

# ICL Series 39

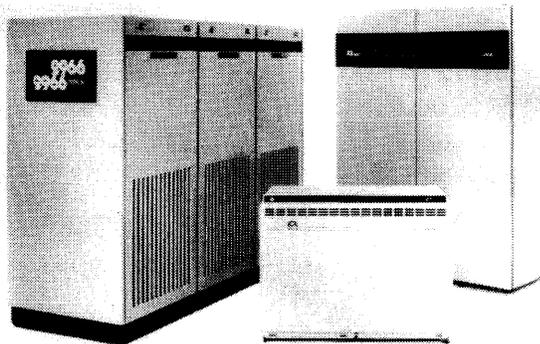
## MANAGEMENT SUMMARY

ICL's new Series 39 mainframe computer line includes two systems: Level 30 and Level 80. Both the Level 30 and the Level 80 consist of single- and dual-processor, or node, configurations and are designed to compete with high-end IBM machines, mainframes in a distributed environment, and superminicomputers.

A top-end mainframe, the Level 80 is an 11 MIPS system and offers up to 32MB of main storage. The system uses air-cooled ECL chips mounted on boards in Fujitsu's cube. The Level 30 is a supermini designed for use in an office environment as a distributed mainframe or scientific supermini. It competes in price and performance with the most powerful scientific superminis. Supporting 200 users simultaneously and more than 2,000 workstations on one system, the Level 30 is a 2.2 MIPS machine constructed around Fujitsu CMOS chips.

ICL offers single-node and dual-node versions of the Series 39. A single-node Level 30 is over 30 percent more powerful than the single-processor IBM 3083 JX; the dual-node Level 30 is rated at 4 MIPS, providing approximately 75 percent of the power of the dual-processor IBM 3090/200 system. The Level 80 single-node system is rated at 11 MIPS, and the dual-Level 80 at 20 MIPS, which is the same as that of the IBM 3090 Model 200.

The Level 30 utilizes 8000 gate-per-chip CMOS technology. The main processor of the Level 80 is based on Emitter Coupled Logic (ECL) chips, and retains CMOS for its input/output system. The Series 39 processors and the advanced CMOS and ECL logic chips incorporated within them have been designed by ICL at the company's mainframe development center in West Gorton, Manchester, U.K. Collaboration with Fujitsu of Japan in the production of the logic chips has enabled ICL to take advantage of the latest VLSI manufacturing technology as it emerged and bring these advanced mainframes to the market ahead of the competition.



Pictured here are the two new processors in the ICL Series 39, the Level 80 on the right, the Level 30 in the center, along with ICL's System 2966 on the left.

Incorporating fiber optic links and Fujitsu microchip technology, the ICL Series 39 mainframe computers consists of Level 30 and Level 80 models. The Series 39 Level 30 is a supermini designed for use in an office environment as a distributed mainframe or scientific supermini. The Series 39 Level 80, the top-end mainframe, is an 11 MIPS system.

**MODELS:** Level 30 and Level 80.

**CONFIGURATION:** Both models are offered in single- and dual-processor configurations, or nodes. Each node contains main memory, an Order Code Processor, input/output controllers, and a Nodal Support Computer.

**COMPETITION:** Level 30—Data General MV/10000, top-end Digital Equipment Corporation VAX systems, and distributed mainframe systems; Level 80—IBM 308X and IBM 3090 Series.

**PRICING:** Purchase prices for the Level 30 range from £150,000 to £230,000; purchase prices for the Level 80 range from £1 million to £3 million.

## CHARACTERISTICS

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## ICL Series 39

➤ ICL has taken a significant step forward in systems design with the development of a nodal architecture that allows Series 39 processing units (referred to as nodes by ICL) and high-speed peripheral devices to be linked together in a modular fashion, without complex controllers, and interact at maximum efficiency.

Based on the processor node concept, the Series 39 Level Code 30 and Series 39 Level 80 consist of an Order Code Processor (OCP), one storage module using 256K-bit chips, one or two I/O controllers, and a Node Support Computer which handles transaction logging and performance monitoring for remote diagnostic purposes. The I/O controllers link the nodes to local area networks, Oslan, and MACROLAN.

