data service for full-time or on-demand, point-to-point or multipoint communication at 56K bps or 1.344/1.544M bps. The new service is available with Skyline Network Service (SNS) and is offered in all areas of the contiguous U.S. covered by the SBS Network since April 2, 1985. Calls are placed via an SBS Selector 500, a dialing and diagnostic device, and routed over dedicated circuits to an SBS switching facility where they are sent via satellite to the destination switching center and routed to the destination over dedicated circuits. Charges consist of leased line costs, equipment charges, and satellite transmission fees.

SBS, a partnership of Aetna Life and Casualty, COMSAT, and

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IBM, was formed in 1975. Since it began offering services in January 1981, SBS has become one of the dominant forces in the domestic communication services industry, and is one of the fastest growing companies in U.S. industry. Revenues have increased from $5 million in 1981, the first year of operation, to $39 million in 1982, $142 million in 1983, and $290 million in 1984. This strong revenue growth is reflective of SBS's expanding services and facilities, and its rapid acceptance as a communication carrier. Its steady revenue growth will fuel future growth and help SBS achieve its goals in 1985.

Although initial SBS services were directed to very large organizations whose volume traffic requirements are satisfied by private satellite-based networks, SBS has since broadened its market thrust to include medium and small business customers, and even the general public. Its strategy is to provide a full range of services, including those available from conventional telephone companies, to meet a broad and growing range of needs satisfied through technological advancements.

☐ Strengths

SBS's strength lies with its increasingly strong revenues, expanding facilities, broadening services, demonstrated achievements, and established goals. Although it is just 4 years since SBS began its operations, it has achieved a strong position as a communication carrier and has demonstrated substantial revenue growth which doubled in 1984. It currently has 20 switching centers/earth stations in major U.S. cities and 4 satellites in orbit with 2 more planned for launch through 1987. The total number of transponders among the existing 4 satellites is 35 each has a capacity of 48M bps for a total capacity of 1.7G bps. In addition to this, SBS is also expanding its terrestrial facilities, which include telephone lines, microwave, and fiber optic transmission media. This large and expanding network capacity provides substantial communication availability to users, reducing traffic congestion and access delays. SBS substantially broadened its scope of services since its inception to meet the needs of not just the large corporate environment, but all businesses as well as residential customers who are receptive to an economical alternative.

Some of SBS's key achievements in 1984 were the expansion of private network services and Interlink International Services, plus the introduction of Videolink service for public room teleconferencing; implementation of bulk encryption for private networks; extension of services to Canada and the expansion of the network with 3 new earth stations and 13,000 additional terrestrial lines; the introduction of new features and functions for Skyline services, including travel access, auto-dialers, T1 access, and DowPhone; FCC approval for joint marketing of SBS services by IBM and SBS; and the successful launch of a fourth satellite.

☐ Limitations

Although the SBS network is large and growing, SBS public services are not available in all geographic locations. Calls cannot be placed to Hawaii or Alaska, and calls cannot originate outside the contiguous U.S. Those restrictions will probably be eventually eliminated as the SBS network expands; however, in the meantime, these limitations can cripple or prevent communication among geographically dispersed organizations that maintain some locations outside the contiguous U.S.

Certain traffic patterns and geographical configurations are compatible with SBS CNS; others are not. For example, organizations with several campus-like clustered facilities over the U.S. could be very well served by CNS with a satellite earth station at each campus office site. Other organizations with less concentrated facilities dispersed over a large number of smaller sites may not be compatible with the network; the cost to link each office site via miles of extension channels to a central earth station could become prohibitive.

Similarly, if any large organization with high-volume traffic does not have a significant portion of its traffic concentrated between 2 or more of its locations, a satellite arrangement would not be an optimum solution. This might be the case for an organization comprised of several branches or regional offices, all remote to one another, where most communications overhead is expended on calls to local customers in each branch area.

Even if a potential user has the geographic configuration and traffic pattern which favor an SBS type of arrangement, there are still other factors to consider. SBS customers pay for a fixed block of satellite transmission capacity, whether they fully utilize it or not. A user's traffic might be such that a metered type of communications facility (such as the switched private-line service from RCA Americom) would be the more cost effective. The user would then pay only for the actual connect time that switched satellite channels are used.

Also, unlike other common carriers which simply terminate a channel at the customer's premises, SBS involves extensive on-site preparation and equipment. The customer is generally responsible for providing the necessary environment, including space and power. Also, the customer needs to secure from the appropriate regulatory authorities the necessary licenses, zoning variances and permits to operate on-site satellite transmission and reception equipment. This is a headache and time consuming, but SBS does alleviate the problem somewhat by providing consulting assistance.

■ NETWORK

☐ Terms & Conditions

Billing Criteria • customers pay for services based on individual customer configurations • basic CNS traffic unit is 224K bps, simplex, satellite transponder capacity, termed Transmission Unit (TU) • customers pay for voice services on the basis of usage for Skyline Long Distance, and the number of dedicated access lines and usage for Skyline WATS • provisions exist for "shared use" whereby SBS customers may resell the service.

Billing Conditions • CNS customers must install at least 3 Network Access Centers (NACs), and lease at least 6 Full-Time Transmission Units (FTUs) or Full Business Day Transmission Units (FBDTUs) • Skyline Network Service (SNS) customers must install at least 3 communication nodes (NACs or Service Points); SNS customers may operate no more than 2 NACs and any number of Service Points • advance termination notice and penalties imposed for service cancellation effectively make contract period at least 1 year; maximum termination charge per NAC is $150,000, reduced by 1/12 (CNS) or 1/3 (SNS) per month for each month NAC is in operation • Skyline WATS customers pay for the number of access channels installed and have a minimum usage criteria of $400 or 50 hours per access channel per month • Skyline Long Distance customers have a minimum usage charge of $15 per authorization code per month.

Other Conditions • SBS services offered subject to availability of facilities and necessary legal permits for operation • SBS assumes no liability for damage or unauthorized use of customer facilities from on-site operations, or for communications privacy or security breaches that may result from service use.

☐ Overview

Communications Network Service (CNS) is a communication service for 2-point or multipoint operation between or among SBS-provided Network Access Centers (NACs) located on customer premises. The minimum configuration is 3 NACs and 6 Full-Time Transmission Units (FTUs) or Full Business Day Transmission Units (FBDTUs). CNS may include Service Extension and Special Services. If a customer's network consists of less than the minimum configuration any one time one year after the initial notice of availability of service to the customer, a charge shall apply in an amount equal to the rates for any additional NACs, FTUs, or FBDTUs, and minimum CAU charges required to satisfy the minimum configuration.

Network Access Centers consist of SBS-provided facilities and are located on customer premises. NACs accommodate access to the service via interconnection of communication channels and provide for switching, administration, and testing of the CNS. At each NAC, the standard capacity is 12,224K bps full-duplex and the standard maximum number of CAUs is nominally 372 analog voice-grade CAUs or their equivalents.

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NAC supplemental capacity units are NAC facilities that are provided to increase the capacity at a NAC by 12,224K bps full-duplex and increase the nominal maximum number of analog voice-grade CAUs or their equivalents by 372.

Multi-Transponder Access Units (MTAUs) are NAC facilities that enable service access through up to 4 transponders. Each NAC in a multitransponder network must be equipped with an access unit and be configured to access the same physical transponders and the same number of transponders. Multitransponder networks accommodate a maximum number of FTUs or FBDTUs, depending on the particular operating characteristics of the customer's network. Two transponders accommodate 350; 3 accommodate 525; 4 accommodate 700 maximum FTUs or FBDTUs.

A Transmission Unit (TU) is 224K bps (simplex) of satellite transponder capacity for use with CNS. Unless Multi-Transponder Access Units are provided, the maximum satellite transponder capacity assignable to a CNS customer network is equivalent to that provided in one of the company's satellite transponders, which capacity is approximately 175 Transmission Units depending on the particular operating characteristics of the customer's network. The minimum number of assigned Full-Time Transmission Units and Full Business Day Transmission Units must be equal to twice the number of NACs and supplemental capacity units in the customer's network. A Full Transmission Unit (FTU) is one TU 24 hours a day, 7 days a week; a Full Business Day Transmission Unit (FBDTU) consists of 224K bps of TU capacity for use 8:00 AM to 8:00 PM inclusive, Monday through Friday, and 32K bps of TU capacity for use all other times. Time will be as measured in Washington, DC.

A Demand Transmission Unit (DTU) is one TU temporarily assigned to a customer's CNS network when the usage on the network exceeds the maximum assigned FTU and FBDTU capacity. DTUs are assigned from a common pool of satellite transponder capacity; the company does not guarantee the availability of any minimum pool of capacity for the purpose of providing DTUs. The customer must request, in advance, authorization to use any DTUs above the maximum FTU and FBDTU capacity assigned to their network. DTU network capacity assigned to a CNS network will not exceed the sum of the network capacity requirements of active digital CAUs. A digital CAU is active if a connection has been established, either switched or nonswitched, or if a connection attempt is in queue due to insufficient network TU capacity. Usage during the nonbusiness day in excess of the sum of assigned FTU and nonbusiness day FBDTU capacity will be charged at the DTU rate, and does not require prior authorization.

Connection Arrangement Units (CAUs) are NAC facilities that allow for the connection of service extensions, special services, and customer-provided facilities to the CNS. Analog voice-grade CAUs come in 3 types, all require 32K bps of TU capacity subject to reduction by voice activity-compression and 32K bps of NAC capacity. Type A1 is for nonswitched; Type A2 is for switched voice connections or analog data connections utilizing customer-provided modems. The nominal maximum data rate for Types A1 and A2 is 2400 bps; the actual data rate will depend on the terrestrial transmission facilities. Type A3 is for use in the establishment of an automatic connection. Up to 64 Type A3 CAUs may be provided with each NAC supplemental capacity unit. Digital CAUs can be either switched or nonswitched with data rates up to 3.088M (2-1.544M) bps. A digital CAU generally requires 32K bps of satellite transponder capacity, however, at data rates less than 19.2K bps, may require less, depending on the number of CAUs at these data rates at the same NAC. The standard network interfaces are RS-449/RS-422A, although other interfaces can be supported.

SBS, at the request of the customer, will provide service from an analog voice-grade CAU at a NAC to an initial point of connection at the customer's premises. Service extensions are provided by means of facilities or services acquired by SBS from other common carriers. SBS may undertake the acquisition, construction, or rearrangement of facilities or the provision of other services incidental to the furnishing of CNS.

SBS Skyline Network Service (SNS) is a communication service for 2-point or multipoint operation. SNS is provided via NACs that are located on the customer's premises and via service points. SNS internodal on-net voice-grade calls are routed from customer premises via a Service Point Extension to a Service Point or via a Service Extension to a NAC, through an analog voice-grade CAU and a half trunk on the originating end, and a corresponding half trunk and analog voice-grade CAU on the terminating end. Call routing is completed via the Service Point and Service Point Extension or via NAC and Service Extension serving the destination customer premises. SNS intranodal on-net to on-net calls are routed from the customer premises via a Service Point Extension to a Service Point or via a Service Extension to a NAC, through an analog voice-grade CAU and another analog voice-grade CAU and Service Point Extension or Service Extension to the destination customer premises. SBS reserves the right to select the facilities with which it will provide SNA, to use SBS-provided facilities at SNS NAC locations to provide services to others and to restrict the expansion of any SNS customer network.

Half Trunks are analog voice-grade facilities providing internodal on-net SNS call transmission from a Service Point or NAC to a hypothetical midpoint for connection with a corresponding Half Trunk terminating in another service point or NAC. For each node at which the customer will have either originating or terminating on-net traffic, at least one Half Trunk must be ordered. Half Trunks provide levels of originating and terminating on-net capacity at a node. Business day usage is any usage occurring between 8:00 AM and 5:00 PM, inclusive, Monday through Friday. Time will be local time at the service point or NAC serving the call originating station. Nonbusiness day usage is any usage other than business day usage.

Internodal on-net usage in excess of the usage levels associated with the number of Half Trunks available in the customer's network will be charged excess usage charges.

Connection Arrangement Units (CAUs) are NAC or Service Point facilities that allow for the connection of Service Point Extensions, special services, and customer-provided facilities to SNS. Analog voice-grade CAUs are provided with required satellite transponder capacity. CAUs are available in 2 types, both require 32K-bps TU capacity subject to reduction by voice activity compression and 32K bps of NAC capacity. Type A1 is for use with nonswitched, while Type A2 is for use with switched voice connections utilizing customer-provided modems. Switched connections are established on a dial-up basis by the user. The nominal maximum data rate for both types is 2400 bps; the actual data rate will depend on the terrestrial transmission facilities, services, and modems that are utilized.

Digital CAUs are used for nonswitched, synchronous, 2-point, full-duplex digital connections and are provided with required satellite transponder capacity on a dedicated basis. The satellite transponder capacity provided for this type CAU may not be used for any other purpose. Data rates are up to 1.544M bps; interface is RS-449/-422A. Digital CAU types D3B are used for switched synchronous digital connections that utilize inband signaling, including associated satellite transponder capacity and is furnished on a usage basis. Data rates up to 1.544M bps; interface is RS-449/422A.

SNS off-net voice calling, at the customer's election, routes analog voice-grade calls to off-net stations in the contiguous U.S, Puerto Rico, U.S. Virgin Islands, and specified locations within Canada via SBS-provided facilities. Analog voice-grade calls may also be routed to customer-specified/customer-provided facilities or services in which event the customer will be responsible for acquiring the interconnected facilities or services. SNS Virtual FX is an off-net voice feature charged for on a fixed rather than usage basis for a specified amount of channel capacity during a monthly billing period.

CNS and SNS customers have several other additional standard features, which are described in the Features section.

Skyline WATS is a switched interstate voice communication service for businesses with medium- to high-volume telephone use. This service allows customers in or near access cities in the U.S. to place interstate calls in the contiguous U.S., Puerto Rico, and the U.S. Virgin Islands using SBS-owned and operated

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switching centers (earth stations). In some states, intrastate calling is also authorized.

Access to the SBS National Network is provided through dedicated access channels from the customer's serving vehicle (PBX, Centrex) to a nearby SBS switching center. Most calls are transmitted via satellite to a switching center to the call's destination. Egress through the switching center to the call's destination is furnished through shared terrestrial telephone facilities either ENFIA or WATS, acquired by SBS from other common carriers.

Skyline FX can be integrated with Skyline WATS service to provide for economical bulk calling for large-volume, long-distance Skyline WATS service from individual customer premises to destination cities on a nonusage sensitive basis. It utilizes the SBS National Network to provide a traffic alternative that combines features of traditional point-to-point service and switched services.

Skyline FX customers may order any number of intercity channels associated with a specified amount of traffic (minutes per month) for service from the customer's premises to the customer's high-traffic volume cities. The remainder of long-distance traffic will be carried as regular Skyline WATS service.

SBS Skyline Long Distance customers can reach any telephone number 24 hours a day, 365 days a year, anywhere in the contiguous U.S., Puerto Rico, and the U.S. Virgin Islands. It also reaches 80 percent of telephones in Canada, covering all major metropolitan areas. Intrastate service is also offered where authorized, currently California, Colorado, Florida, Georgia, Illinois, Minnesota, New York, Pennsylvania, Texas, Virginia, and Washington.

Access is available from 70 cities through earth stations and switching centers in Atlanta, Boston, Chicago, Cincinnati, Dallas, Denver, Detroit, Houston, Los Angeles, Miami, Minneapolis, New Orleans, New York, Philadelphia, Phoenix, Pittsburgh, San Francisco, Seattle, St. Louis, and Washington, DC.

Skyline Toll-Free is an incoming long-distance telephone service. SBS assigns a 6-digit service code which the customer distributes to authorized callers. The customer selects the metropolitan areas from which calls can originate and the telephone number to which calls can terminate.

Calls can originate from anywhere in the contiguous U.S. Calls from direct-coverage Skyline areas, however, are billed at lower rates than calls from other (universal access) areas.

Interlink includes wideband channels for advanced services to a number of other countries. SBS has operating agreements in Canada, Belgium, France, Hong Kong, Italy, Mexico, the Netherlands, Switzerland, and the United Kingdom. A number of other countries are currently being negotiated.

Dataservice is a circuit-switched, high-speed data service. Options include full-time or on-demand, point-to-point or point-to-multipoint transmission, at data rates of 56K bps or 1.344/1.544M bps.

SBS provides transponder services to other organizations. Each SBS satellite contains 10 transponders that receive transmissions from earth, amplify them and retransmit them to their destinations. The Ku band of frequency spectrum allows the use of relatively small dish antennas in metropolitan areas where other communication facilities frequently encounter interference and congestion.

■ COMMUNICATIONS NETWORK SERVICE (CNS)

CNS is a communication service for 2-point or multipoint operation between or among SBS-provided Network Access Centers (NACs) located on customer premises. The minimum configuration is 3 NACs and 6 Full-Time Transmission Units (FTUs) or Full Business Day Transmission Units (FBDTUs). CNS may include service extension and special services. If a network consists of less than the minimum configuration at any time one year after the initial notice of availability of services to the customer, a charge shall apply in an amount equal to rates for any additional NACs, FTUs, or FBDTUs, and minimum CAU charges required to satisfy the minimum configuration.

Traffic Charges

Unlike most metered common carrier services, SBS customers pay for a fixed amount of satellite transponder capacity on a monthly basis. A basic Transmission Unit (TU) provides capacity for 224K bps (simplex) of data traffic, or the equivalent in analog voice channels at 32K bps per channel. When traffic requirements exceed the amount of capacity regularly leased, demand-assigned transmission capacity or Demand Transmission Units (DTUs) are allotted and billed per second of use. When any amount of demand-assigned capacity is required, an amount equal to a basic TU (224K bps) is temporarily assigned.

Full-Time Transmission Unit (FTU) • minimum of 6 FTUs or FBDTUs must be leased for CNS service • monthly charge per FTU:

$2,550 mo

Full Business Day Transmission Unit (FBDTU) • minimum of 6 FBDTUs or FTUs must be leased for CNS service • monthly charge per FBDTU:

2,250

Demand Transmission Unit (DTU) • charge per second or fraction thereof per DTU in excess of regularly leased FTU capacity:

$0.016 sec

Access Charges—Network Access Center (NAC)

The Network Access Center (NAC) consists of a satellite earth station antenna, transceiver, and controller equipment located on the customer site; frequently, however, the antenna may be located some distance from the NAC control center. The NAC control center and antenna facilities are connected by an Intra-NAC Facility Link. Customer pays shipping charge to NAC site; moving, rigging, and emplacing on-site charged on a per-job basis.

CNS NAC Facility • does not include CAUs or transmission capacity • CNS customer must contract for at least 3 NACs • minimum CAU charge of $6,650 to $17,850 per month • shipping charge and monthly charge per NAC:

$11,500 ship | $17,850 mo

Intra-NAC Facility Link • connection between NAC center and antenna • for all cables installed at NAC at same time • installation charge plus charge per foot:

$1,000 instal | $13 ft

NAC Termination Charge • a charge will apply when service at a NAC is terminated before the termination charge has been reduced to zero • the actual termination charge will be the maximum charge reduced by one-twelfth for each month that a CNS NAC is in service • maximum charge:

$150,000 OTC

Moving, Rigging, Emplacing Charges • a nonrecurring charge is made for moving, rigging, and emplacing of antennas and associated equipment at a NAC location.

NAC Supplemental Capacity Charges • a monthly recurring charge for each supplemental capacity unit, and a maximum termination charge will be made • actual termination charge will be the maximum reduced by one-sixth for each month that a NAC supplemental capacity unit is in service • monthly recurring charge and maximum termination charge:

$5,700 mo | $35,000 OTC

Multi-Transponder Access Units (MTAUs) • each MTAU has a monthly recurring charge • termination of each MTAU incurs a maximum charge, actual charge will be the maximum charge

INSTAL: installation charge associated with specific network feature or option. MO: monthly charge for associated service. MIN: charge per minute. SEC: charge per second for CNS Service. SHIP: shipping charge for CNS NAC Facility. FT: charge per foot of cable for Intra-NAC Facility Link. ORD: charge per order for CNS Service Extensions. OTC: one time charge. Prices effective as of February 1, 1985.

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reduced by one-twelfth for each month that a MTAU is in service.

Monthly Recurring Charge, Each MTAU:

$14,200 mo

Two-Transponder Access:

15,800

Four-Transponder Access:

17,400

Maximum Termination Charge:

100,000 OTC

Service Extensions

Service Extensions are communications links that connect NAC with another customer access point either located at the same site or at a remote customer location. Such extensions are provided by SBS, using facilities of another common carrier. Customer pays SBS at the tariffed rate of the other common carrier.

Service Extension • termination charge for connecting NAC center with another customer access point • does not include associated carrier tariff rate charges • installation plus monthly charge:

$25 instal $20 mo

Service Extension Support • SBS, upon customer request, will have performed special construction commonly required for connecting common carrier communications links to extension points • such construction involves special cable or entrance facilities • additional charges related to tariff of common carrier not included • service extension support charges are on a per-job basis plus a fixed nonrecurring charge per order:

$630 ord

Revised Forecast • in the event a revised forecast is necessitated by a customer-requested change of the location at which a NAC is to be placed, or by any other request of the customer, prior to completion by the other common carrier of the specially constructed entrance or building cables, a charge will apply for each revised forecast prepared by SBS for delivery to the other common carrier • charge per request:

$250 OTC

Service Extension Changes • when a change is requested by the customer, a nonrecurring charge per extension shall apply, plus any charges for the change specified in the tariff of the other common carrier, or in the contract between SBS and the other common carrier • nonrecurring charge:

175 OTC

Service Extension Expedite Requests • when a change is processed in a time period that is shorter than SBS's normal service interval for the placement of orders with the other common carriers, a nonrecurring charge shall apply, in addition to any charges from the other common carrier • nonrecurring charge:

200 OTC

Connection Arrangement Unit (CAU)

A Connection Arrangement Unit (CAU) is required to access a NAC or SBS Service Point. Analog CAUs provide a single voice-grade channel connection and require 32K bps of satellite capacity when active. They are designed for voice communication, but may carry data via modem at rates up to 2400 bps; however, full 32K-bps satellite capacity is still required. Digital CAUs support synchronous traffic only, on switched or nonswitched links. Data rates range from 2400 bps to 3.088M bps.

For planning purposes, CNS customers may connect up to 1,100 analog CAUs to a NAC. This equates to carrying up to 1,100 full-duplex voice conversations concurrently on a NAC, assuming that the associated satellite transmission capacity has been also acquired to handle such traffic.

Digital CAUs may be used in conjunction with or in place of analog CAUs. However, such configurations or replacements are not on a one-to-one basis.

Type D1 Nonswitched Digital CAUs • support synchronous traffic only • RS-449/RS-442A interfaces • add $1.50 per foot to installation charge for digital cable pulled through conduit.

2400-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

$200 instal $150 mo

4800-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 250

9600-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 350

19.2K-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 500

56K-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 700

112K-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 1,100

224K-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 1,500

448K-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 1,800

1.344M-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 2,500

1.544M-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 2,500

3.088M-bps Nonswitched Digital CAU • installation plus monthly charge per digital CAU:

200 3,000

Type D1A Nonswitched Digital CAUs • support synchronous traffic and include required satellite capacity (no FTUs or FBDTUs necessary) • add $1.50 per foot to installation charge for digital cable pulled through conduit.

2400-bps Service • installation plus monthly charge per digital CAU:

200 450

4800-bps Service • installation plus monthly charge per digital CAU:

200 450

9600-bps Service • installation plus monthly charge per digital CAU:

200 450

19.2K-bps Service • installation plus monthly charge per digital CAU:

200 450

1.344M-bps Service • installation plus monthly charge per digital CAU:

200 13,000

1.544M-bps Service • installation plus monthly charge per digital CAU:

200 13,000

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Transmission Unit Capacity for Forward Error Correction • applied to nonswitched digital CAU at data speeds of 2400 bps through 19.2K bps • monthly recurring charge per CAU:

$150 mo

Type D2 Switched Digital CAUs • designed for connections that use analog, voice-grade access lines for signaling • support synchronous traffic only • RS-449/RS-422A interfaces • add $1.50 per foot to installation charge for digital cable pulled through conduit.

2400-bps Switched Digital CAU • installation plus monthly charge per CAU:

$200 instal	$165 mo

4800-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	275

9600-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	385

19.2K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	550

56K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	770

112K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	1,210

224K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	1,650

448K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	1,980

1.344M-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	2,750

1.544M-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	2,750

3.088M-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	3,300

Type D3 Switched Digital CAUs • designed for connections that use inband digital signaling • support synchronous traffic only • RS-449/RS-422A interfaces • add $1.50 per foot to installation charge for cable pulled through conduit.

2400-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	150

4800-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	250

9600-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	350

19.2K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	500

56K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	700

112K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	1,100

224K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	1,500

448K-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	1,800

1.344M-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	2,500

1.544M-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	2,500

3.088M-bps Switched Digital CAU • installation plus monthly charge per CAU:

200	3,000

Analog CAUs • 3 types available • Type A1 used for nonswitched analog connections • Type A2 used for switched (dial-up) analog connections • Type A3 uses automatic connection feature of NAC to establish switched connection between 2 stations specified by the customer.

1 to 150 Analog CAUs (All Types) • installation plus monthly charge per analog CAU at same NAC:

$100 instal	$100 mo	NA adtl mo

151 to 300 Analog CAUs (All Types) • installation charge per CAU plus monthly charge per 150 analog CAUs at same NAC, additional charge for each additional CAU over 150:

100	15,000	95

301+ Analog CAUs (All Types) • installation charge per CAU plus monthly charge per 300 analog CAUs at same NAC, additional charge for each CAU in excess of 300:

100	29,250	70

Additional Feature Charges

Bulk Encryption • uses Data Encryption Standard (DES) algorithm to encrypt all customer traffic between or among NACs on customer's network • monthly charge per NAC:

$10,000 mo

Move Charges • when at the customer's request, the physical location of an SBS-provided service component is changed at a customer premises, Special Services charges apply.

Zoning Consultation • charges are made for time expended by SBS personnel in the performance of zoning consultation; they include a per-hour charge, plus travel and living expenses incurred by SBS personnel, also fees and other expenditures made by SBS and non-SBS professionals in the customer's behalf • per-hour charge:

$75 hr

Additional Site Surveys • a charge consisting of the sum of the charges for reasonable travel and living expenses, plus a per-man-hour or major fraction thereof, which will include travel time of SBS personnel • per-man-hour charge:

65 mhr

Changes • for deferral of a requested operational date, the following nonrecurring charges shall apply:

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Service Component	Request Received Within 30 Days of Requested Operational Date	Request Received 31 to 60 Days Before Requested Operational Date
NAC Supplemental Capacity Unit	$4,275	$4,272
Analog Voice Grade CAU	$145	$75
Type D1, D2, or D3 Digital CAU, or Type D1A Digital CAU at a data rate of 19.2K bps or less	$150 plus .75 x appropriate Monthly Recurring Charge specified in Section 5.5.2	$150
Type D1A Digital CAU at a data speed of 1,344K bps or greater	$2,025	$150
Optional Service Features	.75 x the Installation Charge plus .75 x one (1) month's recurring charge for the feature	.75 x the Installation Charge for the feature
Multi-Transponder Access Unit	$18,750	$11,250

Cancellation Charges • for cancellation of service components, or service components resulting from a change to an application for service, the following nonrecurring charges apply:

Service Component	Request Received Within 30 Days of Requested Operational Date	Request Received 31 to 60 Days Before Requested Operational Date
NAC Supplemental Capacity Unit	$35,000	$25,000
Analog Voice Grade CAU	$195	$100
Type D1, D2, or D3 Digital CAU, or Type D1A Digital CAU at a data rate of 19.2K bps or less	$200 plus appropriate Monthly Recurring Charge specified in Section 5.5.2	$200
Type D1A Digital CAU at a data speed of 1,344K bps or greater	$2,700	$200
Service Extension	$100	$65
Optional Service Features	Installation Charge plus one (1) month's recurring charge for the feature	Installation Charge for the feature
Multi-Transponder Access Unit	$25,000	$15,000

Special Services

At the customer's request, SBS may undertake to perform, or have performed, special services. Special Services are services incidental to the provision of CNS. There are 3 classifications: **Special Construction**, which is an undertaking to acquire or construct facilities for a customer on a special-order basis in order to connect CNS to the initial point of connection on a customer

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premises; **Interim Service**, which is an undertaking by SBS to meet the customer requirements until standard CNS service components or capabilities are available; **Other Special Services**, where facilities and services are acquired from other common carriers on a special construction or other special basis shall be provided as special services, except for entrance and building cables associated with service extension support. Contact vendor for specifics and pricing.

■ SKYLINE NETWORK SERVICE (SNS)

SNS (formerly CNS Series B) is a communication service for 2-point or multipoint operation provided via NACs that are located on the customer's premises and via Service Points. SNS internodal on-net to on-net voice-grade calls are routed from customer premises via a Service Point Extension to a Service Point or via a Service Extension to a NAC, through an analog voice-grade CAU and a Half Trunk on the originating end, and a corresponding Half Trunk and analog voice-grade CAU on the terminating end, and completed via the Service Point and Service Point Extension, or via NAC and Service Extension, serving the destination customer premises. SNS intranodal on-net to on-net calls are routed from the customer premises via a Service Point Extension to a Service Point, or via a Service Extension to a NAC, through an analog voice-grade CAU and another analog voice-grade CAU and Service Point Extension or Service Extension to the destination customer premises. The minimum SNS configuration is 3 communication nodes; a node is a NAC or a Service Point. Effective January 1, 1984, all nodes are Service Points, except for NACs made available prior to that date. If a network consists of less than 3 nodes at any time, 6 full monthly billing periods following notice of availability of service, a charge shall apply to satisfy the minimum configuration.

Beginning the latter of 3 full monthly billing periods following commencement of service at a Service Point, or 6 full monthly billing periods following notice of availability of service to the customer, the number of SBS-provided transmission components at a Service Point must be at least 5. SBS-provided transmission components are: Half Trunks, equivalent access channels, and digital CAUs switched or nonswitched equivalents. The minimum number of components at an SNS NAC is 15, with the minimum number of analog voice-grade CAUs being 20. If at any time the minimum number of the components is less, a charge will apply to satisfy the minimum configuration.

At each service point and NAC, the number of Service Point Extensions is limited to 4 times the number of SBS-provided transmission components. If these limits are exceeded, a charge will apply for each additional SBS-provided transmission component required to reduce the ratio to no greater than 4.

The maximum number of NACs in an SNS network is 2, except for SNS networks for which the accepted and confirmed requested operational date for the first service was on or before August 1, 1982. The maximum number of NACs is 3.

Traffic Charges—On-Net Voice Calling

Monthly recurring usage charges include a monthly charge per number of customer Half Trunks, excess usage charges per Half Trunk, plus internodal on-net usage charges based on rate categories of routes between Service Points. A monthly usage level in hours applies to monthly Half Trunk charges; the usage level differs according to time period in which calls are made. Business day usage is any usage occurring between 8:00 AM and 5:00 PM inclusive, Monday through Friday. Time will be local time at the Service Point or NAC serving the call originating station. Nonbusiness day usage is any usage other than business day usage. Customer orders for Half Trunks must be received at least 30 days prior to the requested operational date for service via the Half Trunks. The rates for Half Trunks are presented in **Table 1**.

The minimum average call length required for all on-net calls originating and terminating at a Service Point or NAC during the business day period and during the nonbusiness day period is one-half minute. If the customer's usage in any period averages less than one-half minute, the customer's minutes of use for that period will be adjusted to equal one-half the number of calls made by the customer.

Internodal on-net SNS usage in excess of the usage levels associated with the number of Half Trunks available in a customer

Table 1 • SBS-SNS On-Net Voice Calling Half Trunk Usage Charges.

Number of Half Trunks	Monthly Recurring Charge	Usage Level Hours In Monthly Charge		Excess Usage Charges/Min	
		Bus	Non-Bus	Bus	Non-Bus
1	$ 275	35	14	$0.088	$0.025
2	543	111	43	0.068	0.022
3	804	206	82	0.056	0.02
4	1,058	313	128	0.048	0.018
5	1,306	428	174	0.044	0.018
6	1,548	547	242	0.042	0.016
7	1,786	671	313	0.042	0.016
8	2,021	798	390	0.042	0.016
9	2,253	927	472	0.042	0.016
10	2,483	1,058	558	0.042	0.016
11	2,711	1,191	647	0.040	0.015
12	2,938	1,326	741	0.040	0.015
13	3,164	1,462	837	0.040	0.015
14	3,390	1,599	940	0.040	0.015
15	3,615	1,737	1,044	0.040	0.015
16	3,840	1,876	1,133	0.040	0.015
17	4,065	2,016	1,267	0.038	0.014
18	4,290	2,156	1,385	0.038	0.014
19	4,515	2,297	1,512	0.038	0.014
20	4,740	2,438	1,644	0.038	0.014
21	4,965	2,580	1,779	0.038	0.014
22	5,190	2,722	1,916	0.038	0.014
23	5,415	2,865	2,055	0.038	0.014
24	5,640	3,008	2,196	0.038	0.014
25	5,865	3,152	2,339	0.036	0.012

Additional Half Trunks each provide 145 usage level hours, both business and non-business days. Monthly recurring charge for each additional half trunk is $5,865, plus $225 per half-trunk in excess of 25. Excess usage charges per minute are $0.036 for business day and $0.012 for non-business day.

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network will be charged the Excess Usage Charges presented in **Table 1**. The time-of-day period associated with on-net usage at a NAC or Service Point (whether the usage is originating or terminating) will be the local time at the node serving the call originating station. If business day usage is less than the business day usage level associated with the number of available Half Trunks, the business day usage will be subtracted from the business day usage level and the difference will be added to the nonbusiness day usage level prior to application of Excess Usage Charges to nonbusiness day usage.

In addition to the monthly recurring charges for Half Trunks and Excess Usage Charges, the following charges apply to rate categories of routes between Service Points as presented in **Table 2**.

Rate Category	Business Day/Min	Nonbusiness Day/Min
A	$0.00	$0.00
B	0.18	0.09
C	0.26	0.13
D	0.36	0.18
E	0.52	0.26

Access Charges—Network Access Center (NAC)

The Network Access Center (NAC) consists of an SBS-supplied satellite earth station antenna, transceiver, and controller equipment located on the customer site; frequently, however, the antenna may be located some distance from the NAC control center. The NAC control center and antenna facilities are connected by an Intra-NAC Facility Link. Customer pays shipping charge to NAC site; moving, rigging, and emplacing on-site charged on a per-job basis.

SNS NAC Facility • does not include CAUs or transmission capacity • customer must contract for at least 3 communication nodes; maximum of 2 NACs and any number of service points • shipping charge and monthly charge per NAC:

$11,500 ship — $17,850 mo

Intra-NAC Facility Link • connection between NAC center and antenna, for all cables installed at the same NAC at the same time • installation charge plus charge per foot:

$1,000 instal — $13 ft

NAC Termination Charge • a charge will apply when service at a NAC is terminated before termination charge is zero • the actual termination charge will be the maximum charge reduced by one-third for each month that an SNS NAC is in service • maximum charge:

150,000

SNS Network Charge • monthly recurring charge per SNS network:

1,000 mo

Service Extensions

Service Extensions are communication links that connect NAC with another customer access point either located at the same site or at a remote customer location. Such extensions are provided by SBS using facilities of another common carrier. Customer pays SBS at the tariffed rate of the other common carrier.

Service Extension • termination charge for connecting NAC center with another customer access point • does not include associated carrier tariff rate charges • installation plus monthly charge:

$25 instal — $12 mo

Service Extension Support • SBS, upon customer request, will have performed special construction commonly required for connecting common carrier communications links to extension points • such construction involves special cable or entrance facilities • additional charges related to tariff of common carrier not included • service extension support charges are on a per-job basis plus a fixed nonrecurring charge per order:

$630 ord

Table 2 • On-Net Voice Calling City-Pair Rate Categories.

	Atlanta	Boston	Chicago	Cincinnati	Dallas	Denver	Detroit	Hartford	Houston	Los Angeles	Miami	Minneapolis	New Orleans	New York	Omaha	Philadelphia	Phoenix	Pittsburgh	San Francisco	St. Louis	Seattle	Tampa	Washington
Atlanta	C	A	A	B	A	E	A	D	A	D	A	A	—	C	A	A	A	C	A	C	A	D	A
Boston	C	—	B	A	C	E	A	A	D	D	D	C	D	A	D	A	E	A	D	C	E	D	A
Chicago	A	B	—	A	B	B	A	B	B	B	B	A	B	A	A	A	D	A	B	A	B	B	A
Cincinnati	A	A	A	—	B	C	A	A	B	D	C	A	B	A	A	A	E	A	D	A	E	C	A
Dallas	A	C	B	B	—	A	C	C	*	C	C	B	A	C	A	D	C	C	A	C	C	C	C
Denver	C	E	B	C	A	—	D	E	B	B	D	B	C	C	A	C	A	C	B	B	C	D	C
Detroit	A	A	A	A	C	D	—	A	C	D	D	A	C	A	A	A	E	A	D	A	E	D	A
Hartford	A	A	A	A	C	C	A	—	B	D	B	C	D	A	C	A	E	A	D	B	E	B	A
Houston	A	D	B	B	*	B	C	D	—	B	B	C	A	B	C	C	D	C	D	A	B	B	B
Los Angeles	D	D	B	D	C	B	D	D	B	—	D	D	E	D	C	D	A	D	*	D	B	D	D
Miami	A	D	B	C	C	D	D	D	B	D	—	E	B	B	D	B	E	C	D	C	D	*	B
Minneapolis	C	C	A	A	B	B	A	C	C	D	E	—	D	C	A	C	D	B	D	A	E	E	C
New Orleans	A	D	B	B	A	C	C	D	A	E	B	D	—	D	B	D	D	C	E	A	E	B	C
New York	A	A	A	A	C	C	A	A	B	D	B	C	D	—	C	A	E	A	D	B	E	B	A
Omaha	B	D	A	A	A	A	A	C	B	C	D	A	B	C	—	C	C	B	C	A	D	D	B
Philadelphia	A	A	A	A	D	C	A	A	D	D	B	C	D	A	C	—	E	*	D	B	E	B	A
Phoenix	E	E	D	E	C	A	E	E	C	A	E	D	D	E	C	E	—	E	A	D	D	E	D
Pittsburgh	A	A	A	A	C	C	A	A	D	D	C	B	C	A	B	*	E	—	D	A	E	C	A
San Francisco	D	D	B	D	C	B	D	D	B	*	D	D	E	D	C	D	A	D	—	D	B	D	D
Seattle	A	C	A	A	A	B	A	C	A	D	C	A	A	B	A	B	D	A	D	—	E	C	A
Tampa	A	D	B	C	C	D	D	B	B	D	*	E	B	B	D	B	E	C	D	C	D	—	B
Washington	A	A	A	A	C	C	A	A	B	D	B	C	C	A	B	A	D	A	D	A	D	B	—

*Service for this Route is not available under this tariff.

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Service Point Extensions • SBS provides facility for connecting the customer in the local area of the Service Point to voice-grade CAU at the Service Point, if the customer sites are outside the Service Point area or if access to digital CAU is required • installation and monthly recurring charges per extension.

Co-located Service Point Extensions:

$105 instal	$22 mo

Local Service Point Extensions:

105	86

Extended Service Point Extensions • installation, monthly recurring charge, plus monthly rate specified in the tariff of the other common carrier from which the facility is obtained, or in the contract between SBS and the other common carrier:

105	12

Service Point Extension Surcharge • in addition to above charges, if another common carrier charges SBS a surcharge for special access on the private-line facility SBS uses to provide a Service Point Extension, such surcharge will be charged to the customer.

Revised Forecast • in the event a revised forecast is necessitated by a customer-requested change of the location at which a NAC is to be placed, or by any other request of the customer, prior to completion by the other common carrier of the specially constructed entrance or building cables, a charge will apply for each revised forecast prepared by SBS for delivery to the other common carrier • charge per request:

250

Service Extension Changes • when a change is requested by the customer, a nonrecurring charge per extension shall apply, plus any charges for the change specified in the tariff of the other common carrier, or in the contract between SBS and the other common carrier • nonrecurring charge:

175

Service Extension Expedite Requests • when a change is processed in a time period that is shorter than SBS's normal service interval for the placement of orders with the other common carriers, a nonrecurring charge shall apply, in addition to any charges from the other common carrier • nonrecurring charge:

200

Half Trunks

Half Trunks are analog voice-grade facilities providing internodal on-net SNS call transmission from a Service Point or NAC to a hypothetical midpoint for connection with a corresponding Half Trunk terminating in another Service Point or NAC. For each node at which the customer will have either originating or terminating on-net traffic, at least one Half Trunk is required.

Half Trunk • nonrecurring charge per Half Trunk:

$100 OTC

Virtual FX Access

A nonrecurring charge applies to each Virtual FX channel ordered by a customer in addition to monthly recurring charges applied individually to each Virtual FX route.

Nonrecurring Charge Per Channel:

$100 OTC

Connection Arrangement Unit (CAU)

A CAU is required to access a NAC or Service Point. Analog CAUs provide a voice-grade channel connection and require 32K bps of satellite capacity when active. They are designed for voice communication, but may carry data via a modem at rates up to 2400 bps; however, full 32K-bps satellite capacity is still required. Digital CAUs support synchronous traffic only on switched or nonswitched links. Data rates range from 9600 bps to 1.544M bps.

Analog CAUs • 2 types available • Type A1 used for nonswitched voice connections or nonswitched analog data connections utilizing customer-provided modems; Type A2 used for switched voice connection or with switched analog data connections utilizing customer-provided modems • installation charge, plus monthly recurring charge per CAU:

$100 instal	$50 mo

Nonswitched Digital CAUs • supports synchronous traffic only • RS-449/422-A interfaces • installation charge is $200 per CAU; monthly recurring charge depends on mileage between service points:

Call Speed	Mileage Between Service Points	Monthly Charge
9600 bps	0-150	$ 205
	151-500	205 plus $0.36/mile over 150
	501-1,000	331 plus 0.29/mile over 500
	over 1,000	476 plus 1.55/mile over 1,000
19.2K bps	0-150	385
	151-500	385 plus 0.72/mile over 150
	501-1,000	637 plus 0.58/mile over 500
	over 1,000	927 plus 0.31/mile over 1,000
56K bps	0-820	1,225
	821-1,000	1,225 plus 1.00/mile over 820
	over 1,000	1,405 plus 0.525/mile over 1,000
22.4K bps	0-820	4,187.50
	821-1,000	4,187.50 plus $3.50/mile over 820
	over 1,000	4,187.50 plus 1.54/mile over 1,000
1.344/1.544M bps	0-1,455	14,500
	over 1,455	14,500 plus $9.375/mile over 1,455

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Table 3 • SNS Off-Net Calling • Mainland Usage Rate Schedule.

