ICL 2900 Series, Models 2903-2905

MANAGEMENT SUMMARY

Currently consisting of four models, the low end of ICL's broad 2900 Series covers the performance range from a small, entry level system up to a medium-scale system that forms a bridge to ICL's large-scale systems. All four models—the 2903 Model 25, the 2903 Model 40, the 2904 Model 50, and the 2905—can serve as stand-alone business systems or as part of a distributed processing network.

First introduced in April 1973, the 2903 was renamed the 2903 Model 30 when the entry level 2903 Model 20 was announced in January 1976. Four months later, the 2904 was introduced as an upgrade for 2903 Model 30 users. Then in March 1978, the 2903 Model 25, 2903 Model 40, and the 2904 Model 50 were announced as enhanced versions of the earlier models. In April 1979, ICL completed the 290X range with the addition of the 2905, a system based on the medium-scale 2950.

Compatible with ICL's earlier 1900 Series, the 290X range supports batch processing, remote job entry, time-sharing, and transaction processing. Languages available include RPG2, COBOL, BASIC, and FORTRAN, and system software available includes subsets of ICL's data base management system and data dictionary system. ICL also offers a variety of applications packages.

From the smallest system with a 64K-character memory, 9.8 million characters of disc storage, and two display terminals, the 290X range extends upward to 896K characters of memory, 1600 million characters of disc storage, and a theoretical maximum of 100 display terminals. Users needing even more capacity can install multiple 290X systems or upgrade to larger scale 2900 Series models such as the 2950/10.

CONFIGURATIONS

A basic 2903 Model 25 includes 64K characters of memory, a console keyboard/display, 9.8 million characters of fixed and removable disc storage, a card ▷

The ICL 290X systems, the smallest members of the ICL 2900 Series, combine batch processing, interactive inquiry, and transaction processing capabilities. Among the four current models, the new 2905 serves as a bridge to the larger 2900's. Designed for first-time users, the 290X systems can also be used in distributed processing networks by large organizations.

CHARACTERISTICS

MANUFACTURER: International Computers Ltd., ICL House, Putney, London, SW15 1SW, England. Telephone: (01) 788-7272. Telex: 22971. ICL markets its systems in 80 countries.

MODELS: 2903/20, 2903/30, 2904, 2903/25, 2903/40, 2904/50, and 2905. The first three models are no longer marketed as they have been replaced by the 2903/25, 2903/40, and 2904/50 models.

DATA FORMATS

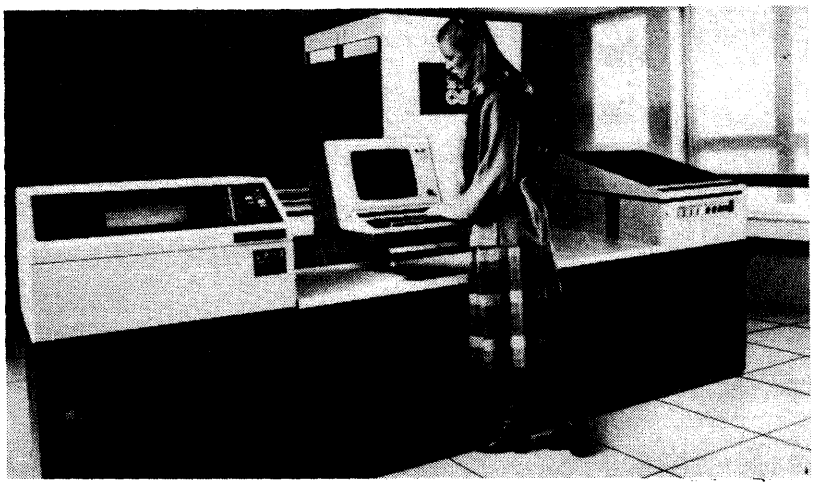
BASIC UNIT: 24-bit word, consisting of four 6-bit characters and two transparent parity bits. Characters are represented in 6-bit BCD (binary-coded decimal) format.

FIXED-POINT OPERANDS: One word (23 data bits plus a sign bit). Products and dividends are double words (46 bits plus sign). By subroutine, double-precision fixed-point operations are possible, using 46-bit-plus-sign operands and 69-bit-plus-sign products and dividends.

FLOATING-POINT OPERANDS: Two words, formatted with a 37-bit fraction and 8-bit signed exponent; performed by executive subroutine ("extracode") or directly by microcode.

INSTRUCTIONS: One word. Memory reference instructions have a 12-bit operation code and 12 address bits, while branch instructions have 9-bit operation codes and 15 address bits.

INTERNAL CODE: 6-bit extended BCD. ▶



Sharing its hardware structure with the larger 2950 and 2956 systems, the 2905 serves as a bridge between the 290X and larger 2900 systems. With cache memory and pipe-lined processing, the 2905 provides between 1.6 and 1.9 times the performance of the 2904 Model 50. The 2905 can support up to 31 synchronous communication lines.

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reader, a 150-lpm line printer, and up to eight keyboard/display workstations. Memory can be expanded to a maximum of 128K characters and disc storage to a maximum of 29.4 million characters. Options include a 600-lpm printer, a remote job entry link to a mainframe, and support for remote terminals.

Equipped with a more powerful processor, the 2903 Model 40 offers a minimum of 96K characters of memory and a maximum of 192K characters. Disc storage is expandable up to 269.4 million characters. A 2903 Model 40 is field upgradable to a 2904 Model 50.

Providing up to 80 percent better performance than the 2903 Model 40, the 2904 Model 50 has a memory capacity of 192K to 768K characters and supports up to 509.4 million characters of disc storage.

