

ENTREX SYSTEM 480

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A System 480 CRT keystation is shown in front of the compact central control group.

MANAGEMENT SUMMARY

The Entrex System 480 now has a 3½-year history of processing data entered at CRT keystations. Extensive editing and validation checks culminate in the recording of relatively error-free data on magnetic tape. This output can be blocked and structured in various IBM-compatible and other industry-compatible formats. To the operator/machine interaction common to shared-processor data entry systems, Entrex has added comprehensive operator and supervisor HELP lists. These easily accessed keying instructions quickly specify the proper operating code to a hesitant operator or supervisor and thereby shorten reaction times appreciably. During the keying of a record format, the system also calls for needed information step by step.

Before starting to key a new batch, the operator selects any of 10 record formats associated with her assigned batch. Of the 10, one format is an 80-character system-supplied program and the other nine are written by the user. Formats can be written to link automatically as records are keyed (chaining). During verification the formats associated with a recalled batch of records are recalled with them. The operator can interrupt an operation at any time by keying HELP. She can then start another operation, key HELP again, and resume the interrupted operation. Any number of operators can use a particular format at the same time.

Fields can be keyed and visually verified, or they can be validated by means of check digit, batch total, or zero balance on any one field at a time or by range-check techniques, as directed by the controlling record format. Totaling and balancing can also be performed on a document level.

The System 480 is a multistation shared-processor data entry system that supports as many as 32 CRT keystations. Keypunch and typewriter-style keyboards are both available. Output consists of 7- or 9-track IBM-compatible magnetic tape. Operation of remotely located keystations over leased lines is possible.

CHARACTERISTICS

MANUFACTURER: Entrex, Inc., 168 Middlesex Turnpike, Burlington, Massachusetts 01803. Telephone (617) 273-0480.

CONFIGURATION

The Entrex System 480 basically consists of 1 to 32 DATA/SCOPE keystations (one of which is assigned to the system supervisor), a minicomputer processor, 1 to 4 magnetic disc drives, and 1 to 4 magnetic tape transports. Tape drive characteristics, when more than one is installed, need not be uniform provided that suitable controllers are used. The processor, central disc, and a magnetic tape drive, which are housed within a single cabinet, are called the central control group. Additional I/O devices include serial and line printers. Modems and interfaces are connected for communications. OCR input is not admitted at present. A keystation can be connected to the processor by cable up to a distance of 1000 feet.

DATA/SCOPE KEYSTATIONS: Incorporate both a keyboard and a CRT display. Keyboard arrangements similar to those of either an IBM 29 Card Punch or a typewriter are available. In addition, each keyboard includes 17 function keys necessary to System 480 operation. A 10-key adding machine cluster for numeric entry is located to the right of the typewriter keys. Both keyboards implement a set of 64 characters.

The DATA/SCOPE screen displays up to 480 characters distributed in 12 lines of 40 characters each. The following kinds of information are presented: field names and delimiters, keyed data, and job status information. Formatting of the displayed information affects the number of fields that can appear on the screen at one time.

The top line on the screen, called the status line, displays information about the job in progress. The second line is reserved for error messages to the operator and is normally blank. The remaining 10 lines contain the formatted data being entered, verified, or examined.

The cursor, a blinking rectangle of light that is equivalent to one character in size, indicates where the next data character will appear on the display.

CENTRAL PROCESSOR: The processor, a Data General Nova, has a 1.2-microsecond memory cycle time, a 16-bit word length, and a 65,536-byte storage capacity. Safety features include power failure detection and automatic restart.

DISC DRIVE: A Diablo Systems Model 31, this is a single-disc unit that utilizes both disc surfaces. The disc pack is organized into 203 cylinders of 2 tracks/cylinder. Each track is divided into 24 sectors of 128 usable words/sector. Average, maximum and track-to-track positioning times are 67, 135, and 15 milliseconds, respectively. Average rotational delay is 20 milliseconds, and data transfer rate is 1.56 million bits/second. Model 31 has fixed read/write heads that retract automatically upon power failure.

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➤ Supervisory duties, which may be performed by a chief operator, concern the management of data flow through the system. She employs one of the data entry keystations rather than a special terminal or console, but only after keying an identity code.

Another unusual System 480 feature is the availability of keystations with either a keypunch or a typewriter-style keyboard. Both kinds can be combined in a single installation. The user can therefore mix keystations according to operator backgrounds and data entry applications. For example, proficient operators with keypunch backgrounds are most productive in the central data entry environment, where high keystroking rates are paramount, but clerks in source data capture locations are more apt to have typewriter experience.

