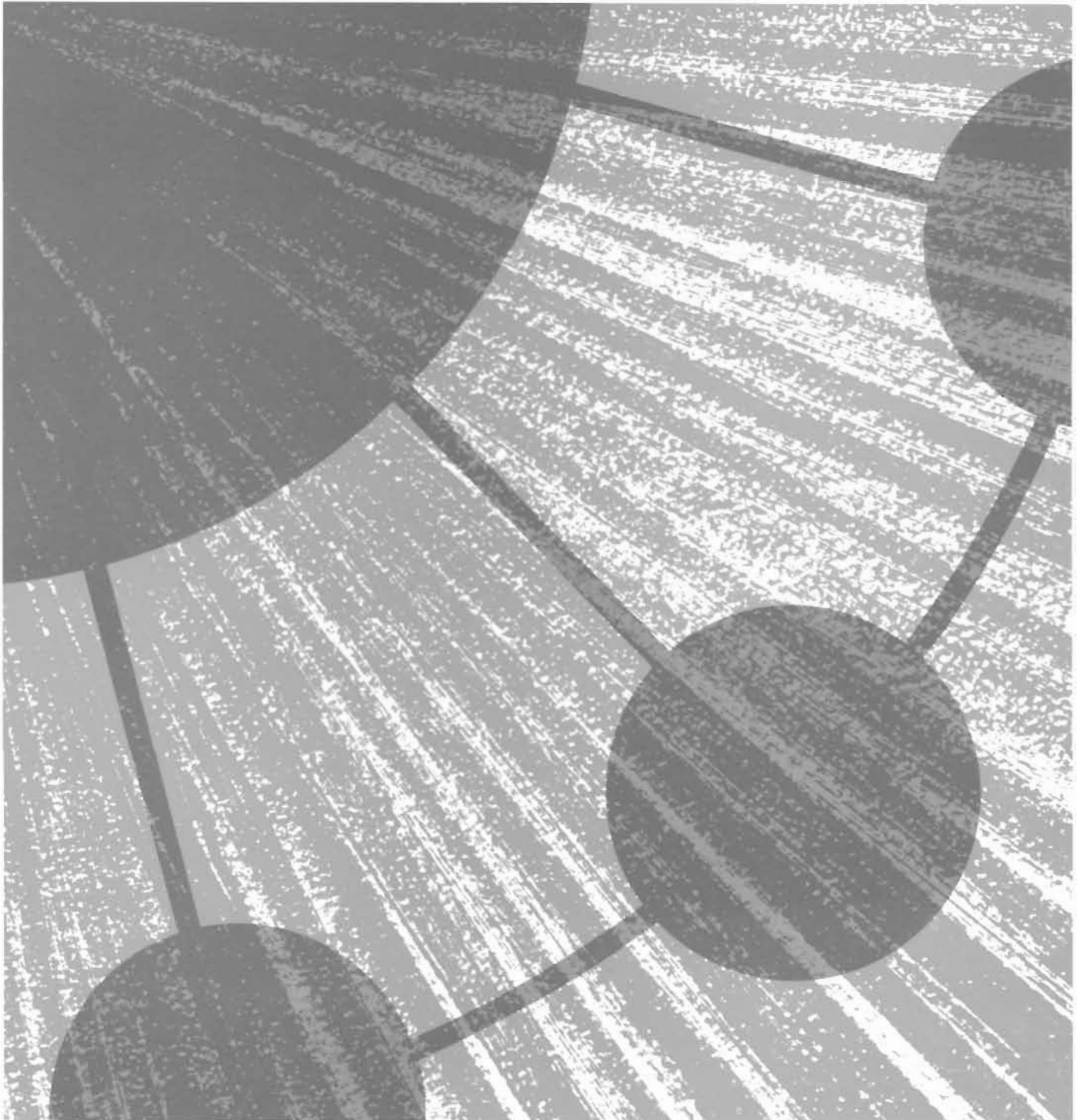


HP 1000 Computers and Systems

HEWLETT  PACKARD

Powerful processing capabilities for
computation, instrumentation, and
data management

Distributed Systems and Communications Data



Introduction

Content and organization of this data book

This data book provides information of software rights and privileges and data sheets on DS/1000 software-firmware and interfaces, the RJE/1000 communications package, CRT and printing terminals and related terminal-per-I/O channel software, multipoint software and interface, and other data communications interfaces.

For fast, easy location of a particular category of information in this data book, use the Quick reference index (facing).

Other related publications

The following additional publications provide supplementary technical data, pricing, and configuration information.

HP 1000 Computers and Systems Peripherals

Data book. Provides data sheets on:

- CRT, printing and data capture terminals
- Disc memories
- Magnetic tape units
- Line printers
- Card readers
- Punched tape I/O subsystems
- Graphics display and plotting devices and interfaces
- Instrumentation interfaces and subsystems
- Cabinets
- Environmental and physical characteristics and power requirements

HP 1000 Computers and Systems Active Software Data book. Provides data sheets on:

- Software support
- User training services for active software
- RTE-M and RTE-IV operating systems
- Program languages, including BASIC subsystems and the RTE Microprogramming package
- Libraries and support packages, including the Diagnostics library and the new GRAPHICS/1000 Graphics plotting software
- Data management software

HP 1000 Computers and Systems Mature Software Data book. Provides data sheets on:

- Software support
- User training services for mature software and subsystems supported by mature software operating systems
- RTE-II, BCS, RTE-B, and RTE-C operating systems
- Program languages
- Supporting libraries, including the 92066A RTE Measurement and Control Software package
- Distributed systems software supported by the mature software operating systems

HP 1000 Computers Hardware Data book. Provides data sheets on:

- HP 1000 F-, E-, and M-Series Computers and M- and E-Series Board Computers
- Memory systems
- Mainframe plug-ins
- Firmware products
- User microprogramming accessories
- Power fail recovery systems
- Input/output and memory extenders
- General purpose I/O interfaces
- Environmental specifications and product support information
- Power specifications and applicability summary

HP 1000 Computer Systems Technical Data book. Provides data on:

- HP 1000 concept and HP 1000 Computer Systems
- HP 1000 Computers, memory systems, and accessories used in HP 1000 Computer Systems
- System consoles
- System disc memories
- Cabinets
- Product support
- Site planning information

HP 1000 Computers Selection and Configuration Guide. Provides selection, configuration, price, and prerequisite information for HP 1000 Computers, options, accessories, and compatible interfaces, peripherals, software, and support services.

HP Computer Systems Configuration and Site Preparation Guide. Provides configuration, price, prerequisite, and site preparation information for HP 1000 Computer Systems, options, accessories, and support services.

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May 1, 1978

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3. The customer must install the customer-reproduced software on a Hewlett-Packard computer equipped with Hewlett-Packard memory of at least the minimum configuration specified in the data sheet for the product.
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"SPECIFIC RIGHTS TO REPRODUCE S/W GRANTED"

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Further information

For additional information, contact your local Hewlett-Packard Sales Representative.

Type I and II Software-Firmware, Software, and Subsystem Products

Type I	Type II
91740A	DS/1000 Software and Firmware for HP 1000 M-Series Computers
91740P	DS/1000 Firmware for HP 1000 M-Series Computers and "Right to Reproduce" 91740A/B Software once
91740B	DS/1000 Software and Firmware for HP 1000 E and F-Series Computers
91740R	DS/1000 Firmware for HP 1000 E and F-Series Computers and "Right to Reproduce" 91740A/B Software once
91741A	DS/1000 Software Enhancement for HP 1000 ↔ HP 3000 Comm.
91741R	"Right to Reproduce" 91741A Software once
92067A	RTE-IV Operating System Software and Firmware
92067R	RTE-IV Firmware and "Right to Reproduce" 92067A Software once
92903A	DATA CAP/1000 Software
92903R	"Right to Reproduce" 92903A Software once
2300B	RTE-B Real-Time BASIC Operating System Software
2300C	RTE-C Operating System Software
20855A	Basic Control System (BCS)
24396A-F	Diagnostics
91700A	Network Communications Package
91703A	Network Communications Package
91704A	Network Communications Package
91705A	Network Communications Package
91730A	Multipoint Terminal Subsystem Software
91780A	RJE/1000 Communications Package
92001B	RTE-II Operating System Software
92060B	RTE-III Operating System Software
92061A	RTE Microprogramming Package
92062A	RTE Drivers Package
92063A	IMAGE/1000 Software
92064A	RTE-M Operating System Software
92065A	BASIC/1000M Software
92066A	RTE Measurement and Control Drivers
92101A	BASIC/1000D Software
92400A	Sensor-Based Utility Library
92409A	Real-Time Plotter Software Library
92840A	GRAPHICS/1000 Graphics Plotting Software

models 91740A/B and 91741A

Distributed Systems/1000 (DS/1000) software and firmware provides an integrated set of high-level network facilities and procedures for HP 1000 Computers or Systems. These facilities and procedures support network resource-sharing, distributed data file management, communication between application programs, and the coordinated distribution of processor workloads to other HP 1000 Computers or Systems and/or to HP 3000 Series II systems.

The 91740A/B DS/1000 software and firmware supports hardwired or modem network connections between HP 1000 Computers or Systems operating under HP's disc-based RTE-IV (or RTE-III) or memory-based RTE-M real-time executive operating system. Such HP 1000 Computers or Systems constitute a DS/1000 network, with each system one node in the network. The 91740A provides firmware and software for HP 1000 M-Series (2108 and 2112) computers; the 91740B provides firmware and software for HP 1000 systems or HP 1000 E-Series (2109 and 2113) and F-Series (2111 and 2117) computers.

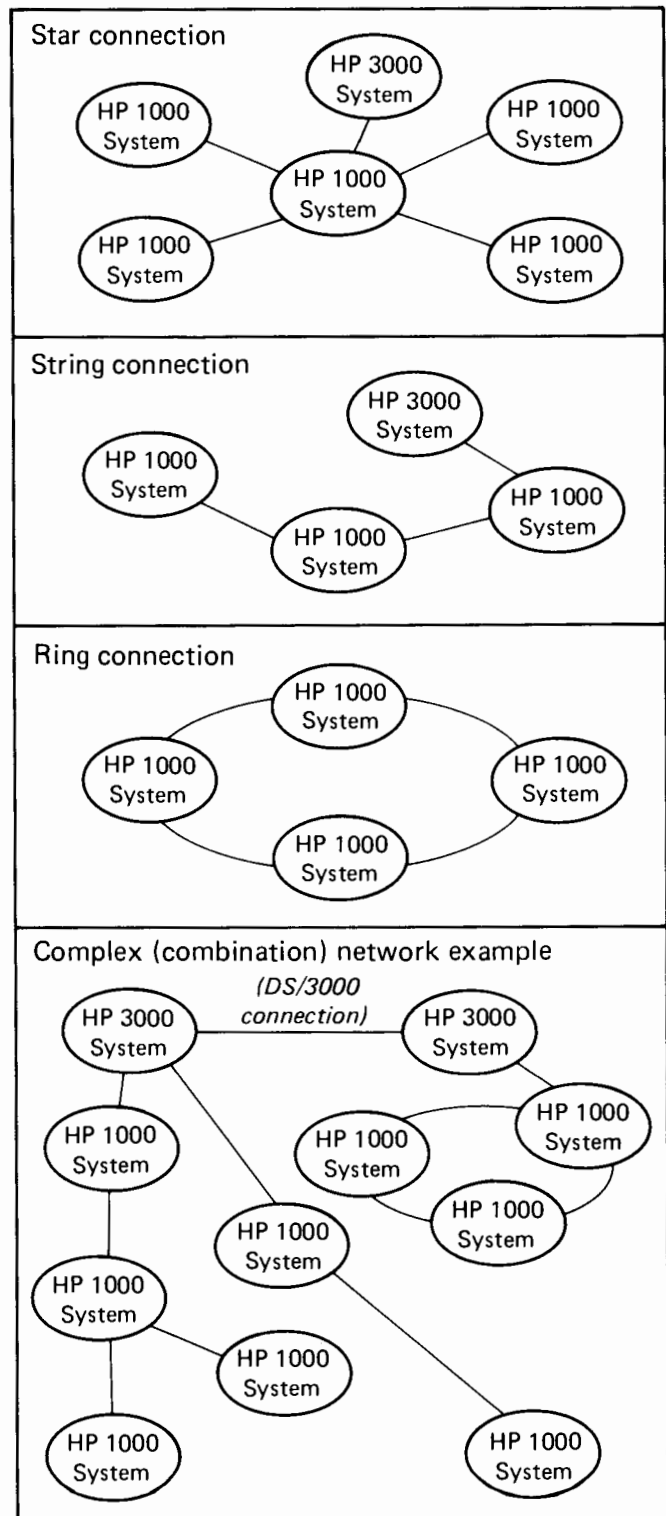
Addition of the 91741A DS/1000 software enhancement to the 91740A/B supports hardwired network connections between RTE-IV (or RTE-III) or RTE-M based HP 1000 Computers or Systems with 32190A DS/3000 software in an HP 3000 Series II system.

Features

- Generalized DS/1000 network architecture
- Compatibility with DS/3000
- DS/1000 network-wide nodal addressing with store-and-forward for maximum configuration flexibility
- Firmware driver optimized for concurrent servicing of multiple hardwired or modem lines with error correction
- Remote system generation and remote program development and testing (between HP 1000 systems only)
- Remote command processing between any DS/1000 network nodes
- HP 1000 virtual terminal capability with respect to HP 3000 Series II system

DS/1000 capabilities

DS/1000 capabilities with respect to both HP 1000-to-HP 1000 and HP 1000-to-HP 3000 communication are summarized in Table 1, on the next page, and discussed in the following paragraphs.



DS/1000 Network configuration choices

Table 1. 91740A/B and 91741A Network communications capabilities

HP 1000 to HP 1000	HP 1000 to HP 3000	HP 3000 to HP 1000	Capability
REMOTE COMMAND PROCESSING COMMANDS			(Local operator's requests to local or remote DS/1000 nodes)
RTE		RTE	The local HP 1000 or HP 3000 operator can issue any RTE system command to the remote HP 1000 system, except for running the file manager, IMAGE/QUERY, or other RTE subsystem requiring a local list device.
	MPE		The local HP 1000 operator can issue most MPE II commands to the remote HP 3000 system, including access to HP 3000 subsystems, such as the Cobol compiler and QUERY/3000, but excluding DS/3000 commands.
REMAT			NOTE: The following additional capabilities are provided by the DS/1000 remote command processor, REMAT; node 1 and/or node 2 can be either local or remote.
CR			Creates a file at node 1.
DL			Lists the file directory at node 1 on LU at node 2.
DU			Dumps a file or LU input from node 1 to LU at node 2.
EX			Terminates REMAT.
FL			Closes a file at node 1.
LC			Displays the local node number.
LI			Lists a file at node 1 on LU at node 2.
LL			Changes the local list or log device.
LO			Loads an absolute program from a node 1 file or LU into an RTE-M system at node 2.
PL			Lists all programs resident in an RTE-M system at node 1.
PU			Purges a file at node 1.
RN			Renames a file at node 1.
SL			Lists all program-to-program "slave" programs at node 1.
SO			Terminates a slave program at node 1.
ST			Stores all records from a file or LU at node 1, to a file at node 2.
SW			Transfers execution of subsequent commands to/from specified nodes.
TE			Sends a message to the operator at node 1.
TR			Transfers control of REMAT to a file or LU at a DS/1000 node.
PROGRAM-TO-PROGRAM (PTOP) INTRINSICS			(Program requests for communication between programs at local and remote HP 1000 and/or HP 3000 systems)
POPEN	POPEN	POPEN	From master program, initiates PTOP communications and schedules a slave program in the remote node, if necessary.
PREAD	PREAD	PREAD	Reads data block from remote program and exchanges tags.
PWRIT	PWRIT	PWRIT	Sends data block to remote program and exchanges tags.
PCONT	PCONT	PCONT	Exchanges user-defined tag field with remote slave program for user-defined control functions.
PCLOS	PCLOS	PCLOS	Disconnects remote slave program from the master and initiates its termination.
GET	GET	GET	Gets next request from the remote master program.
ACEPT	ACEPT	ACEPT	Accepts and completes the master program's request.
REJCT	REJCT	REJCT	Rejects the master program's request.
FINIS	FINIS	FINIS	From slave program, terminates communication with all master programs. Communication can be re-established by the master program by issuing a POPEN.

HP 1000 to HP 1000	HP 1000 to HP 3000	HP 3000 to HP 1000	Capability
REMOTE FILE ACCESS (RFA) INTRINSICS			(Program requests for access to files in a remote HP 1000 or HP 3000 system)
DCRET		DCRET	Creates a file.
DNAME	FRNAM	DNAME	Renames a specified file.
DPURG		DPURG	Removes a file and directory entry.
DOPEN	FOPEN	DOPEN	Opens a specified file.
DCLOS	FCLOS	DCLOS	Closes a specified file.
DREAD	FREAD	DREAD	Transfers one record from a file (sequential file on HP 3000).
	FRDIR		Reads a record from a direct access file.
	FRLAB		Reads a user's file label.
DWRIT	FWRIT	DWRIT	Transfers one record to a file (sequential file on HP 3000).
	FWDIR		Writes a record to a direct access file.
	FWLAB		Writes a user's file label.
	FSTMD		Changes file access mode.
	FLOCK		Dynamically locks a file.
	FUNLK		Dynamically unlocks a file.
	FUPDT		Updates a record in a file.
DPOSN	FSPAC	DPOSN	Positions a file.
DAPOS		DAPOS	Positions a file to a specified record.
	FPOIN		Resets pointer for sequential file.
	FRDSK		Prepares for reading a direct access file.
DCONT		DCONT	Sends control request to peripheral device identified as type 0 file.
	FCNTL		Control of file or terminal device.
DWIND		DWIND	Resets file to first record.
DLOCF	FINFO	DLOCF	Returns file status.
	FCHEK		Requests details on file I/O status.
DSTAT		DSTAT	Returns status of mounted discs.
	FRLAT		Determines if file pair is interactive or duplicative.
REMOTE RTE EXEC CALLS			(Program requests for action by RTE exec in remote system)
DEXEC (1)		DEXEC (1)	Read from an I/O device at remote system.
DEXEC (2)		DEXEC (2)	Write to an I/O device at remote system.
DEXEC (3)		DEXEC (3)	Control an I/O device at remote system.
DEXEC (6)			Terminate a remote program.
DEXEC (9)			Schedule a remote program with wait.
DEXEC (10)		DEXEC (10)	Schedule a remote program without wait.
DEXEC (11)		DEXEC (11)	Request time from the system clock in remote system.
DEXEC (12)		DEXEC (12)	Set execution interval or start time of a remote program.
DEXEC (13)		DEXEC (13)	Request status of a remote system I/O device.
DEXEC (23)			Queue schedule a remote program with wait.
DEXEC (24)			Queue schedule a remote program without wait.
DEXEC (25)			Request partition status from remote system.
DEXEC (99)			Request remote program status.
DS/1000 UTILITY CALLS			(DS/1000 Network utility program requests)
DMESG			Sends message to remote operator's display device or remote system's message processor.
GNODE			Obtains node number of the local system.
FLOAD			Down-loads absolute program into a remote RTE-M node.
FCOPY			Copies a file from one node to another.
EDITR			Provides interactive access to the RTE editor at a remote disc-based RTE node.

Nodal addressing (HP 1000-HP 1000 only)

Within a network of interconnected HP 1000 Computers or Systems, each system is assigned a unique node identification number by the user. Remote operator commands and user program requests reference the number(s) of the node(s) to which they are directed.

Node numbers for DS/1000 network connections are specified after an RTE operating system has been generated and loaded. A Network Routing Vector (NRV), which specifies the logical unit number (LU) through which any DS/1000 transaction goes to get from the local node to the target node, can be generated interactively or read from a Network Description Table (NDT) file at each DS/1000 node. An NDT specifies every connection in the DS/1000 network and consists of a list of the NRV's which reside in each node. An example is shown in Figure 1.

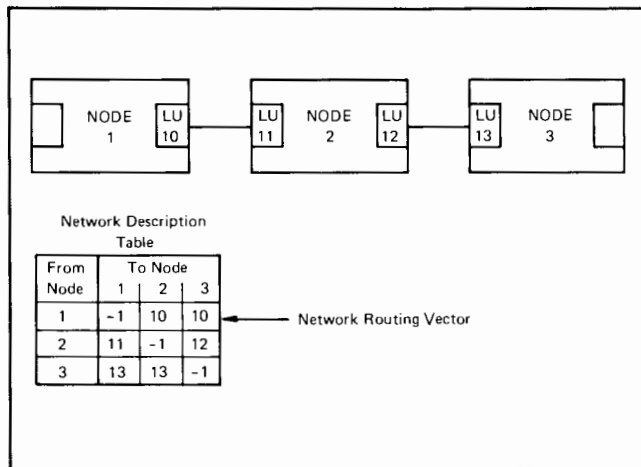


Figure 1. Nodal addressing via Network Description Table

Store and forward operations (HP 1000-to-HP 1000 only)

Using the example of Figure 1, a transaction goes from node 1 to node 2 or node 3 via LU10. At node 2, the DS/1000 communications management processors examine the destination node address on the transaction and either link the transaction to the local network interface monitors for processing if addressed to node 2, or forward the transaction to node 3 via LU12. The NRV describes a single communications path between any two HP 1000 nodes regardless of whether there is a direct, neighbor connection between them. Store-and-forward communications are not limited to a specified number of levels. However, store and forward to or through an HP 3000 system is not supported.

Nodal addressing with store-and-forward offers important advantages. Hardwired or modem-based lines can be shared in a string or ring configuration, reducing initial costs for hardwired connections or operating costs for data communications. A program can be written, debugged, and tested in one node and then transported to any other HP 1000 node in the network while accessing the same local or remote peripheral logical units, or slave application programs. Finally, no user application programs are required to perform store-and-forward functions in any node.

Remote command processing

HP 1000-to-HP 1000. DS/1000 remote command and processing makes it possible for a user at a local terminal to interactively access any HP 1000 system in the DS/1000

network, via the nodal addressing and store-and-forward capabilities of DS/1000. The local operator can use the entire RTE command set* of the remote node as well as special network-oriented commands provided by the DS/1000 remote command processor, REMAT. As shown in Table 1, the REMAT capabilities include local or remote file creation, listing and/or purging, file transfer and remote program scheduling. A Network Security Code (NSC) is required to direct commands to a remote system, which protects the network from unauthorized use of remote command processing. Remote command processing is initiated as easily as:

ON, REMAT
\$SW, N1, N2, NSC

This two-command sequence turns on REMAT and directs subsequent RTE and/or REMAT commands to Node 1 (N1) or from Node 1 (N1) to Node 2 (N2). The accompanying Network Security Code (NSC) is always required. By providing for Node 1 to Node 2 actions, DS/1000 remote command processing supports the direction of activities at unattended DS/1000 nodes.