The Series 39 computers are compatible with each other and with earlier ICL machines that use the VME operating system and software. The Level 30 and Level 80 completely overlap ICL's 2900 Series of mainframes. The current 2900 range is built around a 2966 uniprocessor. The Level 80 is four times as fast as the 2966, while the Level 30 offers half the performance of the 2966.

The improved throughput offered by the Series 39 is achieved through the reduction of the number of clock cycles required to execute an instruction. The Level 80 executes an instruction every seven cycles, compared with the every twelve cycle rate of the 2966. Both system ranges run under the VME operating system, which has been enhanced to handle the nodal operation of the Series 39 systems. ICL claims that the power rating covered with the new series extends from 1 to 25, which is the widest available from any manufacturer under one operating system.

The Series 39 expands and strengthens ICL's product line at the top end of the range. With it, ICL aims to provide existing 2900 users with an upgrade path and take on IBM and Digital Equipment Corporation in the United Kingdom. Series 39 extensions, not incorporated into the previous ICL systems, include fiber optic peripheral connections and new logic chips.

The recently released SV211 version of the Virtual Machine Environment (VME) is the Series 39 operating system. The VME operating system also runs on the company's 2900 Series. VME consists of a base and a series of options to enhance throughput and control. VME is designed to handle mixed batch, teleprocessing, and interactive inputs. Since VME is file-oriented, ICL states that it can be used to take a central part in networks, supporting large numbers of terminals. The virtual machine concept used by VME is designed to reduce overhead. It also prevents each job from corrupting other jobs or the system software.

ICL will continue to offer all existing 2900 Series mainframes. The current version of the VME operating system, SV211, has been developed to run with equal efficiency on Series 39 and 2900 Series processors. ICL's QuickBuild, Decision Support, and office software can run on all mod-

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**DISTRIBUTORS:** ICL also has offices in the following countries: Barbados, Fiji, Ghana, Iraq, Jamaica, Kenya, Malawi, Malaysia, Mauritius, Mexico, Nigeria, Pakistan, Papua New Guinea, Saudi Arabia, Singapore, Sudan, Swaziland, Tanzania, Trinidad, Uganda, United Arab Emirates, Zambia, and Zimbabwe.

**MODELS:** Level 30 and Level 80.

**DATE ANNOUNCED:** April 24, 1985.

**DATE OF FIRST DELIVERY:** Mid 1985.

**NUMBER INSTALLED TO DATE:** Level 30—120; Level 80—40.

### DATA FORMATS

**BASIC UNIT:** 8-bit byte. Each byte can represent one alphanumeric character, 2 BCD digits of 8 binary bits. The word of 32 bits is formed from four consecutive bytes.

**FIXED-POINT OPERANDS:** 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; one word (32 bits) or one doubleword (64 bits) in binary mode.

**FLOATING-POINT OPERANDS:** A word consisting of a 24-bit (6 hex digit) fractional part plus a 7-bit hexadecimal exponent in long form or, in extended form, 4 words with 112-bit fractional part (28 hex digits) plus 7-bit hexadecimal exponent.

**INSTRUCTIONS:** 2 or 4 bytes in length. Most instructions are available in both forms. There also are three instruction formats. Primary format instructions are either computational or miscellaneous. Secondary format instructions are store-to-store instructions. Tertiary format instructions are conditional jump instructions.

**INTERNAL CODE:** EBCDIC (Extended Binary Coded Decimal Interchange Code).

### MAIN STORAGE

**CYCLE TIME:** Level 30—950 ns for 8 bytes; Level 80—400 ns for 32 bytes. (Timing is dependent on the type of access.)

**CHECKING:** All data paths between the central processor and main storage are parity-checked by byte. When data is stored, an error-correcting code is substituted for the parity bits. (An 8-bit modified Hamming code is appended to each 8-byte doubleword of data.) When the data is retrieved, single-bit errors are detected and corrected automatically, and most multiple-bit errors are detected.