The 10-key numeric cluster on the right side of the typewriter keystation provides an additional facility for rapid entry of numeric data.

SOFTWARE

A package of considerable importance called DATA-CHECKS is scheduled for delivery in July 1973. For those who might want to expand the editing and validating power of the system, DATACHECKS offers an Editor language that is a simplified form of COBOL. With the statements provided by this language, the user can design extremely complex routines that fit his special application needs. For example, the logic commands (if greater than, less than, equal to, not equal to) are especially useful for causing stored data to be duplicated automatically when a specified condition in the input data arises, for mandating the skipping of certain input, for setting the conditions of both conditional program linking and conditional verification, for imposing sequences of batch balancing using different totals, or for prescribing different kinds of reformatting upon outputting to tape according to conditions that characterize the data. In reformatting, some examples of allowable operations are the following: data packing, space and zero suppression, automatic data insertion, resequencing of fields, and space, zero, and hexadecimal character insertion. The common objective of all Editor routines is reduction of keystrokes required of the operator.

One type of editing, called record content or on-line checking, supplements the basic error detection capabilities contained in input formats by testing the interrelationships among fields within a record (e.g., numeric-only, must enter, greater than). Record content programs are executed following the entry of their associated record types.

Another type of editing, called batch content programs, adds to the features just described the capability of testing the interrelationship of records in a batch. These tests can be performed automatically upon termination of a batch by the supervisor.

Another useful feature of DATACHECKS is the command sequence library. It stores a name that identifies a se- ➤

➤ As many as 4 drives, with a total capacity of nearly 10 million bytes, can be installed. Disc space is assigned dynamically; that is, requests for space are queued so that data records can be located optimally on the discs.

MAGNETIC TAPE DRIVES: Made by Pertec, these units write formatted, validated data on 0.5-inch IBM-compatible 7- or 9-track tape. One drive is standard, but up to 4 of the same type can be controlled by the central processor. The density of the 7-track tape is 556 or 800 bits/inch; parity can be odd or even. For 9-track tape the density is 800 or 1600 bits/inch with odd parity. Each reel contains 2400 feet of tape. Forward operating speed is 25 inches/second; rewind speed is 150 inches/second.

MODEL 5165 SERIAL PRINTER: Operates at 165 characters/second and prints 132 characters/line, 10 characters to the inch, 6 lines to the inch. It has a 63-character print set formed from a 5-by-7 dot matrix. The paper slewing rate is 24 inches/second. Paper width is 14-3/8 inches maximum.

MODEL 5300 LINE PRINTER: Prints 300 lines/minute, 132 characters/line, 10 characters to the inch, 6 lines to the inch. It has a 64-character print set. The paper slewing rate is 27.5 inches/second. Paper width can be from 3.5 to 19.5 inches.

OPERATING MODES

- Data entry (consists of record format selection, batch or job assignment, keying of data, and error correction).
- Examine (enables operator to access a designated batch stored on the disc and, beginning at any designated record, to scan either forward or backward on the screen; batch can be re-entered for updating or error correction; these functions are often called Search and Re-entry in other systems).
- Verify (character-by-character rekeying of data previously recorded by the same or a different operator for the purpose of direct comparison; in typical operation verification is performed only on fields that contain previously overridden errors or are out of balance; scan verification from the CRT screen without rekeying is often used).
- Record format entry (following completion of layout form by supervisor, an operator or the supervisor calls for record format field definition program while in Entry mode; the system then successively displays questions on the screen; answers from the form are keyed into the format library; this mode, therefore, is a special case of Entry).

SYSTEM OUTPUT

- Industry-compatible magnetic tape (see Magnetic Tape Drives).

SYSTEM PROFILE

Disc storage allocations listed below should be considered common to many Entrex 480 installations rather than a rigid specification. All disc specifications can be increased by simply expanding the disc capacity. Figures appearing below assume a 2.4-megabyte disc capacity.

- Record length—can be up to 1000 characters (or optionally up to 4096 characters) on the output tape; there is no system limitation on the input side.
- Record formats—any number within limits set by the disc capacity, but 250 is representative.
- Data record storage—25,000 80-character records or 18,000 120-character records. ➤

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▷ quence of system operations on the disc. The entire sequence is executed whenever the supervisor keys the assigned code.

Since there is no user experience with DATACHECKS at this date, it is not clear how readily the user can write programs with the Editor language. To be sure, the editing and validation procedures previously available can still be incorporated by Entrex without user involvement. We surmise that for more advanced testing without intricate logic conditions, the user need only call up stored routines in the desired order. To install intricate logic relationships, the user will probably have to make a commensurate effort, but the available macros should be sufficiently broad to keep his exertions within bounds. To what degree on-line validation can be expanded before causing operational delays is indeterminable at this time.