Average Total Hours of use per Access Channel	TIER I RATES (¢/minute)		TIER II RATES (¢/minute)		TIER III RATES (¢/minute)	
	Business Day	Nonbusiness Day	Business Day	Nonbusiness Day	Business Day	Nonbusiness Day
0-49.99	25.66	11.00	28.01	13.00	31.62	19.61
50.00-54.99	24.67	11.00	26.95	13.00	31.51	19.53
55.00-59.99	24.36	11.00	26.57	13.00	31.30	19.40
60.00-64.99	24.06	11.00	26.24	13.00	31.12	19.30
65.00-69.99	23.80	11.00	26.11	13.00	30.97	19.20
70.00-74.99	23.57	11.00	25.85	13.00	30.84	19.13
75.00-79.99	23.35	11.00	25.60	13.00	30.73	19.05
80.00-84.99	23.17	11.00	25.38	13.00	30.50	18.91
85.00-89.99	22.93	11.00	25.23	13.00	30.18	18.71
90.00-94.99	22.55	11.00	25.14	13.00	29.90	18.54
95.00-99.99	22.36	11.00	24.90	13.00	29.64	18.38
100-104.99	22.19	11.00	24.70	13.00	29.42	18.24
105-109.99	22.03	11.00	24.51	13.00	29.20	18.11
110-114.99	21.89	11.00	24.33	13.00	29.01	17.98
115-119.99	21.76	11.00	24.18	13.00	28.84	17.88
120-124.99	21.63	11.00	24.03	13.00	28.68	17.78
125-129.99	21.52	11.00	23.90	13.00	28.53	17.69
130-134.99	21.42	11.00	23.77	13.00	28.40	17.61
135-139.99	21.32	11.00	23.66	13.00	28.26	17.52
140-144.99	21.24	11.00	23.55	13.00	28.15	17.45
145-149.99	21.16	11.00	23.45	13.00	28.04	17.39
150-154.99	21.08	11.00	23.36	13.00	27.93	17.32
155-159.99	21.01	11.00	23.28	13.00	27.84	17.27
160-164.99	20.94	11.00	23.20	13.00	27.75	17.21
165-169.99	20.88	11.00	23.12	13.00	27.67	17.15
170-174.99	20.82	11.00	23.05	13.00	27.58	17.10
175-179.99	20.76	11.00	22.98	13.00	27.51	17.06
180-184.99	20.71	11.00	22.91	13.00	27.44	17.01
185-189.99	20.66	11.00	22.85	13.00	27.38	16.97
190-194.99	20.61	11.00	22.79	13.00	27.31	16.93
195-199.99	20.56	11.00	22.74	13.00	27.24	16.89
200-204.99	20.52	11.00	22.69	13.00	27.19	16.86
205-209.99	20.48	11.00	22.64	13.00	27.13	16.82
210-214.99	20.44	11.00	22.59	13.00	27.08	16.79
215-219.99	20.40	11.00	22.54	13.00	27.04	16.76
220-224.99	20.36	11.00	22.50	13.00	26.99	16.74
225-229.99	20.33	11.00	22.46	13.00	26.94	16.71
230-234.99	20.30	11.00	22.42	13.00	26.89	16.68
235-239.99	20.27	11.00	22.38	13.00	26.86	16.65
240-244.99	20.24	11.00	22.34	13.00	26.81	16.62
245-249.99	20.21	11.00	22.31	13.00	26.77	16.59
250-OVER	20.20	11.00	22.30	13.00	26.76	16.59

Traffic Charges—Off-Net Voice Calling

Analog voice-grade calls to off-net stations in the contiguous United States, Puerto Rico, the United States Virgin Islands, and specified locations within Canada will be routed via SBS-provided facilities, in which event the rates presented in **Tables 3 and 4** will apply.

Off-Net Calling rates are separated into 3 tiers which correspond to calling areas. Tier I and Tier II cities are presented under SNS Access. The Tier III calling area is the contiguous United States, Puerto Rico, and the U.S. Virgin Islands, exclusive of the Tier I and II calling areas. Canadian Off-Net Voice Calling is divided into 2 Tiers.

The capability to call Canadian locations is available to customers served via a NAC or via an SBS-provided facility that was formerly an SNS NAC on the customer's premises.

Analog voice-grade calls may also be routed to customer-specified/customer-provided facilities or services in which event the customer will be responsible for acquiring the interconnected facilities or services.

The number of equivalent Access Channels to be used in calculating usage charges for SNS Off-Net Voice Calling will be determined according to the customer's actual SNS Off-Net Voice Calling usage, including usage via any Virtual FX Routes, for the billing period, originating from each Service Point or NAC. The number of equivalent Access Channels is the lesser of the number of SNS Off-Net Voice Calling business day hours or total hours, as presented in **Table 5**.

Virtual FX is an SNS Off-Net Voice Calling feature charged for on a fixed rather than a usage basis for a specified amount of calling capacity during a monthly billing period. Virtual FX if furnished via routes that provide for the calling capability, form a single Service Point or NAC at which Virtual FX calls originate, through SBS's access and switching facilities in a Virtual FX originating city and to the local calling area of a Virtual FX terminating city. Routes between Virtual FX originating cities and terminating cities are grouped into 5 rate categories, as presented in **Table 6**.

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Table 4 • SNS Off-Net Voice Calling • Canadian Usage Rate Schedule.

Service Point Location	Canadian Tier I Rates* (¢/Minute) Business Day	Non-business Day	Canadian Tier II Rates** (¢/Minute) Business Day	Non-business Day
Atlanta, GA	60	45	65	45
Boston, MA	50	35	65	45
Chicago, IL	50	35	65	45
Cincinnati, OH	55	40	65	45
Dallas, TX	60	45	65	45
Denver, CO	65	45	65	45
Detroit, MI	45	35	65	45
Hartford, CT	50	35	65	45
Houston, TX	60	45	65	45
Los Angeles, CA	65	45	65	45
Miami, FL	60	45	65	45
Minneapolis, MN	60	45	65	45
New Orleans, LA	60	45	65	45
New York, NY	45	35	65	45
Philadelphia, PA	50	35	65	45
Pittsburgh, PA	55	40	65	45
Phoenix, AZ	65	45	65	45
St. Louis, MO	60	45	65	45
San Francisco, CA	65	45	65	45
Seattle, WA	65	45	45	35
Washington, D.C.	55	40	65	45

*served by area codes 416 (Toronto), 514 (Montreal), and 613 (Ottawa).
**served by area codes 403 (Alberta) and 604 (British Columbia).

Table 5 • Equivalent Access Channels Per Hours of SNS Off-Net Usage Originating at a Service Point or NAC.

Business Day Hours (Up to and including)	Total Hours (Up to and including)	Equivalent Access Channels
35	49	1
111	154	2
206	288	3
313	441	4
428	602	5
547	789	6
671	984	7
798	1,188	8
927	1,399	9
1,058	1,616	10
1,191	1,838	11
1,326	2,067	12
1,462	2,299	13
1,599	2,539	14
1,737	2,781	15
1,876	3,009	16
2,016	3,283	17
2,156	3,541	18
2,297	3,809	19
2,438	4,082	20
2,580	4,359	21
2,722	4,638	22
2,865	4,920	23
3,008	5,204	24
3,152	5,491	25
*	**	1

*For each 145 hours, or fraction thereof, in excess of 3,152 hours
**For each 290 hours, or fraction thereof, in excess of 5,491 hours

Table 6 • SBS-SNS Virtual FX City-Pair Rate Categories.

	Atlanta	Boston	Chicago	Cincinnati	Dallas	Denver	Detroit	Houston	Los Angeles	Miami	Minneapolis	New Orleans	New York	Philadelphia	Phoenix	Pittsburgh	San Francisco	St. Louis	Seattle	Washington
Atlanta	—	C	A	A	A	C	A	A	D	A	C	A	A	A	E	A	D	A	D	A
Boston	C	—	B	A	C	E	A	D	D	D	C	D	A	A	E	A	D	C	E	A
Chicago	A	B	—	A	B	B	A	B	B	B	A	B	A	A	D	A	B	A	B	A
Cincinnati	A	A	A	—	B	C	A	B	D	C	A	B	A	A	E	A	D	A	E	A
Dallas	A	C	B	B	—	A	C	*	C	C	B	A	C	D	C	C	C	A	C	C
Denver	C	E	B	C	A	—	D	B	D	B	C	C	C	A	C	B	B	C	C	C
Detroit	A	A	A	A	C	D	—	C	D	D	A	C	A	A	E	A	D	A	E	A
Houston	A	D	B	B	*	B	C	—	B	B	C	A	B	D	C	D	B	A	B	A
Los Angeles	D	D	B	D	C	B	D	B	—	D	D	E	D	D	A	D	*	D	B	D
Miami	A	D	B	C	C	D	D	B	D	—	E	B	B	B	E	C	D	C	D	B
Minneapolis	C	C	A	A	B	B	A	C	D	E	—	D	C	C	D	B	D	A	E	C
New Orleans	A	A	A	A	C	C	A	B	D	B	D	—	D	D	D	C	E	A	E	C
New York	A	A	A	A	C	C	A	B	D	B	C	D	—	A	E	A	D	B	E	A
Omaha	B	D	A	A	A	A	A	B	C	D	A	B	C	C	C	B	C	A	D	B
Philadelphia	A	A	A	A	D	C	A	D	D	B	C	D	A	—	E	*	D	B	E	A
Phoenix	E	E	D	E	C	A	E	C	A	E	D	D	E	E	—	E	A	D	D	D
Pittsburgh	A	A	A	A	C	C	A	D	D	C	B	C	A	*	E	—	D	A	E	A
San Francisco	D	D	B	D	C	B	D	B	*	D	D	E	D	D	A	D	—	D	B	D
St. Louis	A	C	A	A	A	B	A	A	D	C	A	A	B	B	D	A	D	—	E	A
Seattle	D	E	B	E	C	C	E	B	B	D	E	E	E	E	D	E	B	E	—	D
Tampa	A	D	B	C	C	D	D	B	D	*	E	B	B	B	E	C	D	C	D	B
Washington	A	A	A	A	C	C	A	B	D	B	C	C	A	A	D	A	D	A	D	—

*Service for this Route is not available under this tariff.

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Speed	Monthly Recurring Charge	Usage Charge Per CAU			
9600 bps	$ 350	$ 1.50/hr.			
56K bps	770	10.00/hr.			
		Scheduled		Late Scheduled	
		Bus	Non-Bus	Bus	Non-Bus
1.344/1.544M bps	3,000	$150/hr.	N/A	$500/hr.	$200/hr.

The total business day and the total nonbusiness day calling capacities to which the virtual FX rate applies are specified in **Table 7**. Usage in excess of these calling capacity levels for any Virtual FX route will be included in the standard SNS Off-Net Voice Calling usage. Off-Net Virtual FX usage charges are presented in **Table 8**.

Switched Digital CAUs • designed for connections that use analog, voice-grade access lines for signaling • supports synchronous traffic only • RS-499/-422A interfaces • installation charge is $200 per CAU; monthly recurring charge and usage charge are presented above.

SNS Access

SNS Off-Net Calling areas are divided into tiers for billing purposes. Tier I consists of the local calling areas of 20 major cities. Tier II consists of the local calling areas of 320 cities, excluding Tier I cities. Tier III calling area is the contiguous U.S. Puerto Rico, and the U.S. Virgin Islands, exclusive of the Tier I and II calling areas. Canadian calling areas are divided into 2 tiers. Tier I areas are defined by area codes 416, 514, and 613; Tier II areas are defined by area codes 403 and 604.

SNS Tier I Cities

Arizona • Phoenix.

California • Los Angeles; San Francisco.

Colorado • Denver.

District of Columbia • Washington.

Florida • Miami.

Georgia • Atlanta.

Illinois • Chicago.

Louisiana • New Orleans.

Massachusetts • Boston.

Michigan • Detroit.

Minnesota • Minneapolis.

Missouri • St. Louis.

New York • New York.

Ohio • Cincinnati.

Pennsylvania • Philadelphia, Pittsburgh.

Texas • Dallas; Houston.

Washington • Seattle.

SNS Tier II Cities

Alabama • Anniston; Bessemer; Birmingham; Huntsville; Mobile; Montgomery; Prattville; Wetumpka.

Arizona • Tucson; Yuma.

Arkansas • Little Rock.

California • Anaheim; Bakersfield; Chula Vista; Colton; Concord; Fair Oaks; Fontana; Fremont; Fresno; Fullerton; Huntington Beach; La Jolla; La Mesa; Ontario; Palo Alto; Redlands; Rialto; Riverside; Sacramento; San Bernadino; San Diego; San Jose; San Luis Obispo; Santa Ana; Stockton; Sunnyvale; Walnut Creek.

Colorado • Colorado Springs; Pueblo.

Connecticut • New Britain; Bridgeport; Bristol; Danbury; Fairfield; Farmington; Hartford; Manchester; Meriden; Middletown; New Haven; New London; Norwalk; Norwich; Stamford; Waterbury.

Delaware • Newark; Wilmington.

Florida • Boca Raton; Cocoa; Daytona Beach; Ft. Lauderdale; Jacksonville; Melbourne; Orlando; Pensacola; St. Petersburg; Tampa; West Palm Beach.

Georgia • Augusta; Macon; Savannah.

Idaho • Lewiston.

Illinois • Joliet; Peoria; Rock Island; Rockford; Springfield.

Indiana • Indianapolis; Bloomington; Evansville; Ft. Wayne; Gary; Lawrence; Muncie; New Albany; South Bend.

Iowa • Davenport; Des Moines.

Kansas • Atchinson; Leavenworth; Olathe; Paola; Wichita.

Kentucky • La Grange; Lexington; Louisville; Paducah; Winchester.

Louisiana • Baton Rouge; Bogulusa; Covington; Hammond; Houma; Lafayette; Morgan City; Shreveport; Slidell; Thibodaux.

Maryland • Annapolis; Baltimore; Catonsville; Dundalk; Glen Burnie; Towson.

Massachusetts • Brockton; Framington; Lowell; Maynard; Natick; Springfield; Worcester.

Michigan • Ann Arbor; Flint; Grand Rapids; Kalamazoo; Lansing; Pontiac; Saginaw.

Mississippi • Gulfport.

Missouri • Brookfield; Chillicothe; Clinton; Gladstone; Independence; Kansas City; Kirksville; Lexington; Macon; Marshall; Maryville; Moberly; Raytown; Sedalia; St. Joseph; Trenton; Warrensburgh.

Nebraska • Omaha.

Nevada • Las Vegas; Reno.

New Hampshire • Nashua; Pelham; Salem.

New Jersey • Asbury Park; Atlantic City; Camden; Englewood; Hackensack; Haddonfield; Long Branch; Moorestown; Morristown; Mount Holly; New Brunswick; Newark; Orange; Passaic; Paterson; Plainfield; Pleasantville; Rahway; Ramsey; Red Bank; Somerville; Trenton; Union City.

New Mexico • Albuquerque.

New York • Albany; Binghamton; Buffalo; Garden City; Mid-Nassau County; Poughkeepsie; Rochester; Schenectady; Syracuse; Tonawanda; Troy; West Seneca; White Plains; Williamsville; Yonkers.

North Carolina • Charlotte; Greensboro; Raleigh; Winston-Salem.

Ohio • Akron; Brook Park; Canton; Cleveland; Columbus; Dayton; Euclid; Maple Heights; North Olmsted; Reynoldsburg; Springfield; Toledo; Warren; Worthington; Youngstown.

Oklahoma • Collinsville; Edmond; Enid; Jenks; Lawton; Norman; Oklahoma City; Sapulpa; Tulsa.

Oregon • Albany; Astoria; Beaverton; Bend; Coos Bay; Corvallis;

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Table 7 • SBS SNS Virtual FX Usage Rates.

Number of Channels per Route		Monthly Calling Capacity Level per Route by Rate Category (Minutes)				
		A	**B**	**C**	**D**	**E**
1	Business Day	4500	5400	6000	6600	7200
	Nonbusiness Day	1800	2100	2100	2100	2400
2	Business Day	9300	11100	12300	13500	14700
	Nonbusiness Day	3600	4200	4500	4800	5100
3	Business Day	14400	17100	18900	20700	22500
	Nonbusiness Day	5700	6600	6900	7500	8100
4	Business Day	19800	23400	25800	28200	30600
	Nonbusiness Day	8100	9300	9600	10500	11400
5	Business Day	27300	31200	33000	36000	40200
	Nonbusiness Day	11100	12600	13200	13800	15000
6	Business Day	35700	40200	42300	45900	51000
	Nonbusiness Day	15900	17400	18300	18900	20100
7	Business Day	44400	49500	51900	55800	61800
	Nonbusiness Day	20700	22800	23700	24900	26100
8	Business Day	53400	58800	61800	66000	72600
	Nonbusiness Day	26100	28500	29400	30900	32700
9	Business Day	62400	68400	71700	76200	83400
	Nonbusiness Day	31800	34500	35400	37200	39600
10	Business Day	71400	78300	81600	86700	94200
	Nonbusiness Day	37800	40500	42000	43800	46500
11	Business Day	80700	88500	91500	97200	105000
	Nonbusiness Day	43800	46800	48900	50700	54000
12	Business Day	90000	98700	101700	107700	116100
	Nonbusiness Day	50400	53400	55800	57900	61500
13	Business Day	99600	108900	111900	118500	127200
	Nonbusiness Day	57000	60300	63000	65100	69600
14	Business Day	109200	119100	122400	129300	138300
	Nonbusiness Day	64200	67500	70200	72600	78000
15	Business Day	118800	129300	132900	140100	149400
	Nonbusiness Day	71400	75000	78000	80400	86400
16	Business Day	128400	139500	143400	150900	160500
	Nonbusiness Day	78900	82800	85800	88500	95100
17	Business Day	138000	149700	153900	161700	171600
	Nonbusiness Day	86700	90900	93900	97500	104400
18	Business Day	147600	159900	164400	172500	182700
	Nonbusiness Day	94800	99300	102600	106800	114000
19	Business Day	157200	170100	174900	183300	193800
	Nonbusiness Day	103500	108300	111900	116100	123900
20	Business Day	166800	180300	185400	194100	205200
	Nonbusiness Day	112500	117600	121500	125700	133800
21	Business Day	176400	190500	195900	204900	216600
	Nonbusiness Day	121800	127200	131100	135600	144000
22	Business Day	186300	200700	206400	215700	228000
	Nonbusiness Day	131100	137100	141300	145800	154800
23	Business Day	196200	210900	216900	226500	239400
	Nonbusiness Day	141000	147600	151800	156600	165900
24	Business Day	206100	221100	227400	237300	250800
	Nonbusiness Day	151200	158400	162600	167700	177300
25	Business Day	216000	231300	237900	248100	262200
	Nonbusiness Day	161700	169500	173700	179400	189300
	Additional Calling Capacity for each Additional Channel					
	Business Day	9900	10200	10500	10800	11400
	Nonbusiness Day	10500	11100	11400	11700	12000

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Table 8 • SNS Off-Net Virtual FX Usage Charges.

Number of Channels per Route	Rate Categories A	B	C	D	E
1	$ 870	$ 1,050	$ 1,180	$ 1,310	$ 1,440
2	$ 1,648	$ 2,031	$ 2,288	$ 2,578	$ 2,866
3	$ 2,405	$ 3,009	$ 3,402	$ 3,860	$ 4,320
4	$ 3,139	$ 3,966	$ 4,515	$ 5,146	$ 5,796
5	$ 4,067	$ 5,089	$ 5,617	$ 6,425	$ 7,505
6	$ 5,028	$ 6,304	$ 6,950	$ 7,926	$ 9,335
7	$ 5,986	$ 7,503	$ 8,250	$ 9,394	$11,058
8	$ 6,943	$ 8,687	$ 9,536	$10,847	$12,766
9	$ 7,887	$ 9,857	$10,822	$12,286	$14,460
10	$ 8,843	$11,040	$12,128	$13,725	$16,140
11	$ 9,786	$12,210	$13,378	$15,163	$17,806
12	$10,729	$13,378	$14,662	$16,588	$19,485
13	$11,684	$14,547	$15,932	$18,025	$21,149
14	$12,626	$15,716	$17,215	$19,462	$22,814
15	$13,568	$16,884	$18,485	$20,885	$24,465
16	$14,510	$18,052	$19,754	$22,308	$26,115
17	$15,451	$19,219	$21,023	$23,730	$27,766
18	$16,393	$20,387	$22,292	$25,152	$29,403
19	$17,334	$21,553	$23,561	$26,574	$31,039
20	$18,275	$22,720	$24,828	$27,996	$32,687
21	$19,204	$23,887	$26,097	$29,418	$34,335
22	$20,145	$25,041	$27,365	$30,839	$35,983
23	$21,085	$26,194	$28,633	$32,260	$37,631
24	$22,026	$27,348	$29,900	$33,681	$39,279
25	$22,966	$28,501	$31,167	$35,102	$40,927
Each Additional	$ 935	$ 1,150	$ 1,260	$ 1,420	$ 1,630

Eugene; Grants Pass; Hillsboro; Klamath Falls; McMinnville; Medford; Pendleton; Portland; Roseburg; Salem; The Dalles.

Pennsylvania • Allentown; Bethlehem; Canonsburg; Erie; Harrisburg; Lancaster; Reading; Scranton; Washington; Wilkes-Barre; York.

Rhode Island • Cranston; Pawtucket; Providence; Warwick.

South Carolina • Charleston; Columbia; Greenville; Spartanburg.

Tennessee • Arlington; Franklin; Knoxville; Memphis; Nashville.

Texas • Abilene; Angelton; Arlington; Austin; Baytown; Beaumont; Brenham; Bryan; College Station; Crockett; El Paso; Freeport; Ft. Worth; Galveston; Huntsville; Liberty; Lubbock; Lufkin; Nacogdoches; Navasota; Nederland; New Braunfels; San Antonio; Texas City; Wharton.

Utah • Salt Lake City.

Virginia • Fredericksburg; Lynchburg; Newport News; Norfolk; Richmond; Roanoke.

Washington • Aberdeen; Bellingham; Bremerton; Centralia; Everett; Kennelwick; Longview; Olympia; Pasco; Pullman; Richland; Shelton; Spokane; Tacoma; Vancouver; Walla Walla; Yakima.

West Virginia • Charleston.

Wisconsin • Madison; Milwaukee.

Wyoming • Cheyenne.

SNS Other Charges

Maintenance Service Charges • a service charge per man-hour or the major fraction thereof, with a minimum charge of 1 man-hour, applies during normal working hours 8:30 AM to 5:00 PM, local time, Monday through Friday, except holidays or a charge per man-hour or major fraction thereof, with a minimum charge of 4 hours, applies outside the normal working hours; however, when maintenance service begins during normal working hours and continues outside normal working hours, the charges for normal and outside normal hours applies according to the time of day during which service is performed • charges for normal and outside normal working hours are:

$85/hr	$100/hr

SNS Routing Arrangement • requires a nonrecurring charge per routing arrangement, per NAC:

500

T-1 Access • for T-1 access, the customer shall pay SBS at the rates specified in the tariff of the other common carrier, or in the contract between SBS and the other common carrier from which the facility or service is obtained, plus nonrecurring and monthly recurring administrative charges per T-1 access channel • nonrecurring and monthly recurring charge:

25 OTC	12 mo

Off-Net Screening Control • a nonrecurring and monthly recurring charge applies per NPA screened at a service point • nonrecurring and monthly recurring charges are:

75	25

Off-Net Overflow Pattern • a nonrecurring, plus monthly recurring charge and a charge per change in pattern applies to each service point • nonrecurring, monthly recurring and change charges are:

75 OTC	40 mo	15 chg

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Move Charges • when, at a customer's request, the physical location of an SBS-provided service component is changed at the customer premises, special service charges apply.

Deferral of Requested Operational Dates • for the deferral of the requested operational date, nonrecurring charges apply • charges are:

Service Component	Request Received Within 30 Days of Operational Date	After 30 Days of Operational Date
Service Point	$560	$560
Analog Voice-Grade CAU	145	75
Service Point Extension	120	75
Optional Service Features	.75x installation charge plus .75x1 month's recurring charge for the feature	.75x installation charge for the feature

Cancellation Charges • for cancellation of service components, nonrecurring charges apply • charges are:

Service Component	Request Received Within 30 Days of Operational Date	After 30 Days of Operational Date
Service Point	1,500	1,500
Analog Voice-Grade CAU	195	100
Service Point Extension	160	100
Service Extension	100	65
Optional Service Features	Installation charge plus 1 month's recurring charge for feature	Installation charge for feature

SNS Migration Charges • to achieve the migration of existing customers to alternative facilities, SBS will absorb all nonrecurring charges imposed by the other common carriers in connection with the acquisition by SBS of alternative facilities or the services necessary to provide service extensions and service-point extensions at the alternative service locations, and reimburse the customers for all nonrecurring charges imposed by the customer's switch vendor(s) in connection with the acquisition by customers of switch terminations necessary to accommodate service at such alternative service locations.

In addition, for the period of time it deems necessary to transition each customer's service to alternative SBS-provided facilities, SBS will absorb the monthly charges and reimburse the customer as outlined above.

SBS-Provided Transmission Component Charge • for each SBS-provided transmission component necessary to satisfy the minimum requirements for SNS Network limits, a monthly accurring charge will apply:

275 mo

■ SBS SKYLINE WATS

Skyline WATS is a switched voice communication service for businesses with medium- to high-volume telephone use. This service allows customers in or near cities in the U.S. to place interstate calls in the contiguous U.S., Puerto Rico, and the U.S. Virgin Islands using SBS-owned and operated switching centers (earth stations). In some states, intrastate calling is also authorized.

Access to the SBS National Network is provided through dedicated access channels from the customer's serving vehicle (PBX/Centrex) to a nearby SBS switching center. Most calls are transmitted via satellite to a switching center to the call's destination. Egress through the switching center to the call's destination is furnished through shared terrestrial telephone facilities either ENFIA or WATS, acquired by SBS from other common carriers.

Traffic Charges

Traffic charges are determined by call, volume, time of day, tier distribution, and state from which call **originates**.

Calls can be originated through any of the 23 SBS Skyline switching centers located in Arab (Alabama), Atlanta, Boston, Chicago, Cincinnati, Dallas, Denver, Detroit, Houston, Los Angeles, Miami, Minneapolis, New Orleans, New York, Omaha, Philadelphia, Phoenix, Pittsburgh, St. Louis, San Francisco, Seattle, Tampa, and Washington, DC.

There are 4 geographic areas, or tiers, where calls terminate. Tier I consists of the local calling areas of 20 major metropolitan SBS Network cities; Tier II consists of the local calling areas of about 320 additional frequently called cities; Tier III covers the remainder of the contiguous U.S., Puerto Rico, and the U.S. Virgin Islands. Tier IV is equivalent to traditional WATS Band I coverage.

Skyline WATS has 2 rate periods: business day rates apply to calls originating between 8:00 AM and 5:00 PM, local time at the call originating center, Monday through Friday; nonbusiness day rates apply to calls originated from 5:00 PM to 8:00 AM weekdays, and 24 hours on weekends and holidays. Rates are based on local time of day at the originating switching center. Service is also available to most of Canada at special rates. Per-minute usage charges are lowest in Tier I, highest in Tier II, and decrease across all tiers during the business day as calling volumes per dedicated channel increases. Skyline WATS usage charges are presented in **Table 9**.

In addition to per-minute usage charges, there is a one-time installation charge and a monthly recurring charge for each access channel, as well as a minimum usage charge per access channel. The minimum usage charge, however, is waived, if average total hours per access channel is greater to or equal to 50 hours. Monthly minimum usage charge:

$400 mo

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Table 9 • SBS Skyline WATS Usage Charges.

		Average Total Usage Hours Per Access Channel			Usage Charge Per Minute		
Tier	**State**	**AC Low**	**AC High**	**BS High**	**BS Low**	**NB High**	**NB Low**
I	AL	0.0000	250.0000	0.2747	0.2020	0.1100	0.1100
I	AZ	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	AR	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	CA-N	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	CA-S	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	CO	0.0000	250.0000	0.2747	0.1999	0.1100	0.1100
I	CT	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	DE	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	DC	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	FL	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	GA	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	ID	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	IL	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	IN	0.0000	250.0000	0.2747	0.2999	0.1100	0.1100
I	IA	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	KS	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	KY	0.0000	250.0000	0.2747	0.2020	0.1100	0.1100
I	LA	0.0000	250.0000	0.2747	0.1999	0.1100	0.1100
I	ME	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	MD	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	MA	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	MI	0.0000	250.0000	0.2747	0.2020	0.1100	0.1100
I	MN	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	MS	0.0000	250.0000	0.2747	0.1999	0.1100	0.1100
I	MO	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	MT	0.0000	250.0000	0.2747	0.2020	0.1100	0.1100
I	NE	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	NV	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	NH	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	NJ	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	NM	0.0000	250.0000	0.2747	0.2020	0.1100	0.1100
I	NY-NE	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	NY-SE	0.0000	250.0000	0.2747	0.2020	0.1100	0.1100
I	NY-W	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	NC	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	ND	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	OH	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	OK	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	OK	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	OR	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	PA-E	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	PA-W	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	RI	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	SC	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	SD	0.0000	250.0000	0.2747	0.1979	0.1100	0.1100
I	SC	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	TN	0.0000	250.0000	0.2747	0.2020	0.1100	0.1100
I	TX-E	0.0000	250.0000	0.2747	0.1999	0.1100	0.1100
I	TX-S	0.0000	250.0000	0.2747	0.1999	0.1100	0.1100
I	TX-W	0.0000	250.0000	0.2747	0.1999	0.1100	0.1100
I	UT	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	VT	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	VA	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	WA	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	WV	0.0000	250.0000	0.2747	0.2040	0.1100	0.1100
I	WI	0.0000	250.0000	0.2747	0.1999	0.1100	0.1100
I	WY	0.0000	250.0000	0.2747	0.1999	0.1100	0.1100
II	AL	0.0000	250.0000	0.2937	0.2230	0.1300	0.1300
II	AZ	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	AR	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	CA-N	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	CA-S	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	CO	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
II	CT	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	DE	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	DC	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300

Satellite Business Systems (SBS) Communication Services
CNS, SNS & Skyline WATS, FX, LD & Toll-Free Services

Table 9 • SBS Skyline WATS Usage Charges (Cont).

Tier	State	Average Total Usage Hours Per Access Channel		Usage Charge Per Minute			
		AC Low	AC High	BS High	BS Low	NB High	NB Low
II	FL	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	GA	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	ID	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	IL	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	IN	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
II	IA	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	KS	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	KY	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	LA	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
II	ME	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	MD	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	MA	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	MI	0.0000	250.0000	0.2937	0.2230	0.1300	0.1300
II	MN	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	MS	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
II	MO	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	MO	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	MT	0.0000	250.0000	0.2937	0.2230	0.1300	0.1300
II	NE	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	NV	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	NH	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	NJ	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	NM	0.0000	250.0000	0.2937	0.2230	0.1300	0.1300
II	NY-NE	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	NY-SE	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	NY-W	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	NC	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	ND	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	OH	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	OK	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	OR	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	PA-E	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	PA-W	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	RI	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	SC	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	SD	0.0000	250.0000	0.2937	0.2150	0.1300	0.1300
II	TN	0.0000	250.0000	0.2937	0.2230	0.1300	0.1300
II	TX-E	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
II	TX-S	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
II	TX-W	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
II	UT	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	VT	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	VA	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	WA	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	WV	0.0000	250.0000	0.2937	0.2275	0.1300	0.1300
II	WI	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
II	WY	0.0000	250.0000	0.2937	0.2184	0.1300	0.1300
III	AL	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	AZ	0.0000	250.0000	0.3162	0.2767	0.1962	0.1716
III	AR	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	CA-N	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	CA-S	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	CO	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	CT	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	DE	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	DC	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	FL	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	GA	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	ID	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	IL	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	IN	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	IA	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	KS	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	KY	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	LA	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	ME	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716

Satellite Business Systems (SBS) Communication Services
CNS, SNS & Skyline WATS, FX, LD & Toll-Free Services

Table 9 • SBS Skyline WATS Usage Charges (Cont).

		Average Total Usage Hours Per Access Channel			Usage Charge Per Minute		
Tier	State	AC Low	AC High	BS High	BS Low	NB High	NB Low
III	MD	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	MA	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	MI	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	MN	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	MS	0.0000	250.0000	0.3162	0.2676	0.1961	1659.0000
III	MO	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	MT	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	NE	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	NV	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	NH	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	NJ	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	NM	0.0000	250.0000	3162.0000	0.2676	0.1961	0.1659
III	NY-NE	0.0000	250.0000	0.3162	0.2676	0.1961	0.1716
III	NY-SE	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	NY-W	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	NC	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	ND	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	OH	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	OK	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	OR	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	PA-E	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	PA-W	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	RI	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	SC	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	SD	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	TN	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	TX-E	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	TX-SO	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	TX-WO	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	UT	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	VT	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	VA	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	WA	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	WV	0.0000	250.0000	0.3162	0.2767	0.1961	0.1716
III	WV	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
III	WY	0.0000	250.0000	0.3162	0.2676	0.1961	0.1659
IV	AL	0.0000	250.0000	0.2747	0.2114	0.1786	0.1374
IV	AZ	0.0000	250.0000	0.2747	0.2114	0.1786	0.1374
IV	AR	0.0000	250.0000	0.2937	0.2243	0.1909	0.1458
IV	CA-N	0.0000	250.0000	0.2937	0.2328	0.1909	0.1458
IV	CA-S	0.0000	250.0000	0.2747	0.2229	0.1786	0.1449
IV	CO	0.0000	250.0000	0.2937	0.2376	0.1909	0.1544
IV	CT	0.0000	250.0000	0.2289	0.1890	0.1488	0.1229
IV	DE	0.0000	250.0000	0.2289	0.1890	0.1488	0.1229
IV	DC	0.0000	250.0000	0.2289	0.1890	0.1488	0.1229
IV	FL	0.0000	250.0000	0.2747	0.2229	0.1786	0.1449
IV	GA	0.0000	250.0000	0.2532	0.2077	0.1646	0.1350
IV	ID	0.0000	250.0000	0.2747	0.2174	0.1786	0.1413
IV	IL	0.0000	250.0000	0.2747	0.2086	0.1786	0.1356
IV	IN	0.0000	250.0000	0.2747	0.2178	0.1786	0.1416
IV	IA	0.0000	250.0000	0.2747	0.2086	0.1786	0.1356
IV	KS	0.0000	250.0000	0.2937	0.2243	0.1909	0.1458
IV	KY	0.0000	250.0000	0.2747	0.2040	0.1786	0.1326
IV	LA	0.0000	250.0000	0.2747	0.2178	0.1786	0.1416
IV	ME	0.0000	250.0000	0.2747	0.2174	0.1786	0.1413
IV	MD	0.0000	250.0000	0.2420	0.1991	0.1573	0.1294
IV	MA	0.0000	250.0000	0.2420	0.1991	0.1573	0.1294
IV	MI	0.0000	250.0000	0.2747	0.2114	0.1786	0.1374
IV	MN	0.0000	250.0000	0.2937	0.2328	0.1909	0.1513
IV	MS	0.0000	250.0000	0.2747	0.2178	0.1786	0.1416
IV	MO	0.0000	250.0000	0.2937	0.2243	0.1909	0.1458
IV	MT	0.0000	250.0000	0.2747	0.2114	0.1786	0.1374
IV	NE	0.0000	250.0000	0.2937	0.2243	0.1909	0.1458
IV	NV	0.0000	250.0000	0.2747	0.2174	0.1786	0.1413
IV	NH	0.0000	250.0000	0.2420	0.1991	0.1573	0.1294
IV	NJ	0.0000	250.0000	0.2289	0.1890	0.1488	0.1229

Satellite Business Systems (SBS) Communication Services
CNS, SNS & Skyline WATS, FX, LD & Toll-Free Services

Table 9 • SBS Skyline WATS Usage Charges (Cont).

Tier	State	Average Total Usage Hours Per Access Channel		Usage Charge Per Minute			
		AC Low	AC High	BS High	BS Low	NB High	NB Low
IV	NM	0.0000	250.0000	0.2747	0.2114	0.1786	0.1374
IV	NY-NE	0.0000	250.0000	0.2482	0.2028	0.1613	0.1325
IV	NY-SE	0.0000	250.0000	0.2289	0.1890	0.1488	0.1229
IV	NY-W	0.0000	250.0000	0.2482	0.2038	0.1613	0.1325
IV	NC	0.0000	250.0000	0.2532	0.2077	0.1646	0.1350
IV	ND	0.0000	250.0000	0.2937	0.2328	0.1909	0.1513
IV	OH	0.0000	250.0000	0.2747	0.2040	0.1786	0.1326
IV	OK	0.0000	250.0000	0.2937	0.2243	0.1909	0.1458
IV	OR	0.0000	250.0000	0.2747	0.2174	0.1786	0.1413
IV	PA-E	0.0000	250.0000	0.2289	0.1890	0.1488	0.1229
IV	PA-W	0.0000	250.0000	0.2482	0.2038	0.1613	0.1325
IV	RI	0.0000	250.0000	0.2289	0.1890	0.1488	0.1229
IV	SC	0.0000	250.0000	0.2532	0.2077	0.1646	0.1350
IV	SD	0.0000	250.0000	0.2937	0.2243	0.1909	0.1458
IV	TN	0.0000	250.0000	0.2747	0.2114	0.1786	0.1374
IV	TX-E	0.0000	250.0000	0.2937	0.2269	0.1909	0.1475
IV	TX-S	0.0000	250.0000	0.2937	0.2376	0.1909	0.1544
IV	TX-W	0.0000	250.0000	0.2937	0.2376	0.1909	0.1544
IV	UT	0.0000	250.0000	0.2747	0.2174	0.1786	0.1413
IV	VT	0.0000	250.0000	0.2420	0.1991	0.1573	0.1294
IV	VA	0.0000	250.0000	0.2482	0.2038	0.1613	0.1325
IV	WA	0.0000	250.0000	0.2937	0.2328	0.1909	0.1513
IV	WV	0.0000	250.0000	0.2420	0.1991	0.1573	0.1294
IV	WI	0.0000	250.0000	0.2747	0.2178	0.1786	0.1416
IV	WY	0.0000	250.0000	0.2747	0.2178	0.1786	0.1416

Call Detail

Skyline WATS customers receive with their monthly bills a printed summary of call activity and charges, plus 100-percent call detail on microfiche. Information on long-distance calls includes date and time of call, call destination, duration, and tier placement. Up to 1,000 account codes are available for a per-month per-service location fee:

$15 mo

Access Charges

Minimum service period for colocated and local access channels is 30 days; for extended access channels, telephone company minimum service period applies.

Colocated Access Channel • terminated in same building as SBS Skyline switching center • installation plus monthly charge:

$105 instal	$22 mo

Local Access Channel • terminated in SBS-specified exchanges:

105	86

Extended Access Channel • terminated elsewhere; administrative charge, plus charges of other common carrier:

NA	12

Access Cities

Skyline WATS calls may terminate anywhere in the contiguous U.S., Puerto Rico, and the U.S. Virgin Islands. Termination locations are divided into 4 tiers, 3 of which are cities, the fourth tier provides Band 1 equivalent coverage.

Tier I Cities

Arizona • Chandler; Glendale; Mesa; Phoenix; Scottsdale; Tempe.

California • Arcadia; Berkeley; Beverly Hills; Canoga Park; Compton; Covina; East Bay; El Monte; Glendale; Hayward; Inglewood; La Canada; Long Beach; Los Angeles; Oakland; Pasadena; Reseda; San Francisco; San Mateo; San Rafael; Sherman Oaks; Van Nuys; West Hollywood.

Colorado • Arvada; Aurora; Boulder; Commerce City; Denver; Englewood; Lakewood; Littleton; Thornton; Westminster; Wheat Ridge.

District of Columbia • Washington.

Florida • Coral Gables; Hollywood; Miami.

Georgia • Atlanta.

Illinois • Bensenville; Blue Island; Chicago; Downers Grove; Elk Grove; Evanston; Forest Park; Geneva; Glenview; Highland Park; Hinsdale; Maywood; Round Lake; Skokie; Wheaton.

Kentucky • Covington.

Louisiana • Gretna; Kenner; New Orleans; Marrero; Metairie.

Maryland • Bethesda; Chevy Chase; Columbia; Gaithersburg; La Plata; Rockville; Silver Spring.

Massachusetts • Boston; Cambridge; Lexington; Lynn; Randolph.

Michigan • Dearborn; Detroit; Monroe; Plymouth; Warren; Wyandotte.

Minnesota • Minneapolis; St. Paul.

Missouri • Creve Coeur; St. Charles; St. Louis; Valley Park.

New York • New York City.

Pennsylvania • Ardmore; Langhorne; McKeesport; Norristown; Paoli; Philadelphia; Pittsburgh; Wayne.

Texas • Addison; Channelview; Dallas; Houston; Irving; Pasadena; Richardson; Richmond.

Satellite Business Systems (SBS) Communication Services
CNS, SNS & Skyline WATS, FX, LD & Toll-Free Services

Virginia • Alexandria; Arlington; McLean; Reston.

Washington • Bellevue; Seattle.

Tier II Cities

Alabama • Anniston; Bessemer; Birmingham; Huntsville; Mobile; Montgomery; Prattville; Wetumpka.

Arizona • Tucson; Yuma.

Arkansas • Little Rock.

California • Anaheim; Bakersfield; Chula Vista; Colton; Concord; Fair Oaks; Fontana; Fremont; Fresno; Fullerton; Huntington Beach; La Jolla; La Mesa; Ontario; Palo Alto; Redlands; Rialto; Riverside; Sacramento; San Bernardino; San Diego; San Jose; San Luis Obispo; Santa Ana; Stockton; Sunnyvale; Walnut Creek.

Colorado • Colorado Springs; Pueblo.

Connecticut • Bridgeport; Bristol; Danbury; Fairfield; Farmington; Hartford; Manchester; Meriden; Middletown; New Britain; New Haven; New London; Norwalk; Norwich; Stamford; Waterbury.

Delaware • Newark; Wilmington.

Florida • Boca Raton; Cocoa; Daytona Beach; Ft. Lauderdale; Jacksonville; Melbourne; Orlando; Pensacola; St. Petersburg; Tampa; West Palm Beach.

Georgia • August; Macon; Savannah.

Idaho • Coeur d'Alene.

Illinois • Joliet; Peoria; Rock Island; Rockford; Springfield.

Indiana • Bloomington; Evansville; Ft. Wayne; Gary; Indianapolis; Lawrence; Muncie; New Albany; South Bend.

Iowa • Davenport; Des Moines.

Kansas • Atchinson; Leavenworth; Olathe; Paola; Wichita.

Kentucky • La Grange; Lexington; Louisville; Paducah; Winchester.

Louisiana • Baton Rouge; Bogalusa; Covington; Hammond; Houma; Lafayette; Morgan City; Shreveport; Slidell; Thibodaux.

Maryland • Annapolis; Baltimore; Catonsville; Dundalk; Glen Burnie; Towson.

Massachusetts • Brockton; Framingham; Lawrence; Lowell; Maynard; Natick; Springfield; Worcester.

Michigan • Ann Arbor; Flint; Grand Rapids; Kalamazoo; Lansing; Pontiac; Saginaw.

Mississippi • Gulfport; Jackson.

Missouri • Brookfield; Chillicothe; Clinton; Gladstone; Independence; Kansas City; Kiksville; Lexington; Macon; Marshall; Maryville; Moberly; Raytown; St. Joseph; Sedalia; Trenton; Warrensburg.

Nebraska • Omaha.

Nevada • Las Vegas; Reno.

New Hampshire • Nashua; Pelham; Salem.

New Jersey • Asbury Park; Atlantic City; Camden; Englewood; Hackensack; Haddonfield; Long Branch; Moorestown; Morristown; Mt. Holly; Newark; New Brunswick; Orange; Passaic; Paterson; Plainfield; Pleasantville; Rahway; Ramsey; Red Bank; Somerville; Trenton; Union City.

New Mexico • Albuquerque.

New York • Albany; Binghamton; Buffalo; Garden City; Mid-Nassau County; Poughkeepsie; Rochester; Schenectady; Syracuse; Tonawanda; Troy; West Seneca; White Plains; Williamsville; Yonkers.

North Carolina • Charlotte; Greensboro; Raleigh; Winston-Salem.

Ohio • Akron; Brook Park; Canton; Cleveland; Columbus; Dayton; Euclid; Maple Heights; North Olmsted; Reynoldsburg; Springfield; Toledo; Warren; Worthington; Youngstown.

Oklahoma • Colinsville; Edmond; Enid; Jenks; Lawton; Norman; Oklahoma City; Sapulpa; Tulsa.

Oregon • Albany; Ashland; Astoria; Beaverton; Bend; Coos Bay; Corvallis; Eugene; Grants Pass; Hillsboro; Klamath Falls; Medford; McMinnville; Pendleton; Portland; Roseburg; Salem; The Dalles.

Pennsylvania • Allentown; Bethlehem; Canonsburg; Erie; Harrisburg; Lancaster; Reading; Scranton; Washington; Wilkes-Barre; York.

Rhode Island • Cranston; Pawtucket; Providence; Warwick.

South Carolina • Charleston; Columbia; Greenville; Spartanburg.

Tennessee • Arlington; Chattanooga; Collierville; Franklin; Memphis; Nashville.

Texas • Abilene; Angleton; Arlington; Austin; Baytown; Beaumont; Brenham; Bryan; College Station; Crockett; El Paso; Ft. Worth; Freeport; Galveston; Huntsville; Liberty; Lubbock; Lufkin; Nacogdoches; Navasota; Nederland; New Braunfels; San Antonio; Texas City; Wharton.

Utah • Salt Lake City.

Virginia • Fredericksburg; Lynchburg; Newport News; Norfolk; Richmond; Roanoke.