HP 1000 virtual terminal to HP 3000. The operator at an HP 1000 system communicating with HP 3000 can execute most local HP 3000 MPE commands, except DS/3000 commands. The HP 1000 system thereby becomes a virtual HP 3000 terminal, gaining access to facilities not available on the HP 1000, such as the COBOL compiler and QUERY/3000. Security is controlled by the requirement for an account (and, optionally, a password) in the HELLO sign-on command addressed to the HP 3000. Access to the HP 3000 from the HP 1000 is obtained by these three simple commands:

RU, RMOTE
\$SW
#HELLO (account)

HP 3000-to-HP 1000. An operator at the HP 3000 can execute any RTE operator command*, thereby supporting control of an unattended HP 1000 satellite system.

**Only RTE operating system commands are supported. RTE subsystems such as the file manager, IMAGE/QUERY, and RJE/1000 are excluded from remote command processing capabilities available at local HP 1000 or HP 3000 systems since they require a local list device.*

Program-to-program data exchange (PTOP)

Using high-level distributed system calls (Table 1), a FORTRAN or Assembly language program in an HP 1000 node can initiate a data exchange with a named FORTRAN or Assembly language program in a remote HP 1000 system or a FORTRAN or SPL program in a remote HP 3000 Series II system. A program in the HP 3000 can also initiate the PTOPEX exchange.

Multiple PTOPEX data exchanges can be active on the same network connection concurrently and in HP 1000 systems one program can communicate with more than one remote node concurrently. PTOPEX between HP 1000 systems and from HP 1000 to HP 3000 system supports data buffers up to 8k bytes long; PTOPEX from an HP 3000 to HP 1000 system supports 1k byte buffers.

In addition to its use for exchanging data to be processed, the PTOPEX capability can be used by the customer to implement access by remote programs to IMAGE/1000 or IMAGE/3000 data bases residing on their local system. The records can be transferred to/from the remote requesting program, using PTOPEX intrinsics.

Remote file access

High-level DS/1000 calls analogous to standard RTE-FMP or FS/3000 calls can be used by FORTRAN/Assembly language programs in HP 1000 systems and FORTRAN/SPL programs in HP 3000 systems to define, access, control, and query the status of named files in remote HP 1000 or HP 3000 Series II systems. This capability facilitates the establishment, maintenance, and use of distributed data files, by the intrinsics listed in Table 1.

Remote calls to the RTE system executive

FORTRAN/Assembly language programs in an HP 1000 system or FORTRAN/SPL programs in an HP 3000 Series II system can make calls to the system executive of remote HP 1000 systems to write to, read from, control, or get status of I/O devices. Other calls can be used to request partition and/or program status, schedule programs with or without wait, request system clock time, and to set execution interval or start time of a program. A single HP 1000 node can concurrently service multiple system executive request calls, which are listed in Table 1.

Remote FORTRAN read/write (HP 1000-to-HP 1000 only)

The FORTRAN IV formatter for RTE systems, working with DS/1000 subroutine RMTIO, supports locally programmed Fortran read/write statements to read from or write to any logical unit (LU) specified peripheral device at any specified remote node with programming as simple as:

```
CALL DNODE(21)
WRITE(6,10)
10 FORMAT("DS/1000 SUPPORTS REMOTE
FORTRAN I/O")
```

Remote HP 1000 node system generation

Operating systems for RTE-IV (or RTE-III) or RTE-M based DS/1000 nodes can be generated at a single RTE-IV (or RTE-III) based DS/1000 node and copies distributed using FCOPY and loaded locally. RTE-M systems can also be generated remotely and loaded directly into neighboring RTE-M based nodes from RTE-IV based DS/1000 nodes, using the communications bootstrap loader (CBL) ROM.

Remote HP 1000 node program development

Program development for an entire DS/1000 network of HP 1000 nodes can be accomplished at a single DS/1000 node. At an RTE-M node, programs for other DS/1000 nodes can be developed on-line, relocated off-line, and loaded on-line into RTE-M nodes by operator command or program call. If necessary, these programs can be relocated into RTE-IV (or RTE-III) nodes by operator command. At an RTE-IV node, programs can be developed and relocated on-line and loaded into any target RTE-M node using an operator command or a program call. Programs can also be relocated into any target RTE-IV (or RTE-III) node by operator command.

Network utilities (HP 1000-to-HP 1000 only)

Network utilities provide single-call programming for such network tasks as sending messages to remote HP 1000 nodes, retrieving local node numbers, and copying files from any HP 1000 node to any other HP 1000 node. The interactive RTE Editor can be run at remote RTE-IV (or RTE-III) nodes. These capabilities make the network manager's and application programmer's jobs easier.

HP 1000-to-HP 1000 network description

Layered architecture

The DS/1000 software-firmware and hardware for HP 1000-to-HP 1000 connections in each system, or network node, consists of several layers, as shown in Figure 2. The Network Service Intrinsics (NSI/1000) are called by user's application programs or operator commands to generate the transaction format for master requests to remote nodes, with data as required. The master requests generated are those for PTOp, RFA, DEXEC, Remote operator command, and utility program capabilities described in Table 1.

The Network Interface Monitors (NIM/1000) process incoming master requests received from Communications Management software (CM/1000) and link them as required to user's slave PTOp programs, file management routines, or the RTE exec. The CM/1000 layer routes network transactions, queues them, and manages the local system resources necessary for network communications. CM/1000 also manages the store-and-forward operations.

The CM/1000 layer communicates with the interface hardware, which may be several hardwired and/or modem interface cards, via the Communications Access Method/1000 (CAM/1000) software and firmware. CAM/1000 provides a line protocol for the control of communications input and output, including error detection and correction by retransmission. The lower layers are managed by software,

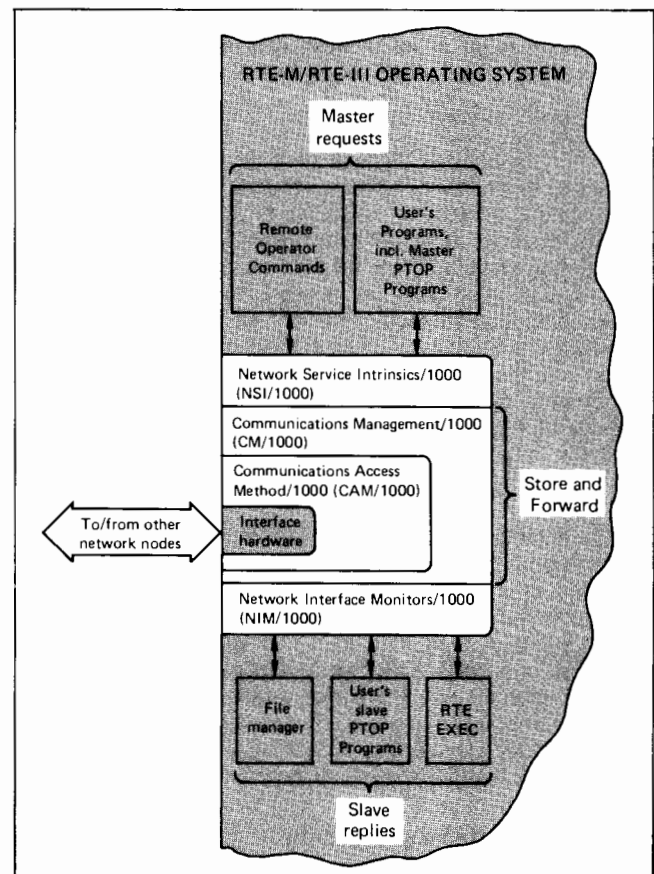


Figure 2. DS/1000 Layered Network Communications Architecture

firmware, and hardware such as to be completely transparent to the user. Changes to these layers of the network can be made with little or no effect on user's application programs.

Modular software supports three upward-compatible levels of DS/1000 node capability

Another advantage of Hewlett-Packard's layered approach to network communications software and firmware is its modularity — modularity that accommodates three main levels of network capability, with many gradations in between.

Minimum RTE-M nodes are low-cost, non-mapped memory based systems intended for execute-only use in measurement and control, automatic test, or data capture applications. This RTE-MII configuration supports HP 1000-to-HP 1000 communication or HP 1000-to-HP 3000 communication, but not both, since this requires more than 64k bytes of memory. For the same reason flexible disc file management cannot be supported in the same node as the 91741A HP 1000-to-HP 3000 software. The non-mapped RTE-M node is dependent upon RTE-IV (or RTE-III) nodes for system generation and program development support. The minimum RTE-M node uses a subset of the DS/1000 software-firmware, a subset that is in keeping with its dedicated role. Yet, whenever more capability is desired in a memory-based node, it can be easily upgraded to a larger mapped RTE-M configuration by adding dynamic mapping and more memory and regenerating the system.

Mapped RTE-M nodes are memory based systems whose larger memory capacity (128k to 2.048 million bytes) give them far more capability than minimum RTE-M nodes. Their RTE-MIII configuration can support both HP 1000-to-HP 1000 and HP 1000-to-HP 3000 communication. They can also provide local flexible disc based program development and off-line system generation capabilities and local program and data files accessed from multiple terminals. These added capabilities are in addition to the ability to perform multiple tasks similar to those of the minimum node. RTE-M program calls are compatible with RTE-IV, which facilitates upgrading.

RTE-IV nodes are the most capable of all. They require 128k bytes of memory, expandable to 2.048 million bytes, and at least 4.9 million bytes of disc memory (up to 400 million bytes can be provided). Because of their large main and disc memory capacities, RTE-IV nodes can provide network-wide support for HP 1000 system generation and program development, high speed computation, and data file facilities to other nodes operating under RTE-M or RTE-IV (or RTE-III). The RTE-IV node can support HP 1000-to-HP 3000 communication as well as communication to other DS/1000 nodes.

Transaction request buffering

The Network Interface Monitors in DS/1000 (for program-to-program data exchange, remote file access, and remote I/O and program scheduling) interface to CM/1000 communications management processors via complete requests and replies with data buffers as required. Therefore, the Network Interface Monitors can service multiple requests or replies concurrently and the monitors themselves can be swapped in RTE-IV while the system performs the data transfer, thereby freeing up memory for other programs or tasks.

CAM/1000 microcoded driver

CAM/1000 is a combination of software and firmware that is specifically designed to keep throughput high while servicing concurrent transactions on multiple hardwired and/or modem-based DS/1000 communication lines. The use of fast-executing firmware for the most time-critical portions of the driver provides fast switching between lines and high transfer rates. Where necessary to minimize interrupt latency time with hardwired communications on heavily-loaded DS/1000 nodes, a privileged interrupt mode can be used. (Privileged interrupt is always used for DS/1000 modem communications).

DS/1000 architecture for HP 1000-to-HP 3000 communication

DS/1000 software as enhanced for HP 1000-to-HP 3000 communications is layered similarly to Figure 2. The important differences appear in the bottom two layers. The CM/1000 layer includes translators for conversion of HP 1000 requests and replies to/from DS/3000 format. CM/1000 software is designed to work with only one remote HP 3000 system and does not provide for nodal addressing or store and forward operation to/from the HP 3000. CAM/1000 for HP 1000-to-HP 3000 communication is a software-only synchronous line controller.

Communications facilities

HP 1000-to-HP 1000 connections

As shown in Figure 3, HP 1000 Computer Systems can communicate via either hardwired or modem links. The 12771A hardwired interface operates at rates to 60.6k bytes/sec† at distances to 180 metres (600 ft) and at lower rates over longer distances up to 3 kilometres (10,000 ft). The 12771A can operate with or without the 12620A interface for privileged interrupt control. In lightly-loaded HP 1000 systems, non-privileged operation gives higher throughput.

The 12773A modem interface operates with full duplex modems asynchronously at rates to 1800 bits/sec or synchronously at rates to 19,200 bits/sec†. The 12773A must be used with the 12620A interface for privileged interrupt control and is compatible with Bell type 103, 201, 202, 208, and 209 Data sets and with Vadic VA3400 modems or equivalent modems.

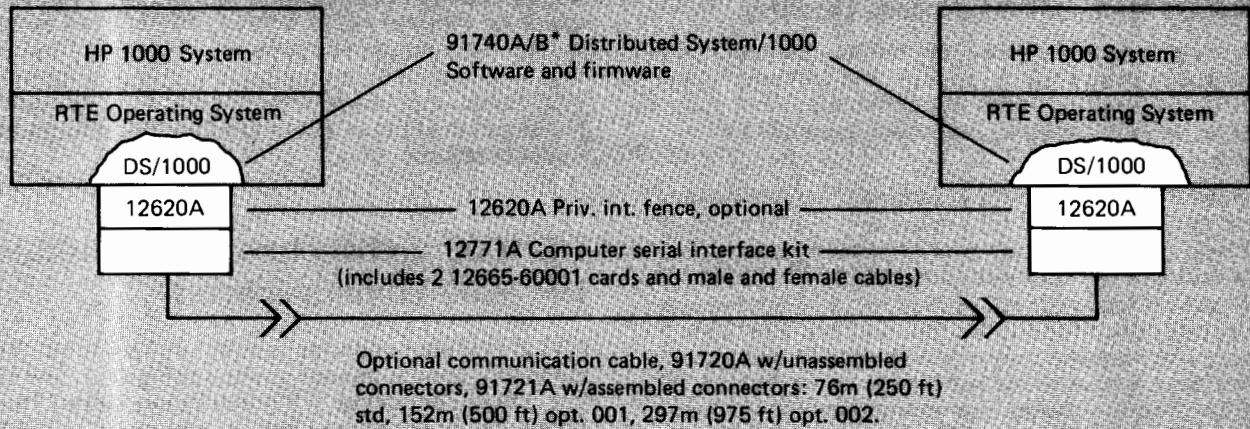
HP 1000-to-HP 3000 connection

As shown in Figure 3C, an HP 1000 Computer System connects to an HP 3000 Series II system via a 12889A Hardwired serial interface and a counterpart hardwired interface in the HP 3000 system. The 12889A operates at rates to 250k bytes/sec† at distances to 300 metres (1,000 ft) or at 125k bytes/sec† over distances to 600 metres (2,000 ft).

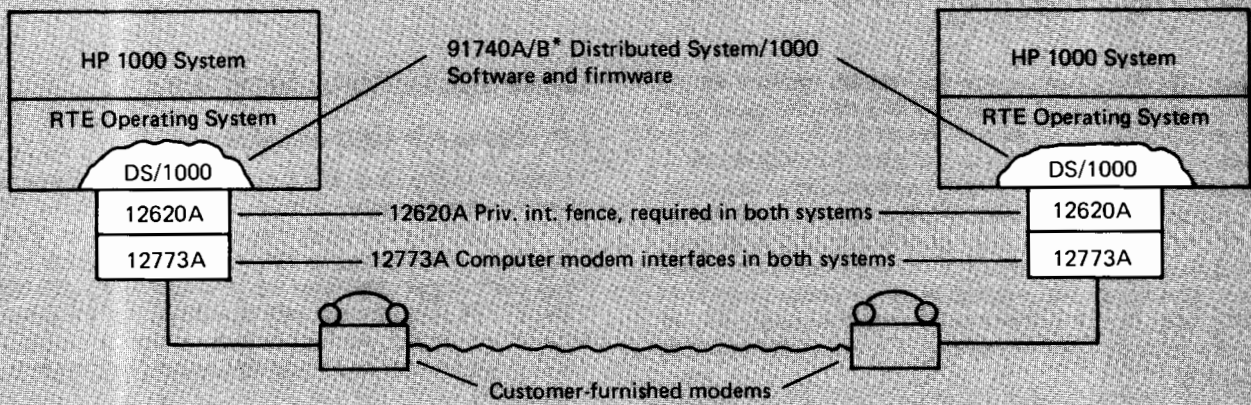
†These are maximum hardware data rates; actual throughput rates will be lower because of the overhead of DS/1000 and RTE operating system software.



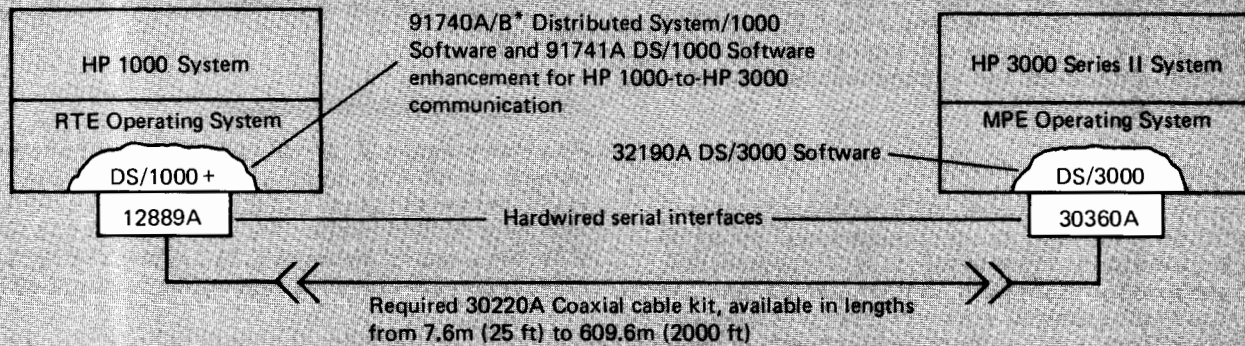
A HP 1000-to-HP 1000 Hardwired connection



B HP 1000-to-HP 1000 Modem connection



C HP 1000-to-HP 3000 Series II Hardwired connection



**91740A DS/1000 Software-firmware is for HP 1000 M-Series (2108 and 2112) Computers
91740B DS/1000 Software-firmware is for HP 1000 Systems and HP 1000 E-Series (2109 and 2113) and F-Series (2111 and 2117) Computers.*

Figure 3. DS/1000 network connections

Efficient error control

HP 1000-to-HP 1000 communication

The accuracy of both hardwire and modem communications between HP 1000 systems is supported by LRC/VRC/DRC (longitudinal, vertical, and diagonal) redundancy checking. Vertical parity is checked by the interface card at the receiving node. Longitudinal and diagonal parity words are generated by the microcoded CAM/1000 drivers in the transmitting and receiving nodes. The receiving node returns its parity words to the transmitter for comparison. A parity word mismatch causes retransmission of the block. Because error control is accomplished mostly in firmware system overhead is kept low.

HP 1000-to-HP 3000 communication

HP 1000-to-HP 3000 communications are error-checked by the CRC-16 error detection method, which is implemented in hardware on the 12889A interface card. Detection of an error results in a request for retransmission.

Functional specifications

Network capacity

HP 1000 nodes per network: Depends upon other activity of the individual nodes and response-throughput requirements.

HP 1000-to-HP 3000 connections: One connection to an HP 3000 per HP 1000 system. Two concurrently active connections to HP 1000s per HP 3000 system. Up to eight HP 1000s may be physically connected to an HP 3000.

Transmission choices and maximum distances

HP 1000-to-HP 1000 hardwire transmission: Up to 3.048 km (10,000 ft); uses 12771A Computer serial interface kit, which includes two interfaces and one male and one female cable.

HP 1000-to-HP 1000 modem transmission: Distances are limited only by the common-carrier networks; uses 12773A Computer modem interface card.

HP 1000-to-HP 3000 hardwire transmission: Up to 608m (2,000 ft); uses 12889A Hardwired serial interface card.

Configuration information

Computer and operating system compatibility

Product	Compatible computers	Compatible op systems
91740A	2108 & 2112	RTE-M/IV/III
91740B	2109, 2111, 2113 & 2117	RTE-M/IV/III*
91741A	2108, 2109, 2111, 2112, 2113, & 2117	RTE-M/IV/III*

*RTE-III has not been run in 2111 or 2117 Computer

Compatibility with other HP network products

The 91740A/B and 91741A DS/1000 software-firmware products are compatible with 32190A DS/3000 software in HP 3000 Series II systems and the 91780A RJE/1000 IBM 360/370 remote job entry package. The DS/1000 software is not compatible with 91700A, 91703A, 91704A, or 91705A Distributed systems communications packages. However, RTE-C and RTE-III/III programs using those packages are upward compatible with DS/1000 with only minor modifications.

Minimum system requirements

For DS/1000 nodes based on HP 1000 computer systems

	Node capability levels		
	Minimum RTE-M (RTE-MII)	Mapped RTE-M (RTE-MIII)	RTE-IV
HP 1000 Product numbers			
— for desk-style system	2174B/5B	2174B/5B	2176B/7B
— for upright cabinet system	2174A/5A	2174A/5A	2176A/7A
128k bytes of memory		Option 014 and 12786A/88A‡	Included
For each hardwired conn.*	12771A	12771A	12771A
For priv. int. control (required w/modem comm., optional w/hardwired comm.)	12620A	12620A	12620A
For each modem conn.**	12773A	12773A	12773A
DS/1000 software-firmware	91740B +020	91740B +020	91740B +020

*The 12771A includes two interface cards, one for the computer at each end of the hardwire connection; for cable lengths longer than 7.3m (24 ft), 91720A/91721A communication cables are available.

**Also requires user-furnished full-duplex modem.

‡Other memory packages are available for providing more than 128k bytes and/or fault control.

For DS/1000 nodes based on HP 1000 M-Series computers

	Node capability levels		
	Minimum RTE-M (RTE-MII)	Mapped RTE-M (RTE-MIII)	RTE-IV
Computer with 9 I/O chan	2108M*		
Computer with 14 I/O chan		2112M*	2112M*
Memory protect	12892B		
Time base generator	12539C	12539C	12539C
Power fail recovery system			
— for 2108A/B	12944A/B	12944A/B	12944A/B
— for 2112A/B	12991A/B	12991A/B	12991A/B
RTE-M operating system	92064A‡	92064A‡	
RTE-IV operating system			92067A‡
System console and standard input unit (can also use CRT or printing terminals without Mini cartridge I/O if 12925A Punched Tape Reader Subsystem is also provided)	2645A/48A w/001, 007, & 030 plus 13260B or +003 12966A +001	2645A/48A w/001, 007, & 030 plus 13260B or +003 12966A +001	2645A/48A w/001, 007, & 030 plus 13260B or +003 12966A +001
For each hardwired conn.	12771A†	12771A†	12771A†
For priv. int. control (required w/modem comm., optional w/hardwire comm.)	12620A	12620A	12620A
For each modem connection**	12773A**	12773A**	12773A**
DS/1000 software-firmware	91740A‡	91740A‡	91740A‡
Disc subsystem; one of:			
— 4.9M byte cartridge disc			12960A
— 14.7M byte cartridge disc			12962C/D
— 19.6M byte cartridge disc			7906M/MR w/13175A i/f 7920M w/13175A i/f
— 50M byte top-loading disc			

*Or 2108A/B or 2112A/B equipped with memory comparable to the 2108M (64k bytes) or 2112M (128k bytes).

