1640A

1640A Description

Model 1640A Serial Data Analyzer offers an efficient method for locating faulty system components in computer networks or, in general, anywhere RS-232C (V24) serial interfaces are used. The network may be small, consisting of a minicomputer or microprocessor and a few terminals, or a complex, centralized CPU-based communications network, either of which require rapid problem location to minimize system downtime. The 1640A can also be used during system design for debugging software, during systems integration, and for preventive maintenance.

As a serial data analyzer, the 1640A monitors RS-232C (V24) status information and records serial data in its 2048 character memory. This passive monitoring capability makes it possible to locate network problems without interrupting communication links other than during initial connection.

In an active mode, the 1640A can simulate a network component and interact with the network by generating specific messages. This allows the 1640A to be connected to a terminal and exercise it as if it were a computer or it can replace a terminal and, when addressed, reply to the computer.

Easy-to-use

Operating simplicity is achieved using menus which present listings of the possible measurement parameters on the CRT. Menu keys across the top of the keyboard are FORMAT, MODE (either Monitor or Simulate), TX ENTRY, and LIST. Each menu presents a display of the parameters and various selections adjacent to each parameter. In most cases, selections are already defined and the operator simply uses (1) the cursor keys to position the cursor to the desired parameter and (2) the Field Select key until the desired selection is displayed in the inverse video field.

Format, Mode, and TX Entry menus can be automatically set up with an optional PROM (10291A) which is installed in the HP-IB board (Option 001). Up to 10 different instrument setups can be specified (two per PROM) by setting rear panel switches and pressing the "Load" pushbutton.

One of the distinguishing characteristics of the 1640A is that it is completely preprogrammed, yet versatile because of the comprehensive set of variables which are menu-entered. If additional capability is desired, the 1640A's feature set can be extended with the Hewlett-Packard Interface Bus (HP-IB, HP's implementation of IEEE-488-1975).

Computer network troubleshooting

The 1640A is much more than a line monitor which observes serial data; it is also an analyzer capable of identifying and locating network problems. Most of these fall into one of three categories: (1) software related problems, usually in protocol sequences; (2) errors in the data; or (3) interface problems—particularly in the RS-232C timing relationships. There are three different internal trigger modes and an external trigger mode to help identify these problems.

With the 1640's powerful trigger capability and a basic set of preprogrammed run modes, common network problems can be quickly located, even by semi-skilled personnel, keeping failure costs to a minimum.

Trigger sources: (1) Protocol errors can be detected with character sequence triggering where up to eight characters in sequence on either the transmit or receive data leads can be specified as the trigger event. (2) Errors in the data, either parity or optional LRC/CRC, can be used as a trigger source. (3) Time interval violations, particularly at the RS-232C (V24) interface, can be detected and used as a trigger. In addition to these three internal trigger sources, the 1640A can be triggered externally from RS-232C handshake ON conditions, or from another source such as a Computer Halt flag output.

Serial data analysis

Most network problems can be diagnosed while passively monitoring the RS-232C (V24) interface. The 1640A's Monitor MODE menu allows selection of Trigger Source and Suppression conditions, as well as one of three preprogrammed RUN modes: Count Triggers, Trigger Starts Display, and Trigger Ends Display. In the Count Triggers mode, data is continuously acquired until the analyzer is manually stopped. The last 2048 characters are retained in memory. In the Trigger Starts Display mode, data collection starts when the trigger event occurs. One complete record of 2048 characters is made and the measurement automatically stops. In the Trigger Ends Display mode, data is continuously acquired until the trigger event occurs, then an additional 64 characters are acquired and the measurement automatically stops. This allows you to see data sequences leading up to the trigger, and the network's attempt to recover after the trigger. After any of the three RUN modes are completed, the 1640A displays the results of the most recent time interval measurement and the number of trigger occurrences which took place during the run.

Network component simulation

Because some network problems cannot be located without interactive testing, the 1640A can simulate both Data Terminal Equipment (DTE) and Data Communications Equipment (DCE) at the RS-232C (V24) interface. Simulation allows loop-back testing so that the precise location of a problem can be found after it is isolated to a particular link. Also, system components can be checked at the site to determine if they are operating properly. A simple matrix setup establishes the proper hardware interface, and the TX ENTRY and Simulate MODE menus provide the software interface.