**STORAGE PROTECTION:** Each segment of virtual storage is protected by three codes: a 1-bit Execution Permission key, an 8-bit Read access key, and an 8-bit Write access key. Only code associated with an Execution Permission bit can be executed. When a store access is made, the contents of the Access Control Register (ACR) are compared with either

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TABLE 1. SYSTEM CHARACTERISTICS

	Level 30	Level 80
<b>SYSTEM CHARACTERISTICS</b>		
Date announced	April 24, 1985	April 24, 1985
Date first delivered	mid 1985	mid 1985
Field upgradable to	Level 80	—
Relative performance	—	—
Number of processors	1	1
Cycle time, nanoseconds	—	—
Word size, bits	32	32
Operating systems	VME	VME
<b>MAIN MEMORY</b>		
Type	CMOS LSI	ECL
Minimum capacity, bytes	4M	16M
Maximum capacity, bytes	16M	32M
Increment size	—	—
Cycle time, ns	950 for 8 bytes	400 for 3.2 bytes

els, and the CAFS-ISP information search processor is also available for both. In addition, the well-established TME operating system is supported on Series 39 Level 30 nodes under the control of VME to provide an upgrade path for existing users of ICL ME29 computers.

Two high-capacity disk storage units, the FDS 300 and the FDS 2500, have been developed for the Series 39. The FDS 300 and FDS 2500 have capacities of 300MB and 2500MB and transfer rates of 2.5MB per second and 2.86MB per second, respectively. The disk units are connected into MACROLAN via a High-Speed Disk Controller (HSDC), an advanced microprogrammed controller based on CMOS 8000 logic. Eight FDS 300 units or four FDS 2500 units can be supported by one HSDC.

Also introduced is a new range of tape decks that operate in PE and GCR modes, featuring transfer rates of 310, 470, or 780KB per second. From one to four tape units can be attached to the system via the High-Speed Magnetic Tape Controller.

ICL has also included as standard in the Series 39 the CAFS-ISP high-speed information retrieval unit. CAFS-ISP is especially appealing to large financial institutions that need to search large files rapidly.

Three new printers have also been introduced. Two of them are medium-speed printers: the Line Writer 400 and the Line Writer 800. The other printer is the LP2000, an extremely fast device, offering OCR quality and speeds of up to 2,000 lines per minute.

The Series 39 also supports a large number of peripherals associated with ICL ME29 and 2900 systems.

Connections between System 39 peripherals and the central processor are achieved through a fiber optic local area network called MACROLAN. Gateways to an Ether-like network called OSLAN provide communications with end-user terminals. According to ICL, this is the first time that

the read or write key of the segment. Sixteen levels of privilege are used. Values of 0 to 9 are set by the system software and values 10 to 15 by the applications programs. Access is granted when the contents of the ACR are equal to, or less than, the key assigned to the segment.

### CENTRAL PROCESSORS

The Level 30 and the Level 80 have been designed around the concept of processor nodes. The processor node consists of an Order Code Processor (OCP), a store module that uses 256K-bit chips, one or two I/O controllers, and a Node Support Computer. The Node Support Computer accommodates transaction logging and performance monitoring for remote diagnostics. The I/O controllers connect the node to local area networks. The OCP operates 2900 order code in native mode. Pipelining techniques have been incorporated into the system for enhanced performance.

The Level 30 processor is based on CMOS LSI 8000 gate array chips. This technology, which produces minimal heat output, supports a high-density construction. ICL has designed 43 different CMOS 8000 gate chips which are used in the node and high-speed disk controller.

The processor in Level 80 is constructed around Emitter Coupled Logic (ECL). The ECL chips are manufactured by Fujitsu with a 0.4 nanosecond gate delay. In addition to being extremely fast, the ECL chips run far cooler than earlier designs of comparable power, resulting in compact structures that greatly reduce cooling requirements.

Functionally, the Level 80 OCP is a development from the ICL 2966 processor, but achieves more than 4 times the performance rate in about half the space through a combination of faster ECL technology and an enhanced OCP design. The central processor of the Level 80 consists of seven to eight boards contained within a steel cube housed within the cabinet. An optional board is offered to function as the scientific unit for floating-point operations.

### CONFIGURATION RULES

Both models are available in single- and dual-processor configurations, or nodes as ICL terms them. Each node contains main memory, an Order Code Processor, input/output controllers, and a Nodal Support Computer.

