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# Word Processors

## *Should You Switch?*

PC Labs tests 8 of today's top competitors.

- Graphical packages storm the market.
- Word and WordPerfect guard their turf.
- Old corporate standards try to hang on.



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# Inside

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CIRCLE 726 ON READER SERVICE CARD

This issue's cover story focuses on the eight major corporate-level word processors that together constitute almost 90 percent of the word processing market.

No other topic elicits such strong reactions from readers. We know how attached you are to your word processor; we know you don't want to switch to a new one; and we don't necessarily recommend that you do. But if you take a look at the innovative features some of these packages include in their latest versions, you may be moved to experiment.

Along with the eight word processor evaluations, we have included a somewhat subjective but nevertheless instructive evaluation of three of the most popular grammar-checking packages. In order to test these

writing assistants in a real-world scenario, assistant editor Rink Murray wrote a truly terrible business memo riddled with all kinds of errors, some subtle, some glaring. Then he pitted the grammar checkers against the best competition he could find: *PC Magazine's* very own grammar checker, copy chief and copy-editing guru Glen Becker. There's no need for suspense; the human being did the best job of cleaning up the messy memo. The contest wasn't even close.

Becker oversees five copy editors, all of whom work under the direction of copy edit manager Karen Carter.

Carter and her staff of sticklers are our guardians of style, the ones who decide that *PC Magazine* will call a megabyte an MB—not an Mb, not a meg and not an Mbyte—and then enforce that rule with an unwavering iron hand.

Along with the editorial-production staff, the copy editors also serve as error-catching consistency cops, taking the time to make sure that when a review cites the price of a software package as \$249, the features table, the fact file, and the Editor's Choice box all agree. Given that the average issue of *PC Magazine* can easily contain 120 product evaluations, that's no small accomplishment.

And as more of the first people to see the ar-

ticles that will evolve into an issue of *PC Magazine*, the copy editors also play the vital role of first readers, bringing unclear or technobabble-heavy paragraphs back to other editors and asking, quite simply, "What's this supposed to mean?"

So as we look back at 1990 and tally up another 4,000 carefully copy-edited pages, we salute the eagle-eyed team that scrutinizes every line. Twice. Their names are Glen Becker, Karen Best, Stephanie Izarek, Michael Muchmore, Ann Ovodov, and Oliver Rist, and I'm sure I've spelled them correctly. —Donald P. Willmott



*PC Magazine's* copy edit team: The people who guarantee every issue's consistency and readability.

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**Advertising Office:** One Park Ave., New York, NY 10016; (800) 33 MAG AD, (212) 503-5100  
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9,600-BPS MODEMS

# Breaking the Speed Barrier

**PC LAN Labs tests seven rapid-fire modems complying with V.32, V.42, and V.42bis standards. They get file-transfer chores done in a hurry while correcting errors and compressing files on the fly.**

by Mike Byrd

Like a teenager with a dragster, the modem industry constantly strives to squeeze the last bit of speed out of its hardware. But the laws of physics and economics limit the maximum electrical signaling speed over dial-up telephone lines, just as they limit the speed of a car on the quarter-mile track. Dreams of shorter elapsed times hinge on turbocharging existing technology. The latest modem turbochargers center on new V.32, V.42, and V.42bis error-checking and data-compression protocols, yielding throughput rates of 9,600, 19,600, and even 38,400 bits per second over dial-up telephone lines.

Do you need all this speed? If your organization must transfer large files over telephone lines, these modems can save time and money. But we found that total compatibility is still more a goal than a reality. For the time being, you should either buy all of your V.42bis modems from the same vendor or test for compatibility before you buy. Also, find out about upgrade information from your vendor if you buy your modem before next spring; additional standards may be in place by then.

This review looks at the hottest modems you can put on dial-up telephone lines, all complying with the V.32, V.42, and V.42bis standards. We evaluate seven high-speed modems from ATI Technologies, Hayes Microcomputer Products, Microcom, Multi-Tech Systems, Telebit Corp., Universal Data Systems, and U.S. Robotics. Although these modems carry retail price tags ranging from \$699 to \$1,345, quantity discounts and mail-order prices are usually available.

#### ESTABLISHING COMMUNICATION

Since phone lines are designed to carry sounds, they're not suitable for conveying the digital data signals in your computer. Phone signals pass through countless transformers and switching stations while they travel from origin to destination; digital signals would simply get lost en route. A modem converts digital bits from your PC to analog tones more suitable for telephone lines. The receiving modem then converts the tones back to digital bits for subsequent processing by a PC.

When you make a voice call, the person at the receiving end usually answers, "Hello." You respond with your name, and the conversation begins. Modems work much the same way, *handshaking* to establish communications. When your modem calls another, the second modem responds with a set of answer tones. The two modems then negotiate to find out how to communicate with each other. The underlying procedure, called a *renegotiation protocol*, helps the modems determine which signaling, error-correction, and data compression protocols to follow.

First they go through a series of questions and answers, establishing first what kinds of modems they are and then what transfer rate they are going to use. Usually this handshake assumes the fastest send rate, negotiating down to the highest common rate. Noise on the telephone line may lower the signaling rate further.

Next, the modems negotiate whether a hardware error-correction protocol is available, starting with the highest protocol level for error correction and data compression. When negotiations are complete, the modems normally transfer control to the PC software for processing.

#### MODEM TALK

Modems typically need some instructions concerning what you want to do. The computer sends a set of characters called a *configuration string* to the modem and tells it

how to communicate with your computer, your phone line, and other modems. You usually use the Hayes Standard AT Command Set or a derivative to tailor your modem's configuration; you can even send Hayes commands directly to your modem to place and answer phone calls. But these commands stop at making the connection; you need more software to perform such activities as transferring files. Once connected, your communications software handles those chores.

Even though the Hayes Command Set is a de facto standard, compatibility remains a problem. A modem isn't necessarily compatible simply because it dials a

As PC hardware and software systems evolved, files got bigger and modems were used for increasingly complex tasks.

number in response to the ATDT command; various companies implement many other important commands differently (for more information see "Inside Talk: 2,400-bps PS/2 Modems," *PC Magazine*, July 1989). You might need to consult both the modem vendor and the vendor of your communications software to get all of your modem's features correctly initialized.

#### ASYNCHRONOUS VS. SYNCHRONOUS

Most modems offer a range of transmission *modes* or connections to a variety of environments. PC-to-PC modem transmissions generally use the *asynchronous* mode. In asynchronous transmissions, the modem sends each character independently, with certain bits announcing the arrival and completion of the character.

The *synchronous* mode provides connectivity from PCs or terminals to mainframe computers. In synchronous format, transmit and receive clocks at both ends of

the link control the precise timing of the characters sent in a block. All the hardware in the link (mainframe port, modems, and PC or terminal) must operate using a single clocking source.

Several synchronous protocols help format and transmit data. These include Synchronous Data Link Control (SDLC), High-level Data Link Control (HDLC), and Binary Synchronous Control (BISYNC). These protocols format the data into blocks, add control information, and check this information to provide error control.

#### THE NEED FOR SPEED

PC users deserve much of the credit for driving the improvements in the technology of modems for dial-up lines. Since the telephone companies and information services bill by the minute, they have no incentive to provide fast hardware. Ten years ago in the United States, roughly when IBM was making plans to introduce its first PC, the Bell Operating Company standards for dial-up telephone lines (Bell 103 and Bell 212) described 300- and 1,200-baud signaling speeds. Modems for these speeds carried prices of over \$400 in less-inflated dollars.

As PC hardware and software systems evolved, files got bigger and modems were used for increasingly complex tasks, such as remote control of networked PCs. Four years ago, Rockwell International Corp. and other manufacturers made chip sets available for modems following the international V.22bis standards. The price of these modems is well under \$300 today.

As PC users moved an ever-growing volume of data through modems, they demanded even higher throughput rates. Hayes Microcomputer Products, Microcom, and U.S. Robotics soon rose to the challenge by offering faster modems using proprietary transfer protocols. These worked their high-speed magic when connected with like modems but regressed to the standard 2,400 and 1,200 bps when a modem from another manufacturer sat at the other end.

#### ENTER STANDARDS

The International Consultative Committee on Telephone and Telegraph (CCITT in French) established the V.32 standard to avert the creation of an electronic Tower of Babel by manufacturers with their proprietary standards (see the sidebar "The Modem Alphanumeric Jungle"). The V.32 standard describes how modems should



## EDITOR'S CHOICE

## • MultiModemV32 MT932EAB

If you're looking into purchasing one of the modems reviewed here, chances are you're buying for speed. A pair of V.32/V.42bis modems will pay for themselves in a few months by shortening the time you spend on long-distance calls. Thus, our Editor's Choice decision is strongly influenced by throughput, along with ease of use.

Some products, particularly the Hayes V-Series Ultra Smartmodem 9600, offer X.25 and a variety of other connection options. If you want those options, then the Hayes becomes the clear and comfortable choice as a high-quality product at a competitive price. Hayes has also made efforts to ensure compatibility with modems from different companies.

From the perspective of performance and ease of use, however, Multi-Tech Systems' MultiModemV32 MT932EAB wins our approval as Editor's Choice. This product usually moved data at least as fast as any other modem under a variety of conditions, and it's ready to work right out of the box.

The Microcom QX/4232hs deserves an honorable mention for its speed. The company holds a strong reputation as a leader in setting technical standards. Yet we generally prefer the Multi-Tech modem's ease of use.

The runner-up for reliability and stability is the ATI 9600etc/e. With its winning price tag of \$699, the modem's full retail cost beats even the street price of competing products. The ATI 9600etc/e wasn't as compatible with other vendors' products as the Hayes, but when two ATI modems were talking together during our tests, they worked through tough conditions without an abort.

Meanwhile, new modems are evolving quickly, and all of the companies assure us that they will work out their compatibility differences within the next few months.

talk to each other using two-way signaling at 4,800 and 9,600 bps over dial-up telephone lines.

Unfortunately the V.32 standard did not provide a method for error control. Since V.32 signaling is more sensitive to noise and echoes on the telephone line than lower-speed protocols are, you need a hardware- or software-driven error-control scheme to retain accuracy.

Microcom developed its own standard for asynchronous data error control, Microcom Network Protocol (MNP). Versions of MNP Classes 2, 3, and 4 are now available in a variety of modems and communications software packages. The software implements the error control protocols either in an application or in a modem's ROM, and the error checking operates independently of the signaling scheme used by the modem.

Last year, the CCITT issued a hardware-implemented asynchronous error-correction standard called V.42, which describes two error-correction schemes. The primary protocol is named Link Access Procedure for Modems (LAPM). The secondary or support protocol is functionally the same as MNP Class 4. If you want to communicate between two modems claiming to be V.42 compliant, you should connect them using the LAPM protocol. If you use one V.42-compliant modem and another compliant with MNP 4, you should employ the MNP 4 protocol. The LAPM method offers slightly better error recovery and reliability than MNP 4.

