ICL 1500 Transaction Terminals

A family of desk-top, keyboard/display terminals designed for data entry and data processing applications.

The terminals feature 8K or 16K bytes of memory; typewriter-style keyboard, 256- or 1920-character display; synchronous or asynchronous communications, and dual mini-cartridge tape drives. Two models also include integral hard disk drives. Peripheral devices supported include flexible disk drives, tape drives, and printers.

The 1500 series terminals can be purchased or leased for one, three, or five years. Purchase prices range from $5,020 for a basic 1501 with 8K bytes of memory, 256-character display, keyboard, and dual cartridge tape drives to $17,995 for a 1503-43 with 16K bytes of memory, 1920-character screen, dual cartridge tape drives, and two 5-megabyte fixed disk drives.
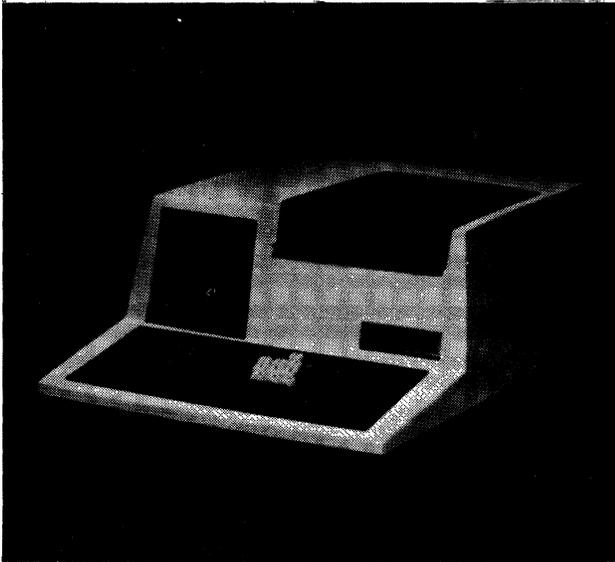
MANAGEMENT SUMMARY

The ICL 1500 Transaction Terminals evolved from Singer's 1500 Intelligent Terminal System, which was based on concepts developed by Cogar Corporation. ICL acquired the 1500 system from Singer in 1977.

The ICL 1500 system emphasizes data entry and data processing in a source data environment and is distinguished by certain unique design features. This uniqueness is derived largely from the 1501's dual tape transport system, which employs snap-in cartridges instead of cassettes or reels. ICL is also promoting the 1501 and its peripheral devices as key elements in data entry/communications complexes. The ICL 1501 is thus a compact, desk-top, general-purpose data entry device or intelligent terminal, and in either case it can be part of a sophisticated communications system. Since its initial introduction in 1971, the basic system has been expanded to include a more powerful processor and disk memory capability.

The Model 1501 Transaction Terminal is the heart of the Series 1500 system. Its processor and I/O interfaces form the bases for all of the other terminals in the product line. The attractive console contains a 5-inch CRT display and either a keypunch-style or typewriter-style keyboard. At the top of the console, easy access is provided to the snap-in cartridges of the internal dual tape transports. Other vital parts include a serial I/O interface, a mini-processor and 8K-byte semiconductor memory, and an optional communications interface, asynchronous or binary synchronous (BSC).

A more recently introduced model of the 1501, designated the 1501-43, employs an integral 5-million character hard disk for program storage and instant random access ▷

CHARACTERISTICS

VENDOR: ICL Inc., Turnpike Plaza, 197 Highway 18, East Brunswick, New Jersey 08816. Telephone (201) 246-3400.

DATE OF ANNOUNCEMENT: Information not available.

DATE OF FIRST DELIVERY: 1971.

NUMBER DELIVERED TO DATE: Over 7500.

SERVICED BY: TRW.

CONFIGURATION

The hub of the 1500 system is the ICL Model 1501 Transaction Terminal, which can be connected to as many as 64 individual peripheral devices via an internal serial I/O interface. Examples of such devices are the Model 1511, 1512, 1513, and 1514 Tape Drives, the Model 1551 Serial Printer, and the Model 155X series Line Printers.

ICL 1533 Dual Mini-Cartridge Drives and the Model 1530 Numeric Keypad interface directly with the internal mini-processor, as does the Model 1539 Synchronous Communications Adapter or the Model 1534 Asynchronous Communications Adapter, both of which are installed inside the 1501 housing. An appropriate modem, such as the Bell 201A, interfaces a voice-grade communications line to the adapter.

ICL 1501 TRANSACTION TERMINAL: As the center of system activity, this unit serves both as a data entry device and as an intelligent terminal. It is a single desk-top console that incorporates two cartridge tape drives (exactly like the Model 1533, but internally mounted), a keyboard, a CRT display, a solid-state 8K-byte memory, a miniprocessor, and a serial I/O interface. Data transfer on the coaxial cable ▶

▷ to data files. One tape cartridge drive is provided for removable data media. The ICL 1501-43 is designed to compete with floppy disk systems by providing reliable hard disk storage at low cost. The unique design of the ICL 1501-43 allows for virtually unlimited program overlays for complex validation requirements.

Another extension of the ICL 1501 is the ICL 1502. This terminal provides a powerful 16K-byte processor and a 1920-character visual display. The large CRT provides document reproduction on the screen for users whose applications require this feature. In addition to the ability to display large amounts of data, an editing capability is enhanced by dual intensity, flashing field, and underline functions. Upper and lower case graphics are standard.

The ICL 1505 Transaction Terminal provides 8K or 16K bytes of memory, a 1920-character display, and a detachable keyboard. Cartridge tape drives and flexible disk drives are optional. The 1505 is designed for use in transaction processing, remote job entry, and data capture systems and to provide stand-alone computing where required. It can be used in a cluster system when connected to an ICL 1501-43 or 1503.

At the top of the Series 1500 product line is the ICL 1503. Designed to provide multiple 1501's (or 1502's or 1505's) with shared access to data files as large as 20 million characters, the ICL 1503 supplies all of the required data structuring and manipulating capabilities. The basic system consists of up to eight disks cabled to an independent processor which performs two functions: the data base management of multiple files and an interface to the central processor. The ICL 1503 is software-compatible with all the other Series 1500 Transaction Terminals and provides full file processing at the remote site.

As an intelligent terminal, the 1501 can be useful in many kinds of business applications. The tape cartridge system makes it easy to change the programming from one application to another. One merely snaps in another cartridge containing the new application program, and the tape transport loads it into the processor. In either data entry or intelligent terminal service, the addition of a synchronous or asynchronous communications adapter turns the 1501 into a communications center, day or night.

Let us see what makes the ICL tape cartridge transport unusual. The mechanism employs reel-to-reel design principles, although a cartridge rather than an open reel is employed. The advantage of a simple replacement of cartridges is thereby gained without sacrificing the reliability of reel-to-reel operation. Tape is automatically threaded and rewound. A friction capstan is used to drive the tape, and the tape speed itself is under servo control.