The Level 30 is a supermini designed for use in an office environment although it competes in price and performance

▷ fiber optics have been used as the standard means of interconnecting computer units. The ultra-fast MACROLAN LAN uses optical fiber cabling to transmit data between nodes and high-speed peripherals as far apart as 1,500 meters at up to 50M bps. ICL claims that MACROLAN provides faster throughput than conventional star configurations and is faster than any other local network in general production today.

MACROLAN operates over a 5 mm cable and is centered around a port switch unit that holds address information and organizes the token passing. Because the cable is only 5 mm in diameter, MACROLAN dramatically reduces cabling requirements and cuts costs. It does away with the need for raised floors and allows peripherals to be located up to one kilometer from the main processors. MACROLAN plays its most important role in building larger systems.

Support for the Open Systems Local Area Network (OSLAN) reflects ICL's commitment to international standards for Open Systems Interconnection. Each OSLAN uses a coaxial cable to link medium-speed devices, such as printers and workstations, to the Series 39 nodes, along with any device conforming to the OSLAN standards, notably other members of ICL's networked product line.

A wide range of applications software is available from ICL and third-party suppliers for financial accounting and business planning, retail, manufacturing, and office systems such as electronic mail, private viewdata, and diary systems.

Future plans call for Unix to be offered as an option on the Series 39. ICL recently joined with five other European manufacturers in an effort to help promote this operating system and to convince third-party software houses to produce Unix application packages through standard tools provided by the six companies.

## COMPETITIVE POSITION

Series 39 mainframes are marketed in the United Kingdom, Denmark, France, Germany, The Netherlands, Sweden, Australia, Asia, and Africa. ICL is Europe's only indigenous mainframe manufacturer. Companies such as BASF and Siemens in Germany, and Bull in France, act as OEMs for Japanese and U.S. mainframe manufacturers. Recognized as the number-two computer company in the United Kingdom, ICL has historically concentrated on its mainframe products, deriving two thirds of its revenues from this market. ICL's objective is to aggressively market the Level 30 and Level 80 along with the 2900 Series, with an emphasis on product line continuity. By employing this strategy, ICL assures users of expansion avenues.

A single-node Series 39 Level 30 is over 30 percent more powerful than the single-processor IBM 3083 JX; the dual node Level 30 is rated at 4 MIPS, providing approximately 75 percent of the power of the dual-processor IBM 3090 200 system. The Level 80 single-node system is rated at 11

▶ with the most powerful scientific superminis. The Level 30 is housed in a compact cabinet, achieved through the use of 8000 gate-per-chip CMOS technology. It is a low-line unit, molded entirely in injection foam polymer plastic which contains the processor, up to 16 million bytes of main storage, connection for up to two OSLANs and four MACROLANs, and a Node Support Computer.

The combination of CAFS, Local Area Networks, and VME operating system enables the Series 39 Level 30 node to support approximately 200 users simultaneously. A single Level 30 has the capability of connecting more than 2,000 workstations. A basic Level 30 single-node system consists of 4MB of main memory, two FDS 300 eight-inch disk drives, and ISP-CAFS.

The ICL Series 39 Level 80 is designed as a powerful information server for the corporate data processing center. It incorporates high-density ECL chips which have fast switching speeds and a high degree of reliability. The Level 80 processing node is housed in an air-cooled, high-line cabinet designed for easy installation in a computer room. Within the stainless steel Level 80 cabinet, the top portion is devoted to two or three CMOS I/O controllers (IOC). The cube contains slots for seven to eight boards. An extra board is available for the optional scientific unit for floating-point work.

The cubes arrive fitted with the boards and slide into the cabinet. The lower portion of the cabinet is devoted to power supplies. The Level 80 incorporates from 16 to 32 million bytes of main memory, connections for up to three OSLANs and six MACROLANs, and the same Node Support Computer that is incorporated into the Level 30 node. The main storage of the Level 80 uses 256K RAM chips.