While the V.42 and MNP 4 protocols help maintain reliability, they don't improve throughput. After you increase the electrical signaling rate as much as possible and improve reliability, the next step in turbocharging involves file compression. When you compress files to remove redundant data or empty sections, the time it takes to send them across the telephone line decreases.

It's possible to compress files prior to transmission using PKZIP or other compression products, but the recipient must then decompress the file before it is usable. While compressing and decompressing files on the fly is easier for all involved, our tests at PC LAN Labs show that you get the best throughput by handling compression as a separate step before starting transmission.

**DATA COMPRESSION PROTOCOLS**

Microcom again led the industry by introducing the MNP Class 5 data-compression

protocol. It soon became a feature in many modems and some application programs. Software supporting the MNP 5 protocol offers the ability to compress files to half their original size during transmission.

In late 1989, the CCITT issued the V.42bis standard (*bis* comes from the French word for revision), describing how to implement data compression on the fly in hardware. Using the Lempel-Ziv compression algorithm, the new V.42bis protocol potentially offers 35 percent greater data compression than MNP 5. For a 9,600-bps modem, this means a potential throughput of 38,400 bps for files with repeating patterns. For most file transfers, however, you can expect throughput of around 19,200 bps for files not previously compressed through other means (see the sidebar "Data Compression: Is It All It Claims?").

The V.42bis standard adapts to the data flow more quickly than MNP 5, turning data compression off and on as required by using an automatic feedback mechanism. This gives it an advantage over MNP 5 when transmitting previously compressed files, since the MNP 5 compression algorithm can cause compressed files to expand, reducing overall throughput. Consequently, its users often must manually disable the MNP 5 protocol when transmitting or receiving previously compressed files. V.42bis compression software works only with software that uses the V.42 error-correction protocol. All of the modems we found on the market with V.42bis also include MNP 5 as an alternative protocol.

It's important to understand that the V.32 standard primarily describes the electrical signaling scheme used over the telephone wire. In this way, V.32 resembles the V.22bis, Bell 103, and Bell 212 standards. Other standards, such as MNP, V.42, and V.42bis, describe actions taking place above the level of electrical signaling. So you can have modems using different combinations of signaling and error correction protocols. The modems in this review use V.32 signaling with V.42 error correction and V.42bis compression. Coincidentally, they also offer MNP error detection and file compression.

**FUTURE STANDARDS**

A modem using V.32 signaling with V.42bis error correction and compression is not the last modem you'll ever need. The CCITT is evaluating a revision to the V.32 standard, appropriately named V.32bis.



V.32bis adds 7,200-, 12,000-, and 14,400-bps transfer rates and a faster renegotiation protocol. V.32bis will be able to renegotiate the protocol in less than 100 milliseconds. The standard is expected to receive final approval from the CCITT by February 1991, and vendors should have V.32bis modems and upgrades available by spring or summer.

Note the recent availability of V.22bis

modems with 2,400-bps signaling and V.42bis data compression. Most new 2,400-bps modems should be V.42bis compatible within a year.

The Integrated Services Digital Network (ISDN) also waits somewhere down the road for many of us. ISDN can convert analog telephone lines to digital lines,

making them more compatible for computers transferring voice and graphics. Many telephone systems are converting to digital capability, but ISDN is not widespread and will not be fully implemented in this country—much less the rest of the world—for a long time. So don't wait for ISDN if you need high-speed wide-area connectivity now. Wait for a new V.32bis/V.42/V.42bis modem next spring; or if

## THE MODEM ALPHANUMERIC JUNGLE

by Mike Byrd

If we didn't have standards, every modem company would use proprietary protocols and no one could communicate using another vendor's modem. Keeping track of the standards often means keeping track of the lingo, and in the world of telecommunications, the lingo translates into some fairly arcane groups of letters and numbers. Nevertheless, before you shop for modems, you need to familiarize yourself with the terminology.

If your modem meets the latest standards, chances are that it can take advantage of recent developments in the telephone network and in communications software. These developments help make possible faster speeds and more reliable error correction.

The International Consultative Committee on Telephone and Telegraph (CCITT) sets the standards that ensure international telephone systems connectivity. The CCITT identifies standards on modem data transmission with the letter V followed by a period and a number. Sometimes the letters *bis* follow the number. *Bis* is a French term meaning second version; it denotes a revision of a protocol, not necessarily an extension of the previous version.

The field of modem communications is filled with other terms with similarly explicit meanings. Following is a guide through the alphanumeric jungle of common modem terminology:

### MODULATION PROTOCOLS

**Bell 103/113** Asynchronous full-duplex modem transmission at up to 300 bits per second.

**Bell 212** Asynchronous and synchronous full-duplex modem transmission at 1,200 bps.

**HST** U.S. Robotics' High Speed Technology: a proprietary modulation allowing connection speeds of up to 14,400 bps. Data flows asymmetricaly, at the high speed in one direction and at 450 bps in the other. The modems dynamically negotiate, assigning the high-speed channel to the modem with the most data to transmit.

**PEP** Packetized Ensemble Protocol: a Teletype proprietary modulation protocol that analyzes the quality of the phone connection at connect time and dynamically compensates for line impairments at 511 separate frequency points.

**V.21** Full-duplex modem transmission at up to 300 bps, also used for Group 3 fax negotiation.

**V.22** Half-duplex modem transmission at 600 bps and 1,200 bps, with a reverse channel (used mostly for responses during file transfers) at up to 75 bps.

**V.22bis** Full-duplex modem transmission at 1,200 and 2,400 bps, with fallback to V.22.

**V.32** Full-duplex modem transmission at 4,800 and 9,600 bps.

**V.32bis** The V.32 protocol extended to speeds of 7,200, 12,000, and 14,400 bps, and with an improved renegotiation protocol.

### ERROR CONTROL PROTOCOLS

**MNP 2, 3, or 4** Microcom Network Protocol: a proprietary, licensed error-control protocol. The numbers indicate specific versions or classes.

**V.42** A standard error-control protocol, backward-compatible with MNP 2, 3, and 4.

### COMPRESSION PROTOCOLS

**MNP 5** Microcom's proprietary, licensed data-compression protocol.

**V.42bis** An international standard for data compression.

### OTHER TERMINOLOGY

**Baud** An obsolete term defining the number of signal-level changes per second. The CCITT now prefers to use *symbols per second*. For example, a V.22bis connection transfers only 600 symbols per second, but in this protocol each symbol can represent up to four values; thus, you have an effective transmission rate of 2,400 bps. V.32 is a 2,400-symbol-per-second (9,600-bps) modulation protocol.

**Duplex** The direction of data flow between modems. *Half duplex* means that data can flow in only one direction at a time. Data flows both directions simultaneously for *full duplex*.

**Throughput** The effective rate of data flow for a file transfer, measured in bits per second. Throughput depends on the connect rate and the error-control and data-compression protocols, if any. For example, V.32 indicates an actual 9,600-bps transmission rate. But when you subtract the extra bits used for error control, the effective rate becomes slightly slower. If V.42bis compression can cut a file size in half, the throughput for that file transfer can approach 19,200 bps.

**Trellis coding** A signal coding scheme. V.32 defines two such coding schemes for 9,600-bps communications: *nonredundant coding* and *trellis coding*. Trellis coding is more noise-resistant except in the presence of an unusual line problem called *impulse noise*.

**UART** Universal Asynchronous Receiver/Transmitter, the chip that controls the input/output of the serial port. ■

you can't wait, get an upgrade promise from your vendor.

#### REVIEW CRITERIA

For this review, we considered only those modems using V.32 signaling with V.42 error checking and V.42bis data compression, the fastest available within CCITT published standards. Not many modems met those criteria; the V.42bis standard is relatively new and costly, and many vendors have delayed the introduction of V.42bis modems because of patent and licensing problems.

One of the products tested, the Hayes V-Series Ultra Smartmodem 9600, offers impressive performance for a small box. When people in the PC market think of modems, they still think of Hayes as the standard of comparison. Modems from U.S. Robotics constitute a different kind of standard. The company recently upgraded its Courier HST Dual Standard to include V.42 and V.42bis. Because of U.S. Robotics' generous price breaks, most electronic bulletin board systems (BBSs) in the U.S. use HST modems. HST's compatibility with BBSs might be an important factor in your purchasing decision.

The other modems we tested were the ATI 9600etc/e, the Microcom QX/4232hs, Multi-Tech Systems' Multi-Modem V32 MT932EAB, the Telebit T2500, and Universal Data Systems' Fast-Talk V.32/V.42b. The Ven-Tel EC9600-Plus/II arrived too late for review, and Practical Peripherals' new model PM9600SA and Intel's 9600EX did not bring shipping until after our deadline. Other modem vendors plan to sell models in this arena but remain in the legal and engineering stages of development.

#### THE PACK

A comparison of the modems revealed many similarities. All of the modems we examined are external. While the vendors package each modem with an RJ-11C line cord and telephone plug, in all cases you must furnish your own RS-232C cable. Normally you would use a DB-25P male-to-male cable for most computers.

Each modem can store at least one default configuration to initialize the modem at power-up. These default settings are programmable through your communications software.

The Hayes, Microcom, Multi-Tech, and U.S. Robotics factory-default configurations let our communications program

immediately call and answer other V.32/V.42/V.42bis installations. The ATI, Telebit, and Universal Data Systems modems required reading the manual and programming the units to achieve V.32/V.42/V.42bis data transfers. This isn't hard, but it does require some knowledge of modems and their command sets. If any questions arise, all of these vendors offer technical support.

The vendors seem to have solved the problem of complying with the standards, but maintaining compatibility between modems of different vendors is a separate

The attitude of every company sounds an upbeat note. They all vow to work for intercorporate compatibility, but they aren't there yet.

problem. All seven modems comply with V.32/V.42/V.42bis standards. This means that each modem connected and negotiated properly using these standards when connected to like modems. But in many instances, modems from one vendor would not connect to another vendor's modems with all three protocols in force. Nevertheless, the attitude of every company sounds an upbeat note; they all vow to work for intercorporate compatibility, but they aren't there yet.

The reasons for incompatibility are not always apparent, but they primarily involve differences in timing or performance thresholds during the handshaking cycle. Each vendor uses its own method and sequence for conducting the protocol handshake, and three offer additional proprietary protocols. Since the handshake method and order of the protocols may influence the final protocol agreement, we strongly recommend that you purchase all your high-speed modems from the same vendor, or at least test the modems for compatibility before you close the deal.

#### ANOTHER WEAK LINK?

Even with the fastest modem in town, you might not be ready to burn up the phone lines yet. We found another weak link in the communications chain.