Radically different in architecture, a basic 2905 includes a pipe-lined central processor with cache memory, a Store Control Unit, 384K characters of main memory, a minicomputer-based Device Control Unit (DCU), and a minicomputer-based operator's station. Memory can be expanded up to 896K characters and a second DCU can be added. Able to support both 290X and 2950 peripherals (excluding 2903/4 integrated devices), a 2905 can be configured in an almost endless variety of ways, limited only by the number of DCU slots required and by operating system restrictions. Each DCU can support 16 communication lines, and each line not being used for a bulk link can support a cluster of display terminals. A 2905 can be field upgraded to a 2950/10.

SYSTEM ARCHITECTURE

When ICL designed the 2900 Series, it decided to use the 32-bit word, 8-bit byte architecture that has become an industry standard. But to provide a smooth upgrade path for its 24-bit word, 6-bit character 1900 Series users, ICL designed all of the 2900 models up through the 2960 so that they also could be microprogrammed to run in 24-bit 1900 Series mode. Currently, 290X models run in 24-bit mode, while the mid-range 2900 models can run in either 24-bit or 32-bit mode. By limiting users to high level languages and by providing standard software interfaces, ICL is setting the stage for its users to move from 24-bit to 32-bit mode by simply recompiling their applications programs. Thus 1900 Series users can move directly to a 2900 Series system, take immediate advantage of the more modern hardware, and run in 24-bit mode while they modify their software to meet ICL's "forward compatibility standards." Having met the standards, they can switch to 32-bit mode and take advantage of other 2900 Series features, such as virtual memory and virtual machines.

SOFTWARE

ICL offers five upward compatible operating systems for the 290X series, ranging from Executive 0 for the 2903 Model 25 to Executive 5S for the 2905.

MAIN STORAGE

TYPE: MOS.

CYCLE TIME: For the 2903 and 2904 Models, 1140 nanoseconds per 24-bit word. For the 2905, 700 ns Read, 750 ns Write.

CAPACITY: The basic 2903/25 is supplied with 16,383 words (24-bit) of main memory, expandable to 32,768. In the 2903/40, 24,576 words are included with the basic system, with expansion capabilities to 49, 152 words in 8,192 word increments. The 2904/50 basic system includes 49,152 words of memory and can be expanded to 196,608 words. The 2905 has storage capacity of up to 917,504 words.

CHECKING: Two parity bits per word are standard. The processor halts upon detection of a parity error in an area of store occupied by the executive. If an error occurs in the user program area, the program is suspended by the Executive, which displays the error and its location on the video console. Hamming code checking is used on the 2905.

STORAGE PROTECTION: None. However, since each program's addresses are relative to the contents of its own datum and limit registers (which determine relative address zero and thus assure program relocatability), proper control of these registers' contents provides adequate protection.

RESERVED STORAGE: The initial eight words of each program's storage area are reserved for use as general registers. These are addressed by three bits of arithmetic, logical, and shift instructions. Three of these registers (1, 2, and 3) can be addressed by two bits in arithmetic, logical, and shift instructions for the purpose of modifying the address denoted in the instruction.

CENTRAL PROCESSOR

GENERAL: The 2903/25, 2903/40 and 2904/50 all share the same central processing unit, while the 2905 uses the same CPU as the larger 2950 systems.

The ICL 2903 Model 25 CPU has a performance level about 30 percent less than that of the 2903 Model 40 and can be field-upgraded to a 2903/40.

The 2904 Model 50 has an enhanced version of the CPU that provides an 87 percent higher performance level than that of the 2903/40.

The ICL 2905 provides between 1.6 and 1.9 times the performance of the 2904 Model 50. Sharing its hardware structure with the larger 2950 and 2956 systems, the 2905 can be upgraded on-site to a 2950/10 or 2956/10, the latter offering a throughput of up to 4 times the 2904/50. The CPU, known as the Order Code Processor (OCP), is microprogrammed and uses pipelining techniques to overlap instruction execution, slave stores (cache memory) to increase fetching rates, and multiple stacks of virtual registers for storing addresses, parameters, and data.

CONTROL STORAGE: 2903 Model 25 has 8K 32-bit words expandable to 12K words, 2903 Model 40 provides 16K, 2904 Model 50 is supplied with 16K, and the 2905 includes 12K or 16K words. In the 2903-2904 models, control storage is implemented in the same technology, and located below and isolated from main memory. Implementation of Direct Data Entry uses 4096 words. The control storage has an access time of 570 nanoseconds (300 nanoseconds for the 2905).

REGISTERS: Only the general registers (eight per program, in the first eight words of each program's storage area) are user-addressable. Three of them can be used for indexing.

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CHARACTERISTICS OF THE ICL 290X PROCESSOR MODELS

	2903/25	2903/40	2904/50	2905
SYSTEMS CHARACTERISTICS				
Date of introduction	March 1978	March 1978	March 1978	April 1979
Date of first delivery	April 1978	April 1978	April 1978	July 1979
Number of central processors	1	1	1	1
Principal Operating Systems	EXEC 0, 1S	EXEC 1S, 2S	EXEC 1S, 2S, 3S	EXEC 5S
MAIN STORAGE				
Storage type	SEMICOND (MOS)	SEMICOND (MOS)	SEMICOND (MOS)	SEMICOND (MOS)
Cycle time, nanoseconds	1140	1140	1140	700 Read, 750 Write
Minimum capacity, characters	64K	96K	192K	384K
Maximum capacity, characters	128K	192K	768K	896K
Increment size, characters	16K	32K	64K	512K
Word length, bits	24	24	24	24
PROCESSING UNIT				
Relative performance	1	1.3	2.2	3.8-4.1
Machine cycle	1140	1140	1140	700, 750
Control storage, words	8K	16K	16K	12K
Access time, nanoseconds	570	570	570	300
SOFTWARE				
Programming Languages	RPG 2, COBOL, FORTRAN	RPG 2, COBOL, FORTRAN	RPG 2, COBOL, FORTRAN	RPG 2, COBOL, FORTRAN
MTS-2	Yes	Yes	Yes	Yes
ETS-2	Yes	Yes	No	No

Executive 0 supports one batch program with input/output spooling and allows file inquiries by temporarily rolling out the batch program to disc. Exec 0 can be used to turn the 2903 Model 25 into a dedicated, key-to-disc system with up to four Direct Data Entry keyboards.