‡Must specify media option for operating systems and DS/1000 software-firmware.

†The 12771A includes two interface cards, one for the computer at each end of the hardwire connection; for cable lengths longer than 7.3m (24 ft) 91720A/91721A communication cables are available.

**Also requires user-furnished full-duplex modem.

Requirement for use of existing 2108A/2112A computer with 12977A or 12976A-003 in DS/1000 node

The DS/1000 firmware in 91740A requires space used by the second FFP card of the 12977A or 12976A-003. For that reason, the 12977A or 12976A with option 003 must be replaced with the 12977B Fast Fortran Processor, which provides both dynamic mapping and fast Fortran instructions on a single board.

For DS/1000 nodes based on HP 1000 E-Series and F-Series computers

The requirements for DS/1000 nodes based on HP 1000 E-Series or F-Series computers are identical to those for DS/1000 nodes based on HP 1000 M-Series computers except as follows:

1. Computers are models 2109A/BE, 2111B/F, 2113A/B/E, or 2117B/F instead of 2108A/B/M or 2112A/B/M.
2. 2109E and 2111F include 64k bytes, respectively, of standard performance or high performance memory; 2113E and 2117F include 128k bytes, respectively, of standard performance and high performance memory. 2109A/B, 2111B, 2113A/B, or 2117B must be comparably equipped.
3. 13304A Firmware accessory board is required.
4. DS/1000 software-firmware is 91740B instead of 91740A.

Additional HP 1000 computer system requirements for HP 1000-to-HP 3000 communication

1. 12889A Hardwired serial interface and appropriate length of 30220A cabling.
2. 91741A + 020 DS/1000 software enhancement for HP 1000-to-HP 3000 communications.
3. 12897B Dual Channel Port Controller (DCPC).

Approximate memory requirements (bytes)

HP 1000-to-HP 1000 communication requirements

Required modules	Gen. in Sys.	Memory - Res.	Partition - Res.‡
CAM/1000 driver (DVA65)	1320		
CM/1000 transaction processors		2320	
Line and node initialization			
— for non-file RTE-M			6860*
— additional in RTE-M/RTE-IV with files			2870*
System available memory space	2048†		
Optional modules			
Remote program loader			
— for non-mapped RTE-M		5020	
— additional with mapped RTE-M or RTE-IV		1090	
Program-to-program monitor			1080
Remote file access			
— with single file monitor			6420
— additional for multi-file operation			2490
DEXEC monitor			
— not including schedule with wait			2020
— additional for schedule with wait			2140
Remote command processing (REMAT)		9590	
Remote RTE operator command monitor			700
Source node program and operating system download monitor			5230
File directory list service routine			1650

‡Partition-resident programs are swappable in an RTE-IV based node, overlayable in an RTE-M node.

*The line and node initialization program can be overlaid by a user program after it runs if the DS/1000 remote program loader and remote file access monitor are both resident (requiring 13.7 or 15.5k bytes) or if the RTE-M local program loader is memory resident (requiring 5.7k bytes).

†The 2048k byte system available memory requirement listed here is the minimum recommended size, and user applications may dictate the need for more system available memory.

Additional requirements for HP 1000-to-HP 3000 communication

Additional modules	Gen. in Sys.	Memory - Res.	Partition - Res.‡
Driver DVG67	1470		
High-speed link control		3910	
Transaction processors		5250	
Request and reply converters			5210
MPE operator interface (RMOTE)			7770
Trace table storage		400	
Console monitor			940

Requirements for HP 1000-to-HP 3000 communication only (no HP 1000-to-HP 1000 communication)

Required modules	Gen. in Sys.	Memory - Res.	Partition - Res.‡
Driver DVG67	1470		
High speed link control		3910	
CM/1000 transaction processors		5250	
Request and reply converters			5210
MPE operator interface (RMOTE)			7770
Trace table storage		400	
Console monitor			940
Line and node initialization			
— for non-file RTE-M			6860*
— additional in RTE-M/RTE-IV with files			2870*
System available memory space	2048†		

‡Partition-resident programs are swappable in RTE-IV based HP 1000 system, overlayable in RTE-M based HP 1000 system.

*These figures are based on use of the standard RTE-M absolute program loader (APLDR), rather than the DS/1000 program loader. In RTE-M systems, the line and node initialization program can be overlaid after it runs.

†The 2048 byte system available memory requirement listed here is the minimum recommended size and user applications may dictate the need for more system available memory.

Responsibilities of the customer

The DS/1000 customer must assume the following responsibilities with the purchase of DS/1000 software-firmware:

1. Site preparation for the network nodes (computer systems) and installation of communication facilities cables and/or modems). This customer action must be accomplished before the nodes or DS/1000 software-firmware can be installed by Hewlett-Packard.
2. One person in the customer's organization must be designated as the network manager, to assume responsibility for configuration and generation of the customer's systems and to function as the focal point for HP's support of the network. This person must be knowledgeable in HP's RTE operating system and must have taken the DS/1000 User's and Theory of Operation courses.
3. The same or additional persons in the customer's organization must be designated as the managers of the individual network nodes. These people should also understand HP's RTE and must have taken the DS/1000 User's course.
4. Hardware, software, and firmware must always be maintained at the latest revision code level. To facilitate such maintenance, especially for the firmware, HP strongly recommends that the customer purchase the Software Subscription Service and Basic Monthly Maintenance for each network node.

Ordering information

91740A DS/1000 Network software-firmware (for HP 1000 M-Series computers)

The 91740A DS/1000 software-firmware includes:

1. Firmware kit, including DS/1000 firmware driver instructions board and communications bootstrap loader (CBL) ROM.

2. One of software media choice options 010 or 020.
3. The following manuals.
 - a. 91740-90001 91740A/B Part number catalog.
 - b. 91740-90002 91740A/B Programmer's manual.
 - c. 91740-90003 91740A/B Network manager's manual.
4. 91740-90007 91740A Firmware manual.

91740B DS/1000 Network software-firmware (for HP 1000 E-/F-Series Computers or HP 1000 Systems)

The 91740B DS/1000 software-firmware includes:

1. Firmware kit, including three 4k ROMs for installation on the 13304A Firmware accessory board and a communications bootstrap loader (CBL) ROM.
- 2-3. Same as items 2 and 3 of 91740A, above.
4. 91740A-90009 91740B Firmware manual.

91740A/B options

- 010: Provides the following software modules on paper tape:
1. 29005-60001 Hardwire interface diagnostic.
 2. 29024-60001 Modem interface diagnostic.
 3. 91740-12001 through 12003 DS/1000 libraries.
 4. 91740-12004 and 12005 RTE-M system libraries.
 5. 91740-12006 and 12007 RTE-M loader/generator and library.
 6. 91740-16001 Network initialization program.
 7. 91740-16002 Network watchdog monitor.
 8. 91740-16003 and 16004 Remote file access monitors.
 9. 91740-16005 Remote executive request monitor.
 10. 91740-16006 Remote operator request monitor.
 11. 91740-16007 Program-to-program communications management monitor.
 12. 91740-16008 Remote scheduling monitor.
 13. 91740-16009 and 16011 Directory list programs.
 14. 91740-16012 Remote down-load monitor.
 15. 91740-16013 Interrupt request handler.
 16. 91740-16014 Request pre-processor.
 17. 91740-16015 Comm. line write-retry processor.
 18. 91740-16016 Communications error logger.
 19. 91740-16017 and 16018 Remote loaders.
 20. 91740-16019 DS/1000 RTE-IV/III loader.
 21. 91740-16020 Communications driver DVA65.
 22. 91740-16021 Network description table generator.
 23. 91740-16022 and 16023 Remote editors.
 24. 91740-16024 Network operator interface.
 25. 91740-16037 Fortran IV remote I/O formatter.
 26. 91740-16070 RTE-M segmented program preparation module.

020: Provides the software modules listed for option 010, above, on Mini cartridges, 91740-13301 through 13305.

91741A DS/1000 Software enhancement for HP 1000-to-HP 3000 communications

The 91741A software enhancement package includes:

1. One of software media choice options 010 or 020.
2. 91741-90001 91741A Part number catalog.

91741A options

010: Provides the following software modules on paper tape:

1. 91741-12001 and 12002 Libraries.
2. 91741-16001 Communications driver DVG67.
3. 91741-16002 Slave request watchdog.
4. 91741-16003 Communications monitor.
5. 91741-16004 and 16005 Request and reply converters.
6. 91741-16006 \$STD list monitor.
7. 91741-16007 Operator access module.

020: Provides the software modules listed for option 010, above, on a Mini cartridge, 91741-13301.

91740P Right to duplicate 91740A for use on an additional HP 1000 M-Series computer system

91740P consists of:

1. The right to make one copy of software purchased with the 91740A DS/1000 the original software-firmware.
2. The right to make one copy of software updates supplied by Hewlett-Packard under the 91740S or 91740T support services for the purpose of updating item 1, above.
3. All manuals furnished with 91740A software and firmware for use on 2108 or 2112 Computer, items 1, 3, and 4 of 91740A, above.

91740R Right to duplicate 91740B for use on an additional HP 1000 E-Series or F-Series computer system

91740R consists of:

1. The right to make one copy of software purchased with the 91740B DS/1000 software-firmware.
2. The right to make one copy of software updates supplied by Hewlett-Packard under the 91740S or 91740T support services for the purpose of updating each item 1, above.
3. All manuals furnished with 91740B software and firmware for use on 2109, 2111, 2113, or 2117 Computer, items 1 and 4 of 91740B, above, and item 3 of 91740A, above.

91740S Software Subscription Service

The 91740S Software Subscription Service provides software and manual updates as required to keep your DS/1000 software current with respect to enhancements and other design changes as they are released by Hewlett-Packard. The 91740S service is ordered in monthly units for at least six months, billable quarterly. A media option, selected from those listed following 91741T, must be specified when ordering 91740S.

91740T Comprehensive Software Support

The 91740T Comprehensive Software Support includes the Software Subscription Service, as described under 91740S, above, and a Phone-In Consulting Service for discussion of questions on your DS/1000 software with a qualified HP Systems Engineer. The 91740T service is ordered, in monthly units for at least six months, billable quarterly. A media option must be selected from those listed following 91741T.



91741R Right to duplicate 91741A DS/1000 Software enhancement for use on an additional computer system.

1. The right to make one copy of the original software purchased with the 91741A DS/1000 Software enhancement.
2. The right to make one copy of software updates supplied by Hewlett-Packard under the 91741S or 91741T support services for the purpose of updating each item 1, above.
3. 91741-90001 91741A Software part number catalog.

91741S Software Subscription Service

The 91741S Software Subscription Service provides software and manual updates as required to keep your enhancement current with respect to enhancements and other design changes as they are released by Hewlett-Packard. The 91741S service is ordered in monthly units for at least six months, billable quarterly. A media option, selected from those listed following 91741T, must be specified when ordering 91741S.

91741T Comprehensive Software Support

The 91741T Comprehensive Software Support includes the Software Subscription Service, as described under 91741S, above, and a Phone-In Consulting Service for discussion of questions on your DS/1000 software enhancement with a qualified HP Systems Engineer. The 91741T service is ordered, in monthly units for at least six months, billable quarterly. A media option must be selected from those listed below.

91740S/91741S and 91740T/91741T Media options

010: Software updates on paper tape.

020: Software updates on Mini cartridges for read-in via 2645A+007 CRT Terminal.

91740T/91741T option 200

91740T/91741T option 200 provides a discount for Comprehensive Software Support of an additional copy of the DS/1000 software or DS/1000 software enhancement.

models 12771A, 91720A, 91721A

The 12771A Computer serial interface is a two card interface with male and female cables that forms a complete hardwired hardware communications link between two HP 1000 computer systems equipped with 91740A/B DS/1000 network software-firmware and managed by HP's RTE-M, RTE-III, or RTE-IV operating system. For convenient interconnection between interface cards supplied with the 12771A over lengths greater than 7.3m (24 ft), Hewlett-Packard offers 91720A and 91721A communications cables in various lengths.

Features

- Data rates to 60,606 bytes/second at distances to 183m (600 ft)
- Transmission distances to 3.048km (10,000 ft) at rates to 3,214 bytes/second
- Simple, individually shielded dual twisted pair cable connection
- Optically isolated input breaks ground loops, maximizes noise immunity.
- Complete two-card link between two computers

Functional specifications

Capacity

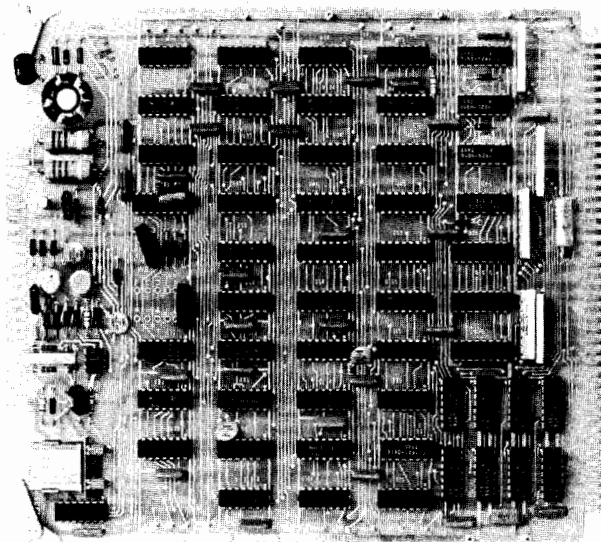
One complete, bit-serial duplex channel per interface, with two cards, one for each computer at either end of the communications channel.

Hardwire cable lengths and maximum hardware transmission speeds

Cable Lengths		Max. Transmission speeds bytes/second†
metres	feet	
0 - 180	0 - 600	60,606
180 - 360	600 - 1200	38,460
360 - 600	1200 - 2000	22,222
600 - 900	2000 - 3000	12,048
900 - 1200	3000 - 4000	22,222*
1200 - 1600	4000 - 5400	12,048
1600 - 2200	5400 - 7300	6,288
2200 - 3000	7300 - 10000	3,214

†Transmission speeds are user-selected by jumper on each interface card to correspond with cable length used. These are maximum hardware speeds; network throughput rates will be lower because of software overhead.

*For cable lengths greater than 900 metres (3000 feet) current limiting resistors are shorted out, giving the increase in transmission speed shown for the 900 - 1200 metres (3000 to 4000 foot) cable length.



Error control

Errors detected in hardware word parity check on the 12771A board and in the longitudinal or diagonal parity checks on the blocks received (which are computed in 91740A/B firmware) are corrected by retransmission.

Configuration information

Computer and system compatibility: The 12771A interface is compatible with 2108, 2109, 2111, 2112, 2113, and 2117 computers and HP 1000 Model 20, 25, 40, and 45 Computer Systems.

Computer I/O channels required: One for each computer interconnection.

Memory required: See 91740A/B data sheet.

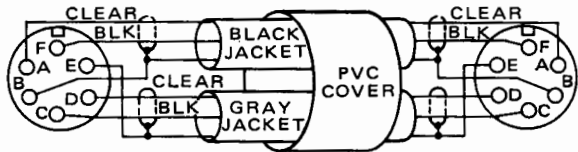
Software required: 91740A/B DS/1000 network software-firmware.

Additional equipment required for installation: For cable lengths greater than 7.3m (24 ft), HP communications cables, model 91720A (with unassembled connectors) or 91721A (with assembled connectors), or user fabricated cables will be required to complete interconnection of the two cards furnished in the 12771A interface (see diagram on next page).



MALE CONNECTOR:
MS3106A-18-12P
CLAMP: MS3057-10A

FEMALE CONNECTOR:
MS3101A-18 12S
CLAMP: MS3057-10A



NOTE: Two lengths of Belden type 8762 Cabling, or equivalents of the required length is recommend for customers desiring to fabricate their own Communications cable.

HP 91721A Communications cable wiring diagram

Installation: Set jumper W1 to select correct data rate and jumper W2 to position A on both interface cards. Then plug the interface cards into the I/O backplanes of their respective computers, interconnect them with the two 3.65m (12 ft) cables furnished, plus communications cables as required, and integrate the interfaces and the 91740A/B DS/1000 network software and firmware into the RTE-M and/or RTE-IV operating systems in each computer.

Electrical specifications

Current required from computer power supply

1.6A(+5V), 0.07A(-2V), 0.09A(+12V), 0.095A(-12V).

Ordering information

12771A DS/1000 Hardwire serial interface

The 12771A Hardwire serial interface includes:

1. Two 12665-60001 Hardwire serial data interface cards.
2. 12665-60002 3.65m (12 ft) Interface cable with male connector.
3. 12665-60003 3.65m (12 ft) Interface cable with female connector.
4. Two 12665-60004 Diagnostic hoods.
5. Two 12665-90001 Interface manuals.

91720A 76m (250 ft) Communications cable (with unassembled connectors)

91721A 76m (250 ft) Communications cable (with assembled connectors)

91720A and 91721A options

- 001:** Adds 76m (250 ft) to cable length for total of 152m (500 ft).
- 002:** Adds 221m (725 ft) to cable length for total of 297m (975 ft).

The 12773A Computer modem interface provides for interconnection of HP 1000 computer systems in the DS/1000 network using full-duplex modems as specified below. The 12773A interface is supported by the 91740A/B network software-firmware package, which operates in computer systems managed by HP's RTE-M, RTE-III, or RTE-IV operating system.

Features

- EIA RS-232-B compatibility
- Full duplex operation
- Compatibility with either synchronous or asynchronous modems
- Built-in error detection

Functional specifications

Interface compatibility

EIA RS-232-B and CCITT V.24 with full duplex operation.

Transmission mode

Bit-serial, synchronous or asynchronous adaptable to modem used.

Transmission link

Full duplex over switched (direct distance dial) or private (leased) common carrier telephone line. Modems may have automatic answering capability.

Data transfer rates

Asynchronous: Approximately 75, 150, 300, 600, or 1200 bits/sec.

Synchronous: Depends upon modem selected.

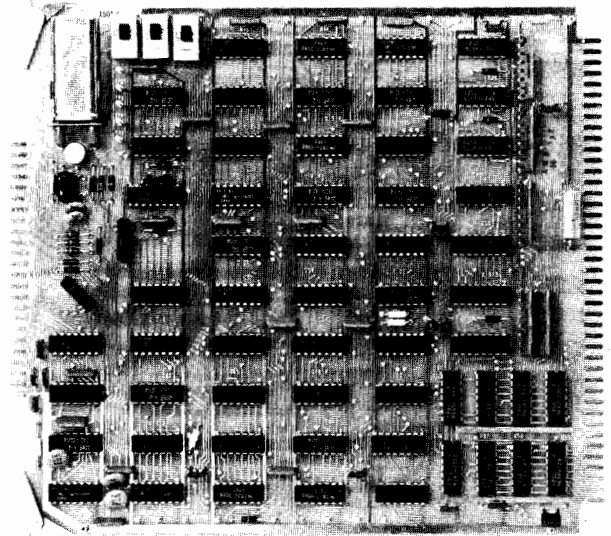
Error control

Errors detected in hardware word parity check on the 12773A board and in the longitudinal or diagonal parity checks on the blocks received (which are computed in 91740A/B firmware) are corrected by retransmission under firmware controls.

Configuration information

Computer and system compatibility: The 12773A interface is compatible with 2108, 2109, 2111, 2112, 2113, and 2117 computers and HP 1000 Model 20, 25, 40, and 45 Computer Systems.

I/O channels required: One for 12620A interface used as privileged interrupt fence and one for each DS/1000 modem communications channel.



Memory required: See 91740A/B data sheet.

Software required: 91740A/B DS/1000 network software firmware.

Additional equipment required for installation: 12620A interface used as privileged interrupt fence and user-furnished modem. Operation requires similarly-equipped system at other end of DS/1000 communications channel.

Installation: Set switches on the interface to select synchronous or asynchronous operation and (for asynchronous operation) set jumper to select appropriate data rate to match modems used at both ends of common carrier communications line. Then plug interface into the computer I/O backplane, connect interface cable to modem, and integrate the interface and DS/1000 software and firmware into the computer operating system.

Electrical specifications

Current required from computer power supply

1.6A(+5V), 0.07A(-2V), 0.04A(+12V), 0.04A(-12V).

Ordering information

12773A DS/1000 Modem interface

The DS/1000 Modem interface includes:

1. 12773-60001 Modem interface card.
2. 12773-60002 3.65m (12 ft) Interface cable.
3. 12773-60003 Diagnostic hood.
4. 12773-90001 Interface manual.

Additional equipment required for operation

User-furnished Bell type 103, 201, 202, 208, 209, or VADIC VA 3400 modem at local system, 12773A and same type modem at remote system, and appropriate communications line. (See compatible modems and recommended options below.)

Compatible modems and recommended options

Bell type 103A2 Data set

The Bell type 103A2 Data set provides full-duplex asynchronous communication via dial-up lines at rates to 300 baud. The options available and recommended for use of the 103A2 data set with the 12773A Computer modem interface are:

Option	Description	Recommendation
A1 A2	With auto calling unit Without auto calling unit	A2 is required.
B3 B4	Auto answer wired Auto answer key controlled	B3 is recommended.
C5 C6	Terminal response to disconnect No terminal response to disconnect	C5 is required.
D7 D8	Terminal initiates disconnect Terminal won't initiate disconnect	D7 is required.
E9 E10	Mark hold Space hold	E9 is required.