**CAFS-ISP:** The Contents Addressable File Store-Information Search Processor (CAFS-ISP) is a standard unit on the Level 30 and Level 80. CAFS-ISP provides fast access to large amounts of data since it retrieves file information directly rather than through a conventional string of related indices. The speed of the CAFS-ISP should increase further since ICL plans to incorporate new fixed disk drives with the unit to furnish faster transfer rates. For additional details on the CAFS-ISP facility, please refer to report number 70D6-505MI-401, Volume 2.

**COMPATIBILITY:** The Series 39 computers are compatible with each other and with earlier ICL machines that use the VME operating system and software. The Level 30 and Level 80 completely overlap ICL's 2900 Series of mainframes. The current 2900 range is built around the 2966 uniprocessor. The Level 80 is four times as fast as the 2966, while the Level 30 offers half the performance of the 2966. The improved throughput offered by the Series 39 is achieved by the reduction of the number of clock cycles required to execute an instruction. The Level 80 executes an instruction every 7 cycles, compared to the 12 cycles required by the ICL 2966. Both the 2900 Series and the Series 39 run under the VME operating system which has been enhanced to accommodate the nodal operation of the Series 39 systems.

## INPUT/OUTPUT CONTROL

**HSDC/Retained Disks:** Two different Retained Disk Controllers are each housed in their own cabinets. One provides equipment or a single-access string of up to eight EDS80, FDS160, and/or FDS640 (MDSS) disk drives. In each case, the disk drives are connected via a coupler to a High-Speed Disk Controller (HSDC/1), which is itself connected via MACROLAN (high-speed network) to a Series 39 input/output controller.

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TABLE 2. MASS STORAGE

MODEL	FDS2500	FDS640	FDS300	FDS160
Cabinets per subsystem	1 to 4	up to 63	2 to 6	up to 30
Disk packs/HDAs per cabinet	1 to 4	1 HDA	2 to 6	2 HDAs
Capacity	2487.5	651.2	312.3	160.1 per HDA
Tracks/segments per drive unit	—	—	—	—
Average seek time, ms	—	—	—	—
Average access time, ms	15	25	20	30
Average rotational delay, ms	8.3	8.3	8.3	8.3
Data transfer rate	3.0	1.2	2.45	1.2
Controller model	HSDC	DCU 1, DCU 2, DSC	HSDC	DCU 1, DCU 2, DSC
Comments	—	—	—	—

▷ MIPS, and the dual-node Level 80 at 20 MIPS which is the same as the IBM 3090 Model 200.

ICL is planning quadratic systems and hopes to have a quadruple Level 80 out by 1987. If ICL can meet its timetable, the company hopes to beat the IBM 3090 Model 400 to the marketplace, making it the first time that ICL has had a more powerful machine than IBM.

The VME operating system chosen by ICL for the Series 39 solidifies its relationship with other ICL computers. VME enables users to have uninterrupted access to the system and produces fast response times. Through uncomplicated menus, users can avail themselves of dedicated sets of system resources. It can act as a host to other operating systems and can also accommodate the processing in parallel of two types of work.

The combination of Series 39 and existing 2900 Series processors enables ICL's VME family of mainframe computer to cover a power range of 1 to 25, a range that is wider than any provided by other companies on a single operating system.

To make the Series 39 even more competitive in the marketplace, ICL also plans to incorporate Unix System V on all of their systems. The Series 39 will support Unix hosted by VME.

At the present time, Series 39 Level 30 competes with Data General MV/10000, top-end Digital Equipment Corporation VAX systems, and distributed mainframe systems. Series 39 Level 80 competes with the IBM 308X and IBM 3090 Series.

### ADVANTAGES AND RESTRICTIONS

The Series 39 is a range designed for today and tomorrow. In creating the line, ICL didn't settle for simply enhancing equipment they already had, but took advantage of the latest developments in chip technology for the construction of the series. Two types of advanced chips, manufactured by Fujitsu to ICL's design, have been employed in the nodes' processors. CMOS 8000 chips have been incorporated into the construction of the processor used in the Level 30. CMOS technology generates minimal heat and supports high-density construction. Emitter Coupled Logic (ECL) is the technology used in the Level 80. ECL is extremely fast and runs coolly, resulting in a compact

▶ The MDSS string can be extended to 16 drives by the addition of a second MDSS coupler. Similarly, the EDS200 string can be extended to 8 drives by the addition of a second EDS200 coupler. MDSS and EDS200 drives cannot be connected to the same Retained Disk Controller. EDS200 drives are supported on the Series 39 Level 80 systems only. An FDS300 CAFS-ISP facility can be fitted in the MDSS Retained Disk Controller for use with MDSS disk drives.