Washington • Aberdeen; Bellingham; Bremerton; Centralia; Everett; Kennewick; Longview; Olympia; Pasco; Pullman; Richland; Shelton; Spokane; Tacoma; Vancouver; Walla Walla; Yakima.

West Virginia • Charleston.

Wisconsin • Madison; Milwaukee.

Wyoming • Cheyenne.

Tier III Cities

Tier III comprises the remainder of the contiguous U.S., Puerto Rico, and the Virgin Islands not included in Tier I, Tier II, or Tier IV.

Tier IV States

Tier IV provides Band 1 equivalent coverage. The states included in each band are:

Alabama • FL, GA, KY, LA, MS, SC, TN.

Arizona • CA-S, CO, NV, NM, UT.

Arkansas • LA, MS, MO, OK, TN, TX-E.

California-North • AZ, ID, NV, OR, UR, WA.

■ SBS SKYLINE FX

Skyline FX can be integrated with Skyline WATS service to provide for economical bulk calling for large-volume, long-distance Skyline WATS service from individual customer premises to destination cities on a nonusage sensitive basis. It utilizes the SBS National Network to provide a traffic alternative that combines features of traditional point-to-point service and switched services.

Skyline FX customers may order any number of intercity channels associated with a specified amount of traffic (minutes per month) for service from the customer's premises to the customer's high-traffic volume cities. The remainder of long-distance traffic will be carried as regular Skyline WATS service.

Traffic Charges

Rates are based on routes between originating cities and destination cities which are grouped into 5 categories (A through E). Rate categories for city pairs are presented in **Table 10**. There are no message unit charges.

The Skyline FX option is available for interstate traffic originating from and terminating in cities as **Tier I cities** in the SBS National Network which include Atlanta, Boston, Chicago, Cincinnati, Dallas, Denver, Detroit, Houston, Los Angeles, Miami, Minneapolis, New Orleans, Philadelphia, Phoenix, Pittsburgh, San Francisco, St. Louis, Seattle, and Washington, DC. The Tier I cities comprise a total of several hundred possible city pairs which are grouped into 5 rate categories.

Satellite Business Systems (SBS) Communication Services
CNS, SNS & Skyline WATS, FX, LD & Toll-Free Services

Table 10 • SBS Skyline FX City-Pair Rate Categories.

	Atlanta	Boston	Chicago	Cincinnati	Dallas	Denver	Detroit	Houston	Los Angeles	Miami	Minneapolis	New Orleans	New York	Philadelphia	Phoenix	Pittsburgh	San Francisco	St. Louis	Seattle	Washington
Atlanta	—	C	A	A	A	C	A	A	D	A	C	A	A	A	E	A	D	A	D	A
Boston	C	—	B	A	C	E	A	D	D	D	C	D	A	A	E	A	D	C	E	A
Chicago	A	B	—	A	B	B	A	B	B	B	A	B	A	A	D	A	B	A	B	A
Cincinnati	A	A	A	—	B	C	A	B	D	C	A	B	A	A	E	A	D	A	E	A
Dallas	A	C	B	B	—	A	C	A	C	C	B	A	C	D	C	C	C	A	C	C
Denver	C	E	B	C	A	—	D	B	B	D	B	C	C	C	A	C	B	B	C	C
Detroit	A	A	A	A	C	D	—	C	D	D	A	C	A	A	E	A	D	A	E	A
Houston	A	D	B	B	A	B	C	—	B	B	C	A	B	D	C	D	B	A	B	B
Los Angeles	D	D	B	D	C	B	D	B	—	D	D	E	D	D	A	D	A	D	B	D
Miami	A	D	B	C	C	D	D	B	D	—	E	B	B	B	E	C	D	C	D	B
Minneapolis	C	C	A	A	B	B	A	C	D	E	—	D	C	C	D	B	D	A	E	C
New Orleans	A	A	B	B	A	C	C	A	E	B	D	—	D	D	D	C	E	A	E	C
New York	A	A	A	A	C	C	A	B	D	B	C	D	—	A	E	A	D	B	E	A
Philadelphia	A	A	A	A	D	C	A	D	D	B	C	D	A	—	E	A	D	B	E	A
Phoenix	E	E	D	E	C	A	E	C	A	E	D	D	E	E	—	E	A	D	D	D
Pittsburgh	A	A	A	A	C	C	A	D	D	C	B	C	A	A	E	—	D	A	E	A
San Francisco	D	D	B	D	C	B	D	B	A	D	D	E	D	D	A	D	—	D	B	D
St. Louis	A	C	A	A	A	B	A	A	D	C	A	A	B	B	D	A	D	—	E	A
Seattle	D	E	B	E	C	C	E	B	B	D	D	E	E	E	D	E	B	E	—	D
Washington	A	A	A	A	C	C	A	B	D	B	C	C	A	A	D	A	D	A	D	—

Each rate category has an associated amount of business day (8:00 AM to 5:00 PM, Monday through Friday) and nonbusiness day usage included in the monthly rate. Calling in excess of the traffic corresponding to the ordered number of channels is treated as Skyline WATS, which is considered as overflow traffic and is billed at regular usage-sensitive Skyline WATS rates.

Skyline WATS and Skyline FX are integrated on common access channel trunk groups. With FX, each additional physical circuit carries fewer hours, meaning FX is not simply a one-for-one circuit replacement but provides, in effect, higher loading resulting in significant economies of scale and lower rates.

SBS Skyline FX rates are presented in **Table 11**. Monthly charges are based on the rate category for the city pair, number of channels ordered, and the corresponding amount of business day and nonbusiness day usage in minutes.

Access Charges

There is a one-time administrative fee per channel. Normal Skyline WATS access channel charges also apply, as do miscellaneous charges • administrative fee:

$100 OTC

■ SBS SKYLINE LONG DISTANCE

SBS Skyline Long Distance customers can reach any telephone number 24 hours a day, 365 days a year, anywhere in the contiguous U.S., Puerto Rico, and the U.S. Virgin Islands. It also reaches 80 percent of telephones in Canada, covering all major metropolitan areas. Intrastate service is also offered where authorized (California, Colorado, Florida, Georgia, Illinois, Minnesota, New York, Pennsylvania, Texas, Virginia, and Washington).

Access is available from 70 cities through 23 earth stations and switching centers in Arab, Alabama; Atlanta; Boston; Chicago; Cincinnati; Dallas; Denver; Detroit; Houston; Los Angeles; Miami; Minneapolis; New Orleans; New York; Omaha; Philadelphia; Phoenix; Pittsburgh; San Francisco; Seattle; St. Louis; Tampa; and Washington, DC.

Table 11 • SBS Skyline FX Usage Rates.

Category	Number of Channels	Minutes Busday	Minutes Nbusday	Monthly Rate
A	1	4500	1800	870
A	2	9300	3600	1648
A	0	14400	5700	2405
A	4	19800	8100	3139
A	5	27300	11100	4067
A	6	35700	159000	5028
A	7	44400	20700	5986
A	8	53400	26100	6943
A	9	62400	31800	7887
A	10	71400	37800	8843
A	11	80700	43800	9786
A	12	90000	50400	10729
A	13	99600	57000	11684
A	14	109000	64200	12626
A	15	118800	71400	13568
A	16	128400	78900	14510
A	17	138000	86700	15451
A	18	147600	94800	16393
A	19	157200	103500	17334
A	20	166800	112500	18275
A	21	176400	121800	19204
A	22	186300	131100	20145
A	23	196200	141000	21085
A	24	206100	151200	22026
A	25	216000	161700	22966
B	1	5400	2100	1050
B	2	11100	4200	2031
B	3	17100	6600	3009
B	4	23400	9300	3966
B	5	31200	12600	5089
B	6	40200	17400	6304
B	7	49500	22800	7503
B	8	58800	28500	8687
B	9	68400	34500	9857
B	10	78300	40500	11040
B	11	88500	46800	12210
B	12	98700	53400	13378
B	13	108900	60300	14547

Satellite Business Systems (SBS) Communication Services
CNS, SNS & Skyline WATS, FX, LD & Toll-Free Services

Table 11 • SBS Skyline FX Usage Rates (Cont).

Category	Number of Channels	Minutes Busday	Minutes Nbusday	Monthly Rate
B	14	119100	67500	15716
B	15	129300	75000	16884
B	16	139500	82800	18052
B	17	149700	90900	19219
B	18	159900	99300	20387
B	19	170100	108300	21553
B	20	180300	117600	22720
B	21	190500	127200	23887
B	22	200700	137100	25041
B	23	210900	147600	26194
B	24	221100	158400	27348
B	25	231300	169500	28501
C	1	6000	2100	1180
C	2	12300	45000	2288
C	3	18900	6900	3402
C	4	25800	9600	4515
C	5	33000	13200	5617
C	6	42300	18300	6950
C	7	51900	23700	8250
C	8	61800	29400	9536
C	9	71700	35400	10822
C	10	81600	42000	12128
C	11	91500	48900	13378
C	12	101700	55800	14662
C	13	111900	6300	15932
C	14	122400	70200	17215
C	15	132900	78000	18485
C	16	143400	85800	19754
C	17	153900	93900	21023
C	18	164400	102600	22292
C	18	174900	111900	23561
C	20	185400	121500	24828
C	21	195900	131100	26097
C	22	206400	141300	27365
C	23	216900	151800	28633
C	24	227400	162600	29900
C	25	237900	173700	31167
D	1	6600	2100	1310
D	2	13500	4800	2578
D	3	20700	7500	3860
D	4	28200	10500	5146
D	5	36000	13800	6425
D	6	45900	18900	7926
D	7	55800	24900	9394
D	8	66000	30900	10847
D	9	76200	37200	12286
D	10	86700	43800	13725
D	11	97200	50700	15163
D	12	107700	57900	16588
D	13	118500	65100	18025
D	14	129300	72600	19462
D	15	140100	80400	20885
D	16	150900	88500	22308
D	17	161700	97500	23730
D	18	172500	106800	25152
D	19	183300	116100	26574
D	20	194100	125700	27996
D	21	204900	135600	29418
D	22	215700	145800	30839
D	23	226500	156600	32260
D	24	237300	167700	33681
D	25	248100	179400	35102
E	1	7200	2400	1440
E	2	14700	5100	2866
E	3	22500	8100	4320
E	4	30600	11400	5796
E	5	40200	15000	7505
E	6	5100	20100	9335
E	7	61800	26100	11058
E	8	72600	32700	12766
E	9	83400	39600	14460

Table 11 • SBS Skyline FX Usage Rates (Cont).

Category	Number of Channels	Minutes Busday	Minutes Nbusday	Monthly Rate
E	10	94200	46500	16140
E	11	105000	54000	17806
E	12	116100	61500	19485
E	13	127200	69600	21149
E	14	138300	78000	22814
E	15	149400	86400	24465
E	16	160500	95100	26115
E	17	171600	104400	27766
E	18	182700	114000	29403
E	19	193800	123900	31039
E	20	205200	133800	32687
E	21	216600	144000	34335
E	22	228000	154800	35983
E	23	239400	165900	37631
E	24	250800	177300	39279
E	24	262200	189300	40927

Traffic Charges

Traffic charges are based on call destinations and the time of day a call is placed.

Location of calls include neighboring states, regional, and coast-to-coast. Neighboring state rate includes calls to adjacent states and intrastate calls; coast-to-coast rate applies to calls between states that border the Pacific Ocean and states that border the Atlantic Ocean, plus Vermont, Pennsylvania, and Washington, DC; calls to Puerto Rico and the Virgin Islands are also considered coast-to-coast; regional rates apply to all other calls. Rates are higher to Canadian areas served by Skyline and for universal access calls made from outside Skyline originating cities. Time of day includes weekdays 8:00 AM to 4:59 PM; weeknights 5:00 PM to 10:59 PM; late nights 11:00 AM to 7:59 AM, Monday through Friday; weekends 11:00 PM Friday to 7:59 AM Monday.

	Weekday	Weeknights	Late Nights	Weekends
Neighboring State	$0.27/ min	$0.15/ min	$0.11/ min	$0.11/ min
Regional	0.37	0.20	0.15	0.15
Coast-to-Coast	0.43	0.24	0.17	0.17

Canadian Calls

Skyline Long Distance per-minute call rates to Canada are divided into 4 groups that match call-originating states with call-terminating provinces.

	Weekday	Weeknights	Late Nights/ Weekends
Group I	$0.42/min	$0.29/min	$0.25/min
Group II	0.49	0.34	0.29
Group III	0.55	0.39	0.34
Group IV	0.65	0.46	0.39

Skyline calls are rounded off to the next half minute. An additional 2-percent discount is applied to next month's bill if payment is made by the discount due date. There is a per-month minimum

Satellite Business Systems (SBS) Communication Services
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usage requirement:

$15 mo

Access

Access requires no special equipment or interruption of present telephone service; it is handled through standard equipment and a Skyline authorization card.

Special Features

Travel • customer authorization codes can be activated in all cities where Skyline service originates for a one-time fee to add one city or to add all cities • customers who activate their codes in all originating cities can use the Universal Access Travel Feature to place calls at special rates to any other location in the contiguous U.S., Puerto Rico, the U.S. Virgin Islands, and to 80 percent of the telephones in Canada • one-city and all cities charges:

$4 mo **$20 mo**

Directory Assistance • customers can obtain 2 numbers in one area code through a single call which counts toward the monthly minimum usage requirement • charge per single call:

0.45 ea

Accounting Codes • for internal cost accounting, customers can obtain up to 99 two-digit codes or up to 999 three-digit codes for a monthly charge • charge for 2-digit and 3-digit codes:

$5 mo **$10 mo**

Auto-Dialing • optional E-Z Dial and E-Z Dial Plus features provide instant access to the Skyline Network • E-Z Dial requires a touch tone phone; E-Z Dial Plus is available for touch tone or rotary dial phones • E-Z Dial and E-Z Dial Plus allow local, toll-free, and/or operator-assisted calls and maintain authorization code confidentiality • E-Z Dial Plus feature and options include last number redial, control of local and/or operator-assisted calls (Restrict-A-Call), call direction through least cost routing (Route-A-Call), and abbreviated dialing (Speed-A-Call).

E-Z Dial • requires minimum monthly usage of $75; no charge when monthly usage exceeds $200 • implementation charges do not exceed $200 • charge per feature for implementation and service:

$50 instal **$6 mo**

E-Z Dial Plus • requires minimum monthly usage charge of $150; no charge when monthly usage exceeds $300 • implementation charges do not exceed $225 • charge per feature for implementation and service:

$75/$50 first/ea adt'l **$10 mo**

Call Routing • to make a long-distance call, the customer dials a national access number, a private authorization code, and the destination number • in equal access areas, customers dial 1 + area code and destination number.

Customer Service • through an online computer access to records, a centralized customer service center provides speedy attention to and resolution of questions regarding billing, order status, and service.

■ SBS SKYLINE TOLL-FREE

Skyline Toll-Free is an incoming long-distance telephone service. SBS assigns a 6-digit service code which the customer distributes to authorized callers. The customer selects the metropolitan areas from which calls can originate and the telephone number to which calls can terminate.

Calls can originate from anywhere in the contiguous U.S. Calls from direct-coverage Skyline areas, however, are billed at lower rates than calls from other (universal access) areas.

The caller uses a Touch-Tone phone to enter an SBS Skyline access number; after the dial tone, the caller enters the called party's service code. An SBS Network switch then automatically routes the call. As few as 13 digits are entered. The same digits are used in any city where the service is available. The call is billed to the called customer, who receives 100-percent call detail with the bill.

Skyline Toll-Free can process as many simultaneous calls as the customer has phone lines associated with their predesignated telephone number.

After the first minute, calls are billed in 30-second increments.

Traffic Charges

Rates are based on time of day and usage. After the first minute, a call is billed in 30-second increments; costs per minute decrease as usage increases. Day rates include 8:00 AM to 4:59 PM, Monday through Friday; evening rates include 5:00 PM to 10:59 PM, Monday through Friday; night/weekend rates include 11:00 PM to 7:59 AM, Monday through Friday, and holidays, all day and night on weekends. Volume discounts are offered on a usage-sensitive basis.

BASIC RATES

Day	Evening	Night/Weekend
$0.35/min	$0.188/min	$0.15/min

Volume Discounts

Volume discounts are a percentage of total monthly charge per customer computed at base rates. Volume discounts start after the first 50 hours and increase as usage increases.

Dollar Volume	Percentage	Rate Per Minute Day	Evening	Night/Weekend
$ 0 - 49.99	0	$0.35	$0.188	$0.15
50 - 99.99	3	0.34	0.182	0.146
100 - 249.99	5	0.333	0.179	0.143
250 - 499.99	8	0.322	0.173	0.138
500 - 749.99	12	0.308	0.165	0.132
750 - 1,499.99	15	0.298	0.160	0.128
1,500 - 4,999.99	17	0.291	0.156	0.125
5,000 - 9,999.99	19	0.284	0.152	0.122
10,000 +	21	0.277	0.149	0.119

Universal Access Rates per minute:

Day	Evening	Night/Weekend
$0.57	$0.37	$0.27

Monthly Minimum Usage

There is a monthly minimum usage charge per service code for 1 to 50 codes; or a monthly charge times the total number of service codes for 10 to 200 codes • monthly charges:

$15 mo **$50 mo**

Access

No special phone lines are required. Calls can be completed to the customer's regular business telephone number.

Customers with high-inward-incalling volumes may elect to have SBS to install Skyline Toll-Free dedicated lines. Service can be implemented through shared facilities until the dedicated lines are installed.

Access Cities

Arizona • Mesa; Phoenix; Scottsdale; Tempe; Tucson*.

Satellite Business Systems (SBS) Communication Services
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California • Anaheim; Bakersfield*; Berkeley; Beverly Hills; Burlingame; Canoga Park; Capistrano; Compton; Concord; El Monte; El Segundo; Fremont; Fullerton; Garden Grove; Glendale; Hayward; Huntington Beach; Inglewood; Long Beach; Los Angeles; Newport Beach; Oakland; Palo Alto; Pasadena; Riverside; Sacramento*; San Diego*; San Francisco; San Jose; San Mateo; San Rafael; Santa Ana; Santa Cruz; Santa Monica; Stockton*; Sunnyvale; Thousand Oaks; Torrance; Vallejo*; Van Nuys; Walnut Creek.

Colorado • Aurora; Boulder; Colorado Springs; Denver; Englewood; Golden.

Connecticut • Bridgeport*; Hartford; New Haven*; Stamford; Waterbury*.

Delaware • Wilmington.

District of Columbia • Washington.

Florida • Boca Raton; Fort Lauderdale; Hialeah; Hollywood; Miami; Orlando*; St. Petersburg*; Tampa+; West Palm Beach.

Georgia • Atlanta; Decatur; Marietta; Norcross; Smyrna.

Illinois • Bensenville; Blue Island; Chicago; Downers Grove; Elk Grove; Evanston; Forest Park; Geneva; Glenview; Hinsdale; Joliet; La Grange; Maywood; Morton Grove; Naperville; Oak Lawn; Palatine; Schaumberg; Skokie; Springfield*; Waukegan.

Indiana • Gary; Indianapolis*; South Bend*.

Kentucky • Cincinnati suburbs; Covington; Lexington*; Louisville*.

Louisiana • Baton Rouge*; Metairie; New Orleans.

Massachusetts • Bedford; Boston; Brockton; Cambridge; Framingham; Lawrence; Lowell; Maynard; Natick; Randolph; Springfield*; Worcester.

Maryland • Baltimore; Bethesda; Clarksburg; Columbia; Gaithersburg; Laurel; Rockville; Silver Spring; Suitland.

Michigan • Ann Arbor; Dearborn; Detroit; Farmington; Flint*; Grosse Pointe; Pontiac; Roseville; Southfield; Wyandotte.

Minnesota • Minneapolis; Minnetonka; St. Paul; Wayzata.

Missouri • Clayton; Creve Coeur; Hazlewood; Kansas City*; St. Charles; St. Louis.

Nebraska • Omaha+.

New Jersey • Camden; Cherry Hill; Elizabeth; Fort Lee; Hackensack; Hoboken; Jersey City; Metuchen; New Brunswick; Newark; North Bergen; Orange; Paramus; Passaic; Paterson; Rahway; Secaucus; Somerville; Summit; Teaneck; Tenafly; Trenton*; Wayne.

New York • Albany*; Bronx; Brooklyn; Long Island; Manhattan; Nassau County; New York City; Queens; Schenectady*; Staten Island; Suffolk County; Westchester County; White Plains; Yonkers.

Ohio • Akron*; Buford; Cincinnati; Clarksville; Cleveland*; Columbus*; Decatur; Goshen; Toledo*; West Chester; Youngstown.

Oregon • Portland*.

Pennsylvania • Allentown; Conshohocken; Duquesne; Erie*; Jenkintown; King of Prussia; Main Line; Monroeville; New Kensington; Norristown; Philadelphia; Pittsburgh; Reading; Washington.

Rhode Island • Providence*.

Texas • Arlington; Beaumont; Dallas; Fort Worth; Galveston; Houston; Irving; Plano; Richardson.

Utah • Salt Lake City*.

Virginia • Alexandria; Arlington; Fairfax; Falls Church; McLean; Reston; Richmond*; Springfield.

Washington • Bellevue; Everett; Kent; Olympia; Seattle; Tacoma.

Wisconsin • Milwaukee*.

SBS Skyline Toll-Free direct coverage extends to additional communities too numerous to list. Contact your local sales representative for information. Calls may also originate from non-Skyline communities at special "universal access" rates.

*Planned for 1985 service, subject to regulatory approval. This list may change.

+High-usage service currently available; basic service and call origination planned for 1985.

■ SBS SKYLINE CALL HOME

Call Home is a variation of Toll-Free. It is a service for persons away temporarily or for extended periods who frequently call long distance to a single telephone number.

☐ Additional Services

SBS Interlink International Services

Interlink includes wideband channels for advanced services to a number of other countries. SBS has operating agreements in Canada, Belgium, France, Hong Kong, Italy, Mexico, the Netherlands, Switzerland, and the United Kingdom. A number of other countries are currently being negotiated.

SBS Data Service

Data Service is a circuit-switched, high-speed data service. Options include full-time or on-demand, point-to-point or point-to-multipoint transmission, at data rates of 56K bps or 1.344/1.544M bps.

Transponder Capacity Services

SBS provides transponder services to other organizations. Each SBS satellite contains 10 transponders that receive transmissions from earth, amplify them and retransmit them to their destinations. The Ku band of frequency spectrum allows the use of relatively small dish antennas in metropolitan areas where other communications facilities frequently encounter interference and congestion.

• END

Software AG COM-PLETE
TP Monitor System

■ PROFILE

Function • TP monitor; multithread and multitasking.

Computers/Operating Systems Supported • IBM System/370, 3000, 4300, and compatible systems; DOS/VSE, OS/VS1, OS/VS2(MVS), and MVS/XA.

Networks & Protocols • SNA; all IBM protocols.

Language Interfaces • COBOL, FORTRAN, PL/1, IBM assembler.

DBMS Interfaces • directly to ADABAS; indirectly (CALL statements) to most other major DBMS products.

Native Languages • no separately defined languages.

TP & File Access Methods • CTAM, VTAM; BDAM, ISAM, VSAM.

Terminals • all standard IBM and compatible terminals.

Special Hardware/Software • optional software Conversational Transaction Processing Subsystem and Interactive Program Development Subsystem.

Security • user profile facility, user exits, plus an optional extended security system for protection to the program function level.

Logging/Accounting • links to IBM SMF file facilities.

Failure Recovery • use of hardware/software protection eliminates all storage violations; multitasking nucleus overlaps error recovery processing with normal application processing.

Current Version • 4.3.

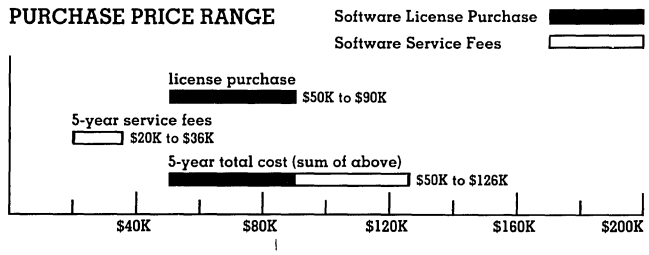
Installations • 300 estimated.

Vendor • Software AG of North America, Inc; 11800 Sunrise Valley Drive, Reston, VA 22091 • 703-860-5050.

■ ANALYSIS

COM-PLETE, unlike its sister product ADABAS from Software AG, is not as strongly characterized by its derivation from a specific technology, such as hierarchical, inverted list, or any of the other qualifiers used to describe a DBMS. COM-PLETE is a straightforward telecommunications monitoring system generically identified as a TP (teleprocessing) monitor. But in spite of its technological independence from ADABAS, COM-PLETE is a similarly well-engineered product that shows the same qualities of careful attention to detail and user-accommodating options that characterize ADABAS. Heavy emphasis is placed on application program protection. At present, COM-PLETE is one of the few IBM-oriented TP monitors that continues to compete with CICS. It is to Software AG's credit that they are prepared to maintain the commitment to COM-PLETE that is required to stay in this market. Other major TP monitor vendors have either quit the market or have let their products stagnate.

PURCHASE PRICE RANGE



SOFTWARE AG COM-PLETE PRICING • solid bar shows typical min/max configuration price range for bundled system; open bar shows corresponding service fee range for 5-year period, but fees are computed for 4 years (48 mos) because first-year service is included in license purchase price • **MINIMUM CONFIGURATION** reflects the cost for a DOS/VSE version of COM-PLETE • **MAXIMUM CONFIGURATION** is the cost for an MVS version of the system.

☐ Strengths

COM-PLETE offers an exceptionally fine range of features and facilities, but the general effect of the entire package can be best summed up by the coming-into-vogue descriptor of "robustness." Users report that COM-PLETE is practically invulnerable to user mistakes. Apparently, it can isolate and absorb local errors without causing the system to crash. This is no mean feat, and although it is not a tangible feature, such as "COM-PLETE handles xxx terminals and xx threads," it ranks very high on our list of significant intangible features.

In the more tangible realm, one of COM-PLETE's most noteworthy features is that primary system control functions are separated from the operational software and are consolidated into a group of privileged utility programs. These privileges can then be assigned to any terminal in the network to accommodate changing network conditions. Another significant feature is a linkage facility into IBM's SMF, which provides COM-PLETE with the same logging/analysis/reporting facilities available to OS/VS.

☐ Limitations

Software AG's implicit goal for COM-PLETE is to replace IBM's CICS with an easier to use and more flexible TP monitor for about the same cost, and Software AG has apparently been somewhat successful in promoting a COM-PLETE alternative to a substantial number of IBM users. However, Software AG has not yet built all the software interfaces into COM-PLETE that will permit COM-PLETE to use the large number of both IBM and non-IBM products available to CICS users. As an example, in Version 4.3 there are no DOS/VSE interfaces for the IPF and ICCF program products and DASD security is also not supported.

■ OVERVIEW

☐ Terms & Support

Terms • COM-PLETE is a software bundle whose price depends on host system; package licenses can be purchased (unlimited use) or leased; purchases can be financed through Software AG; month-to-month, 2-, 3-, 4-, or 5-year lease plans are available; discounts can be negotiated for educational users and for quantity purchasers and typically range from 25% to 80%.

Support • one-year free technical service is provided for all leased or purchased licenses; continuing technical service support is provided for an annual fee of 10% of the then-current purchase price for COM-PLETE license purchase includes a 2-day on-site orientation for the purchaser's COM-PLETE Administrator, a 4-day on-site training course, and one set of documentation; license lease includes all of the preceding; instructor expenses for on-site training and technician expenses for technical assistance are not included in the support bundle and must be borne by the user.

☐ Product Definition

COM-PLETE is a large-scale TP monitor roughly comparable to IBM's CICS. In addition to the TP kernel, there are 2 major subsystems within the COM-PLETE package: Conversational Transaction Processing (CTP) and Interactive Programming Development (IPD). The system is priced according to the operating system under which it will run.

Software AG COM-PLETE
TP Monitor System

COM-PLETE • for IBM MVS-based systems:

$90,000 lcns	$3,410/$1,750 mo	$750 serv

COM-PLETE • for IBM OS/VS1 systems:

60,000	2,556/1,182	500

COM-PLETE • for IBM DOS/VSE systems:

50,000	2,130/985	417

■ FUNCTIONAL FACILITIES

☐ Computers/Operating Systems

COM-PLETE runs on IBM System/370, 4300, 3000 Series computers, and on all comparable systems from plug-compatible vendors. It runs under OS/VS1, OS/VS2(MVS), MVS/XA, and DOS/VSE operating systems.

☐ Minimum Operating Requirements

COM-PLETE runs in a minimum memory partition of 400K bytes and can support over 20 terminals; large configurations of 1,000 or more terminals can be supported with additional user-controlled main storage allocations.

☐ Protocols & Network Interfaces

As a standalone monitor, COM-PLETE supports IBM SNA/SDLC, bisync, and async protocols in local, remote, or dial-up mode. Terminals using COM-PLETE may also be driven concurrently by another TP monitor.

☐ Access Methods

The COM-PLETE Terminal Access Method (CTAM) is functionally similar to BTAM and TCAM. The 3 terminal access methods may be used either singly or in combination. VTAM is also fully supported to provide the basis for SDLC/SNA-compatible TP operations. CTAM operates independently of the host operating system.

☐ File/DBMS Interface

Although COM-PLETE is vended as a standalone TP monitor, it is most frequently combined with Software AG's ADABAS DBMS to form the equivalent of IBM's IMS-based DB/DC facility. Non-ADABAS DBMS file support includes VSAM, ISAM, BDAM, and COM-PLETE's own sequential/direct (SD) access method, a high-performance option used primarily for temporary work files. File-related statements within programs written to VSAM files are captured and translated directly by COM-PLETE to interface between the programs and the target VSAM files.

☐ Main Storage Management

Temporary, or dynamic, buffer facilities are created and maintained by COM-PLETE for multiple job/program streams (threads) and for output spooling. Up to 15 threads can be accommodated, subject to the storage and interfacing limitations of the host systems. Thread size is fixed during execution and can range from 10K bytes to 252K bytes. Programs larger than 252K bytes are handled through overlay techniques. The same storage protection mechanism used by the operating system to prevent storage violations between partitions is used by COM-PLETE to isolate threads from each other as well as from the COM-PLETE nucleus. The output spooling task is integrated into the general message switching facility and is handled through queue-driven dynamic buffer space assignments. Any terminal in the network can be spooled, including terminals operating under HASP/JES.

Paging is implemented in 2 ways: terminal and user thread. The terminal paging task permits an operator to leaf through a multiple-page output response, to call specific pages, and to send selected pages to other terminals. The user thread paging task is handled through a dedicated, integral supervisor, which functions more as a queue/resource-driven task manager rather than as a true pager. The supervisor supports multiple threads as multiple tasks and also permits each thread to be multiprogrammed. The paging supervisor and other, similar modules common to both system tasks and to user applications are all coded as fully reentrant multithreaded modules to eliminate the need for reentrant coding in the applications.

☐ Message-Switching Facilities

The message-switching facility within a COM-PLETE network permits messages to be switched from any originating point in the system—terminal, online program, or batch program—and any messages can be discretely routed or broadcast to the network. Messages directed to an inoperative terminal can be queued and rescheduled. Any message delivery can also be defaulted to an alternate terminal, and messages can be backed up to the preceding page for retransmission over an error or failure. Any terminal can call for a 24-hour message summary and can request a transmission of any message sent during the period. Messages designated for printout are automatically spooled and queued.

■ USER INTERFACES

☐ Languages Supported

COM-PLETE interfaces with COBOL, FORTRAN, PL/1, IBM assembler, and Software AG's NATURAL fourth generation language. Several language and command extensions enable NATURAL to use the work files, color graphics, printout spooling, and screen paging facilities of COM-PLETE.

☐ Terminal User Facilities

COM-PLETE's terminal user interface is driven by a user profile system, a portion of which is available to the user to change defaults for program function keys, printout destinations, and utility functions. COM-PLETE's main menu, which is tailored for each user according to established System Administrator profiles, is the control for invoking programs and utilities. Terminal session flexibility is extended through the COM-PLETE parallel program facility, which enables the operator to address up to 10 interactive programs at one time. A program can be suspended, recalled, or swapped with another program at any time. Recalled programs resume at the point from which they were suspended. The main menu maintains a menu of currently suspended programs.

☐ Batch Facilities

Batch programs are not executed directly under COM-PLETE, but they can be manipulated by the various system facilities to better manage various operational sequences: e.g., spooling for remote print control, automatic tape capture for file recovery, and embedded security features. Related batch programs that must be executed in a sequence can also be controlled and linked more easily among remote locations through the auxiliary message facilities. Furthermore, the interactive utility component of COM-PLETE provides comprehensive batch management functions, such as remote job entry, active job monitoring, remote system console support, system queue and spool browsing, and spooling to network printers.

☐ Transaction Processing

The combination of COM-PLETE and ADABAS in a transaction processing environment supports a direct communications interface with NATURAL (an optional free-form query facility—refer to detailed product report on NATURAL which follows this report). A screen development aid is available, which enables users to "paint" the desired map on the terminal screen, eliminating the macro definition operation. The COM-PASS feature enhances flexibility by providing multiple levels of parallel program execution at each terminal. It allows users to be in conversation with several online programs simultaneously, supporting the starting, stopping, and switching between the programs in any sequence, and resuming each conversation at the point where it was interrupted. The Conversational Transaction Processing (CTP) Subsystem provides for the development of online data entry and inquiry programs and the updating of applications programs, which constitute the bulk of transaction processing tasks.

LCNS: one-time license purchase charge; includes first year of service. MO: first figure is monthly charge for a month-to-month arrangement; second figure is monthly charge on a 5-year lease plan; both figures include first-year service. SERV: monthly charge for service on an ongoing basis; applies after first year of any license arrangement. Prices are effective as of August 1984.

Software AG COM-PLETE
TP Monitor System

☐ Remote Site Support

The terminal I/O transfer facility supports access to remote processors. It allows terminals attached to a COM-PLETE, CICS, TSO, or CMS system to connect as a local user to a remote copy of COM-PLETE. Printout spooling between the connected systems is also supported. Within a single network, remote terminal users can use COM-PLETE to perform almost all of their operations and maintain tasks locally, including job submission and monitoring, system console functions, job queue management, and regular and special forms printing.

Large networks of concurrently executing programs are supported with a program-transparent rollin/rollout technique, which allows each thread to be shared by multiple programs. Any program waiting for a terminal response is automatically rolled out using a single I/O to a disk area or to an optional main storage buffer. When a terminal response is detected, the program is rolled in and program status is automatically reestablished. This same mechanism provides a program-transparent facility for suspending and reactivating (in arbitrary order) up to 10 parallel conversations per terminal user.

☐ Task Management

Separate operating system subtasks are assigned to each thread and to independent functions within the COM-PLETE nucleus, including operator communication, rollin/rollout management, message and printout management, terminal screen paging, and terminal device management.

The level of multitasking used by COM-PLETE conveys program independence from printing, screen paging, and message management functions, and allows coordinated use of network printers and other shared resources. In addition, the ability to overlap system page fault and error recovery processing with normal application processing isolates programs from the detrimental effects of unrelated processes.

☐ Programming & System Facilities

A comprehensive set of interactive utilities is included in the COM-PLETE package. They address program development, computer operations, system maintenance, problem resolution, and information management operations. There are security facilities to limit the utilities to authorized users. Utility functions include: text editing, interactive screen painting, file and catalog maintenance, system queue maintenance, and spool management. Programmers can display device status data, VTOC (Volume Table of Contents) entry data, disk record contents, and other system-related information.

☐ Message & Printout Management

The message-switching facility of COM-PLETE permits terminal messages and printouts to be routed to any combination of CRTs, printers, or users within the network. Messages and printouts may originate from both online and batch programs. In addition, many of the interactive utilities provided with the monitor include options to route system spool data, file contents, and screen images. All messages and printouts are queued automatically to their destinations, even if a device or user is unavailable. Messages and printouts can be redisplayed or reprinted anytime within 24 hours after initial transmission. A message warmstart option automatically requeues unacknowledged messages at initialization time.

☐ Security Facilities

User profiles established with a password-protected utility drive the terminal user interface. Each profile defines user defaults, restrictions on program and command use, and names and descriptions of programs listed on COM-PLETE's main menu. Further restrictions on program and file access and the use of specific utility functions can be imposed via a menu-driven extended security option. An extensive number of exit points are provided in the nucleus and in the utilities to support conditional or mandatory branches into user-defined security procedures.

☐ Accounting Facilities

System accounting relies on a software linking capability into the facilities of IBM's SMF component of OS/VS and a separate log file for DOS. Information is collected by user ID and account number. Accounting records are all optional and can be specified for log-on/log-off, program termination, and at selected user-defined points within each user session.

☐ Recovery & Integrity Facilities

An ABENDing application program is automatically intercepted, and the thread contents are rolled out to a dump file. The dump is then available for online conversational analysis and printout. ABEND processing is overlapped with normal program execution, assuring consistent system response; even in heavy test environments. Built-in hardware and software protection features insulate the system and other threads from individual program faults.

■ USER REFERENCE LIST

The following users can be contacted directly by Data Decisions subscribers for firsthand opinions and advice about the products covered in this report:

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- Mr. Ken Virgil
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  Wichita Falls, TX 76308
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• END

Sperry DCA
Distributed Communication Architecture

■ PROFILE

Architecture • Distributed Communications Architecture (DCA).

Network Configuration Summary • DCA network can include DCA hosts, DCA terminals, network processors, (front ends, nodal processors, and remote concentrators) transmission facilities, and foreign attachments; must include at least 2 Termination Systems and 2 Termination System Transport Network interfaces, such as contained in DCA host and DCA terminal • host can be Sperry 1100 or 90 Series (90/60, /70, /80 under VS9) System • DCP-10, DCP-20, and DCP-40 are the primary network processors • functioning as front-end processors, DCP-10, DCP-20, and DCP-40 support direct channel interfaces to 1 or more host systems; DCP-20 is limited to 3 directly connected hosts; DCP-40 is limited to 16 hosts; each connection reduces number of communications line modules by 1; number of communications lines supported is 192 (DCP-20) or 1,000 (DCP-40); DCP-10 limited to connection to 1 host, with 20 asynchronous lines, or 5 synchronous lines • see Figure 1.

Network Management • resides in Telcon • runs on DCP-10, DCP-20, or DCP-40.

Job/Batch Transaction Processing Management • under control of Data Management Routine (DMR) online interface between application programs and DMS 1100 database on Sperry 1100 Series hosts • under control of IMS (resident routine) online interface between application programs and DMS 90 database on Sperry 90 Series • under background batch processing facilities of VORTEX II Operating System on V77 Series; batch has zero priority in this real-time foreground/background operating system.

Transaction Processing Management • under control of Transaction Interface Package (TIP) that resides under Total Information Management System (TIMS) on Sperry 1100 host • under control of IMS (resident routine) online interface between application programs and database itself on Sperry 90 Series host • under PRONTO Monitor on V77 Series.

Database Management • via DMS 1100 for Sperry 1100 Series host; via DMS 90 for Sperry 90 Series host; Data Management Package (DMP) or TOTAL DBMS on Sperry V77 Series.

Gateways to Other Networks • to public and private X.21 circuit and X.25 packet-switched networks, such as Telenet, PSS, Transpac, and Datapac; considered subarchitectural network by DCA system • DCP also emulates IBM 3270 and 2780/3780 BSC and IBM 3270/3770 SNA protocols for access to IBM hosts •

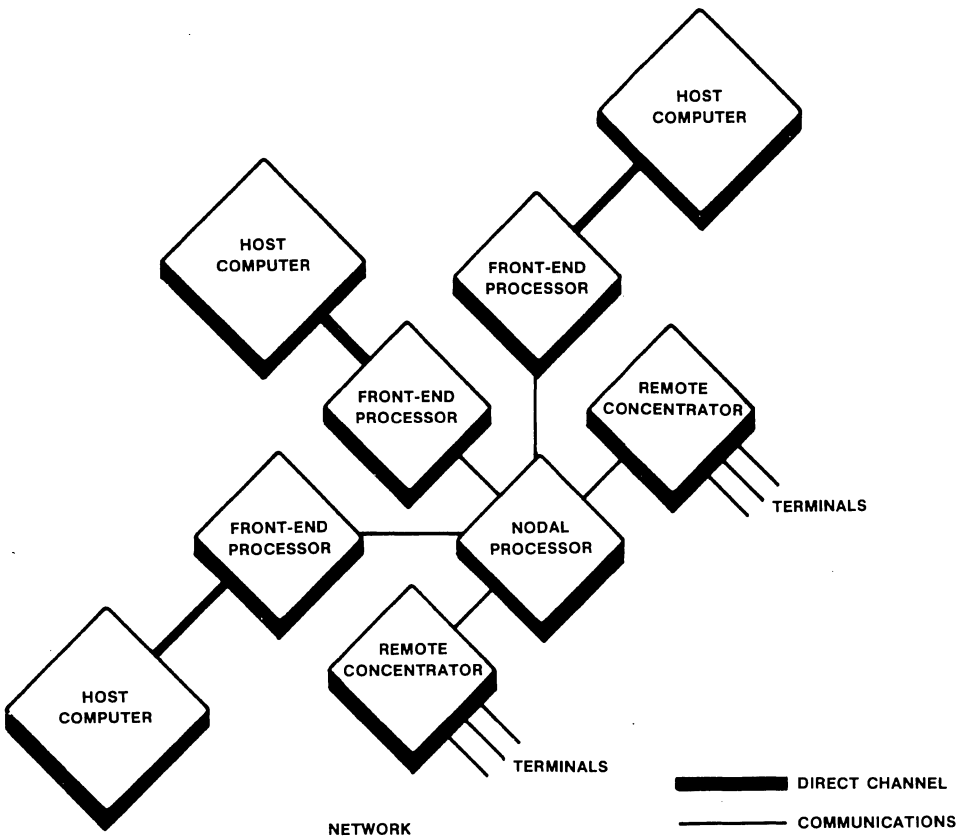


Figure 1 • DCA network.

Sperry DCA
Distributed Communication Architecture

electronic mail feature of SperryLink interfaces to Western Union's Electronic Mail Services.

Support of Foreign Terminals • Teletype 33/35, IBM 3270 and IBM 2780/3780 BSC and 3270/3770 SNA terminals • ADAPTS software maps non-DCA devices into DCA environment; treats device as Communications System User (CSU), performs function of terminal handler/line protocol handler, and transforms received units into units required by DCA units.

Security • user establishes security and access control rules using Sperry products • primary security is through password sign-on when session is established and through database facilities for file access protection.

Announced • 1975.

First Delivery • 1977.

Systems Delivered • over 2,100 DCP systems.

Comparable Systems • IBM SNA (Systems Network Architecture); Digital Equipment DNA (Digital Network Architecture); Honeywell DSA (Distributed System Architecture); Burroughs BNA (Burroughs Network Architecture); NCR CNA (Communications Network Architecture); and Hewlett-Packard DSN (Distributed System Network); and other systems based on OSI (Open Systems Interconnection) • for limited application areas, PRIME Primenet, Tandem EXPAND, Data General XODIAC.

Vendor • Sperry Corporation; P.O. Box 500, Blue Bell, PA 19424 • 215-542-4011.

■ ANALYSIS

Sperry introduced DCA 2 years after IBM announced its Systems Network Architecture (SNA). At that time, the mainframe vendors were most concerned with connecting their systems together into communication networks using standard protocols for network functions. The proliferation of protocols had reached proportions that led planners to shudder at the prospect of developing the software needed to implement heterogeneous or multivendor networks. Something had to be done to bring order into the communications/network environment, and to delimit the amount of system software a mainframe vendor needed to interconnect systems.

The mainframe vendors had created many of their own problems by not maintaining compatibility among product lines. Sperry, for example, had 2 totally incompatible lines (Series 90 and Series 1100), and even further incompatibility between the 9000 Series, with the 90/30 and 90/40 running under OS/3, and the 90/60, 90/70, and 90/80 running under VS/9. The Series 90 lines stemmed from 2 origins; 1 from the Sperry 9000 Series (OS/3 systems) which was to some extent IBM 360-compatible and the other (VS/9 systems) from the RCA computer line which was also designed to be IBM 360-compatible. The Series 1100 line dates back to the 1960s, and has gone through many evolutionary changes since the first 1108 was introduced. The Series 90 computers use a 32-bit word CPU while the Series 1100 computers use a 36-bit word CPU.