Bell type 103A3 Data set

The Bell type 103A3 Data set provides full-duplex asynchronous communication at rates to 300 baud. The options available and recommended for use of the 103A3 data set with the 12773A Computer modem interface are:

Option	Description	Recommendation
A1 A2	Rotary dial Touch-tone	Select option that best meets your needs
B3 B4	With card dialer Without card dialer	Select option that best meets your needs
C5 C6	Loss of CXR disconnect No loss of CXR disconnect	C5 is required
D7 D8	Send space disconnect No send space disconnect	D7 is required
E9 E10	Receive space disconnect No receive space disconnect	E9 is required
F11 F12	Auto answer permanent Auto answer selective	F11 is recommended

Bell type 201A3 Data set

The Bell type 201A3 Data set provides full-duplex synchronous communication via dial-up or leased lines at rates to 2000 baud. The options available and recommended for use of the 201A3 Data set with the 12773A Computer modem interface are:

Option	Description	Recommendation
A1 A2	EIA interface Contact interface	A1
B3 B4	With alternate voice Without alternate voice	B3
C5 C6	With new sync Without new sync	C6
D7 D8	Half duplex operation Full duplex operation	D8 required; D7 is not compatible with 12773A
E9 E10	4-Wire continuous carrier 4-Wire w/carrier controlled by request to send	E9

Bell type 201C Data set

The Bell type 201C Data set provides full-duplex, synchronous communication via dial-up or leased lines at rates to 2400 baud. The options available and recommended for use of the 201C Data set with the 12773A Computer modem interface are:

Option	Description	Recommendation
A1 A2	Transmitter internally timed Transmitter externally timed	A1 is required
B3 B4	Without 801 Automatic call unit With 801 Automatic calling unit	B3
C5 C6	EIA ring indicator Contact ring indicator	C5 is required
D7 D8	Without auto answer With auto answer	D8
E9 E10	Auto answer permanent Auto answer selective	E9 is recommended

Bell type 202T Data set

The Bell type 202T Data set provides full-duplex, asynchronous communication via dial-up or leased lines at rates to 1800 baud. The options available and recommended for use of the 202T Data set with the 12773A Computer modem interface are:

Option	Description	Recommendation
A1 A2	Multi-point circuit Point-to-point	A2
B3 B4	Half duplex operation Full duplex operation	B4 is required; B3 is not compatible with 12773A
C5 C6	Master station, continuous carrier Switched carrier	C5
D7 D8	One second holdover used One second holdover not used	D8
E9 E10	Telephone company engineered timing options Customer-engineered timing options	E9
F11 F12	Operation at rates to 1200 bps Operation at rates above 1200 bps	F12

Bell type 208A Data set

The Bell type 208A Data set provides full-duplex, synchronous communication via leased lines at rates to 4800 baud. The options available and recommended for use of the 208A Data set with the 12773A Computer modem interface are:

Option	Description	Recommendation
A1 A2	Transmitter internally timed Transmitter externally timed	A1
B3- B4	Continuous carrier Switched carrier	B3
C5 C6	Switched request to send Continuous request to send	C6
D7 D8	One second holdover used One second holdover not used	D8
E9 E10	New sync used New sync not used	E10

Bell type 209A Data set

The Bell type 209A Data set provides full-duplex synchronous communication via leased lines at rates to 9600 baud. Five jacks on the back of the 209A can be used for multiplexing the 9600 baud communication rate, permitting a choice of:

- One channel at 9600 baud, or
- One channel at 7200 baud and one at 2400 baud, or
- Two channels at 4800 baud, or
- One channel at 4800 baud and two at 2400 baud, or
- Four channels at 2400 baud.

The options available and recommended for use of the 209A Data set with the 12773A Computer modem interface are:

Option	Description	Recommendation
A1 A2	Transmitter internally timed Transmitter externally timed	A1 is required
B3 B4	Data set ready off Data set ready on	B3
C5 C6	Timing slaved Timing not slaved	C6
D7 D8	Elastic store in Elastic store out	D8
E9 E10	Continuous carrier Switched carrier	E9
F11 F12	Switched request to send Continuous request to send	F12

Vadic corporation VA3400 modem

The Vadic model VA3400 modem provides full-duplex synchronous or asynchronous communication via dial-up or leased lines at rates to 1200 baud. It is similar to the Bell type 103 Data set, but communicates at the faster 1200 baud rate and can only communicate with another VA3400 modem. The following characteristics must be specified for VA3400 modems that are to operate with the 12773A Computer modem interface:

- The type of line to be used (leased or dial-up).
- Operating mode (synchronous or asynchronous).
- Automatic answer is required.

Modems for use outside of the United States and Canada

In areas outside of the United States and Canada, check with the public telephone authority or independent modem supplier and the local Hewlett-Packard representative to determine modem compatibility with the 12773A Computer modem interface.



Hardwired serial interface and cables

models 12889A and 30220A

The 12889A Hardwired serial interface provides for high speed, asynchronous, long-distance, point-to-point data transfer between two HP 1000 computers, using a 12889A interface in each computer, and separate coaxial cables for sending and receiving to achieve immediate line turnaround. It is also used for communication between a local HP 1000 computer system and an HP 3000 system with 30360A Hardwired serial interface via an appropriate length of 30220A cabling.

Features

- Transfer rates to 250k bytes/sec
- Transmission distances to 609m (2000 ft)
- Programmable error detection
- Optically isolated receiver circuit

Functional specifications

Data transfer

Maximum cable length: 304.8m (1000 ft) std; 609.6 m (2000 ft) with option 001.

Maximum data rate: 250k bytes/sec std; 125k bytes/sec with option 001. This is a hardware rate; software overhead will result in slower system throughput.

Transmission mode: Bit-serial, asynchronous, using separate cables to send and receive for immediate line turnaround.

Error detection: Uses a Cyclical Redundancy Code (CRC) technique with a 16-bit feedback shift register that implements a 15th degree polynomial.

Configuration information

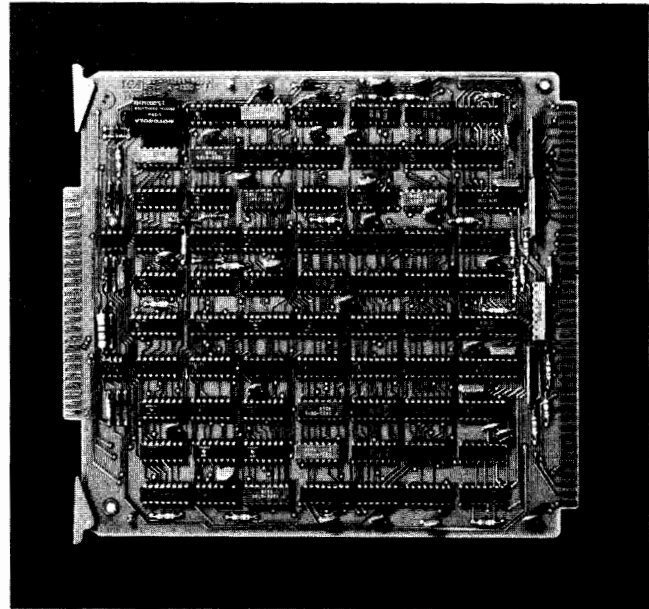
Computer and system compatibility: The 12889A is hardware-compatible with all HP 1000 computers and with HP 1000 Model 20, 25, 40, and 45 Computer Systems.

Computer I/O channels required: One.

Software support: HP 1000-to-HP 3000 communication is supported by in the HP 1000 System 91740A/B and 91741A DS/1000 software-firmware.

Prerequisite: Appropriate length of 30220A cable for connection to 30360A interface in HP 3000 system. (User can provide his own 75-ohm coaxial cabling, type RG-59/U, or Belden NO. 9259, or equivalent, two cables per connection).

Installation: To install, plug the 12889A interface into the computer I/O backplane, connect the cable from the interface in the local computer and to the counterpart interface in the remote computer, and integrate the interfaces and recommended software into the operating systems of both computers.



Electrical specifications

Current required from computer power supply

2.25A(+5V), 0.01A(-V), 0.125A(+12V), 0.05A(-12V).

Ordering information

12889A Hardwired serial interface

The 12889A Hardwired serial interface includes:

1. 12889-60001 Hardwired serial interface card.
2. 1813-0046 15 MHz clock oscillator.
3. 12889-60004 3.048m (10 ft) Hood and coaxial signal cable assembly.
4. 24335-16001 Diagnostic on paper tape.
5. 12889-90001 Interface manual.
6. 02100-90169 Diagnostic manual.

12889A Option 001

Replaces 1813-0046 15 MHz clock oscillator with 1813-0052 7.5 MHz clock oscillator.

30220A 7.6m (25 ft) Cable kit for connection of 12889A interface in HP 1000 computer to 30360A interface in HP 3000 system

30220A options

- 001: Increases cable length to 30.48m (100 ft).
- 002: Increases cable length to 76m (250 ft).
- 003: Increases cable length to 152m (500 ft).
- 004: Increases cable length to 304.8m (1000 ft).
- 005: Increases cable length to 609.6m (2000 ft).

RJE/1000 is a data communications interface package that equips RTE-IV, RTE-II, or RTE-C based Hewlett-Packard 2108, 2109, 2111, 2112, 2113 or 2117 Computers or HP 1000 Model 30, 40, and 45 Computer Systems for Remote Job Entry (RJE) communication with certain IBM 360/370 Systems via telephone lines and user-furnished modems.

Features

- Emulation of IBM 2780
- Remote Job Entry (RJE) for batched-job communication with IBM 360/370 using IBM Bisync protocol
- Autoanswer and autoturnaround
- Line speeds to 9600 bits/sec
- Operation in disc-based RTE-IV or RTE-II system using 7900, 7905, 7906, or 7920 disc or memory-based RTE-C systems
- Communication with HASP or user application programs using BTAM and TCAM software in the IBM system
- Choice of ASCII or EBCDIC code
- Dial-up or private line communication, either half-duplex or full-duplex
- Choice of transparent or non-transparent mode
- Choice of timeout or indefinite wait (if using dedicated leased lines)
- Configurable for variable or fixed-length records
- A wide choice of input, list, and punch-stream devices

Functional specifications

Emulation

RJE/1000 emulates the IBM 2780 Data Transmission Terminal.

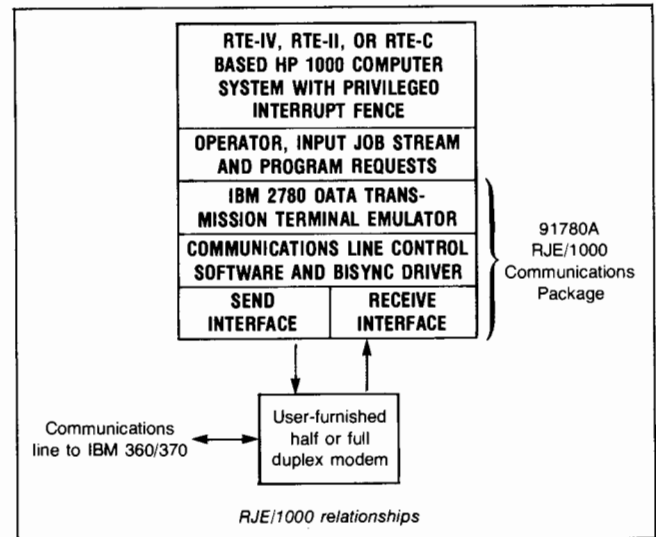
System compatibility

Local Hewlett-Packard system

RJE/1000 is compatible with 2108, 2109, 2111, 2112, 2113, or 2117 Computers or HP 1000 Model 30, 40, or 45 Computer Systems operating under RTE-IV or RTE-II/BSM or RTE-C real time executive system.

Remote system

RJE/1000 is compatible with HASP and user application programs using BTAM and TCAM software in the remote IBM 360/370 system. It is also compatible with another RJE/1000 in a remote Hewlett-Packard system. In addition RJE/1000 may be compatible with other host systems or other 2780 emulators, but it is specifically NOT WARRANTED TO FUNCTION WITH ANY HOST OTHER THAN IBM 360/370 WITH HASP, BTAM, OR TCAM OR ANY 2780 EMULATOR OTHER THAN RJE/1000.



Unsupported 2780 features

RJE/1000 does not support these IBM 2780 features:

- Terminal identification.
- Multipoint operation.
- Bell operation.

Connections and modems

RJE/1000 is compatible with the telephone connections and modems listed in Table 1, next page. Regardless of which modem is used, it must meet the following requirements:

1. Synchronous operation.
2. Timing internal to the modem.
3. EIA RS232C or CCITT V.24 compatibility.
4. New Sync is not used.
5. Reverse channel is not used.
6. Unattended answering is optional.
7. Alternate voice should be available for voice coordination.
8. Full-duplex modems may be used to reduce line turnaround time and improve throughput, but half-duplex is the minimum requirement.

Transmission

Data format

The user submits data to RJE/1000 in card and/or printer images for transmission in the same manner as standard tab card and line printer data.

Transmission codes

RJE/1000 is configurable for transmission in either ASCII or EBCDIC code.



Table 1. Connections Modems, and Data Rates

Connection Via	Modem Type	Maximum Synchronous Data Rate, half or full-duplex
Switched telephone (Direct Distance Dialing) Network	Bell 201A Bell 201C Bell 208B	2000 bits/sec 2400 bits/sec 4800 bits/sec, half duplex only
	Non-Bell	4800-9600 bits/sec
Private lines	Bell 201B Bell 201C Bell 208A Bell 209A	2400 bits/sec 2400 bits/sec 4800 bits/sec 9600 bits/sec, half, full, or multiplexed†
	Non-Bell	4800-9600 bits/sec

†Multiplexed modems allow line sharing by terminals as follows:
 1 terminal at 7200 bps and 1 terminal at 2400 bps
 2 terminals at 4800 bps or 4 terminals at 2400 bps
 1 terminal at 4800 bps and 2 terminals at 2400 bps

RJE input sources at local HP system

Disc files in RTE-IV or RTE-II/BSM system, Mini cartridge tapes, card readers, punched tape reader, 9-track mag tape units, and keyboard-CRT/printer terminals.

RJE output destinations at local HP system

Disc files in RTE-IV or RTE-II/BSM system, Mini cartridge tapes, line printers, 9-track mag tape units, keyboard-printer terminals, and keyboard-CRT terminals.

Pre-transmission and post-reception formatting

RJE/1000 does not format binary data files for transparent transmission, nor does it reformat them when they are received. Formatting must be accomplished by user's programs.

Distances and data rates

Transmission distance is limited only by the telephone network. Line speeds, up to 9600 bits/sec, are determined by the user's choice of connection and modem, as summarized in Table 1, above.

Multi-record transmission

RJE/1000 blocks and transmits multiple records, which improves throughput by avoiding line turnaround at the end of each record.

Horizontal format control

An electronic tab function identical to the tab on a typewriter allows deletion of spaces in formatted lines, increasing transmission throughput of meaningful data.

Auto turnaround

RJE/1000 automatically switches to receive, without operator intervention, after sending a message, minimizing line time.

End of media (optional, configurable)

RJE/1000 indicates the end of a record when variable-length records are sent. This reduces line time because trailing blanks in a record are not sent.

Auto answer

RJE/1000 automatically answers an incoming call on a dial-up communication line.

RTE priorities and throughput

RJE/1000 uses privileged interrupt, which gives it the highest priority in the system, assuring fast response and maximizing throughput. However, it is possible to set up another privileged interrupt activity in the system. If set up, that other activity must be assigned a lower priority than RJE/1000 to assure proper functioning of RJE/1000.

RJE/1000 control

Operator requests

ON,RJE schedules RJE/1000 to send or receive data, designating the local source and/or destination(s) by logical

unit number of the peripheral device(s) involved, or by file name(s) in a previously-prepared configuration file.

#M in RTE-II/BSM or RTE-IV environment provides for on-line configuration or reconfiguration of RJE/1000 prior to start of communications activity.

*BR,RJE (or ON,#INRP for non-BSM version) interrupts data stream being received from remote IBM 360/370 system, permitting insertion of HASP commands or other data into the input stream, using the system console.

ctrl-D terminates the insertion of data, permitting continuation of the original processing.

OF,RJE terminates line activity to get line out of data mode in #D or #T input stream request.

Program request

EXEC9,10,23, or 24, RJE sets up a data transfer to/from remote IBM 360/370 system, with choice of local dialing or answering. Provides for specifying the input device or file and the print and punch output device or file, using logical unit numbers or a configuration file containing the names of source and destination files.

Input stream requests

#E gives automatic line turnaround with approximate 20-second listen time (configurable).

#R gives automatic line turnaround with approximate 60-second listen time (configurable).

#W provides automatic line turnaround with continual listening to the line. This feature is for leased-line operations where dial-up line charges are not a factor. The continual wait interval can be interrupted with the *BR,RJE or *ON,#INRP operator interrupt command.

#D causes transmission of disconnect sequence.

#I causes temporary substitution of system console as source of input data stream.

#C,xx changes source and/or destination of input, print, and punch streams. Automatically creates specified files for list and punch streams if they do not already exist.

#T,xx switches RJE/1000 to transparency mode for input from the current input stream device with automatic transfer to logical unit number xx or file with name xx following detection of end-of-file for the current data stream. It also provides for reconfiguration of the list and punch streams as in the #C,xx request.

System requirements

In RTE-C environment: Same as 2300C RTE-C system, but with at least 32k bytes of memory and 12620A interface for privileged interrupt control.

In RTE-II/BSM environment: Same as 92001B RTE-II system, but with at least 64k bytes of memory and 12620A interface for privileged interrupt control.

In RTE-IV environment: Same as 92067A RTE-IV system, but with 12620A interface for privileged interrupt control.

Computer I/O channels used

Three, one each for send, receive, and privileged interrupt control.

Compatible operating systems	RTE-IV	RTE-II/BSM	RTE-C
Compatible computers*		2100	2100
		2108	2108
		2109	2109
		2111	
		2112	2112
		2113	2113
		2117	

*Computer compatibility with RTE-IV is subject to the serial prefix qualifications covered in the 92067A RTE-IV data sheet.

Computer memory usage (bytes₁₀)

	Resident	B-G Area	S/S Global Area
RTE-IV config. #1	820	15214*†	—
RTE-IV config. #2	820	9926*†	5288
RTE-II/BSM config. #3	820	13176*	—
RTE-II/BSM config. #4	4660	9324*	—
RTE-C	9844		

*Including FMP and library subroutines.

†Including 1024 words for partitions's base page in RTE-IV.

Config. #1 maximizes user partition space, but does not allow swapping in the partition where RJE/1000 is running.

Config. #2 provides faster execution for RJE/1000 and allows swapping.

Config. #3 minimizes the amount of resident memory used.

Config. #4 provides maximum flexibility in use of memory, since partition required for RJE/1000 can also be used for other programs.

Power requirements

Computer interface current required

2.8A (+5V), 0.095A (+12V), 0.07A (−12V), 0.23A (−2V).

Customer's responsibilities

The customer is responsible for integrating RJE/1000 with the IBM 360/370. To confirm beforehand that such integration is practical, the customer, prior to purchase, must provide the responsible Hewlett-Packard system engineer with accurate information on the following:

1. IBM Computer type to be interfaced.
2. Operating system and telecommunication language used (HASP, BTAM, TCAM, etc.).
3. Whether end-of-media is required.
4. What pad characters are required.
5. Modem and network type (customer must have modems installed prior to installation of RJE/1000).
6. Transmission code used (ASCII or EBCDIC).
7. Baud rate of the IBM modem and telephone line connection.
8. Any other pertinent data that will help HP complete a successful RJE/1000 installation for the customer.

Ordering information

91780A RJE/1000 communications package

RJE/1000 consists of:

1. Synchronous communications interface cards, receive (12621-60001) and send (12622-60001).
2. Test connector assemblies, receive (12621-60005) and send (12622-60006).
3. Branched cable assembly (12618-60001).
4. Diagnostics manuals (12621-90008 and 12622-90008).
5. 12618A interface operation and service manual (12618-90001).
6. 12621A and 12622A interface manuals (12621-90001 and 12622A-90001).
7. RJE/1000 programmer's guide (91780-93001).
8. RJE/1000 software numbering catalog (91780-93004).
9. Interface diagnostic routines (12621-16001 and 12622-16001) on punched tape.

10. The following software modules on punched tape.
 - a. RJE device emulators: 91780-16001 for use with File Manager Program (FMP) in RJE-II/IV systems and 91780-16002 for use in RTE-C system or without FMP in RTE-II/IV system.
 - b. #COMN bisync timeout values and data buffers module (91780-16003).
 - c. #DIAL manual dialing program (91780-16004).
 - d. DVR50 system-resident bisync driver front-end (91780-16005).
 - e. #BSC bisync driver (91780-16006).
 - f. #INXT operator interrupt library program for RTE-C or non-FMP use (91780-16007).
 - g. #INRP operator interrupt program for RTE-C or non-FMP use (91780-16008).

91780A Options

- 020: Replaces the paper tape software modules listed under item 10, above, with software on one HP Mini cartridge (91780-13301) for reading by 2645A/2648A + 007 or 2644A CRT Terminal interfaced to the computer via the 12966A + 001 interface and to the operating system via RTE driver DVR05/DVA05. This option is not compatible with RTE-C, which does not support DVR05 or DVA05.
- 100: Deletes items 1 through 6 and 9, above to provide only communications software and manuals for the customer who already has the 12618A (12621A and 12622A) interface kit.

Additional equipment required for operation

1. 12620A breadboard interface, used for privileged interrupt control.
2. IBM 360/370 with HASP, BTAM, or TCAM and suitable telephone and modem communications link.

91780S Software Subscription Service

The 91780S Software Subscription Service provides software and manual updates as required to keep your RJE/1000 software current with respect to enhancements and other design changes as they are released by Hewlett-Packard. The 91780S service is ordered in monthly units for at least six months, billable quarterly. A media option, selected from those listed following 91780T, must be specified when ordering 91780S.

91780T Comprehensive Software Support

The 91780T Comprehensive Software Support includes the Software Subscription Service, as described under 91780S, above, and a Phone-In Consulting Service for discussion of questions on your RJE/1000 software with a qualified HP Systems Engineer. The 91780T service is ordered in monthly units for at least six months, billable quarterly. A media option must be selected from those listed below.

91780S and 91780T Media options

- 010: Software updates on paper tape
- 020: Software updates on Mini cartridges for read-in via 2645A+007 and 2648A+007 CRT Terminal.



CRT terminals and auxiliary printers

models 2640B, 2645A, 2648A, 13246A/B, 13349A, and 2631A+240

The 2640B, 2645A, and 2648A are keyboard-display terminals that can serve as additional local or modem-connected terminals for HP 1000 Computers or Systems operating under HP's RTE-M, RTE-II, or RTE-IV real-time executive system.