Data records on the 0.15-inch-wide cartridge tape must be converted to computer-compatible format for entry into a computer. However, data on the cartridge tape can be transmitted over communications lines, as can data on standard tape. The 100 feet of tape in a standard cartridge ▷

▶ connected to the I/O interface is bidirectional; hence, one line can service all attached peripheral devices. The transfer rate is 24,000 bytes/second in bit-serial form. When a system configuration includes multiple terminals, the 1501 can communicate with any other station and any other I/O device under program control.

ICL 1501-43 TRANSACTION TERMINAL: The unit is a programmable intelligent terminal designed for high-performance data entry, data validation, and communications functions. It is a desk-like device that includes a keyboard, CRT, tape cartridge drive, solid-state 16K-byte memory, miniprocessor, and 5-million-byte hard disk. Also included is a serial I/O interface with the same characteristics as that of the 1501.

ICL 1502 TRANSACTION TERMINAL: This terminal is an extension of the Model 1501. It includes, in a desk-like enclosure, a keyboard, a 1920-character visual display, two tape cartridge drives, a solid-state memory of 16K bytes, and a miniprocessor. The 1920 VDU is a self-contained unit that functions as a fully buffered I/O device. The editing functions are controlled by a 4K read-only memory built into the display unit itself; no user space in the 1502's 16K processor memory is used to control the functions of the display. Also included is a serial I/O interface with the same characteristics as that of the 1501.

ICL 1503 TRANSACTION TERMINAL: This unit is designed to provide full file processing at a remote site. It includes a keyboard, 5-inch diagonal CRT, two tape cartridge drives, solid-state memory of 16K bytes, disk controller, up to eight disk drives, and a miniprocessor. Multiple 1501's or 1502's can access a 1503's disk storage by being cable-connected through the serial I/O channel. All required data base management functions are performed by the 1503. Software packages (provided by ICL) permit communication of disk files to a central processing unit or within a self-contained ICL Series 1500 network.

ICL 1505 TRANSACTION TERMINAL: The 1505 is a desk-top unit that includes a detachable keyboard with numeric pad, a 1920-character CRT, a serial I/O interface, and an 8K-byte or 16K-byte processor. The 1505 is available with or without dual cartridge tape drives. Both versions can also be configured with up to four 485,888-byte dual-drive flexible disk units. The terminal can be used as a stand-alone unit or in a clustered configuration with the 1501-43 or 1503 terminals.

TRANSMISSION SPECIFICATIONS

One medium of communication among two or more 1501 terminals is the coaxial line of the serial I/O channel. For transmission over substantial distances, however, one of two data communications adapters must be installed.

The Model 1539 Synchronous Communications Adapter, when coupled to an appropriate modem such as the Singer 2024, the Bell 201A or 201B, or equivalent, permits communication over switched or leased networks with any computer employing IBM binary synchronous communications (BSC) protocol, including the Singer System Ten computer and the Singer 4300 Magnetic Data Recording System. The interface conforms with EIA RS-232C and CCITT V.24 standards. The Model 1539 SCA is available with or without unattended answer capability. Transmission speeds up to 9600 bits/second are possible on half-duplex two- or four-wire lines. The 1539 can also be interfaced to asynchronous modems, such as the Bell 202C or equivalent, and operate at a rate of 600, 900, 1200, or 1800 bits/second. Normally, the program sets the transmission rate, which is then controlled by the internal system clock. ▶

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▷ can hold 900 records of 136 bytes each. A 200-foot cartridge is also available for applications that require data files on the cartridge.

The disadvantage of the cartridge arrangement stems from the same factor that gives it its strength; i.e., it is unique. The number of suppliers handling the cartridges is limited.

An integral facility of the 1501 is a serial I/O interface, to which up to 64 I/O devices can be connected. These include several models of printers with speeds ranging from 30 cps to 650 lpm, as well as a number of magnetic tape units that can be used to transcribe data from the cartridges to computer-compatible tape. Also available are paper tape and punched card readers. Data transfer over the I/O cable is bidirectional, so that one line suffices for all activity. Phase-encoded techniques and address polling make operation economical and flexible without disregarding reliability and throughput. The data transfer rate is 24,000 bytes/second.

Other I/O devices, such as the keyboard, the 1530 Numeric Keypad, and add-on 1533 Dual Cartridge Transports, interface directly with the internal processor. The CRT display has direct access to the memory. As mentioned previously, the optional communications interfaces can be mounted internally. Data can then be directed to a transmission line through an appropriate modem. All major system functions are under the direct control of the controlling processor program. These provisions enable the user to add compatible peripherals and interfaces at will without interruption to activity. Furthermore, system functions can be changed or modified by simply loading a new tape program from the software library, or by selecting options within a single program.

The procedure for preparing a 1501 for use has implications that should be understood. Fully developed and tested programs are stored on cartridge tape. An appropriate cartridge is inserted into the tape transport mechanism, and when the tape is run, the program is entered into memory. Now the 1501 is capable of performing specific functions. It can generate and print an accounting form such as an inventory control sheet, a tax form, a purchase requisition, or a bill of lading, to name a few examples. Arithmetic operations such as add, subtract, and multiply can be carried out.

Alternatively, the programs read from the tape can prepare the system for data entry. The record formats intended for a specific job are written at the beginning of every tape. Instructions to link the formats automatically in either direction are included. Instructions for skipping, right and left justification, and duplicating are a basic part of the record format. Constants and constant fields can be stored in memory. Several categories of omission detection can be implemented. Range tables can be stored, and table look-up operations can be performed. Instructions for comparisons can be included, as well as instructions for field balancing and batch balancing. The ▷

▶ Alternatively, the Model 1534 Asynchronous Communications Adapter provides a start-stop transmission capability. It interfaces with the previously mentioned asynchronous modems.

DEVICE CONTROL

All operations are software-controlled by application programs that reside on cartridge tape. These programs direct the execution of specific operations and produce a sequence of displayed options on the CRT screen that guide the operator in selecting a proper operating mode and in specifying certain job functions within the selected mode.

The 1500 system operator begins by inserting the cartridge that contains the desired application program in the cartridge recorder. After automatic threading of the take-up reel is completed, an index or "menu" of operations accompanied by corresponding index symbols is read from the tape and displayed on the CRT screen. The operator selects one of these operations by keying its index symbol.

The system then executes a search of the application tape for the designated program. When located, the program is read from the tape and stored in memory. Then the application tape is rewound for removal. Operation as prescribed by the stored program now ensues.

Operating modes of the 1500 system consist of Program Entry, two classes of Data Entry, Data Verify, Search, Copy, Communications, Edit, and Print.

The three data entry software packages currently available for the ICL 1500 are called Advanced Data Entry (or ADE), Complex Data entry (or CDE), and Business Transaction Language (BTL). All three packages organize keyed data into appropriate fields (alphabetic or numeric, as defined), and also implement the usual operation functions such as automatic skipping and duplicating and right and left field justification (left zero fill and blank insertion). Accuracy testing procedures, such as check digit verification, and certain field accumulations and balancing operations are also carried out. Other details are presented under the SOFTWARE heading.