DCA, as first announced in 1976, was a philosophical exercise as much as anything else, and gave assurances to users that Sperry was committing itself to support a 7-level architecture. This is no criticism of DCA because all the network architectures of the era including IBM's SNA were philosophical exercises, with few products available to build the networks being defined. It was, however, an important step to commit a direction to its networking products.

In 1977, Sperry introduced the Telcon System, which is a communications network implementation of DCA. Telcon is a software product to implement a data communications network consisting of Sperry hosts, network processors, and terminals. Telcon has gone through many revisions; Telcon Release 6 is the current version. Telcon separates completely the network transmission system from the applications system. The Distributed Communications Processor (DCP) performs all the network/transmission system control functions.

In 1982, Sperry announced the SPERRYLINK Office System which provides facilities for an automated office including a store-and-forward voice message system. SPERRYLINK can interface to DCA networks through Distributed Communication Processor (DCP-10/20/40).

The DCA Telcon networks will conform to the OSI (Open Systems Interconnection) model of the ISO (International Organization for Standardization) when it is adopted. Sperry is very active in the OSI committee and has been shaping its DCA products toward the recommendation as it is being developed. The OSI model is an international standard, but only the lower 5 layers are backed up with the Services and Protocol Specifications standards. The Presentation Layer and a number Application Layer standards are under development.

☐ Modes of Operation

A DCA network can operate as a host-controlled hierarchical network or function as a distributed processing network with DCP front-end and nodal processors controlling the network. The 90 Series and UTS 4000 systems can function as independent processing systems and access host processors throughout the network.

☐ Ease of Use Features

Telcon software is modular, and modules are available in the standard software library. Generally the software is table driven, and the user primarily supplies parameters for the tables. Also the software is phased; the DCP-40 can operate in DCP-compatible mode to support older applications software and in DCP-40 mode for new capabilities.

CS 1100 is a communications simulator for the 1100 operating system for proposed configurations and terminals used for DCA network development.

The Telcon software is developed on a Series 90 or Series 1100 processor through an assembler that can generate procedures and macros. It can be loaded into the DCP-10/20/40 either through channel attachment or downline loaded over communications line.

MAPPER (Maintaining, Preparing, and Producing Executive Reports) is a real-time, easy-to-use, general-purpose application development system that runs on the 1100 Series.

☐ Strengths

Sperry recognizes it does not have the power to dominate the computer industry, and has no intention of dissipating strength by "going it alone" in developing a unique, noncompatible architecture. Instead, the company has followed the path of conformance to the ISO Open System Interconnection (OSI) model so far as it goes. In addition, Sperry has committed itself to future compatibility with OSI when all the layers of protocols are standardized. This commitment is a big plus for one of the mainframe dwarfs (albeit a multibillion dollar dwarf) of the computer industry.

Sperry has organized its software to minimize the problems associated with interconnecting noncompatible systems together in networks. Also, it has developed the "Adapt" software, which in principle at least, indicates the desire to make it easy to interface foreign terminals to a DCA network.

These moves put Sperry in the best possible position for remaining competitive in the future when heterogenous networks are populated with many vendors, mainframes, distributed processors, and terminals.

The introduction of SPERRYLINK extends DCA down to local area networks, a logical extension to the automated office.

☐ Limitations

It is easy to see why Sperry arrived at its admirable position of total commitment to OSI when one looks at the compatibility pattern of its own product line. The 90 Series and 1100 Series are incompatible. The lines are brought together in the 1100 Attached Virtual Computer (AVC) which operates like an 1100 processor with an attached processor emulating the Series 90, VS/9-oriented models. The 1100 Series use 36-bit word systems, and the Series 90 32-bit word systems.

Sperry DCA
Distributed Communication Architecture

The DCP-10 and -20 use a 16-bit word CPU; the DCP-40 is upward compatible but a pseudo 32-bit word CPU. None are compatible with any other product.

Despite this broad range of computer incompatibilities, it should be pointed out that Sperry has maintained compatibility within its terminal lines. The DCT, U100, U200, and UTS 400 terminal protocols have been around a long time, and the new UTS 4000 terminals implement them.

Although Sperry's computer compatibility picture is in a rather sorry state, it is certainly no worse than IBM's or Honeywell's. Honeywell plasters over its incompatibilities by calling different things by the same name, such as its GECOS designation for totally different operating systems. IBM offers an extra-cost attachment feature or software package to make things work together. Sperry, like the other mainframe vendors, is bringing all its products together under its network architecture umbrella in DCA.

■ ARCHITECTURE SUMMARY

Sperry's stated purpose for DCA is to provide the unifying force for all of the company's data communications products—those already in the marketplace and those yet to be introduced. It is to serve that purpose by specifying logical concepts and structures, rules and guidelines, and allowable system configurations.

To make DCA networks easy to use, the communications system is transparent. It will support full range networking, distributed processing, integrated network control, attractive network features, and foreign attachments. The attractive features include high efficiency, low overhead, ultraresiliency, and security.

DCA is a distributed architecture in concept. Network resources are not owned by a host, but are owned by the network under control of a network management system usually residing in a DCP-10, DCP-20, or DCP-40. Sperry has more or less stated that the objective of DCA is to connect any computing system located anywhere to other computing systems located remotely into a harmonious and freely interacting network. The only requirement is that each computer facility is performing some function that other computer facilities want to use. The devices that attach to the network can be classed as DCA incompatible, DCA physical, and DCA compatible. The physical attachments are defined through a subarchitecture interface that can be replaced without disturbing the upper architecture.

☐ Logical Concepts

DCA divides the total network environment into 2 major categories: the Applications Environment (AE) and the Communications System (CS). A part of every terminal or host on the network must be dedicated to CS; that portion is called the Termination System (TS). The rest of the terminal or host resources can be used for AE to perform work for the user. The combination of TS and AE are collectively called the termination environment (TE). The rest of CS is devoted to implementing the Transport Network (TN), the communications facilities that transfer data between interface regions or Termination Systems (TS). The TS provides the bridge between the termination environment and communications system.

The only difference between hosts and terminals on a DCA network are in the complexity of the facilities provided. Communication System Users (CSUs) reside in the AE/TE (Application Environment/Termination Environment). The number of CSUs in a host are much greater than those in a terminal reflecting the complexity of the functions performed in a host.

☐ Guidelines

The network features for which DCA supplies guidelines are network security; availability, reliability, and maintainability (collectively called ARM); network definition; and network performance.

The DCA network security philosophy is to provide the basic elements of security so users can configure systems meeting the application needs. The user is responsible for providing a closed society if total security is required. Basic security facilities include protection of programs and data against intentional or accidental access, and protection of a user from interference by another user.

The DCA objective for ARM (availability, reliability, and maintainability) is to offer a range of products allowing the user to provide a stable affordable network. Messages will not be lost or delivered in error without the user knowing it. Failures will be "soft" so the system can be recovered. The network will operate with "graceful" degradation so a failure is not catastrophic. The network will perform online fault isolation and produce information on network performance and error rates.

In order to help the user configure a network, DCA includes network definition services. These services generate device, line, processor, and location requirements for a specific network topology. It is generated automatically from input parameters supplied by the user. They configure the software for the communications network processor, host communications configuration, terminal communications configuration, network message generators for network simulation, and network definition services for network administrator to change, simulate, or monitor the network.

☐ Network Performance

DCA establishes criteria for measuring the network performance. It is based on the performance of a session path (SP)—the end-to-end path between communication system users, usually applications programs. It is based on such things as transfer rate, residual error rate, availability, and so on.

Multiple sessions can occur through network nodes usually implemented by a network processor. The performance of the node is based on message type and communications functions performed.

Overall system performance is measured by cost as well as the power of the host and the communications system capability.

■ DISTRIBUTED SYSTEM MANAGEMENT

Networks are set up to handle at least 3 data processing tasks: sessions, jobs, and transactions. All of these fall within the realm of the application environment.

For sessions, a terminal or applications program is connected to a subsystem in one of the processors on a network for a conversation; the terminal or application logs on for the duration of the conversation then logs off. Primary products associated with session control are Communications Management System (CMS) in Series 1100 and Virtual Integrated Communications Access Method (VICAM) in the Series 90 computer systems.

For jobs, batch entry subsystems route jobs through the network to the processor which will execute the job and return results. Primary products that implement job entry applications is NTR (Nine Thousand Remote) on 1100 Series and the integrated facilities in VS/9 operating system for Series 90.

For transaction processing, the network routes transactions according to the information supplied with a message, to the appropriate subsystem on the network. Primary products used to implement network transaction processing are Transaction Interface Package (TIP) on the Series 1100 and Information Management System (IMS) 90 on the Series 90.

☐ Network Management

Telcon software manages the network, running on the DCP-10, DCP-20, or DCP-40 Distributed Communications Processors. Network management is provided by Network Management Services (NMS) which are distributed into 4 levels of control. A global NMS performs functions that affect the total network; it synchronizes, loads and initializes lower levels, and performs recovery functions for lower levels. The total network can be divided into physical or logical areas, and each area is controlled by an area NMS; an area can include one or more nodes. Each node and its set of termination systems (hosts and terminals) physically associated with it are controlled by a local NMS.

A node can be further divided into regions. Each region consists of one or more terminals. Each region has its own NMS control facilities.

Sperry DCA
Distributed Communication Architecture

Network Management Services (NMS) provide session, physical resource, maintenance, security, and network administrator services. As implemented in Telcon, NMS controls data flow including pacing and throttling, routes messages, determines message priorities, handles unsolicited or undeliverable message, reports status and activities on request, maintains system activity logs, provides time and day settings, protects network against unauthorized access, performs measures to overcome hardware or software failures, institutes recovery procedures when component fails, and establishes degraded operation mode until network fully recovers.

Telcon Network Administration System—Network Information Services (TNAS-NIS) • used to monitor, supervise, and maintain communication networks; supports database and applications software; provides alarm/event processing to monitor status and performance of network components; maintains inventory of network components; keeps traffic statistics for lines, channels and terminals • runs on 1100 host:

$21,600 prch	$450 mo	$90 serv

DCP/40 O/S • Telcon Release 5 is current release; for DCP/40:

NA	300	70

DCP/20 O/S • Telcon Release 5 for DCP/20:

NA	100	120

DCP/10 O/S • Telcon Release 5 for DCP/10:

NA	150	92

☐ Session Management

A session defines the logical path to exchange data between 2 end users. Subsets of the session path are used for logical port-to-logical port and for network control element-to-network control element. A session can be host-to-host, host-to-terminal, or terminal-to-terminal. Session services set up, maintain, and disconnect paths between Termination Systems (TSs). The NMS Session Services receive and validate requests from Application Management Services (AMS), set up path within the Transport Network (TN), initiate AMS and NMS start-up and discontinue procedures, allocate session identifiers, select routes and their alternates, and perform accounting function. See Figure 2.

In Telcon implementation, prior to Release 4, session paths have fixed assignments at system initialization time. Telcon Release 4 allows either fixed sessions or dynamic end-user session selection. All possible sessions are pre-generated, and the user selects the system session. Alternate paths can also be assigned in case of primary path failure. All session paths are bidirectional. Through multiplexing, multiple end users can use the same session path.

☐ Host Access Methods

The Communications Management System (CMS) provides the interface between Series 1100 operating system and the network devices, and builds queues for message processing. The Transaction Interface Package (TIP) supports communications-oriented environment; accesses the CMS queues, and processes them concurrently with batch, timesharing, and real-time processing.

The Virtual Integrated Communications Access Method (VICAM) on Series 90 consists of a set of software components to interface user to remote devices and message files.

CMS (Communications Management System) 1100 • provides connection between Series 1100 Operating System users and communications devices attached to Series 1100 computer • supports communications interface between 1100 Series systems in network configuration via Distributed Communications Architecture (DCA) and DCP Telcon software; maintains message queue that is accessible to TIP (Transaction Interface Package) • requires 10K to 12K words of resident main memory; supports all Sperry terminals plus popular "foreign" devices • supports file and job transfer for applications between Series 1100 and Series 90 processors equipped with communications interface to Telcon network:

NA prch	$650 mo	$78 serv

VICAM (Virtual Integrated Communications Access Method) • for Sperry 90 Series • functional components include MCP (Message Control Program) and CUP (Communications User Program) • MCP includes channel control routines, remote device handlers, network controllers to control traffic between handlers and message queues; queues messages; activities scheduler with priority control and timer service • CUP user-generated code processes incoming messages and generates responses; user selects COS (Communications Oriented Software) modules to generate CCP (Communications Control Processor) and CUP applications; interfaces to MCP through macros; CUPs interface CCP through VS/9 operating system; each CUP is task under VS/9 • included with VS/9.

☐ Message Management

Message control is responsible for transporting data across the network, routing it for end-to-end connection, and queueing it if necessary while waiting for use of a data link.

In Telcon implementation, messages are bundled into data units that can be managed as they cross logical interfaces in the network. The data units contain information describing origin and destination, priority, sequencing, class of service, and acknowledgement requirements. Messages too large for the fixed data unit size are segmented. Primary and alternate routing paths are determined, and the session set up. Procedures are followed for unsolicited messages, and for handling undeliverable messages.

The Telcon software provides queueing services in the DCP Series Communications Processor. Each session is assigned a priority level for access to trunk links that carry traffic between DCP nodes. Flow control facilities pace the number of messages put on the data links to keep network traffic moving and to satisfy user requirements for service. Termination systems also have pacing and throttling mechanisms to control data flow into and out of the network.

☐ Interactive Processing Management

Sperry supplies a number of packages to support interactive processing. Main programs are IPF (Interactive Processing Facilities), CTS (Conversational Time-Sharing), and HVTS (High Volume Time-Sharing System) on 1100 Series hosts and Extended BASIC and Fast FORTRAN on 90 Series hosts. On distributed processing systems, the OS/3 on System 80 provides interactive support for program development and execution of up to 16 jobs.

IPF 1100 • interactive processing facility, in timesharing and batch modes, supports EDIT 1100, language processors, applications performance improvements • included with OS/1100.

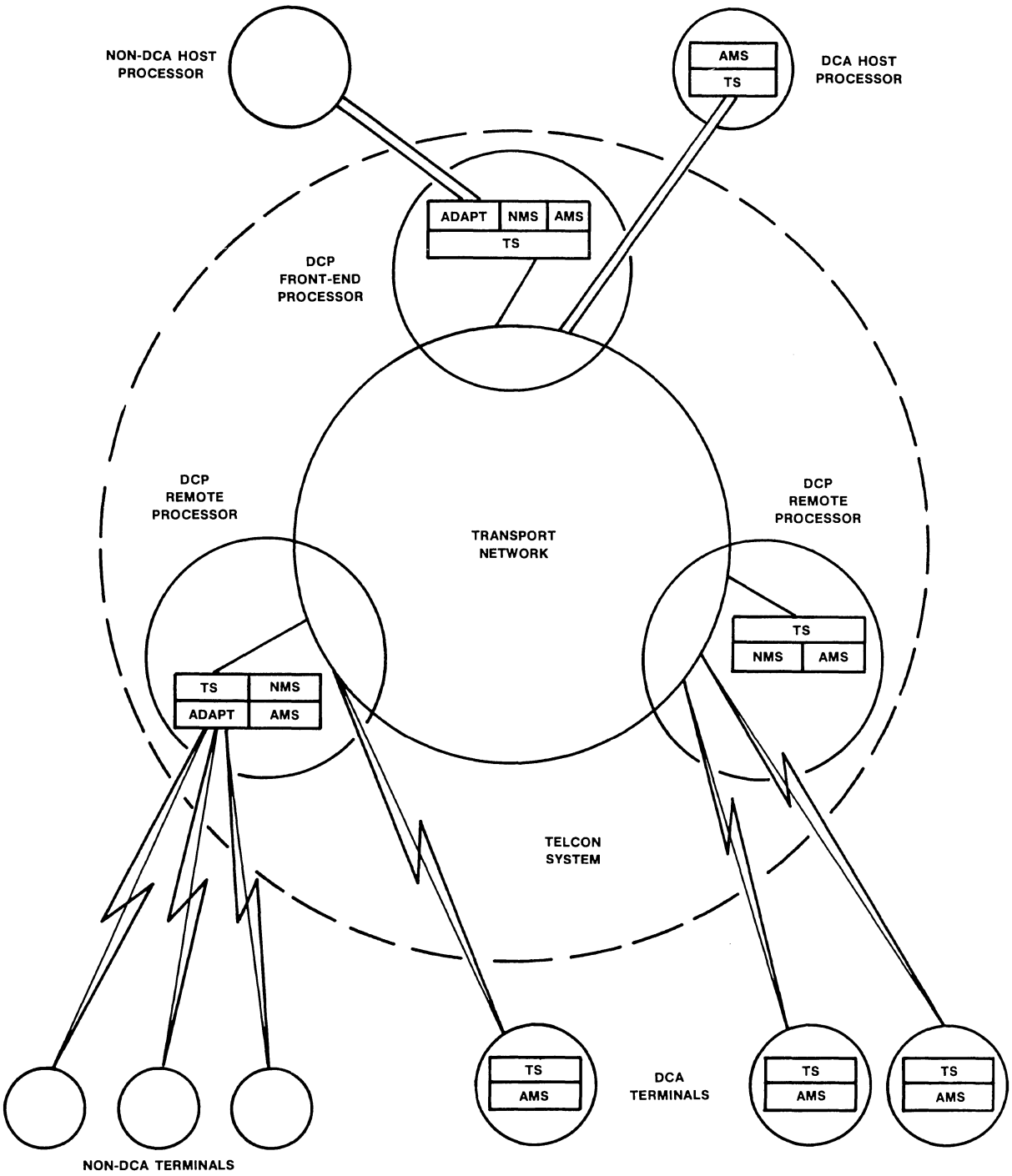
CTS (Conversational Time-Sharing) • included with 1100 Series host system • interactive timesharing software package provides syntax analysis, file editing, compilation, program execution • supports programs written in any 1100-supported language and has line-by-line syntax analysis for BASIC, FORTRAN, COBOL, and APL • HELP processor provides user prompting • desk calculator function:

NA prch	$275 mo	$47 serv

HVTS (High Volume Time-Sharing System) • for 1100 Series host • supports medium and high ranges of terminal usage in DATA/CONSULT/BASIC/FORTRAN/APL modes; each user has private program/data library files; security procedures include full file privacy, partial privacy, list of authorized users, total connect time allowed per program, program sizes allowed • data entry/editing commands include RESEQUENCE/MERGE/GO/LOCATE/CHANGE/DELETE/BRIEF/LIST; HELP command to assist users • runs HVTS BASIC compiler with matrix support, intrinsic functions, subprograms, chaining • FORTRAN prescanner provided as well as HVTS FORTRAN and APL • requires CMS 1100 and Quota Input Processor (QUIP); QUIP

PRCH: purchase price. MO: monthly rental. SERV: monthly service. NA: not available. Prices are current as of December 1984.

Sperry DCA
Distributed Communication Architecture



LEGEND:

TS—TERMINATION SYSTEM
AMS—APPLICATION MANAGEMENT SERVICES
NMS—NETWORK MANAGEMENT SERVICES

Figure 2 • DCA/Telcon session management.

Sperry DCA
Distributed Communication Architecture

allows manager to display, insert, delete, modify user IDs and allows user to obtain status of account:

NA	635	127

Extended BASIC • for Series 90 • essentially implementation of language that can operate in compile-and-go mode.

Fast FORTRAN • for Series 90 • compiles programs quickly and executes them immediately.

☐ Job/Batch Processing Management

Sperry's data processing products can co-reside on a network with each other as well as with transaction processing and timesharing or interactive processing. Specific products from Sperry include CMS 1100 DCP and NTR (Nine Thousand Remote) on Sperry 1100 Series. Remote job entry and remote batch processing on Sperry 90 Series is provided by VS/9 operating system and software in the programmable Multichannel Communication Controller (MCC) as well as interactive program development, transaction processing, inquiry/response, data collection and message switching.

CMS 1100 DCP • CMS 1100 plus remote batch independent of terminal type • dynamic configuration capability.

CMS 1100 DCP/GCS • provides network support for DCP/20 and DCP/40 plus transaction/demand support for Uniscope, Teletype, and Data Speed 40/4 terminals operating through GCS 1; resides in host.

For 1100/60 & 1100/70:

NA prch	$550 mo	NA serv

For 1100/80 & 1100/90:

NA	650	130

CMS 1100 DCP/20 • provides DCA network support through Telcon running on DCP/20 • includes device independent transaction, demand, and remote batch environments with dynamic configuration, error logging/statistics, and security.

For 1100/60 & 1100/70:

NA	250	NA

For 1100/80 & 1100/90:

NA	500	100

CS 1100 DCP/40 • same as CMS 1100 DCP/20 in function but designed for DCP/40.

For 1100/60 & 1100/70:

NA	500	NA

For 1100/80 & 1100/90:

NA	600	120

CMS 1100 GCS • replaces CMS and Executive Interactive Control routine; supports UDLC link to DCP when interfaced through GCS.

For 1100/60 & 1100/70:

NA	550	NA

For 1100/80 & 1100/90:

NA	650	100

NTR (Nine Thousand Remote) • included with system • allows OS/3 system to function as remote batch terminal via full-duplex communications lines • requires Data Communications Subsystem or Communications Adapter on the OS/3 system • supports Fieldata, ASCII or EBCDIC codes, and card reader/punches, printer, plotters and paper tape reader/punches attached to 9000 systems.

☐ Transaction Processing Management

Transaction processing is closely tied to the database management systems running on the host computers. Some packages, however, can be identified as supporting transaction processing independently of the database. Support is provided by TIP (Transaction Interface Package) on a Sperry 1100 Series host.

TIP (Transaction Interface Package) • included with Sperry 1100 Series system • supports online communications-oriented environments concurrently with batch, timesharing, and real-time • processes messages in the queue built by CMS; arranges for appropriate programs to be loaded to handle specific messages between application programs written in COBOL, FORTRAN, PL/1, or assembly language • interfaces between 1100 Operating System and online user application programs • requires 4K to 6K words of resident main memory in any 1100 system with CMS • supports 5 to 50 "standard" transactions per second depending on the 1100 system model (one standard transaction has 50 characters input, 100 characters output, 6 direct access storage searches, and executes a 4000-word user program):

NA prch	$1,500 mo	$300 serv

Transaction Performance Auditing System (TPAS) • provides 1100/TIP user with accounting and performance measurement tools; summary reports are generated for transactions, database management, message management, and HV TIP subprograms:

NA	500	125

Transaction Test System (TTS) 1100 • provides an advanced user friendly method to test display type and standard TIP transactions in online environment:

NA	215	50

☐ Database Management

The primary database management systems for DCA networks are DMS 1100 for Sperry 1100 Series and DMS 90 for Sperry 90 Series hosts.

Sperry 1100 Series Database Facilities

Sperry places its products involved with information management on the 1100 Series into a grouping called "TIMS."

TIMS (Total Information Management Systems) • umbrella term used to refer to complete set of software represented by CMS 1100 (Communication Management System), TIP 1100 (Transaction Interface Package), RPS 1100 (Remote Processing System for generalized file interface), QLP 1100 (Query Language Process), and DMS 1100 (Data Management System).

DMS 1100 (Data Management System) • supports hierarchical or indexed-sequential data structures • CODASYL-type system based on the Data Base Task Group (DBTG) Report of April 1971 and June 1973 Data Description Language Journal of Development • standalone data description language uses COBOL-compatible data description; data grouping includes concept of areas related to physical storage, sets and records • data manipulation language provides host language support for COBOL, FORTRAN, or PL/1 access to database • data management routine updates database and controls access to it; data reorganization utility used to restructure database • DDS-1100 Data Dictionary available.

RPS 1100 (Remote Processing System) • provides access to DMS 1100 database structures via Uniscope 100 or 200 display terminal • file access commands, computational ability, and report generation ability are all provided with RPS 1100 through self-prompting, tutorial processor system control language.

Maintaining, Preparing & Producing Executive Reports (MAPPER) • a highly successful interactive, easy-to-use, general-purpose application development system that Sperry originally developed for use with its manufacturing control systems; since evolved for general-purpose, commercial processing; generally end users do their own applications development online using simple, non-procedural commands and a report structured database; includes extensive "Help" information online; compatible with other Sperry software; interfaces to UNIS (Sperry Industrial System) and SUFICS (Sperry Financial Integrated Control System) • James Martin in his book **Applications Development Without Programmers** (SAVANT Research Studies, Carnforth, Lancashire, England) has indicated that end users with MAPPER are more innovative than DP professionals, even in complex data processing environment • includes facilities for real-time updating, report processing/generating, and form generating with extensive security techniques for protection against improper data access • runs on Sperry 1100 Series processor with all its system software.

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Query Language Processor (QLP 1100) • conversational English language-oriented processor with generalized facilities for inquiry and update of DMS 1100 databases; batch mode optional • macro facility allows for definition of user commands; list/count/change global commands • report statements can be saved for later generation of report • includes high-level procedure language facility • QLP 1000/PCIOS Interface allows QLP 1100 to access standard data files for inquiry, update and reporting by providing interface between QLP and PCIOS • PCIOS (Processor Common Input/Output System) establishes compatible files usable by program written in any language.

IMS 1100 (Information Management System) • compatible with IMS 90 • access to both database and conventional files.

Sperry 90 Series Database Facilities

The main program that provides database management support under the VS/9 operating system on the Sperry 90 Series is DMS (Data Management System) 90.

DMS (Data Management System) 90 • conforms to CODASYL specification of 4/1971 • designed to operate with COBOL for application program development and with IMS 90 to make information readily available • includes DDL (Data Description Language), DMCL (Device/Media Control Language), DML (Data Manipulation Language), DBMS (Data Base Management System), System Support Utilities, and DUPL (DMS 90 Utility Processor Language).

☐ Gateways To Other Networks

Gateways to SNA networks are through emulation of IBM 3270 terminal controllers and IBM 2780/3780 terminals and support of BSC protocol. Sperry calls these facilities "IBM coexistence." The DCPs not only allow Sperry terminals to appear a IBM 3270 terminals to IBM hosts, but also allow IBM 3270 terminals to appear as UTS 400/4000 terminals to a Sperry host, see Figure 3. Similar facilities are also available for 2780/3780 terminals to allow them to connect to both IBM and Sperry hosts, see Figure 4.

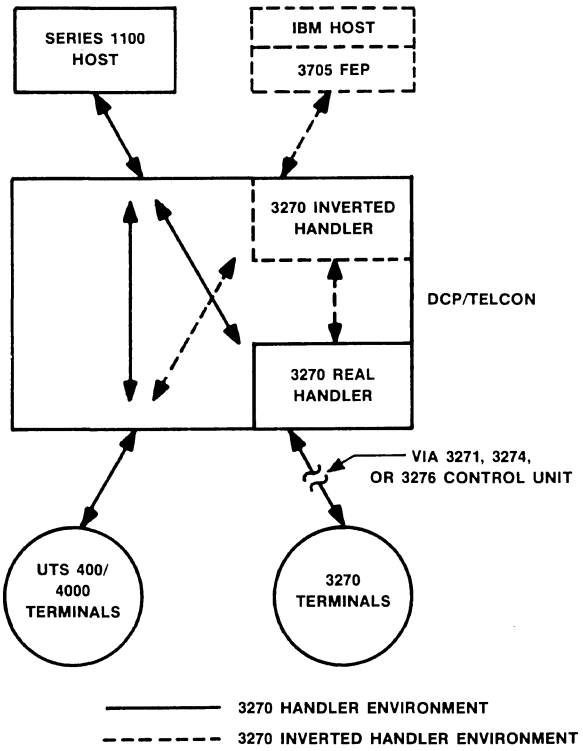
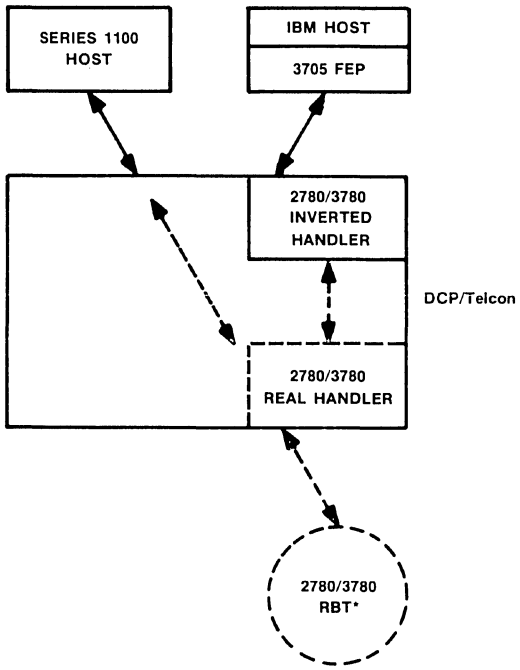


Figure 3 • IBM 3270 coexistence.



*IBM, SPERRY, OR OTHER IBM-COMPATIBLE TERMINAL

Figure 4 • IBM 2780/3780 coexistence.

Gateways to X.21 circuit-switched and X.25 packet-switched public data networks are provided through subarchitecture feature of DCA; the network is treated as a transmission facility.

6257-00 DATEX-P DCP PSCS • adds support to Telcon software for X.25 DATEX-P packet-switched network in Germany; allows communication between DCPs or between DCP and UTS 4000 terminal using DATEX-P network; 1 allowed per node • for DCP/20 and DCP/40 only:

NA prch	$175 mo	NA serv

T6257-00 DATEX-PDCP PSCS • same as 6257-00 except for DCP/10 only:

NA	175	NA

6257-01 PSS DCP PSCS • adds support to Telcon software for X.25 PSS packet-switched network in United Kingdom; allows communication between DCPs or between DCP and UTS 4000 terminal using PSS network; 1 allowed per node; for DCP/20 and DCP/40 only:

NA	175	NA

T6257-01 PSS DCP PSCS • same as 6257-01 except for DCP/10 only:

NA	175	NA

6258-00 Nordic DCP CSCS • adds support to Telcon software for X.21 NPDN circuit-switching network in Scandinavia; allows communication between DCPs or between UTS 20 and DCP using NPDN network; for DCP/20 and DCP/40 only:

NA	175	NA

T6258-00 Nordic DCP CSCS • same as 6258-00 except for DCP/10:

NA	175	NA

DCPs, UTS 4000 Series controllers, System 80 distributed processors, and Series 90 OS/3 Systems can interconnect through the various public data networks. Various system pairs can communicate through NPDN (Scandinavia) X.21 circuit-switched network and DATEX-P (West Germany), PSS (United Kingdom), TRANSPAC (France) and DATAPAC (Canada)

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X.25 packet-switched public data networks. Deliveries of support for some pairs began in 1982. Sperry has announced plans to add support for DN-1 (Netherlands), TELENET (U.S.), DDX (Japan), AUSTPAC (Australia), TELEPAC (Switzerland), and DATEX-P (Austria). See 980-S644-0020 Report on Sperry DCP Series.

SPERRYLINK Office System offers an electronic mail system for document distribution. Through DCP, SPERRYLINK can interface to Western Union networks for store and forward message delivery systems which operate both nationally and internationally.

☐ Support For Foreign Terminals

The DCP-10, DCP-20, and DCP-40 Distributed Communication Processor support any terminals that implement TTY Terminal or IBM BSC protocols. Specifically, they support Teletype Models 33 and 35, IBM 3270, and IBM 2780 and 3780 BSC terminals. See 980-S644-0020 Report on Sperry DCP Series.

6276-00 BSC 3270 • handler accommodates IBM 3270 terminals used with Telcon software; supports IBM 3270 (Models 1 and 2), 3274 (1C and 51C), and 3276 (1, 2, 3, and 4) Control Units for communication with Sperry Series 1100 hosts • for DCP/20 and DCP/40 only:

NA prch	$150 mo	NA serv

6276-01 BSC 3270I • inverted handler accommodates Telcon systems communicating with IBM host over emulated point-to-point or multipoint line from BSC 3270 (6276-00) or from Sperry UTS 4000 standard Telcon handler:

NA	100	NA

T6276-02 BSC 3270 • same as 6276-00 except for DCP/10 only:

NA	150	NA

T6276-03 BSC 3270I • same as 6276-01 except for DCP/10 only:

NA	100	NA

6277-00 BSC 2780I • inverted terminal handler for use with Telcon software when interfacing an IBM host; an emulated point-to-point configuration using the Telcon BSC 2780 handler:

NA	75	NA

T6277-00 BSC 2780I • same as 6277-00 except for DCP/10 only:

NA	75	NA

The ADAPT software is located in the Communications Network Processor (usually a DCP-10, DCP-20, or DCP-40). It is considered a communications system user and ADAPT is part of the application management services. ADAPT performs the protocol transformation and data conversions needed to conform to DCA. Some flow control and presentation services may be completed in the termination system.

■ SECURITY

☐ System Security

Generally, the system security depends on management establishing security policy and access control rules, and assigning responsibility for implementing them with products supplied by Sperry. Users can write software for the DCP Series to make security meet the application requirements. Generally, the Sperry products provide security through passwords or ID establishment at the time of network access.

The Network Management System (NMS) provides 4 levels of network access: Global, Area, Local, and Regional. Access by network control consoles is confined to the console's access level. See Figure 5.

☐ Data Security

Data security is provided through virtual addressing, mode protection, privileged instructions, queue/buffer isolation, program confinement and error detection routines. The Database Management Systems on Sperry 1100, 90, 80 and V77 systems provide file security mechanisms for user and system files which the user specifies at the time files are created. Terminal Security System (TSS) on Sperry 1100 provides for user ID and password verification through security file.

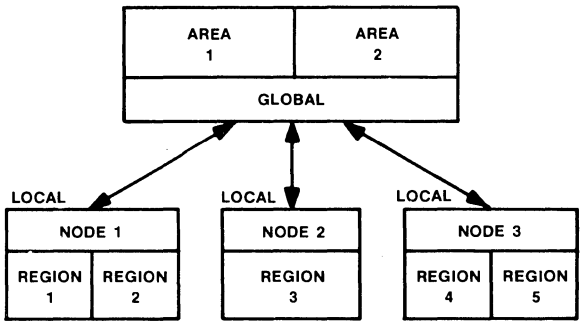

Figure 5 • network management services levels of control.

Terminal Security System • verifies batch and demand users by requiring user-ID and password:

NA prch	$189 mo	$38 serv

■ PHYSICAL NETWORK

☐ DCA Nodes

Unlike IBM's SNA architecture, Sperry's DCA does not emphasize the concept of "network nodes." However, using IBM's "concept" of such nodes, DCA networks can be considered as consisting of the following node types—terminal systems, network processors, and host processors interconnected by data links.

Host processors and terminal systems are architecturally identical (termination systems) but their range of functionality is drastically different. Both contain end users (EUs), application management services (AMS), communications system users (CSU), logical ports (LPs), logical port multiplexer, and data link handlers. The terminal and the host, when connected to a hard-wired multiplexer, include a UDLC handler. The host when connected to a front-end processor also includes a channel interface.

The distributed network processor (DCP) can be configured as a front-end processor or remote concentrator. It includes the ADAPT Environment and its end user (EU) if needed for non-DCA terminals; network management services (NMS) and its EUs applications management services if user's own code is present; logical ports (LPs) including port presentation services (PPSs) and port flow control (PFC); logical port multiplexer; trunk control (TC); route control (RTC); data unit control (DUC); UDLC link to DCA terminals, and host channel connection.

Hosts can be the Sperry 1100 Series and 90 Series.

The DCP-10, DCP-20, and DCP-40 Distributed Communications Processors can operate as front ends for both the Sperry 1100 and 90 Series host computers. The older DCP Distributed Communication Processor can front-end Sperry 1100 Series hosts and operate as remote concentrator.

The DCP-10, -20, and -40 connect to the byte multiplexer channel of the Series 90 host and to the word channel of the Series 1100 host. Connections between DCP processors, which operate as nodes on the DCA network, are over UDLC trunk lines. UDLC is the standard DCA protocol. Transmission is synchronous at up to 19,200 bps. With wideband facilities, transmission can be up to 56K in U.S., and up to 64K bps in Europe.

The DCPs provide the following interfaces: EIA RS-232C/CCITT V.24 and V.28, RS-449, and X.21 Interfaces (DCP only), Wideband CCITT V.35, and Dialing—U.S. RS-366 and Japanese NTT. Transmission methods are asynchronous at 45.5 to 2400 bps with specialized equipment for up to 9600 bps, synchronous at up to 19.2K bps, and wideband synchronous at up to 64K bps via European CCITT V.35 interface and 56 bps via U.S. V.35 interface.

The DCP-resident Telcon software supports the following

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non-DCA protocols: Teletype terminals, asynchronous/synchronous for Uniscope Display Terminals, full-duplex for Sperry 1100 systems, Remote 1 (REM1) for Sperry 90 systems, and IBM BSC/SDLC. These protocols and Telcon software support the following non-DCA terminals: Teletype Models 33 and 35; IBM 2780/3780/3270/3277 BSC/SDLC terminals; Sperry Uniscope Display Terminals, Universal Terminal System (UTS) 400 and 4000 Series, Data Communications Terminal (DCT) 500 and 1000, 1900 Computer Assisted Data Entry (CADE) System, 1900/10 System, UDS 2000 Universal Distributed System, 1004 Card Processing System, 90/25/30/40 Systems, 9200/9300 Systems, Business Computer (BC)/7 Systems and V77 computer systems. Other non-DCA terminals can be supported by ADAPT software.

☐ Session Control

Session control resides within Applications Management Services (AMS). An End User (EU) within its own Application Environment requests AMS to establish a connection to another EU. AMS validates the request (address and connection allowed), and the Communications Systems User (CSU) provides resources for the session. AMS selects a logical port, and prepares it for the presentation services and flow control algorithms. AMS uses a pre-established session path and send the request to the appropriate Network Management System (NMS) which continues the processing. Multiple NMS elements may be required to reach the AMS associated with the EU recipient of the session request.

NMS will validate the request from a network point of view, and make the transport network linkages to establish the session route. The receiving AMS will validate the request from the receiving EU point of view, allocate resources, set address linkage, and return a "session accept" through NMS. The session is then established, and the EUs linked such that information can flow without further AMS/NMS operations until the session is terminated.

☐ Network Control

Human administration of the network is through operator consoles attached to a host system, nodal processor or terminal. Consoles are assigned network management responsibilities (security, maintenance, or general administration of a region, node, area, or total global network). Commands are available for initializing, booting, or shutting down any part of the system; reconfiguration; maintenance of network status and files; initiating diagnostic and debugging procedures; accessing network files and system logs; and start or stop I/O operations.

Users can program applications through interfaces provided for that purpose. Users can program terminal and line handlers, file access methods and control, message switching or store-and-forward services, extensions of standard services provided such as security, and statistics and analysis procedures.

Availability, Reliability & Maintainability (ARM) • designed to user application • multiple recovery levels—automatic retry, repeat, or restart to recover immediately and continue after discovery of error; if that doesn't work move on to a higher level, such as switch to backup equipment • enables network to continue operation in spite of errors through graceful degradation when components must be disconnected from network due to errors • online and off-line diagnostic tools allow isolation of faulty components • guarantee safe data transport with high probability of message delivery; no lost message without user being informed • collection of statistical data on errors and system operations • designed to be resilient through rapid recovery from errors and continued degraded operation in spite of errors; pacing and throttling of data flow when queues filled, lines overloaded, buffers overused; thresholds are optional network parameters • online terminal and peripheral verification routines can be executed by network administrator • DCP backup is supported with Line Switch Module Hardware and Software under Telcon Release 5 • one plan allows up to 8 DCPs at a node to loadshare traffic in primary mode and to operate a backup for part of another DCP's load in secondary mode if a DCP goes down, a second scheme allows 3 DCPs to share a DCP warm standby for backup • also DCPs operating as front-end processors can be configured redundantly; see Figure 6.

☐ Network Analysis

Telcon provides statistics gathering facilities that can be specified at system generation time. Such statistics cover hardware, software, and system errors; system performance such as buffer usage, idle pacing, and throttling; and throughput rates. Users can write programs to collect specific data and to analyze the statistics obtained.

☐ Protocols

DCA provides Termination Environment (TE) and Communications System (CS) environments. The CS handles intersystem communication while TE interfaces the user to CS. TE and CS are further subdivided—TE into the Management Environment (ME), Application Environment (AE) and Termination System (TS); and CS into Transport Network Control (TNC) and Termination System (TS). TS resides in both TE and CS, and provides the major interface between the 2. TNC moves messages between systems using transmission facilities and software network control modules.

The AE contains all the tasks and facilities that use the network; all messages are generated and received here. AE consists of a number of Communications System Users (CSUs) and End Users (EUs). CSU interfaces EUs to the TS and performs some controlled relative addressing. One CSU and its associated EUs make up an application system.

EUs are identified by IDs that are translated by the CS to a logical port address. Addressing is relative to a CSU so an EU need not have a unique network-wide address. EUs are the sources and sinks of data in the networks; they are program segments, I/O devices, or operators.

The ME includes the Applications Management Services (AMS), Communications System Administrator (CSA), and Network Management Services (NMS). AMS contains the facilities to initiate, maintain/monitor, and terminate sessions. NMSs control the TN within CS. The CSA provides commands so a human administrator can reconfigure the network. When a network includes DCP-10, DCP-20, or DCP-40 Distributed Network Processor at a node, it contains the NMS software modules. NMS can also be located only at the node where the administrator resides and be omitted from all other local nodes.

The TS contains one or more logical ports, with one logical port for each CSU and a logical port multiplexer. Each logical port contains flow control and presentation software service modules. Flow control regulates message traffic so the logical ports at both ends of a transmission are not overloaded. Presentation services convert or transform data and control information into formats the transport network and the destination logical port can use.

The TNC provides 3 types of transport network control: data unit, route, and trunk. Data Unit Control (DUC) manages logical connection between TS and TNC layers. Route Control (RC) performs the actual packet routing between nodes; it can be set at session initiation and remain fixed throughout the session unless facilities break down, or it can be dynamically routed on a per-message basis. Trunk Control (TC) manages multiple parallel links between nodes; a separate TC section is provided for each logical path and subarchitectural interface in the transmission facility.

The transmission facility can be over a communications link or within a system where messages are transmitted by placing them in a queue. When transmitted over a communications link, the facility includes the two SubArchitecture Interfaces (SAIs) and the link. The SAIs initialize the line, manage the physical interface, and perform recovery and transmission queue management tasks. Line transmission is Universal Data Link Control (UDLC) protocol which supports SDLC, BSC, and X.25 subsets, or a channel protocol.

DCA supports 3 types of sessions: system sessions between End Users (EUs) through a common Communications System User (CSU); logical port session between EUs sharing common Termination System (TS); and Transport Network (TN) sessions where messages pass through the transport network.

For a session, the CSU builds a User Data Unit (UDU) for an EU, passes it to the logical port in the Termination System (TS). The

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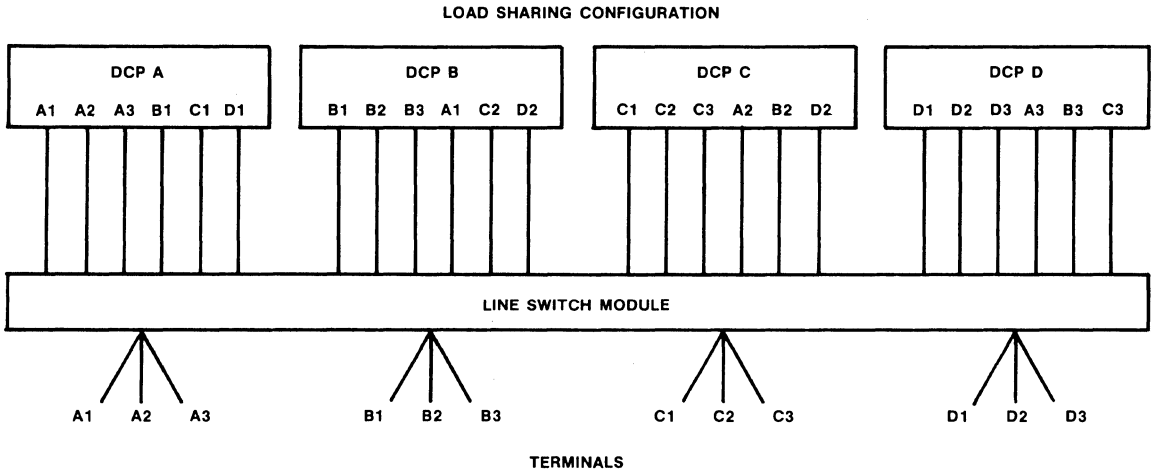

Figure 6 • load sharing among DCPs with total backup for DCP failure recovery.

logical port converts or transforms the unit if required for the destination EU or the TN. The TS combines or segments the UDU into a Port Data Unit (PDU). The TN takes PDU and builds a Network Data Unit (NDU) which is transmitted over the network.