### MASS STORAGE

See Table 2.

### INPUT/OUTPUT UNITS

See Table 3.

### COMMUNICATIONS CONTROL

**MACROLAN:** Internal communications between System 39 peripherals and main processors is achieved through the high-speed MACROLAN network. MACROLAN uses fiber optic cables to transmit data between nodes and high-speed peripherals as far as 1,500 meters apart at a maximum speed of 500M bps. The use of fiber optic technology in MACROLAN represents the first time that fiber optics has been used as the standard means of interconnecting computer units. A maximum number of 15 magnetic device controllers can be connected to MACROLAN in order to support up to 15 units. ICL claims that MACROLAN provides faster throughput than conventional star configurations, making it faster than any other local network in general production today. MACROLAN operates over a 5 mm cable and is centered around a port switch unit that holds address information and organizes token passing.

**OSLAN:** The trunk cable of OSLAN (Open Systems Local Area Network) supports the connections between up to three user devices such as ICL workstations, ICL server devices, ICL nonmagnetic peripherals, non-ICL workstations, and non-ICL peripherals. Having been adopted by many manufacturers as a standard, OSLAN operates at 10M bps with up to 1,024 peripheral devices linked to it. OSLAN reflects ICL's commitment to international standards for Open Systems Interconnection (OSI). Each OSLAN uses a coaxial cable to link medium-speed devices, such as printers and workstations, to the Series 39 nodes, along with any device conforming to the OSLAN standards. Protocols supported include ICL CO3, X.25, IBM 2780/3780, Async, and Viewdata.

▶ **PERILAN:** Perilan is a 2900 peripheral interface to the OSLAN converter and is used for connection to the Series 39 system of LP1500 line printers, CR300 card readers, and/or CR1000 card readers retained from 2900 Series systems. One 2900 peripheral interface is provided as standard, and a second interface is offered as an option. When two interfaces are fitted, the types of retained 2900 peripherals connected to them need not be the same. Perilan is

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▷ arrangement and lowered cooling requirement. A powerful series, the Level 30 delivers more processing power than an ICL 2957 and the Level 80 offers approximately four times the processing power of an ICL 2966. In translating this power to practical applications, the Level 30 can support a user community of 250 (although in some cases this figure can be raised to almost 1,000), and the Level 80 can support thousands of users.

ICL also used an innovative technique in selecting fiber optics for the cabling of MACROLAN, the high-speed data network in the Series 39. The MACROLAN data network links high-speed disks and magnetic tapes to a Series 39 node over a distance of 1,500 meters, allowing nodes and peripherals linked to MACROLAN to be located well away from each other, thus allowing users a great deal of flexibility in installing their systems. The system views a high-speed peripheral on MACROLAN as not being attached to any particular node, rather it considers it as a resource available to all network users. If any nodes are removed or added from a configuration, the system's operation is not disrupted.

Joining ICL's Network Product Line, the Series 39 can accommodate the occasional user (who may access the central system through a One-Per-Desk machine), as well as the user who needs unrestricted access to the system most of the day, every day.

OSLAN, also a member of ICL's Network Product Line, is a medium-speed network implemented through a coaxial cable that operates at 10M bits per second. After OSLAN has been routed through a building, it allows terminals, workstations, and printers to be easily plugged in. These peripherals can be placed anywhere in the building and can be moved whenever necessary without causing any problems.

To accommodate the critical problem of immediate access to vast and complex databases, ICL has equipped the Series 39 with the CAFS Information Search Processor. Via this unit, search speeds are accelerated as much as 60 times. Its use is also not restricted to data processing professionals. Users seek out information by asking simple questions and referring to only one segment of the information, such as an appropriate number, date, word, or part of a word. Since the CAFS-ISP has its own processing power, the search is conducted with only a minimum impact on system throughput.