The TX ENTRY menu allows up to 1024 characters to be sent in up to eleven separate blocks. Transmit data can be entered through the keyboard, a "copy" or "learn" feature, or remote entry.

Messages can be composed directly from the 1640A's hexadecimal keyboard with the characters displayed in any code set during composition. A cursor shows the position of the next character to be entered. Only information bits have to be entered because parity or optional CRC characters are automatically added during transmission. Edit keys allow the composer to insert or delete characters during any phase of the composition.

Protocol sequences are often too long and complicated for convenient manual entry. If the 1640A's monitor mode is used to record the actual network protocol, its "Copy Transmit Monitor" or "Copy Receive Monitor" feature will automatically transfer appropriate data to the transmit message buffer. After transfer, the message can be edited, broken into blocks, syncs added, address changed, idles deleted, etc., through the keyboard.

Messages may be entered remotely using a teletype through the current loop interface (HP Model 10284A) or with the optional HP-IB interface (IEEE-488-1975) and an HP Model 9825A Computing Controller.

PROMS (10291A) containing user-definable "canned" messages can be installed on the HP-IB board and automatically loaded into the TX ENTRY buffer with a rear panel pushbutton. This allows fast and error-free message entry without an accompanying Computing Controller—a feature especially useful in field service applications.

The 1640A's Simulate Mode menu allows selection of HDX/FDX operation, the choice of Transmit First or Receive First, the Reply condition and three different preprogrammed RUN (execute) modes. In addition, you can specify any of the three internal trigger sources and a suppression condition if desired.

Preprogrammed run modes: Single and Count Trigger mode directs the 1640A to send an entire message once. After a total of 2048 TX and RX characters has been captured the run stops automatically. The Repeat and Count Triggers mode causes the message to be sent each time the reply condition occurs. The run must be manually halted. The Repeat and End on Trigger mode causes the message to be sent after each occurrence of the reply condition until the specified trigger condition occurs. This allows repetitive testing with a permanent display of the data at a suspected fault. At the end of any test, the number of trigger events, number of transmit message repetitions, and results of the last time interval measurement are displayed.

Programmable operation

The 1640A is designed to solve most network problems in a passive sense, or when necessary, as an interactive simulator. For more complex network interaction the HP-IB option, along with a suitable controller, adds such capabilities as remote control, sophisticated programming, mass storage, data manipulation, and hard copy.

1640A Specifications

Note: Specifications describe the instrument's warranted performance. Supplemental Characteristics provide information useful for applying the instrument by giving non-warranted operating parameters.

Inputs

Impedance: > 30 kΩ on all interface connections except ground.
Connector: mates with RS-232C (V24) interfaces.

Format

Framing: 5, 6, 7, or 8 information bits with or without a parity bit.
Data codes: ASCII, Hex, or EBCDIC. Other optional code sets in addition to or in lieu of EBCDIC are available.

Data modes

Asynchronous: 1 or 2 stop bits in addition to information and parity bits.
Synchronous: 1 or 2 user-entered synchronizing characters. Sync search may be initiated on a user-entered character immediately followed by a user-entered number of idle characters from 0 to 99. Idle is defined as a steady mark (logic 1's) in all bit positions.

Speed

External Clock (Synchronous):

CHARACTER SIZE INCLUDING PARITY (bits)	NORMAL OPERATION		HIGH SPEED MODE*	
	Bits Per Second		Bits Per Second	
	HDX	FDX	HDX	FDX
9	19200	9600	19200	9600
8	14400	7200	19200	9600
7	14400	7200	19200	9600
6	9600	6400	14400	7200
5	9600	4800	9600	7200

*Memory data is not displayed while a run is in progress. High speed switch located on rear of Patch Panel Matrix.

Internal Clock (Asynchronous): 50, 75, 110, 134.5, 150, 200, 300, 400, 600, 900, 1200, 1800, 2400, 4800, and 9600 bps, ±1%. Also, any external X1 clock to a maximum of 9600 bps may be used for asynchronous operation.
Note: asynchronous operation follows the same speed vs. character specification as synchronous operation.
ERROR CHECK: odd, even, or no parity; optional (003) BCC generation and checking based on LRC-8, CRC-16, or CRC-CCITT from a user-entered beginning to a user-entered ending character. Optional (002) SDLC frame check sum (FCS) generation and error checking for SDLC frames.