For system and logical port sessions, the messages are directed back into the logical port rather than out to the transport network.

DCA Protocol Layers Compared With OSI Model

Sperry's DCA implements its architecture layers in a manner that closely follows the Open System Interconnection (OSI) model for protocols according to the International Organization for Standardization (IOS).

OSI Physical Layer (X.21) • DCA implements physical layer as SubArchitecture Interface (SAI) in transmission facility.

OSI Data Link Layer (HDLC) • DCA's UDLC protocol; bit-oriented protocol that includes HDLC as subset.

OSI Network Layer (Routing & Transmission) • DCA's Transport Network Control.

OSI Transport Layer (Addressing, Data Assurance, Flow Control) • DCA's Termination System (TS).

OSI Session Layer (End-to-End-Initiate, Maintain, Terminate) • DCA's Applications Management Services (AMS) in the Termination System (TS).

OSI Presentation Layer (Formatting, Converting Information Conversions) • DCA's Logical Port in Termination System (TS).

OSI Application Layer (End User Access to Network) • DCA's end user (EU) connection to network through communications system user (CSU) interface.

■ EQUIPMENT SUMMARY

□ Host Computers

Series 90 Processors • Models 90/60, 90/70, and 90/80 run under VS/9 operating system • medium-scale systems in 0.3 to 1.3 MIPS range, derived from RCA's IBM-compatible product line • memory range from 524K to 8.4M bytes • using Multichannel Communication Controller (MCC) and DCP-40 running in compatibility mode, system can support up to 128 half-duplex or 64 full-duplex communications lines • software includes Database Management System 90 (DMS 90) that conforms to CODASYL 1971 specification; and interactive, transaction-oriented Information Management System (IMS) 90 • Virtual Integrated Communications Access Method (VICAM), Message Control Program (MCP), and Communications Oriented Software (COS) support the user in developing applications for communication-oriented environments • DCP-10, DCP-20, and DCP-40 processors support both 90 Series and 1100 Series processors on same front-end processor concurrently.

1100/60 Series • members of long-lived 1100 Series of processors, available in 1100/60 uniprocessor models and 1100/62 dual-processor configurations for range of processing power from 0.6 to 2.8 MIPS • 1100/60 Attached Virtual Processor (AVP) upward compatible with 90/80 Series processor running VS/9; AVP can attach to any 1100/60 uniprocessor producing a dual-processor configuration that can run both 1100

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Series and 90 Series applications programs • 1100 operating system provides virtual memory environment for concurrent batch processing, timesharing and real-time/communications processing; Total Information Management System (TIMS) refers to DMS 1100, RPS, CMS, and TIP; DMS 1100 with Query Language Processor conforms to CODASYL specification; Remote Processing System (RPS) provides interactive data management and file processing • communications management system (CMS) interfaces system to DCA network; Transaction Interface Package (TIP) provides interface between applications programs and the operating system • uses DCP-10, DCP-20, and DCP-40 front ends and Telcon software to support DCA.

1100/70 Series • based on the same processors as the 1100/60 • includes 19 models: 7 uniprocessor models, 4 dual-processor models, and 8 multiprocessing models with performance range of 0.5 to 5.4 MIPS • fully software and hardware compatible with all other members of the 1100 Series; memory capacity range is from 512K to 32M bytes.

1100/80 Series • upward compatible with 1100/60 Series • available in 1100/80 and 1100/81 uniprocessor, 1100/82 dual-processor, 1100/83 tri-processor, and 1100/84 quad-processor configurations for performance range from 1.3 to 6.4 MIPS • versions of all models can contain scientific accelerator • memory range from 2M to 32M bytes • runs same software as the 1100/60 Series.

1100/90 Series • upward compatible with 1100/60 and 1100/80 Series • available in uniprocessor (1100/91), dual-processor (1100/92), tri-processor (1100/93), and quad-processor (1100/94) configurations for performance of 7.5, 14, 20, and 25 MIPS, respectively • maximum memory capacity ranges from 8M to 64M bytes • runs same software as the 1100/60 and 1100/80 Series.

☐ Communications Processors

Sperry's Models DCP-10, DCP-20, and DCP-40 Distributed Communications Processors are the network processors for DCA. They operate as remote concentrators, nodal processors, or front-end processors for host systems. As remote concentrators, they operate as cluster controllers for terminals, format and route messages, interface to foreign networks, switch network traffic, and regulate data flow. As nodal processors, they also provide an interface to foreign networks, route messages, and switch and regulate network traffic. As front-end processors, they offload network and line control functions from the 1100 and 90 Series processors, interface terminals and foreign networks, switch messages, and route traffic. The channel connection to the host is to the word channel of an 1100 Series host and to the byte multiplexer channel of a 90 Series host.

Both DCP models are complete data processing systems that support relatively large error checking and correcting memory, diskette or cartridge disk storage, magnetic tape drives, and operator console with printer. They run the Telcon communications control software. Both feature a multiprocessor design utilizing technology similar to that of the 1100/60 Series. One processor operates as the central communications processor and up to 16 additional virtual processors operate as "port" (I/O) processors which handle the channel connections to hosts, I/O to peripheral devices, and interfaces to communications lines. The processors communicate with each other through shared memory.

In addition, the DCP-40 can run in compatibility mode using microcode to emulate the hardwired MCC front end for the Series 90.

The communications line modules available for the DCPs support asynchronous communications compatible with CCITT V.24 and V.28 and EIA RS-232C standards at up to 9600 bps; synchronous communications compatible with CCITT V.24 and V.28 and EIA RS-232C standards at up to 19,200 bps; and wideband communications compatible with CCITT V.35 standards at up to 64,000 bps and using AT&T Digital DATAPHONE Service at up to 56,000 bps in the U.S. Protocols supported with line control modules and microcode include TTY, async (U100-compatible), sync (U100-compatible) Universal Data Link Control (UDLC), 1100 FDX (full-duplex) byte-oriented, REM 1 half-duplex, byte-oriented for 9200, 9300, and 90/30 Series processors, and IBM BSC.

The DCPs operate as gateways to other networks including X.25 packet-switched public data networks and X.21 circuit-switched public data networks. Currently the DCPs can interface to DATEX-P (Germany), PSS (United Kingdom), DATAPAC (Canada), and NPDN (Scandinavia). Other interfaces to public data networks are available through System 80 and UTS 4000 Series cluster controllers.

The DCPs also interface to IBM hosts through inverted handlers that emulate IBM 3270 controller and IBM 2780/3780 RJE terminals. In addition, the DCPs can interface IBM 3270/2780/3780/3770 terminals to Sperry hosts through software handlers.

Software, developed on host Series 90 or 1100 system, can be loaded into the DCP from diskette subsystem, integrated diskette, cartridge disk subsystem, host channel, or communications line for downline load. Operator's console is UTS 20 CRT workstation.

DCP-10 • entry-level system; 512K-byte memory capacity; single host interface; 5 to 8 communication ports that support up to 5 synchronous or 24 asynchronous communication lines; 256K-byte diskette and 4.6M/9.2M/14.25M/28.5M bytes of disk storage; operator console with optional 80-/200-cps printer.

DCP-20 • memory capacity ranges from 256K to 512K bytes; memory has only one port which is shared by all processors • 16 "virtual" processors implemented by basic processor which incorporates functions of communications processor and I/O processor, can be expanded with 2 additional I/O processors • includes integral diskette drive to load system and Telcon software • supports up to 192 data communications lines, up to 3 channel connections to host processors, and variety of peripheral devices • aggregate I/O data rate is 1.2M bytes per second maximum.

DCP-40 • memory capacity ranges from 128K to 3.5M bytes; memory has 4 entry ports, which are shared when the system includes more than 3 I/O processors • can expand to communications processor and up to 16 I/O processors • includes integrated diskette drive and controller for loading system and one additional diskette controller with 2 drives • supports up to 1020 data communications lines; each I/O processor can support up to 2 host channel connections, thus, theoretically, DCP-40 could support up to 32 host processors • maximum aggregate I/O data rate 1.2M bytes per second per I/O processor; maximum total system throughput based on microcode used • DCP-40 running in compatibility mode uses same basic components but requires compatible mode microcode, 3 compatible interface modules and different communication scanners; configuration limited to 128K bytes of memory and 2 I/O processors; DCP-40 is dedicated when running in compatibility mode; supports up to 64 full- or 128 half-duplex lines.

☐ Distributed Computers

Sperry is now offering the System 11, a smaller version of the 1100 to operate as a distributed processing system in installations with large 1100 system networks. The Mapper 10 is based on the same hardware as System 11 but it is packaged with different software. Sperry still supports the UDS 2000 and the UTS 4000 Series as distributed processing systems. The latest releases of the Telcon software no longer support the V77 Series nor the OS/3 operating system that runs on the low end of the 90 Series (90/20, 30, 40) and on System 80.

Sperry System 11 Distributed Data Processing • based on a new implementation of the 1100 Series architecture called the T3065 processor; operates in the 0.5 MIPS range, comparable to the low end of the IBM 4341 line; differs from 1100 Series in that it costs less, includes an Integrated Communications Processor (ICP), main memory range is 1M to 4M words (4.5 to 18M bytes), and runs under a somewhat limited version of the 1100 operating system • ICP is basically a DCP-10 enclosed in the main cabinet; System 11 can also support external DCP-10, -20, and -40 communications processors for additional line attachment; a Local Workstation Control Unit can connect to up to 16 UTS 20 and 30 terminals through a 250K-bps coaxial cable; up to 5

Sperry DCA
Distributed Communication Architecture

workstation controllers can connect to a System 11, a Communications Line Control Unit supports one line operating at 19.2K bps, it can control communications between a System 11 and remote UTS 20 or 30 terminals or between 2 System 11s • the ICP can use the DCP line modules that operate at 2400 to 250K bps; it can interface to public data networks as well as operate with other front-end processors.

Sperry MAPPER 10 • version of the System 11 hardware packaged with MAPPER 10 software, designed for easy-to-use end-user application development.

Sperry Universal Data System (UDS) 2000 • diskette-based data entry system that consists of system controller and master workstation • controller can support up to 8 workstations; supports diskettes, card reader/punch, printer, and magnetic tape peripherals • in DCA environment can emulate UNISCOPE Display Terminal or operate as UDLC terminal • also provides BSC communications and can emulate IBM 2780, 3741, and 3780.

UTS 4000 Series Cluster Controllers • includes UTS 4020 and 4040 cluster controllers • can perform interactive data entry under local control, maintain files, generate reports, batch data for transmission to host, process local COBOL programs, and query host systems.

☐ Local Area Networks

Sperry has announced SPERRYLINK Office System, which operates as a local area network (LAN) with interfaces to DCA through the DCP-10, -20, or -40. So far, Sperry has indicated it supports a token ring LAN architecture, although no such product has been announced. Sperry has installed its SPERRYLINK Office System using the Interactive Systems/3M broadband LAN. The company emphasized that SPERRYLINK is LAN-independent. In fact, the Desk Station which gives a user access to SPERRYLINK services can interface to host systems through either switched or voice-grade telephone links or direct connect link.

Products announced so far include the Desk Station which functions as the user workstation. The Desk Station can run in standalone mode for file/document creation, word processing, and personal computer operations. It can also run in cooperation with the Office Support System software on a DOPS/10 for a local automated office and with the Interoffice Support Package on a Sperry 1100 mainframe for controlling multiple automated offices. It gains access to the Series 1100 host through a DCP front-end processor, which runs the Gateway Support Package software to provide access to other network facilities including Voice Information Services (VIS). See Figure 7.

SPERRYLINK includes a Voice Information System (VIS) in its Office System. Sperry has signed an agreement with Northern Telecom to supply Sperry with its SL/1 PBX system for use as the control switch for VIS. The VIS will perform a voice/message store-and-forward using the office system and a telephone exchange. User access to system is through a touch-tone telephone.

SPERRYLINK Desk Station • intelligent keyboard/CRT workstation functions as typewriter, computer terminal, word processor, personal computer, or an interface to automated filing and distribution system • supports 2 optional peripherals: diskette subsystem that can control 1 or 2 diskette drives (1M byte each) and choice of character serial printer (40 cps to 160 cps) or correspondence-quality printer (45 cps) • communicates with host by direct connection or over data communication links; uses 7-level ASCII plus parity transmission code; half-duplex, synchronous transmission up to 9600 bps, over voice-grade switched or private line; RS-232C interface • runs under CP/M Level 2.2 operating system; requires diskette drive • Desk Station Support Package software is user's primary interface to SPERRYLINK Office System; also provides word processing, local filing, document processing, and local printing • can interface to DOPS/10 office system for local office control or to host system or DCA network through DCP-10, -20, or -40 communications processor.

Distributed Office Processing Station (DOPS/10) • 16-bit word computer system functions as hub of localized network operating in a distributed office environment; includes 256K-byte

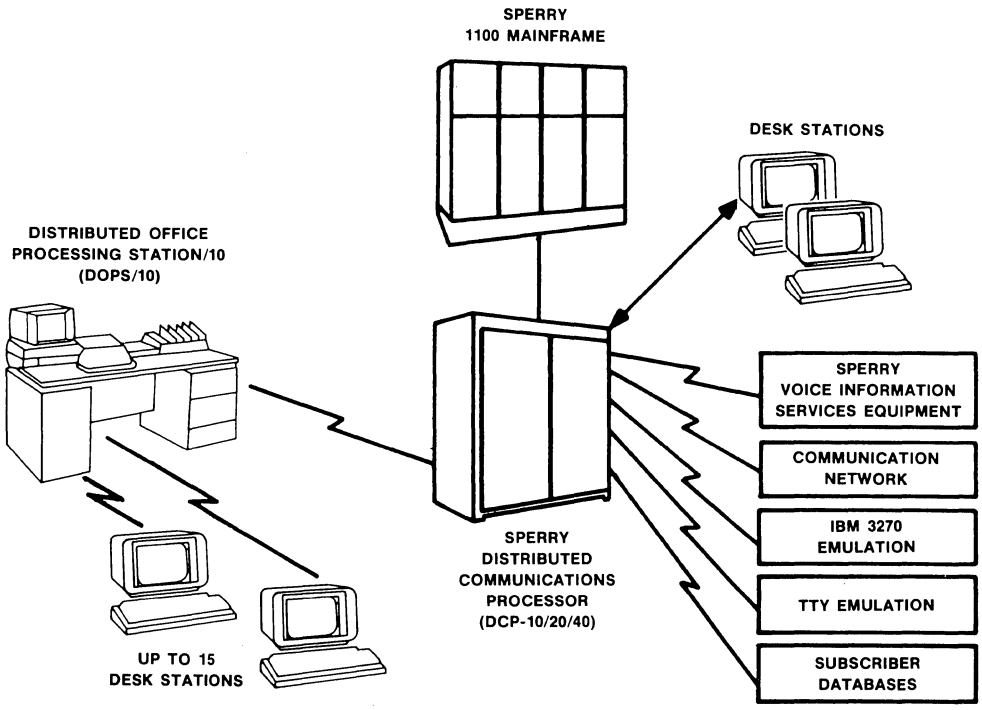

Figure 7 • SPERRYLINK Office System.

Sperry DCA
Distributed Communication Architecture

memory, administrator's keyboard/CRT console, up to 4 diskette drives (1M byte each), fixed-disk subsystem with 4 drives (100M-byte total capacity), and 25-ips tape unit; draft line printer (180/300/640 lpm) optional • processor performance about 0.2 MIPS • runs under Office Support Package that supports up to 15 SPERRYLINK Desk Stations for electronic filing and retrieval, file copying, electronic mail, administrative services, archiving, monthly calendar, time-of-day clock, and access to data processing • operates in conjunction with Desk Station Support Package, Interoffice Support Package (running on 1100 host) and Gateway Support Package (running on DCP).

Distributed Communication Processor (DCP-10/20/40) • interfaces Desk Station and/or DOPS/10 to Sperry 1100 host functions, other manufacturers mainframes, communication links, VIS, and subscriber databases • runs Gateway Support Package in addition to the TELCON/DCA software such as IBM 3270 and TTY emulation and network management.

Sperry 1100 Mainframe • provides meeting scheduler and communication between office support packages under the Interoffice Support Package Software in addition to other functions provided by DCA/Telcon facilities.

☐ Cluster Controller Subsystems

System 80 and UDS 2000 distributed processor systems can function as cluster controllers. System 80 can support up to 40 locally attached workstations and up to 8 9600-bps communications lines; up to 16 workstations or terminals can be multiplexed onto one line. System 80, however, is no longer supported as a DCA product under the latest release of Telcon software. The UDS 2000 supports 4 workstations. The 1900/10 and 1900/20 key-to-disk systems also provide cluster controller functions for their keystations.

Sperry UTS 4020 Cluster Controller • can control up to 12 UTS 4000 Series of workstation/terminals and associated printers (UTS 10 TTY-mode CRT, UTS 20 Editing CRT, and UTS 40 Programmable CRT) • hardware includes processor with up to 256K bytes of memory in 64K-byte increments, integrated 1M-byte diskette, and control for up to 16 peripherals and 12 workstations • runs under control of System Control Program that acts as manager of all hardware/software resources; includes modules for workstation, peripheral, and communications support, diskette file management, and system utilities; can run up to 10 user programs • program development facilities include UTS COBOL, Interactive Program Generator (IPG), and Edit Processor; IPG is tutorial processor; UTS COBOL programs compiled on host 1100 or 90 Series system • data transmission is synchronous using ASCII code, at data rates up to 19.2K bps • can operate in UTS 400 mode for compatibility with UTS 400 terminals and in Uniscope U100 and U200 modes • DDP 4000 system control software is compatible with DCA at the communications level and with UNISCOPE at the applications level; includes Terminal Command and Response Language (TCRL) which is used to control distributed data processing functions, host connection, and remote batch processing • newer DDP 4000 designed to provide smooth transition from Uniscope to DCA/DDP environment; also operates as bridge between UTS 400 program products and full-function DDP terminal; provides file and job transfer facilities, support for 8409 Disk Subsystem, and ISAM (Indexed Sequential Access Method) file access method, and new kernelized operating system for security, reliability, and expandability • DDP 4000 is message oriented with facilities for queuing messages.

Sperry UTS 4040 Cluster Controller • can control up to 32 UTS 20/40 CRT workstations and associated terminal printers and 48 peripherals in addition to peripherals connected to workstations • basic system includes processor, 1M-byte integral diskette as load device, power supply, communication interface, 64K-byte memory expandable in 64K-byte modules to 512K bytes, and interface for up to 4 UTS 20 workstations or 2 UTS 40 workstations; can support up to 7 additional workstation interfaces and up to 6 single or dual 8-bit peripheral interfaces; a choice of 4 printers available • runs same software as UTS 4020 for distributed processing: System Control Program (SCP), UTS COBOL, Interactive Program Generator (IPG), Edit Processor, Loadable Character Set Generators and Text Processing Utility; also provides compatibility with UTS 400 COBOL so UTS 400 users can migrate to UTS 4040 • can operate in 48 different processor states, which isolate user programs from each other; keylocks are standard to prevent unauthorized access • system includes user diagnostic diskette • also runs under DDP 4000 system control software; see entry under Sperry UTS 4020.

☐ Terminals

Sperry produces 3 terminal lines—Uniscope (U) Series of display terminals, Data Communications Terminal (DCT) batch/modular terminals, and the Universal Terminal System (UTS) series of intelligent terminals. The 9000, 90/25, 90/30, 90/40 Series computers and the successor 80 Series systems can function as Nine Thousand Remote (NTR) remote batch terminal to a Series 1100 System. The UDS 2000 data entry system can emulate a Uniscope Display terminal and can operate as a UDLC terminal. The 1900/10 and 1900/20 Systems are key-to-disk systems that can communicate with a Sperry or IBM host as a terminal • Sperry Personal Computers can interface to DCA network using Uniscope Protocol.

Uniscope (U) 100 & 200 Terminals • display terminals that differ in display area, number of characters displayed and character generation • display area is 10x5 inches (U100) and 10x7 inches (U200); number of characters displayed is 980/1024 (U100) and 1536/1920 (U200); character generation is closed stroke (U100) and dot matrix (U200) • 9 numeric and alphanumeric keyboard types available • complete systems that support cassette tape and a printer (30/200 cps) • interfaces available: RS-232C; MIL-STD-188; IBM compatible; and Sperry Terminal Multiplexer, Data Communications Subsystem and Communications Terminal Module Controller, and Sperry 3760 Communications Controller • Sperry Terminal Multiplexer can connect 8/12/16 terminals to one communications line; multiplexers can be connected in cascaded configuration to support up to 256 terminals on one communication line • half-duplex transmission; synchronous up to 9600 bps, asynchronous 300 to 2400 bps, and direct 2400, 4800, 9600 bps • requires Sperry U-201 synchronous or U-202 asynchronous modem or equivalent • host processor can address display terminal or peripheral device or both.

Universal Terminal System 400 • microprocessor-based, programmable display system consisting of master terminal, controller, and up to 6 slave terminals; designed for interactive communications with a host processor; provides 8K bytes of user memory; can support up to 12 peripheral devices: cassette tape, diskette subsystem, printer (4 models ranging from communications output to letter-quality printer), and magnetic stripe reader • base of UTS 400 Text Editor Terminal for publishing industry • used for data entry, data accessing, control and monitor, conversational interaction and off-line operation; can be programmed from host and downline-loaded • RS-232C/CCITT V.24 and MIL-STD-188 interfaces; requires Sperry U-201 synchronous modem or equivalent or Sperry U-202 asynchronous modem or equivalent; transmission rates up to 9600 bps synchronous and 300 to 2400 bps asynchronous • can interface to a Sperry terminal multiplexer which can support from 8 to 16 terminals • compatible protocol with Uniscope U100 and U200 terminals, thus, can be included in multidropped and multiplexed configurations with U100s and U200s.

Universal Terminal System 4000 Family • includes the 4020 and 4040 cluster controller and a number of microprocessor-based CRT/workstation terminals: TTY-compatible, editing display, user programmable terminals • 4020 can support up to 12 workstations • designed as single station display workstations as well as workstations that attach to the cluster controller; as single stations, transmission is half-duplex, synchronous/asynchronous up to 9600 bps; RS-232C/CCITT V.24 interface • line sharing requires Sperry terminal multiplexer • designed for data entry, data access, and conversation interaction applications as well as off-line operation • operates as single-station or as workstation on 4020 cluster controller.

Sperry UTS 10 Workstations • CRT display terminal • unbuffered TTY mode for console or TTY replacement, buffered mode offers full screen application as well as support for magnetic stripe reader, 12-inch CRT with detached keyboard • supports 80-/160-cps printer.

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Sperry UTS 20 Workstations • microprocessor-based CRT display terminal with 16K-/64K-byte memory • operates as single station or cluster workstation • as single station combines features of Uniscope terminal with UTS 400 features, can operate in UTS 400 mode; as cluster workstation, connects directly to 4020 cluster controller • 12-inch CRT with detached keyboard; supports magnetic stripe reader and printer (80/200 cps).

Sperry UTS 30 Programmable Terminal • user-programmable workstation/desktop computer; includes 12-inch display, 96-character (software expandable), and 24 lines x 80 charcters; uses 7-level ASCII code; transmits in synchronous half-duplex mode at 9600 bps; includes RS-232C or CCITT X.21 interface; connects to host using UDLC protocol • runs under UTS 4000 System Control Software • compatible with rest of UTS line.

Sperry UTS 40 Workstations • microprocessor-based intelligent CRT/display terminal • operates as single interactive station or cluster workstation on 4020/4040 cluster controller • provides up to 64K bytes of user memory, magnetic stripe reader, and up to 4 peripherals: 1.3M bytes of diskette storage, 55/80/200-cps matrix printer, 45-cps letter-quality printer • can operate in UTS 400 mode for compatibility with UTS 400 and Uniscope U-100 and U-200 terminals • operates under firmware control which implements communications protocol, dialogue with host processor, transactions between UTS 40 and peripherals, and function key operations; program development via UTS COBOL, which is compiled on Sperry 1100 or 90 Series system, either VS9 or OS/3 system • running under CP/M PLUS operating system, UTS 40 is a personal computer; CP/M software package includes an 8080 assembler, file conversion utility, character set create and load facility, configurator, diagnostic facility, and diskette prep utility • Sperry offers CP/M TTY communications and CP/M Program Conversion Utilities for CP/M PLUS.

Nine Thousand Remote (NTR) System Terminals • 9000 Series, 90/30, 90/40, and System 80 computers running NTR system utility under OS/3 operating system and ICAM terminal support facility • allows system to operate as remote batch terminal to 1100 Series system.

Sperry UTS 60 Color Workstation • same as the UTS 30 except operates as a graphics terminal that runs under the Sperry Business Graphics Utility Program; includes character generator for 384 characters • includes diskette for program loading; has second screen capability so it enters data in one screen while other screen is printing; supports printer • compatible with rest of UTS line.

Sperry 1900/10 System • a key-to-disk, shared processor system (128K to 512K bytes of memory) that can support up to 32 keystations; system includes processor, one or more magnetic tape units, one or more disks, keystations, and printers • can communicate directly with host or with other 1900/10 Systems or can communicate over data links • integrated communication adapter provides RS-232C interface for synchronous transmission at up to 9600 bps; also supports BSC procedures and can emulate IBM 2770, 2780, 3780 terminals, IBM 3271 control unit, or HASP terminal for communication with IBM S/370-compatible host and Sperry Uniscope 100 Display Terminal for communication with Sperry 90 and 1100 Series systems.

Sperry 1900/20 System • multiprocessor version of the 1900/10; additional functionality includes ANSI 74 COBOL compiler and Multiport Communications Processor (MCP) • MCP includes its own 32K-byte memory and provides 2 or 4 concurrent communications ports • 1900/10 systems can be upgraded to 1900/20.

Sperry Personal Computer • available in 7 models (100, 200, 250, 300, 400, 450, and 500) that differ in type of display (monochrome, medium-resolution color, high-resolution color), and support of disk storage (single diskette, dual diskette, combined single diskette/10M bytes fixed disk) • all are based on the Intel 8088-2 dual speed microprocessor with built-in time-of-day clock and speaker • includes self-test in ROM, 256K-byte RAM expandable to 640K bytes, 4.77 MHz-to-7.16 MHz processing speed switch, 1 or 2 360K-byte diskette drive/s, 50 bps to 9600 bps asynchronous communications, 7-slot IBM-compatible expansion bus • Models 100, 200, and 400 include monochrome display, Models 250 and 450 include medium-resolution color display, Models 300 and 500 include high-resolution color display • Model 100 includes a single 360K-byte floppy disk drive, Models 200, 250, and 300 include 2 360K-byte floppy diskette drives, Models 400, 450, and 500 include single 360K-byte floppy diskette drive and a single 10M-byte fixed disk drive • all can connect to DCA network host using TTY, UNISCOPE, or IBM 3270 protocol.

☐ Multiplexers

Sperry Terminal Multiplexer • for UTS 4000 systems; connects up to 8 data terminals to one communications line; can be expanded to support up to 16 terminal connections in 4-connection increments • additional multiplexers can be attached to the connection points on the primary multiplexer to support up to 256 terminals • Sperry U-201 synchronous modem or U-202 asynchronous modem optional • permits full-duplex communications.

☐ Modems

U-201 Synchronous Modem • up to 9600 bps.

U-202 Asynchronous Modem • up to 2400 bps.

Direct Connection Module (DCM) • freestanding modem replacement module; operates half- or full-duplex; for synchronous transmission at 2400/3600/4800/7200/9600 bps; for asynchronous transmission at up to 9600 bps; one DCM required per terminal; up to 4 DCMs can be configured on multidropped system • can be located up to 15,000 feet from host or controllers.

• END

Sperry DCP Series
DCP/10, DCP/20 & DCP/40 Distributed Communication Processors

■ PROFILE

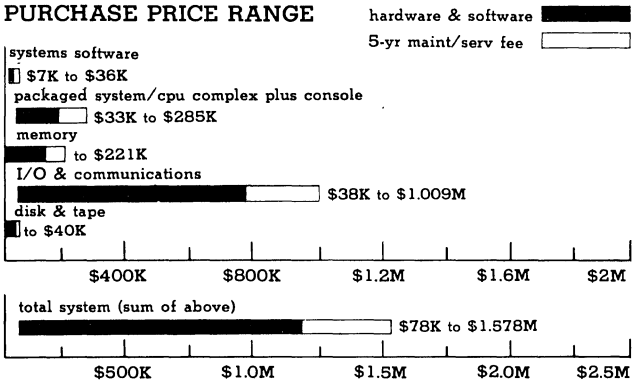
Function • programmable front-end processor, remote concentrators, or network processors.

Associated Systems/Networks • Sperry 1100 Series and 90 Series host processing systems in Distributed Communications Architecture (DCA) networks • X.25 gateway from DCA to other networks • BSC and SNA gateway to IBM systems • public data networks such as NPDN, DATEX-P, PSS, TRANSPAC, DATAPAC • SNA gateway planned for 1984.

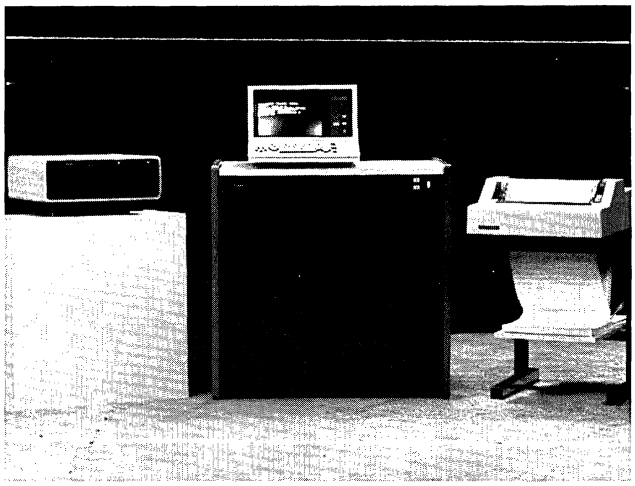
Communications/Networks • supports up to 24 asynchronous or 5 synchronous lines (DCP/10), up to 180 (DCP/20) or 1,000 (DCP/40 native mode) half-/full-duplex 2400-bps asynchronous or 9600-bps synchronous lines • medium-to-high-speed modules support asynchronous communication to 19.2K bps and BSC data rates up to 9600 bps, and UDLC and other Sperry synchronous protocols up to 19.2K or 64K bps; X.21 circuit/packet line module to 19.2K bps • attachment to 1 (DCP/10), up to 3 (DCP/20), or 8 (DCP/40) direct channel-interfaced hosts • DCP/40 in MCC-compatible mode can support up to 3 Type II scanner subsystems with ports for 64 full- or 128 half-duplex lines each, and data rates of 1800/9600 bps asynchronous/synchronous; support for up to 1 Series 90 or 2 Series 1100 channel-attached hosts in compatible mode, wideband facilities for 19.2K/40.8K/50K/230K bps • X.21-compatible adapter for synchronous line up to 100K bps; wideband facilities for 1 line from 19.2K to 230K bps; V.35-compatible interface for Bell DDS at rates up to 56K bps.

Operating System • DCP/10, DCP/20, and DCP/40 OS for operating in native mode; MCC OS for DCP/40 operating in MCC-compatible mode; • support Telcon software for DCA networks, generated on 1100 or 90 Series host, then loaded into DCP/10, DCP/20, and DCP/40.

PURCHASE PRICE RANGE



SPERRY DCP SERIES PURCHASE PRICING bar graphs cover price ranges between "small" DCP/10 and "large" DCP/40 native mode configurations for software and hardware products (solid bars), and for associated 5-year period maintenance fees (open bars) • **SMALL SYSTEM** based on DCP/10 **CPU complex** with 512K-byte memory and console; DCP OS **system software**; 4 2400-bps asynchronous and 4 9600-bps synchronous **communication interfaces**; 1 1100 Series host and 2 peripheral **I/O interfaces**; 256K integral diskette and freestanding diskette subsystem with 2 drives • **LARGE SYSTEM** based on DCP/40 native mode **CPU complex** with 512K-byte memory, 3 expansion cabinets, console, and 200-cps printer; DCP OS and OS extended **systems software** service; add-on **memory** for 3.5M bytes total; 700 2400-bps asynchronous, 50 9600-bps synchronous, 4 19.2K-bps synchronous and 2 64K-bps synchronous **communication** interfaces; 6 1100 Series and 2 Series 90 host interfaces, and 1 peripheral **I/O interface**; 256K integral diskettes, and 2 14M-byte non-removable **disks**, and a single 25-ips magnetic **tape subsystem**.



Languages/Program Development • assembler, system generator, collector, and network generator facilities on Series 1100 or 90 host • application unique assembled programs stored in library as relocatable binary elements; input parameter statements define system so collector can select standard system modules as well as assembled modules from software library for system generation • network generation independent of system generation; configures site-unique information such as terminal and line data.

Processor • 512K to 2.5M bytes on DCP/10, 512K to 2.0M bytes on DCP/20; 512K to 3.5M bytes on DCP/40; 128K bytes on DCP/40 running in compatible mode • support diskette, cartridge disks, nonremovable disks, magnetic tape, and console with printer peripherals • DCP/40 performance about 4 times that of DCP/20.

First Delivery • 1980 for DCP/40; 1981 for DCP/20; 1983 for DCP/10.

Systems Delivered • over 1,000.

Comparable Systems • perform functions for Sperry systems that are similar to IBM 3705-II and 3705-80 Communications Controllers, Burroughs CP 3680 and CP 3680-01 High-Performance Data Communications Systems and NCR 721 Communications Processors.

Vendor • Sperry Corp; P.O. Box 500, Blue Bell, PA 19424 • 215-542-4011.

Distribution • worldwide through direct sales and service offices.

■ ANALYSIS

The DCP/10, DCP/20, and DCP/40 software controlled processors can be configured as network processors and as local and remote front ends to relieve the Series 1100 and 90 hosts of

Sperry DCP Series
DCP/10, DCP/20 & DCP/40 Distributed Communication Processors

handling routine communication line and network tasks. They provide direct-channel interfaces to one or more hosts, and control the transfer of data between the host and communication network. They format messages, route them through the network, regulate data flow over network circuits, and perform network management functions.

When operating as remote/nodal communication processors, the DCP/10, DCP/20, and DCP/40 transfer data over communication links between host processors and terminals or between other network components.

The DCP/40 can also run in "compatible" mode to emulate Multichannel Communications Controller (MCC) processor front ending the Series 90. The DCP/40-compatible mode doubles the throughput attainable on the emulated systems as well as gaining entry to the greater functionality of the DCP/40.

The DCP/10, DCP/20, and DCP/40 are integral to Sperry's Distributed Communications Architecture (DCA) which is evolving from the Telcon communication network stage to compliance with the Open Systems Interconnection (OSI) recommendation of the International Standards Organization (ISO). The DCP/10, DCP/20, and DCP/40 perform no distributed processing tasks, but are totally devoted to network and communication tasks—implementing the DCA network protocols, formatting and routing messages, pacing transmissions, and controlling the network.

☐ Ease of Use Features

Programs for the DCP/10, DCP/20, and DCP/40 are generated primarily by entering statements into a 1100 or 90 Series host to select preprogrammed modules from a program library. User programs can be added to the library through the host assembler. The system is generated by a collector program that links the selected programs together into a loadable system module. Networks are generated by entering the parameters for a specific user's network (number of lines, type of lines, hosts, number of terminals, type of terminals, and other components). The network generator uses the parameters to distribute the software modules required to implement the network.

☐ Modes of Operation

The DCP/10, DCP/20, and DCP/40 running in native mode can be configured as front ends for up to 1 (DCP/10), 4 (DCP/20), 16 (DCP/40) 1100, 1 (DCP/10), 3 (DCP/20), or 8 (DCP/40) 90 Series host processors or as remote/nodal processors controlling transmission of data between points in a network. The DCP/10 and DCP/20 run only in native mode. The DCP/40, however, also runs in MCC-compatible mode, which emulates the Multichannel Communications Controller (MCC) front ending a Series 90 host.

☐ Strengths

The DCP/10, DCP/20, and DCP/40 were designed as integral parts of Sperry's Distributed Communications Architecture (DCA) as currently embodied in Telcon hardware/software systems. They were designed to be flexible and appropriate for many applications, providing a broad range of capabilities and power, supporting host computers and a full spectrum of data communication facilities and line speeds. Major strengths are therefore related to performance of these functions.

The DCP/10, DCP/20, and DCP/40 are microprocessor-based systems. Microprocessors in DCP/20 and DCP/40 are used to distribute communication processing away from the general-purpose communication processor to I/O processors (IOPs) which handle communication between channel-attached hosts and the network communication lines. The DCP/10 provides no IOPs. The DCP/20 in its smallest entry-level configuration uses only the general-purpose processor but generates virtual IOPs to handle transmission tasks. Large configurations can use up to 2 IOPs to distribute communication processing. The DCP/40 can implement up to 16 IOPs with throughput for each IOP 1.13M bps. IOPs also have direct access to memory.

Throughput for the DCP/10 and DCP/20 is more limited than for the DCP/40 not only by the number of IOPs it supports, but by the number of access ports to memory. The DCP/10 and DCP/20 have 1 port to memory. The DCP/40 has 4 ports to memory. The general-purpose communication processor uses 1 port, and the IOPs share the other 3 ports. This arrangement makes the DCP/40 about 4 times as powerful as DCP/10 or DCP/20.

The memory range is also large. Minimum memory is 512K bytes in native mode for DCP/40 systems, and 128K bytes for DCP/40-compatible mode. Maximum memory is 2.0M bytes for DCP/20, 3.5M bytes for DCP/40, and 2.5M bytes for the DCP/10.

The Telcon software, which runs on the DCP/10, DCP/20, and DCP/40, provides a total environment for DCA network operations. Telcon software implements a number of availability, reliability, maintainability (ARM) features to allow recovery from errors, continued operation when errors occur, graceful degradation if components fail, safe transport of messages, and services to isolate and diagnose faults.

The DCP/40-compatible mode is available to provide a bridge between Series 1100 and Series 90 systems. The DCP/10, DCP/20, and DCP/40 are also compatible with each other. All in all they are systems well designed, designed to follow DCA as it continues to evolve.

☐ Limitations

In order to maximize performance and throughput, Sperry designed the DCP systems for network processing only. The DCP Series is not intended for use as distributed processing systems or as standalone systems. They were designed to control data communication lines, to manage networks, to format and route messages, and to pace transmissions. That is all they can do. Sperry provides other systems such as System 80 for distributed data processing. The DCP/10, DCP/20, and DCP/40 are dependent on host systems for program development and will always operate in conjunction with one or more host processors.

■ SOFTWARE

☐ Terms & Support

Terms • unbundled software such as DCP/10 OS, DCP/20 OS, DCP/40 OS, and MCC Emulate OS; are available on monthly rental fee basis.

Support • included with monthly charge.

☐ Operating Systems

DCP/10, DCP/20 & DCP/40 O/S • DCP native-mode operating system; Telcon software • includes communication software modules for network control: network management interface, internetwork communication, statistics gathering for error control, online diagnostics, status monitoring, command processing, and system synchronization • once loaded DCP processors can handle all network control functions independent from the host, thus network can continue to function even when host goes down • general network management functions include data flow control through pacing and throttling, message routing, message prioritizing, handling broadcast and unsolicited messages, and automatic or demand status and events logging and reporting • operator interface allows initialization, rebooting, shutdown, reconfiguration, performance of diagnostics and recovery, maintenance, solicitation of status information, I/O start/stop control, and automated line-switching control • Telcon now at Release 6 which provides enhancements over previous releases for ease of use, IBM and PDN Gateway support, direct connect support for terminals, maintainability and increased availability, and increased disk storage support • supports warm DCP standby for 3 active DCPs and load sharing among up to 8 DCPs at a node.

6136-03 DCP/40 O/S • current release is Telcon Release 6: **$300 mo**

6136-92 DCP/10 O/S • Telcon Release 6: **150**

MO: monthly software license fee including service. Prices effective as of September 1984.

Sperry DCP Series
DCP/10, DCP/20 & DCP/40 Distributed Communication Processors

6136-95 DCP/20 O/S • Telcon Release 6:
200

Extended Support Service • programming aids for DCP native mode OS.

6136-91 DCP/10 Extended Support:
70

6136-96 DCP/20 Extended Support:
92

6136-97 DCP/40 Extended Support:
120

DCP/40 MCC Emulate O/S ○ provides for operation of DCP/40 in MCC emulate mode for front ending Series 90 • 6144-00 DCP/40 MCC Emulate O/S:
95

☐ Communications/Networks

Telcon software facilities sold with Series 1100 or 90 hosts, and with the DCP/10, DCP/20, and DCP/40 includes capabilities for generating user- and configuration-dependent system programs on host; file management; data management; peripheral handlers; and loaders. Files are generated and maintained primarily for configuration and system data management. File management runs as application program with interfaces to local operating system and management services. Peripheral handlers support cartridge disk, hard disk, diskette and magnetic tape subsystems. Loaders provided from disk, communications lines, or host channels.

Telcon separates the network transmission system from the applications system in DCA networks. The DCP processors perform all network and transmission system control functions under their own native or compatible mode operating systems.

An IBM 2780/3780 terminal handler is one of the standard handlers in the Telcon communication software. The handler includes a 2780/3780 to NTR adapt program to interface Sperry hosts and a 2780/3780 passthrough to interface IBM hosts.

The handler supports point-to-point configurations via switched or dedicated lines, and accommodates both ASCII and EBCDIC character codes.

Adapt software maps non-DCA devices to a DCA environment. NTR (Nine Thousand Remote) is standard Sperry protocol for remote batch terminals.

The 2780/3780 terminal handler is in the Telcon 3RIA release as well as in later releases.

SNA coexistence software to the DCP is available; the interface connects IBM 3270 terminals and Sperry UTS 4000 terminals to DCPs.

Sperry provides other communication products separate from the Telcon software. These include an IBM Inverted Handler that supports Sperry terminals as 2780/3780 terminals for IBM hosts, an IBM 3270 Terminal Handler, and an IBM 3270 Inverted Handler.

Sperry also provides standard program products to interface public data networks. Current support includes NPDN (Scandinavia), DATEX-P (West Germany), PSS (United Kingdom), TRANSPAC (France), and DATAPAC (Canada). Future support will include DN-1 (Netherlands), TELENET (USA), DDX (Japan), AUSTPAC (Australia), TELEPAC (Switzerland), and DATEX-P (Austria).

6276-00 BSC 3270 • handler accommodates IBM 3270 terminals used with Telcon software; supports IBM 3270 (Models 1 and 2), 3274 (1C and 51C), and 3276 (1, 2, 3, and 4) Control Units for communication with Sperry Series 1100 hosts • for DCP/20 and DCP/40 only:
$150 mo

6276-01 BSC 3270I • inverted handler accommodates Telcon systems communicating with IBM host over emulated point-to-point or multipoint line from BSC 3270 (6276-00) or from Sperry UTS 4000 standard Telcon handler:
100

T6276-02 BSC 3270 • same as 6276-00 except for DCP/10 only:
150

T6276-03 BSC 3270I • same as 6276-01 except for DCP/10 only:
100

6277-00 BSC 2780I • inverted terminal handler for use with Telcon software when interfacing an IBM host; an emulated point-to-point configuration using the Telcon BSC 2780 handler:
75

T6277-00 BSC 2780I • same as 6277-00 except for DCP/10 only:
75

6257-00 DATEX-P DCP PSCS ○ adds support to Telcon software for X.25 DATEX-P packet-switched network in Germany; allows communication between DCPs or between DCP and UTS 4000 terminal using DATEX-P network; 1 allowed per node • for DCP/20 and DCP/40 only:
175

T6257-00 DATEX-PDCP PSCS • same as 6257-00 except for DCP/10 only:
175

6257-01 PSS DCP PSCS • adds support to Telcon software for X.25 PSS packet-switched network in United Kingdom; allows communication between DCPs or between DCP and UTS 4000 terminal using PSS network; 1 allowed per node; for DCP/20 and DCP/40 only:
175

T6257-01 PSS DCP PSCS • same as 6257-01 except for DCP/10 only:
175

6258-00 Nordic DCP CSCS • adds support to Telcon software for X.21 NPDN circuit-switching network in Scandinavia; allows communication between DCPs or between UTS 20 and DCP using NPDN network; for DCP/20 and DCP/40 only:
175

T6258-00 Nordic DCP CSCS • same as 6258-00 except for DCP/10:
175

☐ Program Development

All program development is done on a Series 1100 or 90 host. Users can develop programs using host assembler. Programs are then stored in a library with standard system program modules which implement Telcon communications networks. The user enters statements defining the DCP/10, DCP/20, or DCP/40 system configuration. A collector uses the statements to build the operating software for the DCP systems. Each host and DCP system is configured independently of all other systems. The network software is then integrated to handle specific network configurations.