Features

Models 2640B, 2645A, and 2648A

- Plug-in character set flexibility, including upper/lower case, math, line drawing set, and user-designed character set options
- Character or block mode operation
- Built-in self test
- Full editing capability
- Multi-task keyboard
- Off-screen storage with scrolling capability
- Programmable protected fields for forms
- Inverse video for highlighting
- Optional blinking, underline, and half-bright display
- Microprocessor control

Additional 2645A and 2648A features

- Automatic data logging with optional Minicartridge I/O
- Formatted ASCII or binary program/data storage
- User-definable display/control/transmission functions
- Choice of three different auxiliary printers for hard copy output
- Flexible, powerful multiple data paths
- Multipoint compatibility for low cost connection

Additional 2648A features

- Independent graphics memory with 720×360 displayable points
- Automatic plotting
- Hardware pan and zoom

Functional specifications

Display

Screen size: 127×254mm (5×10 in).

Capacity: 24 lines × 80 columns (alphanumeric), 720 dots × 360 rows (graphics in 2648A only).

Character generation: 7 × 9 dot matrix enhanced by dot shifting in 9 × 15 character cell; non-interlaced raster scan.



2640B and 2645A Character set: 64 upper-case Roman standard, 128 upper/lower case Roman with option 001. Drawing sets available as accessories.

2648A character set: 128 upper/lower case Roman. Drawing sets available as accessories.

Cursor: Blinking underline.

Display modes: White on black or black on white (inverse video).

Implosion protection: Bonded implosion panel.

2645A or 2648A Mini cartridge tape transports

Option 007 equips the 2645A or 2648A Terminal with two Mini cartridge tape transports.

Read/write speed: 10 ips.

Search/rewind speed: 60 ips.

Recording density: 800 bpi.

Storage capacity: 110k bytes/cartridge, maximum; actual useful storage depends upon the number of inter-record and inter-file gaps.

Data rates

2640B: 110, 150, 300, 1200, 2400 baud (11, 15, 30, 120, 240 char/sec), switch selectable.

2645A or 2648A, system to alphanumeric display: Same as 2640B, plus 4800 and 9600 baud (480 and 960 char/sec).

2645A or 2648A, display or system to/from Mini cartridge: 200 to 350 char/sec, depending on record length.

2648A, graphics display: Up to 190 vectors/second.

Option slots available

Model:	2640B	2645A	2648A
Slots:	Two	seven	four



Memory

2640B: 1024 bytes of RAM memory (enough for 8 full lines or 50 short lines), expandable to 8192 bytes by adding two 13234A memory modules.

2645A: 4096 bytes of RAM memory, expandable to 12,288 bytes by adding two 13234A memory modules.

2648A: 37 lines of 80 alphanumeric characters (less control codes) and 720 dots by 360 rows of displayable points for graphic display.

Keyboard

2640B: Full ASCII code keyboard, 8 special function keys, 12 additional control and editing keys, 10-key numeric pad, cursor pad, multi-speed auto repeat, N-key rollover; standalone with 1.22m (4 ft) cable.

2645A: Same as 2640B, but with 18 control and editing keys.

2648A: Same as 2640B, but with graphics pad in place of 10-key numeric pad and 18 control and editing keys.

Configuration information

Terminal model	H/M*	Terminal options & accessories	System I/O card	Driver
2640B	H	None required	12880A+001	DVR00
	H	None required	12966A+001	DVR05 or DVA05
	M	13232M/N†	12531D+002	DVR00
	M	13232M/N†	12966A+002	DVA05
2645A/ 48A (with out tape or aux. printer)	H	None required	12880A+001	DVR00
	H	None required	12966A+001	DVR05 or DVA05
	M	13232M/N†	12531D+002	DVR00
	M	13232M/N†	12966A+002	DVA05
2645A/ 48A (with tape)	H	Opt 007 & 030 + 13260B (13260B+003 for 2648A)	12966A+001	DVR05 or DVA05
	M	Opt 007 + 13232M/N†	12966A+002	DVA05

* H = Hardwired local; M = Modem

NOTE: Auxiliary printer subsystems may be used with 2645A or 2648A and DVR05 or DVA05. Hardware configurations should be one of the following:

- 2645A or 2648A without tape: opt. 030+13260B+13261A +12966A+001 (hardwired) or 13216A+12966A+002 + 13232M/N† (modem) interface and cable.
- 2645A or 2648A with tape: opt. 007 and 030+13260B+12966A+001 (hardwired) or opt. 007+12966A+002 + 13232M/N† (modem) interface and cable.

†13232M is cable for connection of terminal to European modems;
13232N is cable for connection to RS323C interfaces.

2645A as system console

Options supplied: 001 (128 character set), 007 (dual Mini-cartridge transports), 013 (five mini cartridges), 030 deletes standard asynchronous communications interface).

Accessory supplied: 13260B extended asynchronous communications card in terminal.

System I/O card supplied: 12966A and 001 cable (supports Mini cartridge transports and terminal printer subsystems).

Software support: Local driver DVR05 or modem driver DVA05, supplied in 92062 RTE drivers package and 92840A GRAPHICS/1000 plotting software for 2648A.

2648A as system console

Same as 2645A, above, except that 128 character set is standard in 2648A, so option 001 is not needed, and 13260B+003 extended asynchronous communications card is required in terminal.

2640B, 2645A, and 2648A as additional terminals

The 2640B, 2645A, and 2648A can be used as additional terminals in HP 1000 systems that support multi-terminal operation. The following table summarizes configuration alternatives for terminal per-interface communication. Configuration for multipoint communication is covered in the 12790A multipoint terminal interface data sheet.

Ordering information

NOTE: One 2645A terminal or one 2648A terminal is supplied with each HP 1000 Computer system for use as the system console. Additional terminals may be ordered as shown below.

HP 2640B CRT display terminal

The 2640B CRT display terminal includes:

- 02640-90011 Owner's manual.
- 02640-90012 Installation and service manual.

2640B Options

- 001: 128 character set, Roman.
015: 230V operation.
016: 100V/50 Hz operation.

2640B Accessories

13231A Display enhancements (blinking, half-bright, and underline; also provides space for addition of three 128-character sets; uses one option slot).

13231A option 201 64 character math symbol set

13231A option 202 64 character line drawing set

13234A +4k byte terminal memory module (uses one option slot).

13240A Option slot extender (adds five option slots and fan to the two available in the std 2640B).

13250A Asynchronous data communication interface (same as 2640B option 020).

HP 2645A Display station

The 2645A Display station includes:

- 02645-90001 User's manual.
- 02645-90005 Reference manual.

HP 2648A Raster-scan graphics terminal

The 2648A Graphics terminal includes:

- 02648-90001 User's manual.
- 02648-90002 Reference manual.

2645A and 2648A options

001: 128 character set, Roman (2645A only).

007: Integrated dual Mini cartridge tape transports; uses two option slots).

015: 230V operation.

030: Delete standard asynchronous communications card for local hardwired communications with 2645A/2648A+007. (Substitute communications card, must be ordered separately.)

2645A and 2648A accessories

13231A Display enhancements and options same as for 2640B, above.

13234A +4k byte terminal memory module (uses one option slot).

13236B Integrated dual cartridge tape upgrade kit for field installation of mini cartridge I/O, requires 13261A, below.

13246A/B auxiliary Printer Subsystem† (see separate listing below).

13349A auxiliary Printer Subsystem† (see separate listing below).

2631A+240 auxiliary Printer Subsystem† (see separate listing below).

13260B Extended asynchronous communications card for 2645A (required for Mini cartridge and/or auxiliary printer compatibility with 12966A+001 system interface).

13260B+003 Extended asynchronous communications card for 2648A (same purpose as 13260B for 2645A).

13261A Device support firmware (required by tapeless 2645A or 2648A to support 13236B tape upgrade kit or auxiliary printer subsystems, listed above).

†Printer subsystems each use one option slot, and require 13261A when used with tapeless 2645A or 13261A+003 for tapeless 2648A.

2645A and 2648A accessories for multipoint operation

NOTE: Mini cartridge I/O and auxiliary printers are not supported in multipoint operation in HP 1000 Computers or Systems.

13260C Asynchronous multipoint communications card for 2645A or 2648A (used with 12790A Multipoint interface).

13260D Synchronous multipoint communications card for 2645A or 2648A (used with 12790A Multipoint interface).

13232P 9 metre (30 ft) Modem multipoint cable.

13232U 1.5 metre (5 ft) Modem bypass cable for connection between 12790A option 001 modem cable and 13232P Multipoint cable.

13232Q 9 metre (30 ft) Multipoint cable for continuation of multipoint line.

13232R 30.4 metre (100 ft) multipoint extension cable

13232T 9 metre (30 ft) Power protect multipoint cable providing continuity around "down" terminal.

Auxiliary printers for 2645A and 2648A

HP 13246A (9866A) Printer subsystem

The 13246A is an auxiliary thermal printer subsystem with 64 character set that provides permanent hard-copy records for suitably equipped 2645A or 2648A CRT terminals at 240 lines/min in 80 column line. It will not copy graphics memory from 2648A or alternate character sets in 2645A or 2648A. It includes:

1. 9866A Printer with power cord, fuses, and dust cover.
2. 13238A interface for 2645A/2648A terminal.
3. 13238-60001 interface cable.
4. Two 9281-0414 rolls of printer paper.
5. 13246-90901 Operator's manual.

13246B (9866B) Printer subsystem

The 13246B is an auxiliary printer subsystem identical to the 13246A, except that it has a 96 character set and uses the 9866B Printer instead of the 9866A Printer. It will not copy graphics memory in 2648A or alternate character sets in 2645A or 2648A.

13246A/B Supplies

1. 9281-0414 roll of blue printer paper 76.2m (250 ft).
2. 9281-0413 roll of black printer paper 76.2m (250 ft).

HP 13349A (9871A) Printer subsystem

The 13349A is an auxiliary impact printer subsystem with 96 character set that provides permanent hard-copy records for suitably-equipped 2645A or 2648A CRT terminals at rates to 30 char/sec in 132 column line. It will not copy graphics memory in 2648A or alternate character sets in 2645A or 2648A. It includes:

1. 9871A+122 Line printer.
2. 1530-1811 package or three ASCII print disc.
3. 9282-0561 package of three ribbon cartridges.
4. 02640-60031 interface for 2645A/2648A terminal.
5. 02640-60116 interface cable.
6. 13349-90901 Operator's manual.
7. 09871-90030 Service manual.

13349A options

001: Tractor feed platen instead of friction feed.

003: Cyrillic character set in place of ASCII; replaces 1530-1811 ASCII print disc with 1530-1895 Cyrillic print discs.

13349A supplies

1. 1530-1811 package of three ASCII print discs.
2. 1530-1895 package of three Cyrillic print discs.
3. 9282-0561 package of three ribbon cartridges.

2631A+240 Printer subsystem

The 2631A is an auxiliary impact printer subsystem with 128 character set that provides permanent hardcopy records for suitably-equipped 2645A or 2648A CRT terminals at rates to 180 char/sec in 136 column line. It will not copy graphics memory in 2648A or alternate character sets in 2645A or 2648A. It includes:

1. 2631A Printer with cartridge ribbon, cleaning brush, and hex key for print-head replacement
2. 02631-90901 Operator's manual.
3. 02635-90905 Reference manual.
4. 5952-9427 Pocket Guide.
5. 13238A 2645A/2648A interface for use of 2631A as auxiliary printer.
6. 13232J Cable for connection to the 13238A interface from the 2631 printer.
7. Adaptation of 2631A to function as auxiliary printer for 2645A/2648A CRT terminal.

26098A Stand for 2631A

26098A+001 Stand with casters for 2631A



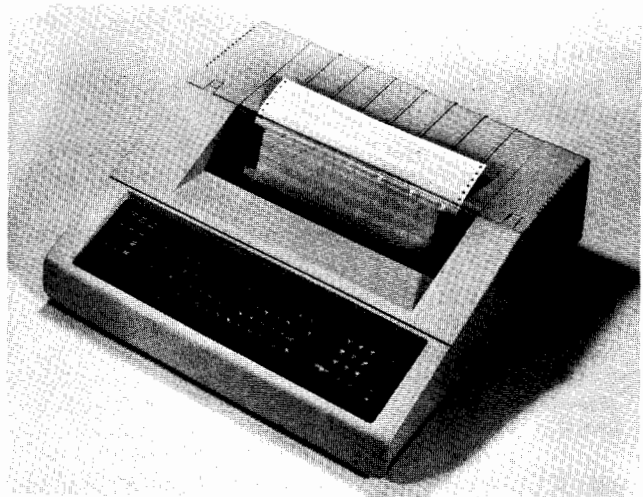
Printing terminal

model 2635A

The 2635A is a keyboard-printer terminal that can serve as an additional local or modem-connected terminal(s) for HP 1000 Computers or Systems operating under HP's RTE-M, RTE-II, or RTE-IV real-time executive system.

Features

- 128 character USASCII character set
- Bi-directional printing at 180 char/sec with leading and trailing blanks skipping for high throughput
- Conveniently replaced cartridge ribbon
- Wide choice of interfaces
- Single or multi-part forms (up to 6 copies)
- 8-channel ROM-based vertical forms control
- Typewriter-style keyboard with separate numeric and control keypad
- Manual or programmable tabs for report formatting
- Normal, expanded, or compressed printing
- Manual or programmable control of line-to-line spacing



Software support: Drivers DVR00, DVR05, and DVA05, supplied in 92062A RTE drivers package and in 92064A RTE-M, 92001B RTE-II, and 92067A RTE-IV real-time executive operating systems.

Functional specifications

Printer

Printing technique: 7 x 9 dot matrix, impact, cartridge ribbon.

Speed: 180 characters/second, bi-directional.

Pitch: 10 characters/inch, normal; 5 characters/inch, expanded; 16.7 characters/in, compressed.

Characters/line: 136 normal, 68 expanded, 227 compressed, on standard 37.8 cm (14-7/8 in) wide computer paper.

Character set: 128, upper & lower case & control characters.

Paper advance: Tractor feed.

Keyboard

All 128 USASCII codes plus terminal reset, remote/local, self test, auto line feed, set & clear tab, and display function keys.

Configuration information

2635A Config.	H/M	Computer Interface	Driver Used	Max. Data Rate
+051	H	12966A+001	DVR05 or DVA05	180 char/sec
Std	M	12966A+002	DVA05 only	120 char/sec*
Std	H	12531D+001	DVR00	120 char/sec
Std	M	12531D+002	DVR00	120 char/sec*
+051	H	12531D+004	DVR00	120 char/sec
+051	H	12880A+001	DVR00	120 char/sec

*120 char/sec is maximum rate for modem communication; actual rate will depend upon the choice of modem.

Ordering information

2635A Printing terminal

The 2635A Printing terminal includes:

1. 2635A Printing terminal with cartridge ribbon, cleaning brush, and hex key for print-head replacement.
2. 02631-60065 3.8m (12-1/2 ft) modem cable.
3. 02631-90901 Operator's manual.
4. 02635-90905 Reference manual.
5. 5952-9427 Pocket guide.

2635A options

015: 220V operation.

016: 100V operation.

017: 240V operation.

051: Replaces standard interface and 02631-60065 modem cable (item 2, above), with RS232C interface and 264xA/B edge connector.

26097A Stand for 2635A

26097A+001 Stand with casters for 2635A

Software driver routines DVR00, DVR05, and DVA05, which are provided with the RTE-M, RTE-II, and RTE-IV real-time executive systems, support single or multiple terminal communication in which each of the CRT and/or printing terminals served communicates with the HP 1000 Computer or System via its own interface and I/O channel in the computer.

Multi-device driver DVR00 specifications

Compatible interfaces, terminals, and modems

1. 12531C Teleprinter interface with appropriate option, which may be used with 2752A/2754B Teleprinter* for local connection or remote connection via Bell Type 103 Data Set or equivalent modem.
2. 12531D Terminal interface with appropriate option, which may be used with the following terminals and modems:
 1. 2635A Printing terminal with appropriate option for local connection or remote connection via Bell Type 103 Data Set or equivalent modem.
 - b. 2640B, 2645A, or 2648A CRT terminal for local connection or remote connection via Bell Type 103 Data Set or equivalent modem.
 - c. 2762A/B Terminal printer* for local connection or remote connection via Bell Type 103 Data Set or equivalent modem.
3. 12880A CRT terminal interface, which may be used with 2640B, 2645A, or 2648A CRT terminal for local connection only.

Supported capabilities

1. Character mode keyboard input (ASCII).
2. Punched tape input (ASCII or binary), using 2748B Punched tape reader or 2752A/2754B Teleprinter*.
3. Printer/CRT display output (ASCII).
4. Punched tape output (ASCII or binary), using 2895B Tape punch or tape punch on 2752A/2754B Teleprinter* (can be independent of teleprinter printout).
5. Enabling/disabling of program scheduling by terminal keystroke.
6. Keyboard terminal operation with Bell type 103 Data Set or equivalent modem.

Capabilities not supported

1. Mini cartridge I/O or auxiliary printers on 2645A or 2648A CRT terminal.
2. Auto answer.
3. Horizontal or vertical tabs or form options on 2762A/B Terminal printer.

Character set

DVR00 passes the entire ASCII character set, but only upper case characters can be used in system, file manager, or editor commands or program statement names and labels. Other characters, such as lower case, result in an error message from the software operating system or subsystem. However, this does not exclude the entry/retrieval of other ASCII characters in data files, their use in program documentation comments, or the editing of strings containing lower case characters by the editor.

Memory requirements

DVR00 requires 1120 bytes of memory.

Supported capabilities

1. Keyboard input in block or character mode.
2. Write to/read from display.
3. Enabling/disabling of program scheduling by terminal keystroke.
4. Mini cartridge and/or auxiliary printer I/O with 2645A/2648A CRT terminals.
5. Write EOF, forward/backspace one record or file, or locate specific file, on Mini cartridge transport 1 or 2 (2645A+007/2648A+007 or 2644A*).
6. Write to/read from Minicartridge tape unit 1 or 2 (2645A+007/2648A+007 or 2644A*).
7. Print output on 2631A+240, 13246A/B, or 13349A auxiliary Printer subsystem (requires 2645A+007, 2648A+007, or 2645A or 2648A with 13261A).
8. Bidirectional control of printwheel carrier on 13349A Printer.
9. Modem communication via Bell Type 103A2 or 103A3 Data Set, VADIC VA 3400, or equivalent modems to 2635A, 2640B, 2645A, and 2648A terminals (DVA05 only)
10. Hardwired communications to any supported peripheral (DVR05 and DVA05).

Capabilities not supported

Plotting or reverse linefeed on 13349A Printer or remote system console operation over modem links.

Character set

DVR05 and DVA05 pass the extended character sets and display enhancements of the 264xA/B series CRT terminals, but these are not recognized by the operating system or program processing software. Only upper case ASCII characters and numerals are usable in operating system, file manager, or editor commands, or in program statement names and labels. Other characters, such as lower case, result in an error message from the software operating system or subsystem. However, this does not exclude the entry/retrieval of other characters in data files, their use in program documentation comments, or the editing of strings containing lower case characters using the interactive editor.

Memory requirements

DVR05: 1800 bytes without Mini cartridge or auxiliary printer support; 2900 bytes with Mini cartridge and auxiliary printer support.

DVA05: 3200 bytes.

Ordering information

RTE drivers DVR00, DVR05, and DVA05 are all included in the 92064A RTE-M, 92001B RTE-II, and 92067A RTE-IV real time executive operating systems. These drivers are also independently available in the 92062A or 92062B RTE drivers package.

Operating systems compatibility exclusions

RTE drivers DVR05 and DVA05 are specifically not compatible with the RTE-B or RTE-C operating system or with disc-based HP RTE operating systems other than RTE-II, RTE-III, or RTE-IV.

Page mode driver DVR05 and DVA05 specifications

Compatible interface, terminals, and modems

12966A Buffered asynchronous communications interface with appropriate option, which may be used with the following terminals and modems:

1. 2640B+020 CRT terminal for local connection or remote connection via Bell Type 103 Data Set or equivalent modem.
2. 2645A Display station without tape or auxiliary printer for local connection or remote connection via Bell Type 103 Data Set or equivalent modem.
3. 2648A Graphics terminal without tape or auxiliary printer for local connection or remote connection via Bell Type 103 Data Set or equivalent modem.
4. 2645A+007, 030 Display station with 13260B Extended asynchronous communications for local connection (supports Mini cartridge I/O and/or auxiliary printer operation).
5. 2648A+007,030 Graphics terminal with 13260B+003 Extended asynchronous communications for local connection (supports Mini cartridge I/O and/or auxiliary printer operation).
6. 2645A+007 Display station for remote connection via Bell Type 103 Data Set or equivalent modem (supports Mini cartridge I/O and/or auxiliary printer operation).
7. 2648A+007 Graphics terminal for remote connection via Bell Type 103 Data Set or equivalent modem (supports Mini cartridge I/O and/or auxiliary printer operation).
8. 2644A +020 Mini data station for local connection or remote connection via Bell Type 103 Data Set or equivalent modem (supports Mini cartridge I/O).

**The 2752A/2754B Teleprinters, 2762A/B Terminal Printers 2644A Mini Data Station are no longer available; they are listed here for reference only.*

The 91730A is a software support package for multipoint terminal communication between HP 2645A and/or 2648A CRT terminals and an HP 1000 Computer System, using the new HP 12790A Multipoint Terminal interface.