Initially we set up our performance tests with two relatively fast Dell System 220s. These AT clones function as our workhorses in most of our workstation LAN testing. But the modem results disappointed us right from the start. The receiving computer just couldn't keep up with the data flow from the sending side. A little investigation revealed that the Dell System 220 contained the old 8250 UART chip usually found in XT machines. Normally AT clones include the faster 16450 UART.

UART (Universal Asynchronous Receiver/Transmitter) chips control the serial port. During modem communications, the PC's UART and the CPU transfer a great deal of information. Unfortunately, if the communications program asks the CPU to manage large changes on the screen or to move data to and from the hard disk, the UART on the receiving side can drop bits, particularly if it runs under a multitasking environment like *DESQview*, *Microsoft Windows*, or *OS/2*.

The new 16550 UART solves the problem by creating a FIFO (first in, first out) buffer stack. This buffer allows the UART to save any incoming data while waiting on the CPU. Once we changed to faster machines (a pair of ALR PowerCache 4s) with the 16550 UART, our reception problems disappeared. Although the 16550 acts as a direct replacement for the 8250 and 16450, it needs communications software that initializes it to use its FIFO stack. Luckily, most modem communications programs do.

If your old 8250 or 16450 UART still occupies a socket, you can purchase a new 16550 and replace the chip for less than \$15. Anyone interested in high-speed modem communications will find this a good investment.

#### FLYING FAST

Once you've flown at 38,000 bps, it's difficult to grind along at slower speeds. The speed and functionality of these modems is addictive. If you or your business currently uses 2,400-bps modems on phone lines for an hour each day, a V.32/V.42/V.42bis modem can pay for itself through reduced phone costs in less than six months. The arithmetic is easy. Can you afford being without a high-speed modem?

## ATI TECHNOLOGIES INC.

## ATI 9600etc/e

All Reviews by Mike Byrd

The ATI 9600etc/e modem provides quality and performance in a small package for a low price. Its principal assets are simplicity and ease of use. For just \$699 you get advanced CCITT communications standards and the most throughput for the buck. The product works reliably, is easy to set up, and offers excellent value.

The 9600etc/e supports the Hayes Standard AT Command Set but extends it to allow tailored configurations for specific applications. The unit also communicates in synchronous mode for use in PC-to-minicomputer or PC-to-mainframe environments.

This modem combines the latest CCITT protocols with older industry standards. It features the V.32 9,600-bps transfer protocol with V.42 error control, plus V.42bis and MNP level 5 data compression. The modem detects V.42 at the remote modem, with dynamic fallback to MNP levels 4, 3, or 2, and it uses no error control if the remote modem does not work with any of these protocols.

Specifically, if the remote modem is not V.32/V.42/V.42bis compliant, the 9600etc/e automatically establishes a connection at the highest mutual operating level. If it cannot establish LAPM error correction, it tries to work at MNP levels 2 to 4. Likewise, if it cannot establish a V.42bis data-compression handshake, it attempts an MNP 5 handshake. Its downward compatibility also includes connectivity with V.22bis, V.22, Bell 212, and Bell 103 modems, and MNP error-correction modems. All of these automated protocol negotiations are invisible to the user.

## BRIGHT LIGHTS, SMALL MODEM

The compact black package measures just 6 by 1.5 by 10 inches. LEDs and control switches occupy its front panel. The back panel includes the power switch, power plug, RS-232C connector, and wall/telephone plugs, all of them labeled and easy to read. A slide switch on the right side controls the volume of the 2-inch internal speaker.

The LEDs display 12 status indications: power on/off, modem ready, terminal ready, receive data, send data, carrier detect, error control detect, data mode on/off, auto-answer on/off, transmission

speed, synchronous/asynchronous operation, and test on/off. The error control LED shows you when it is connected to another error control modem, but not what type. Red and green lights display modem speed, with combinations representing 9,600, 4,800, 2,400, 1,200, and 300 bps.

The modem's five control switches offer settings for data, auto-answer, speed select, sync select, and test. You can use the data switch to instruct the modem to redial the last number, toggle between voice and data, or quickly disconnect a call. The speed select switch lets you manually adjust the modem speed. The sync switch toggles between synchronous and asynchronous operation.

The brief and concise documentation does not give you a quick reference card, but it needs none since it comes ready for V.32, V.42, and V.42bis operations. The manual specifically explains how the modem negotiates the modulation, error con-



**ATI 9600etc/e**  
ATI Technologies Inc., 3761 Victoria Park Ave., Scarborough, Ontario, Canada M1W 3S2; (416) 758-0718.  
List Price: \$699.  
In Short: The ATI 9600etc/e provides a low-cost alternative among high-speed modems. It offers simplicity and reliability for high-speed file transfers under the most difficult telephone line conditions.

CIRCLE 006 ON READER SERVICE CARD

## DATA COMPRESSION: IS IT ALL IT CLAIMS?

by Mike Byrd

If your business transfers files over telephone lines and doesn't use data compression, you are wasting time and money.

Several popular file-compression utilities are available, including *Lharc*, a freeware program, and *PKZIP*, a shareware program. Both offer high file-compression rates. If you compress your files using one of these utilities prior to transmission, you won't need to use V.42bis or MNP 5 to compress them from the modem. In fact, as our tests show, MNP 5 can slow down your throughput by expanding a file during transmission. It won't corrupt the file, however, since the receiving modem eventually strips the bits added to the compressed file.

Of the two popular off-line compression programs, *Lharc* normally offers slightly better compression. *PKZIP* compresses and expands files much faster. Software companies are well aware of the power of these utilities. For example, *CoreDRAW*, Version 1.21B, comes on seven 360K floppy disks. The installation process uses *Lharc* to expand the program's files. Without *Lharc*

or another file-compression routine, *CoreDRAW* would easily consume 14 or more disks. You can find *Lharc* and *PKZIP* both in PC MagNet's Utilities Database and in Library 2 of its Utilforum/Tips Forum under the filenames LH113C.EXE and PKZ110.EXE.

## THROUGHPUT TESTING

The chart in Figure 1 shows the impact of two types of on-the-fly data compression (V.42bis and MNP 5), along with one software compression scheme (*PKZIP*, Version 1.10), on the throughput of seven types of data files. We used two MultiModem V32 MT932EAB units for these tests. An XT clone from Syntax Computer, attached to one of these modems, transferred the files from its RAM disk. An AST Premium/286 Model 140 with an AST FastBoard 386 was attached to the other modem and received the files.

The repeated character file, 43,008 bytes large, included a single repeated ASCII character. The mixed data file comprised different types of data, including text, assembly language code, *dBASE* records, and repeated characters; it totaled 44,032 bytes. The hex

rol, and data compression protocols, and it includes a noteworthy chapter on troubleshooting. The documentation also offers top-notch diagrams and a thorough explanation of the command set.

#### RUGGED OPERATION

The performance of the 9600etc/e on typical voice-grade lines is average. But when transferring noncompressible files under impaired line conditions, it shines. It was the only modem that succeeded on the first attempt for each impaired-line file transfer test; it won three noncompressible file tests on impaired lines and took second place on the other three.

We tested ATI modem compatibility with the Multi-Tech and Hayes modems. The Multi-Tech successfully connected with the ATI 9600etc/e in the ATI's host mode but failed to connect when the ATI initiated the call. The ATI did not connect with the Hayes modem in send or receive modes.

ATI supplies a two-year limited war-

ranty, plus free technical support through a toll number and an ATI-supported BBS.

An excellent value, the ATI 9600etc/e definitely offers a good solution to renegotiation problems until V.32bis modems are available. Its incompatibility with the Hayes Ultra 96 is troubling, but we'll bet that it will be solved by the time this issue goes to press.

#### HAYES MICROCOMPUTER PRODUCTS INC.

### Hayes V-Series Ultra Smartmodem 9600 (Ultra 96)

If you want modem standardization and speed, the Hayes V-Series Ultra Smartmodem 9600 (or Ultra 96) marches in the

numbers file was a CCITT file containing a random selection of hexadecimal numbers; it measured 64,512 bytes. The database data file, a 77,824-byte CCITT file, was also used in our modem performance tests. The spreadsheet file, generated by *Quattro Pro*, totaled 43,250 bytes. The .TIF graphics file originated from an image we scanned in using the Logitech hand scanner ScanMan Plus; we cleaned it up with *PaintShow*, Version 2.1, and the resultant file measured 54,272 bytes. The ZIP compressed file—compressed by PKZIP prior to transmission—measured 52,224 bytes.

#### COMPRESSION TEST CONCLUSIONS

The files with many repeated characters and blank spaces enjoyed compression rates under PKZIP far beyond the compression performed by on-the-fly algorithms. The transmission of the file containing the repeated ASCII character went so fast after off-line compression that the throughput number could only be approximated. V.42bis gave the best improvement we found using on-the-fly protocols; on the repeated-char-

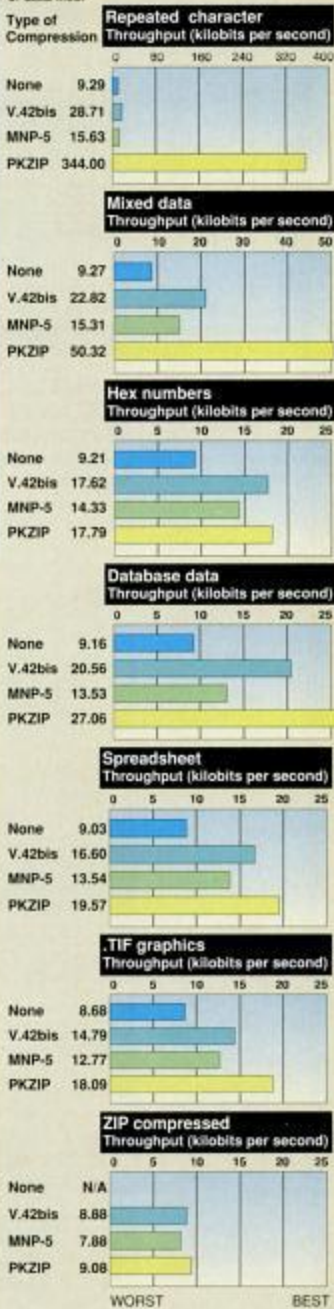
acter test, it produced more than three times the throughput we measured using an uncompressed file.

Most computer bulletin board systems store their files in compressed form. As our test results show, people using MNP 5-compatible modems should turn off MNP 5 before downloading compressed files (precompression only confuses this protocol, which then expands the file instead of compressing it). V.42bis does not have that disadvantage. It offers real-time data-flow monitoring, turning data compression off and on as needed.

Overall, on-the-fly compression with V.42bis rates as the most desirable and economical mode of operation for most applications. But if you really want to squeeze the most out of your communications lines, compress the files with an external file-compression utility before transmission, and don't use MNP 5 for already compressed files.

Compression, through either hardware or software, is the best way to save time and money during data transfers. If you are not taking advantage of file compression, someone else is taking advantage of you.