■ HARDWARE

☐ Terms & Support

Terms • equipment can be purchased or acquired on either a monthly rental or 5-year lease basis; maintenance charges are not included in the monthly rental or the 5-year lease prices • 7-year lease is available for state/local government and educational institutions • initial system at new educational account eligible for 15% discount.

Support • maintenance service available under the Basic Monthly Maintenance Charge (BMMC) for Group A, B, C, D, or E equipment under differing terms; Group A equipment includes the CPUs; Group B covers intelligent terminals and complex communications subsystems; Group C covers data entry subsystems; Group D covers a variety of terminals and modems; and Group E covers the UTS 4000 Series • DCP Distributed Communications Processors fall into Group B but are supported

Sperry DCP Series
DCP/10, DCP/20 & DCP/40 Distributed Communication Processors

under same terms as Group A when located at same site as a Series 1100 or Series 90 computer system • the principal period of BMMC maintenance for Group A is consecutive 9-hour period per day between 7:00 AM and 6:00 PM, Monday through Friday; maximum of 2 hours may be scheduled outside these hours for an additional charge of 5% of the BMMC • for Group B, same conditions as Group A apply except that premium of 10% applies to 2 hours scheduled outside the basic period • additional extended periods of scheduled maintenance are permitted for Group A equipment only; at premiums from 5% (4-hour coverage on Saturday) to 20% (24-hour coverage on Sunday) • maintenance services outside principal period available on on-call basis.

☐ System Overview

The DCP/10, DCP/20, and DCP/40 communication processors are the replacements for and were developed from the original Sperry DCP series designed to run with Telcon software. The DCP/10 is an entry-level system, supporting up to 8 communication ports, including 1 host word channel attachment and an I/O line module supporting diskette/disk subsystem. It is upward compatible with DCP/20 and DCP/40. The DCP/20 serves as a middle-range system, supporting up to 48 communication ports and up to 3 host channel attachments. The more powerful DCP/40 supports up to 255 ports over 1,000 lines using multiple line modules and up to 192 lines using multiple line module host channel attachments. The DCP/40 can also be programmed to run in a "compatible" mode to support the Multichannel Communications Controller (MCC) for the Series 90 processor. In compatible mode, the DCP/40 supports up to 384 half-duplex lines via 3 scanner modules.

The DCP systems concentrator and network operate as front-end, remote concentrator and network processors under DCP native mode, or MCC-compatible mode operating system software. As front ends, they off-load the host and run software to control data transfers between the host and the communication network. Functions performed include the formatting and routing of messages; the control of communication line facilities between terminals and other devices; and the regulation of data flow across the network. As remote communication processors, the DCP/10, DCP/20, and DCP/40 operate as remote concentrators or as nodal network processors. Remote concentrators transfer data to central hosts from remote processors and terminals. Nodal network processors route messages to other nodes in the network but provide no terminal interfaces. The communication processors can handle various combinations of asynchronous, synchronous, and wideband facilities.

The DCP/20 and DCP/40 communication processors use microprocessors to distribute communication tasks, thereby increasing throughput. The heart of the system is a general-purpose communication processor with associated memory to control the network and manage messages. Input/output processors (IOPs) handle I/O units, host channel connections, and line modules.

Each IOP can accommodate 18 printed circuit cards implementing 16 logical ports. Aggregate throughput per IOP is 1.3M bytes per second. The DCP/10 can implement up to 9 "virtual" IOPs and the DCP/20 up to 17 virtual IOPs. The DCP/20 can also implement up to 2 microprocessor-based IOPs; the larger DCP/40 can implement up to 16 microprocessor-based IOPs.

The DCP/40 in compatible mode uses different I/O and communication line modules. A host channel adapter (HCA) provides an I/O interface to a byte channel on a Series 90 host. The DCP/40 also implements a remote input/output controller (RIOC) which provides direct connection to 1100 Series hosts and parallel connections to disks and other DCP peripherals. The communication processor is also supported by the Type II-E scanner which supports up to 64 full- or 128 half-duplex lines. Depending on the use of IOPs configured with the DCP/40, up to 3 scanners can be used in compatible mode operations.

Redundant DCP configurations can offer backup in case of equipment failure. A remote control module (RCM) can provide remote control for up to 4 processors in unattended DCP operation. The RCM can be connected by direct link or through a data communication line.

A Line Switch module is available to support unattended operation of communication subsystem; it switches lines and peripherals between DCP/10s, between DCP/20s, or between DCP/40s.

DCP/10 Configuration

Minimum Configuration • 512K-byte memory • single host interface; 6 line interfaces (ports) • integral 655K-byte diskette • optional 1M-byte standalone diskette subsystem or disk subsystem supports 4.6M/9.2M/14.25M/28.5M bytes of storage • operator console.

Maximum Configuration • 2.5M-byte memory • supports single host and 8 communication ports; 6 communication ports with multiline adapter can provide 24 asynchronous lines; each of 3 communication ports support single synchronous line • integral 256K-byte diskette and 28.5M bytes of disk storage • operator console with 80-/200-cps printer.

DCP/20 Configurations

Minimum Configuration • 256K-byte memory • 1 host and 1 line interface • integral 256K-byte diskette, and 10M-byte disk modules • operator console.

Maximum Configuration • 2.0M-byte memory • 3 host and 48 line interface ports; with multiline adapter can connect up to 192 synchronous or asynchronous lines • integral 256K-byte diskette and 28.5M bytes of disk storage • 25-ips 800-bpi tape module • operator console with 80-/200-cps printer.

DCP/40 Native Mode Configurations

Minimum Configuration • 256K-byte memory • 1 host and 1 line interface • integral 256K-byte diskette and standalone 4.6M-byte fixed disk drive or 10M-byte disk cartridge • operator console.

Maximum Configuration • 3.5M-byte memory • 16 host and 255 line interface ports; with multiline adapter can connect up to 1,000 synchronous or asynchronous lines • integral 256K-byte diskette, and 28.5M bytes of disk storage • 25-ips 800-bpi tape module • operator console with 80-/200-cps printer.

DCP/40-Compatible Mode Configurations

Minimum Configuration • 128K-byte memory • 1 host and 64/128 full-/half-duplex line interfaces • integral 256K-byte diskette, and standalone 512K-byte diskette modules • operator console.

Maximum Configuration • 128K-byte memory • 1 host and 192/384 full-/half-duplex line interfaces • integral 256K-byte diskette, and standalone 512K-byte diskette modules • operator console with 200-/300-cps printer.

☐ CPU & Memory Packages

DCP/10 CPU & Memory

1986-99 DCP/10 FEP with Diskette • CPU with 512K-byte memory; operator and maintenance panels power supply, 1 ISI host I/F line module, integral 256K-byte diskette, and freestanding diskette subsystem with 2 drives • supports 5 communication ports and optional disk storage • front-end configuration for Series 1100 System • requires UTS 20 or UNISCOPE-compatible terminal as a console; 6136-92 operating system software; and communication line modules to fit application:

$814/$646 mo	$27,687 prch	$159 maint

1986-91 DCP/10 FEP with 4.6M-Byte Disk • same as 1986-99 but with 4.6M-byte disk instead of freestanding diskette subsystem:

1,028/800	31,577	208

MO: 1-year/5-year rental/lease charge without maintenance. PRCH: purchase price. MAINT: monthly maintenance charge. NC: no charge. Prices effective as of September 1984.

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DCP/10, DCP/20 & DCP/40 Distributed Communication Processors

1986-83 DCP/10 FEP with 14M-Byte Disk • same as 1986-99 but with 14M-byte disk instead of freestanding diskette:

1,127/873	32,631	220

1986-95 DCP/10 Remote with Diskette • CPU with 512K-byte memory, operator and maintenance panels, power supply, and integral 256K-byte diskette • remote concentrator configuration supports up to 6 communication ports • requires 6136-92 operating system software and line modules to fit application:

684/541	22,847	131

1986-87 DCP/10 Remote with 4.6M-Byte Disk • same as 1986-9 but with 4.6M-byte disk instead of freestanding diskette:

897/694	26,695	180

1986-79 DCP/10 Remote with 14M-Byte Disk • same as 1986-95 but with 14M-byte disk instead of freestanding diskette:

997/768	27,791	192

DCP/20 CPU & Memory

F8597-98 DCP/20 Mod I/1100 • preconfigured diskette-based DCP/20 for Series 1100 host systems • includes DCP/20 CPU with 384K bytes of memory, 2M bytes of diskette storage, integrated 1939 diskette, Series 1100 I/F, and 8-bit peripheral I/F • supports up to 13 communication ports • requires UTS 20 or UTS 400 as console, DPS/200S, and communication line modules to fit application:

$1,242/$991 mo	$46,980 prch	$249 maint

8597-94 DCP/20 MOD I/90 • preconfigured diskette-based DCP/20 for Series 90 host systems • includes same capabilities as the 8597-98 except supports up to 16 communication ports and includes S/90 host I/F (F1947-00) instead of S/1100 host I/F (F1946-02):

1,242/991	46,980	249

8597-82 DCP/20 MOD II/1100 • preconfigured 8409 disk-based DCP/20 for Series/1100 host • includes 8597-99 DCP/20, 384K-byte memory, F1939-00 integrated diskette, F1946-02 S/1100 I/F, F3878-00 8-bit peripheral I/F, T8409-99 4.6M-byte disk, and F2895-00 active line indicator • requires UTS 20 or UTS 400 as console, DCP/20 OS, and communication line modules to fit application:

1,482/1,165	51,725	301

8597-86 DCP/20 MOD II/90 • preconfigured cartridge disk-based DCP/20 for Series 90 host systems • includes 8597-99 DCP/20, F1939-00 integrated diskette, F1947-00 S/90 host I/F, F1948-01 16-bit peripheral I/F, 8408-02 disk controller, F2380-XX 10M-byte disk drive, and F2895-00 Active Line Indicator • supports up to 11 communication ports requires UTS 20 or UTS 400 as console, DPS/20 OS, and communication line modules to fit the application:

1,706/1,323	66,489	380

8597-80 DCP/20 MOD III/1100 • preconfigured 8409 disk-based DCP/20 for Series 1100 host systems • includes 8597-99 DCP/20, 384K-byte memory, F1939-00 integrated diskette, 1946-02 S/1100 I/F, F3878-00 8-bit peripheral I/F, 8409-97 14M-byte disk, and F2895-00 active line indicator • supports up to 12 communication ports • requires UTS 20 or UTS 400 as console, DCP/20 OS, and communication line modules to fit application:

1,582/1,239	52,821	313

F8597-99 DCP/20 • CPU with 256K-byte memory, operator and maintenance panels, and power supplies • space for up to 16 line modules, 1 host interface and 2 peripheral interfaces • requires F1939 series integral diskette, a freestanding T8406 diskette subsystem or T8408 disk cartridge modules; UTS 20 or UTS 400 console; DCP/20 operating system software; and host I/O and communications/peripheral line interfaces • aggregate processor throughput is 1.2M bytes per second:

756/605	29,040	145

8597-01 DCP/20 Expansion Cabinet • freestanding cabinet for expanding system; contains power, cooling, maintenance panel, operator panel, and IOP; provides up to 8 line modules expandable to 16 • maximum of 2 per DCP/20 system:

625/500	24,000	109

F3539-00 128K Storage Expansion • 128K-byte add-on memory module; uses 16K-bit chips • up to 2 per DCP/20 providing maximum of 512K bytes:

131/105	4,500	22

F3539-99 256K Expansion • 256K-byte memory module using 16K-bit chips; 1 can be added to 8597-99:

225/180	8,650	44

F1936-00 Storage Port Expander • provides multiplexed interface to a single local storage access port for up to 4 accesses for DCP/20- and DCP/40-compatible mode processors:

95/75	3,550	19

F2894-00 Line Module Expansion • provides for 8 additional line modules in 8597-01:

460/250	12,000	60

F2895-00 Active Line Indicators • provides for monitoring up to 16 half-/full-duplex lines in 8597-99 or 8597-01:

25/20	890	4

F3835-02 Remote Partitioning Feature • provides DCP/20 with Series 1100 remote partitioning capability; can control up to 4 host interface line modules:

25/20	960	5

DCP/40 Native Mode CPU & Memory

8596-96 DCP/40 • CPU with 512K-byte memory using 64K-bit chips, integral IOP, operator and maintenance panels, and power supply • space for up to 3 additional 512K-byte memory modules, 3 additional IOPs, 64 line modules, 1 host interface • requires F1939 series integral diskette; F2380 with F8408 disk cartridge; or 8409 disk subsystem with F3878 line module; UTS 20 or UTS 400 console; 6136 operating system software; host I/F and communication line modules to fit application:

$2,195/$1,755 mo	$84,245 prch	$402 maint

8596-79 DCP/40 MOD I/1100 • preconfigured 8409 disk-based DCP/40 for Series 1100 host system • includes 8596-96 DCP/40, integrated F1939-00 diskette, F1946-02 S/1100 I/F, 8409 disk control and 4.6M-byte disk, and F1825-05 active line indicators • supports up to 11 communication ports • requires 3560-XX UTS 20 or UTS 400 as console and 6136-01 DCP/40 OS:

2,809/2,225	102,675	584

8596-91 DCP/40 MOD I/90 • preconfigured cartridge disk-based DCP/40 for Series 90 host system • includes 8596-96, integrated F1939-00 diskette, F1947-00 S/90 host I/F, F1948-01 16-bit peripheral I/F, T8408-02 disk controller, F2380-XX 10M-byte disk drive, and F1825-05 active line indicators • supports up to 9 communication ports • requires UTS 20 or UTS 400 console and 6136-01 DCP/40 OS:

3,033/2,383	117,439	663

8596-77 DCP/40 MOD II/1100 • preconfigured 8409 disk-based DCP/40 for Series 1100 host systems • same as 8596-79 except configurations include 14M-byte 8409 disk and second IOP • supports up to 27 communication ports • requires UTS 20 or UTS 400 as console and 6136-01 DCP/40 OS:

3,324/2,629	119,651	674

8596-83 DCP/40 MOD II/90 • preconfigured cartridge disk-based DCP/40 for Series 90 host systems • same as 8596-91 except includes second IOP and supports up to 25 communication ports • requires UTS 20 or UTS 400 as console and 6136-01 DCP/40 OS:

3,448/2,713	133,319	748

F1930-01 Storage Expansion (512K Bytes) • provides expansion for memory in 8596-96 DCP/40 cabinet; uses 64K-bit memory chips; up to 3 can be added to 8596-96:

410/325	15,600	116

1945-00 DCP/40 Expansion Cabinet • supports up to 3

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512K-byte storage banks using 16K-bit chips in conjunction with F2942 controller • can also be used with F1929-99 storage controller and F1930-00 128K-byte storage modules • supports up to 4 IOPs in conjunction with F1933 controller module • up to 3 per DCP/40, but only 1 can contain memory expansion:

705/565	27,060	134

F2942-00 Storage Controller • controller with 128K-byte memory module using 16K-bit chips • supports up to 3 F1930 memory modules to provide 512K-byte storage bank via T1945 cabinet • only 1 per system:

700/560	26,880	133

F1929-99 Storage Controller Expansion • controller supporting up to 4 F1930 memory modules to provide additional 512K-byte storage banks via T1945 cabinet • up to 2 per system:

365/290	13,950	71

F1930-00 128K Storage Expansion • 128K-byte add-on memory module using 16K-bit chips • up to 3 per F2942 controller for 2nd 512K bank • up to 4 per F1929-99 controller for 3rd and 4th 512K banks:

145/115	5,570	32

F1936-00 Storage Port Expander • multiplexed interface for 4-port memory access to DCP/40:

99/75	3,550	17

F1928-00 Operator Station • freestanding sit/stand work surface for local console and flexible disk for DCP/40 system (both modes):

30/25	1,200	NA

F1825-05 Active Line Indicator • provides visual display of line activity on up to 16 lines on single IOP; mounts on top of cabinet containing IOP:

25/20	960	4

F3854-00 ALI Switch • allows selection of 1 of the 4 sets of lines that can be monitored; mounts in the F1825-05:

5/4	200	1

F3835-00 Remote Partitioning Feature • provides DCP/40 with Series 1100 remote partitioning capability; can control up to 4 SU00057 Host Interface Line modules located in 1 cabinet or 2 adjacent cabinets:

25/20	960	5

DCP/40-Compatible Mode CPU & Memory

F8596-98 DCP/40 • CPU with 128K-byte memory using 16K-bit chips, integral IOP, I/O controller, operator and maintenance panel, and power supply • requires F1939 integral diskette; F1928 scanner; and 3542 console • also requires F1947 host channel connection; and 6144-00 emulation software • MCC mode supports up to 64/128 half-/full-duplex line interfaces • MCC mode will not support any peripherals other than console (3542) or integral diskette; allows only 1 Type II-E scanner:

$1,500/$1,200 mo	$57,600 prch	$287 maint

DCP/40 Compatible-to-Native Mode Upgrade

F1930-99-Compatible Upgrade • converts DCP/40 8596-98-compatible mode processor to 8596-97 native mode model • 128K-byte memory • requires 8408 disk cartridge or 8409 disk subsystem and 6136-XX DCP/40 OS • subsequent upgrades are as 8596-97 system:

$150/$120 mo	$5,665 prch	$34 maint

F1929 Primary Upgrades • upgrade 256K/384K/512K-byte 8596-99/-97 system to 8596-96 DCP/40 with 1M-byte memory; uses 64K-bit memory chips.

F1929-94 Upgrade • 512K-byte 8596-99 or -97 to 1M-byte 8596-96:

590/470	22,460	165

F1929-95 Upgrade • 384K-byte 8596-99 or -97 to 1M-byte 8596-96:

735/585	28,030	197

F1929-96 Upgrade • 256K-byte 8596-99 or -97 to 1M-byte 8596-96:

880/700	33,600	229

F1929-97 Upgrade • 128K-byte 8596-99 to 1M-byte 8596-96:

1,025/815	39,170	261

☐ I/O & Communications

DCP/10 I/O & Communications Modules

The basic 1986-99 DCP/10 CPU controller cabinet includes a processor that is logically partitioned into 9 virtual processors, 1 is dedicated to communication processing and the remaining 8 are used as port processors dedicated to I/O functions, 5 ports can be used for asynchronous and 3 for synchronous transmission; parallel line modules provide interfaces to Sperry Series 1100 host (host word channel) and to peripheral standalone disk or diskette subsystems. Line Switch Module and Remote Control Modules are intended primarily for large configurations but are also optionally available for the DCP/10.

DCP/20 I/O & Communications Modules

The basic F8597-99 DCP/20 CPU controller cabinet contains virtual input/output processors (IOPs) that can support up to 16 line interfaces, 1 host channel interface and 2 peripheral interfaces. Additional I/O and communication facilities are implemented by the attachment of 1 or 2 expansion cabinets.

DCP/40 Native Mode I/O & Communications Modules

The basic F8496-96 DCP/40 CPU controller cabinet contains an integral input/output processor (IOP) that can support up to 16 line interface ports. In addition, up to 3 additional IOPs (each, in turn, supporting up to 16 ports), up to 2 host channel interfaces, and up to 4 peripheral interfaces may also be supported. Additional I/O and communication facilities are implemented by the attachment of 1 to 3 F1945 expansion cabinets.

F1933 IOP Controller Module • IOP controller with 1st 16-line IOP • supports up to 3 additional F1932/F2941 series IOPs and F1936 storage port expander • standard with 8596-96 DCP/40 CPU controller; option for F1945 expansion cabinet:

$380/$305 mo	$14,680 prch	$72 maint

F2941-99 Second IOP Expansion • 2nd 16-line IOP • requires F1933; also requires F1936 storage port expander if installed in 2nd F1945 expansion cabinet • includes power for 2 more IOPs:

390/310	14,920	74

F1932-99 Third IOP Expansion • 3rd 16-line IOP • requires F2941-99 IOP • mounts in 1945 or in 6596-96 • includes storage port expander:

370/295	14,185	70

F1932-98 Fourth IOP Expansion • 4th 16-line IOP • requires F1932-99 IOP • does not include storage port expander:

280/220	10,635	52

DCP/40-Compatible Mode I/O & Communications Modules

The basic F8596-98 DCP/40-compatible mode processor contains integral input/output processor (IOP), and I/O controller modules that handle host channel and peripheral attachment through implementing host channel adapter (HCA) and remote I/O controller (RIOC) facilities. Also supports additional IOP and up to 3 communication scanners which, in turn, support up to 64/128 full-/half-duplex communication lines each.

F1928-03 Type II Scanner • scanner to control data transfer between DCP/40-compatible mode processor storage and communication lines • requires F1935 scanner adapter, F1934 scanner interrupt and F1801 line base modules • uses F2263 line adapter chassis for expansion of capacity by 32-port increments to maximum of 128 • maximum 1 scanner per MCC mode; 3 per DCP-compatible mode:

$575/$431 mo	$23,000 prch	$72 maint

Sperry DCP Series
DCP/10, DCP/20 & DCP/40 Distributed Communication Processors

F2263-00 Line Adapter Chassis • 1st and 3rd 32-port add-on for F1928 scanner • requires F1801 line base:

59/44	2,360	13

F2263-02 Line Adapter Chassis • 2nd 32-port add-on for F1928 scanner • requires F1801 line base:

28/21	1,120	5

F1801-01 Line Base II • 16-port line base • up to 8 per scanner:

15/11	600	3

F1801-02 Line Base II • same as F1801-01 line base with scan capability up to 230.4K bps:

15/11	600	3

F2381 UDLC Procedures • allows up to 128 ports to operate with UDLC, SDLC, ADCCP HDLC, or other bit-oriented procedures:

43/32	1,720	8

F1869-01 Auto-Line Speed Detect • automatic determination of line speed based on 1st character received from asynchronous terminal • maximum 1 per T1928 scanner:

11/9	452	3

F1825-02 Line Indicator • visual line activity indicator for 8 ports (8/16 full-/half-duplex lines) • maximum 8 per T1928 scanner:

11/9	440	2

F1935 Scanner Storage Adapter • interface for DCP/40-compatible mode processor attachment to F1928 scanner:

55/45	2,160	10

F2941-99 Second IOP • provides second IOP module for DCP/40 in DCP mode only • requires F1936 storage port expander and F1934/F1950 command/interrupt:

390/310	14,920	74

F1934-99 Scanner Command Interrupt • control interface between F8596-98 DCP/40-compatible mode processor and up to 3 F1928 scanners and/or F1950 IOP command/interrupt line module • includes 1st command/interrupt line module:

75/60	2,880	14

F1950-00 Command/Interrupt Module • provides control interface between F8596-98 DCP/40-compatible mode processor and add-on 2nd IOP:

20/15	720	3

DCP/10, DCP/20 & DCP/40 Native Mode Communications Interfaces

Interfaces attach to DCP/10, DCP/20, or DCP/40 native mode processors via IOPs (integral in DCP/10 system) and line attachment modules incorporated with basic CPU controller or expansion chassis. Each IOP with associated line modules supports up to 8 interface ports maximum on DCP/10 system, up to 16 interface ports on DCP/20 and DCP/40 systems. DCP/20 supports up to 3 IOPs or 48 ports; DCP/40 native mode processor supports up to 16 IOPs or 255 ports. Note that peripheral device attachments require line interface ports, and that the above maximums may be less with respect to communication line handling abilities.

F2523-00/01 Line Switch Module • line switch control in 3 modes: remote program control; local program control; manually • provides capability to switch lines and/or peripherals from a local or remote control source:

$748/$597 mo	$28,750 prch	$112 maint

F8590-00 Remote Control Module (RCM) • controls power, system program load, and start/stop operations for up to 4 processors; receives control commands via serial communication lines:

355/280	13,526	61

F1941-00 Asynchronous Line Module • full-duplex, 45.5- to 2400-bps, RS-232C/CCITT V.24/V.28 asynchronous interface:

20/20	960	3

F1942-00 Synchronous Line Module • full-duplex, 9600-bps, RS-232C/CCITT V.24/V.28 synchronous interface:

25/20	960	3

F3163-00 Medium-Speed Loadable Line Module • microprogrammed format interface loaded from diskette • full-duplex; synchronous/asynchronous; RS-232C/CCITT V.24-/V.28-compatible up to 19.2K bps; AT&T DDS compatible up to 9600 bps • may be formatted for UDLC to 19.2K bps; REM 1 to 19.2K bps; 1100 Series full-duplex to 19.2K bps; TTY asynchronous to 19.2K bps; Uniscope synchronous to 19.2K bps • auto data rate detection in asynchronous modes:

35/30	1,275	7

F3163-01 Medium-Speed Loadable Line Module • microprogrammed format interface loadable from diskette • full-duplex; synchronous protocols supported; X.21 circuit-switching or X.25 packet-switching formats at data rates up to 19.2K bps • basic synchronous up to 19.2K bps; BSC up to 9600 bps; UDLC up to 19.2K bps; 1100 full-duplex up to 19.2K bps:

63/50	2,500	13

F3163-04 Medium-Speed Loadable Line Module • microprogrammed format interface loadable from diskette • full-duplex; synchronous protocols supported; EIA RS-449 interface operates at data rates up to 9600 bps • basic synchronous, UDLC, BSC, REM 1, and 1100 protocols supported:

50/40	1,920	10

F3164-00 High-Speed Loadable Line Module • microprogrammed format interface loadable from diskette • full-duplex interface to AT&T-IS 303 modem for data rates up to 64K bps • can support data formats for basic synchronous, UDLC, BSC, REM 1, and 1100 full-duplex protocols:

188/150	7,200	35

F3164-01 High-Speed Loadable Link Module • microprogrammed format interface loaded from diskette • full-duplex; European V.35-compatible up to 48K bps; Bell DDS- or SDDS-compatible up to 56K bps • can be formatted for UDLC, Uniscope, BSC, REM 1, or 1100 Series full-duplex to 64K bps:

100/80	3,745	19

F3165-00 Multiline Asynchronous Line Module • full-duplex, RS-232C interfaces for up to 4 asynchronous data sets operating at 45.5 to 2400 bps • supports TTY protocol only with automatic baud rate detection:

75/60	2,880	13

F1945-00 Auto-Dialing Line Module • AT&T 801, CCITT V.24-/V.25-compatible automatic calling units:

25/20	1,005	4

F1945-01 Auto-Dialing Line Module • NTT Japan compatible • DCP/20 only:

25/20	1,005	4

DCP/40-Compatible Mode Communications Interfaces

Interfaces attach to DCP/40-compatible mode processors via scanners (communications) or IOPs (hosts and peripherals). DCP/40 MCC mode supports 1 scanner (32 ports or up to 64/128 full-/half-duplex lines); DCP/40-compatible mode supports up to 3 scanners (128 ports or up to 192/384 full-/half-duplex lines).

F1828-00 Asynchronous Line Adapter • full-duplex RS-232C/CCITT V.24/V.28 asynchronous interface • 1 per scanner line base port:

$15/$13 mo	$600 prch	$7 maint

F1828-01 Asynchronous Line Adapter • full-duplex RS-232C/CCITT V.24/V.28 asynchronous interface with 5-bps reverse channel for AT&T 202 modem • 1 per scanner line base port:

19/16	760	8

F1828-02 Asynchronous Line Adapter • full-duplex RS-232C/CCITT V.24/V.28 asynchronous interface with 150-bps supervisory channel • 1 per 2 scanner line ports:

23/20	920	10

Sperry DCP Series
DCP/10, DCP/20 & DCP/40 Distributed Communication Processors

F1829-00 Asynchronous Line Adapter • full-duplex MIL-STD-188C and STD-100 asynchronous interface • 1 per scanner line base port:

15/13	600	7

F1832-00 Asynchronous Relay Line Adapter • full-duplex 20- to 75-mA neutral or 10- to 40-mA polar current-loop TTY interface • 1 per scanner line base port:

15/13	600	7

F1835-00 TWX Line Adapter • 1 per scanner line base port:

15/13	600	7

F1836-00 Telex Line Adapter • 1 per scanner line base port:

15/13	600	7

F1826-00 Synchronous Line Adapter • 9600-bps full-duplex RS-232C/CCITT V.24/V.28 synchronous interface • supports direct connect to Uniscope 100/200, UTS 400 or terminal multiplexer as well as to communication line modems • 1 per scanner line base port:

19/16	760	8

F1826-01 Synchronous Line Adapter • same as F1826-00 with 150-cps supervisory channel • 1 per 2 scanner line base ports:

29/25	1,160	10

F1827-00 Synchronous Line Adapter • same as F1826-00 with MIL-STD-188C and STD-100 interface • 1 per scanner line base port:

19/16	760	8

F1830-00 Wideband Line Adapter • 19.2K/40K/50K/230K-bps full-duplex synchronous interface • used with AT&T 300 modems:

23/20	920	10

F1834-00 Wideband Line Adapter • same as F1830 with CCITT V.35 interface • operates up to 56K bps over AT&T DDS service:

23/20	920	10

F3357-00 Synchronous Line Adapter • 100K-bps full-duplex ANSI X.21, CCITT X.27, and RS-422 synchronous interface • not software supported:

30/20	1,020	5

F1831-00 Single Dial Adapter • AT&T 801 automatic call unit interface for F1826 synchronous and F1828/F1835 asynchronous adapters:

15/13	600	7

F2519-00 Asynchronous Clock • 300/600/1200/1800-bps, 7-/8-level code clock • full-duplex RS-232C/CCITT V.24/V.28 interface:

19/14	760	8

2521-00 Parallel Line Adapter • provides interface to AT&T 407A/B to allow parallel input from touchtone telephones:

25/19	1,000	11

DCP/10, DCP/20 & DCP/40 (Both Modes) Host & Peripheral Interfaces

F1946-02 1100 Series ISI Interface • FDX word channel interface to 1100 Series host attachment:

$105/$85 mo	$4,000 prch	$23 maint

F1947-00 Series 90-Byte Interface • to byte or block multiplexer channel on Series 90 host:

105/85	4,000	21

F1947-02 SU Block Mux Channel Interface for 1100 Series • interfaces to a block multiplexor channel:

105/85	4,000	23

C3560-00/01 DCP/40 Operator Panel • provides control panel with provisions to mount Enable/Disable Test Switch and indicator for F1947 Series 90 I/F line module in either 8596 or T1945 cabinet:

NC/NC	NC	NC

C3560-02/03 DCP/20 Operator Panel • provides control panel with provisions to mount Enable/Disable Test Switch and indicator for F1947 Series 90 I/F line module:

NC/NC	NC	NC

F1800-2 S-90 Byte I/F Switch • provides capability to switch F1947-00 manually between selector/multiplexer channels of single host or 2 separate hosts; used in DCP/40-compatible mode only:

83/62	4,305	17

F1948-01 16-Bit Peripheral Interface • 8-bit or 16-bit mode peripheral interface:

80/65	3,000	15

F1949-00 Peripheral Interface • 8-bit interface for peripherals such as diskette subsystem (8406):

30/25	1,045	4

F384-00 Direct Connect Line Module • attaches a UTS 20L single station via coaxial cable:

29/23	1,000	5

F3878-00 Byte Interface Line Module • provides 8-bit interface to freestanding 1M-byte diskette subsystem and 8409 disk subsystem:

56/45	1,900	11

☐ Disk & Tape

F1939-00 Integral Flexible Diskette • 256K-byte drive controller for mounting in DCP/40 series communication processors:

$50/$40 mo	$1,920 prch	$11 maint

8406 Diskette Drive • standalone 256K-byte drive controller • 138-millisecond average access time • 31K-byte-per-second transfer rate • requires F1949 interface • available as option for DCP/10 and DCP/20 only:

98/74	3,360	21

F3145 Diskette Expansion • 2nd 256K-byte diskette drive for F8406 with write protocol:

31/23	1,040	11

8408-02 Cartridge Disk Control • controller and cabinet for attaching up to 2 F2380 disk drives to DCP/20 or DCP/40 (both nodes) • requires F1948 interface:

139/104	5,564	29

F2380 Disk Drive • 10M-byte dual disk drive; 5M-byte fixed and 5M-byte removable disks • 50-millisecond average access time • 2.5M-byte-per-second transfer rate • requires 8408 controller:

439/314	17,750	114

F2187 Dual Cartridge Disk Interface • 2nd I/O interface for dual configuration to share a disk subsystem; requires 8408 controller:

39/29	1,568	8

8409-99 8409 Disk Subsystem, 4.6M Bytes • cabinet includes controller and 4.6M-byte nonremovable disk drive • disk access time: 12-millisecond minimum; 45-millisecond average; 85-millisecond maximum • 625K-byte-per-second transfer rate • requires F3878-00 interface:

378/280	9,650	82

F3900-00 8409 Disk Expansion 4.6M Bytes • provides second 4.6M-byte disk drive for expansion of 8409-99 subsystem:

158/117	3,777	54

F4085-00 Disk Expansion Upgrade • expands capacity of 4.6M-byte drive to 14.25M bytes:

100/74	1,096	12

8409-97 8409 Disk Subsystem, 14M Bytes • same as 8409-99, but with 14M-byte disk drive:

478/354	10,746	94

F3900-01 8409 Disk Expansion, 14M Bytes • provides second 14M-byte drive to expand 8409 subsystem:

188/139	4,207	66

Sperry DCP Series
DCP/10, DCP/20 & DCP/40 Distributed Communication Processors

8409-95 8409 Disk Subsystem, 23M bytes • same as 8409-99 but with 23M-byte disk drive:

578/427	11,842	106

F3900-02 8409 Disk Expansion, 23M bytes • adds second 23M-byte disk drive to 8409-95 subsystem:

219/162	4,676	78

F388-00 Dual Disk Control • provides second DCP interface to 8409 disk subsystem:

65/50	2,000	9

F2721 Uniservo 10 Tape Controller • controller for attaching up to 2 Uniservo 10 tape drives to DCP/20 or DCP/40 • requires F1948 interface:

284/215	10,320	51

0871-01 Uniservo 10 Tape Drive • 9-track, 25-ips NRZ/PE 800-/1600-bpi tape drive o forward/backward read; auto-thread • requires F2721 controller:

294/221	13,425	85

F2879 AC Power Switch • required for attachment of 2nd Uniservo 10 drive to F2721 controller; allows remote control from 8596 processor:

32/25	1,200	5

☐ Consoles & Printers

3560-93 UTS 20 Console • with expanded keyboard; keyboard-display console for DCP/10, DCP/20, and DCP/40 native mode processors • 8K RAM with program cartridges for UTS 400 mode function keys • bit-serial interface requiring modem or DCM multiplexer for attachment to communication line of processor; synchronous RS-232C interface:

$128/$97 mo	$3,225 prch	$33 maint

3542-93 DCP Console • keyboard-display console for DCP/40-compatible mode processor • requires line module attachment to processor:

170/125	6,690	65

F0797-99 Console Printer • 80-cps 7x7 dot-matrix impact printer • 80-column • 6/8 lpi • connects to UTS 20 console for DCP/20 or DCP/40 native mode processors:

84/63	1,900	27

F0798-99 Printer • 200-cps bidirectional 7x7 dot-matrix impact printer • 132-column • 6 lpi • full line buffer • bit serial interface connects to UTS 20 console for DCP/10, DCP/20, or DCP/40 native mode processors:

188/156	6,650	64

F3582-00 6/8 LPI • 6-/8-lpi capability for F0798 printer:

4/3	152	1

F3583 Print Head • 7x9 dot-matrix print head for lowercase character generation on F0789 printer:

16/9	300	2

F0786-56 Console Printer • 200-cps 7x7 dot-matrix impact printer • 132-column • 6 lpi • connects to 3542 console for DCP/40-compatible mode processors:

140/117	5,250	36

F0786-54 Console Printer • same as F0786-56 with bidirectional printing:

180/155	6,960	60

• **END**

Sperry UTS 4000
Universal Terminal System

■ PROFILE

Function • user-programmable, diskette-based standalone or cluster-controlled multiterminal system; supports local and distributed-mode data processing, data entry, query, and local applications program tasks • terminals/workstations upgradable to CP/M-controlled personal computers.

Architectures Supported • Sperry 1100 (OS), Series 90 (VS/9 and OS/3) Series 80, and V/77 in Sperry DCA distributed architectures.

Communications • TELCON under DCA via UTS 400 emulation • CMS 1100 for Sperry 1100 under OS; IMS/90 for Series 90 under VS/9 and OS/3 • single line, up to 19,200 bps half-duplex, ASCII code • point-to-point/multipoint.

Operating System • interactive, real-time • supports up to 32 workstations serviced on round-robin basis • sequential physical file organization; sequential or direct access.

Database Management • none; only in conjunction with the host processor under CMS 1100 and IMS/90.

Transaction Processing Management • locally through System Control Program • distributed through host CMS 1100 and IMS/90.

Support Software • UTS COBOL and BASIC compiler at host • CBASIC compiler locally • Pascal and PL/1 compilers locally • disk/diskette data set maintenance utilities • data entry/edit support.

Processor • 129K to 2M bytes of RAM; expandable in 128K- and 256K-byte increments • disk/diskette subsystems.

Terminals/Workstations • up to 32 keyboard-display workstations • up to 48 printers and/or disk/diskette subsystems; up to 32 workstation printers.

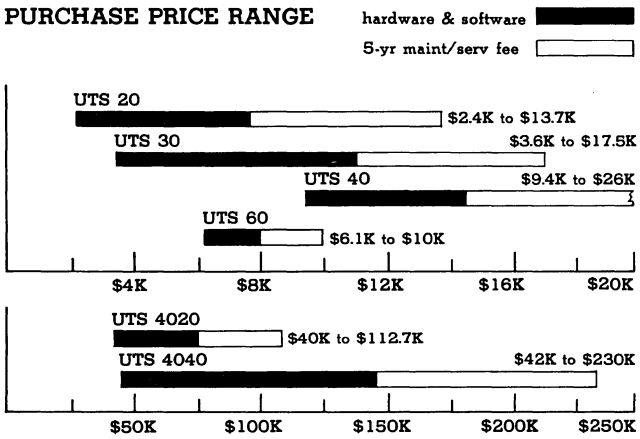
First Delivery • 1981.

Systems Delivered • unknown.

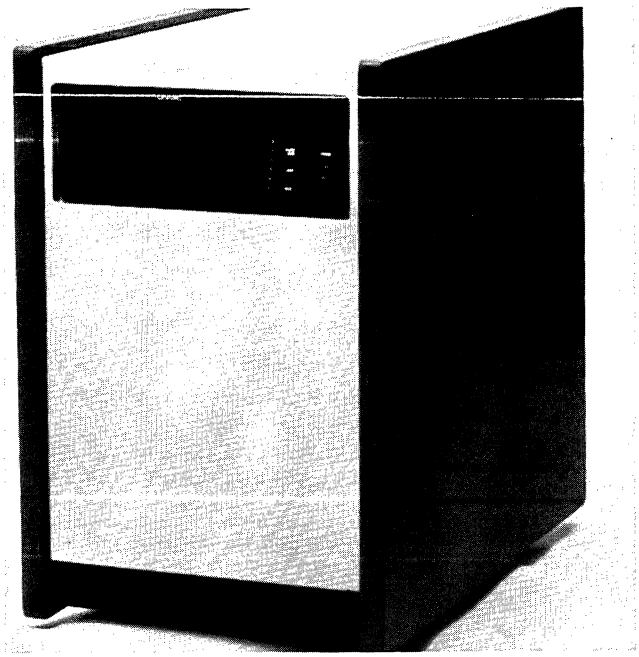
Comparable Systems • functionally comparable to a number of small-scale systems or programmable terminals marketed by other vendors for local/remote processing tasks • most notable are IBM 5280 Series; Datapoint 1800; Raytheon PT 100, 200, and PTS/1200; and to a degree Data General CS/10 and 20, and Harris 8210/8212.

Vendor • Sperry Corporation; P.O. Box 500, Blue Bell, PA 19422 • 215-542-4011.

PURCHASE PRICE RANGE



SPERRY UTS 4000 SERIES PURCHASE PRICING bar graphs cover price range between "small" and "large" configurations for hardware/software (solid bars) and associated 5-year period maintenance fees (open bars) • **UTS 4020 small** system consists of a 4020 cluster controller, a System Control Software program, 256K-byte RAM, a Model 8406 diskette subsystem, 3 UTS 20W and 3 UTS 40W workstations, 6 extended keyboards, 2 Model 0797 matrix printers, and UTS COBOL; **large UTS 4020** consists of 4020 controller, 1 System Control Software program, 3 256K-byte RAM modules, a Model 8409 4.6M-byte disk subsystem, 6 UTS 20W and 6 UTS 40W workstations, 12 extended keyboards, 2 Model 0797 matrix printers, a Model 3463 I/O interface module, and UTS COBOL • **UTS 4040 small** configuration consists of 4040 controller with 1 System Control Software program, 3 256K-byte RAM modules, a model 8409 4.6M-byte disk subsystem, 6 UTS 20W and 6 UTS 40W workstations, 12 extended keyboards, 2 Model 0797 matrix printers, a Model 3463 I/O interface, and UTS COBOL; **large UTS 4040** consists of 4040 controller, 1 System Control Software program, 5 256K-byte RAM modules, 2 workstation interfaces, a Model 3463 I/O interface module, a Model 8408 27M-byte disk subsystem, 12 UTS 20W workstations, 12 UTS 40W workstations, 24 extended keyboards, 2 Model 0791 correspondence printers, 2 Model 0798 matrix printers, a Model 0789 line printer, UTS COBOL, and BASIC • **UTS 20 small** configuration consists of basic display plus a program cartridge and an extended keyboard; **UTS 20 large** system consists of basic configuration plus a Model 0791 correspondence printer • **UTS 30 small** configuration consists of basic display, program cartridge, and extended keyboard; **UTS 30 large** configuration consists of the basic configuration plus 128K-byte RAM extension module, 2 Model 8439 diskette subsystems, CP/M Plus operating system, a CP/M program cartridge, and a Model 0797 matrix printer • **UTS 40 small** configuration is made up to the basic display plus an extended keyboard, 32K-byte RAM module, and a program cartridge; **UTS 40 large** configuration consists of an intelligent terminal option, an extended keyboard, a 32K-byte RAM module, a 32K-byte RAM extension module, a CP/M peripheral interface, a Model 8406 diskette subsystem, and a Model 0797 matrix printer • **UTS 60** consists of basic display plus an extended keyboard • **Note**: UTS COBOL and BASIC prices based on 5-year rental term • all prices single-quantity purchase.



Sperry UTS 4000
Universal Terminal System

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Distribution • worldwide through local Sperry sales offices.

■ ANALYSIS

The Sperry UTS 4000 was introduced in 1981, and has been significantly enhanced over its 4 years of service. As a result, it is now positioned to do well in the distributed processing marketplace. With its local cluster controllers, called the UTS 4020 and 4040, users can choose between systems supporting from 12 to 32 terminal/workstations and up to 48 disk/diskette subsystems and/or printers, all under control of a local operating system. This, plus up to 2.3M bytes of RAM, delivers a package capable of providing a good deal of local processing with no host processor interaction. Sperry supplements this processing power with substantial application development software. COBOL, BASIC, Pascal, and PL/1 compilers are available, along with an edit processor for interactive creation and modification of source files. Application support, however, is weak. The principal new products introduced are principally business-oriented graphics.

Missing from UTS 4000 is a database management facility, especially for the UTS 4020 and 4040. While the introduction of the DDP 4000 System Control Software is an improvement that "operating system" still only provides basic file management facilities plus ISAM.

