SOLID-STATE ELECTRONICS...BUILD AND LEARN

Radio-Electronics®

75¢ FEB. 1975

THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS

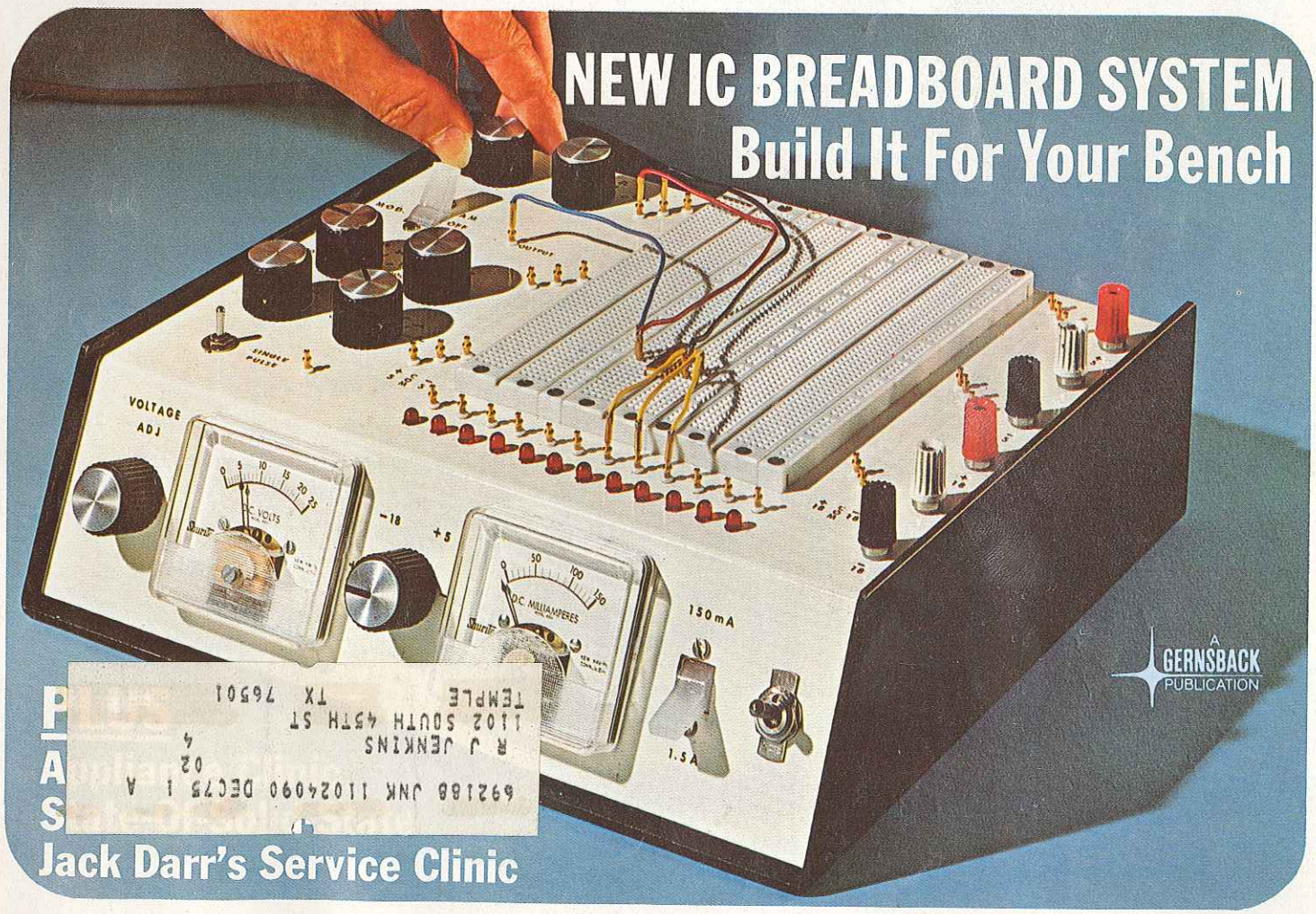
R-E EXCLUSIVE TV TYPEWRITER II
It's A Computer Terminal