Executive 1S for the 2903 Model 40 supports one batch job stream with spooling and concurrently direct data entry from up to eight DDE keyboards. File inquiries interrupt the batch program while the DDE program remains active. A second version of Exec 1S supports transaction processing terminals instead of DDE keyboards, and a third version supports remote job entry instead of DDE or transaction processing terminals.

Executive 2S, also for the 2903 Model 40, offers the same support choices as Exec 1S but provides support for up to four concurrent batch job streams instead of one.

Executive 3S for the 2904 Model 50 supports up to eight batch job streams, two I/O spooling slots, a remote job entry link, and, with MTS-2, 40 transaction programs (8 of which are resident and 32 swapped). Exec 3S also can support a direct data entry operation instead of transaction processing.

Executive 5S for the 2905 supports up to eight batch job streams, two I/O spooling slots, a remote job entry link, and the MTS-2 multiple transaction system. MTS-2 supports up to eight resident and 32 swapped transaction processing tasks. MINIMAC, a BASIC language time-sharing system, runs under MTS-2. Direct data entry

Six non-addressable registers are included in the processor's microcode, including a program address register, main and intermediate accumulators, instruction register, and datum register.

ADDRESSING: The ICL 2903-2905 computers are user programmable only through higher-level languages. ICL does not recommend programming at the machine or assembler level and has released no details concerning the internal operations.

INDEXING: Three registers can be addressed by two bits in arithmetic, logical, and shift instructions.

INSTRUCTION REPERTOIRE: The standard 290X instruction set has 111 instructions, including 85 fixed-point arithmetic, branching, shifting, logical, and code conversion (between decimal and binary) instruction; 11 input/output instructions; 4 control instructions; and 8 floating-point arithmetic instructions which invoke "extracode" when the microcode option is not present.

PHYSICAL SPECIFICATIONS: The 2903 and 2904 CPU's and consoles are assembled in desk cabinets with free-standing associated peripheral devices placed on either side. The basic system is 79 inches wide, 32 inches deep, and 39 inches high. Weight of the basic system is 1166 pounds. The basic system requires a floor area of approximately 11 feet by 10 feet. Fixed-exchangeable disc storage (FEDS) units are 24 inches wide, 32 inches deep, 39 inches high, and weigh 638 pounds. Disc storage units with removable packs are 28 inches wide, 38 inches high, 38 inches deep, and weigh 700 pounds.

A basic 2905 configuration consists of the following hardware units: 1) the processor itself, housed in a Common Hardware Cabinet, 2) an operating station, 3) a range of specially designed "Medium Systems" peripherals, and 4) optional link units. A 2905 system consisting of a processing unit, a card reader, a line printer, 3 EDS 80 disc drives, and 3

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(DDE) keyboards are not supported because their character-by-character operating mode would not make efficient use of the 2905 hardware. ICL recommends that DDE applications be moved to a dedicated 2903 or 2904 system, to a 7500 range clustered terminal system, or to a 1500 intelligent terminal. Alternatively, DDE applications can be rewritten as transaction processing tasks.

COMMUNICATIONS

All 2903 and 2904 models can support the attachment of multiple synchronous links for communications with an ICL or IBM mainframe, or another 290X system, but only one at a time may be active. In addition, an ICL 7500 range intelligent terminal system can be concurrently supported for bulk data transfers. Protocols available include 7500 emulation for communicating with a larger ICL system and IBM 2780 or HASP emulation for communicating with an IBM mainframe. Interactive terminals are supported on multiple lines using ICL Basic mode procedures.

A 2905 system can support multiple synchronous links. Software scheduled to be released before the end of 1980 will provide 7500 emulation for communications with ICL 2900 or 1900 Series mainframes. Currently available software enables a 2905 to act as a host for smaller 290X systems and 7500 range systems.

COMPATIBILITY

The 290X data structure allows most ICL 1900 Series software and data files to be transferred to a 290X system without modification. Standard interface peripherals from the 1900 Series can be transferred to the 2903 Model 40, the 2904 Model 50, and the 2905.

Because the 290X systems are microprogrammed to emulate the 24-bit 1900 Series, they are not compatible with the larger 2900 models running in 32-bit mode. All 2900 models up to and including the 296X, however, can be microprogrammed to run in 1900 Series mode.

Within the 290X family, Model 25 programs will execute on the Model 40 and all Model 25 and Model 40 programs will execute on the 2904 Model 50 and on the 2905. ETS1 inquiry programs are now obsolete and must be recompiled for ETS2 or rewritten for MTS-2.

COMPETITION

The 2903 and 2904 systems compete with systems such as the IBM System/32 and System/34. The 2905 competes against the IBM System/38, the IBM 8100, and the IBM 4300.

USER REACTION

Datapro has not yet completed a survey of European 290X users, but Datapro interviewed six ICL 2903 users

MT60 tape drives, would occupy 600 to 900 square feet. The specifications of the logic cabinet alone are 26 inches wide, 31 inches deep, 67 inches high, and 814 pounds in weight.

Voltage provisions to meet a specific country's power requirements are provided. No special environment beyond normal office condiutions is required.

INPUT/OUTPUT CONTROL

I/O CHANNELS: On the 2903 and the 2904, separate peripheral controllers are used. Five of these are for the standard peripherals: operator's video console, disc drives, integrated card reader, integrated or 1900 Series line printer, and Direct Data Entry keystations. The Peripheral Attachment Plane, available as an enhancement on all models, extends the I/O HIghway to provide facilities for attaching EDS30 or EDS60 disc drives, a console hard copy word printer, and five additional control adapters.