Record formats can be keyed into memory or prepared formats can be entered from tape in the Program Entry mode. (Note that a record format is the data entry equivalent of an application program.)

Either sight or key verification can be utilized. In the latter case (Data Verify mode), a complete record is read into memory from a previously recorded entry tape and compared character for character with data rekeyed by the operator. Verified records are then written on a second tape. Corrections must be reverified within a field before verification can continue. An important feature of this tape-to-tape technique is the ability to insert or delete records during the verification process. This enables record updating to be accomplished.

The High-Speed Search mode allows the operator to locate a record with the same identifier as that keyed in; any portion of the record can be used as an identifier.

The Copy mode permits duplication of entire tape files or selected records from special files. The operator can select either of the two cartridge tape drives at a given moment, and can select among the externally connected computer-compatible tape drives if there is more than one.

In the Edit mode, data records on cartridge tapes can be transcribed to a computer-compatible format on standard tape. The Edit program can alternately switch between two ▶

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◺ user can devise his own check digits. And he can change any program at will simply by introducing a new cartridge that holds the desired program.

All programs include instructions for the display of advisories to the station operator. The required procedure is described in simple statements, and the operator is told what data to enter.

USER REACTION

In September 1979, Datapro interviewed eight ICL Series 1500 users, whose names were provided by ICL. These users had a total of 144 terminals, which had been installed for periods ranging from one year to six years. The users' ratings are presented in the table below.

	Excellent	Good	Fair	Poor	WA*
Overal performance	1	6	1	0	3.0
Ease of operation	2	5	1	0	3.1
Display clarity	1	5	2	0	2.9
Keyboard feel & usability	0	7	1	0	2.9
Hardware reliability	2	5	1	0	3.1
Maintenance service	0	4	2	0	2.7
Software & technical support	1	3	3	0	2.7

*Weighted Average on a scale of 4.0 for Excellent.

Key advantages of the Series 1500 cited by these users included versatility, flexibility, hardware durability, software support, and ease of programming.

However, one user complained that the tape cartridges were expensive and were not compatible with non-ICL equipment. Another user reported problems with the non-cartridge tapes coming off the reel during use, and a third reported defective memory boards, although these were eventually replaced. TRW's service was described as "slow" by one user, who also complained that ICL had assigned so many different account representatives to his account that he never knew whom to call. □

▶ cartridge drives to provide continuous transcription through overlapped rewind and read operations. In addition, the Edit program provides for code translation, reformatting, and insertion of deletion of data.

Conventional read-after-write checking is performed as tape records are written, and cyclic redundancy checking is performed as tape records are read. Data written on tape is compared bit for bit with the data retained in memory. The 1500 system automatically rereads a record up to eight consecutive times subsequent to a detected error, after which operator intervention is required. The tape system also features automatic compensation to offset apparent speed changes that arise from physical changes in the tape itself.

The 1500 system has a variety of interlocks to guard against operator error. These interlocks provide file detection sensing, ensure that cartridges are in place, prevent conflicting action when the cartridges are in use, and provide end-of-tape detection. Tape rewinding can be accomplished with or without interlock protection.

Keying errors detected by the operator can be corrected by backspacing and rekeying.

SOFTWARE

The *Advanced Data Entry* package contains various selectable programs that add, to the standard functions described under Device Control, the following features: interfield products and accumulations (up to eight batch totals); up to eight job formats available to the operator on the program tape and, within each format, eight levels that can be linked automatically; logical and string formatting; range checking; equality and inequality comparisons; a record counter and column counter; date validation; check digit verification; and a print format generator. One job format is called from the program tape and stored in memory at a time.

The *Complex Data Entry* package includes all features of the Advanced Data Entry package plus the following: high-level interfield dependency checks; an unlimited number of interpreters for special data checks without reprogramming; and up to 12 job formats available to the operator on the program tape, with 15 levels that can be linked automatically within each job format. The operator is notified in the event of entry error, and all necessary error-recovery capabilities are included. Entry of formatted or unformatted data is permitted at 120 characters per tape block.

The *Business Transaction Language* package is an extension of the Complex Data Entry package. In addition to providing the features available with CDE, BTL provides the advantages inherent in a disk-based system. Large amounts of interrelated data can be stored on disk, and accessed during the data entry job. BTL programs themselves are also stored on the disk, thus making the operation of the system easier and faster than a tape-loaded system. The BTL system provides great flexibility for processing and manipulating data right at the entry point.

The *Tape Sort/Merge* package allows the operator to sort or merge data records contained in tape cartridges and write the data onto other tape cartridges or computer-compatible tape. Supervisory instructions are displayed on the CRT.

The *Copy File Utility* package implements changes to either data files or program files, whether on cartridge tape or computer tape. It is this package that makes possible the procedures of the Copy and Edit modes. Thus, the user can copy complete files of data records or programs, or copy only indicated portions. Furthermore, he can copy up to a specified record, or he can skip records and start with a particular one. He can display designated records. A particularly useful utility is a tape advance function that allows the operator to add records at the end of an existing file. New parameters can be introduced whenever an input tape has been completed, but throughout a job the input and output devices originally selected remain the same. Finally, there is a program interrupt that enables the user to override any selected functions.

The *High-Speed Search and Update Generator* package allows the user to construct a specialized program tape capable of both random retrieval and display of cartridge tape records from either of the two drives in the terminal. This package can also be used for file inquiry and selected record updating. Supervisory messages are displayed.

Communications packages allow replacement of teletypewriter and Telex networks at improved efficiency. A number of synchronous packages are also available for 1500-to-1500 communication (SQUIC), as are several industry-compatible emulators. Transmission speeds up to 9600 bits/second are supported.

Software routines are also available to accumulate operator and production statistics, such as operator (station) code, number of records keyed, elapsed time, number of key- ▶

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▶ strokes, number of error conditions, and number of records verified.

ICL has announced Business Basic and COBOL packages for the 1500 series.

COMPONENTS

CONTROL PROCESSOR: This unit has 45 instruction types plus a serial I/O channel, a 3 to 6 microsecond instruction cycle time, 1 accumulator, 7 index registers for each 2K bytes of memory, a 16-member instruction address stack, a stack pointer, and a hardware bootstrap loader. Supporting the miniprocessor is a solid-state memory of 8K or 16K bytes. External tape transports and the keyboard interface with the processor via separate channels rather than the I/O interface.

KEYBOARD: The keyboard comprises 53 keys, which can be arranged in either a keypunch or typewriter pattern. Other arrangements are available upon request. An audible keying cue is provided.