Triggering (trap) modes

Character sequence: up to 8 sequential characters including NOT and DON'T CARE may be used as a trigger and may be specified on either the send or receive data lead.
Note: DON'T CARE is the set of all possible bit patterns of any given character framing length. The NOT character is the set of all characters except the one specified. For example, NOT C ($\overline{C}$) is set of all non C (A, B, D, etc.).
Time interval: time intervals between two RS-232C events may be used as a trigger. Max or min times to 6553 ms with 1 ms resolution may be specified.
Error: data errors, as defined in the FORMAT menu under ERROR CHECK, may be used as a trigger.
External: trigger supplied from user hardware or RS-232C ON conditions (>+3 V).

General

Memory: 2048 characters of monitor buffer and 1024 characters of transmit message buffer.
Display: 10 cm by 13 cm CRT which displays up to 480 characters. All characters in memory can be viewed via the ↑↓ Cursor keys.

1640A supplemental characteristics

Patch panel matrix: permits the 1640A to be configured to a variety of system interface formats depending on the application. The 1640A has 9 inputs which allow the following RS-232C (V24) pin assignments: TX (transmit data) −2, RX (receive data) −3, RTS (request to send) −4, CTS (clear to send) −5, DSR (data set ready) −6, CAR DET (carrier detect) −8, SCT (serial clock transmitter) −15 or −24, SCR (serial clock receiver) −17, and DTR (data terminal ready) −20. For modem simulation applications, the matrix would be reconfigured. Mylar overlays are provided with prepared pin configurations for common applications to facilitate matrix setup. An auxiliary, tri-state LED may be used to monitor any pin 2 through 25. The matrix also provides access to the time interval counter, external trigger input, trigger output, clock output, and buffered power supplies (±12 V, ground).

Test results: after any of the three run modes (monitor and simulate) is stopped, the following test results are displayed:
1. Last time interval measured, or the time interval trigger event, between user-definable start and stop events available on the patch panel matrix.

2. Number of trigger events counted during the run.
3. Number of messages transmitted by the 1640A (simulate only).
Default: returns the displayed menu to its wakeup condition.
Display hold: pressing and holding the RUN key prevents the display from being over-written with new data for extended viewing of data of interest while a run is in progress.
Suppression: allows capturing only information of interest for efficient use of memory, easier data analysis. Synchronizing characters, idles (all logic one's), nulls (all logic zero's), or everything but trigger and next n characters (with n from 0 to 99) may be suppressed.

Monitor mode
Run (execute) modes
Count Triggers: continuously monitors and records data and counts trigger occurrences; record stopped manually.
Trigger Starts Display: trigger starts a single record of 2048 characters (any combination of transmit and receive data).
Trigger Ends Display: trigger stops a continuous record. Built-in delay of 64 characters captures 64 characters after trigger event.

Simulate mode
The 1640A can simulate a CPU, terminal, or the digital side of a modem.
Output: ≥3 V into 3 kΩ load. Output rows on the patch panel matrix are TX (Transmit Data), RTS (Request To Send), and DTR (Data Terminal Ready).
Interface control signaling: automatic with additional control available through the matrix.
State: ON is > +3 V; OFF is < −3 V. Nominal values of driven leads are ±8 V to ±12 V.
HDX: Request To Send is on only during transmission. Data Terminal Ready is always on.
FDX: Data Terminal Ready is always on; Request To Send is programmable via the matrix, either always on or on only during transmission. Idle condition between transmissions is a steady mark (asynchronous) or the user-entered sync character (synchronous).
Reply on: similar to, but separate from, trigger. A Reply On sequence of from 1 to 8 characters, including DON'T CARE and NOT characters, immediately followed by an internally generated time delay from 0 to 6553 ms may be entered which enables a message block to be sent only when these two events occur.
Run (execute) modes
Single and Count Triggers: a message block is transmitted after each occurrence of the REPLY ON condition until all message blocks have been sent once. The RUN automatically stops when a total of 2048 characters (including the transmitted message) have been recorded in the monitor buffer.
Repeat and Count Triggers: a message block is transmitted after each occurrence of the REPLY ON condition until all message blocks have been sent. The process repeats until manually stopped with the last 2048 characters retained in memory.
Repeat and End on Trigger: a message block is transmitted after each occurrence of the REPLY ON condition until all message blocks have been sent. The process repeats and automatically stops when the trigger event occurs with the last 2048 characters prior to the trigger event retained in memory.
Transmit modes
Transmit First: the first message block is sent by pressing RUN. Succeeding blocks are sent following each occurrence of the REPLY ON condition.
Receive First: a message block is sent after each occurrence of the REPLY ON condition.
Transmit message entry: a total of 1024 characters including block delimiter continue symbols (|>) and the end symbol (|—), may be entered. The transmit memory may be loaded through the Hex keyboard, by transferring contents of monitor memory to the transmit memory with a single keystroke, or, with Option 001 (HP-IB), through a remote ASCII keyboard or user-definable PROMS (10291A).