Except on the entry-level 2903 Model 25, the following devices also can be supported by the plane: a floppy disc drive, one or two 600-lpm LP 720 line printers, and the Synchronous Multiline Communications Coupler (SMLCC).

This coupler, similar to that used on the 2950, supports up to 8 communications lines. The ability to connect multiple lines to one coupler releases some of the backplane slots to be used for other peripheral devices, thus increasing system connectivity. These 8 lines plus 5 for local and remote communications provide a total of 13 lines per system.

On the Model 2905, the minicomputer-controlled Device Control Unit (DCU) includes a multiplexor channel and one or more peripheral adapters. Connected to memory via the Store Control Unit, the DCU has a maximum transfer rate of 2 million characters/second. In addition to supporting local peripherals, a DCU can support up to 16 synchronous communications lines. A 2905 system can have two DCU's.

CONFIGURATION RULES: The basic 2903 Model 25 comprises:

- CPU and video console
- 8K 32-bit words of control storage
- 16K words of main memory
- 2822/01 FEDS fixed and exchangeable disc storage (9.8 million-characters)
- 2108/02 integrated card reader (300 cpm).

A new 600-lpm LP 720 line printer and a dual diskette device may also be connected (unlike the Model 20), as well as up to four Direct Data Entry keystations, and three communications lines operating under the Enquiry Terminal System (ETS 2) buffered system. As an alternative one of the three lines may be used for an RJE link.

The basic 2903 Model 40 system consists of:

- CPU and video console
- 16K 32-bit words of control storage
- 24K words of main memory
- Store Enhancement Plane.

Space is provided for the first extension to the integrated disc subsystem, for the peripheral couplers, and for a hard copy printer (10 characters/second) to log console output. As with the Model 25, the operator's video console is mounted on an attached working table. Depending upon the peripheral devices selected, this basic layout can be extended by the addition of more disc drives, a diskette unit, or a second line printer.

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in the United States in October 1976. Each had one system. The users included a municipality, two professional societies, a large bank, an engineering firm, and a large beverage distributor. The average installed life for the six systems was slightly over one year. Five of the six used the 2903 systems for traditional accounting functions, i.e., general ledger, acocunts receivable, accounts payable, inventory control, etc. The sixth user employed the 2903 solely for one particular application, operating the system as an adjunct to a very large IBM System/370.

The two professional societies, in addition to conventional accounting functions, were using their systems for member records, publication subscription records, and extensive statistical work directed primarily toward developing membership profiles.

There was little variation among the systems we surveyed, consistent with ICL's policy of marketing standard configurations with limited latitude for expansion. System memory sizes varied between 16K and 32K words, with the average at 24K words. Three systems included two 60-million-character disc pack drives, one had two 60-million-character cartridge disc drives, one had one of each type of disc drive, and one employed only one 9.8-million character drive. Four of the systems each included two direct data entry terminals.

The responses of the six ICL users to our standard questions are tabulated below.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	5	1	0	0	3.8
Reliability of mainframe	5	1	0	0	3.8
Reliability of peripherals	2	4	0	0	3.3
Responsiveness of maintenance service	4	2	0	0	3.7
Effectiveness of maintenance service	2	4	0	0	3.3
Technical support	5	1	0	0	3.8
Operating systems	1	4	1	0	3.0
Compilers and assemblers	2	2	0	0	3.5
Applications programs	1	3	0	0	3.3
Ease of programming	2	2	0	0	3.5
Ease of conversion	2	1	0	0	3.7
Overall satisfaction	3	3	0	0	3.5

*Weighted Average on a scale of 4.0 for Excellent.

The weighted averages make it clear that these users were well satisfied with their 2903 systems. All of the users were impressed with the system reliability, particularly that of the CPU. Most were also impressed with the quality of maintenance service and technical support available from ICL.

Generally, there were no negative comments. Failures had been encountered chiefly during the start-up period and had ceased to be a concern to any of these users. The lone user complaint we received during the interviews concerned the length of time required to install a communications controller and to bring it on-line.

The basic 2904 Model 50 system comprises:

- CPU and video console
- 16K 32-bit words of control storage
- 48K words of main memory
- Store Enhancement Plane

The 2904/50 offers the same configurations as the 2903/40, but allows for more connectability of peripherals and 4 additional EDS30 and EDS60 exchangeable disc drives.

The basic configuration of the 2905 includes:

- CPU
- 12K or 16K 32-bit words of control storage
- 96K words of main memory
- Store Control Unit (5-port)
- Device Control Unit (up to 2)
- Operating Station.

The 2905 can have a maximum of 31 communication lines. The lines are supported by a Device Control Unit. Direct Data Entry keystations are not supported by the 2905.

MASS STORAGE

CARTRIDGE DISC SUBSYSTEMS: Two models of fixed/exchangeable disc storage (FEDS) units are available as integrated peripherals. The basic FEDS consists of a single spindle on which is mounted a fixed disc and an exchangeable disc cartridge. The capacity of each disc is 4.9 million characters, and up to two drives can be connected to any 2903 or 2904 system.

A 4.9 million-character cartridge disc drive employing an IBM 5440-type disc is also offered for the 2903 Model 40 and 2904 Model 50 systems. Up to three of these drives may be connected to the system in addition to the standard 9.8 million-character drive.

On the larger 2903/4 systems, no more than two 9.8 million-character drives and no more than four drives of any type can be connected, yielding a maximum disc capacity of 29.4 million-characters (9.8 + 9.8 + 4.9 + 4.9). Data is recorded on both surfaces of each disc at 512 characters per sector, 12 sectors per track, and 400 tracks per surface.

Average access time, including rotational delay, is 52.5 milliseconds for all FEDS units. Data transfer rate is 416K characters per second. The cartridge disc drives are manufactured by Data recording Instrument Company (DRI), a former subsidiary of ICL.