INSIDE DIGITAL ELECTRONICS
What Digital Really Is

3-UNIQUE DIGITAL CLOCKS
Build Them Today

NOISELESS DISCS AT LAST
New Noise-Reduction System That Really Works

TAMING THE BASS REFLEX
Get The Most From This Design



Jack Darr's Service Clinic

BUILD THIS

This new TV Typewriter is primarily designed around TTL logic and provides the builder with many plug-on option boards. The options include a manually operated cursor control, computer operated board and much more

by ED COLLE

TV TYPEWRITER II

AFTER SEEING THE OVERWHELMING response shown for the TV typewriter story featured in the September 1973 issue of **Radio-Electronics** magazine, it is obvious that there are many readers interested in these units. As described in the previous article, there are many uses for a display such as this with the possibilities limited only by the imagination of the user.

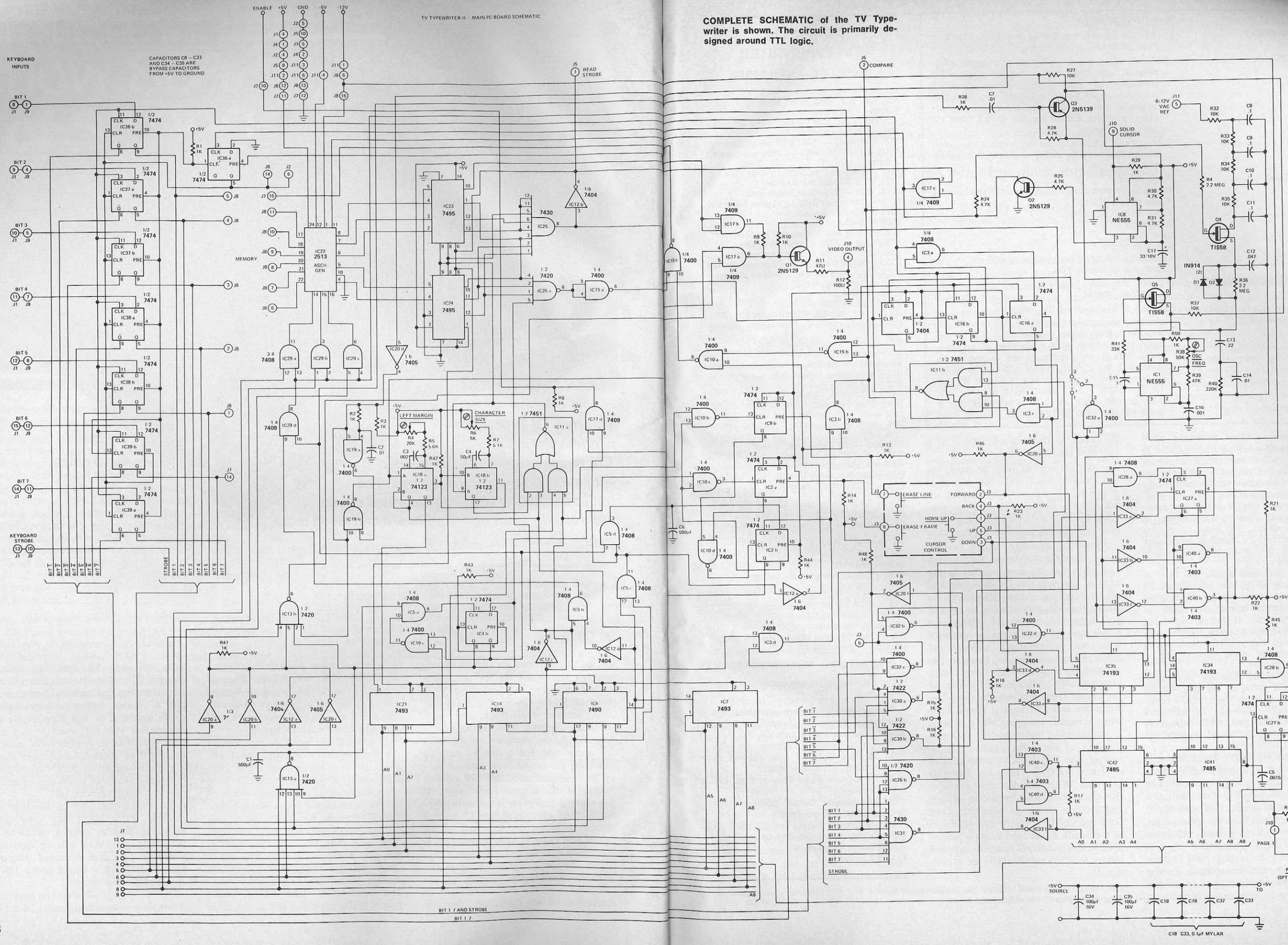
One of the biggest applications of these units, however, is for data communications with computers. Combined with a keyboard, we have one of the fastest and most efficient means for an individual to communicate with a machine. An excellent example is the Mark-8 minicomputer shown on the front cover of the July 1974 issue of **Radio-Electronics** magazine. You can be sure that more powerful and more economical units will follow. Then of course, if you don't have or don't want your own machine, you can always tie into a full size time-shared system, assuming you have access to one.