The standalone UTS 30, 40, and 60 workstations offer conventional data editing and formatting, but can be equipped with multiple printers and diskette subsystems. These terminals also have their own system control software which allows some local processing and file handling. Users have the option of running applications in the high-level languages mentioned, and may connect these terminals locally to the host or remotely through an RS-232C interface. The UTS 20 terminal is also a standalone unit, but its 16K-byte RAM upper limit and no diskette severely limits its usefulness.

The UTS 40 is another product not well equipped for extended local processing or personal computer applications due to its 64K-byte RAM limit. Further, when teamed with the 8406 diskette subsystem with its sluggish 260-millisecond access time, local processing is further hindered. Once Sperry develops a cluster version of UTS 30 for use with the 4020 and 4040, the UTS 40 will probably be phased out.

Besides the standalone UTS 30, 40, and 60, Sperry offers a personal computer version which runs under CP/M and CP/M Plus. The latter is basically a CP/M Level 2.2 machine with assembler and utility programs included. The concept of this level of processing autonomy is to off-load the host while providing distributed processing strength at the terminal level. Incidentally, Sperry will let you upgrade either the standalone or cluster versions of UTS 30, 40, and 60 personal computers.

The viability of a product like the UTS 4000 is questionable in light of the impact of personal computers. Those units offer a high-level of autonomous processing power with operating systems like DOS, MS-DOS, UNIX, both diskette and Winchester hard disk, extended RAM storage, and high-level programming languages such as COBOL, FORTRAN, APL, and BASIC. Personal computers can also link to host mainframes via protocol converters, some of which also support upline and downline file transfers. All of these facilities do not bode well for clustered systems. On the otherhand, UTS 4000 and like systems allow local processing and file sharing without running up communication costs (e.g., lines, modems, and front-end ports), or implementing a LAN. The UTS 4000 also permits the building and administration of a local database, a facility not easily done with personal computers only.

☐ Strengths

Processing autonomy is beneficial to the distributed processing user, and UTS 4000 certainly has it. With up to 2.3M bytes of RAM in the 4040, plus the extensive local auxiliary storage in the form of up to 48 disk/diskette combinations, users should have ample resources even with a fully loaded 32-terminal system.

Providing personal computing at the terminal level further augments processing independence. Sperry doesn't short the user on application development either, with support for COBOL, BASIC, Pascal, and PL/1. When employed with the file management facilities of CP/M, users could perform considerable local processing and only employ the host for high-level database facilities or "number crunching."

With the addition of the Distributed Data Processing (DDP) 4000 support software, all UTS terminals can now become part of Sperry's Distributed Communications Architecture (DCA) implementation of distributed processing control. Unfortunately, only the UTS 30 can implement DDP-4000 independent of the UTS 4020/4040 controllers.

UTS 4000 also implements screen bypass on all terminals except the UTS 40. With screen bypass, received data is directed from the host to the attached terminal printer without passing through the screen. The user benefits from this facility because printing does not interfere with data entry.

☐ Limitations

The principal limitations are primarily the lack of data compression, encryption, and database management facilities on the UTS 4020 and 4040. The lack of data compression might be the lesser of the group, given the amount of local processing support provided. However, data encryption is important. One of the basic tenets of distributed processing is the distribution of file data, some of which is bound to be sensitive and should be encrypted.

The lack of an effective database management system is a more severe problem. With extensive auxiliary storage available, shared files would further remove dependence on the host. However, with only basic file management facilities to retrieve data and a moderately loaded system (about 16 terminals), system performance could become unsatisfactory.

One of the factors that limits the overall performance of the UTS 4000 is the relatively slow average access times of the diskette. The old 8406, for example, required 260 milliseconds. The new 8439, to our surprise, is even slower (390 milliseconds). If these diskettes are ticketed for terminal use only, these speeds **might** be acceptable. With the 4020 and 4040, however, they appear to be too slow. For users with large files and large configurations, the new 8409 disk subsystem is recommended.

■ COMMUNICATIONS FACILITIES OVERVIEW

☐ Distributed Communications

Communication control between the Cluster Controllers is under CMS 1100 for Sperry 1100 systems and IMS/90 for the Series 90. Sperry also provides a BTAM-like protocol for more rudimentary applications. On the Sperry Distributed Communications Architecture (DCA), the 4020/4040 runs under TELCON in UTS 400 emulation mode.

Data transmission is bit serial, employing a standard 7-level ASCII code. Transmission is half-duplex, point-to-point over switched or dedicated lines at speeds up to 19.2K bps. An integral AT&T 201- or 202-type modem is available, as is a 16-channel multiplexer. Communication with the host is via the UTS 400 interactive protocol.

☐ Distributed Configurations

The UTS 4020 and 4040 are microprocessor-based cluster controllers which handle real-time, online interactive processing. They may be specified as batch/inquiry systems for point-to-point and multipoint communication. The 4020 supports up to 12 concurrently operating workstations, and can accommodate up to 16 disk/diskette drives and/or associated printers. The 4020's memory ranges from 128K bytes of RAM up to 1M bytes. The basic UTS 4020 configuration provides one microprocessor-controlled I/O interface (handles up to 6 workstations or other peripherals), a built-in diskette for handling the System Control Program (operating system), and an RS-232C communications line interface. The basic configuration, however, has no provision for processing applications, and the operating system requires 64K bytes. So figure on at least a 128K-byte RAM module.

The 4040 supports up to 32 workstations and accommodates up to 48 system printers and/or disk/diskette subsystems. The main

Sperry UTS 4000
Universal Terminal System

memory ranges from 256K bytes to 2.3M bytes of RAM. The 4040, like the 4020, comes with only one I/O interface which handles up to 6 workstations. It also employs the same System Control Software and the same RS-232C-type communication. And, also like the 4020, no RAM is provided for applications programs or the operating system.

The workstations employed with the 4020/4040 are the UTS 20W and 40W, modified versions of the standalone UTS 20 and UTS 40. Other standalone workstations are the newly announced UTS 30 and UTS 60, the latter being a full-color terminal.

The UTS 20 comes with 16K bytes of RAM and an interface for attaching a single printer; expansion is not supported. The UTS 30, on the other hand, is delivered with 128K bytes of RAM with an additional 128K bytes optional. This unit supports 1 or 2 diskettes and a printer, and can be upgraded to a personal computer operating under CP/M Plus. The UTS 30 can also accommodate the DDP 4000 system control software, making it suitable for direct attachment to DCA networks.

The UTS 40 has no standard application RAM, but can be equipped with two 32K-byte RAM modules. This unit comes with I/O interfaces for handling 2 printers and 2 diskette subsystems. It can also be upgraded to personal computer status by adding CP/M. The UTS 60 color terminal has 128K bytes of RAM as standard, but can be expanded to provide up to 2M bytes. Standard interfaces handle 2 diskette subsystems and a printer; a CP/M upgrade is optional. The UTS 60 represents a departure in processing architecture for the terminal line. While all other numbers employ a Z80A microprocessor, this unit emloys the 16-/32-bit Motorola MC68000. When equipped with the CP/M facility and 2 diskettes, the UTS 60 should prove to be a very powerful personal computer.

■ SOFTWARE

☐ Terms & Support

Terms • fully unbundled with monthly rental (1-year renewable license) or purchase charges for all software provided by Sperry, except for certain language and applications processors that may either be older versions of current products, or in some cases may be no-charge, public-domain programs.

Support • service/enhancements are included with monthly license charge.

☐ Operating System

The UTS 4020 and 4040 can run under the older UTS 400 System Control Software or the new DDP 4000. The new control software makes the UTS 4000 family of terminals compatible with Sperry's Distributed Communications Architecture (DCA) at the communication level, while maintaining UNISCOPE compatibility at the application level. In addition, DDP 4000 has a Terminal Command and Response Language (TCRL) which is used to control distributed data processing functions, host connection, and remote batch processing. DDP 4000 also acts as a bridge between UTS 400 mode program products and the full function of a Distributed Data Processing terminal.

The UTS 400 mode features retained in DDP 4000 include user interfaces through the control page and keyboard; file media and format; and host program interface (UNISCOPE device/screen control). New features consists of DCA communication (UTS 30 and cluster controllers); DDP file and job transfer facilities (cluster controllers only); TCRL 4000 (Terminal Command and Response Language for UTS 4000 systems) interface for controlling DDP, host connection and remote batch operations; 8409 Disk Subsystem Support (cluster controllers only); Indexed Sequential Access Method (ISAM) (cluster controllers only); and new kernelized operating system for better security, reliability, and expandability (cluster controllers only).

As an operating system for the cluster controller, DDP 4000 is a general-purpose, process-oriented operating system supporting a message-oriented software architecture. Most parts of the system and all user application programs are represented in the system as processes. Only a small part, the kernel, has direct access to the hardware. Most of the operating system executes in the same type of protected environment provided to user processes, thus helping to achieve the overall goals of the system.

The process-oriented structure of the DDP 4000 also permits modular construction and expansion of both the system and user application program. Since most of the system is embodied as processes, new features may be added and unnecessary features removed by adding or removing the appropriate processes. Any function that can be put into a process is moved out of the kernel.

The DDP 4000 is also a message-oriented operating system. There are also convenient facilities for queuing messages to destination processes until they can be acted upon. Processes are provided for sending and receiving messages.

6180-01 System Control Program • UTS 400 compatibility mode operating system • multiprogramming, real-time interactive • prompts in English • supports up to 12 concurrently processing jobs serviced on sequential basis • assigns and controls peripheral devices to jobs/workstations; supports peripheral sharing • assigns RAM to application programs • requires 64K bytes of RAM minimum • required on 4020 cluster controller:

$99/NA mo	NA prch	NA maint

6180-01 UTS 400 Mode SCP • same as 6180-01 except prompts in French:

99/NA	NA	NA

6180-02 UTS 400 Mode SCP • same as 6180-01 except prompts in German:

99/NA	NA	NA

6180-03 UTS 400 Mode SCP • same as 6180-01 except prompts in Italian:

99/NA	NA	NA

6180-04 UTS 400 Mode SCP • same as 6180-01 except prompts in Spanish:

99/NA	NA	NA

6707-XX DDP 4000 Mode SCP • provides DCA interface and advanced job control (see introduction) to 4020/4040 controllers • versions available which prompt in French, German, Italian, Spanish:

99/NA	NA	NA

6708-00 UTS 30 SCS • UNISCOPE compatibility for UTS 30 using RS-232C interface:

30/NA	750	NA

6709-00 UTS 30 SCS • same as 6708, except for UTS 30 with X.21 interface:

30/NA	750	NA

6710-00 UTS 30 SCS • provides DDP 4000 mode functions to UTS 30 with RS-232C interface:

30/NA	750	NA

CP/M Support

The UTS 30, 40, and 60 can be field upgraded to provide personal computer facilities under control of CP/M. Sperry's support of this operating system consists of CP/M Level 2.2 and CP/M Plus.

CP/M Level 2.2 Operating System • single-user, 8-bit • includes standard assembler, file management, text editor, dynamic debugging tools, and utilities • requires F3576-07 program cartridge, F3643-99 peripheral interface (8-bit), and single 8406 diskette system • standard on 3561-68 and -78 terminals:

NC/NC	NC	NC

F3889-99 CP/M Upgrade • field-upgrade for 3561-82 and existing 3561-74 programmable terminals • provides same

MO: software monthly license fee (1-year renewable) including service. PRCH: single-quantity purchase price. MAINT: monthly maintenance fee. NA: not available/ applicable. NC: no charge. Prices effective as of February 1985.

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functions and requires same options as CP/M used with 3561-68 and -78:

15/NA	690	7

F6728-00 CP/M Plus Operating System • same basic features of CP/M Level 2.2 Plus includes assembler and utility programs • runs on 3561-78 in banked and nonbanked modes:

NA/NA	300	NA

6728-01 CP/M Plus Operating System • same as 6728-00, except supports RS-232C peripheral interface on RAM I/O feature F4041-00 and for 5.25-inch diskette interface F4042-00:

NA/NA	300	NA

6718-00 CP/M Plus Operating System • same as F6728-00, except runs on UTS 30:

NA/NA	300	NA

☐ Program Development/Language Processors

UTS COBOL • subset of ANS X3.23-1974 • extensions allow interactive data entry and program control, CRT screen management and data formatting • produces interpretable instructions and places them into an object element • syntactic and semantic checks in source code; also supports debugging mode clause of standard COBOL; execution-time, line-number trace of execution logic flow provided • symbolic COBOL interactive debugger (SCID) debugs functions at source code level; TRAP, NEXT, and GO TO commands supported • multiple files supported; files may be dedicated, shared, or reassigned • UTS COBOL runs in Sperry 1100 under OS, Series 90 under VS/9 and OS/3, and requires 32K bytes.

6130-08 UTS 4000 COBOL SYS 80:

$45/NA mo	NA prch	NA maint

6130-05 UTS 4000 COBOL OS/3:

87/NA	NA	NA

6130-06 UTS 4000 COBOL VS/9:

91/NA	NA	NA

6130-07 UTS 4000 COBOL 1100 OS:

133/NA	NA	NA

6702-00 UTS 4000 BASIC • meets ANSI standards for minimum BASIC:

70/NA	NA	NA

6183 Edit Processor • allows interactive creation and modification of source files composed of data lines:

53/NA	NA	NA

6165-02 Text Processing • allows creation, management, modification, and reproduction of text documents stored locally on diskette:

90/NA	NA	NA

6782-00 CBASIC • provides 14-digit decimal arithmetic, random and sequential disk addressing, string processing, debugging, enhanced source code maintenance, cross-referencing, and assembly code interface • UTS 30/40 only:

NA/NA	150	NA

6783-00 CB-80 • CBASIC compiler • requires F6718-00 or F6728:

NA/NA	500	NA

6786-00 Pascal/MT+ • block-structured compiler language for scientific, commercial, and industrial applications • includes compiler, linker, run-time support library, disassembler, symbolic program debugger • UTS 30/40 only:

NA/NA	350	NA

6787-00 PL/1-80 • subset of G-level PL/1 • includes native code compiler, assembler, relocating linker, cross-reference generator, 15-digit precision, display manager, and GSX graphics • UTS 30/40 only:

NA/NA	500	NA

6784-00 CIS COBOL • provides compact, intermediate code for running large programs • certified ANSI 1974 COBOL • UTS 30/40 only:

NA/NA	850	NA

6785-00 Level II COBOL • GSA certified ANSI 1974 COBOL • UTS 30/40 only:

NA/NA	1,600	NA

6790-00 Display Manager • programmers' tool for designing screen displays to interface with compiler languages:

NA/NA	400	NA

6793-00 Graphics • graphic system extension to CP/M • offered on UTS 30 only:

NA/NA	60	NA

6794-00 DR-Kernel • subroutine containing 2-dimensional graphic primitives • offered on UTS 30 only:

NA/NA	500	NA

6795-00 DR-PLOT • produces bar graph, pie charts, histograms, line graphs, scatter plots, drawing facilities • offered on UTS 30 only:

NA/NA	500	NA

6796-00 DR-Access-10 • converts UTS 30 into a Plot 10-compatible terminal:

NA/NA	500	NA

6798-00 DR-GRAPH • interactive package for creating business-oriented graphs like done for 6795-00:

NA/NA	295	NA

■ HARDWARE

☐ Terms & Support

Terms • equipment may be purchased or acquired on either monthly rental or 5-year lease basis; maintenance charges are not included in monthly rental or lease prices • educational allowance of 15% available to qualified institutions for lease or purchase terms • 6-year commercial lease term available at 85% of rates for 5-year contract; 7-year lease available for state/local government and educational institutions • quantity discounts available on 5-year lease or purchase agreements.

Support • equipment warranted for defect or malfunction for 90 days following installation; thereafter maintenance service available under 9-hour period per day between 7:00 AM and 6:00 PM, Monday through Friday • maintenance or repair charge is available on on-call basis; Monday through Friday charges are $70 per hour plus travel.

☐ UTS 4000 Overview

The UTS 4000 hardware components are composed of 2 cluster controllers, 4 standalone terminals/workstations, 2 cluster-controlled terminals/workstations, 9 printers, a magnetic stripe reader, a hard disk subsystem, and 2 diskette subsystems. The UTS 4020 and 4040 cluster controllers provide a measure of local processing capabilities, as well as host-processor interface to the System 1100, System 90, and Series 80 mainframe. The processing functions performed by both controllers are identical; they differ in the number of peripherals, terminals, and RAM supported. The UTS 4020 will handle up to 12 terminal/workstations, 16 diskette/disk subsystems, and/or system printers, and be configured with up to 1M bytes of RAM. The 4040 attaches up to 32 terminals/workstations, 48 printers and/or disk/diskette subsystems, and accommodates up to 2.3M bytes of RAM. Both controllers run under system control software, a relatively primitive operating system.

The UTS 20, 30, 40, and 60 standalone terminals support data-entry and local editing and communicate with Sperry 1100, 90, and 80 computers through local connection or remote communication over dedicated lines or the DDD network at speeds up to 9600 bps in half-duplex mode using 7-level ASCII code. A version of the UTS 20 and 30 are available with an X.21 communication interface for connection to an X.25 network. In addition, the 20L, a special version of the UTS 20, is offered for use with the DCP 10/20/40 systems. This terminal can only be attached locally, and has a transmit speed of 256K bps. The

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locally attached UTS 20, 30, 40, and 60 transmit at 19.2K bps.

The terminals/workstations employed with UTS 4020 and 4040 are the UTS 2000 and 4000. Both provide the same facilities as the standalone versions, but have no remote communication facilities. Currently, no clustered version of UTS 30 is available, but sources tell us one is in development.

The UTS 60, a relatively new terminal, is a standalone unit which provides 8-color display facilities; 8 additional colors are optional. The UTS 60 employs an RS-232C interface for remote communication at 9600 bps in half-duplex mode using 7-level ASCII code. Local host attachment of 19.2K bps is also permitted.

All UTS terminals, except the model 20, can be ordered with or field-upgraded to personal computers with the addition of a CP/M option. This, along with the optional diskette, provides a sound level of local processing to augment the services offered by the host processor.

Sperry has upgraded its disk/diskette support for the UTS 4000 with the addition of its 8439 5.25-inch double-sided, double-density diskette subsystem and 8409 hard-disk subsystem. Both supplement the old 8406 diskette subsystem still available. The 8439 has 2 diskettes per enclosure, each with a 655K-byte capacity. The 8409 is offered in single- or dual-disk assemblies, with up to 3 platters per assembly. Storage capacity is 4.75M/14.25M/23.75M bytes for 1, 2, and 3 platters, respectively. The 8409, incidentally, **cannot be used directly** by any of the terminals/workstations.

Printers are comprised of the old 0791 correspondence printer plus the 0797, 0798, and 0425 matrix printers. Sperry recently added Model 0789, a 180-lpm line printer; Model 0429, a 400-cps matrix printer with 2- or 4-color printing; and Model 431, a 55-cps Shannon text correspondence-quality printer. While most of the matrix printers will attach to any of the terminals/workstations, the line printer **will not**.

☐ Controllers

The Sperry clustered terminal systems are controlled by either the UTS 4020 or UTS 4040 cluster controllers. Both are "smart" controllers using System Control Software as an operating system to control terminal/peripheral services and communication functions.

The functions performed by both controllers are identical; however, they differ in the number of terminals/peripherals supported, maximum RAM configurations, and maximum peripheral interfaces. UTS 4020 supports a maximum of 12 keyboard/displays and associated terminal printers, up to 16 diskette drives and/or system printers, or up to 16 hard disk subsystems. The 4020's main memory is a minimum of 128K bytes, but can be expanded in 128K- or 256K-byte increments up to 1M bytes. All expansion memory modules are extra-cost units.

The UTS 4040, on the other hand, attaches up to 32 keyboard/displays and associated terminal printers, and up to 48 system printers and/or disk/diskette subsystems. The 4040's main memory is a minimum of 256K bytes, expandable in 256K-byte increments to 2.3M bytes. All 4040 memory is also an extra-cost option.

Both the 4020 and 4040 support 6 keyboard/displays as standard equipment. Therefore, to attach the full complement of peripherals both controllers must employ optional peripheral interfaces. Two types are available: an 8-bit parallel interface supporting 4 printers and/or disk/diskette subsystems, and a dual 8-bit parallel unit supporting 8 printers and/or disk/diskette subsystems. A maximum of 2 interfaces can be employed with the 4020, and up to 6 with the 4040.

System Control Software consists of the old UTS 400 mode operations and newer DDP 4000 mode control program. Both provide multiprogramming real-time interactive support, assign and control peripheral devices, and monitor job executions. With the DDP 4000, however, the UTS 4000 family of terminals can operate under Sperry's Distributed Communications Architecture (DCA) at the communication level, while maintaining UNISCOPE compatibility at the applications level. For more on DDP 4000, see Operating Systems section of this report.

8600-96 UTS 4020 Cluster Controller • microprocessor-controlled system with 1M-byte integral diskette load device, interface for 6 workstations, RS-232C/CCITT V.24 communication interface; requires UTS 400 mode control (Feature 6180-XX) or DDP 4000 mode SCS (6707-XX):

$311/$207 mo	$7,000 prch	$66 maint

8601-97 UTS 4040 Cluster Controller • microprocessor-controlled system with 1M-byte integral diskette load device, interface for 6 workstations, RS-232C/CCITT V.24 communication interface; requires UTS 400 mode control (Feature 6180-XX) or DDP 4000 mode SCS (6707-XX):

468/312	10,520	81

☐ CPU & Memory

The UTS 4020 and 4040 controllers employ a 16-bit architecture implemented by combining four 4-bit AMD 2901A microprocessors. A total of 32 16-bit registers are used for internal operations, and fixed-length time-slicing is used to service individual applications. Processing supervision is under control of the UTS 400 mode or DDP 4000 mode System Control Programs.

The UTS 4020 require a minimum of 128K bytes of RAM, and can be expanded up to 1M bytes total. The UTS 4040 requires at least 256K bytes of RAM, and has an upper limit of 2.3M bytes. All memory is extra cost. Under the memory mapping scheme employed by both controllers, up to 32M bytes can be addressed.

The UTS 20, 30, and 40 workstations are Z80A microprocessor controlled. The UTS 20 comes with 16K bytes of RAM, with no expansions offered. The new UTS 60 color workstation employs the 16-/32-bit Motorola MC68000 microprocessor, and is delivered with 128K bytes of RAM. This number can be increased to 2M bytes through expansions. The UTS 30 comes with 128K bytes of RAM, and has an upper limit of 256K bytes. The older UTS 40 is delivered with no application RAM, but can be fitted with 64K bytes.

F3462-02 128K RAM Expansion • add-on 128K-byte RAM module for 4020/4040 • maximum of 1 per system:

$156/$104 mo	$3,500 prch	$13 maint

F3462-03 256K RAM Expansion • add-on 256K-byte RAM module for 4020/4040 • maximum of 4 on 4020 and 8 on 4040:

267/178	6,000	20

F3642-00 RAM Module • 32K-byte RAM for UTS 40 • one per system:

50/40	1,600	3

F3642-01 RAM Module • additional 32K-byte RAM for UTS 40 • one per system:

24/20	800	2

F4041-00 RAM I/O Module • 64K-byte RAM for UTS 40 • also includes 8-bit peripheral interface for 2 printers and 2 diskette subsystems with RS-232C interfaces:

38/30	1,200	8

F3987-02 RAM Module • 128K-byte RAM for UTS 30:

45/30	1,000	4

☐ I/O Channels

UTS 4020 & 4040

Both controllers are delivered with a peripheral interface for attaching 6 workstations. Optional interfaces (called line modules) are required to attach additional workstations, printers, and disk/diskette subsystems. Both the 4020 and 4040 communicate with the host processor via switched or dedicated facilities at speeds up to 19.2K bps. Interface is RS-232C/CCITT V.24.

MO: monthly rental/5-year lease charge without maintenance. PRCH: single-quantity purchase price. MAINT: monthly maintenance fee for rental/lease and purchased units. NA: not applicable/available. NC: no-cost item. Prices current as of February 1985.

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I/O Line Module • Z80A microprocessor-controlled I/O terminal and peripheral module • supports 3 workstation and/or peripheral interface modules • included in cluster controller.

F3464-00 Workstation Interface • supports direct attachment of 6 keyboard/display terminals • 1 standard on cluster controller:

$36/$24 mo	$800 prch	$4 maint

F3463-02 Peripheral Interface • 8-bit parallel interface • supports direct attachment of 4 printers and/or disk/diskette subsystems • maximum of 2 on 4020 and 6 with 4040:

26/17	560	3

F3463-03 Dual Peripheral Interface • dual 8-bit parallel interface • supports direct attachment of 8 printers and/or disk/diskette subsystems • maximum of 2 on 4020 and 6 with 4040:

36/24	820	3

UTS 40 Workstation Peripheral Interfaces

The UTS 40 and 40W both contain interfaces for 2 printers and 2 diskette subsystems. Additional interfaces are available for attaching RS-232C-interfaced printers and a 5.25-inch diskette. With the CP/M option and interface, up to 4 5.25-inch diskette drives can be attached. The standalone UTS 40 communicates with the host processor over switched or dedicated lines at speeds up to 9600 bps. The UTS 40W attaches directly to the 4020/4040 controllers.

F3643-98 Peripheral Interface • provides 8-bit peripheral interface for up to 4 devices (2 printers and 2 diskette drives) • supports loading CP/M • provides 64K-byte RAM for applications:

$38/$30 mo	$1,200 prch	$9 maint

F3644-99 Peripheral Interface • provides 8-bit interface and provides for additional loadable character set on UTS 40 and 40W • provides 64K-byte RAM for applications • supports CP/M 2.2 (6187-00):

38/30	1,200	9

F3644-04 Expansion Module • supports loading of CP/M; required with 8-bit peripheral interface (F3643) and processor-loadable character sets:

15/12	480	2

F3644-02 Peripheral Interface • provides peripheral interface for UTS 40 with loadable character set • requires F3644-04:

10/8	320	2

F3643-01 Peripheral Interface • provides 8-bit interface for 2 printers and 2 diskettes for UTS 40, or 1 printer and 1 diskette for UTS 40W • supports loading CP/M 2.2 (6187-00) on terminals with CP/M:

21/14	560	3

F3643-99 Peripheral Interface • same as F3643-01 except is field-replacement for F3643-00 when CP/M upgrade is used:

21/14	560	3

F4041-00 Peripheral Interface • provides 64K bytes of RAM for applications, and 8-bit peripheral interface for 2 printers and diskette with RS-232C interfaces • requires program cartridge F3576-11 • operates with UTS 40 only:

38/30	1,200	8

F4044-00 RS-232C Peripheral Attachment • allows attachment of RS-232C interfaced devices to UTS 40 • requires F4041:

12/8	300	8

F4044-01 RS-232C Peripheral Attachment • same as F4044-00 but has real-time clock:

24/16	600	NA

F3881-00 Dual Disk Control • provides interface for second UTS 4020/4040 to an 8409 Disk Subsystem:

65/60	2,000	9

☐ Communications/Networks

The UTS 4020 and 4040 operate in a polled environment with send/receive messages sent to the host via the cluster controller. The cluster controller polls the workstations; all transmission between the host and the 4020 are initiated by the host. The communications protocol (bisync-like) is the same as used on the UTS 400, and supports polling and performs parity checking.

The UTS 4020 and 4040 use the UTS 400 communications protocol to communicate with the host. In a distributed-host supported network, interaction is handled by CMS 1100 and IMS/90. If Sperry's DCA is employed, the controller runs under TELCON in UTS 400 emulation mode.

The standalone UTS 20, 30, 40, and 60 workstations can be directly connected to the host processor, or can communicate from remote sites via point-to-point or multipoint polled lines. Direct connection is made via interface modules (8610-00) which allow the terminals to be located 15,000 feet from the host. Data transmission rate in this mode is 19.2K bps.

Remote communication is handled by leased lines or the DDD network. Each standalone terminal employs an RS-232C or CCITT V.24 interface, and transmits synchronous data at 9600 bps, in half-duplex mode, using ASCII code. All use the UTS 400 communication protocol.

For installations with more than one terminal per site, an optional multiplexer is offered which concentrates the output of each terminal over one line using one modem per end. If your host and terminals are located less than 15,000 feet apart, you may want to take advantage of the Direct Communications Module (DCM). This is essentially a modem eliminator and requires a dedicated point-to-point line. The interface is RS-232C.

8610-00 Direct Connection Module (DCM) • freestanding modem eliminator for dedicated local line applications • supports asynchronous/synchronous 2400-bps rates up to 15,000 feet; synchronous 3600-bps rates up to 15,000 feet, or asynchronous up to 5,000 feet; synchronous 4800/7200/9600-bps rates up to 10,000 feet, or asynchronous up to 5,000 feet; synchronous 19.2K-bps rates up to 5,000 feet • half-/full-duplex modes • up to 4 DCMs may be configured in multidropped network • internal or external clocking • RS-232C interface:

$33/$29 mo	$852 prch	$8 maint

8609-00 Local Terminal Multiplexer • accommodates and controls up to 16 workstations/terminals • transmits/receives on polled basis • RS-232C/internal DCM interfaces • 2400 bps to 19.2K bps • used with 4020/4040 controllers:

65/49	2,138	10

8538-99 Terminal Multiplexer • concentrates the outputs from 8 workstations/terminals over a voice-grade facility • RS-232C interface:

65/49	2,138	10

F1970-01 202 Integral Modem • 1200-bps, point-to-point switched/dedicated line modem • AT&T 202 equivalent:

32/24	1,202	11

F1970-00 201 Integral Modem • 2400-bps, switched/dedicated line, point-to-point modem • AT&T 201 equivalent:

45/34	1,781	14

F2004-00/F2005-00 Auto-Answer • auto-answer capability for 201-/202-type, 2400-/1200-bps modems:

4/3	178	1

F3576-03 Program Cartridge • provides UTS 400 mode operation with editing and FCC capabilities • provides screen bypass function • used with UTS 40:

23/15	505	NA

F3576-07 Program Cartridge, CP/M • same as F3576-03, except provides operator-invokable CP/M mode:

27/16	595	NA

F3576-06 ANSI Program Cartridge • used with UTS 40:

16/13	505	NA

F3575-00 Program Cartridge • provides UTS 400 mode

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operation with editing and FCC capabilities • used with UTS 20:

7/5	200	NA

F3575-99 UTS 20 Screen Bypass • supports screen bypass in addition to F3575-00 functions:

18/15	505	NA

F3838-01 UTS 20 X.21 Program Cartridge • same as F3535-00 except supports X.21 interface:

7/5	200	NA

F3991 Program Cartridge • provides UTS 30 with Uniscope mode operation similar to UTS 20 with screen bypass, plus supports UTS 30 screen attributes:

23/15	505	NA

F3991-01 Program Cartridge X.21 • same as F3991, except supports X.21 interface:

23/15	505	NA

☐ Disk/Diskette

Both hard disk and diskettes are available for UTS 4000 components. The UTS 30, 40, and 60 workstations all support the Model 8439 Double-Sided Diskette Subsystem, and the UTS 40 also accommodates the Model 8406 Double-Sided Diskette Subsystem.

Hard-disk storage is provided by the relatively new Model 8409 Disk Subsystem. This unit stores up to 47.5M bytes, and can be ordered with 1 or 2 disk drive assemblies. A fully configured disk drive contains 3 platters and 3 sets of read/write heads. A single-platter system contains 4.75M bytes; 2 platters, 14.25M bytes; and 3 platters, 23.75M bytes. The 8409 attaches via an 8-bit peripheral interface, and is offered for the 4020 and 4040 controllers.

8406-04 Diskette Subsystem • 8-inch single-drive controller tabletop module • 980K-byte capacity • 260-millisecond access time • 62.5K-byte-per-second transfer rate:

$120/$80 mo	$2,700 prch	$22 maint

F3145-00 Diskette Drive Expansion • expands 8406 Diskette Subsystem to 2-drive module:

67/44	1,500	11

6181 Diskette Utility • provides format conversion and media preparation • requires 32K bytes of RAM:

21/NA	NA	NA

8439 Double-Sided Diskette Subsystem • standalone, tabletop unit • double-sided 5.25-inch diskette; 2 diskettes per enclosure with 655K bytes (formatted) storage each • 80 tracks per side, 9 sectors per track, 512 bytes per sector • double-density • 6 milliseconds track-to-track; 50-millisecond settle time; 100-millisecond latency; 300-rpm rotational speed; 390-millisecond average access time; 250K-byte transfer rate:

56/37	1,245	10

8409-95 Disk Subsystem • standalone, floor standing single- or dual-disk drive assemblies; 3 platters and 3 sets of read/write heads per drive • storage capacity of 4.75M/14.25M/23.75M bytes for 1, 2, and 3 platters, respectively • 580 usable tracks per surface; 8192 bytes per track; 478 tracks per inch • 5800-bit-per-inch (bpi) recording density • 12-millisecond track-to-track; 45-millisecond average; 8.3-millisecond average latency • 3600-rpm rotational speed • 5M-bps transfer rate • requires DDP 4000 SCS (6707):

578/427	11,842	106

8409-99 Disk Subsystem • provides cabinet and 4.6M-byte disk drive • requires DDP 4000 SCS (6707) • expandable to 14M or 23.3M bytes by adding F4085-00 or -01 • may be expanded by addition of second drive (F3900-XX):

378/280	9,650	82

8409-97 Disk Subsystem • same as 8409-99 except provides 14M bytes of storage:

478/354	10,745	94

F3900-00 4.6M-Byte Expansion • expands 8409-XX by adding a second disk drive with 4.6M-byte capacity:

158/117	3,777	54

F3900-01 14M-Byte Expansion • expands 8409-XX by adding a second disk drive with 14M-byte capacity:

188/139	4,207	66

F3900-02 23.3M-Byte Expansion • expands 8409-XX by adding a second disk drive with 23.3M-byte capacity:

219/162	4,676	28

F4085-00 Expansion • upgrades 4.6M-byte disk drive to 14M bytes:

100/74	1,096	12

F4085-01 Expansion • upgrades 14M-byte disk drive to 23.3M bytes:

100/74	1,096	12

☐ Terminals/Workstations

The terminal/workstation lineup consists of 4 standalone, 2 cluster-controlled, and 3 personal computers. The basic terminals for this group are the UTS 20, 30, 40, and 60, all standalone units which can connect locally or remotely to a Sperry 1100, 90, and 80 mainframe. The cluster-controlled versions of the UTS 20W and 40W provide the same facilities and support the same peripherals as their standalone siblings, but have no remote communication capability.

The personal computer version can be ordered as such from the factory or field-upgraded. As a personal computer, local control is under the CP/M operating system with local storage provided by the available diskette subsystems. Both the standalone and clustered terminals can be field-upgraded. **No version of the UTS 20** can be equipped as a personal computer.

All of these terminals employ loadable software which allows them to operate in UTS 400 mode. Here the standard UNISCOPE protocol is employed. In addition, the UTS 30 can be equipped to function under Sperry's DCA in DDP 4000 mode. The others can also function in this environment but only under control of UTS 4020 or 4040.

UTS 20 Workstation

Configuration • standalone (Model 20) and cluster (Models 20W) workstations • Model 20W employed with 4020/4040 cluster controllers • detached modular typewriter, expanded typewriter Katakana/English and UTS 400-format keyboards • 16K bytes of RAM, 4K bytes of ROM, fixed-base CRT, peripheral interface, and 2 keylocks.

Display • 12-inch diagonal • 7x11 dot matrix • 1920-character, 24-line x 80-character format; 25th status line • 96-/128-character ASCII/Katakana sets; European sets optional.

Edit & Format Features • auto-repeat, n-key rollover • cursor up, down, left, right pad; new line, new tab, tab forward and backward; erase display, character erase, erase to end of line, erase to end of field; insert in line, insert in display, delete in line, delete in display; line duplication, line insert, line delete, line feed, forms feed; scrolling; field intensity, blinking, reverse video; protected fields; computer/terminal formats.

Communications • via cluster controller for Model 20W • RS-232C/CCITT V.24 interface to modem or multiplexer (Model 20).

Peripherals • magnetic stripe reader • 40/80/160/167/400-cps matrix printer.

3660-76 UTS 20 Programmable Terminal • 16K bytes of RAM, 4K bytes of ROM, fixed-base display, bit-serial peripheral interface, RS-232C/CCITT V.24 communication interface • requires F3619-00, F3620-00, or F3621-00 keyboard, and F3575-XX program cartridge:

$69/$46 mo	$1,562 prch	$31 maint

3660-82 UTS 20W Cluster Terminal • fixed-base display, bit-serial peripheral interface, interface module to 4020/4040 controller • requires F3619-00, F3620-00, or F3621-00 keyboard

Sperry UTS 4000
Universal Terminal System

• includes 15-foot cable:

63/42	1,405	26

3660-74 UTS 20 X.21 Terminal • same as 3660-76, except has X.21 interface • requires program cartridge F3838-01:

83/55	1,862	31

UTS 30 Workstation

Configuration • standalone workstation • detached modular expanded typewriter keyboard with numeric keypad or text-processing keys • 128K bytes of RAM expandable • up to 256K bytes • fixed-base display • supports 1 or 2 diskettes and printer • upgradable to personal computer under CP/M Plus operating system.

Display • 12-inch diagonal • 10x16 dot matrix • 1920-character, 24-line x 80-character format; 25th status line • 96-character ASCII set.

Edit & Format Features • auto-repeat, n-key rollover • cursor up, down, left, right • new line, new tab, tab forward and backward • erase display, character erase, erase to end of line, erase to end of field • character underscore and blanking • up to 80 field-control characters per line • insert in line, insert in display, delete in line, delete in display; line duplication, line insert, line delete, line feed, forms feed • field intensity, blanking, reverse video, protected fields • computer/terminal formats • scrolling.

Communications • RS-232C/CCITT V.24 and X.21 interface to modem or multiplexer (see Communications section for details).

Peripherals • 2 double-sided 5.25-inch diskette subsystems with 655K bytes each • 55-cps correspondence-quality printer • 40/80/160/167/400-cps matrix printers.

3575-99 UTS 30 Programmable Terminal • program loader and ROM, interface for character printer, security keylock, and RS-232C/CCITT V.24 communication interface • requires F3982-XX keyboard and F3991 program cartridge • requires 8439-XX diskette subsystem and UTS 30 SCS (6708-00) to operate as programmable unit • requires CP/M Plus (6718-00) operating system to operate as personal computer:

$101/$67 mo	$2,277 prch	$29 maint

3575-97 UTS 30 X.21 Terminal • same as 3575-99, except requires F3991-01 program cartridge:

101/67	2,277	29

UTS 40 Workstation

Configuration • standalone (Model 40) and cluster-controlled (Model 40W) workstations • Model 40W employed with 4020/4040 cluster controllers • detached modular expanded typewriter keyboard with numeric keypad, expanded typewriter keyboard with text processing keys and UTS 400 format keyboard • 64K bytes of RAM • fixed-base CRT • 4 peripherals supported by UTS 40W and UTS 40 • both workstations upgradable to personal computers operating under CP/M Plus operating system.

Display • 12-inch diagonal • 7x11 dot matrix • 1920-character, 24-line x 80-character format; 25th status line • 96-/128-character ASCII/Katakana sets; European sets optional.

Edit & Format Features • auto-repeat, n-key rollover • cursor up, down, left, right • new line, new tab, tab forward and backward • erase display, character erase, erase to end of line, erase to end of field • character underscore and blanking • up to 80 field-control characters per line • insert in line, insert in display, delete in line, delete in display; line duplication, line insert, line delete, line feed, forms feed • field intensity, blanking, reverse video, protected fields • computer/terminal formats • scrolling.

Communications • via controller for UTS 40W • RS-232C/CCITT V.24 interface for UTS 40 (see Communications section for details).

Peripherals • magnetic stripe reader • 2 double-sided, double-density 5.25-inch diskette subsystem with 1M-byte capacity • 2 double-sided 5.25-inch diskette subsystem with 655K-byte capacity • 40/80/160/200-cps matrix printers • 55-cps correspondence-quality printer • 180/300/640-lpm line printers.

3561-80 UTS 40 Programmable Terminal • security keylock, peripheral interface for attaching 2 printers and 2 diskette subsystems, RS-232C communication interface • requires F3620 or F3621 keyboard and F3576-03 program cartridge:

$104/$69 mo	$2,333 prch	$43 maint

3561-76 UTS 40 Intelligent Terminal • same as 3561-80 except requires F3576-07 program cartridge • permits load and execution of CP/M; use of CP/M requires 8-bit interface (F3643 on F3644-04 with F3644-02) and 1 diskette drive (8406-04):

119/79	2,683	46

3561-74 UTS 40W Cluster Terminal • security keylock, peripheral interface for attaching 2 printers and 2 diskette subsystems • interfaces with 4020/4040 controllers • requires F3620 or F3621 keyboards:

90/60	2,024	34

3561-70 UTS 40W Intelligent Terminal • same as 3561-74 except permits load and execution of CP/M • use of CP/M requires 8-bit interface (F3643-01 or F3644-04 with F3644-02) and diskette drive (8406-04):

105/70	2,375	37

UTS 60 Color Workstation

Configuration • standalone workstation with modular detached expanded keyboard with numeric keypad • 128K bytes of RAM expandable to 2M bytes; 16-/32-bit Motorola MC68000 CPU • fixed-base CRT • interfaces 2 diskettes and character printer • optional CP/M operating system.

Display • 14.5-inch diagonal • provides 8 standard colors (red, green, blue, yellow, magenta, cyan, white, and black); 8 optional colors with Dot Graphics Feature • 9x15 dot matrix • 1920-character, 24-line x 80-character format; 25th status line • 96-character ASCII set.

Edit & Format Features • auto-repeat, n-key rollover • cursor up, down, left, right • new line, new tab, tab forward and backward • erase display, character erase, erase to end of line, erase to end of field • character underscore and blanking • up to 80 field-control characters per line • insert in line, insert in display, delete in line, delete in display; line duplication, line insert, line delete, line feed, forms feed • field intensity, blanking, reverse video, protected fields • computer/terminal formats • scrolling.

Communication • RS-232C/CCITT V.24 interface to modem or multiplexer (see Communications section for details).

Peripherals • 2 double-sided 5.25-inch diskette subsystem • 55-cps correspondence-quality printer • 40/160/167/400-cps matrix printers • single 5.25-inch 30M-byte formatted or 737K-byte unformatted mass storage subsystem:

NA/NA mo	$5,618 prch	$47 maint

F3619 Typewriter Keyboard • typewriter-style (ISO-standard key layout) with 22 programmable functions:

14/9	403	2

F3620-00 Expanded Typewriter Keyboard • ISO-standard typewriter-style keyboard with 22 programmable functions, numeric keypad, separate cursor control cluster:

20/13	428	3

F3621-00 UTS 400-Format Keyboard • ANSI-standard keyboard with 22 program function keys, numeric keypad, cursor control cluster:

20/13	453	4

F3982 Expanded Typewriter Keyboard • low-profile unit with numeric keypads to right and left of central position • offered with United States, United Kingdom, Germany, Spain, France, Denmark/Norway, Sweden/Finland, and Italy keycaps:

20/13	453	4

F3574-00 Tilt/Rotate Base • tilt and rotate base for CRT; tilt adjustment is 40 degrees and rotate is 90 degrees:

8/5	160	NA

☐ Printers

The UTS 4020 and 4040 accommodates up to 16 and 48

Sperry UTS 4000
Universal Terminal System

terminals, respectively. In addition, each of the workstations can also interface printers for independent (from the controller) printing. Printers that attach to each workstation are listed with the descriptions of UTS 20, 30, 40, and 60.