DISC PACK SUBSYSTEMS: The 2903 Model 40 will accommodate up to four EDS30 or EDS60 disc pack units, and the 2904 Model 50 will accommodate up to eight EDS30 or EDS60 disc pack units. These units are not supported by the 2903 Model 25.

EDS30: The EDS30 exchangeable disc drive provides storage of 30.7 million characters. Containing 11 discs, the EDS30 records on 20 surfaces, 203 tracks per surface. Each track is divided into 15 sectors of 512 characters each. Average access time, including rotational delay, is 72.5 milliseconds, and the transfer rate is 416,000 characters/second.

EDS60: The EDS60 exchangeable disc drive is a double-density version of the EDS30 (406 rather than 203 addressable tracks). EDS60 packs hold 60 million characters each and four EDS60's attached to a 2903 system raise the total disc storage capacity to 245.6 million characters. The

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The 2903 and the more recent 2904 have established themselves as viable and cost-effective alternatives to several low and middle-range members of the IBM computer product line. The systems also offer competition to several other established business computer manufacturers such as Honeywell, NCR, and Burroughs. From the reactions of the users, it is apparent that the ICL systems can perform their intended functions reliably.

Since the survey was made, the number of installed 290X systems has exceeded 3,000, representing a strong vote of confidence from users and making the 290X computers ICL's most successful series.□

EDS60 has an average access time of 37.5 milliseconds, including rotational delay, and a data transfer rate of 416K characters per second. EDS disc drives are connected to the system through the integrated EDS30/60 coupler.

With the 2905, in addition to the EDS60, the Device Control Unit will support various combinations of EDS80, EDS100D, and EDS200 exchangeable disc stores.

EDS80: The EDS80 stores up to 110 million characters of data on two 55 million character removable disc packs. Average access time, including rotational delay, is 38.3 milliseconds. The peak transfer rate is 1.21 megabytes/second.

EDS100D: The EDS100D Exchangeable Disc Store stores up to 76 million characters of data on disc packs with 11 discs and 19 recording surfaces. Average access time, including rotational delay, is 38.3 milliseconds. The peak transfer rate is 806 kilobytes/second. Recording is on 404 tracks plus 7 reserve tracks. Data are recorded in variable-length sectors. Each sector contains a count block followed by a data block. An EDS100D can be upgraded to an EDS200.

EDS200: The EDS200 Exchangeable Disc Store is a double-desntiy version of the EDS100D. It stores 155 million characters per disc pack. Each surface has 808 tracks plus 14 reserve tracks.

INPUT/OUTPUT UNITS

2255/2 OPERATOR'S CONSOLE: This CRT/keyboard displays 20 lines of 50 characters each. Lines 3, 4, 5, and 6 are used to present short lines of system information; i.e., inquiry responses. A system running under Executive 1 or 2 can support immediate hard copy on a 2421/1 Hard Copy facility.

2905 OPERATING STATION: The operating station for the 2905 system comprises a System Control Processor (SCP), a keyboard/display console, and, optionally, up to three repeater screens without keyboards for functions not requiring interactive communication with the system. The display format is 24 lines of 40 characters per line.

The SCP, a minicomputer with a stored control program, is used by the operator for control of normal running and by maintenance engineers for diagnostic purposes. The SCP control panel allows the operator to initiate diagnostics stored in read-only memory (ROM), and to load SCP control programs via a selected DCU.

LP 360 LINE PRINTER: This unit prints 300 lines per minute with a 64-character train. It has 132 print positions at 10 characters per inch and a standard ECMA OCR-B character font. A 96-character train is available as an option.

LP 720 IMPACT PRINTER: The LP 720 prints 440 lines per minute with a 96-character train, 600 lpm with a 64-character train, and 720 lpm with a 48-character train.

LP 1130 LINE PRINTER: This unit prints 660 lines per minute with a 96-character train, 900 lpm with a 64-character train, and 1130 lpm with a 48-character train. It has 132 print positions at 10 characters per inch and uses the ECMA OCR-B character font.

2430 HIGH-SPEED TRAIN PRINTER: This train printer can be used as an alternative to, or in addition to, the integrated printer. It prints at 1500 lpm with a 64-character EBCDIC set, or at 1100 lpm with a 96-character ASCII set. It is available with either 132 or 160 print positions.

2903/2904 PRINTERS: The following two printers are available on the 2903 and 2904 systems only.

241X LINE PRINTER: As the standard integrated line printer with the 2903 Model 25, this unit can be supplied in 150 or 300 lpm versions. Only one can be attached. With the 2903 Model 40 and the 2904 Model 50, this unit operates at 300 lpm. A maximum of two printers is permitted on the system; however, only one can be integrated, the other being chosen from the other available types.

2421 SERIAL PRINTER: This is an ASR 33 Teletype associated with the operator's console for hard-copy output. It prints at a speed of 10 characters/second using a standard 64-character set.

2905 PRINTER: The following line printer belongs to the larger 2900 Models, and can be connected only to the 2905.

LP-1500 TRAIN PRINTER: The LP-1500 is available with either 132 or 160 print positions. It operates at 1500 lines per minute with a 48-character set, 1200 lpm with a 64-character set, and 858 lpm with a 96-character upper/lower case set. OCR-B is the standard font. A train cartridge has 96 slugs, each with four characters on it. Cartridges are interchangeable by an operator. Up to four character-set codes are stored in read-only memory, and the correct code is automatically loaded into a buffer when a cartridge is mounted. Spacing is 6 or 8 lines/inch, and printing is at 10 characters/inch. Format control is under software direction. Forms can range from 3.25 to 20 inches wide and 6 to 18 inches long. The hopper and stacker hold up to 10 inches of paper.

2510/2511 MAGNETIC TAPE SYSTEM: Provides 9-track, 1600-bpi phase-encoded or, optionally, 800-bpi NRZI recording on standard ½-inch magnetic tape. The 2510 consists of a controller and an integrated transport in the same cabinet. Up to five additional 2511 single transport drives can be connected to a 2510, allowing a maximum of a controller and six transports for any one subsystem. Tape speed is 37.5 inches/second and rewind speed is 150 inches/second. Data transfer rate is 80,000 characters/second for phase-encoded recording or 40,000 characters/second with the NRZI option. Each transport can have automatic tape loading.