Figure 1: How two types of on-the-fly data compression and PKZIP affect the throughput of seven types of data files.



N/A—Not applicable; ZIP compressed files are not transmitted without data compression.



## HIGH-SPEED MODEMS: SUMMARY OF FEATURES

**Chip set** indicates the company whose support logic provides the heart of the modem—the ability to convert digital signals to analog form and back again. In some cases the chip set is proprietary or custom-made, or it may work in tandem with another chip, like the Motorola 68000 included with the AT1 9600etc/c.

**Uses DIP switches** DIP switches generally control the configuration of the modem at power-up time. Normally they are set at installation and never touched again. Many users find it easiest to configure modems with DIP switches; others prefer software commands.

**Volume of on-board speaker controlled by hardware or software** Each of these modems has an on-board speaker, which helps you monitor the call connection, negotiation, and data flow by listening to the sounds the modem makes. You can control the volume either using a manual switch or by setting modem initialization strings through software.

**Number of phone numbers stored on-board** Each modem can be preconfigured with telephone numbers, which may be used for automatic dialing or remote callback. The MultiModemV32 MT932EAB stores 10 phone numbers on-board for outgoing calls and 30 phone numbers for its callback security feature.

**Communications program included** Some modem vendors include a communications program with their hardware—often a shareware program you can try right away and pay for later. The FasTalk V.32/V42b includes a certificate for SoftKlone Distributing Corp.'s *Mirror*.

**Automatic feature negotiation** occurs at connect time. The modems themselves agree on the type of signaling, data rate, error correction, and data communication.

Communications software performs the subsequent data transfer.

**Configurations stored in memory** indicates the number of initialization configurations you can preset in the modem. The AT1 9600etc/c allows you to store two configurations in memory, and it comes from the factory preset with three more on chips.

**Warranty period** A two-year warranty is standard in the modem industry. You can opt to extend the warranty from Hayes or Telebit for two additional years. U.S. Robotics offers warranty extensions for \$25 per year.

**PBX control** indicates whether the modem can function in a PBX environment. You may have the option of inserting pauses for access to outside lines, or optional dial characters.

**Flow control** refers to the techniques that the computer and modem use to stop or restart the flow of data from each other. Flow control is necessary because the transmitter or receiver may not always be able to keep up with the rate of transmission; it should be able to tell the other party to stop while it catches up. Flow control signaling includes XON/XOFF, RTS/CTS, and ENQ/ACK.

**Modulation protocols** can be equated to modem connect speeds. Each protocol indicates a standard electronic signaling format for transmitting data at a specific rate. Trellis-coded modulation works as a fairly noise-resistant V.32 coding scheme for 9,600 bits per second, except under unusual line conditions. The Hayes Ultra 96's Ping-Pong is a 9,600-bps proprietary protocol designed for compatibility with V-Series Smartmodem 9600 modems. The Microcom QX/4232hs supports Bell 103, but currently only Microcom's international

model supports Bell 103, V.21.

**Synchronous protocols** connect PCs to mainframes or minicomputers. They require an external device to provide timing information such as start/stop on data transfers.

**Self-tests** are used at power-up time and when troubleshooting. They can point to potential problems with the modem or the communications line.

**Remote access, control, or diagnostics** allow reconfiguration or troubleshooting of a modem from a remote modem.

**Telephone-line analysis** means the modem has the capability to monitor line noise dynamically and adjust the transmission parameters to achieve optimal throughput.

**Auto-dial capability** allows the modem to dial a prestored number automatically at power-up or call back a prestored number when triggered by an inbound call.

**AT commands** (attention commands) initialize and configure a modem for specific applications. Hayes has set the de facto standard for modem commands, and most vendors use the Hayes Standard AT Command Set as a basis for their modem command sets.

**Hayes model that most closely resembles the unit's AT command set** Because the Hayes Command Set is not yet an official standard, this entry identifies the given modem's command set in terms of the Hayes model it most closely resembles.

**Error correction and data compression** lists specific hardware protocols available in the modem.

CONTINUES

forefront. Its \$1,199 price tag makes it competitive with most other products, while its compatibility and features bring it even better value. This Hayes modem offers full compliance with the CCITT protocol along with the most frequently used modem-industry technologies, allowing it to communicate with PCs, local area networks, mainframes, minicomputers, and synchronous terminals. While the modem lacks status indicators for data compression and error correction, Hayes provides useful extras like country-specific versions of the product.

The unit automatically negotiates with other modems to analyze such features as modulation, error control, and data compression, and to establish the most efficient communications session. This process works transparently, automatically allowing a wide range of capabilities and communications options.

A comprehensive, well-documented chart lists all the commands and register settings, allowing you to initialize or change the internal modem settings yourself. Naturally the Ultra 96 supports the Hayes Standard AT Command Set—but

also extends it to implement the new CCITT standards.

**ABIDING BY ALL STANDARDS**

The Ultra 96 does everything a modem can do: It connects at all current CCITT data rates and standards, including V.32 at 9,600 bps, with V.42 error control and V.42bis data compression. It also supports MNP levels 1 to 4 error control and MNP 5 data compression for compatibility with older modems. Downward compatibility also includes V.22bis, V.23, V.22, V.21, Bell 212, and Bell 103 standards.

**COMMUNICATIONS**  
**HIGH-SPEED MODEMS**



**HIGH-SPEED MODEMS: SUMMARY OF FEATURES**

Products listed in ascending price order



	ATI Technologies Inc. ATI 9600etc/c	Microcom Inc. Microcom QX/4232hs	Universal Data Systems Inc. FasTalk V.32/V42b	Multi-Tech Systems Inc. MultiModemV32 MT932EAB	Hayes Microcomputer Products Inc. Hayes Ultra 96	U.S. Robotics Inc. Courier HST Dual Standard	Teletbit Corp. Teletbit T2500
List price	\$699	\$1,099	\$1,145	\$1,149	\$1,199	\$1,295	\$1,345
<b>GENERAL FEATURES</b>							
Chip set	Rockwell, Motorola	Rockwell	Custom-made	Rockwell	Phylon (custom-made)	Rockwell, proprietary	Texas Instruments
Uses DIP switches	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Volume of on-board speaker controlled by hardware or software	Hardware	Hardware	Software	Hardware	Software	Hardware	Software
Number of phone numbers stored on-board	3	9	4	10	4	4	10
Communications program included	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Automatic feature negotiation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Configurations stored in memory	2	1	1	1	4	1	2
Warranty period	2 years	1 year	1 year	2 years	2 years	2 years	1 year
PBX control	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>FLOW CONTROL</b>							
XON/XOFF	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RTS/CTS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ENQ/ACK	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Flow control can be turned off	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>MODULATION PROTOCOLS</b>							
Bell 103, V.21 (300 bps)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Bell 212A, V.22 (1,200 bps)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
V.22bis (2,400 bps)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
V.32 with Trellis-coded modulation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other asynchronous modulation protocols	None	None	None	V.23	Ping-Pong, V.23	HST (proprietary)	PEP (proprietary)
Synchronous protocols supported	Sync	V.22, Bell 212A, V.22bis, V.32	Sync	V.25bis	AutoSync	V.32	PEP (proprietary), V.32, PEP, SNA/SDLC
<b>SELF-TESTS</b>							
Local analog loopback	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Local digital loopback	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Remote analog loopback	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Remote digital loopback	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Test-pattern generation and checking	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Power-on self-test	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>INSTALLATION OPTIONS</b>							
Remote access, control, or diagnostics	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Telephone-line analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Auto-dial capability	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>AT COMMANDS</b>							
Uses AT commands	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Accepts mixed uppercase and lowercase input	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Hayes model that most closely resembles the unit's AT command set	Ultra 96	2400/9600	Smartmodem 2400	Smartmodem 2400 (early)	Smartmodem V9600	Smartmodem 2400	V9600 Series
<b>ERROR CORRECTION AND DATA COMPRESSION</b>							
CCITT V.42 error-control compliance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CCITT V.42bis data-compression compliance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MNP levels included	2-5	2-5, 10	2-5	2-5	1-5	1-5	1-5
Other error-correction schemes	None	LAPM	Trellis	None	LAPB	None	CRC (PEP)
Other data-compression options	None	None	None	None	Hayes Adaptive Data Compression (proprietary)	None	Teletbit Lempel-Ziv (PEP)

PC—Editor's Choice    —Yes    —No

ENDS

V.42bis, MNP 5, and the Hayes Adaptive Data Compression protocol all furnish data compression for connectivity. The last-named is a proprietary protocol found in the Hayes V-Series modems, achieving compression ratios of up to 2:1.



Hayes V-Series Ultra Smartmodem 9600 (Ultra 96)

Hayes Microcomputer Products Inc., P.O. Box 105203, Atlanta, GA 30348; (404) 441-1617.  
List Price: \$1,199. BBS operator discounts available.

**In Short:** Speed, standardization, and compatibility with other Hayes modems make the Ultra 96 well worth considering. It includes the best documentation and a cost-effective feature that enables synchronous communications through the serial port, but it lacks some useful status displays. Country-specific versions are available.

CIRCLE 606 ON READER SERVICE CARD

The Ultra 96 also supports Hayes' proprietary LAPB error control scheme, giving it compatibility with other Hayes V-Series modems. LAPB provides link-level error control for access to packet-switched networks using X.32. The Ultra 96 is likewise compatible with the Hayes V-Series Smartmodem 9600 Ping-Pong protocol for 9,600-bit-per-second and 19.2-kilobit-per-second throughput.

You normally use asynchronous modems for PC communications, but the Ultra 96 can support SDLC, HDLC, and BISYNC synchronous transmission for connection to mainframes and minicomputers. Typically you can connect a PC with a synchronous adapter card to a modem for direct connection with a mainframe. The Hayes AutoSync feature allows you to connect a PC's standard asynchronous serial port directly to the modem for synchronous communications. This eliminates the necessity and cost of a synchronous adapter card, and this is a plus when you are comparing prices.

#### HAYES CLASSIC

After some design excursions in the Hayes product line, the Ultra 96 reflects the classic Hayes design found in the familiar Smartmodem 1200 and 2400. The lights reside where they should, and anyone who has spent a few years plugging in modems will feel comfortable with the Ultra 96.

Although it measures only 5.5 by 1.8 by 9.6 inches, the small-footprint Ultra 96 looks rugged and professional. It comes in a burnished aluminum case with a black plastic front and eight LED status indicators: modem read, terminal ready, send data, receive data, off-hook, carrier detect, auto-answer, and high-speed. There is no status display for error correction or data compression.

The power switch, serial connector, power connector, and wall/telephone connectors are well marked on the back of the case. A 2-inch speaker with a software-programmable volume control lets you listen to the progress of the call and monitor the data transfer.