CRT DISPLAY: Up to 256 characters can be displayed in 8 lines of 32 characters each on a 5-inch CRT screen. Characters are formed from a 5-by-8 dot matrix. The screen is refreshed directly from the MOS memory. For the information it displays, the screen has direct access to memory areas as well, and these are program-selectable from any one of 16 memory pages (256 bytes per page). Selective interlacing of half-pages is possible. Other provisions include a nondestructive cursor (underscore), selective blanking, and the ability to vary the display characters in accordance with special user needs, such as German umlauts, Arabic symbols, etc.

The larger 1920-character CRT (standard on the 1502 and 1505, optional on the 1503) includes many of the above features as well as flashing field, underline, and dual intensity functions.

CARTRIDGE TAPE DRIVES: Each terminal contains two mechanically independent tape transports that employ polyester magnetic tapes one mil in thickness and 150 mils wide. These transports utilize a special heart-shaped cartridge. The cartridges, which hold either 100 or 200 feet of tape, are snapped into place, and the tape is then automatically threaded and loaded on the take-up reel. The manufacturer claims exceptional reliability for this unique design.

Tape formatting, read forward/backward, and read/write checking are all under processor control. Record size, interrecord gaps, check data, and number of retrys are software parameters. Under the standard software, each cartridge has a nominal capacity of 1000 records of 128 bytes each.

Data is serially recorded by bit at 1600 bpi by means of phase encoding. The record length can be specified as either 128 or 80 bytes. Read/write tape speed is 10 inches/second. A high-speed mode, utilized during rewind and for bi-directional searching, moves the tape at 40 inches/second. Records are counted during high-speed searching.

Hardware logic is provided to allow reading backward without the need of software intervention to invert and shift the data. An 8-bit buffer holds a character on cue for 512 microseconds; during this time, data can be processed before the character is released.

ICL 1533 DUAL MINI-CARTRIDGE TRANSPORT: These units are duplicates of the dual-transport drives that are self-contained in each terminal. Up to three additional dual-drive units can be connected in series with the 1501 terminal to expand the total tape facility of the terminal to a maximum of eight drives. The external drives serve as an auxiliary storage medium for the 1500 system. They can also be used with standard 1500 software for cartridge file sort/merges.

COMPUTER-COMPATIBLE MAGNETIC TAPE UNITS: Aside from data communications, information exchange between the ICL 1501 and other data processing systems is effected by means of the ICL 1511/1512 and 1513/1514 tape drives. The main purpose of these drives is to permit data recorded on cartridge tape to be transcribed to standard half-inch, computer-compatible magnetic tape for direct computer entry or other purposes. The first pair of drives employs 7-inch reels, and the other pair employs standard 10½-inch reels. The 1511 produces output tape recorded at 556 or 800 bpi on 7-track tape, while the 1512 records at 800 bpi on 9-track tape. The 1513 records at 800 bpi and the 1514 records at 1600 bpi, both on 9-track tape.

ICL 1551 MATRIX PRINTER: Prints on continuous forms from 4 to 14¾ inches wide at speeds at up to 165 character/second (60 lines/minute) for the Model 1551-S, or at up to 330 characters/second (125 lines/minute) for the Model 1551-D; 132 print positions are provided. Each character is formed via a 7-by-9 dot matrix. Horizontal and vertical spacing is 10 characters/inch and 6 lines/inch, respectively.

ICL 1553-56 LINE PRINTERS: Prints on continuous paper forms at speeds up to 400 lpm, 132 characters/line. Horizontal character spacing is 10 characters/inch, and vertical line spacing is 6 lines/inch. Coding is ASCII.

PRICING

The ICL 1500 Transaction Terminal System can be obtained by lease or purchase. Lease contracts are available for one, three, and five years. Maintenance costs are not included in the lease prices that appear below; leased and purchased units are serviced under a separate maintenance arrangement. Standard maintenance, including preventive maintenance procedures, is performed during the prime-shift hours of 8 a.m. to 5 p.m. on weekdays. ▶

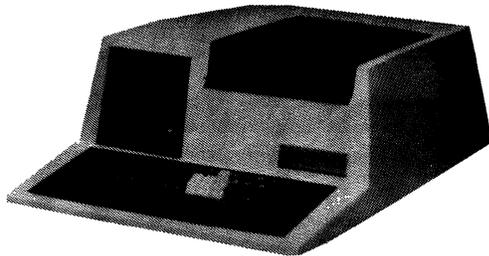|		Monthly Charge*				
		1-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.**
7401/06	1501 Transaction Terminal with 8K bytes of memory, 256-char. display, keyboard, and dual mini-cartridge drives	$147	$128	$119	$ 5,020	$ 61
7401/07	1501 Transaction Terminal with 16K bytes of memory, 256-char. display, keyboard, and dual mini-cartridge drives	158	138	128	5,400	67
7401/85	1501-43 Transaction Terminal with 256-char. display, keyboard, and 5-million-byte fixed disk drive	499	435	404	16,995	90

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		Monthly Charge*				
		1-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.**
7402/16	1502 Transaction Terminal with 8K bytes of memory, 1920-char. display, keyboard, and dual mini-cartridge drives	245	213	198	8,332	83
7402/17	1502 Transaction Terminal with 16K bytes of memory, 1920-char. display, keyboard, and dual mini-cartridge drives	292	255	237	9,960	92
7403/47	1503-43 Clustered Controller with 16K bytes of memory, 256-char. display, keyboard with numeric pad, and dual mini-cartridge drives	512	446	414	17,425	167
7403/57	1503-43 Transaction Terminal with 16K bytes of memory, 1920-char. display, keyboard with numeric pad, dual mini-cartridge drives, serial I/O disk interface, and two 5 million byte fixed disk drives	529	461	428	17,995	175
7405/61	1505/61 Transaction Terminal with 8K bytes of memory, 1920-char. display, and keyboard with numeric pad	161	140	130	5,495	—
7405/62	1505/62 Transaction Terminal with 16K bytes of memory, 1920-char. display, and keyboard with numeric pad	177	155	143	6,045	—
7405/71	1505/71 Transaction Terminal with 8K bytes of memory, 1920-char. display, keyboard with numeric pad, and dual mini-cartridge drives	191	166	154	6,495	—
7405/72	1505/72 Transaction Terminal with 16K bytes of memory, 1920-char. display, keyboard with numeric pad, and dual mini-cartridge drives	213	185	172	7,245	—
7430/61	1530 External Numeric Keypad (for 7401 only)	8	7	5	299	3
7433/61	1533 External Dual Mini-Cartridge Tape Drives (for 7401 only)	56	49	45	1,895	15
7451/61	1551-S Matrix Printer; 165 cps (single print head)	166	145	135	5,670	67
7451/63	1551-D Matrix Printer; 330 cps (dual print head)	205	179	166	6,995	85
7453/61	1553 Line Printer; 125 lpm	267	320	297	12,500	92
7454/61	1554 Line Printer; 200 lpm	382	333	309	12,995	107
7455/61	1555 Line Printer; 300 lpm	411	358	333	13,995	151
7456/61	1556 Line Printer; 400 lpm	441	384	357	14,995	182
7411/61	1511 Magnetic Tape Unit; 7-track 556/800 bpi, 12.5 ips, 7-inch reel	191	166	154	6,495	45
7412/61	1512 Magnetic Tape Unit; 9-track, 800 bpi, 12.5 ips, 7-inch reel	191	166	154	6,495	45
7413/61	1513 Magnetic Tape Unit; 9-track, 800 bpi, 12.5 ips, 10-inch reel	235	205	190	7,995	85
7414/61	1514 Magnetic Tape Unit; 9-track, 1600 bpi, 12.5 ips, 10-inch reel	352	307	285	11,995	113
7443/61	1543 Fixed and Exchangeable Disk Drive; 5 million bytes (up to 4 drives max.)	293	256	237	9,995	60
F2530/60	Disk Drive Extension Cabinet	73	63	59	2,495	—
7470/62	1570 Flexible Disk System	132	115	107	4,495	—
F2506/60	1534 Asynchronous Communication Adapter	11	10	8	395	10
F2506/61	1534-1 Asynchronous Communications Adapter; serial I/O; 75 to 1800 bps	43	38	35	1,495	7
F2506/62	1534-2 Asynchronous Communications Adapter; Telex	58	51	47	1,995	10
F2511/60	1539 Synchronous Communications Adapter; 600 to 9600 bps	14	12	11	495	10
F2510/60	1538 Auto Dial Feature	29	25	23	995	18