2905 MAGNETIC TAPE UNITS: The following four units are available only for 2905 systems.

MT30 MAGNETIC TAPE SYSTEM: A 7-track drive that records at 200, 566, or 800 bits/inch in NRZI mode, the MT30 operates at 37.5 inches/second and rewinds at 150 inches/second. The transfer rate at 800 bits/inch is 30K characters/second. Up to 8 drives can be connected to one controller in the Device Control Unit.

MT60 MAGNETIC TAPE SYSTEM: A 9-track drive that records at 1600 bits/inch, phase encoded (PE), or at 800

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bits/inch NRZI. The transfer rate is 60K characters/second. The drive operates at 37.5 inches/second and rewinds at 150 inches/second. Up to 8 drives can be connected to one controller in the Device Control Unit.

MT120 MAGNETIC TAPE SYSTEM: A 9-track transport, the MT120 operates at 75 inches/second with a recording density of 1600 bits/inch PE or, optionally, 800 bits/inch NRZI. Rewind is 240 inches/second. Up to 4 transports can be clustered.

MT200 MAGNETIC TAPE SYSTEM: The MT200 is a 9-track transport recording in 1600-bpi PE mode, optionally in 800 bpi NRZI. The tape speed is 125 inches/second. The transfer rate is 257K characters/second PE and 100K characters/second NRZI. Up to 4 transports can be clustered.

2903 and 2904 CARD EQUIPMENT: The following three card units are available only for the 2903 and 2904 models.

2108 INTEGRATED CARD READER: Integrated with the CPU, this unit reads 80-column cards at 300 cards/minute. The hopper and stacker each hold up to 400 cards. Microcode options allow various card formats to be read.

2104 CARD READER: A non-integrated unit that reads 80-column cards at 600 cards/minute, the 2104 is attached via a standard interface coupler. The hopper and stacker each hold up to 1000 cards.

1920 CARD PUNCH: The 1920 punches standard 80-column cards at 100 cards/minute. It is attached via a standard interface coupler. Hopper capacity is 800 cards; stacker capacity is 650 cards.

2905 CARD EQUIPMENT: The following two units are available ony for 2905 systems.

CR300 CARD READER: Attached to the Device Control Unit, the CR300 reads 80-column cards at 300 cards per minute. The input hopper can accommodate 1000 cards as can the output stacker.

CR1000 CARD READER: This 1000-card/minute unit reads 80-column cards and can accommodate up to 1000 cards in its input hopper and the output stacker. It attaches to the DCU.

2903, 2904, and 2905 Systems are also able to support some of the older 1900 Series peripherals such as paper tape readers and punches, other line printers and magnetic tapes, and graph plotters. These units are attached via the Standard Interface Coupler.

COMMUNICATIONS CONTROL

All 290X models will support multiple communication lines. Two types of Remote Communications Controllers are available to establish a data communications capability. The F2149, which replaced the F1560, is a new coupler capable of handling a single line in ASCII or EBCDIC mode. A further coupler, F2147 SMLCC, can handle up to 8 lines (mixture of local and remote, up to 9600 bps in ASCII mode). The system can support up to 12 VDU's and/or transparent line sharing adapters operating over a single communications line. Synchronous or asynchronous operation is supported.

To equip the 2903 as a remote job entry (RJE) system, a remote communications controller, supported by a special microcode module, is used to provide synchronous communications at 2400, 4800, or 9600 bits/second (depending upon the protocol used).

A 2903 Model 25 can support one synchronous line and four Direct Data Entry or keyboard/display, asynchronous terminals.

A 2903/40 or 2904/50 system can support synchronous lines and the ETS inquiry system or the MTS transaction system.

The 2905 supports up to 16 synchronous lines per Device Control Unit (DCU), and each line can support a cluster of local or remote terminals. MTS-2 supports transaction processing, and MINIMAC provides multi-user access. Batch data links from 7502 and 2903/4 systems are supported, but links to other processors are not currently supported. DDE is not supported.

2251/1 DIRECT DATA ENTRY KEYSTATION/CRT: These units attach locally to the system at distances of up to 300 feet. Up to four DDE's can be connected to each DDE controller of which there may be two on either the 2903 Model 40 or the 2904 Model 50, providing up to eight DDE keystations. A DDE keystation/CRT features 51 keys (with shift, 64 characters) and an 8-line, 32-characters-per-line display format. The last line presents 30 characters of commands, replies, or data entry, verification and editing. These activities are supported by ICL software, which also lets any DDE be designated as a supervisory unit that can be used to initiate batches, create and store format programs, release completed batches for processing, and call up statistics for viewing.

In addition to use as data entry stations, 2251/1 units can be used for file inquiry functions. The Inquiry Program can be operated in roll-in/roll-out mode, or held in store if preferred.

7181/2 AND 7184 DISPLAY UNITS (VDU's): These VDU's can be connected locally and/or via data communication lines on all 2903 and 2904 systems to provide on-line file inquiry/update facilities. ICL provides supporting software for these activities. The VDU features a typewriter style keyboard plus numeric keypad (92-character set), keyboard control keys (tab, delete, erase, line controls, etc.), and a 2000-character CRT display. It can operate on 600-, 1200-, 2400-, or 4800-bits/second communication lines. A Termiprinter can be connected to each VDU as a hard-copy output device.