The Ultra 96 has four DIP switches. Although you normally wouldn't need to access them, you can reach them by removing the front cover. You need to change the default settings only when you connect your modem directly to a printer, use the modem as a dedicated synchronous device, or adjust the carrier level.

The installation guide takes you step by step through the process of connecting the modem to your computer and phone system, and it leads you through any changes

The Ultra 96 reflects the classic Hayes design found in the Smartmodem 1200 and 2400.

required for your particular setup. The documentation is the best we've seen. The user's reference explains in simple English how a modem works and how to set up and communicate using the modem.

In the performance tests, the Ultra 96 rated a solid third. It emerged the overall winner for transferring noncompressible files, indicating the robustness of the



#### PERFORMANCE TESTS: HIGH-SPEED MODEMS

Running a high-speed modem at top efficiency means eliminating bottlenecks. Make sure your PC has an up-to-date UART, set the port speed to 38.4 kilobits per second, ask vendors whether your communications program and modem setup string are a good match for your modem, and buy modems from the same vendor to ensure compatibility.

The **Baseline** test uses a simulated U.S. telephone line with typical long-distance-circuit levels of such measurable signal characteristics as intermodulation distortion, noise, frequency shift, and phase jitter. Specifically, we used input levels of -10 dBm (decibels referenced to 1 milliwatt) and output levels of -23 dBm, intermodulation distortion of 52 dB and 50 dB for second- and third-level harmonics, a frequency shift of 1.25 Hz, and 8 degrees of phase jitter.

Each of the **Impaired Line** tests (1V32 to 6V32) adjusts the level of envelope delay distortion and the attenuation curve, in addition to other conditions such as phase jitter. With envelope delay, some frequencies transmitted simultaneously are received ahead of others. Attenuation of signals means a drop in volume. For example, test 1V32 introduces 15 degrees of phase jitter, a deviation in phase typical of a circuit with poorly aligned equipment. Other tests introduce noise and rapid excursions of both amplitude and phase, typical of the effects of weather on microwave radio systems.

All of the Impaired Line tests meet the Test Channel Impairment Combination standards established by the EIA for V.32 modems, as described in EIA/TIA standard 496-A. We did, however, adjust the loop loss to U.S. standards to simulate the loss in signaling on a typical phone circuit. Anyone who wants to do the same testing should consult the full EIA documentation and use a product like the TAS 122.

V.42bis data-compression algorithm as it turned off data compression when it wasn't needed. The Ultra 96 connected to the MultiModemV32 MT932EAB at 9,600 bps in the latter's host mode, but the MultiModemV32 did not successfully negotiate 9,600 bps with the Hayes when the Hayes was in host mode. The Ultra 96 is fully compatible with the Telebit T2500, FastTalk V.32/V42b, and Courier HST Dual Standard. It would not connect with the ATI 9600etc/e in either send or receive mode.

Country-specific versions of the Ultra 96 are available to comply with each regulatory agency's requirements. Specific

**COMMUNICATIONS**  
**HIGH-SPEED MODEMS**

We used two ALR PowerCache 4/33 computers, one at each end of the connection, to send and receive files. These machines come equipped with 33-MHz 80486 processors, while 16550 UARTs control their serial ports. We ran the computers at a port speed of 38.4 kilobits per second to allow maximum throughput. Only the Telebit modem would not support a port speed of 38.4 kbps and had to be set to 19.2 kbps.

We ran Hilgraeve's HyperAccess/5 as the communications software, and we transferred files using the YModem-G protocol. This protocol has no data compression and no error correction; that makes it the appropriate protocol to run when the modems contain both features. But YModem-G will abort the transfer when any glitch occurs between the modem and the computer.

The TAS 122 Telephone Network Simulator, marketed by Telecom Analysis Systems, helped us simulate a complete telephone network, with capabilities for two- and four-wire connections, dual-tone multifrequency dialing, and internal impairment generators driven by a stored suite of profiles. These profiles meet the standards established for testing by the Electronic Industries Association (EIA). A unit like the TAS 122 is essential for any type of meaningful and repeatable modem testing.

We tested each modem over seven telephone line configurations, and for each line configuration we transmitted four different files provided by the CCITT: a noncompressible file containing a completely random sequence of data; a mixed, compressible file of ASCII characters, database data, repeated characters, and assembler code; a database file; and a .PIC graphics file. All files were over 50K in size.

Greater numbers represent better performance.

N/A—Not applicable; the product did not complete this test.

**Noncompressible Data File**

Throughput (kilobits per second)

	Baseline Test	Impaired Line Tests					
		1V32	2V32	3V32	4V32	5V32	6V32
Hayes Ultra 96	8.89	5.85	5.88	5.81	5.25	5.42	5.43
Courier HST Dual Standard	8.79	1.56	1.65	1.46	1.58	1.58	1.58
ATI 9600wcv	8.30	5.58	5.59	5.77	5.69	5.56	5.56
MultiModem V32 MT932EAB	8.22	4.74	5.43	5.33	5.29	5.43	4.80
Microcom QX4232hs	7.86	5.01	5.05	5.05	5.02	5.04	5.05
Telebit T2500	7.55	N/A	N/A	N/A	N/A	N/A	N/A
FasTalk V.32/V42b	6.78	4.36	4.47	4.42	4.40	4.43	4.40

**Mixed Data File**

Throughput (kilobits per second)

	Baseline Test	Impaired Line Tests					
		1V32	2V32	3V32	4V32	5V32	6V32
Hayes Ultra 96	22.93	16.78	17.20	15.09	14.83	15.29	16.15
Courier HST Dual Standard	22.05	5.75	5.95	N/A	N/A	5.93	6.52
ATI 9600wcv	19.77	13.71	13.76	13.87	14.64	13.87	14.39
MultiModem V32 MT932EAB	34.06	22.93	22.05	23.72	22.93	19.66	19.59
Microcom QX4232hs	34.40	21.77	21.64	21.23	21.10	20.98	21.64
Telebit T2500	31.27	N/A	N/A	N/A	N/A	N/A	N/A
FasTalk V.32/V42b	26.46	16.78	18.01	17.84	18.01	17.11	18.11

**Database Data File**

Throughput (kilobits per second)

	Baseline Test	Impaired Line Tests					
		1V32	2V32	3V32	4V32	5V32	6V32
Hayes Ultra 96	21.33	15.42	14.97	15.15	15.52	13.84	11.91
Courier HST Dual Standard	25.95	4.99	4.60	4.97	5.14	4.89	5.64
ATI 9600wcv	19.84	10.94	10.85	10.94	10.71	11.03	12.67
MultiModem V32 MT932EAB	25.35	16.73	16.31	16.73	16.62	12.06	13.40
Microcom QX4232hs	25.60	16.10	16.20	16.41	16.20	16.20	16.41
Telebit T2500	23.49	N/A	N/A	N/A	N/A	N/A	N/A
FasTalk V.32/V42b	19.54	12.99	13.13	12.99	13.06	12.37	12.80

**.PIC Graphics File**

Throughput (kilobits per second)

	Baseline Test	Impaired Line Tests					
		1V32	2V32	3V32	4V32	5V32	6V32
Hayes Ultra 96	18.10	10.70	11.60	12.56	11.34	10.56	11.88
Courier HST Dual Standard	18.10	3.45	4.01	3.84	4.01	3.85	4.00
ATI 9600wcv	15.05	10.27	9.68	8.99	9.50	9.74	10.13
MultiModem V32 MT932EAB	19.24	12.99	12.46	12.26	12.56	12.77	11.69
Microcom QX4232hs	19.00	11.88	11.26	12.46	12.36	12.77	11.97
Telebit T2500	17.47	N/A	N/A	N/A	N/A	N/A	N/A
FasTalk V.32/V42b	15.20	9.68	10.13	10.13	10.27	10.20	9.93

CONTINUES

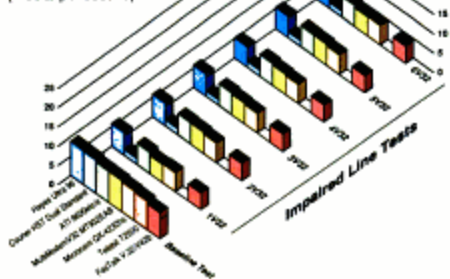




PERFORMANCE TESTS: COMPOSITE VIEW

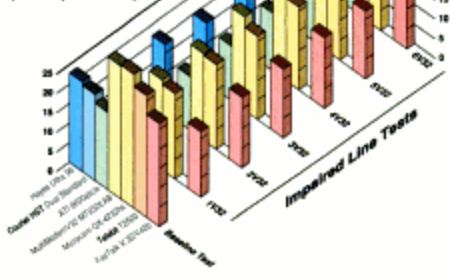
**Noncompressible Data File**

Throughput  
(kilobits per second)



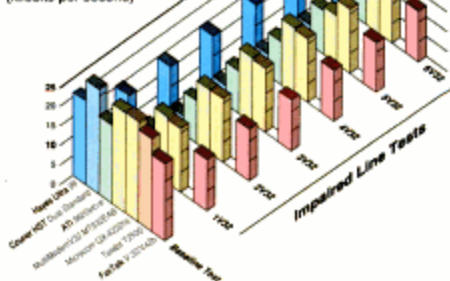
**Mixed Data File**

Throughput  
(kilobits per second)



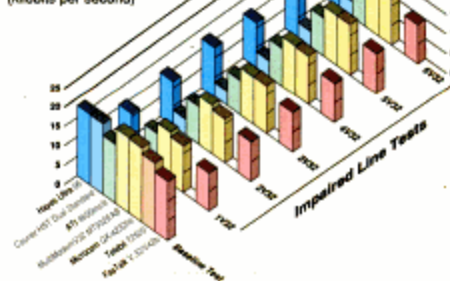
**Database Data File**

Throughput  
(kilobits per second)



**.PIC Graphics File**

Throughput  
(kilobits per second)



(Taller bars represent better performance)

features for a different country's version may vary to meet those requirements.

The Ultra 96 comes with a two-year warranty and free customer support through a toll number or toll-free BBS. The Hayes BBS offers four toll-free lines for messages and information, and four toll lines for file uploads and downloads.

Speed, standardization, and compatibility are the assets of the Ultra 96, which offers connectivity to the most modern Hayes modems as well as older ones. You can't go wrong with Hayes.

**MICROCOM INC.**

**Microcom QX/4232hs**

When it comes to industry standards, Microcom not only sets them, it delivers turbocharged performance with its QX/4232hs modem. For \$1,099, you get one of the fastest-performing modems that is compatible with the latest MNP and CCITT standards. The QX/4232hs also comes with some handy remote-access

features, but it lacks an on/off switch, runs hot, and offers just a one-year warranty.