COMPANY INFORMATION

The first installation of the Entrex System 480 was made in February 1970. The first installation subsequent to field testing took place in March 1971. The company says that at present there are 150 systems operating in North America. Delivery time is quoted as 60 days.

Entrex has sales offices in a number of major U.S. cities, predominantly in New England and the mid-Atlantic states, but also in Chicago, Los Angeles, and San Francisco. The company provides its own maintenance from all of these locations. Various service organizations are designated to provide maintenance in secondary population regions.

In addition to selling in the United States, Entrex also markets in Canada through a subsidiary and in the United Kingdom through Redifon Data Systems, a wholly owned subsidiary of Rediffusion Organization. Redifon has purchased \$3.7 million worth of systems from Entrex since 1971 and has contracted for more in the current year. In addition, Nixdorf of West Germany has contracted for \$1 million worth of systems in each quarter of the current year and will market them throughout Europe.

It is difficult to assess the financial stability of Entrex at the present time. Founded in 1969, this privately held company, which now employs 260 people, grossed \$3,200,000 in the fiscal year ended December 31, 1972. Unprofitable in past years, Entrex reports that it grossed \$2,800,000 in the first quarter of 1973 and earned a profit of \$91,000. Funding appears to be adequate, at least for the near term, if one may judge from Entrex's marketing and product development activities. The installation base claimed by the company is certainly encouraging for this stage of its history. Moreover, the features and capabilities of the System 480 are clearly up to date and offer some advantages not present in competing systems.

USER REACTION

Users of the Entrex System 480 leave no doubt of the system's reliability. One said that in a year and a half of ▷

- ▶ ● Special edit routines (including command sequence macros)—up to about 250 routines.
- System management storage—up to 25,000 records denoting job status, statistical information, accumulation totals, edit and validation routines, and check digit routines.

SOFTWARE

All system operations are carried out under software control. Examples are data station operation, data station display, supervisory functions, job and operator statistics, I/O device control, data transfer between system components, reformatting of data records and blocking on output tape, tape-to-disc transfer, error checking, validation, editing, record format entry and assembly, totaling, balancing, searching, communications, etc. There are 100 software accumulations, with five available for conditional verification. A particular feature under software control in the Entrex system is the operator's list of HELP functions.

DATACHECKS: Performs input error detecting and editing, advanced output reformatting, error logging, batch sorting, tape searching, batch validation, and batch updating. In addition, it implements command sequence macros and media conversion. It maintains a library of codes, such as EBCDIC, BCD, ASCII, NCR, and others, for availability during output recording. It will also control all editing and validation operations, range checking, value table lookup, check digit verification, field boundary checks, field definition checks, mandatory entry, batch balancing, batch totals, right justification, zero or space filling, keying, scanning, and conditional verification that have previously been under other software packages. Check digits can be generated for modulo 7, 10, or 11. The outstanding aspect of this package is that it provides the user with a fairly simple Editor language resembling COBOL as a means of writing programs for editing, validation, logically triggered duplication and skipping, table lookup and range checking, and accumulation and balancing routines involving all four arithmetic operations. Other details are in the Management Summary.

OPERATOR'S HELP LIST: Has been expanded under DATACHECKS and divided into two categories. One contains all those functions that are available to the operator when a batch is not active at the keystation (e.g., Start Standard Job). The other lists all functions available once a batch is open.

OPERATOR STATISTICS: Provides the supervisor, upon keyed request, with summary information on a particular operator. It states the operator's identification, her total keystrokes (including use of certain function keys such as cursor backspace and field release), net keystrokes (non-data keys excluded), total time, total and net keystroke rates/hour. For the Verify operator, the number of corrections is included as well.

OUTPUT TAPE RECORDING: Includes record reformatting and record blocking in addition to the basic recording operations. Variable record lengths within a batch are allowed. Records on the disc can be sequenced in a specified order when transferred to tape. These features enable the operator to record source data in any convenient order while the system determines its final form.

SYSTEM OPERATION

The supervisor gives the individual operators their daily assignments and monitors their performance through statistical printouts. Supervisory functions are presented by a second list of operations (Supervisor's HELP List). Access to this list is gained via the Operator's HELP List by keying the entry "Supervisor" followed by a nondisplayable password. ▶

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▷ operation the system has never been down; others placed the failure rate at less than 2 percent of the time. These reports put the Entrex system on the same reliability footing as that of competitive data entry systems.