7502 MODULAR TERMINAL SYSTEMS: The 7502 is an intelligent software-controlled communications system. Data is transmitted bit serially at speeds up to 9600 bps. Four configurations are available with the following characteristics:

- 7502/10 Interactive Terminal System, 12K to 16K byte processor, up to 8 video terminals, and up to 4 hard copy printers.
- 7502/15 Interactive/Stand-Alone Terminal System, 16K to 40K byte processor, up to 6 video terminals, and 4 hard copy printers; options include 0.5-megabyte floppy disc system, 300-lpm printer, and personal identification device readers.
- 7502/20 Remote Printing Terminal System, 16K to 40K byte processor, one video terminal, and a 300-lpm printer; options include a 0.5-megabyte floppy disc system, up to 4 hard copy printers, and additional video terminals.
- 7502/25 Remote Batch Terminal System, 16K to 28K byte processor, one video terminal, a 300-lpm printer, a 300-cpm card reader, and a personal identification reader; options include a 0.5-megabyte floppy disc system.

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Programs can be downline loaded into 7502 systems by the 290X system, a feature not available on the 7503 Modular Terminal System. Systems employing a floppy disc system can load programs from the diskette.

SOFTWARE

OPERATING SYSTEMS: Five upward compatible operating systems are offered for the 290X series, ranging from Executive 0 for the 2903 Model 25 to Executive 5S for the 2905.

Executive 0 is available only for 2903/25 systems with a maximum of 16K words of memory and supports only minimum configurations consisting of FEDS disc drives, integrated line printer, integrated card reader, and Direct Data Entry terminals. It does not support 1900 series peripherals or spooling facilities. It allows the running of a single batch stream. Files inquiries from the video console or DDE keystations are allowed using a roll-in/roll-out technique. Alternatively, Exec 0 can run a system dedicated to Direct Data Entry. VDU-based inquiry and remote job entry are not supported by Exec 0.

Executive 1S provides the operator's "Super-screen" facility. The "S" versions allow "pages" of information to be taken from the System Journal File for easier monitoring of activities being run on the system. Exec 1S provides support for a single batch slot (under JCL or operator control), up to 8 DDE keystations, a spooling slot with one input and one output stream concurrent, a Remote Job Entry slot, a Communications Bulk Input slot providing RJE from 7502, and inquiry or transaction support (ETS2 or MTS).

Executive 2S for the 2903 Model 40 has similar facilities to Executive 1S, but allows up to four batch streams to be run concurrently and provides a CPU timer.

Executive 3S for the 2904 Model 50 is similar to Executive 2S but permits the concurrrent running of up to 8 batch streams and provides two input/output spooling slots.

Executive 5S, the 2905 operating system, concurrently supports eight batch streams, two spooling slots, eight locked (resident) MTS-2 programs, thirty-two unlocked (disc-resident) MTS-2 programs, and a remote batch link from ICLC-02 protocol terminals (e.g., 7502, 2903/4). The ability for the 2905 to act as a satellite system in a network is not offered in the initial release of Exec 5S.

EXEC+ provides extra facilities not included in the normal Executive. EXEC+ comprises a number of facilities which extend the normal executives:

- Job Analyzer—replaces the normal JCL job analyzer and provides many extra options including macro file ownership, nested macros, increased job description limits, comment lines in job descriptions, and nested parameters.
- Global Document Editor—allows documents to be edited during job processing.
- Selective Journal—a monitoring file which enables all the messages relevant to a job to be printed out at the end of the job.
- Create/Erase—disc files can be created and erased during the running of a job description.
- Accounting—The accounting option provides for the breakdown of costs to cost centers and thus gives an accurate basis for charging departments for work performed.

DATABASE MANAGEMENT: A reduced version of the Integrated Data Management System (IDMS) is now available for the 290X models. IDMS-E offers a subset of the full IDMS CODASYL database system and provides a simplified user interface for customers who initially required less sophisticated facilities but wish to retain the flexibility to grow to full IDMS. For further details on the full version of IDMS, refer to Report 70E-272-02 in the Software section of *DATAPRO 70*.

Also available on 2905 models is a reduced version of the Data Dictionary System, known as DDS-E. This subset is restricted in the area of data ownership and version numbering. It maintains an integrated database which holds four distinct types of information: details of real-world processes such as invoicing, order entry, payrolls and other typical business functions; real-world data such as order and worksheet details; details of computer processes such as systems, programs, and modules; and computer data such as files, records, and IDMS sets. DDS-E offers the user facilities to record, manipulate, and call for a large variety of reports on this data.

MINIMAC: A multi-user access system designed for ICL 290X range computers, MINIMAC provides up to 60 terminal users with interactive facilities consisting of:

- A procedure for submitting batch jobs from terminals, with automatic running of these jobs
- User-managed filestore
- An interactive text editor
- A BASIC interpreter

MULTIPLE TRANSACTION SYSTEM: MTS-2 for the 2903/40, 2904/50, and 2905 is an enhanced version of MTS including a central file handler, a facility for use of remote VDU's as console operator keystations, message passing between transaction programs, and transaction program access to the system spool file. Also newly added is an Interactive Screen Formatter for ease of screen development and a Testing Mode Facility which reads and writes pseudo VDU data to and from discs. MTS-2 automatically adapts to the number of active terminals in the system and concurrently supports up to 39 transaction programs plus a message router. Seven (plus router) of these may be locked in store and the other 32 unlocked (swapped).

Transaction programs may be written in either RPG2 or COBOL. These programs may incorporate the ETS2 (Enquiry Terminal System) subroutines or can use the MTS interface subroutines which provide the same method of communicating with the terminals but which reduce store occupancy by eliminating unnecessary program buffers. Upgraded existing 2903 systems can run ETS2 without change; however, a message router program must be generated. ETS2 is not supported by the 2904/50 and 2905 and is not recommended for new users of 2903 models.