Model 0791 Correspondence Printer • 45-cps bidirectional tabletop, daisywheel printer with interchangeable print wheels • 96-character ASCII/multinational/OCR-A/OCR-B character sets • 132 columns at 10 cpi and 158 characters at 12 cpi • several interchangeable tractor drives up to 15-inch continuous or precut paper forms; card stock acceptable:

$222/$148 mo	$4,995 prch	$69 maint

F3313-00 Pin-Feed Platen • 9-inch pin-to-pin; standard 8.5-inch form:

NA/NA	260	NA

F3313-01 Pin-Feed Platen • 9.375-inch pin-to-pin; standard ISO A4 form:

NC/NC	260	NC

F3313-02 Pin-Feed Platen • 14.375-inch pin-to-pin; standard 13.875-inch form:

NC/NC	260	NC

F3316-00 Forms Tractor • for rear- or bottom-fed continuous forms; requires friction platen:

20/13	600	3

F3540-00 Cut Sheet Feeder • automatic feeder for precut individual sheets:

63/49	1,932	14

F3314-00 Printer Stand • provides shelf to hold paper during bottom feed operations:

NC/NC	225	NC

Model 0797-97 Matrix Printer • 80-cps, unidirectional, impact, 7x9 dot-matrix tabletop printer • 96-character ASCII/European sets • 80 columns at 10 cpi • 6- or 8-cpi vertical spacing • friction-fed platen handles 8.5-inch precut forms; pin feed for 9.5-inch forms and sprocket feed for 10-inch forms optional:

67/50	750	27

F3563-00 Forms Tractor • accommodates sprocketed continuous forms from 3 inches to 10 inches:

6/5	152	1

F3564-00 Pin-Feed Platen • accommodates sprocketed 9.5-inch forms:

6/5	152	1

Model 0798 Matrix Printer • 200-cps, bidirectional, 7x7 or 7x9 dot-matrix tabletop printer • 64- or 96-character ASCII/European character set • 132 columns at 10 cpi; 14 cpi optional • 6- or 8-lpi vertical spacing • up to 15-inch sprocket feed paper:

188/156	4,000	64

F3582-00 6/8 LPI • operator selectable printing at 6 or 8 lpi:

4/3	152	1

F3583-00 9-Wire Printhead • prints lowercase ASCII characters with decenders:

16/9	300	2

F2648-00 Document Parting Bar • allows removal of printed pages without removing paper from tractors:

3/2	114	1

F3587-00 Compressed Print • compresses character width to allow 14-cpi printing:

6/5	185	1

Model 0425-96 Matrix Printer • 40/100/133/160-cps bidirectional, serial-character, tabletop printer • 9x7 dot matrix at 100/133/160 cps; 18x40 dot matrix at 40 cps • 132 columns at 10, 12.5, or 16.6 cpi; 6/8 lpi • 96 ASCII/multinational/ISO character set; 128-character Katakana set • forms handling: 4, 5, 6, 8, 8.5, 11, 12, 14 inches long; 3 to 16 inches wide • rear-feed forms tractor; original plus 5 copies • 8-bit parallel peripheral interface:

60/50	1,395	44

Model 0425-97 Matrix Printer • 160 cps bidirectional • 9x7 dot matrix • all other features same as 0425-96:

55/45	1,275	38

F3864 Printer Converter • converts 0425-97 to 0425-96:

35/30	500	5

F3861 Forms Tractor • tractor set for forms with industry-standard sprocket holes:

5/4	95	1

Model 0789-63 Line Printer • 180 lpm • 48 characters • 132 columns; 6/8 lpi • requires F2865-XX print band:

315/233	10,584	95

F2865-XX Print Band • 48-character alphanumeric set • available with scientific, United Kingdom, Finland/Sweden characters:

NA/NA	225	NA

F2865-05 Print Band • contains 96 ASCII character set:

NA/NA	225	NA

0429-99 Model 35 Matrix Printer • tabletop unit operating at 167/375/400 cps • 9x7 dot matrix with decenders; 18x40 dot matrix at 167 cps only • 66x75 dot-graphics printing • 96-character ASCII/ISO; 128-character Katakana • 132 columns at 10 cpi; 158 columns at 12 cpi; 198 columns at 15 cpi • 5, 6, 7.5-cpi expanded vertical spacing; 10 cpi normal; 12 or 15 cpi compressed • friction-feed platen handles 5.7 to 12 x 8 to 14-inch precut forms, or folded-forms 3 to 16 x 4 to 22 inches • 20 vertical tabs; 32 horizontal tabs; 660-cps tabulating rate • 256-character line buffer • RS-232C interface:

174/116	3,900	40

Tractor Feed • push-pull tractors for continuous forms:

NA/NA	480	NA

Downline Load • allows downline loading of user-defined character sets:

3/2	80	NC

Sheet Magazine • input/output magazine-stacker holding 230 sheets:

83/55	1,860	16

F4000-00 Dot Graphics • provides dot-addressable graphics; prints 75 dots per inch; adds 7K bytes of buffer memory for addressing each dot in full-line 13.2 inches of printing:

11/7	250	2

0429-96 Model 35 Color Printer • same as 0429-99 matrix printer, except features 2- or 4-color printing:

201/134	4,500	45

0431-00 Character Printer • tabletop unit prints at 55 cps (Shannon text) • daisywheel, 96-character ASCII set; over 100 different type styles and character sets available • bidirectional printing • 10, 12, 15 cpi and proportional column spacing; 6, 8 lpi, and 1 to 2 line up/downline spacing • 13.2-inch line length; 15-inch maximum form width • form-length control is 3, 3.5, 4, 5.5, 6, 7, 8, 8.5, 11, 11.67, 12, and 14 inches • single sheet or continuous forms • friction feed standard; tractor optional:

117/78	2,641	30

☐ Other Peripherals

F3389-00 Magnetic Stripe Reader • reads International Air Transport Association A or B formats or American Banking Association format; switch-selectable format:

$12/$8 mo	$280 prch	$5 maint

• END

Sytek LocalNet 20
Broadband Local Area Network

■ PROFILE

Architecture • LocalNet 20 local area networks.

Type • broadband packet-switched network using 75-ohm coaxial cable or standard CATV 300- to 400-MHz cable, connections, and fittings • LocalNet requires 16 percent of 300-MHz bandwidth; 84 percent remains for other applications, such as voice and video.

Transmission Speed • aggregate data rate is 15.4M bps divided into 120 channels each with 128K-bps aggregate data rate.

Cable Length • up to 50 kilometers (31 miles).

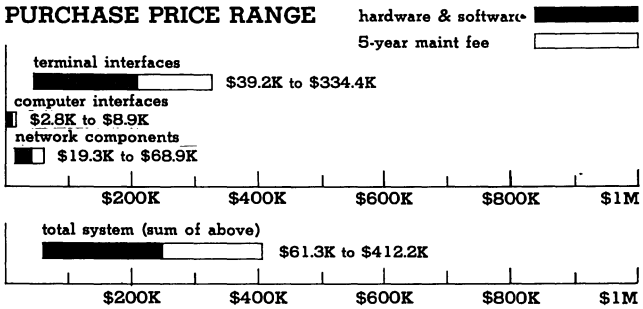
Applications • local area networks for office automation, distributed processing, and industrial control and monitoring with gateways to global networks • low-speed lines primarily used to interconnect terminal devices with computers.

Configuration • up to 255 devices can reside on each channel; bridges provide gateways between channels • maximum S-MUX configuration supports 20,000 concurrent users.

Interface • through Packet Communication Unit (PCU) or S-MUX; PCU available in 2 models for LocalNet 20 to connect either 2 or 8 units to a low-speed channel; S-MUX can connect from 2 to 32 units to a LocalNet 20 channel • PCU includes RF transceiver with frequency agile modem assigned to designated frequency for Frequency Division Multiplexing (FDM) of channels on the cable (see Figure 1).

Gateways • BSC option on LocalNet 20 allows connection to any device supporting BSC • Sytek is developing gateway to X.25 networks to be available in 1985 time frame.

PURCHASE PRICE RANGE



SYTEK LOCAL AREA NETWORKS PURCHASE PRICE bar graph covers price range of small to large LocalNet 20 LAN • **SMALL SYSTEM** uses 2 LocalNet 20 channels to interconnect 100 terminals and 2 host computers; each channel interconnects 50 terminals with 1 host; a bridge is used to interconnect the 2 channels • small system includes two 20/220 S-MUX (32 ports) with 32 20/222 asynchronous Packet Communications Processors (PCPs), 2 dual-ported 20/100 Packet Communication Unit (PCU), 2 dual-ported 20/105 PCUs (synchronous), and four 8-ported PCUs • small system network components include 50/50 Central Retransmission Unit with TO1 Filter Group, 50/201 Brink/Link Chassis, and 50/210 Bridge Interface Kit (BIK) for 2 channels with AO1 Filter Group • terminals are assumed to use an RS-232C interface and asynchronous protocol; host computers use RS-232C interface and synchronous protocol • **LARGE SYSTEM** uses 4 channels to interconnect 500 terminals with 4 hosts; each channel interconnects 125 terminals with one host; a bridge is used to interconnect channels • large system includes 16 20/220 S-MUXs (32 ports each), 252 20/222 asynchronous PCPs, and four 20/105 dual-ported PCUs (synchronous) • network components include 50/50 Central Retransmission Unit with TO1 Filter Group A, 50/201 Bridge/Link chassis, two 50/210 BIKs (2 channels each), 50/120 Statistical Monitor, 50/100 Network Control Center (Base Unit), and VO2 Digital Monitor • bar graph **DOES NOT** include prices for cable wiring, host processors, and terminals.

Support of Foreign Devices • vendor independent • BSC device support on LocalNet 20/100 PCU for terminals such as IBM 2770, 2780, and 3780 workstations, IBM 3270 terminals and controllers, and HASP workstations.

Communications Management • distributed among all nodes attached to LocalNet; Network Control Center (NCC) automates network management services on LocalNet 20.

Protocols • CSMA/CD for access control of each channel; FDM for access to each channel • each node implements lower 6 layers of protocols defined by Open Systems Interconnect (OSI) model of the International Standards Organization (ISO) • IBM has licensed Sytek's LocalNet/PC protocols for the IBM PC Network • will also be available to other vendors by mid-1985.

Distributed Functions • communication and network management and services • communication services include file transfers for data buffers up to 32K bytes long, datagram service for data buffers up to 32K bytes long, and message datagram services • applications programmed by user.

Support Software • Version 2 software in PCU, UNIX Version 7 on NCC.

First Delivery • LocalNet 20; 1980.

Systems Delivered • over 650 LocalNet 20 networks and over 100,000 ports.

Comparable Systems • no other LAN is quite comparable because LocalNet is vendor independent and broadband; Ethernet is comparable in terms of applications but uses baseband technology; Wangnet uses broadband technology but is vendor dependent; Ungermann Bass with its Ethernet-compatible baseband and broadband Net/One is most comparable • Network Systems Corporation with its HYPERchannel to interconnect high-speed devices and computers, and HYPERbus to interconnect slow-speed office equipment is similar in philosophy, but WSC's networks are baseband.

Vendor • Sytek, Inc; 1225 Charleston Road, Mountain View, CA 94043 • 415-966-7300.

Canadian Headquarters • Sytek, Inc; 235 Yorkland Boulevard, Suite 300, Willowdale, ON M2V 4Y8 • 416-494-8200.

Distribution • through 18 sales offices in the United States and through distributor networks in Europe, United Kingdom, Israel, and Asia • associated with General Instruments Data System Group, which provides service for all LAN products.

GSA Schedule • listed.

■ ANALYSIS

Sytek was founded in 1979 by a group from Ford Aerospace whoi were involved with systems software and network development and secure systems research. Initially, the company provided consulting services for network design and development. In 1980, Sytek acquired the Network Resources Corporation (NRC), which produced products for network implementation. With NRC, Sytek developed its LocalNet product line, and NRC has become the production arm of Sytek.

In 1981, General Instruments invested $6M in Sytek with arrangements to continue investing in the company as it grows and develops. The Jerrold Divisions Data Systems Group of General Instruments, primarily involved in CATV operations, now services all of Sytek's LANs. General Instruments is also building a Metropolitan Area Network (MAN) called MetroNet based on the Sytek broadband architecture.

Sytek was profitable from the start. Its revenues have doubled or

Sytek LocalNet 20
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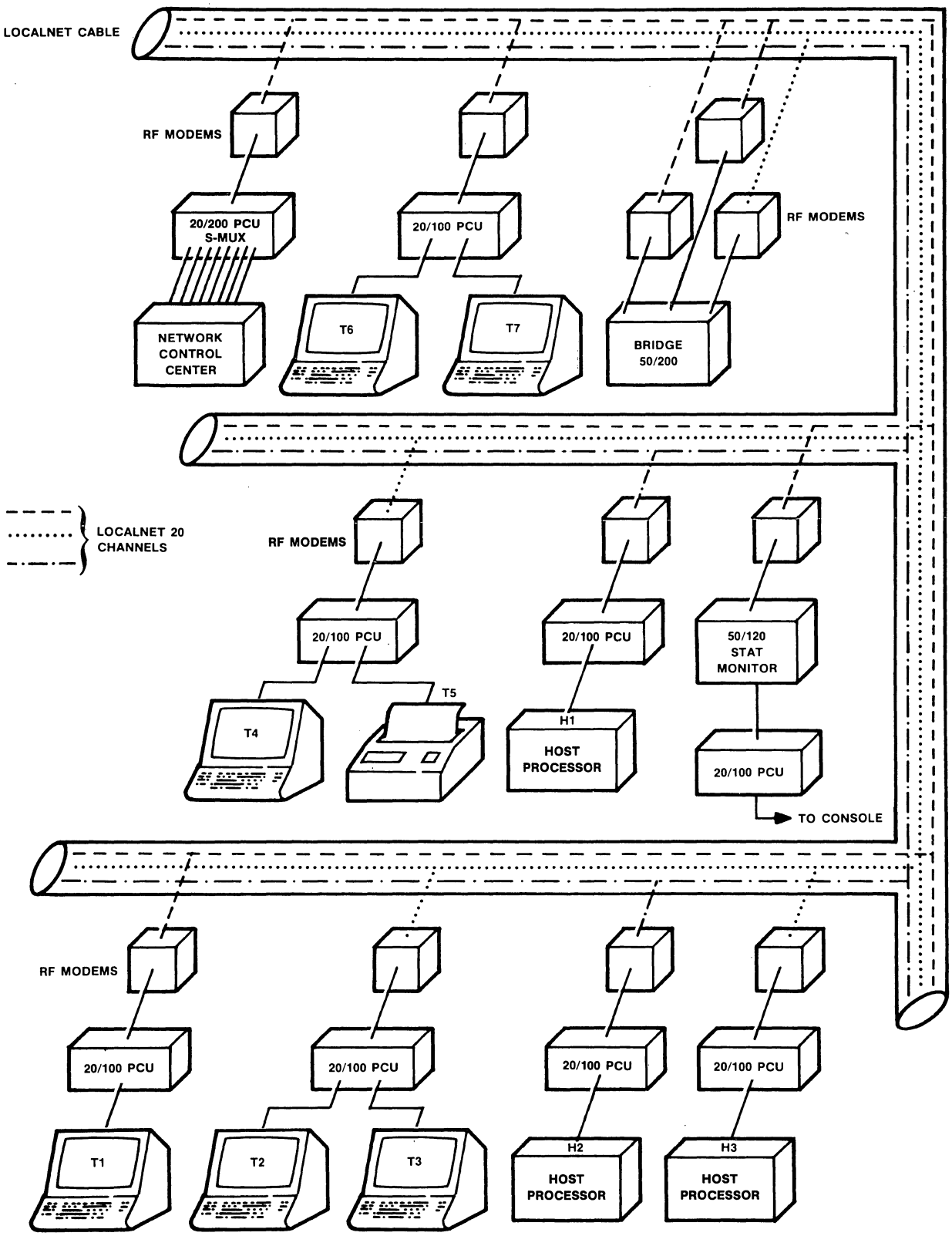

Figure 1 • LocalNet configuration.

Sytek LocalNet 20
Broadband Local Area Network

more than doubled each year since it was founded. Revenues were $1.28M in first year; $2.5M in 1981; $6.6M in 1982; $16.4M in 1984. This year's revenues for its fifth year of operation ending May 31, 1984 were $30.6M. Such revenue growth indicates the great need for LANs as well as Sytek's ability to fulfill that need.

LocalNet is a broadband local area network with a total throughput capacity of 15.4M bps available in 120 channels (128K bps). Each channel is actually an individual LAN that can be used by itself or bridge can interconnect up to 8 channels. The interchannel bridge passes traffic to the other channel only when the message frame is addressed to a device interfaced to the other channel.

Sytek also plans to offer a gateway to X.25 global networks, which should be announced before the end of 1985. Sytek not only offers hardware products but comprehensive software to control its networks. The software implements functions comparable to the lower 6 layers of the OSI model for distributed processing. Sytek's LocalNet/PC protocols have been licensed by IBM for use in the IBM PC Network; they will also be available for general licensing to other companies by mid-1985.

The basic physical network components are standard CATV components: cable, connectors, and fittings. The chips used to implement the digital channel protocol are standard HDLC chips. The company's relationship to General Instruments allows it to take advantage of a large service organization for maintaining LocalNets.

The largest LocalNet currently installed has more than 3,500 network ports. Most large networks utilize no more than 2 or 3 channels. Thus, LocalNet customers need not worry about outgrowing its capacity. A large network with cascaded bridges can interconnect up to 65,000 devices. This still leaves room for video and voice on the same cable.

Sytek offers an inexpensive solution to interconnect computers and terminals with its LocalNet 20. LocalNet not only handles the protocols for a Datagram service but also the higher-level protocols for guaranteed message delivery and for other services, such as name service/access control and key distribution control for secure networks.

In August, 1984, IBM announced its IBM PC Network, a broadband LAN, to interconnect PCs. Under OEM agreements with IBM, IBM helped design and develop the PC Network. Currently, Sytek manufactures the Adapter Card, a board that plugs into the back of the PC, and the Network Translator Unit.

☐ Strengths

Sytek offers a complete line of broadband products for the distributed processing, real-time control, and monitoring environments. It can interconnect a broad range of terminals and computers using standard CATV cables, fittings, and connectors.

Especially impressive is the Sytek software residing in the PCU located at each network node. It implements the lower 6 levels of the OSI model. Most LANs offer software support for only the 2 lowest levels. Exceptions are Xerox with its office systems connected by Ethernet and Network Systems with its NETEX software for HYPERchannel and HYPERbus. Also, Digital implements all higher-level protocols with DECnet IV. These 3 vendors, however, offer baseband, not broadband, LANs.

LocalNet is based on a comprehensive architecture, first in LocalNet 20, now in LocalNet/PC. The main features of that architecture include partitioning of service by application, full set of protocols, internetworking, and security.

Also, Sytek's broadband LocalNet will fit into nondata applications developing for broadband LANs. Voice and video (for teleconferencing) can fit on the same physical network as the one used by LocalNet. Buildings can be "wired" once for LocalNet with fittings and connectors in each room so that devices can be moved or added with no stringing of new wires.

So far, most customers implement no more than 3 or 4 LocalNet channels, thus LocalNet has plenty of capacity for additional services.

☐ Limitations

Sytek is still a small company, although its affiliate, General Instruments, is a $1 billion company. Sytek's product plans as announced are impressive, but it remains to be seen if the company can remain steadily on course and deliver new products as scheduled. Especially crucial are the gateways to X.25 and other global networks. Currently, Sytek offers only a BSC interface to IBM hosts.

Network Summary

LocalNet is a broadband Local Area Network (LAN) that uses Frequency Division Multiplexing (FDM) for data distribution. The network uses standard 70-ohm CATV coaxial cable and has a bandwidth of 300 MHz to 400 MHz. Transmission over the cable is unidirectional, therefore, various topological configurations are used to obtain bidirectional transmission. The use of 2 cables to achieve bidirectional transmission is the simplest solution. Bidirectional transmission can be achieved using a single cable through midsplit and subsplit techniques. These techniques split the bandwidth into a set of frequencies; some are assigned to transmission in one direction while the others transmit in the opposite direction. Highsplit or midsplit topology assigns half the frequencies to one direction and the other half to the opposite direction. Subsplit assigns specific frequencies for each direction. A head-end frequency translator converts transmit frequencies to receive frequencies.

A user device is connected to the cable via a Radio Frequency (RF) "frequency agile" modem, a split-frequency modem that can be adjusted to discrete transmit and receive frequencies within a band. The modem is tuned to transmit at one frequency and receives at another. Sytek's modems are designed for a 6-MHz transmit or receive bandwidth. Separation between the 2 frequencies is 156 MHz for midsplit operation and 216 MHz for subsplit operation. The frequency agile modems are switched to a new frequency by a command given manually from a keyboard. Sytek does not use the modem's agility to switch traffic from one channel to another. This is done through an interchannel bridge.

LocalNet 20 provides 120 channels with a channel-to-channel separation of 300 KHz. Transmit and receive frequency bandwidths are each 36 MHz for midsplit operation and 18 MHz for subsplit. Midsplit frequencies range from 70- to 106-MHz transmit, and from 226 to 262 MHz receive. Subsplit frequencies range from 10- to 28-MHz transmit, and from 226- to 244-MHz receive.

Transmission speed is 128K bps on each LocalNet 20 channel. Sytek offers a LocalNet 50/200 bridge to allow devices connected to 1 channel on LocalNet 20 to communicate with devices connected to other LocalNet 20 channels. The bridge can interconnect to up to 8 channels and act as a store-and-forward packet gateway.

Devices connect to a LocalNet channel through a Packet Communications Unit (PCU) which is a sophisticated RF transceiver, implemented using a microprocessor to interface an RF modem to the user device. The PCUs provide the modem to interface to the LocalNet cable. The frequency of the modem is software controlled.

The PCUs provide the distributed intelligence in the network. They handle the CSMA/CD access protocol, control communications, provide error and flow control, support local or centralized network control, and implement the network architecture in accordance with the lower 6 levels of OSI reference model for distributed processing. The LocalNet 20/100 and 20/200 PCUs can be set to operate at any of 20 different frequencies.

The LocalNet 20/100 PCU has dual ports for user devices. It operates in full-duplex mode and provides an RS-232C interface to the user device. The LocalNet 20/200 PCU has 8 ports for interfacing user devices. Each handles either bisynchronous or asynchronous protocols.

Sytek provides for redundancy of the LocalNet 50/50 Head-End Frequency Translator with the LocalNet 50/55 Redundant Translator Auto Switch Unit, which switches to the backup translator if the primary translator fails. The transfer is automatic,

Sytek LocalNet 20
Broadband Local Area Network

and users are unaffected by the switchover. Manual switching is also provided.

The LocalNet 20/220 S-MUX is a modular Packet Communication Unit (PCU) with up to 32 ports per unit for high performance, low-cost host applications. Ports are added in increments of 2-port cards. The S-MUX allows multiple hosts to share a single unit, thereby minimizing costs and rack space requirements. The 20/220 connects to the standard LocalNet 20 broadband cable.

The LocalNet 50/100 Network Control Center (NCC) automates LocalNet 20 network management services such as network administration, access control, and secure communication. Multiple NCCs can be connected for redundancy or to divide services. The NCC is supported by the LocalNet PCUs and Interchannel Bridge.

NCC also supports a Key Distribution Center Option that operates with secure PCUs to implement secure LocalNet 20 transmissions. The service operates as an end-to-end encryption service.

The 50/120 Statistical Monitor is a passive device that can listen to up to 8 LocalNet 20 channels to monitor channel activity. It is used in conjunction with the Digital Monitor option on NCC for automatic system collection of statistical data for network management.

The LocalNet 50/70 Cable Test Unit is a portable, self-contained device that provides quantitative test data to determine the radio frequency continuity of midsplit cable systems (single and dual cable) and to indicate how well the system is functioning. If the Cable Test Unit indicates the system is not operating within design specifications, it can initiate corrective measures (such as translator gain adjustment) or it can locate a specific failure point (such as a faulty amplifier, malfunctioning cable tap, or cable break).

■ SOFTWARE

☐ Terms & Support

Terms • the only real software available for LocalNet 20 is in the Network Control Center (NCC); the PCU is firmware-controlled and the firmware is bundled with the hardware.

Support • software is supported with the hardware under contract with General Instruments.

☐ Operating Systems

UNIX

The Network Control Center (NCC) operates under control of a subset of the UNIX V.7 operating system, providing a multitasking environment and a structured file system. The software system is NCC database driven. The database consists of a set of data-dictionary data files. Access to the files is through a Database Interface (DBI) program.

Name service and access control services are provided by multiple copies of the User Interface (UI); each UI services a separate UI port on NCC.

The network manager can access DBI and the configuration (config) process through a user service port (after special validation) and through the UNIX system's console port. DBI is an interactive program. Other programs run as background tasks. The network manager can use UI and config to view, print, archive, and clear files as needed.

PCU Software (Firmware)

The PCU software is constructed as a set of cooperating sequential processes that are scheduled by a central event processor in response to communication events. Two processes are provided for each level of LocalNet's protocol architecture: one process is on the receiving side and the other on the transmitting side of the PCU ports. PCU implements the port, session, transport, network, and link architecture levels. The PCU contains a command language interpreter through which it is controlled for initialization, configuration, and troubleshooting.

Flow control to user devices is selectable: none, EIA signal level flow control, or XON/XOFF flow control.

With the encryption option, the PCU stores a master key for access to the NCC Key Distribution Center (KDC) to establish secure sessions over LocalNet 20. The PCU uses a session key distributed by KDC to encrypt/decrypt messages.

■ HARDWARE

☐ Terms & Support

Terms • LocalNet components are available for purchase only • the 50-Hz 220VAC units are not available for U.S. customers but are available for international customers only • dollar-volume discounts are available up to 30 percent.

Support • various contracts available through Business System Services group within General Instruments • standard monthly maintenance is for on-call support with 4-hour guaranteed response time, 5 days per week, 8 hours per day; includes regularly scheduled preventive maintenance; monthly maintenance fee is up to 1 percent of purchase price for specialty items; fixed monthly maintenance fees for the most common LocalNet 20 components are $10.50 for LocalNet 20/100 PCU, $22.60 for LocalNet 20/200 PCU, and $15.40 for LocalNet 50/50 PCU Central Retransmission Unit.

LocalNet 20 Packet Communication Unit • microprocessor-based, packet-mode network interface unit for each device; provides distributed intelligence and connection between user device and CATV-based local area network; compatible with midsplit-, subsplit- and dual-cable installations; uses branching-tree cable topology so failure of node or branch does not affect rest of network; provides virtual connection support and value added services such as protocol and code conversion, directory services, and end-to-end encryption • can select from among 120 channels spaced 300 KHz apart; data rate is 128K bps • select frequency agile RF modem that can operate on preselected frequencies (up to 20) with fixed spacing between receive and transmit frequencies • implements CSMA/CD access method so up to 200 devices can use cable concurrently • receiver frequency range is 226.25 to 262.25 MHz (midsplit topology) or 226.25 to 244.25 MHz (subsplit topology); transmitter frequency range is 70 to 106 MHz (midsplit topology) and 10 to 28 MHz (subsplit topology) • EIA RS-232C asynchronous digital interface with full modem control; byte synchronous protocols are optional; flow control is EIA (RTS/CTS), XON/XOFF, or none; data rate range is 300 bps to 19.2K bps; provides 2 or 8 interfaces • supports 4 or 16 concurrent virtual connections per unit • parameters and functions for DTE interface similar to CCITT X.3; LocalNet interface similar to CCITT X.28; line protocol is HDLC-derivative designed for LAN use • programmed with extensive set of user commands for its operation and status display.

LocalNet 20/100 PCU • includes 2 user-interface ports and supports 4 concurrent virtual connections:
$1,090 prch

LocalNet 20/105 PCU • includes 2 user-interface ports, synchronous only:
1,390

LocalNet 20/200 PCU • includes 8 user-interface ports and supports 16 concurrent virtual connections:
3,750

P01 User Device Protocol • asynchronous, not available on 20/105 PCU:
NC

P02 User Device Protocol • bisynchronous; supports 2780/3780 RJE and HASP Multileaving workstations, 327X cluster

PRCH: purchase price. NC: no charge. NA: not available/ not applicable. RFQ: request for quotation. Standard maintenance prices available for most prevalent items as shown under Hardware Support section. Prices current as of May 1985.

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controllers, and 270X/370X communication controllers; includes RS-232C control port for asynchronous ASCII terminal; available on 20/105 only:

110

U00 User Device Physical Interface • RS-232C:

NC

W00 60-Hz Power • 115 VAC:

NC

Z01 Asynchronous Secure PCU • required to convert 20/100 to secure PCU to implement secure LocalNet option; available on 20/100 PCU only • conforms to National Bureau of Standards Encryption Standard (DES) • used with master key stored on secure PCU to initiate and establish secure sessions; session key generated and distributed by KDC under master key control used to encrypt and decrypt data messages • encryption occurs at the session layer of LocalNet's protocols; see Figure 2 • requires 50/100 V03 at NCC:

500

X01 Asynchronous Extended Performance PCU • available on 20/100 PCU only; offers 19.2K-bps data rate and provides Hewlett-Packard block-mode terminal support; provides flow control protocol conversion from ENQ/ACK to XON/XOFF:

160

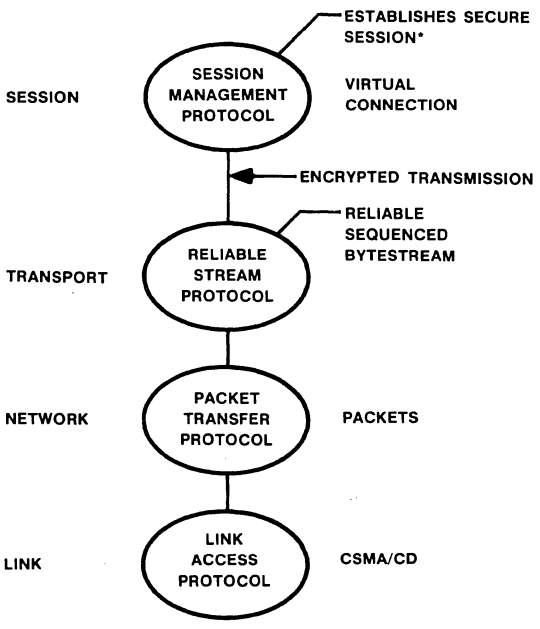

Figure 2 • LocalNet protocol hierarchy.

LocalNet 20/220 S-MUX • 32-port packet communication unit concentrator with overall throughput of 40K bps; data rates per port up to 19.2K bps • modular system that can be configured with from 2 to 32 ports • Base Unit with A01 standard modem:

2,200

20/222 Asynchronous PCP (Packet Communication Processor) • up to 16 per S-MUX; each provides 2 ports to LocalNet 20:

550

A01 Single-Cable Midsplit Channel Group • Group A for 20 channels, 300 KHz apart • transmits at 70 to 76 MHz and receives at 226 to 232 MHz:

NC

E01 Single-Cable Midsplit Channel Group • Group E for 20 channels, 300 KHz apart; transmits at 94 to 100 MHz and receives at 250 to 256 MHz:

60

LocalNet 50/50 Central Retransmission Unit • head-end frequency converter; supports up to 60 LocalNet 20 FDM channels • requires selection of a filter group to specify operating range:

3,500

LocalNet 50/55 Redundant Head-End Switch • provides automatic switchover to backup unit if frequency drifts outside limits:

4,000

T01 Filter Group A • transmits in 70-MHz to 76-MHz frequency range and receives 226-MHz to 232-MHz frequency range:

400

T04 Filter Groups J, K, A • transmits in 58 MHz to 64 MHz (J), 64-MHz to 70-MHz (K), or 70-MHz to 76-MHz (A) frequency range and receives in 214-MHz to 220-MHz (J), 220-MHz to 226-MHz (K), or 226-MHz to 232-MHz (A):

NC

T15 Filter Group L • transmits in 10-MHz to 16-MHz frequency range and receives in the 226-MHz to 232-MHz frequency range:

400

T18 Filter Groups C, D, E • transmits in 82-MHz to 88-MHz (C), 88-MHz to 94-MHz (D), or 94-MHz to 100-MHz (E) frequency range and receives in 238-MHz to 244-MHz (C), 244-MHz to 250-MHz (D), or 250-MHz to 256-MHz (E) frequency range:

480

T31 Pilot Tone Option for 50/55 • for use with T01 and T04 50/50; one per 50/55:

NC

T34 Pilot Tone Option for 50/55 • for use with T18 50/50; one per 50/55:

400

LocalNet 20 Bridge • provides interconnection of different frequency channels on 1 cable and of different frequency channels on different cables, allowing devices on different channels to communicate as if they were attached to the same channel; acts as a store-and-forward gateway; maintains a routing memory, mapping the network configuration to locate point-to-point paths for sessions across channels • designed to operate in parallel with other bridges to allow for backup or load sharing; can be organized into cascaded configurations so that up to 65,000 ports can be connected to LocalNet; implements link and network layer protocols • Motorola 68000 controls functions and multiple Z80 provides intelligence in Bridge Interface Kits (BIKs); each BIK supports 2 channels using Link Interface Kits (LIKs), provides access to other networks.

LocalNet 50/201 LocalNet 20 Bridge/Link Chassis • supports up to 4 Bridge/Link Interface Kits (BIKs):

9,000

LocalNet 50/210 Bridge Interface Kit (BIK) • 128K-bps interface; supports 2 LocalNet 20 channels; requires selection of Channel Group Options and Link Interface Kits; all other channel groups require special approval and quote from factory:

4,500

50/231 RS-422 Link Interface Kit (LIK) • provides access to another network through RS-422 link:

4,500

50/232 RS-232C/V.24 Link Interface Kit (LIK) • provides access to another network RS-232C/V.24:

4,500

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A01 Single-Cable Midsplit Channel Group • Group A: NC

E01 Single-Cable Midsplit Channel Group • Group E: 120

A02 Dual-Cable Midsplit Channel Group • Group A: 400

E02 Dual-Cable Midsplit Channel Group • Group E: 600

L11 Single-Cable Subsplit Channel Group • Group L: 400

LocalNet 50/100 Network Control Center (NCC) • provides high-level network administration and control including access control and secure communications; multiple NCCs can be connected to LocalNet for backup or division of services; remotely accessible from any terminal in the network • supports Network Resource Management Package, Digital Monitor Option, and Key Distribution Center option • Resource Management Package includes configuration manager, access server, name server, and access controller; Digital Monitor Option provides continuous displays of network operation and status, such as throughput error rates and packet size, with network alarms • Key Distribution Center Option provides control for secure LocalNet communication • implemented using MC68000L 8-MHz microprocessor with 512K-byte dynamic, parity RAM, 16K/32K/64K-byte EPROM, up to 2 10M-byte Winchester disks, 8 or 16 RS-232C serial I/O ports, and 20M-byte streaming tape drive; runs under subset of UNIX/V7 operating system • database capacity with 10M-byte disk provides for 3,000 users, 1,200 PCUs, and 300 symbolic destinations; increases to 6,000 users, 2,400 PCUs, and 600 symbolic names with two 10M-byte disks • report file capacity is for 5,000 names, server, and configuration control interactive reports • provides 8 or 16 RS-232C ports with recommended data rate of 4800 bps: port 0 is dedicated to hard-copy printer, port 1 provides direct access to NCC for the Network Manager Terminal, port 2 supports configuration control for remote Packet Communication Units (PCUs), port 3 supports communication with remote 50/120 Statistical Monitors, and ports 4 to 7/15 provide User Interfaces (UIs) for name service/access control/remote network manager access to NCC and/or Key Distribution Center (KDC) interfaces for secure session management; the number dedicated for UIs or KDC interfaces depends on the network requirements, but all the UIs and all KDC interfaces operate as a rotary and appear to the user as a single UI or KDC service • NCC ports connect to LocalNet 20 through ports on 20/100 or 20/200 PCUs, see Figure 3 • KDC requires a secure PCU; other PCUs connected to NCC may also need to be secure, depending on network security requirements; all PCUs involved in secure communication must be secure • NCC performance for name service and access control is measured as a function of number of new session requests, busy-period interval, user-to-NCC session interval (hold time), and number of name service ports; hold time is the major factor, thus the user service program enforces a limit of 90 seconds; NCC with 13 user-service ports can handle up to 500 new session requests per hour if average hold time does not exceed 30 seconds • configuration control can initialize up to 60 PCU ports,

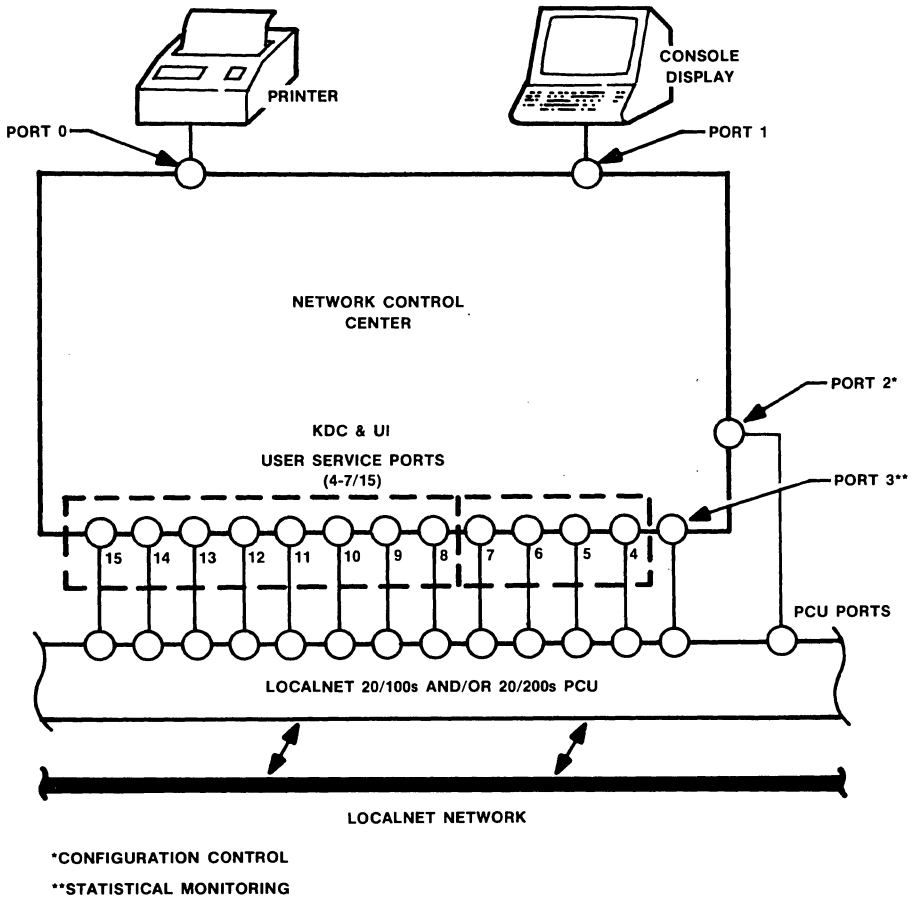

Figure 3 • NCC port allocation.

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update up to 140 PCU ports, or poll up to 240 PCU ports per hour.

50/100 Base Unit NCC • includes 8 ports and 10M-byte disk:
18,000

V01 Network Resource Manager Option • required to control and optimize network; basic package provides configuration tool, database creation tool, and name server access controller • data dictionary-driven database records administrative and operational data on each network component; database interface is screen oriented to allow network manager to define component configurations, symbolic destination names, user IDs and passwords, and access rights of user, destination, and components • configuration tool allows network manager to initialize, monitor, and enforce component configurations • network manager can configure user PCUs to call the name server/access controller ports of the NCC to translate destination names to physical LocalNet addresses, to validate user PCU access rights, and to create a session between user and destination • status information includes channel throughput, error rates, and alarms:
3,000

V02 Digital Monitor Option • automates centralized monitoring, collection, and display of network performance data and alarms for up to five 50/120 Statistical Monitors on LocalNet channels; traffic alarms are displayed when channels are congested or number of channel errors reaches significant level • uses port 3 on NCC for statistics collection; requires 1 or more 50/120 Statistical Monitor(s):
2,000

V03 Key Distribution (KDC) Center Option • control center of the secure LocalNet 20; 1 installed per network • operates as a set of servers with each server attached to a port; as many ports as needed can be dedicated to KDC, but all ports belong to same rotary and appear to user as a single service • maintains list of master keys on the network, generates and distributes session keys; each secure PCU has a different master key; master keys are never transmitted over the network; only 2 master keys are available for each secure PCU, one is stored in the KDC database, and the other is in the secure PCU memory • shares many of same files as other NCC processes but also adds its own KDC file to the NCC database • Secure PCUs and nonsecure PCUs can reside on the same network, and secure and nonsecure traffic can flow over the same network • when KDC option is implemented, all PCUs used to connect NCC to the network must be secure PCUs • secure sessions can be established between secure PCUs only:
3,000

V04 Development Package • provides additional UNIX software modules in NCC; requires V11, additional 10M-byte disk; allows user to customize user interface on NCC; allows use of NCC as a personal computer:
3,500

V11 Mini-Winchester Disk • additional 10M-byte disk drive:
3,000

V12 8 I/O Ports • additional ports for basic NCC:
2,500

V50 Rackmount Kit • for 50/100:
175

LocalNet 50/120 Statistical Monitor • gathers performance statistics for 1 LocalNet channel during a specific user-specified time interval; operates as a passive device that monitors the line • includes RF modem interface for connection to LocalNet 20 and RS-232C serial interface for connection to an ASCII terminal console for standalone use or to a PCU for operation in conjunction with a Network Control Center for centralized network management • all statistical data supplied on a single-screen display • responds to 10 individual commands to manipulate monitoring functions; commands include such functions as channel spacing, specific channel, generate a report, reset, type of report, begin and end reporting • Base Unit:
1,890

A01 Channel Group • also supports A02, L11, and L12:
NC

E01 Channel Group • also supports E02 channel group:
60

50/10 Test Bed Cable Kit • allows user to simulate broadband LAN:
100

50/70 Cable Test Unit • self-contained portable RF generator and field strength meter to isolate faults, verify gain attenuation for single or dual cable:
2,360

☐ Specification

LocalNet implements a network architecture comparable to the lower 6 layers of the OSI architecture model for distributed processing: physical, data link, network, transport, session, and presentation layers, see Figure 2. Only the application layer must be user programmed.

The **physical layer** is broadband coaxial cable that distributes data among the devices connected to it.

The **data link control layer** uses an HDLC-derived packet-mode protocol for data transmission. Another link level protocol used to control access to the channels is CSMA/CD. Other protocols are used in the bridge and gateway products.

The **network layer** implements a datagram service with addressing and routing of packets. Datagram packets are unacknowledged.

The **transport layer** provides error-controlled connections and flow control between the PCUs on LocalNet. This level provides in-sequence delivery, end-to-end acknowledgement, and packet retransmission. Up to 4 (LocalNet 20/100 PCU) concurrent virtual connections are supported.

The **session layer** handles access control, service accounting, name directory, and extended addressing services. It is responsible for resource protection, data security, network authentication, and symbolic-to-physical name translation.

The **presentation layer** provides virtual terminal, stream transfer, and datagram services for communication. The virtual terminal service, oriented toward character-at-a-time transmission, is a single transport layer virtual connection constructed from network layer datagram packets. Facilities allow formatting and converting data to conform to requirements of the communicating devices. The stream transfer service (STS) provides reliable file transfers of up to 32K bytes; larger files are segmented into multiple 32K-byte packets. The datagram service is message oriented and provides simple unacknowledged delivery; includes broadcast facility to send messages to all nodes on the network.

Packet Format

The packet format is HDLC based. Sytek uses a standard HDLC chip but does not use all fields of format; thus it implements an HDLC subset. Each packet contains a variable-length message field that uses a flag character to signal the end of message.

Transmission Characteristics

Transmission is by standard-frequency modulation techniques using Radio Frequency (RF) carriers on the LocalNet portion of the RF spectrum. Using Frequency Division Multiplexing (FDM), LocalNet establishes 120 LocalNet 20 digital channels. These channels can operate concurrently with other services that use other portions of the RF spectrum on the cable.

Each LocalNet channel is shared by up to 200 devices using Time Division multiplexing (TDM) to utilize the channel's capacity. LocalNet uses CSMA/CD access method to allocate the channel to devices requesting its use.

Channel Encoding • uses own clock interval, not Manchester encoding.

Data Rate • 128K bps on LocalNet 20 channels.

Carrier • Radio Frequency (RF) carrier.

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Control Procedure

LocalNet uses CSMA/CD access method to control access to each digital channel. Detects collisions by transmitting device listening on receive channel and comparing received data with transmitted data. Cross-channel communications are controlled by the bridge device connecting the channels.

Transmission Medium

LocalNet uses standard 75-ohm CATV coaxial cable, fittings, and connectors. Buildings can be "wired" with fittings so that devices can be plugged in anywhere (like electrical outlets) and moved from one place to another with no change in the device's operation.

Use

LocalNet has been designed to integrate the local communication facilities of computers and terminals. Applications include the automated office, real-time monitoring and control, and distributed processing.

• END