On the other hand, some temporary problems were experienced during original installation and during later expansion of the disc storage capacity. Users stated their satisfaction with Entrex service during these periods and felt that the difficulties were reasonably short-lived. One user expressed the opinion that debugging of the components was such a simple matter that his transition to the system would have been shortened by faster delivery.

Users concurred in liking the two-keyboard approach of Entrex. One said that it enables him to minimize the number of high-paid keypunch operators in favor of lower-paid typists who, he said, perform as well or better. Another said that he prefers keypunch operators in the central data entry location and typist clerks in source data capture activities. Others remarked that the two-keyboard mix of stations has changed the character of their work forces.

Frequent mention was made of source data capture. Some keystations were placed in source data sites situated within 1000 feet of the Supernova processor and connected by cable. Stations at remote sites were connected by communications lines. Some dissatisfaction was expressed with the limited scope of the communications presently available, and especially with the inability to communicate with computer systems.

A favorable comment about the ability of the supervisor to assume system control from any keystation is particularly interesting. When an operator is situated away from the central location, perhaps on another floor, and cable-connected to the processor, she may occasionally call the supervisor to her station for help. The ability of the supervisor to interrogate the system from that station spares her from walking back to her console for this purpose.

Users consistently said that editing and validating software was a principal reason for their choice of the Entrex 480 originally, and expressed satisfaction with its effectiveness. Interest in the forthcoming DATACHECK package was voiced; a desire of users to write their own programs was also expressed.

The number of keystations among those questioned varied from 12 to 28, with a median of about 20. Typical disc storage capacity was 5 megabytes. □

▶ **ERROR CONTROL:** Parity generation and checking is performed on data transferred between the computer and disc and between disc and tape or to other output devices. Odd parity is written on 7-track tape and either odd or even parity on 9-track tape. Longitudinal and cyclic redundancy characters are created and written on disc and tape. A read-after-write check is performed on both tape and disc. Data written on a disc is read during the next revolution and compared with the original data in core; erroneous data is immediately rewritten. Validation and other errors lock the keyboard and cause a tone to sound.

COMMUNICATIONS: Each remote site can incorporate one or more keystations connected over a leased telephone line or the switched telephone network to the Nova miniprocessor. Standard software or DATACHECK software controls the remote stations. A leased line must be full duplex and C1 conditioned. One line is required for each keystation and must be dedicated while the station is in operation. Entrex supplies the modem. Transmission is at the rate of 1200 bits/second.

PRICING

The Entrex System 480 can either be purchased or obtained under a one-, two-, three-, or five-year lease. Maintenance charges are included in the lease costs that follow, but a separate contract must be arranged for purchased items. Service is provided at normal rates during the user's prime shift; emergency service, however, incurs a surcharge. Total system cost depends on the size of the configuration. The table below lists charges for installations according to their incorporated number of keypunch data entry stations. Charges are included for the appropriate control group, consisting of the mini-computer, one 9-track magnetic tape drive, and 2.4 million bytes of disc storage for the 15-station case, 4.8 million bytes for the 24-station case, and 7.2 million bytes for the 32-station case. The cost per data station and rentals are based on a 3-year lease term.

Data Stations	Cost per Data Station	Rental	Purchase	Maint.
15	\$162/mo.	\$2,430/mo.	\$110,685	\$375/mo.
24	148/mo.	3,547/mo.	161,530	551/mo.
32	144/mo.	4,599/mo.	205,970	703/mo.

The basic control group, which includes the mini-computer, multi-disc controller, multi-tape controller, a 7- or 9-track magnetic tape drive, and a disc drive rents for \$1,140 or \$1,483 (including maintenance) and sells for \$51,735 or \$67,210. The lower prices include one 2.4-megabyte disc drive and the higher ones include two drives.

Each keystation with keypunch-style keyboard rents for \$86/month (including maintenance) and sells for \$3,930; maintenance for purchased units is priced at \$14/month. The typewriter-style keyboard with numeric keyset rents for \$92/month and sells for \$4,215; maintenance costs \$15/month. These figures are also based on a 3-year lease.

Other charges are as follows (3-year lease):

Device	Monthly Rental	Purchase	Monthly Maint.
First Additional Disc Drive with Cabinet	\$343	\$15,475	\$50
Additional Disc Drive	274	13,000	40
Additional Tape Drive	279	12,800	40
Additional Tape Control	60	2,500	10
Serial Printer	182	8,500	20
I/O Typewriter	150	6,200	20
Line Printer	554	27,000	50
Communications Controller	192	8,750	30
Check Digits (7, 10, 11)	90	3,840	-
Batch testing	90	3,840	-
Operator Analysis	125	5,200	-
Calculation Capability	270	11,520	-