LANGUAGES: On the 290X systems, ICL is promoting use of its RPG2 language, which is largely compatible with IBM's RPG II. The RPG2 compiler requires 12K words of user store. The language can be used to program the remote use of VDU's and is also compatible with 1900 Series RPG. 1900 Series RPG2 diagnostics are available in English, French, or German. COBOL, Range COBOL (not yet available), BASIC, and FORTRAN are also offered. Available COBOL options are a COBOL preprocessor, a data name cross reference, a COBOL library routine, and COBOL disc sort. The new Range of COBOL will provide for portability from DME (24-bit mode) to VME (32-bit mode) systems. It is largely compatible with the C2 compiler used for VME systems. Also available is Application Manager, a parameterized programming language; VERSE, an on-line source program editor; and Program Development Aids which help programmers write, debug, and document programs.

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COMMUNICATIONS SOFTWARE: ICL offers communications between 2903/2904 systems and IBM 360/370 host systems or IBM System/3's using IBM 2780 or HASP multileaving procedures. The 2780 emulator can be one of a number of programs running concurrently under Exec 1S, Exec 2S, or Exec 3S. All IBM 2780 peripherals, such as card readers, line printers, or card punches, can be emulated; multiple records can be transmitted; printer horizontal formats can be controlled, and data from the host system can be spooled.

Emulation of HASP multileaving procedures, a recent enhancement, provides an alternate means of communication between 2903 or 2904 models and IBM mainframe processors. The software will support a line printer, card punch, and card reader in either spooled or real mode online to one IBM mainframe.

UTILITIES: Available utilities include disc file reorganization, sort/merge, copiers, formatters, initializers, labelers, dumps, utilization reporters, loaders, file creators, and library maintenance routines. All utilities are grouped together and are priced separately from other Software products.

APPLICATIONS SOFTWARE: For the entry level 2903/25 through to the 2905 the following are available in RPG2: A Bill of Materials Processor (BOMP), Stock Control, Direct Order Entry, Card Order Entry, On-Line Order Entry System (O.L.O.E.), On-Line Manufacturing Control (OMAC), and conventional accounting packages.

Available in PLAN (1900 Series assembly language) is PROSPER, which requires floating-point; linear programming and statistics; the FIND2 file search system; and the company payroll program.

For the 2905, ICL offers a variety of applications programs for business, engineering, and scientific functions. Following are brief descriptions of currently available packages. They are divided into the following three general application areas: financial packages, technical and statistical packages, and manufacturing packages.

Financial Packages: LUCRE—A ledger update and control system which creates and maintains sales, purchase and general ledgers.

PROSPER and PROSPER+—Both of these systems are used for financial modeling. They are used for cash flow forecasting, project selection, breakeven analysis, costing analysis, etc.

COMPAY, COMPAY+ (UK only)—COMPAY processes a user's payroll, calculating gross wages, net wages, national insurance payments, tax and pensions, and updating employee records.

BACSTER (UK only)—BACSTER provides an interface for input into the BACS system. it picks up a user's own financial data, such as Bank Giro credits and debits, and puts it onto magnetic tape in a form ready for input to the Bankers Automated Clearing Services (BACS).

BANK GIRO INTERCHANGE PROGRAM (UK only)—This program enables users to submit certain money transfers on magnetic tape directly to the BACS computer system.

INSURANCE SYSTEM—This system provides smaller insurance companies with a flexible means of maintaining and servicing its policy register and related files.

BASIC SYSTEMS—PAYROLL—This system provides all the calculations to produce net pay for hourly, weekly, and monthly payrolls.

BASIC SYSTEMS—LEDGER—The sales ledger system provides for the creation and maintenance of Sales Ledger Accounts.

BASIC SYSTEMS—PURCHASE LEDGER—This system provides all the facilities needed to maintain a purchase ledger and associated files.

BASIC SYSTEMS—NOMINAL LEDGER—This system provides all the facilities needed to maintain a nominal ledger file.

Technical and Statistical Packages: PERT and ENHANCED PERT—PERT aids the planning and control of projects, taking time and resource constraints into account.

TRANSPORTATION PROGRAM—This program optimizes the use of transport and limited resources in the manufacturing and distribution industries.

COMTRAK—COMTRAK provides information needed to control container traffic in and out of a container terminal.

DEPOT SITING—This system selects the optimum site for a depot.

LINEAR PROGRAMMING SYSTEMS (Mark 3)—This system is used to solve problems involving multiple factors and aids the optimization of resources.

STATISTICAL ANALYSIS PACKAGE—This package enables the user to derive a variety of different statistical figures and tables.

GINO-F, GINO-GRAF, GINOZONE—GINO is a set of routines used for producing graphic output.

FLAPS—Flexibility Analysis of Pipe Systems analyzes large pipe systems used in such places as refineries.

MELAPT 20 & MELAPT 40—the MELAPT systems are used for numerical control planning in manufacturing industry.

Manufacturing Packages: OMAC—OMAC is an on-line manufacturing control system. It aids planning and controlling of producing levels in manufacturing industry.

BILL OF MATERIALS PROCESSOR (BOMP)—BOMP provides a list of all parts, sub-assemblies, and raw materials used to make up a given product and the operations involved in making the product.

CARD ORDER ENTRY & ON-LINE ORDER ENTRY—Each of the order entry packages produces invoices, dispatch notes, credit reports, and stock level reports.

STOCK CONTROL—The ICL Stock Control system enables the minimum amount of stock to be held while still satisfying all orders. It also provides stock reports and inquiry facilities.

SHOPLAN—SHOPLAN is used in manufacturing industry to produce workshop schedules.

SLIM—SLIM is for use in the retail and distribution industry to control stocks at shelf level.

PRICING

POLICY: ICL offers the 290X system for purchase or lease. Maintenance is priced separately for both purchased and

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leased equipment. Lease terms can vary from one to five years. All software is separately priced. The U.K. supplies other countries with master files of available software. Some of it, however, is only applicable to U.K. and overseas countries develop their own products where necessary. Prices, terms, and available configurations may vary in other countries to suit location conditions.

ICL did not provide complete pricing information; however, entry level pricing begins at £ 25,000.■