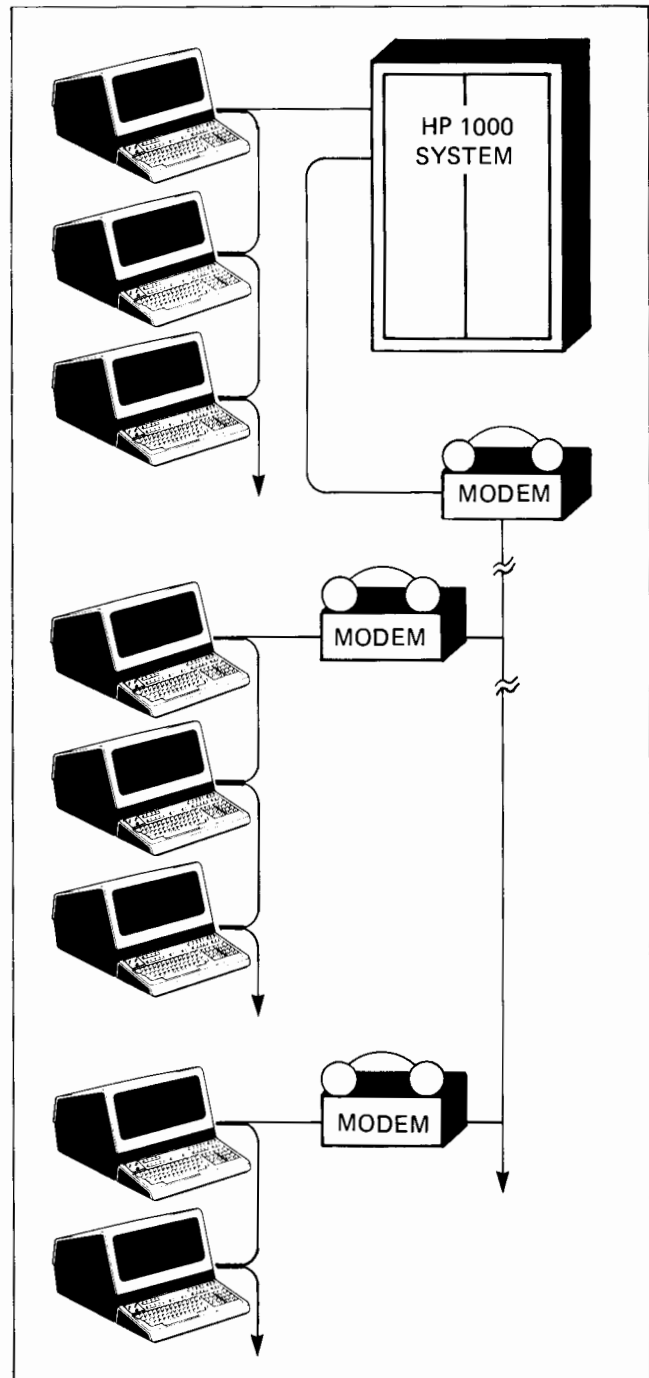
Features

- Supports single I/O channel communication with multiple CRT terminals on a single communications line.
- Program development and/or application program execution at multipoint terminals on RTE-IV based systems
- Application program execution on RTE-MIII based systems
- Computer-interface block transfers up to 1000 characters long at DCPC (direct memory access) rates
- Support for up to eight 12790A Multipoint terminal interfaces
- Multipoint master application program capability
- Multipoint network status display program
- "Who Are You" command identification of multi-point terminals
- Auto acknowledgement of data entry
- Group and line message broadcast capability
- Intelligent polling algorithm
- System level exerciser program
- Power fail restart subroutine.

Functional description

Multipoint terminal usage

User-written application programs access multipoint terminals by their Logical Unit (LU) number. Reading from and writing to terminals is supported from both FORTRAN READ/WRITE statements and RTE EXEC calls. Each multipoint terminal can be running under the control of its own unique application program for read and write only. Therefore, a single communications line and computer I/O channel can be shared and effectively utilized. Multipoint software driver DVR07 queries the status of all terminals in sequence such that: (1) Pending Read, Write, and Control requests to a terminal can be serviced, and (2) an enabled terminal can be "routinely polled" and can thereby get RTE system attention or can schedule a multipoint master application program. This querying process is transparent to the user's application program. Users at multipoint terminals can develop new application programs, each utilizing a copy of the RTE File Manager, Editor, FORTRAN IV compiler, RTE Assembler, or BASIC/1000D interpreter, in the RTE-IV system.



The 91730A Multipoint Terminal Interface Subsystem Software Package supports connection of multiple 2645A/2648A CRT Terminals to HP 1000 Computers or systems, as shown above, via single hardwired or modem communications lines and the new 12790A Multipoint interface.

Data transfer mode

All data transfers between the buffer on the 12790A Multipoint interface and the user's application program is done via direct memory access under the control of the Dual Channel Port Controller (DCPC). All multipoint terminals operate in block mode and make use of the ENTER key on the 2645A or 2648A to transmit a message to the system. Direct memory access transfers are extremely fast (approximately 160k bytes per second) and are very efficient for medium to long blocks of text.

Support of user-written master application program

Multipoint supports provision of a user-written master application program to facilitate control of application environments by multipoint terminal users. This program might, for example, display a menu of many application programs from which the terminal operator can choose. The choice could be easily implemented with a 2645A/2648A "soft" key. The master application program can be scheduled by depressing the ENTER key, or one of the soft keys when DVR07 does not expect any terminal response to its routine poll. That would be the case if there is no application program read request pending on the terminal. Also, if a long write to a terminal is in progress and the appropriate edit mode flag has been set, the user could depress the BREAK key, which would cause DVR07 to schedule the master application program after the next block mode write.

Auto acknowledgement

Multipoint software optionally provides for audible auto acknowledgement at any multipoint terminal. As soon as the 12790A Multipoint interface has unloaded a message to the computer system, an audible response is sounded at the terminal, alerting the operator that data can now be entered. This saves user application program overhead and provides a quicker response to the operator.

Multipoint status display

The multipoint software includes a program which displays pertinent information about all currently active multipoint lines and terminals. By terminal LU, it displays terminal ID and availability, Equipment Table number and status, the active program's name, the status of the edit mode flags, whether routine polling is enabled, and a number of other parameters. The display device can be one of the multipoint terminals.

Terminal status querying and initialization

A "Who Are You" command available to the application programmer obtains the device identification and status of every operational (power turned on) terminal within a group of terminals on a multipoint line. A Group is a logical subset of all of the terminals connected to the multipoint line. The terminals respond in the sequence of their physical position within the group. Then, if the system has been suitably generated, it is possible to programmatically initialize all the terminals within the group so that each may begin an application program or program development. Alternatively, multipoint terminals can be initialized by File Manager control commands from the system console.

Message broadcasting

The multipoint software provides the ability to broadcast a message simultaneously to all of the terminals in a group, or all of the terminals on a multipoint line. This ability assists in

the efficient coordination and management of a multipoint applications environment.

Intelligent terminal servicing

Multipoint software driver DVR07 implements an intelligent terminal servicing algorithm which prevents line monopolization by a single terminal while prioritizing activity on the multipoint line. DVR07 queries the status of each terminal sequentially and directs the 12790A to generate Bisync Poll Messages (for Reads and Routine Polls) or Bisync Select Messages (for Writes or Control requests), as determined by the algorithm. In a status inquiry at a given terminal, DVR07 checks for active Write, Read, or Control requests from a system or user program. A Control request or a Write to a terminal, if pending, is serviced immediately. A Read from a given terminal is done after the status of all other terminals on the multipoint line has been queried once. No more than 1000 characters of text can be written to or read from a given terminal before a status inquiry is performed on all terminals in sequence. Likewise, if a status inquiry for a terminal shows no active Write, Read, or Control requests, then that terminal will, if enabled, be "routinely polled" for operator intervention to get RTE system attention or schedule the multipoint master application program **after** a status inquiry of all other terminals on the multipoint line has been performed once. In this way, the intelligent terminal servicing algorithm gives Writes and Control requests priority over Reads and Routine Polls. It also prevents one terminal from monopolizing the line by doing a status inquiry at all other terminals (and potentially servicing them) before more than 1000 characters in a long message are transmitted to or from that one terminal. Each terminal operator thus has equal access to the resources of the system.

System level exerciser

A system-level exerciser program is supplied with the multipoint software. The exerciser sends a specified terminal one or more lines of data, and causes the same lines of data to be transmitted back to the exerciser program for verification. The exerciser is useful in verifying the integrity of the multipoint network and helpful in isolating a malfunction.

Functional specifications

Compatibility

Operating system: 92064A RTE-M system (RTE-MIII configuration) for application program execution and 92067A RTE-IV system for both application program execution and program preparation.

Hardware: 12790A Multipoint terminal interface and cable and 2645A and 2648A CRT terminals which are compatible with that interface.

Number of terminals per multipoint line

Nominally, up to 32 terminals can be connected to the 12790A interface via a single multipoint line. The following three important factors determine the number of terminals which can be connected:

1. The number of terminals that can be *physically* connected depends upon the transmission mode. *Asynchronously*, up to 32 terminals can be *physically connected*; the distance between any two terminals can be 609 metres (2000 ft), provided that the total line length does not exceed 4876 metres (16000 ft), regardless of

transmission speed up to a maximum of 9600 bps. For synchronous operation, the maximum distance between any two terminals is also 609 metres (2000 ft) and maximum total line length is also 4876 metres (16000 ft), but the number of terminals per line depends upon the average distance between terminals and line speed, as summarized in Table 1.

2. The maximum number of *logically connectable* terminals may be constrained by the logical unit number capacity of the RTE operating system in which the 12790A and its supporting 91730A software are operated.
3. Finally, the number of terminals that can be *realistically* supported depends upon the amount of text character I/O generated by each terminal on the line, the length of those text blocks, the speed of the line itself, and other user-dependent requirements, such as response time.

Table 1. Average line lengths between multipoint terminals on a synchronous line

Terminals per line	Average line length versus line speeds of:		
	2400 bps	4800 bps	9600 bps
4	609m (2000 ft)	609m (2000 ft)	609m (2000 ft)
8	609m (2000 ft)	609m (2000 ft)	365m (1200 ft)
16	609m (2000 ft)	365m (1200 ft)	146m (480 ft)
32	365m (1200 ft)	146m (480 ft)	36.5m (120 ft)

Maximum system usage per 12790A interface

The maximum requirement for time that would otherwise be available to a compute-bound user program in the RTE system occurs during Routine Polling while there is no Read, Write, or Control communication with any of the multipoint terminals. This is true for the no-communication condition because that results in the highest rate of HP 1000 computer interrupts and therefore imposes a maximum demand on system processing time. System usage is essentially independent of the number of terminals on the multipoint line, but is a direct function of the number of 12790A interfaces and is also dependent upon the transmission mode and line speed. The following usage figures apply to operation of the 91730A Multipoint software in an HP 1000 E-Series Computer with standard performance memory operating under RTE-IV;

Transmission Mode:	Synchronous	Asynchronous
Line speed:	9600 bps	9600 bps
Approximate requirement for other-wise user-available processing time	6%	10%

Character set

The character set passed by the multipoint software is limited to CRT screen-displayable ASCII characters and escape sequences; non-displayable control codes or other codes can not be transmitted.

RTE system capabilities accessible from multipoint terminals

The multipoint software, gives multipoint terminals the same access to system capabilities as non-multipoint terminals, with the following exceptions:

1. Mini cartridges on multipoint 2645A/2648A terminals cannot be accessed from user-written programs or sub-routines executing in the HP 1000 Computer or System in conjunction with the the 91730A software. Mini cartridges and auxiliary printers can be used locally in operations that do not reference the multipoint line.

2. Transparent data (e.g., binary files, relocatable or absolute programs) cannot be written to or read from multipoint terminals because certain sequences may be interpreted as multipoint bisync control characters.
3. Intra-line character edits (CTRL/R,I,C,T to Replace, Insert, Cancel, or Truncate characters) are not effective in the multipoint environment wherein whole lines are transmitted to the RTE EDiTR at a time. However, the multipoint terminals have the intelligence, buffering, and predefined keys to support selective forward tab spacing and backspacing, and the replacement, insertion, or deletion of characters within a line without interrupting the 12790A interface.
4. The operator at a multipoint terminal cannot use the RTE-IV DEBUGR utility.

Minimum system requirements

Same as RTE-IV system or RTE-MIII (multi-user) configuration of RTE-M system plus an HP 12790A Multipoint terminal interface and one or more 2645A and/or 2648A CRT terminals configured to be compatible with the 12790A interface (see 12790A data sheet for more information).

Power fail restart

Working in conjunction with the RTE power fail/auto restart routines, a power fail restart subroutine furnished with the multipoint software resets each 12790A interface in the system so that I/O may resume after a power failure. This subroutine also runs the 12790A firmware-controlled self test. If the power failure occurred during a phase of the I/O operation from which recovery is not possible, an I/O error message is sent to the affected terminal(s). A power failure message is broadcast to all multipoint terminals on the system.

Approximate memory requirements

Multipoint driver DVR07: 2500 bytes
 Terminal peripheral write subroutine: 650 bytes
 Terminal peripheral read subroutine: 230 bytes
 Terminal peripheral control subroutine: 360 bytes*
 Power fail restart subroutine: 120 bytes*
 System-level exerciser program: 4200 bytes*
 System status program: 2460 bytes*

*These subroutines and programs can be placed in the resident library or appended to a user's application program.

Ordering information

91730A Multipoint terminal subsystem software package

The 91730A package consists of:

1. Software media option 020, which must be ordered.
2. Multipoint software numbering catalog (91730-90001).
3. Multipoint user's guide (91730-90002).

91730A Option

020: Provides all multipoint software on a single Mini cartridge (91730-13301) for read-in by a 2645A+007 CRT Terminal.

91730S Software Subscription Service

The 91730S Software Subscription Service provides software and manual updates as required to keep your multipoint software current with respect to enhancements and

other design changes as they are released by Hewlett-Packard. The 91730S service is ordered in monthly units for at least six months, billable quarterly. A media option, listed following 91730T, must be specified when ordering 91730S.

91730T Comprehensive Software Support

The 91730T Comprehensive Software Support includes the Software Subscription Service, as described under 91730S, above, and a Phone-In Consulting Service for discussion of questions on your multipoint software with a qualified HP Systems Engineer. The 91730T service is ordered, in monthly units for at least six months, billable quarterly. A media option must be specified.

91730S and 91730T Media option

020: Software updates on Mini cartridges for read-in via 2645A+007 or 2648A+007 CRT Terminal.

91730T option 200

91730T option provides a discount for comprehensive software support of an additional copy of the 91730A Multipoint software.

The 12790A Multipoint Terminal Subsystem Interface is a microprocessor-based interface card that is microprogrammed to manage a hardwired or modem-based RS232C interface, the Binary Synchronous 2645A Multipoint Line protocol, and an on-board data buffer. In conjunction with the 91730A Multipoint Terminal Subsystem Software Package, the Multipoint Interface supports 2645A or 2648A CRT Terminals in block mode for program development or program execution under the control of one or more user application programs.

Hardware and firmware features

- Microprocessor management of 2645A Multipoint Protocol, line/modem control signals, and on-board data buffer.
- Nominally, up to 32 2645A and/or 2648A Terminals per multipoint line
- Hardwired or modem-linked communications
- Full-duplex or half-duplex modem compatibility
- Synchronous or asynchronous communication at rates to 9600 bits/second
- CRC-16 error checking
- 1024 byte RAM memory for I/O operations
- Firmware-controlled self tests
- Compatibility with HP 1000 M, E, and F-Series Computers and powerful 2645A/2648A capabilities
- Sharing of communications resources

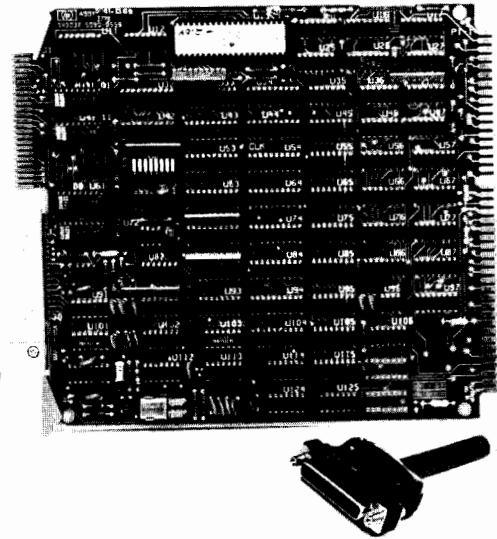
Functional description

Sharing of communications resources

With multipoint as opposed to point-to-point operation, a number of 2645A/2648A terminals can share valuable communications resources, including the daisy-chained hardwired or modem-based communications line, the HP 1000 computer I/O channel, the interface card, and modems, if used.

Built-in microprocessor off-loads the computer

A powerful, control-oriented microprocessor on the 12790A interface manages routine communications processing, freeing the computer itself for applications-oriented tasks. The multipoint protocol implemented on the interface is 2645A Multipoint Protocol, which is similar to IBM Bisync. Under the control of firmware, the microprocessor converts a control word into actions, such as polling a terminal for data, selecting a terminal for a write, or loading/unloading text. CRC-16 Cyclical Redundancy Error Checking is performed on the interface for all text blocks received or sent. The microprocessor automatically requests up to 8 retransmissions upon detection of an error, unless directed to request any other number of retransmissions from zero to 16 by the user's program.



The microprocessor also manages synchronous or asynchronous modem control signals and is capable of setting additional modem control lines, such as Rate Select, upon receiving the appropriate command word from the user's program. A controllable watchdog timer is used to generate communications line timeouts.

The microprocessor manages the data buffer used to store blocks of data being sent to or received from the computer. This buffer management includes packing bytes into words for direct memory transfers to the computer via DCPC and unpacking words into bytes for transmission to terminals.

Finally, under programmatic initiation, the interface can perform several optional text editing functions automatically. On writes to a terminal, these include "homing" the terminal's cursor, clearing the display screen, and/or appending a carriage return/line feed after the last character of text. On reads from a terminal, the interface strips group separators and optionally can strip carriage returns, line feeds, and/or the record separators which define protected fields on the 2645A/2648A.

Bisync multipoint protocol

The 12790A interface supports a character-oriented Bisync Multipoint Protocol that manages the communications activity on a multipoint line. Message sequences, for example, define which terminal is to be selected for a write from the computer or which terminal is to be polled for text to be read into the computer. The message sequences also report whether an addressed terminal is ready for I/O and transfer user's text to and from the terminal. Protocol characters frame each message and also provide error control on any text blocks transferred in a given message. The activity on a multipoint line thus consists of protocol-related characters and terminal user text characters.

Built-in text buffering for efficient operation

For any given line speed, large block mode character transfers make the most efficient use of protocol characters, communications line capacity, and computer processing time. For that reason, the 12790A interface incorporates a 1024-byte random access memory which allows up to 998-byte block data transfers to the computer and up to 1000-byte block transfers from the computer to the interface. All transfers are directly to or from the computer memory via the Dual Channel Port Controller (DCPC) in the computer, which promotes extremely efficient utilization of each interrupt to the computer and of every request sent over the communications line. One block mode data transfer can fill over half of a terminal's display screen. Messages longer than 1000 bytes can be transmitted by multiple block mode data transfers of approximately 1000 bytes each. DCPC access to the computer is thus consistent with, and supports, the high performance block mode capabilities of the 12790A interface plus 91730A multipoint software.

Firmware-controlled self tests

On-board firmware-controlled self tests help assure reliable operation of the interface. These check out the data buffer, the baud rate generator used for asynchronous communications, and certain logic functions. The self tests are invoked by the PRESET button on the computer and the results are checked by driver DVR07 in the 91730A Multipoint Terminal Subsystem Software upon initializing a communications line.

Functional specifications

Interface level

EIA RS232C and CCITT V.29.

Transmission mode

Bit serial, asynchronous or synchronous via hardwired cables or half or full duplex modems and telephone lines. (For more information on modems, see section on *Requirements for remote multipoint operation*).

Number of terminals per multipoint line

Nominally, up to 32 terminals can be connected to the 12790A interface via a single multipoint line. The following three important factors determine the number of terminals which can be connected:

1. The number of terminals that can be *physically* connected depends upon the transmission mode. Asynchronously, up to 32 terminals can be *physically connected*; the distance between any two terminals can be 609 metres (2000 ft), provided that the total line length does not exceed 4876 metres (16000 ft), regardless of transmission speed up to a maximum of 9600 bps. For synchronous operation, the maximum distance between any two terminals is also 609 metres (2000 ft) and maximum total line length is also 4876 metres (16000 ft), but the number of terminals per line depends upon the average distance between terminals and line speed, as summarized in Table 1.
2. The maximum number of *logically connectable* terminals may be constrained by the logical unit number capacity of the RTE operating system in which the 12790A and its supporting 91730A software are operated.

3. Finally, the number of terminals that can be *realistically supported* depends upon the amount of text character I/O generated by each terminal on the line, the length of those text blocks, the speed of the line itself, and other user-dependent requirements, such as response time.

Line lengths

Interface to nearest terminal or modem: 15.2 metres (50 ft), maximum.

Maximum length between any two terminals: 609 metres (2000 ft).

Maximum total line length: 4876 metres (16000 ft), not including distance between modems.

Table 1. Average line lengths between multipoint terminals on a synchronous line

Terminals per line	Average line length versus line speeds of:		
	2400 bps	4800 bps	9600 bps
4	609m (2000 ft)	609m (2000 ft)	609m (2000 ft)
8	609m (2000 ft)	609m (2000 ft)	365m (1200 ft)
16	609m (2000 ft)	365m (1200 ft)	146m (480 ft)
32	365m (1200 ft)	146m (480 ft)	36.5m (120 ft)

Character buffering

Maximum of 998 characters from interface buffer to computer, 1000 characters from computer to interface buffer.

Error detection and correction

Errors are detected using CRC-16 cyclical redundancy error checking on blocks received or sent. Interface retransmits, or requests retransmission of block with error to attain error-free data transfer. User can program-specify any number of retransmissions up to 16; if not user-specified, the number of retransmissions is defaulted to eight.

Line continuity past a "down" terminal

Optional 13232T Power Protect Multipoint Cables can be used for terminal-to-terminal connection after the first terminal in a cluster to ensure line continuity through a terminal that is down.

Multipoint line protocol

The 12790A interface implements 2645A Multipoint Protocol, which is similar to IBM Bisync.

Configuration information

Computer compatibility: The 12790A Multipoint interface is compatible with 2108, 2109, 2111, 2112, 2113, and 2117, Computers operating under RTE-M or RTE-IV real time executive system.

Computer I/O channels required: One per interface.

Compatible terminals: 2645A+001 or 2648A Terminal, both also requiring option 030, 13234A 4k byte terminal memory module, and 13260C (asynchronous) or 13260D (synchronous) Multipoint communications card, either of which can be equipped with option 001 Monitor mode capability.

Option 001 on the 2645A provides the full 128 character ASCII set, including upper and lower case characters, which is required for program development and monitor mode operation. It can be omitted if application program execution is to be the only use of the terminal.

A terminal on a multipoint line can be equipped with Mini cartridges for local use, but the Mini cartridges cannot be accessed from user-written programs or subroutines running in the HP computer or system.