*Lease prices *do not* include maintenance.
**Monthly maintenance prices are for guidance only; consult TRW for a definite quote.■

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MANAGEMENT SUMMARY

International Computers Limited acquired the Singer 1500 Intelligent Terminal System (as well as the Singer System Ten) from the Singer Company with the formation of ICL, Inc. in January 1977, as a wholly-owned subsidiary. The manufacturing operation of ICL Inc. is based at the former Cogar facility in Utica, New York.

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The Model 1501 Transaction Terminal is the heart of the Series 1500 system. Its processor and I/O interfaces form the bases for all of the other terminals in the product line. The attractive console contains a 5-inch CRT display and either a keypunch-style or typewriter-style keyboard. At the top of the console, easy access is provided to the snap-in cartridges of the internal dual tape transports. Other vital parts include a serial I/O interface, a miniprocessor and 8K-byte semiconductor memory, and an optional communications interface, asynchronous or binary synchronous (BSC).

A more recently introduced model of the 1501, designated the 1501-40, employs an integral 2.5-million character hard disc for program storage and instant random access to data files. One tape cartridge drive is provided for removable data media. The ICL 1501-40 is designed to compete with floppy disc systems by providing reliable hard disc storage at low cost. The unique design of the ICL 1501-40 allows for virtually unlimited program overlays for complex validation requirements. ▷

A versatile, desk-top, operator-prompting, workstation used for data entry and intelligent terminal functions.

The 8K-byte 1501 model can be extended to a 16K-byte model 1502 or changed to a 1501-40 model that incorporates programmability. The system was recently expanded to include the model 1503, offering disk-based processing and a more powerful processor.

A typical intelligent terminal configuration with synchronous communications and a line printer costs $647 on a one-year lease, including maintenance.

CHARACTERISTICS

VENDOR: ICL Inc., Turnpike Plaza, 197 Highway 18, East Brunswick, New Jersey 08816. Telephone (201) 246-3400.

DATE OF ANNOUNCEMENT: Information not available.

DATE OF FIRST DELIVERY: 1971.

NUMBER DELIVERED TO DATE: Over 7500.

SERVICED BY: TRW.

CONFIGURATION

The hub of the 1500 system is the ICL Model 1501 Transaction Terminal, which can be connected to as many as 64 individual peripheral devices via an internal serial I/O interface. Examples of such devices are the Model 1511, 1512, 1513, and 1514 Tape Drives, the Model 1525 Serial Printer, and the Model 155X series Line Printers.

ICL 1533 Dual Mini-Cartridge Drives and the Model 1530 Numeric Keypad interface directly with the internal miniprocessor, as does the Model 1535 Synchronous Communications Adapter or the Model 1534 Asynchronous Communications Adapter, both of which are installed inside the 1501 housing. An appropriate modem, such as the Bell 201A, interfaces a voice-grade communications line to the adapter.

ICL 1501 TRANSACTION TERMINAL: As the center of system activity, this unit serves both as a data entry device and as an intelligent terminal. It is a single desk-top console that incorporates two cartridge tape drives (exactly like the Model 1533, but internally mounted), a keyboard, a CRT display, a solid-state 8K-byte memory, a miniprocessor, and a serial I/O interface. Data transfer on the coaxial cable connected to the I/O interface is bidirectional; hence, one line can service all attached peripheral devices. The transfer rate is 24,000 bytes/second in bit-serial form. When a system configuration includes multiple 1501 can communicate with any other station and any other I/O device under program control.

ICL 1501-40 TRANSACTION TERMINAL: The unit is a programmable intelligent terminal designed for high-performance data entry, data validation, and communica- ▶

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▷ Another extension of the ICL 1501 is the ICL 1502. This terminal provides a powerful 16K-byte processor and a 1920-character visual display. The large CRT provides document reproduction on the screen for users whose applications require this feature. In addition to the ability to display large amounts of data, an editing capability is enhanced by dual intensity, flashing field, and underline functions. Upper and lower case graphics are standard.

At the top of the Series 1500 product line is the ICL 1503. Designed to provide multiple 1501's (or 1502's) with shared access to data files as large as 20 million characters, the ICL 1503 supplies all of the required data structuring and manipulating capabilities. The basic system consists of up to eight discs cabled to an independent processor which performs two functions: the data base management of multiple files and an interface to the central processor. The ICL 1503 is software-compatible with all the other Series 1500 Transaction Terminals and provides full file processing at the remote site.

As an intelligent terminal, the 1501 can be useful in many kinds of business applications. The tape cartridge system makes it easy to change the programming from one application to another. One merely snaps in another cartridge containing the new application program, and the tape transport loads it into the processor. In either data entry or intelligent terminal service, the addition of a synchronous or asynchronous communications adapter turns the 1501 into a communications center, day or night.

Let us see what makes the ICL tape cartridge transport unusual. The mechanism employs reel-to-reel design principles, although a cartridge rather than an open reel is employed. The advantage of a simple replacement of cartridges is thereby gained without sacrificing the reliability of reel-to-reel operation. Tape is automatically threaded and rewound. A friction capstan is used to drive the tape, and the tape speed itself is under servo control.

Data records on the 0.15-inch-wide cartridge tape must be converted to computer-compatible format for entry into a computer. However, data on the cartridge tape can be transmitted over communications lines, as can data on standard tape. The 100 feet of tape in a standard cartridge can hold 900 records of 136 bytes each. A 200-foot cartridge is also available for applications that require data files on the cartridge.