If you tried to build the terminal in the September 1973 issue, you probably discovered as many did that although the printed circuit boards were commercially available, some of the semiconductor chips were rather difficult to get. For this reason, this terminal has been built using 74 series TTL IC's that are common, easy to get, and inexpensive. The only MOS chips used are 2102 RAM's (Random Access Memories) and a 2513 character generator. And just to make things really easy, the unit is available as a complete kit including circuit boards, IC's, discrete components, interconnectors and optional power supply. A cabinet, however, is not being made available at this time. Since in most cases you will want to use the TV typewriter in combination with a keyboard of some kind to enter messages, the supplier of the TV typewriter is making available a low-cost compatible keyboard/encoder too.

To make the unit as flexible as possible, extra effort has gone into designing plug-on options including a manually operated cursor control board, a computer operated plug-on board, screen read board and a URT communications board.

(text continues on page 30)
(complete schematic on pages 28 & 29)

COMPLETE SCHEMATIC of the TV Typewriter is shown. The circuit is primarily designed around TTL logic.



SPECIFICATIONS

DATA FORMAT	1024 characters arranged as 2 pages of sixteen lines of 32 characters each.
OUTPUT	2.25-volt video pulse — 1-volt sync pulse compatable with the video input of a standard television or video monitor. The display's response must be to 1.6 MHz for maximum character size and to 3 MHz for minimum character size and should be flat to 4.5 MHz for best appearance.
INPUT	7 bit parallel ASCII positive logic with a key-press strobe that may be either positive or negative going.
CONTROLS	Page select Home up (moves cursor to upper left hand corner) Erase to end of line Erase to end of frame Cursor on off Line feed Carriage return Adjustable left hand margin positioning Adjustable character size
POWER REQUIREMENTS	5 Vdc, 2A, 5% regulation; —5 Vdc, 15mA; —12 Vdc, 20mA.
SIZE	12" long × 9¾" wide × 3½" high.
ACCESSORIES	Manual cursor control board. Computer cursor control board. Screen read board (allows transfer of accumulated data to an outside device — should be used with the cursor control and URT boards). URT board (receives and transmits data in RS 232 format using 7 bit ASCII code at 110, 220, 440, or 880 baud or if a different crystal is used 150, 300, 600, or 1200 baud).

1. **Cursor control (manually operated)** allowing the operator to position the cursor anywhere on the screen by using a set of switches similar to the keyboard switches.
2. **Cursor control (computer operated)** allowing the operator to position the cursor on the screen by sending commands to the display through software.
3. **Screen read** allows the user to edit all of the information on the screen using the cursor control board and then to send all of the accumulated data out to some external device using URT board, or as parallel data directly to a computer.
4. **URT board** receives and transmits data in RS 232 format using a seven-bit ASCII code. Baud rates can be multiples of either 110 or 150 depending upon a choice of crystals, up to 1200 baud.

The basic character organization is very similar to the original TV Typewriter, in that there are sixteen lines of 32 characters, however, this unit has a second page of memory as part of the basic unit rather than as optional accessory, providing a total character memory of 1024 characters.

Since the FCC is very rigid in their requirements for transmitters in the television frequencies, the unit has been designed to be connected directly to the input to the video amplifier of a standard television set.

Although any set may be used, the small-screen black and white portables give the best picture. The connections are simple and a jack can be provided to allow switching between terminal and normal television operation.