Software support: Operation of the 12790A interface in RTE-M (RTE-MIII configuration) and RTE-IV systems is supported by the 91730A Multipoint Terminal Subsystem Software Package, which has the following set of features, described in the 91730A data sheet:

- Program development and/or application program execution at multipoint terminals on RTE-IV based systems
- Application program execution on RTE-MIII based systems
- Support for up to eight 12790A interfaces
- Multipoint network status display program
- "Who are you" command to get status of multipoint terminals
- Auto acknowledgement of data entry
- Group and line message broadcast capability
- Intelligent line polling algorithm
- System level exerciser program
- Power fail restart subroutine

Configuration recommendations:

1. At least one terminal in each local cluster, preferably the one closest to the computer or modem, should be equipped with Monitor mode (13260C/D option 001) to aid in troubleshooting a data communications environment.
2. The 13232T Power Protect Multipoint Cable should be used where terminals are located remotely from each other such that easy audible or visual communication is not possible. This cable cannot be connected to the first terminal on a multipoint line, but can be used on all the others.

Installation: To install, set the 12790A configuration switches for Baud rate, synchronous or asynchronous operation, and modem control; plug the interface into the computer I/O backplane; connect the standard hardwire interface cable to the first terminal or the option 001 cable to a customer-furnished synchronous or asynchronous modem; integrate the interface and 91730A software into the RTE-MIII or RTE-IV operating system, and complete remaining connections to terminals. (See Figure 1.) (NOTE: The 12790A and 91730A ordered with an HP 1000 Model 40 or 45 Computer System will be included in the primary system. When both the 12790A and 91730A are ordered on an HP 1000 Model 20 or 25 Computer System with sufficient memory to support the RTE-MIII configuration they will be custom-generated into the system.)

Electrical specifications

Current required from computer power supply

+5V	+12V	-12V	-2V
2.5A	0.1A	0.05A	0.06A

Ordering information

12790A Multipoint Terminal Subsystem Interface

The 12790A interface consists of:

1. 5061-1389 Multipoint interface card.
2. 12790-80006 through 80009 Control Roms.
3. 5061-1393 10.6 metre (35 ft) interface cable for hardwire connection to first multipoint terminal.
4. 12790-90001 Multipoint Terminal Interface Subsystem Reference Manual.

12790A Options

001: Substitutes a 7.6 metre (25 ft) interface-to-modem cable (5061-1391) for the 5061-1393 hardwire cable, item 3, above.

Additional equipment required for operation

Multipoint terminals: One or more 2645A Display Stations and/or 2648A Graphics Terminals each equipped with:

1. Option 030 (deletes standard comm. card).
2. 13234A 4k byte terminal memory module.
3. 13260C (Asynchronous) or 13260D (Synchronous) Communications Card; 13260C/D monitor mode option 001 is recommended for the terminal nearest the 12790A interface.

Cable for connection to first terminal:

13232P 4.5 metre (15 ft) modem or multipoint cable for connection to first terminal, with provision for connection to multipoint cable for next terminal.

Modem bypass cable: 13232U 1.5m (15 ft) cable for connection between 12790A option 001 modem cable and 13232P cable.

Cables for connection to succeeding terminals:

1. 13232Q 4.5 metre (15 ft) multipoint cable for continuation of multipoint line.
2. 13232R 30.4 metre (100 ft) multipoint extension cable.
3. 13232T 9 metre (30 ft) Power protect multipoint cable providing continuity around "down" terminal.

Requirements for remote multipoint operation

Remote multipoint operation requires user-furnished modems of the same type connected via an appropriate communications line between the 12790A interface at the HP 1000 Computer System and the remote multipoint terminals (see Figure 1).

Compatible modems

The 12790A interface is compatible with Bell type 103, 201, 202, 208, and 209 data sets and VADIC VA3400 modems used on dial-up or leased lines as specified below.

Advantage of full-duplex operation

At any given bit rate, modems capable of full-duplex operation eliminate line turnaround times and can therefore offer significant throughput improvements in an interactive environment. (Certain modems, such as the Bell 208A, require a four-wire circuit for full-duplex operation.)

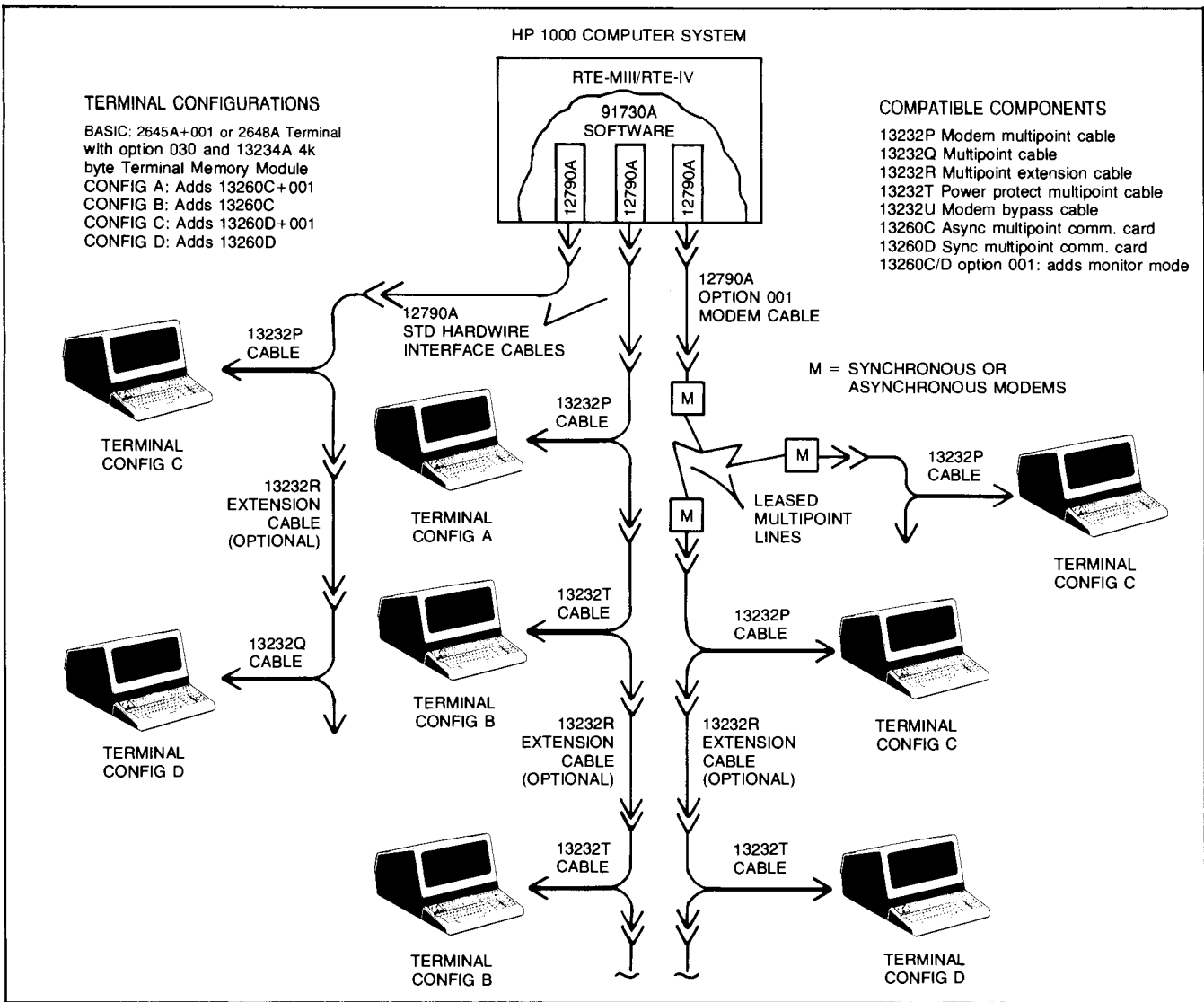


Figure 1. Typical local and remote multipoint connections

Multiple modem connection via 12790A interface

If more than two modems are to be connected to a modem at the 12790A interface, this must be done as shown in Figure 1, and private leased line modems are required. In some areas, data rates of 4800 and 9600 bits/sec may require telephone line conditioning; check with your local telephone representative.

Recommended modems and options

Modems and options recommended for use with the 12790A interface are listed below.

Bell type 201A3 Data Set provides half-duplex, two-wire, or full-duplex four-wire synchronous communication via dial-up or leased lines at rates to 2000 baud. Option recommendations for use with the 12790A interface are:

Option	Description	Recommendation
A1	EIA interface	A1
A2	Contact interface	
B3	With alternate voice	Select the option that best meets your needs
B4	Without alternate voice	
C5	With new sync	C6
C6	Without new sync	
D7	Half-duplex operation	D7 for two-wire circuit
D8	Full-duplex operation	D8 for four-wire circuit
E9	4-wire continuous carrier	E9
E10	4-wire w/carrier controlled by request to send	

Bell type 201C Data Set provides half duplex, two-wire, or full-duplex, four-wire synchronous communication via dial-up or leased lines at rate to 2400 baud. Option recommendations for use with the 12790A interface are:

Option	Description	Recommendation
A1	Transmitter internally timed	A1 is required
A2	Transmitter externally timed	
B3	Without 801 Auto call unit	B3
B4	With 801 Auto call unit	
C5	EIA ring indicator	C5
C6	Contact ring indicator	
D7	Without auto answer	D8
D8	With auto answer	
E9	Auto answer permanent	E9 is recommended
E10	Auto answer selective	

Bell type 202T Data Set provides half-duplex, two-wire, or full-duplex, four-wire asynchronous communication via dial-up or leased lines at rates to 1200 baud, and on C2 conditioned leased lines at rates to 1800 baud. Option recommendations for use with the 12790A interface are:

Option	Description	Recommendation
A1	Multipoint circuit	A2 at interface end of line; otherwise user's option
A2	Point-to-point	
B3	Half-duplex operation	B3 for two-wire circuit
B4	Full-duplex operation	B4 for four-wire circuit
C5	Master station, continuous carrier	C5
C6	Switched carrier	

D7	One-second holdover used	D8
D8	One-second holdover not used	
E9	Telephone Co. engineered timing options	E10
E10	Customer engineered timing options	
F11	Operation at rates to 1200 bps	Depends upon line to be used
F12	Operation at rates above 1200 bps on conditioned leased lines	

Bell type 208A Data Set provides full duplex, four-wire synchronous communication via leased lines at rates to 4800 baud. Option recommendations for use with the 12790A interface are:

Option	Description	Recommendation
A1	Transmitter internally timed	A1 is required
A2	Transmitter externally timed	
B3	Continuous carrier	B3
B4	Switched carrier	
C5	Switched request to send	C6
C6	Continuous request to send	
D7	One second holdover used	D8
D8	One sec holdover not used	
E9	New sync used	E10
E10	New sync not used	

Bell type 208B Data Set provides half-duplex, two-wire synchronous communication via dial-up lines at 4800 baud. Option recommendations for use with the 12790A interface are:

Option	Description	Recommendation
A1	Transmitter internally timed	A1 is required
A2	Transmitter externally timed	
B3	Without 801 Auto call unit	B3
B4	With 801 Auto call unit	
C5	CC off when analog loop is present	C5
C6	CC on when analog loop is present	
D7	Without auto answer	D8 on interface end
D8	With auto answer	D7 on terminal end
E9	Desk mounting	Either is OK
E10	Rack or cabinet mounting	

Bell type 209A Data Set provides full-duplex, four-wire synchronous communication via leased lines with D1 conditioning at rates to 9600 baud. Option recommendations for use with the 12790A interface are:

Option	Description	Recommendation
A1	Transmitter internally timed	A1 is required
A2	Transmitter externally timed	
B3	Data set ready off when AL on	B3
B4	Data set ready on when AL on	
C5	Timing slaved	C6
C6	Timing not slaved	
D7	Elastic store in	D8
D8	Elastic store out	
E9	Continuous carrier	E9
E10	Switched carrier	
F11	Switched request to send	F12
F12	Continuous request to send	

Vadic corporation VA3400 modem provides full-duplex synchronous or asynchronous communication via dial-up or leased lines at rates to 1200 baud. It is similar to the Bell type 103 Data Set, but communicates at the faster 1200 baud rate and can only communicate with another VA 3400 modem. The following characteristics must be specified for VA 3400 modems that are to operate with the 12790A interface:

- Type of line to be used (leased or dial-up)
- Operating mode (synchronous or asynchronous)
- Automatic answer is required

Modems for use outside of the United States and Canada should be selected with the guidance of the public telephone authority or independent modem supplier and the local Hewlett-Packard representative to ensure compatibility with the 12790A interface.

The 12531C, 12531D, and 12880A interfaces provide for local or modem connection of printing or non-cartridge tape CRT terminals to HP 1000 Computers and Systems.

Features

- EIA RS-232-C and CCITT V.24 compatibility
- Simplex, half duplex, or echoplex operation
- Jumper-selectable data transfer rates to 2400 bits/second with 2 stop bits

Functional specifications

Application

12531C: The 12531C is for interfacing HP 2752A/2754B or equivalent ASR 33/35 type Teleprinters to HP 1000 computers. Optionally, the 12531C can also interface Bell type 103 or equivalent data sets, operated in manual mode only.

12531D: The 12531D is for interfacing a variety of terminal devices to an HP 1000 computer or system, either locally or via Bell type 103A data set or equivalent modem operating in manual mode.

12880A: The 12880A is for interfacing 2640B, 2645A, or 2648A CRT terminals without cartridge tape or auxiliary printer capabilities to a local HP 1000 computer or system. It is designed to function at the data rate set by the interfaced terminal.

Interface level

12531C or 12531D: 20 mA or EIA/CCITT.

12880A: EIA/CCITT.

Jumper-selectable baud rates with internal clock

12531C: 110, 220, 440, 880, and 1760 bits/second.

12531D: 150, 300, 600, 1200, and 2400 bits/second.

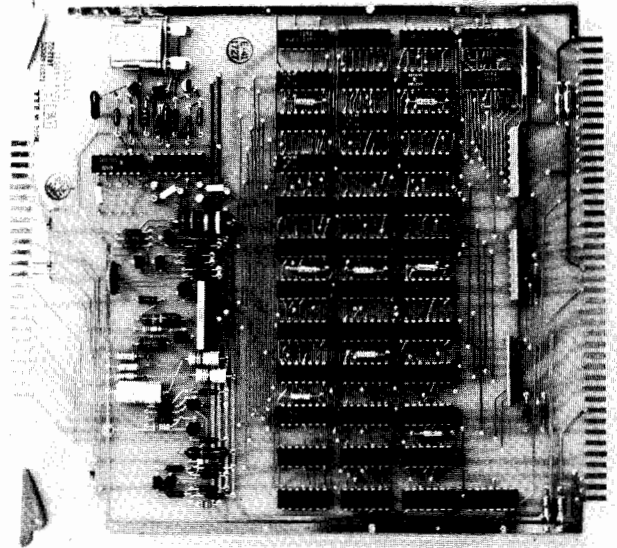
Maximum baud rate with external clock from terminal

12531C: 2400 bits/second.

12531D or 12880A: 9600 bits/second.

Character size, stop bits, and buffering

8-bit character with one or two stop bits. Each interface buffers a single character at a time for transfer to/from the computer.



12531D Terminal interface

Modem interface capability

12531C and 12531D: Bell type 103 or equivalent, manual only.

12880A: Local interfacing only, no modem capability

Configuration information

Compatibility: The 12531C, 12531D, and 12880A terminal interfaces and supporting software are compatible with 2105, 2108, 2109, 2111, 2112, 2113, and 2117 computers with BCS, RTE-B, RTE-C, RTE-M, RTE-II, RTE-III, or RTE-IV operating system. No other operating system environment is supported.

Computer I/O channels required: One.

Approximate memory required: 710 bytes for each terminal interface in BCS system; 1220 bytes for all terminal interfaces in RTE-B/C/M/II/III/IV system, which also serves the punched tape reader and tape punch subsystems.

Software recommended: The 92062 RTE drivers package, which is included in the 92001B RTE-II, 92060B RTE-III, 92067A RTE-IV, and 92064A RTE-M operating systems, provides the real-time multi-device driver DVR00, which is used by the 12531C, 12531D, and 12880A terminal interfaces. The 24396A-F Diagnostic library contains diagnostics required to check operation of the terminal interfaces.

Installation: To install, plug the terminal interface into the computer I/O backplane, connect the interface cable to the terminal or modem, and integrate the interface into the operating system.

Electrical specifications

Current required from computer power supply

	+5V	-2V	+12V	-12V
12531C:	0.76A	0.05A	0.05A	0.1A
12531D:	0.76A	0.05A	0.24A	0.01A
12880A:	0.86A	0.05A	0.24A	0.01A

Ordering information

12531C Teleprinter interface

The 12531C Teleprinter interface includes:

1. 12531-60022 Teleprinter interface card.
2. 12531-16001 Diagnostic on paper tape.
3. 12531-90033 Interface manual.
4. 12531-90042 Diagnostic manual.

12531C Options

001: Adds 12531-60021 7.6m (25 ft) EIA terminal cable.

002: Adds 12531-60024 7.6m (25 ft) Data set cable.

12531D Terminal interface

The 12531D Terminal interface includes:

1. 12531-60025 Terminal interface card.
2. 12531-90038 Interface manual.

12531D Options

001: Adds 12531-60026 7.6m (25 ft) EIA terminal cable.

002: Adds 12531-60024 7.6m (25 ft) Data set cable.

004: Adds 02640-60058 15.2m (50 ft) HP 2640 CRT terminal cable.

12880A CRT Terminal interface

The 12880A CRT Terminal interface includes:

1. 12880-60001 Terminal interface card.
2. 12880-60003 15.2m (50 ft) EIA terminal cable.
3. 12880-90001 Interface manual.

12880A Option 001

12880A option 001 replaces the 12880-60003 EIA terminal cable with the 12880-60005 15.2m (50 ft) HP 2640 CRT terminal cable.

The 12966A, 12968A, and 12587A interfaces provide for connection of Bell type 103 or type 202 data sets or equivalent modems to HP 1000 computers, offering three levels of capability and sophistication to the user. The 12966A is HP's most powerful single terminal interface and is supported under RTE-M/II/III/IV for local or modem interfacing of 2631A Printers, 2635A Printing terminals, or 2640B, 2645A, or 2648A CRT terminals with mini cartridge I/O and/or auxiliary printers to HP 1000 computers and systems.

Features

- EIA RS-232-C and CCITT V.24 compatibility
- Compatibility with Bell 103 and 202 data sets or equivalent
- Data set control implemented through software
- Simplex, half duplex, or echoplex operations with secondary data channel
- Selectable data rates to 9600 bits/second
- Multiple character buffering
- Special character recognition/interrupt capability with 256 byte special character memory (12966A only)
- Selectable character size, parity checking, and number of stop bits
- Hardware break detection (12966A and 12968A)

Functional descriptions

12966A Buffered asynchronous communications interface

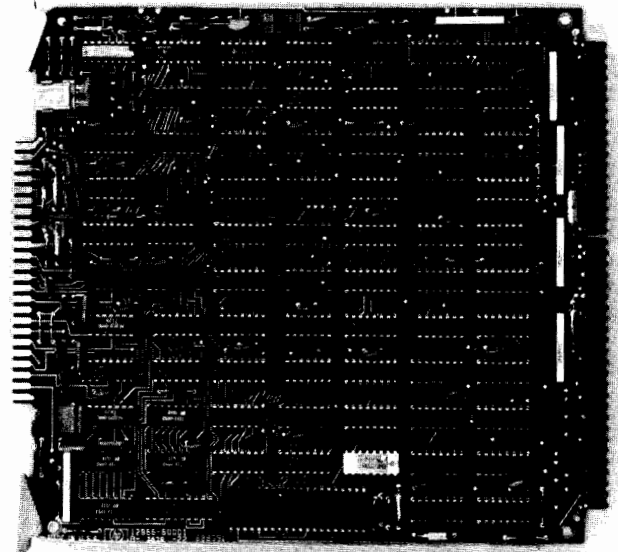
The 12966A contains a 128 character buffer which supports block-mode data transfers for efficient use of computer time. Interface flags indicate buffer status, improving computer utilization by reducing the number of times an interrupt must be serviced. The 12966A also contains a special character recognition/interrupt capability with a 256 byte RAM special character recognition/interrupt capability with a 256 byte RAM special character memory. The special character memory gives the user the ability to specify up to 256 different special characters and cause an interrupt flag to be set whenever one of them is received. The interface operates at speeds to 9600 bps.

12968A Asynchronous communications interface

The 12968A offers the same speed capabilities as the 12966A, but has only a two-character buffer and no special character recognition/interrupt capability.

12587B Asynchronous communications interface

The 12587B is the simplest asynchronous communications interface Hewlett-Packard offers for use with Bell type 103 or type 202 data sets. It provides asynchronous communication at hardware jumper-selected, internally-clocked rates to



12966A Buffered asynchronous communications interface card

2400 bits/second or externally-clocked rates to 9600 bits/second. character size, parity generation and checking, and number of stop bits are programmable. The 12587A conforms to EIA and CCITT specifications.

Functional specifications

Interface level

EIA OR CCITT

Jumper-selectable baud rates with internal clock

12966A and 12968A: 50, 75, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600 bits/second.

12587B: 45, 50, 75, 110, 134.5, 150, 165, 200, 220, 300, 330, 440, 600, 880, 900, 1050, 1200, 1760, 2400 bits/second.

Program-selectable baud rates with internal clock

12966A and 12968A: Same as jumper-selectable baud rates, listed above.

12587B: Baud rates of the 12587B are not program selectable.

Maximum baud rate with external clock

9600 bits/second.

Programmable character size

12966A and 12968A: 5, 6, 7, or 8 bits.

12587B: Any size from 1 through 8 bits.

Stop bit selection

12966A and 12968A: 1, 1-1/2, or 2, program selectable.

12587B: 1 or 2, jumper selectable.

Programmable parity generation and checking

No parity, odd, or even.

Character buffering

12966A	12968A	12587B
128 char	2 char	1 char

Special character memory

256 characters in 12966A only.

Modem interface capability

12966A: interface and supporting DVA05 software driver are compatible with Bell type 103 Data Sets and Vadic VA3400 1200 bps modem.

12968A and 12587B: interfaces are hardware compatible with Bell type 103 and 202 Data sets, and provide a secondary data channel.

Break detection

12966A and 12968A: hardware break detection.

12587B: Software break detection with type 202 data set.