The disadvantage of the cartridge arrangement stems from the same factor that gives it its strength; i.e., it is unique. The number of suppliers handling the cartridges is limited.

An integral facility of the 1501 is a serial I/O interface, to which up to 64 I/O devices can be connected. These include several models of printers with speeds ranging from 30 cps to 650 lpm, as well as a number of magnetic tape units that can be used to transcribe data from the cartridges to computer-compatible tape. Also available ▷

▶ tions functions. It is a desk-like device that includes a keyboard, CRT, tape cartridge drive, solid-state 16K-byte memory, miniprocessor, and 2.5-million-byte hard disc. Also included is a serial I/O interface with the same characteristics as that of the 1501.

ICL 1502 TRANSACTION TERMINAL: This terminal is an extension of the Model 1501. It includes, in a desk-like enclosure, a keyboard, a 1920-character visual display, two tape cartridge drives, a solid-state memory of 16K bytes, and a miniprocessor. The 1920 VDU is a self-contained unit that functions as a fully buffered I/O device. The editing functions are controlled by a 4K read-only memory built into the display unit itself; no user space in the 1502's 16K processor memory is used to control the functions of the display. Also included is a serial I/O interface with the same characteristics as that of the 1501.

ICL 1503 TRANSACTION TERMINAL: This unit is designed to provide full file processing at a remote site. It includes a keyboard, 5-inch diagonal CRT, two tape cartridge drives, solid-state memory of 16K bytes, disc controller, up to eight disc drives, and a miniprocessor. Multiple 1501's or 1502's can access a 1503's disc storage by being cable-connected through the serial I/O channel. All required data base management functions are performed by the 1503. Software packages (provided by ICL) permit communication of disc files to a central processing unit or within a self-contained ICL Series 1500 network.

TRANSMISSION SPECIFICATIONS

One medium of communication among two or more 1501 terminals is the coaxial line of the serial I/O channel. For transmission over substantial distances, however, one of two data communications adapters must be installed.

The Model 1535 Synchronous Communications Adapter, when coupled to an appropriate modem such as the Singer 2024, the Bell 201A or 201B, or equivalent, permits communication over switched or leased networks with any computer employing IBM binary synchronous communications (BSC) protocol, including the Singer System Ten computer and the Singer 4300 Magnetic Data Recording System. The interface conforms with EIA RS-232C and CCITT V.24 standards. The Model 1535 SCA is available with or without unattended answer capability. Transmission speeds up to 9600 bits/second are possible on half-duplex two- or four-wire lines. The 1535 can also be interfaced to asynchronous modems, such as the Bell 202C or equivalent, and operate at a rate of 600, 900, 1200, or 1800 bits/second. Normally, the program sets the transmission rate, which is then controlled by the internal system clock.

Alternatively, the Model 1534 Asynchronous Communications Adapter provides a start-stop transmission capability. It interfaces with the previously mentioned asynchronous modems.

DEVICE CONTROL

All operations are software-controlled by application programs that reside on cartridge tape. These programs direct the execution of specific operations and produce a sequence of displayed options on the CRT screen that guide the operator in selecting a proper operating mode and in specifying certain job functions within the selected mode.

The 1500 system operator begins by inserting the cartridge that contains the desired application program in the cartridge recorder. After automatic threading of the take-up reel is completed, an index or "menu" of operations accompanied by corresponding index symbols is read from the tape and displayed on the CRT screen. The operator selects one of these operations by keying its index symbol. ▶

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▷ are paper tape and punched card readers. Data transfer over the I/O cable is bidirectional, so that one line suffices for all activity. Phase-encoded techniques and address polling make operation economical and flexible without disregarding reliability and throughput. The data transfer rate is 24,000 bytes/second.

Other I/O devices, such as the keyboard, the 1530 Numeric Keypad, and add-on 1533 Dual Cartridge Transports, interface directly with the internal processor. The CRT display has direct access to the memory. As mentioned previously, the optional communications interfaces can be mounted internally. Data can then be directed to a transmission line through an appropriate modem. All major system functions are under the direct control of the controlling processor program. These provisions enable the user to add compatible peripherals and interfaces at will without interruption to activity. Furthermore, system functions can be changed or modified by simply loading a new tape program from the software library, or by selecting options within a single program.

The procedure for preparing a 1501 for use has implications that should be understood. Fully developed and tested programs are stored on cartridge tape. An appropriate cartridge is inserted into the tape transport mechanism, and when the tape is run, the program is entered into memory. Now the 1501 is capable of performing specific functions. It can generate and print an accounting form such as an inventory control sheet, a tax form, a purchase requisition, or a bill of lading, to name a few examples. Arithmetic operations such as add, subtract, and multiply can be carried out.

Alternatively, the programs read from the tape can prepare the system for data entry. The record formats intended for a specific job are written at the beginning of every tape. Instructions to link the formats automatically in either direction are included. Instructions for skipping, right and left justification, and duplicating are a basic part of the record format. Constants and contant fields can be stored in memory. Several categories of omission detection can be implemented. Range tables can be stored, and table look-up operations can be performed. Instructions for comparisons can be included, as well as instructions for field balancing and batch balancing. The user can devise his own check digits. And he can change any program at will simply by introducing a new cartridge that holds the desired program.

All programs include instructions for the display of advisories to the station operator. The required procedure is described in simple statements, and the operator is told what data to enter.

Is the 1500 Transaction Terminal System a sensible replacement for the old keypunch? There are two situations for which a frank answer of "No" must be given. When the objective is nothing more than electronic keying in place of mechanical operations, with little need ▷

▶ The system then executes a search of the application tape for the designated program. When located, the program is read from the tape and stored in memory. Then the application tape is rewound for removal. Operation as prescribed by the stored program now ensues.

Operating modes of the 1500 system consist of Program Entry, two classes of Data Entry, Data Verify, Search, Copy, Communications, Edit, and Print.

The three data entry software packages currently available for the ICL 1500 are called Advanced Data Entry (or ADE), Complex Data Entry (or CDE), and Disc Data Entry (or DDE). All three packages organize keyed data into appropriate fields (alphabetic or numeric, as defined), and also implement the usual operation functions such as automatic skipping and duplicating and right and left field justification (left zero fill and blank insertion). Accuracy testing procedures, such as check digit verification, and certain field accumulations and balancing operations are also carried out. Other details are presented under the SOFTWARE heading.

Record formats can be keyed into memory or prepared formats can be entered from tape in the Program Entry mode. (Note that a record format is the data entry equivalent of an application program.)

Either sight or key verification can be utilized. In the latter case (Data Verify mode), a complete record is read into memory from a previously recorded entry tape and compared character for character with data rekeyed by the operator. Verified records are then written on a second tape. Corrections must be reverified within a field before verification can continue. An important feature of this tape-to-tape technique is the ability to insert or delete records during the verification process. This enables record updating to be accomplished.