Automatic carriage return is provided after the last character of each line, returning the cursor to the beginning of the next line. Unless switched off, a blinking cursor always shows where the next character is to go and you have the option of writing on either one of two pages of memory which are independently selected and displayed on the screen, through the PAGE SELECT switch. This same switch also provides automatic carry-over of the cursor from one page to the other when the end of frame is reached; or when selected, automatically performs a "home up" (return to line 1— column 1) of the same page. Erase to end of line (EOL) and erase to end of frame (EOF) functions are also provided. When enabled, they perform the erase function from the cursor location on the page selected. Line feed and carriage return are provided as well; with a line feed being a binary 0001010 or a control J, and a carriage return as a binary 0001101 or a control M.

PARTS LIST
TV TYPEWRITER

PARTS LIST — MAIN BOARD

IC1, IC8 — NE555 timer
IC2, IC4, IC9, IC16, IC27, IC36, IC37, IC38, IC39 — 7474 dual "D" flip flop
IC3, IC5, IC28, IC29 — 7408 quad AND gate
IC6 — 7490 decade counter
IC7, IC14, IC21 — 7493 4 bit binary counter
IC10, IC15, IC19, IC32 — 7400 quad NAND gate
IC11 — 7451 dual AND-OR-INVERT gate
IC12, IC33 — 7404 hex inverter
IC13, IC26 — 7420 dual NAND gate
IC17 — 7409 quad AND gate (open collector)
IC18 — 74123 dual one shot
IC20 — 7405 hex inverter (open collector)
IC22 — 2513 ASCII character generator
IC23, IC24 — 7495 4 bit shift register
IC25, IC31 — 7430 8 input NAND gate
IC30 — 7422 dual NAND gate (open collector)
IC34, IC35 — 74193 4 bit up/down counter
IC40 — 7403 quad NAND gate (open collector)
IC41, IC42 — 7485
R1, R2, R3, R8, R9, R10, R13 to R23, R26, R29, R42 to R49 — 1000 ohms, ¼-watt carbon
R4 — 20,000 ohms, trimmer
R5 — 5600 ohms, ¼-watt
R6 — 5000 ohm trimmer resistor
R7 — 5100 ohms, ¼-watt, 5%
R11 — 47 ohms, ½-watt
R12 — 100 ohms, ½-watt
R24, R25, R28, R30, R31 — 4700 ohms, ¼-watt
R27, R32 to R35, R37 — 10,000 ohms, ¼-watt
R36, R50 — 2.2 meg ohms, ¼-watt
R38 — 50,000 ohm trimmer
R39 — 47,000 ohms, ¼-watt
R40 — 220,000 ohms, ¼-watt
R41 — 33,000 ohms, ¼-watt
C1, C6 — 500 pF
C2, C7, C14 — 0.01 μF
C3 — 0.002 μF
C4 — 50 pF
C5 — 0.0015 μF
C8, C9, C10, C11, C15, C18 to C33 — 0.1 μF
C12 — 0.047 μF
C13 — 0.22 μF Mylar
C16 — 0.001 μF
C17 — 33 μF, 10V, tantalum
C34, C35 — 100 μF, 16V, electrolytic
Q1, Q2 — 2N5129 silicon
Q3 — 2N5139 silicon
Q4, Q5 — TIS58 field effect transistor
D1, D2 — 1N914 silicon

PARTS LIST — MEMORY BOARD

IC1 to IC6 — 2102 1024 bit static RAM
C1, C2 — 0.1 μF, 10V

The following items are available from Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX.

#CT-1024 Terminal System Kit with 1024 Memory Card — less cabinet or power supply. $175.00 postpaid.

#CT-E Screen Read Plug-in Card kit. $17.50 postpaid.

#CT-M Manual Cursor Control Plug-in Card kit. $11.50 postpaid.

#CT-P Power Supply for CT-1024 — 115-230 Volt Primaries. $15.50 postpaid.

#KPD-2 Keyboard Kit — 53 Keys. $39.95 postpaid.

Next month's issue will contain the construction details and foil patterns plus a detailed description of how the unit works.