Microcom derives a competitive edge from its constant push for newer and better standards. The QX/4232hs modem represents the company's current vision of maximum performance and compliance with existing standards. Not only is the QX/4232hs compliant with CCITT V.32, V.42, and V.42bis standards, it embraces all the MNP protocols, including Microcom's new MNP 10 error-correction methodology.

During our testing, we quickly learned the importance of having the proper Universal Asynchronous Receiver/Transmitter (UART) in the test PCs. Machines with slow UARTs often experience overruns on the receiving side when the V.32 and V.42bis protocols deliver fast throughput, so we used fast 16550 UARTs.

We learned another lesson about setting the port speed between the test PCs and the modems. Don't assume that a PC's port speed should be 9.6 kilobits per second simply because that is the signaling speed of the connected modems. Thanks to compression, data comes from the modem with a faster throughput than the modem's signaling rate. Setting the PC's port speed to 38.4 kbps is the best practice.

Furthermore, most communications programs don't have the right initialization strings in place to connect to these new modems. Often the built-in setup strings set the port to 9.6 kbps. If your modem program reports a consistent throughput of 960 characters per second, then the link between your PC and the modem is set to 9.6 kbps, and it is the slowest portion of the entire communications circuit.

We used HyperAccess/5 as the modem software, working with Hilgraeve's technical support people to develop the proper setup strings for the modems on both sides of the links. When you are using a new modem, a call to the modem or software manufacturer will usually reveal any potential problems, but developing the proper setup string can still be a difficult task.

For our compatibility tests (discussed in the reviews), we didn't try every modem with every other modem in every mode because our initial results with the Hayes Ultra 96 and the MultiModemV32 MT932EAB in originate and answer modes proved the point: Despite the publication of the standard, many modems are not able to establish V.42bis connections with

modems from other companies. All of the companies assured us that they were anxious to establish compatibility and were working toward that goal, but they haven't reached it just yet.

#### THROUGHPUT RESULTS

In the performance tests, Multi-Tech's MultiModemV32 MT932EAB proved the best performer overall, providing the fastest file transfers for about half of the tests. Second place went to the Microcom QX/4232hs, which lost just by a nose. The Hayes Ultra 96 rated a solid third.

On the Baseline tests, run on a standard U.S. telephone line with no special impairment, the modems from Multi-Tech and Microcom show the fastest performance. The modems from Telebit, U.S. Robotics (Courier HST Dual Standard), and Hayes don't lag far behind.

When we introduced the EIA-standard impairments into the lines for the Impaired Line tests, our two leaders stayed clearly in front. When we calculated some averages, Multi-Tech's MultiModemV32 MT932EAB emerged the general winner on four of the six types of V32 Impaired Line tests. The Microcom modem placed first or second on most of the tests in this group. The Courier HST Dual Standard was unable to complete two tests and generally slipped in the rankings. The FasTalk V.32/V42b got going when the going got tough and pulled data through the impaired conditions with little difficulty.

In the noncompressible file tests, Hayes emerged the overall winner, while Microcom slipped in its ranking. The MultiModemV32 MT932EAB was roughly tied with the Microcom unit as the winner for transferring database files, and it won at transmitting graphics files.

Unfortunately, the Telebit modems were not able to complete the data transfer tests under any of the EIA-standard impairment conditions. We saw similar problems using these modems under their native PEP mode.

planning exactly how to configure the modem for synchronous operations using the DIP switches.

The QX/4232hs has remote access features to let your local modem view or change the configuration status of a remote modem. This may be useful in a variety of reconfiguration and troubleshooting situations. You can protect remote access to your modem by means of a password. Auto-log-on features let your local modem automatically access a remote system by executing a predefined log-on sequence. You can use the auto-log-on sequence in either originate or auto-answer mode.

#### SWITCHES, LIGHTS, AND BUTTONS

The QX/4232hs comes in external and rack-mount models. We tested the external model. Its black molded plastic case measures just 10.7 by 6.5 by 1.8 inches. The front panel contains seven indicator lights and two push-button switches—talk/data and originate/answer. The talk/data switch transfers control between the data line and a telephone connected to the modem. The originate/answer switch controls whether the modem goes off-hook in originate or answer mode when you press the talk/data switch.

Ten DIP switches are located behind the front panel. The rear panel contains a DB-25P serial plug, eight more DIP switches, the power plug, a manual volume control, a reset push button, and the wall/telephone plugs. The reset button functions just like a reset button on your computer; pressing it is equivalent to unplugging the modem and plugging it back in. You can adjust the volume control with a screwdriver, but the modem has no power switch.

The seven LEDs include power, test, off-hook, high-speed, data terminal ready, transmit, and receive. The test light flashes when the modem retransmits, showing that error correction is taking place. The high-speed LED indicates connect speeds from 300 to 9,600 bps through a combination of blinking green and red lights, and it helps compensate for the lack of a data compression display.

The 18 DIP switches control the modem configuration and the instructions it uses at power-up. The circuit board also contains a number of jumpers. Usually you will not need to adjust any of these unless you need a nonstandard configuration.

On the downside, with all those other switches you would hope to see an on/off switch on the QX/4232hs, particularly

#### THE MICROCOM EDGE

In a forthcoming review of a Microcom modem using MNP 10 over cellular radio links, we will observe the benefit of this protocol over the poor connections of a cellular phone. MNP 10 automatically and dynamically adjusts data transfer parameters under fluctuating line conditions. It not only slows down transfer rates as line noise increases, it automatically increases the data transfer speed when line noise decreases. The QX/4232hs also supports V.22bis, V.22, and Bell 212A and 103.

This modem boasts compatibility with the Hayes Standard AT Command Set, but extends the command set to let you tailor the modem configuration to include MNP protocols. The factory-default configuration provides for V.32, V.42, and V.42bis operation, but you can implement MNP error-correction and data-compression protocols by using the command set.

The QX/4232hs also supports synchronous operation using the V.32, V.22bis, and V.22 standards. The user reference manual includes a step-by-step tutorial ex-

ENDS

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Keyboard	101 Style	101 Style	101 Style
Mouse	Option	Option	Standard
Min. System Burn-In	48 Hrs	48 Hrs	48 Hrs
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HIGH-SPEED MODEMS

PC  
FACT FILE



**Microcom QX-4232hs**  
Microcom Inc., 500 River Ridge Dr., Norwood, MA 02062; (800) 822-8224, (617) 551-1958.  
List Price: \$1,099.  
In Short: Microcom lives up to its reputation for state-of-the-art high-speed data transfer. The QX-4232hs is a top-line modem for CCITT- and MNP-compatible connectivity. It includes the new MNP 10 protocol and useful remote-access features, but the warranty is for one year.

CIRCLE 607 ON READER SERVICE CARD

since it runs extremely hot to the touch compared with the other modems we tested. Microcom, please let us turn this thing off without pulling the plug out of the wall.

SECOND-BEST, BUT CATCHING UP

The reference manual is succinct and clear, and it comes with a quick-reference card. The guide has setup examples for using the modem over poor phone lines, along with three common host-to-remote installations. It also describes the configuration requirements for each of six popular software programs: *Carbon Copy Plus*, *Crosstalk Mk.4*, *Crosstalk XVI*, *HyperAccess*, *ProComm Plus*, and *Relay Gold*.

Second place is not winning, but the QX/4232hs just lost by a nose. It placed consistently first or second in most of our file and line impairment tests. The only problems we encountered occurred in the noncompressible file tests, where it slipped in its ranking. When it was second, it lost only by a slight margin. Lower-placing modems ran significantly slower in most categories. The QX/4232hs connected successfully with the MultiModem V32 MT932EAB and the Hayes Ultra 96.

The unit comes with only a one-year warranty, but unlimited, free technical support is available via a toll number.

Microcom is clearly gunning for number one. The QX/4232hs is an excellent modem for any application.

COMMUNICATIONS  
HIGH-SPEED MODEMS

MULTI-TECH SYSTEMS INC.  
**MultiModem V32  
MT932EAB**

Multi-Tech Systems' MultiModem V32 MT932EAB emerges a winner under the most constraining telephone line impairments. For \$1,149, you get the highest overall rates we measured for data transfer using V.32 communications, V.42 error correction, and V.42bis data compression with and without telephone line impairments. Its command instruction set offers considerable configuration flexibility for specific applications. This modem will save you both time and telephone costs.

Although Multi-Tech claims compatibility with the Hayes Standard AT Command Set, it extends that command set to permit user control of the modem's configuration. The extended command set is very powerful but complex. All the commands are self-explanatory, and they offer complete control of the modem's internal configuration, but the multitude of commands can be confusing.

**RELIABILITY AT ANY SPEED**

The MT932EAB uses the latest available technologies to achieve reliable high-

speed and full-duplex operations over dial-up and two-wire lines. V.42 error-correction and V.42bis data-compression options minimize transmission errors while increasing modem throughput to 38,400 bps.

The MT932EAB's strengths include the ability to connect at these protocols and its support for MNP 2 to 4 error correction

and MNP 5 data compression. The MT932EAB can also connect with other modems using V.32, V.22bis, V.22, Bell 212A, and Bell 103/113. These features provide compatibility with lower speeds and should allow the MT932EAB to talk to virtually any modem almost any time.

The factory-default settings strive to connect using the most efficient data rate, error correction, and data compression available between the two modems. If

**PC** **FACT FILE**  
**EDITOR'S CHOICE**



**MultiModem V32 MT932EAB**  
Multi-Tech Systems Inc., 2205 Woodale Dr., Mounds View, MN 55112; (800) 328-9717, (612) 785-3500.  
**List Price:** \$1,149  
**In Short:** The MultiModem V32 MT932EAB offers flexible compatibility with a variety of modems using CCITT and MNP protocols. It can be configured for almost any application; it works under severely impaired lines, and it wins first prize for fast data transfers.

CIRCLE 611 ON READER SERVICE CARD



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CIRCLE 290 ON READER SERVICE CARD

## HIGH-SPEED MODEMS

both modems are capable, the transfer rate will be 9,600 bps with LAPM error correction and V.42bis data compression. If the modems connect with LAPM, MNP 5 data compression is available for communicating with modems that are not V.42bis compliant.

## MONITORING BY SOUND AND LIGHT

The unit comes in an off-white molded plastic case measuring 7.3 by 1.6 by 11 inches. The front panel uses eight LED status indicators, a voice/data toggle switch, and a 9,600-/2,400-/1,200-bps speed selection switch. Twelve DIP switches are accessible through the bottom of the modem chassis. The back contains the power connector, DB-25P serial connector, power switch, volume control, and wall/telephone plugs. All connectors are well marked, but Multi-Tech places the power switch between the DB-25P connector and the line jack, making on/off operations awkward with the cables connected.

You can monitor calls with the 2-inch cone speaker and adjust the volume through the rear of the modem case. The eight LED indicators show the status for send data, receive data, carrier detect, off-

hook, terminal ready, and 9,600 bps, 2,400 bps, and 1,200 bps. Three dual-purpose speed lights indicate the type of error correction and data compression by different blink rates—an excellent feature when

The MultiModem was the best performer, providing the fastest file transfers for more than half the tests.

you want to monitor the modem connection.