The High-Speed Search mode allows the operator to locate a record with the same identifier as that keyed in; any portion of the record can be used as an identifier.

The Copy mode permits duplication of entire tape files or selected records from special files. The operator can select either of the two cartridge tape drives at a given moment, and can select among the externally connected computer-compatible tape drives if there is more than one.

In the Edit mode, data records on cartridge tapes can be transcribed to a computer-compatible format on standard tape. The Edit program can alternately switch between two cartridge drives to provide continuous transcription through overlapped rewind and read operations. In addition, the Edit program provides for code translation, reformatting, and insertion of deletion of data.

Conventional read-after-write checking is performed as tape records are written, and cyclic redundancy checking is performed as tape records are read. Data written on tape is compared bit for bit with the data retained in memory. The 1500 system automatically rereads a record up to eight consecutive times subsequent to a detected error, after which operator intervention is required. The tape system also features automatic compensation to offset apparent speed changes that arise from physical changes in the tape itself.

The 1500 system has a variety of interlocks to guard against operator error. These interlocks provide file detection sensing, ensure that cartridges are in place, prevent conflicting action when the cartridges are in use, and provide end-of-tape detection. Tape rewinding can be accomplished with or without interlock protection.

Keying error detected by the operator can be corrected by backspacing and rekeying. ▶

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for records over 80 characters in length and little concern for advanced editing and balancing operations, the 1500 system is simply too expensive compared with a keypunch. On the other hand, if huge volumes of data must be processed, requiring many entry stations at a single location, the 1500 system is equally unsuited. But in the vast middle ground between these extremes, especially in a source data environment where a modest cluster of 1501 terminals would be ample for the data requirements, and particularly when the site requires data processing independent of that provided by the central computer facility, the 1500 system appears admirably well suited. It is compact, fairly inexpensive, and equipped with processing flexibility that can be readily adapted to new applications needs.

The history of the Singer 1500 Intelligent Terminal System is interesting. The basic concepts, including the unique magnetic tape cartridge, were developed by Cogar Corporation and introduced in that company's System/4 product in January 1971. Datapro viewed the product favorably at that time, and regretted having to report the demise of the system as an end-user product a few months later. Singer Business Machines took the basic concepts and added its own ideas to come up with the 1500 system, which was uniquely Singer's.

USER REACTION

In November 1977, Datapro interviewed six users of the ICL 1500 who reported on their experience with a total of 40 ICL 1500 series terminals. Their ratings are as follows:

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	1	4	1	0	3.0
Equipment reliability	1	4	1	0	3.0
Maintenance service	1	3	2	0	2.8
Ease of programming	0	4	2	0	2.7
Software effectiveness	1	5	0	0	3.2
Technical support	1	2	2	1	2.5

*Weighted Average on a scale of 4.0 for Excellent.

Most of the users had had their terminals installed for at least two years. Little down time was reported by most users, although, one user did report considerable downtime with one of his 1501's. Users reported the software as effectively performing the job it was designed for. Three users mentioned that maintenance service was not as good as it had been just after ICL acquired the 1500 system, but that now it is back to normal.□

► SOFTWARE

The *Advanced Data Entry* package contains various selectable programs that add, to the standard functions described under Device Control, the following features: interfield products and accumulations (up to eight batch totals); up to eight job formats available to the operator on the program tape and, within each format, eight levels that can be linked automatically; logical and string formatting; range checking; equality and inequality comparisons; a record counter and column counter; date validation; check digit verification; and a print format generator. One job format is called from the program tape and stored in memory at a time.

The *Complex Data Entry* package includes all features of the Advanced Data Entry package plus the following: high-level interfield dependency checks; an unlimited number of interpreters for special data checks without reprogramming; and up to 12 job formats available to the operator on the program tape, with 15 levels that can be linked automatically within each job format. The operator is notified in the event of entry error, and all necessary error-recovery capabilities are included. Entry of formatted or unformatted data is permitted at 120 characters per tape block.

The *Direct Data Entry* package is an extension of the Complex Data Entry package. In addition to providing the features available with CDE, Disc Data Entry provides the advantages inherent in a disc-based system. Large amounts of interrelated data can be stored on disc and accessed during the data entry job. Disc Data Entry programs themselves are also stored on the disc, thus making the operation of the system easier and faster than a tape-loaded system. The DDE system provides great flexibility for processing and manipulating data right at the entry point.

The *Tape Sort/Merge* package allows the operator to sort or merge data records contained in tape cartridges and write the data onto other tape cartridges or computer-compatible tape. Supervisory instructions are displayed on the CRT.

The *Copy File Utility* package implements changes to either data files or program files, whether on cartridge tape or computer tape. It is this package that makes possible the procedures of the Copy and Edit modes. Thus, the user can copy complete files of data records or programs, or copy only indicated portions. Furthermore, he can copy up to a specified record, or he can skip records and start with a particular one. He can display designated records. A particularly useful utility is a tape advance function that allows the operator to add records at the end of an existing file. New parameters can be introduced whenever an input tape has been completed, but throughout a job the input and output devices originally selected remain the same. Finally, there is a program interrupt that enables the user to override any selected functions.

The *High-Speed Search and Update Generator* package allows the user to construct a specialized program tape capable of both random retrieval and display of cartridge tape records from either of the two drives in the terminal. This package can also be used for file inquiry and selected record updating. Supervisory messages are displayed.

Communications packages allow replacement of teletypewriter and Telex networks at improved efficiency. A number of synchronous packages are also available for 1500-to-1500 communication (SQUIC), as are several industry-compatible emulators. Transmission speeds up to 9600 bits/second are supported.

Software routines are also available to accumulate operator and production statistics, such as operator (station) code, number of records keyed, elapsed time, number of keystrokes, number of error conditions, and number of records verified.

COMPONENTS

CONTROL PROCESSOR: This unit has 45 instruction types plus a serial I/O channel, a 3 to 6 microsecond instruction cycle time, 1 accumulator, 7 index registers for each 2K bytes of memory, a 16-member instruction address stack, a stack pointer, and a hardware bootstrap loader. Supporting the miniprocessor is a solid-state memory of 8K ►

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➤ or 16K bytes. External tape transports and the keyboard interface with the processor via separate channels rather than the I/O interface.

KEYBOARD: The keyboard comprises 53 keys, which can be arranged in either a keypunch or typewriter pattern. Other arrangements are available upon request. An audible keying cue is provided.

CRT DISPLAY: Up to 256 characters can be displayed in 8 lines of 32 characters each on a 5-inch CRT screen. Characters are formed from a 5-by-8 dot matrix. The screen is refreshed directly from the MOS memory. For the information it displays, the screen has direct access to memory areas as well, and these are program-selectable from any one of 16 memory pages (256 bytes per page). Selective interlacing of half-pages is possible. Other provisions include a nondestructive cursor (underscore), selective blanking, and the ability to vary the display characters in accordance with special user needs, such as German umlauts, Arabic symbols, etc.