Noiseless Discs At Last

New noise reduction system can be carried right up to and including the finished disc. For the first time, noiseless discs may become a reality.

by LEN FELDMAN
CONTRIBUTING HIGH FIDELITY EDITOR

IN A RECENT ISSUE OF RADIO-ELECTRONICS (October, 1974), we summarized some of the techniques currently being used in the recording and high-fidelity industries to overcome one of the few remaining impediments to "total fidelity" — noise. We pointed out that a company called *dbx, Incorporated,* though in existence barely four years, was devoting its primary efforts to the development of a variety of noise-reduction products for professional recording use and for audiophile use and promised to tell you more about the *dbx* processors in the future.

Between the time we wrote that article and now, *dbx* has announced and demonstrated yet another breakthrough in the noise-reduction battle and the results are so startling as to warrant a complete look at the *dbx* approach. Instead of confining their compression-expansion system to master tapes only (which are then used in the cutting of a master disc), they have carried the process right up to and including the finished disc itself, thereby offering the audio enthusiast the potential of records free of audible surface noise and capable of reproducing wider musical dynamic range than ever before.

Noise and dynamic range

Musical dynamic range can be defined as the difference between the maximum recorded peak musical signal and the minimum significant program material, expressed in decibels. As residual or background noise level is reduced, the available dynamic range increases proportionately. This is illustrated in Fig. 1, where the loudest sounds to be reproduced are limited by one or more of such factors as tape saturation, amplifier power output limitations, loudspeaker power input limits, and the like. Lowest level of sounds, on the other hand, are limited only by ambient noise conditions which may include residual tape hiss or noise (from the master tape), residual surface noise determined, even in a fresh disc, by the smoothness of the vinyl compound from which the disc is pressed and even the ambient noise conditions in the listening room (usually not the limiting factor). As can be seen in Fig. 1, any device that serves to reduce the "lower noise limit" relative to the fixed, loudest sounds, improves the overall signal-to-noise ratio directly.

In live concerts, loudest musical passages may well be 100 dB above quietest passages. Unfortunately, even the very best tape recorders, operated with some safety margin so as to keep peak distortion levels at a low value, have a usable dynamic range of approximately 60 dB. A common method of reducing musical dynamic range is for the recording engineer to alter instantaneous levels with manual gain controls while the recording is being made. This requires the recording engineer to be somewhat of a musical expert so he can study the musical score and anticipate sudden crescendos and compensate for them by reducing recording level and then deliberately increase levels when quiet passages occur to record them "above" the level of tape noise.

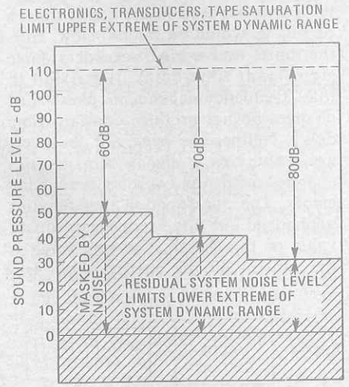


FIG. 1—IF NOISE LEVEL could be lowered, dynamic range can be increased.

Automatic gain controls, such as compressors and limiters are also often used in professional recording studios. Compressors work by gently or gradually reducing gain in the presence of loud signals while increasing gain as signal levels are diminished.

The result of the various forms of dynamic range reduction through signal tampering is that while soft sounds are recorded on tape above noise level and crescendos have been reduced in relative scale, the excitement of the performance has also been compromised. The use of professional noise-reduction systems (such as Dolby "A" or the professional versions of *dbx* compress-expand systems designed for recording studio use) on individual tracks of a 16- or 24-track master tape and on the subsequent mix-down tape (each successive mix-down would normally add to the residual noise problem) at least partly eliminates the need to restrict the dynamic range of the program to prevent tape-noise build-up. Even if the finished master tape recording had a 100-dB usable dynamic range (a condition which cannot be fulfilled by conventional recording tapes) the music must be transferred to a conventional disc which has, at the very best, a 65-dB dynamic range. Thus, there is still the problem of a musical dynamic range which is 30 to 45 dB too great for the recording medium.

The dbx system applied to tape

Since the *dbx* system was first applied to professional tape recording situations, it will be helpful to understand how this system works in that medium. A linear decibel compressor-expander can be set up as shown in Fig. 2. Voltage-controlled amplifiers control the input and output gain. Input and output level-sensors control gain with an appropriate control polarity to produce compression in section