Data set signals provided

EIA Designation	12966A	12968A	12587B
Protective ground			(AA)
Transmitted data	(BA)	(BA)	(BA)
Received data	(BB)	(BB)	(BB)
Request to send	(CA)	(CA)	(CA)
Clear to send	(CB)	(CB)	(CB)
Data set ready	(CC)	(CC)	(CC)
Signal ground	(AB)	(AB)	(AB)
Received line signal detector	(CF)	(CF)	(CF)
Secondary received line	(SCF)*	(SCF)*	(SBA)
Secondary received data	(SBB)*	(SBB)*	(SBB)
Secondary request to send	(SCA)*	(SCA)*	
Data terminal ready	(CD)	(CD)	(CD)
Ring indicator	(CE)	(CE)	(CE)

*The 12966/12968A user may choose any one of the pairs SBA, SBB; SBA, SCF; SCA, SBB; or SCA, SCF. Wiring details are given in the Reference and Application Manual.

Configuration information

Computer compatibility: The 12966A, 12968A, and 12587B interfaces are hardware compatible with all HP 1000 computers.

System compatibility: The 12966A interface used with RTE driver DVR05 or DVA05 is compatible with all HP 1000 Computer Systems.

Computer I/O channels required: One per interface.

Software support: The 12966A+001/002 interface is supported by RTE drivers DVR05 and DVA05 in the 92062 RTE drivers package for use with 2631A Printers, 2635A Printing terminals, and 2640B, 2645A, and 2648A CRT terminals. The 12966A interface is also supported by the 24396A-F Diagnostics library. Software support of the 12968A and 12587B interfaces is limited to the diagnostics available for them in the 24396A-F Diagnostics library. A user-written driver programmed in assembly language will be required for use of the 12968A or 12587B interface in an HP 1000 Computer.

Installation: To install, plug the interface into the computer I/O backplane, connect the interface cable to the modem, and integrate the interface into the operating system.

Electrical specifications

Current required from computer power supply

	+5V	-2V	+12V	-12V
12966A	1.95A	0.07A	0.02A	0.06A
12968A	1.3A	0.05A	0.01A	0.04A
12587B	1.6A	0.07A	0.08A	0.05A

Ordering information

12966A Buffered async communications interface

The 12966A Buffered async communications interface includes:

1. 12966-60001 Asynchronous comm. interface card.
2. 12966-60003 Test connector assembly cables.
3. 12966-60004 15.2m (50 ft) standard EIA terminal cable.
4. 12966-16001 Diagnostic on paper tape.
5. 12966-90001 Interface ref. and application manual.
6. 12966-90004 Diagnostic manual.

12966A options

- 001:** Replaces 12966-60004 standard EIA terminal cable with 12966-60005 15.2m (50 ft) cable to 264xA/B CRT terminal or 2631A or 2635A Printer or printing terminal.
- 002:** Replaces 12966-60004 standard EIA terminal cable with 12966-60006 15.2m (50 ft) cable to data set.
- 003:** Replaces 12966-60004 standard EIA terminal cable with 12966-60007 7.6m (25 ft) cable to HP 2749 Teleprinter.

12968A Asynchronous communications interface

The 12968A Asynchronous communications interface includes:

1. 12968-60001 Asynchronous comm. interface card.
2. 12968-60003 Test connector assembly cables.
3. 12968-60004 15.2m (50 ft) standard EIA terminal cable.
4. 12968-16001 Interface ref. and application manual.
5. 12968-90001 Interface ref. and application manual.
6. 12968-90003 Diagnostic manual.

12968A options

12968A options 001 through 003 are the same as 12966A options 001 through 003, above. No other options are available for the 12968A.

12587B Asynchronous communications interface

The 12587B Asynchronous communications interface includes:

1. 12587-60004 Asynchronous comm. interface card.
2. 12587-60006 15.2m (50 ft) standard data set cable.
3. 12587-16001 Diagnostic on paper tape.
4. 12587-90006 Interface manual.
5. 12587-90013 Diagnostic manual.

The 12920B Asynchronous multiplexer provides a convenient way to interface up to 16 low speed (110 or 300 bps) asynchronous data communications devices (terminals or data sets) to HP 1000 computers. The multiplexer can be used with a combination of terminals operating hardwired and/or via half-duplex or full-duplex modems.

Features

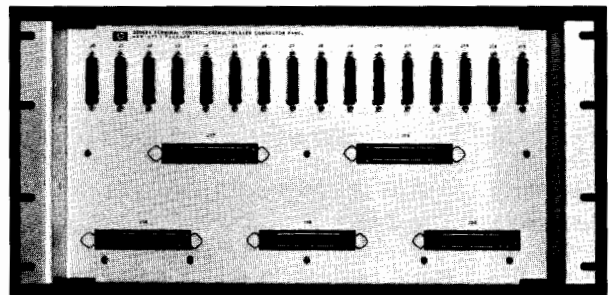
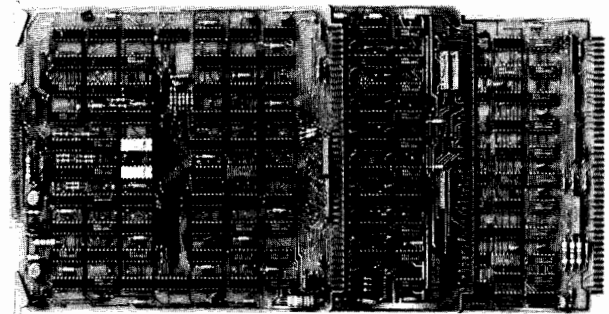
- Inexpensive multi-port interface for up to 16 devices
- EIA RS-232-C and CCITT V.24 compatibility
- Programmable data rates
- Programmable character length from 5 to 12 bits
- Programmable speed detection for up to six standard rates plus detection for the IBM 2741
- Automatic break detection
- Automatic answering
- Character assembly performed by hardware
- Hardware compatibility with up to eight Bell type 801 automatic calling units
- Programmable split speed operation
- Full duplex, half duplex, or echoplex transmission
- Programmable parity generation and checking

Functional description

The 12920B Asynchronous Multiplexer provides multiplexed terminal support for asynchronous low speed (110 or 300 bps) terminals hardwired to the multiplexer or connected by full duplex modems. Multiplexer hardware is capable of operating at programmable data rates of up to 2400 bps on any given channel. However, since the 12920B hardware utilizes single character buffering, software drivers written to operate under an RTE operating system should attempt to support no more than the aggregate throughput of 16 terminals at 300 baud each.

The 12920B Asynchronous multiplexer provides three interface cards, cables, and a connector panel. For devices hardwired directly to the multiplexer, the computer simulates a data set, so any terminal that can work directly with a data set will work directly with the multiplexer. Dialers, terminals, and data sets may be intermixed, with the restriction that each dialer uses two of the 16 ports provided by the multiplexer.

For data set applications, the multiplexer provides the signals needed to operate up to 16 type 103 data sets or 14 type 103 data sets and 2 type 202 data sets at 1200 baud. The type 103 data sets, including the 103A, E, F, and G, and 113A, are full duplex 300 baud asynchronous modems. Any combination of 16 103 type data sets and terminals may be connected and operated simultaneously. With 12920B option 001 an additional interface card increases the number of



control and status lines so that half-duplex Bell type 202 data sets with optional reverse channels can also be connected and operated.

Functional specifications

Capacity

16 channels for transmit and 16 for receive with external data sets or terminals. (Automatic calling units use two channels each.) Five channels for receive only are internal to interface for diagnostic purposes.

Multiplexer panel connector pin assignments

Pin No.	Multiplexer Designation	EIA Designation
2	Data in	(BB) Received data
3	Data out	(BA) Transmitted data
4	Status 2	(CF) Signal detector
6	Command 1	(CD) Data Terminal ready
7	Common return	(AB) Common return
8	Command 2	(CA) Request to send
11	Status 1*	(SB) Supervisory receive
12	Command 1*	(SA) Supervisory transmit
20	Status 1	(CC) Data set ready
22	Status 2*	(CB) Clear to send
23	Command 2*	(CH) Frequency select

*Signals available only with 12920B option 001 second (202 data set) control card.

NOTE: One cable is required for each input/output channel.

Communication

Bit transfer rate (Baud): 57 to 2400 bits/second, programmable.

Character length: 5 to 12 bits/character, programmable. Character size is the total number of bits (start, plus data, plus stop bits).

Mode of communication: Asynchronous bit serial.

Interrupt trigger: Leading, trailing, or both edges of the status line signal, program selectable.

Data lines: Two data lines to each of 16 channels.

Data in: Received data (BB).

Data out: Transmitted data (BA).

Control lines from first control card: These two lines to each of 16 channels.

Command 1 (C1): Data terminal ready (CD).

Command 2 (C2): Request to send (CA).

Control lines from second (option 001) control card:

These two lines to each of 16 channels.

Control 1 (C1): Supervisory transmit (SA).

Control 2 (C2): Data signal rate selector (CH/CI).

Status lines from first control card: These two lines to each of 16 channels.

Status 1 (S1): Data set ready (CC).

Status 2 (S2): Received line signal detector (CF).

Status lines from second (option 001) control card:

These two lines to each of 16 channels.

Status 1 (S1): Supervisory receive (SB).

Status 2 (S2): Received line signal detector (CF).

Logic levels at data set connectors*

Command and status lines:

Logic 1 (high): More positive than +3V (on).

Logic 0 (low): More negative than -3V (off).

Data lines:

Logic 1 (low): More negative than -3V (mark).

Logic 0 (high): More positive than +3V (space).

*Refer to EIA standard RS-232-C.

Configuration information

Computer compatibility: The 12920B is hardware compatible with 2108, 2109, 2112, and 2113 computers.

Computer I/O Channels required: The 12920B requires 3 computer I/O channels; the addition of 12920B option 001 requires one additional I/O channel.

Software support: Contact your HP Sales Representative for information. The 12920B includes a diagnostic, which is also available in the 24396A-F diagnostic library.

Connecting cables: To complete installation, cables will be required for data sets or automatic dialers connected to the 12920B. In most instances, the EIA standard cable supplied with a terminal equipped to connect to a modem, will connect directly, or through an extension cable, into the multiplexer connector panel.

Panel connectors: The 16 connectors on the multiplexer connector panel are standard EIA 232, 25 pin "cinch" connectors.

Installation: To install, plug the two data interface cards into adjacent slots in the computer I/O backplane and the control interface into a third I/O slot, which does not have to be

adjacent to the data interfaces. If used, the 12920B option 001 second control card plugs into a fourth I/O slot. Then mount the connector panel in the rear of the cabinet housing the computer (within reach of the 3.6m (12 ft) interface-to-connector panel cables), connect the data and control cable assemblies between the interface cards and the connector panel. Then integrate the asynchronous multiplexer into the computer's operating system and connect terminals and/or modems to it.

Electrical specifications

Current required from computer power supply

Supply voltages:	+5V	-2V	+12V	-12V
Standard 12920B	5.53A	0.258A	0.241A	0.477A
Add'l control card:	1.44A	0.102A	0.156A	0.236A

Physical characteristics

Connector panel height

22.2 cm (8-3/4 in).

Weight

Standard 12920B: 3.7 kg (8 lb).

Add'l control card: 270 g (10 oz).

Ordering information

12920B 16-channel Asynchronous multiplexer

The 12920B Multiplexer includes:

1. 12920-60001 Data interface card, upper select code.
2. 12920-60002 Data interface card, lower select code.
3. 12921-60003 3.6m (12 ft) Data cable assembly.
4. 12922-60001 Control interface card.
5. 12922-60003 3.6m (12 ft) Control cable assembly.
6. 30062-60002 Connector panel assembly.
7. Panel mounting hardware.
8. 30062-60017 Connector panel.
9. 30062-60016 Multiplexer test assembly.
10. 12920-16001 and 16002 Diagnostics on paper tape.
11. 12920-90007 Multiplexer reference and application manual.
12. 12920-90009 Diagnostics manual.

12920B option 001

12920B option 001 adds:

1. 12922-60001 Control interface card (second control card).
2. 12922-60003 3.6m (12 ft) Control cable assembly.

Accessory cables available

For data sets: 30062-60004 7.6m (25 ft).
30062-60007 15.2m (50 ft).

For automatic calling units: 30062-60005 7.6m (25 ft).
30062-60008 15.2m (50 ft).

Extender cables: 30062-60006 7.6m (25 ft).
30062-60009 15.2m (50 ft).
30062-60012 30.4m (100 ft).

The 12967A and 12618A interfaces provide for connection of Bell type 201, 203, 208, or 209 data sets or equivalent modems to HP 1000 computers, offering a choice of half duplex only or half or full duplex operation to the user.

Features

- EIA RS-232-C and CCITT V.24 compatibility
- Compatibility with Bell type 201, 203, 208, and 209 data sets or equivalent and IBM bisynchronous protocol
- Half (12967A) or full duplex (12618A) operation with secondary data channel
- Data transfer at rates to 20,000 bits/second, under program or dual channel port controller (direct memory access) control
- Double character buffering
- Special character recognition

Functional descriptions

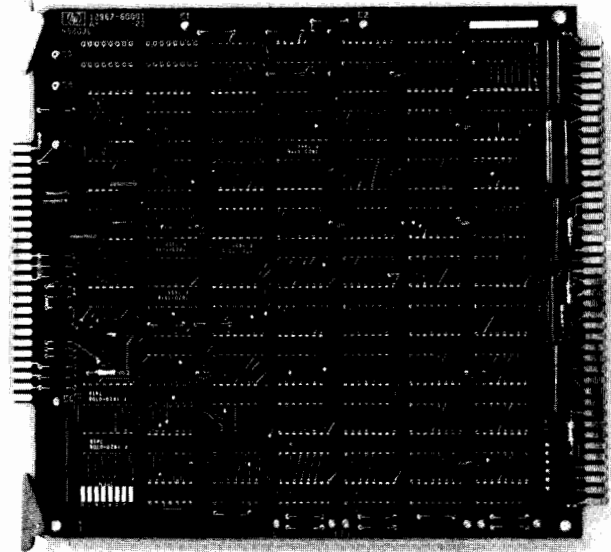
12967A Synchronous communications interface

The 12967A provides 20,000 bits/second transmission speed in half-duplex mode only, although it can be used with full-duplex data sets to reduce line turnaround time. A secondary data channel facility offers reverse interrupt capability.

Parity generation and checking (none, odd, or even) are programmable and the data set is controlled via the interface by programmed commands. A program controlled status monitor can be used to selectively enable or disable data set status interrupts to the computer. This feature makes it possible for the 12967A to interface to data sets conforming to EIA RS232C specifications.

12618A Synchronous communications interface

Unlike the 12967A, the 12618A is a two-card interface that can operate in either full or half duplex mode with Bell type 201, 203, 208, or 209 or equivalent data sets that provide timing. It communicates at rates to 9600 bits/second with fully-independent send and receive channels. Parity generation and checking (none, odd, or even), sync character, and character size are program-selectable, and the 12618A provides special character recognition/interrupt capability.



12967A Synchronous communications interface card

Functional specifications

Interface level

EIA or CCITT.

Operational mode

12967A: Half duplex only.

12618A: Half or full duplex.

Maximum data rate

12967A: Up to 20,000 bits/second.

12618A: Up to 9,600 bits/second.

Character size

12967A: Fixed at 8 bits.

12618A: Programmable, 1 to 8 bits.

Character buffering

Two characters.

Parity generation and checking

Programmable: none, odd, or even.

Special character recognition

12967A: None.

12618A: Program selectable.

Modem interface capability

The 12967A and 12618A interface with Bell type 201, 203, 208, and 209 data sets or equivalent data sets and provide secondary data channel.

Data set signals provided

EIA Designation	12618A		12967A
	Receive	Trans	
Protective ground	(AA)	(AA)	
Transmitted data		(BA)	(BA)
Received data	(BB)		(BB)
Request to send		(CA)	(CA)
Clear to send		(CB)	(CB)
Data set ready	(CC)	(CC)	(CC)
Signal ground	(AB)	(AB)	(AB)
Received line signal detector	(CF)		(CF)
Secondary received line signal detector			(SCF)*
Secondary transmitted data	(SBA)		(SBA)*
Transmitter signal element timing		(DB)	(DB)
Secondary received data		(SBB)	(SBB)*
Receiver signal element timing	(DD)		(DD)
Secondary request to send			(SCA)*
Data terminal ready	(CD)	(CD)	(CD)
Ring indicator	(CE)	(CE)	(CE)

*The user may choose either the pair SBA, SBB or SCA, SCF. wiring details are given in the 12967A Reference and Application manual.

Configuration information

Computer compatibility: The 12967A and 12618A synchronous interfaces are hardware compatible with all HP 1000 computers.

Computer I/O channels required: One for 12967A, two for 12618A.

Software support for 12967A: Software support for the 12967A Synchronous communications interface is limited to the diagnostic furnished with it, which is also available in the 24396A-F diagnostic library. A user-written driver programmed in assembly language will be required to run this interface in a real-time computer system.

Software support for 12618A: The 12618A is supported by the 91780A and option 100 RJE/1000 communications software, which includes a bisynchronous driver and an IBM 2780 Emulator for remote job entry to suitably equipped IBM 360/370 systems. (For more information, see the RJE/1000 data sheet in the HP 1000 computers and systems active software data book, available from Hewlett-Packard field offices.) The 12618A is also supported by a diagnostic furnished with it, which is also available in the 26396A-F diagnostic library. Otherwise, a user written driver, programmed in assembly language, will be required to run this interface in a real-time computer system.

Installation: To install, plug the interface(s) into the computer I/O backplane, connect the interface cable(s)

to the modem, and integrate the interface(s) into the operating system. With the 12618A, the receive card uses the higher priority (lower select code number) I/O channel, and the send card uses the next lower priority channel. A 12620A Breadboard interface is required to serve as a privileged interrupt fence for the 12618A interface used with RJE/1000 software; it would be installed in the next lower priority I/O channel following the 12622A send interface.

Electrical specifications

Current required from computer power supply

	+5V	-2V	+12V	-12V
12967A	1.75A	0.06A	0.01A	0.02A
12618A	2.8A	0.23A	0.1A	0.07A

Ordering information

12967A Synchronous communications interface

The 12967A Synchronous communications interface includes:

1. 12967-60001 Synchronous communications interface card.
2. 12967-60003 Test connector assembly.
3. 12967-60004 15.2m (50 ft) Data set cable.
4. 12967-16001 Diagnostic on paper tape.
5. 12967-90003 Interface reference and application manual.
6. 02100-90157 Diagnostic manual.

12618A Synchronous communications interface

The 12618A Synchronous communications interface includes:

1. 12621-60001 Receive interface card.
2. 12622-60001 Send interface card.
3. 12621-60005 Receive test connector assembly.
4. 12622-60005 Send test connector assembly.
5. 12618-60001 15.2m (50 ft) Branched data set cable.
6. 12621-16001 and 12622-16001 Diagnostics on paper tape.
7. 12618-90001 Interface users manual.
8. 12621-90001 Interface manual.
9. 12622-90001 Interface manual.
10. 12621-90006 and 12622-90005 Diagnostic manuals.

91780A & 100 RJE/1000 Software (for 12618A)

For listing of items included, see the 91780A RJE/1000 data sheet, page 2-1.

The 12589A Automatic calling unit interface can be used with any HP 1000 M-Series computer equipped for data communications and a Bell 801 automatic calling unit or equivalent. The interface together with the 801 allows the computer to automatically dial a predetermined phone number to access a remote terminal for data transmission. Automatic calling can be used with HP asynchronous or synchronous interface kits.

Features

- EIA RS-232-C and CCITT V.24 compatibility
- Operates in conjunction with Bell 801 automatic calling unit or equivalent
- May be used with any HP synchronous or asynchronous communications interfaces

Functional description

When placed in operation, the calling unit interface card is initialized by instructions and control words from the computer. The interface then indicates to the calling device that the computer is ready to initiate a call. When the calling device is ready for operation, the computer outputs the numbers to be dialed. At the completion of dialing, the calling device switches the transmission line to the data set to allow data transmission. Remote terminals calling into the system are routed directly to the data set for automatic answer and subsequent data transmission.

Functional specifications

Device status lines

Power indicator (PWI)
Present next digit (PND)
Data line occupied (DLO)
Data set status (DSS)
Abandon call and retry (ACR)

Device control and dialing lines

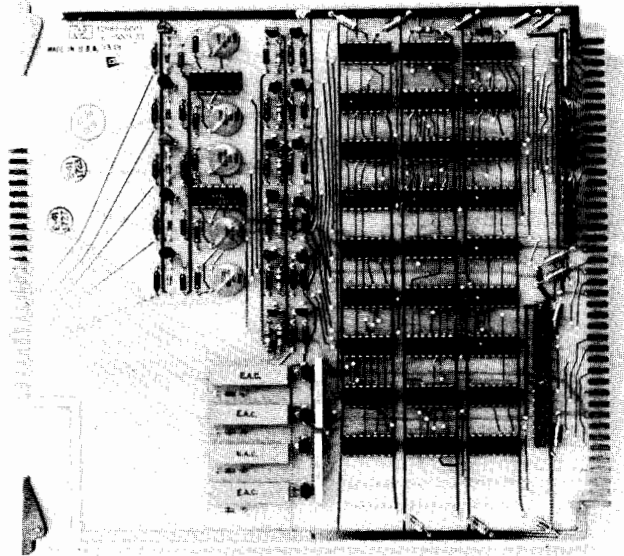
Call request (CRQ)
Digit present (DPR)
Four digit leads (NB1, NB2, NB4, NB8)

Compatible communications equipment

The 12589A is compatible with Bell 801A or 801C automatic calling unit or equivalent

Interface level

EIA RS-232-C, CCITT V.24



Configuration information

Computer compatibility: The 12589A is hardware-compatible with the 2105, 2108, 2109, 2112, and 2113 Computers.

Computer I/O channels required: One.

Software support: Contact your HP Sales Representative for more information.

Installation: To install, plug the 12589A interface into the computer backplane, connect the interface cable to the automatic calling unit, and integrate the interface into the operating system.

Electrical specifications

Current required from computer power supply
0.65A(+5V), 0.05A(-2V), 0.05A(+12V), 0.055A(-12V)

Ordering information

12589A Automatic calling unit interface

The 12589A Automatic calling unit interface includes:

1. 12589-6001 Automatic calling unit interface card.
2. 12589-6004 Interface cable.
3. 12589-6005 Test connector.
4. 12589-90002 Interface manual.



Sales and service from 172 offices in 65 countries.
1501 Page Mill Road, Palo Alto, California 94304

Printed in U.S.A. 3/78 5953-0816(22)