Message Editing Keys
CONTINUE: Places a |> symbol in the message as a block delimiter. Up to 10 continue symbols may be entered. The continue symbol is recognized only by the 1640A and is not sent as part of data.
END: places a |— symbol as a message terminator. Additional messages may be added after end symbol as user instructions but will not be transmitted. The end symbol is not sent as part of data.
INSERT: inserts a space for an additional character at the point indicated by a moveable cursor by automatically shifting all following characters one cell to the right.
DELETE: deletes character immediately above a moveable cursor. All following characters are automatically shifted one space left.

General
Power: 100, 120, 220, 240 Vac; −10% to +5%; 48 to 440 Hz; 150 VA max.
Size: 251 H x 335 W x 546 mm D with handle (9⅞" x 13³⁄₁₆" x 21½"); 445 mm D without handle (17½").
Operating environment: temperature, 0°C to +55°C; humidity, to 95% relative humidity at +40°C; altitude, to 4600 m (15 000 ft); vibration, vibrated in three planes for 15 min. each with 0.3 mm (0.015 in.) excursions, 10 to 55 Hz.
Weight: net 11.4 kg (25 lb); shipping, 15.9 kg (35 lb).
Accessories supplied: one 3 m (10 ft) RS-232C interface cable; Model 10289A Mylar overlay kit, shorting pins and Mylar punch; front panel cover; one 2.3 m (7.5 ft) power cord; one operator's guide; and one service manual.

Options and accessories

	Price
001: HP-IB Interface	add $475
002: SDLC (Synchronous Data Link Control)/HDLC (High Level Data Link Control) Interface	add $200
003: LRC, CRC-16, and CRC-CCITT Check/Generation	add $150
H07: Adds capability for up to seven additional internal code sets in addition to ASCII and Hex. Any combination of 5, 6, 7, or 8 bit codes may be specified with the appropriate 10290A option	$100
10281A HP-IB Interface: field installable kit to provide Option 001 capability	$475
10282A SDLC/HDLC Interface: field installable kit to provide Option 002 capability	$200
10283A LRC, CRC-16, and CRC-CCITT Check Generation: field install kit provides Opt 003 capability	$150
10284A Current Loop Interface: provides 20/60 mA interface to most common teletype units	
10287A MIL 188-C Interface	
10289A Mylar Overlay Kit: consists of 3 prepunched matrix overlays for common applications and 20 blank overlays for user-definable tests	$40
10290A Special Code Set ROM: special PROM's for displaying data in other codes such as BCD, TRANS-CODE etc., in lieu of (or, on special order, in addition to) the standard code set	
10291A User-Definable Menu PROM: special PROM's that allow up to 2 different user-definable tests for fast reconfiguring of the 1640's menus. The 1640A must have the HP-IB Option. Up to 5 PROMS (10 tests) may be installed	
10292A Firmware Package for 9825A: application programs allow tests to be performed without learning 1640A Opt 001 (HP-IB) device dependent commands and 9825A controller instructions	
10299A Rack Mount Adapter: adapts 1640A to standard 483 mm (19 in.) rack. Adapter is 310 mm (12⁷⁄₃₂ in.) H, 540 mm (21¼ in.) W, and 540 mm (21¼ in.) D	$225
1007A Testmobile: offers efficient mobility for the 1640A Serial Data Analyzer which makes it easier to move to different test locations. The 1007A is a basic testmobile which is configured to your needs through add-on options. These options range from trays to drawers plus a power strip.	$245
1640A Serial Data Analyzer	**$5800**