The larger 1920-character CRT (standard on the 1502, optional on the 1503) includes many of the above features as well as flashing field, underline, and dual intensity functions.

CARTRIDGE TAPE DRIVES: Each terminal contains two mechanically independent tape transports that employ polyester magnetic tapes one mil in thickness and 150 mils wide. These transports utilize a special heart-shaped cartridge. The cartridges, which hold either 100 or 200 feet of tape, are snapped into place, and the tape is then automatically threaded and loaded on the take-up reel. The manufacturer claims exceptional reliability for this unique design.

Tape formatting, read forward/backward, and read/write checking are all under processor control. Record size, inter-record gaps, check data, and number of retrys are software parameters. Under the standard software, each cartridge has a nominal capacity of 1000 records of 128 bytes each.

Data is serially recorded by bit at 1600 bpi by means of phase encoding. The record length can be specified as either 128 or 80 bytes. Read/write tape speed is 10 inches/second. A high-speed mode, utilized during rewind and for bi-directional searching, moves the tape at 40 inches/second. Records are counted during high-speed searching.

Hardware logic is provided to allow reading backward without the need of software intervention to invert and shift the data. An 8-bit buffer holds a character on cue for 512 microseconds; during this time, data can be processed before the character is released.

ICL 1533 DUAL MINI-CARTRIDGE TRANSPORT: These units are duplicates of the dual-transport drives that are self-contained in each terminal. Up to three additional dual-drive units can be connected in series with the 1501 terminal to expand the total tape facility of the terminal to a maximum of eight drives. The external drives serve as an auxiliary storage medium for the 1500 system. They can also be used with standard 1500 software for cartridge file sort/merges.

COMPUTER-COMPATIBLE MAGNETIC TAPE UNITS: Aside from data communications, information exchange between the ICL 1501 and other data processing systems is effected by means of the ICL 1511/1512 and 1513/1514 tape drives. The main purpose of these drives is to permit data recorded on cartridge tape to be transcribed to standard half-inch, computer-compatible magnetic tape for direct computer entry or other purposes. The first pair of drives employs 7-inch reels, and the other pair employs standard 10½-inch reels. The 1511 produces output tape recorded at 556 or 800 bpi on 7-track tape, while the 1512 records at 800 bpi on 9-track tape. The 1513 records at 800 bpi and the 1514 records at 1600 bpi, both on 9-track tape.

ICL 1551 MATRIX PRINTER: Prints on continuous forms from 4 to 14¾ inches wide at speeds at up to 165 character/second (60 lines/minute) for the Model 15515, or at up to 330 characters/second (125 lines/minute) for the Model 1551D; 132 print positions are provided. Each character is formed via a 7-by-9 dot matrix. Horizontal and vertical spacing is 10 characters/inch and 6 lines/inch, respectively.

ICL 1553-56 LINE PRINTERS: Prints on continuous paper forms at speeds up to 400 lpm, 132 characters/line. Horizontal character spacing is 10 characters/inch, and vertical line spacing is 6 lines/inch. Coding is ASCII.

PRICING

The ICL 1500 Transaction Terminal System can be obtained by lease or purchase. Lease contracts are available for one, three, and five years. Maintenance costs are not included in the lease prices that appear below; leased and purchased units are serviced under a separate maintenance arrangement. Standard maintenance, including preventive maintenance procedures, is performed during the prime-shift hours of 8 a.m. to 5 p.m. on weekdays.

		Monthly Charge*				
		1-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.**
7401/06	1501 Transaction Terminal with 8K bytes of memory, 256-char. display, keyboard, and dual mini-cartridge drives	$152	$133	$104	$5,200	$45
7401/07	1501 Transaction Terminal with 16K bytes of memory, 256-char. display, keyboard, and dual mini-cartridge drives	158	138	108	5,400	49
7401/27	1501-40 Transaction Terminal with 256-char. display, keyboard, and 2.5 million-byte fixed disc drive	400	349	272	13,623	70
7402/16	1502 Transaction Terminal with 8K bytes of memory, 1920-char. display, keyboard, and dual mini-cartridge drives	285	249	194	9,720	61
7402/17	1502 Transaction Terminal with 16K bytes of memory, 1920-char. display, keyboard, and dual mini-cartridge drives	305	265	207	10,373	65

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		Monthly Charge*				
		1-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.**
7403/47	1503-43 Clustered Controller with 16K bytes of memory, 256-char. display, keyboard with numeric pad, and dual mini-cartridge drives	529	461	360	18,000	144
7403/57	1503-43 Transaction Terminal with 16K bytes of memory, 1920-char. display, keyboard, with numeric pad, dual mini-cartridge drives, serial I/O disk interface, and two 5 million byte fixed disk drives	591	515	402	20,100	143
7430/61	1503 External Numeric Keypad (for 7401 only)	8	7	5	286	3
7433/61	1533 External Dual Mini-cartridge Tape Drives (for 7401 only)	56	49	38	1,917	15
7451/61	155-S Matrix Printer; 165 cps (single print head)	194	169	132	6,600	50
7451/63	155-D Matrix Printer; 330 cps (dual print head)	250	218	170	8,510	63
7453/61	1553 Line Printer; 125 lpm	368	320	250	12,515	68
7454/61	1554 Line Printer; 200 lpm	411	358	280	14,000	79
7455/61	1555 Line Printer; 300 lpm	420	366	286	14,304	112
7456/61	1556 Line Printer; 400 lpm	472	411	321	16,052	134
7411/61	1511 Magnetic Tape Unit; 7-track 556/800 bpi, 12.5 ips, 7-inch reel	194	169	132	6,611	33
7412/61	1512 Magnetic Tape Unit; 9-track, 800 bpi, 12.5 ips, 7-inch reel	194	169	132	6,611	35
7413/61	1513 Magnetic Tape Unit; 9-track, 800 bpi, 12.5 ips, 10-inch reel	258	225	175	8,778	63
7414/61	1514 Magnetic Tape Unit; 9-track, 1600 bpi, 12.5 ips, 10-inch reel	391	341	266	13,327	83
7443/61	1543 Fixed & Exchangeable Disk Drive; 5 million bytes (up to 4 drives max.)	280	244	190	9,533	44
F2530/60	Disk Drive Extension Cabinet	90	78	61	3,077	—
F2506/60	1534 Asynchronous Communication Adapter	11	10	8	400	3
F2506/61	1534-1 Asynchronous Communications Adapter; serial I/O; 75 to 1800 bps	44	38	30	1,508	5
F2506/62	1534-2 Asynchronous Communications Adapter; Telex	50	44	34	1,729	7
F2506/60	1535 Synchronous Communications Adapter; 600 to 9600 bps	11	10	8	400	3
F2510/60	1538 Auto Dial Feature	29	25	20	1,000	13

* Lease prices *do not* include maintenance.
**Monthly maintenance prices are for guidance only; consult TRW for a definite quote.■