The twelve DIP switch positions control the modem's initialization or set default values for the command mode. The DIP switch functions differ depending on whether you are operating in synchronous

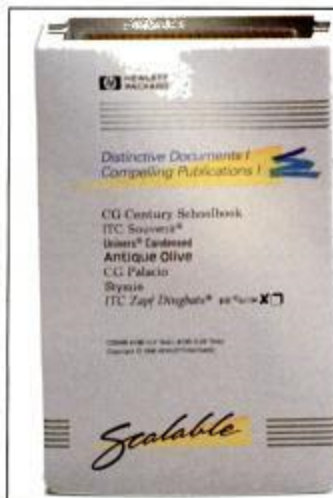
or asynchronous mode. Jumpers inside the modem control CTS/RTS, CTS V.25bis, SDLC or DSC mode, and DSR options.

The clear and concise documentation provides insight into modem operations. There is no separate quick-reference card, but every modem includes a summary of switch settings located on the bottom right next to the easily accessible DIP switches. You couldn't ask for a design that is easier to set up.

The package offers an interactive automatic-dialing capability and a command mode option. You can store up to ten commands or telephone numbers in the modem's nonvolatile memory. The modem can recognize dial tones and busy signals for reliable call-progress detection.

## WINNING PERFORMANCE

The MT932EAB proved the best performer overall, providing the fastest file transfers for over half of the tests. It emerged as the general winner for four of the impaired line tests. It also tied with the Microcom unit as the winner for transferring database files, and it won the race to transmit graphics files. It came in third for transferring noncompressible files, but only by a small



## How many fonts can you get out of HP's scalable typeface cartridges?

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the wealth. Without downloading. Without using up memory. Because the typefaces are printer resident.

With HP scalable typeface cartridges you get more than great typeface styles. You get them in the exact

margin. Overall, the MT932EAB possesses an excellent implementation of the V.42bis data-compression algorithm.

Compatibility with other V.32 modems remains an issue. The Hayes Ultra 96 and the Coufiar HST Dual Standard connected successfully with the MT932EAB in the host (answer) mode. But when the MT932EAB functioned as the calling modem, it did not connect with the Ultra 96, and it aborted file transfers with the Dual Standard. Although the MT932EAB connected successfully to the ATI 9600etc/e in the ATI's host mode, it did not connect when the ATI was in the originate mode and the MT932EAB in the host mode. And the FasTalk V.32/V42b did not connect to the MT932EAB in either direction.

The MT932EAB includes an industry-standard two-year warranty, with free technical support through a toll-free number. Multi-Tech also maintains a bulletin board service for its customers, providing new product information, product upgrade data, problem-solving tips, and message support.

If you choose the MultiModem V32 MT932EAB, its ease of setup and high-speed efficiency over both standard and

impaired lines will transfer your files faster and help keep your long-distance charges down.

## TELEBIT CORP.

**Telebit T2500**

The Telebit T2500 executes high-speed file-transfer operations using either the CCITT protocol standards—for worldwide compatibility and error-free, data-compressed transmission—or its own proprietary Packetized Ensemble Protocol (PEP). For a high \$1,345 you get a V.32/V.42/V.42bis-compliant modem allowing connectivity from 300 to 9,600 bps. The Telebit modem did not perform well under any of our degraded-line tests using either its V.32 or PEP mode. Also on the minus side are its one-year warranty, nonstandard defaults, and lack of LED indicators for speed, data compression, and error correction, but the modem does offer useful built-in security features.

The T2500 supports error correction over standard full-duplex V.32, V.22bis, V.22, and Bell 212 and 103 connections. It fully implements V.42, providing backward compatibility between V.42 and existing MNP modems. And it supports MNP 5.

The unit can also connect using the PEP modulation protocol. PEP overcomes some telephone-line limitations. It analyzes the quality of the connection at 511 separate frequency points and compensates for existing line impairments. This reduces retransmission of blocks and improves data throughput.

PEP dynamically provides real-time line analysis and adaptation to achieve maximum data transmission during the connection. With PEP, the modem can transmit or receive asynchronous data at up to 18,000 bps over standard telephone lines, or up to an effective 19,200 bps when data compression is turned on. PEP is available only when you are connecting to another Telebit modem.

The T2500's callback security feature allows an originating user to dial a predefined number. The answering modem prompts for a password. If the originating

sizes you need. Each one is scalable from .25 to 999.75 points in 1/4 point increments—you say when.

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Say when.

modem sends a valid password, the answering modem hangs up the phone, waits 10 seconds, then calls back. Because the called modem has the originating modem's number indexed against its password, the called modem can easily look up the number. Password security is also available to control connections between selected modems.

#### SELECTION BY SWITCH

The off-white molded plastic Telebit unit measures 8.5 by 2.4 by 13 inches. The front displays eight LED status lights, an A/B configuration toggle switch, and a talk/data switch. The LEDs show PEP status, carrier detect, off-hook, receive data, send data, clear to send, data terminal ready, and modem ready. The well-marked back contains the power switch, power plug, DB-25P serial plug, and wall/telephone plugs. An internal speaker, with software-programmable volume, facilitates call-connection and data-transfer monitoring. The modem provides no visual indications of the speed, error correction, or data compression technique in use.

The T2500 also has no DIP switches; instead, it comes with four factory-default configurations. You choose among them with the A/B toggle switch and talk/data switch.

You can select one of two possible operating profiles with the A/B switch. When

you turn on or reset the modem, it loads its initial configuration from the profile indicated by the A/B switch position. The talk/data switch contains several functions, depending on the profile loaded at power-up. It lets you switch from data to voice or vice versa. When appropriately configured, it

If you want the Telebit T2500 to connect with another T2500 using V.32, you must instruct it to do so. If they can't connect at 9,600 or 4,800 bps, the modems break connection.

can automatically dial a preset number.

The LEDs visually display any of the four modes selected: enhanced command mode (asynchronous), conventional command mode (asynchronous), enhanced command mode (SDLC synchronous), and enhanced command mode (V.32 synchronous). Telebit's user reference gives clear, step-by-step instructions on how to select the mode desired.

You get both a fast-start guide and a user reference as documentation. The user reference includes tear-out quick-reference guides for both conventional and enhanced command sets. While it is thorough, this user reference is intended for computer and terminal users who possess a basic understanding of data communications.

#### A NOVEL APPROACH

Telebit takes a slightly different approach to connecting. Ordinarily it always tries to select PEP over V.32 and lower-speed protocols. When you want a V.32 connection to a different vendor's modem, this is not a problem. But if you want a T2500 to connect with another T2500 using V.32, you must instruct it to do so. If they cannot connect at 9,600 or 4,800 bps, the modems break connection.

Normally the modem will automatically handshake to check for LAPM or MNP 4 error correction. If LAPM is agreed on, the modems negotiate the use of V.42bis. If V.42bis is not suitable, or if they select MNP 4, the handshake continues to check whether they can agree on MNP 5 data compression. If not, the modem performs no data compression.

The unit gave us a few headaches while we were trying to set up for V.32/V.42/V.42bis testing. Because the default configuration tries to connect with another Telebit modem using PEP first, we needed several phone calls to technical support to get the modem configured for our performance tests.

The T2500 showed average performance on the baseline tests. It was not successful for any of our 24 impaired line tests, despite repeated tries and extensive consultation with the company. It connected with the Multi-Tech modem when the Telebit originated the call, but not when the Multi-Tech originated a call to the Telebit. It did connect successfully with the Hayes Ultra 96 in both originate and answer modes.

The unit comes with only a limited one-year warranty, but optional coverage is available for a second and third year. Unlimited technical support is free through a toll number.

The Telebit T2500 gives you high-speed data compatibility with both Telebit modems and V.32 modems, and it includes all the current advanced CCITT protocols for error control and data compression. But because it did not pass the impaired line tests, we cannot recommend this modem.

#### UNIVERSAL DATA SYSTEMS INC.

### FasTalk V.32/V42b

The FasTalk V.32/V42b represents a step toward Universal Data Systems' goal of becoming the fastest, most reliable source for high-speed modems. For \$1,145, the FasTalk supports the major CCITT and industry connectivity protocols, but it doesn't include some of the connectivity options found in its competitors.

The FasTalk connects your PC or computer terminal to telephone or leased-line operations at 300, 1,200, 2,400, 4,800, or 9,600 bps. It can be complicated to set up at first, but advanced CCITT error control



#### Telebit T2500

Telebit Corp., 1315 Chesapeake Terrace, Sunnyvale, CA 94089; (800) 835-3248, (408) 734-4333.

List Price: \$1,345.

**In Short:** The Telebit T2500 is a high-speed modem suited to large-file transfers with Telebit and other fast CCITT-compliant modems over noise-free lines. Its callback security feature is a plus. Drawbacks include the one-year warranty, unusual configuration, lack of some useful status displays, and difficulty with impaired lines.

CIRCLE 608 ON READER SERVICE CARD

## HIGH-SPEED MODEMS

**FasTalk V.32/V.42b**

Universal Data Systems Inc., 5000 Bradford Dr.,  
Huntsville, AL 35805-1993; (800) 631-4869,  
(205) 430-8000.  
List Price: \$1,145.

**In Short:** The FasTalk V.32/V.42b meets industry standards for connectivity, allowing you to tailor it for special applications. The initial configuration process can be complicated, but the unit works solidly under impaired line conditions. Its warranty period is only one year.

CIRCLE 609 ON READER SERVICE CARD

(V.42bis or MNP 5) for the handshake to agree on. This level of detail is not available in most other modems.

Surprisingly, the UDS factory defaults call for a configuration of 2,400 bps, with no error control or data compression. The FasTalk comes out of the box thinking that it is a plain-vanilla V.22bis modem. To enable V.32, V.42, and V.42bis or the MNP levels, you must manually reprogram the initialization configuration—not a difficult operation, but strange considering the expense of this high-speed modem. If you buy it, you will probably want to use it in its fastest mode.

The FasTalk is synchronous, capable of several configuration options depending on the application. The default configuration caused some complications in preparing the modem for testing, requiring several phone calls to the technical support group before we could configure the modem properly to V.32/V.42/V.42bis standards.

FasTalk uses one internal jumper that selects the modem configuration at power-up. The user reference explains the settings for this jumper with the help of excellent instructions and schematic drawings. Alternatively, you can choose to stay with the factory or stored configuration. Other jumpers reside on the board, but the book cautions you not to alter them. The documentation is quite thorough; in addition to the reference manual, you get a quick-reference card. Yet once you install the modem, you will rarely require the references again.

Once configured, the FasTalk should connect with any CCITT or industry-standard high-speed modem that uses V.32, V.42, or MNP 2 to 4, and V.42bis or MNP 5. It will also talk to most lower-speed modems.

**LED SIGN LANGUAGE**

The off-white molded plastic unit measures 6 by 1.5 by 9.5 inches. The rear panel displays the well-labeled on/off switch, power jack, DB-25P serial connector, and wall/telephone jacks. The front panel contains the talk/data switch and eight LED indicators. The talk/data switch allows you to originate or answer both data and voice calls manually. An internal speaker with software-controlled volume lets you monitor call connections and data transfers.

The modem-status LED indicators show error control, modem ready, termi-

nal ready, send data, receive data, off-hook, carrier detect, and high-speed conditions. The error control light turns on when the modem connects in an error control state—V.42 or MNP 2, 3, or 4—but you don't see a visual indication of the type of error control in use.

The high-speed light turns a persistent green during 9,600-bps operation. It flashes green at 4,800 bps and shines a steady red during 2,400-bps operation, with flashing red at 1,200 bps. The LED shuts off during 300-bps operation.

**COMPARATIVE PERFORMANCE AND FEATURES**

Once properly initialized, the modem gave average performance. It did better than many of its competitors during the impaired line testing, consistently ranking third for the mixed data file transfers and third or fourth for the database file transfers over impaired lines. It would not connect with the Multi-Tech unit at 9,600 bps but did connect successfully with the Hayes Ultra 96 in both send and receive modes.

The modem comes with only a one-year warranty, but UDS staffs a toll-free

The FasTalk starts with the Hayes Standard AT Command Set but extends it to allow many user options over a wide range of operating environments.

and data compression provide maximum compatibility. This helps ensure data integrity and increased data throughput, making the FasTalk a solid performer when telephone line conditions are less than optimal.

The FasTalk offers full compliance with the CCITT V.32 standard for full-duplex transmission at 9,600 bps. It incorporates V.42 and MNP level 2 to 4 error-control functions for dependable data transmission over noisy telephone lines, while modem-negotiated V.42bis or MNP 5 data compression increases overall throughput. The unit automatically adjusts its data rate and modulation protocol to the other connected modem. It will connect with any modem compatible with V.32 at 9,600 bps, Trellis coded or uncoded; 9,600 and 4,800 bps, synchronous or asynchronous; CCITT V.22bis 2,400 and 1,200 bps, synchronous or asynchronous; and Bell 103J 300 bps, asynchronous.

**COMPLEX CONFIGURATION**

The FasTalk starts with the Hayes Standard AT Command Set but extends it to allow many user options over a wide range of operating environments. You can configure it to answer and negotiate a variety of configurations, depending on your requirements. For example, you can specify the type of V.42 protocol (LAPM or MNP) or the type of data compression

telephone number to provide unlimited technical support.

The FasTalk V.32/V.42b doesn't include certain connectivity features that separate it from the rest of the pack. Other modems, such as the Hayes, Microcom, Telebit, and U.S. Robotics units, contain useful proprietary modes and bells and whistles. The ATI modem distinguishes itself on price, the Multi-Tech on performance. Nevertheless, the FasTalk proves itself a solid performer when telephone line conditions are less than perfect.



U.S. ROBOTICS INC.

## Courier HST Dual Standard

Flexibility, compatibility, and high-speed data flow are the hallmarks of U.S. Robotics' Courier HST Dual Standard modem. For \$1,295 (or \$1,249 for the internal model), you can communicate with CCITT V.32 modems and all HST modems. Although the unit runs into trouble

The PC LAN Labs crew liked the Courier HST Dual Standard modem because it's easy to use and versatile. Also, U.S. Robotics products enjoy an excellent reputation earned over years of service.

on severely degraded phone lines during V.32 transmissions, its flexibility gives you access to synchronous and asynchronous modems ranging from 300 bps to 14,400 bps using the major data-transfer standards: CCITT, Bell, and HST.

The PC LAN Labs crew likes this modem because it is easy to use and versatile. Also, U.S. Robotics products enjoy an excellent reputation earned over years of service. So we were quite surprised to see marginal performance from the Dual Standard on degraded telephone lines. When the going got tough, it slowed down considerably and often aborted transfers.

### CONNECTIVITY SMORGASBORD

The Dual Standard offers a smorgasbord of connectivity protocols, along with two specific options for high-speed connectivity, CCITT V.32 and the company's proprietary HST modulation protocol. At pre-

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CIRCLE 727 ON READER SERVICE CARD

# The question is not "do you need a network?"; the question is "what kind of network do you need?"

If your company has more than one computer, connecting them together is either an immediate concern or soon will be. There are numerous connectivity methods available. The choice your company makes will directly affect you. Want to discover the most appropriate connectivity method for *your* needs? It may be a surprise.

## Check off the capabilities you need:

- 1. Share access to one or more printers or plotters
- 2. Share access to a modem
- 3. Exchange electronic mail and messages with other users
- 4. Electronically transfer data files between computers (rather than pass diskettes)
- 5. Access a common library of data files, like drawings, document templates, memos, boilerplate, etc.
- 6. Access a common database, where multiple users must access the same records simultaneously (e.g. an order entry system)

If you checked any or all of the first five capabilities listed above, but not number six, your company does **not** need a full-blown LAN. This news can save your company a lot of money and make life much simpler for everyone concerned. Skip to the next paragraph immediately. If you selected the sixth capability, a data-sharing LAN is needed, but only for those users who must access the shared database. To achieve the other capabilities, your best—and most economic—solution is...

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Dallas, Texas, U.S.A.

sent the fastest connectivity is with HST-compatible remote modems. When connected to a V.32 modem, the Dual Standard allows 9,600-bps transmissions; the HST mode yields transfer rates up to 14,400 bps when the unit is connected to

The Courier HST Dual Standard offers a smorgasbord of connectivity protocols, along with two specific options for high-speed connectivity, CCITT V.32 and the company's proprietary HST modulation protocol.

another HST modem. If it encounters a slower remote modem—or noise too severe for high-speed connectivity—it slows down.

Specifically, if the remote modem is not HST compatible but is V.32 compliant, the modems try to connect at 9,600 or 4,800 bps instead. If the line conditions or the remote modem are neither HST nor V.32 capable, the modems try to connect at 2,400, 1,200, or 300 bps. After the modems agree on the transfer protocol, they negotiate error control and data compression in the same manner.

The Dual Standard supports V.42 and MNP 1 to 4 error control protocols. If the remote modem supports an error control protocol, it enables V.42 in one of its two modes. The modems select data compression using either V.42bis or MNP 5. The Dual Standard supports all major modulation standards, including Bell 103 and 212 and CCITT V.22bis, V.22, and V.21. All of these protocols are available in any combination for the most efficient connectivity.

The Dual Standard's negotiations are automatic and transparent to the operator,

**Courier HST Dual Standard**

U.S. Robotics Inc., 8100 North McCormick Blvd., Skokie, IL 60076; voice: (800) 342-5877, (708) 982-5001; BBS: (708) 982-5092.

**List Price:** External or rack mount, \$1,295; internal, \$1,249. BBS operator discounts available.

**In Short:** The Courier HST Dual Standard is a versatile high-speed modem geared for automatic connectivity with both asynchronous and synchronous modems, but it's not suited to high-speed V.32 data transfers on telephone lines with severe signal degradation. It includes a handy DIP switch chart at the bottom.

CIRCLE 610 ON READER SERVICE CARD

but you can override any of them by commands to the modem for specific applications. By changing the default power-on configuration, you can force a Dual Standard modem to use the V.32 protocol rather than HST when it talks to another Dual Standard, but normally this results in slower transmissions.

The Courier HST Dual Standard uses the Hayes Standard AT Command Set, along with an extended command set to address all the configuration and protocol options. Your commands can override the DIP switches and initialize or change the modem settings.

The Dual Standard is available in external, internal, and rack-mount models. We tested only the external model. Its black molded plastic case measures 8.3 by 1.6 by 12.7 inches. The front displays 12 LED status indicators. The well-marked power switch, DB-25P serial connector, power plug, 10 DIP switches, and wall/telephone plugs occupy the back of the case. As usual, you can monitor call connections through an internal speaker, using a software-programmable volume control.

**SIGNAL LIGHTS BUT NO SPEEDOMETER**

The LED status indicators include high-speed, answer, carrier detect, off-hook, receive data, send data, terminal ready, modem ready, request to send, clear to send, error control, and synchronous mode. The

U.S. Robotics includes a good chart on the bottom of the modem explaining the function and the default setting of each DIP switch.

high-speed LED comes on for connections above 2,400 bps; there is no differentiation between an HST and a V.32 connection. The error control LED is on when the modem successfully connects with another modem using error control. Again, you

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Symantec Corporation, 10201 Torre Avenue, Cupertino, CA 95014, 408/253-9600.

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won't know whether the connection is V.42 or MNP 1 to 4.

U.S. Robotics includes a good chart on the bottom of the modem explaining the function and default setting of each DIP switch, making it easy for you to adapt the modem to your equipment and your own requirements from power-on defaults. The company deserves high praise for this simple and inexpensive step. Furthermore, it provides a pamphlet describing switch settings for the major communications programs. Once they're set, you rarely have to change them.

Documentation for the Courier HST Dual Standard encompasses all the U.S. Robotics high-speed modems—the Courier HST Dual Standard, Courier HST, and Courier V.32. The common user manual reflects the degree of compatibility between these modems. Explanations of the modem instruction set are clear and precise. Even if you know very little about modems, you'll find the descriptions easy to follow.

Since the unit is equally adept with synchronous applications, the manual devotes an entire chapter to steps for converting to synchronous operation. You also get a

handy quick-reference card for the modem commands, DIP switch settings, and S-register values.

**U.S. Robotics supplies free technical support over a toll-free number, along with a BBS offering product news, upgrades, discounts, and user e-mail conferences.**

The overall performance was disappointing. The Courier HST Dual Standard did rate first for transferring database files

in the baseline tests, but its performance on CCITT impaired telephone line tests was substandard. We conducted all tests in the V.32 mode, so no conclusions about the performance of the HST modulation mode should be drawn from these tests.

The Courier HST Dual Standard did connect with the MultiModem V32 MT932EAB at 9,600 bps and vice versa, but it aborted the file transfers when it was in host mode. It is fully compatible with the Hayes Ultra 96.

U.S. Robotics supplies free technical support over a toll-free number, along with a BBS offering product news, upgrades, discounts, and user e-mail conferences. The unit comes with a two-year parts-and-labor warranty, with warranty extensions available at \$25 per year.

The Courier HST Dual Standard performs well except over severely impaired telephone lines. Its strength lies in its versatility, with a variety of protocols for automatic connections to other modems. ■

*Mike Byrd, a fighter pilot for the U.S. Air Force, is a division chief in a branch of the federal government that develops sophisticated electronic systems.*

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