Reliability of the Level 30 and Level 80 is greatly enhanced through the incorporation of a Node Support Computer, an independent computer, into the configurations. This computer instantly detects any problem that might occur and collects relevant fault data. After this diagnostic information has been ascertained, it is transferred to the Support and Maintenance software for evaluation and action, if necessary. Diagnostic information can also be transmitted across a telephone link to ICL.

On a physical basis, the Series 39 offers many advantages. Its compact design achieved through advanced chip tech-

▷ housed in a small, freestanding box and is connected to the peripheral via the peripheral's cable, and to OSLAN via an OSLAN drop cable and transceiver.

### SOFTWARE

**OPERATING SYSTEM:** The Series 39 runs under the recently released SV211 version of the VME (Virtual Machine Environment) operating system which offers facilities for the provision and control of a mixed-mode computing service to end users with varying needs. The SV211 version of VME offers a number of new features which complement the functionality and security of the Series 39. These features include a facility to allow serial, ordered, and direct serial files to be searched by CAFS-ISP for the first time; a new relational CAFS interface to link Cobol programs directly to CAFS-ISP; support for ISO Transport Layer 4 and full X.25 packet-switching facilities; file exchange between ICL and non-ICL mainframes; and improvements in the resilience of the ICL Transaction Processing Management System (TPMS) and the ICL Integrated Data Management Series (IDMS).

VME offers a number of methods of working that can be used in any combination:

- Multiple Access Computing (MAC);
- Transaction Processing Management (TPM);
- Local Batch; and
- Remote Job Entry (RJE).

MAC enables users to have immediate interactive access to the system via local or remote terminals. It includes HELP, screen editing, and program development facilities.

The VME Transaction Processing Management System (TPMS) provides direct connection between the terminal user and applications software. TPMS supports multiple applications within one service while VME will support multiple TP services if required. Data and message security and recovery features are available within TPMS. TPMS provides facilities to interface to ICL's IDMS database system, using high-level languages.

Batch facilities are controlled from an operator's local or remote workstations. Remote job entry provides a method of submitting batch work from a remote location and receiving output back if required.

The DME (Direct Machine Environment) operating system, which permits emulation of earlier ICL products such as the 1900 and System 4 machines, can run concurrently with VME under CME (Concurrent Machine Environment). CME is optionally available with the 2900 Series.

**LANGUAGES:** Algol, APL, Basic, Cobol, Fortran, Pascal, and RPG II compilers are available.

**Basic:** The Basic interpreter follows the informal standards set by Dartmouth Basic and by the National Computing Centre and incorporates a number of capabilities not included in earlier ICL versions of the language.

**Cobol:** This compiler follows the guidelines used in developing American National Standard (ANS) Cobol-74 and offers capabilities equal to the highest level of all ANS modules except Report Writer and Communications, which are not implemented. ReportMaster can be used for preparing reports, and the ACCEPT and DISPLAY verbs can be used to provide transaction processing facilities. ICL has added a number of extensions to the standard, including floating-point arithmetic, and has removed a number of restrictions.

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed Inches/Sec.	Transfer Rate, Bytes/Sec.
GTS-2 310	9	6250	GCR	50	310
	9	1600	PE	50	80
	9	800	NRZI	50	40
GTS-2 470	9	6250	GCR	75	470
	9	1600	PE	75	120
	9	800	NRZI	75	60
GTS-2 780	9	6250	GCR	125	780
	9	1600	PE	125	200
	9	800	NRZI	125	100
MTS 310	9	6250	GCR	125	312
	9	1600	PE	125	80
	9	800	NRZI	125	40
MTS 470	9	6250	GCR	125	470
	9	1600	PE	125	120
	9	800	NRZI	125	60
MTS 780	9	6250	GCR	125	781
	9	1600	PE	125	200
	9	800	NRZI	125	100
MTS 61	9	1600	PE	37.5	60
Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
LP 1440	1440 (48)	132	10	6 or 8	4-16.75x 8-14
	1200 (64)				
	829 (96)				
LP 2000	2000 (48)	132	10	6 or 8	—
	1640 (64)				
	1200 (96)				
	OCR quality	160	10	6 or 8	—
	1570 (48)				
	1300 (64)				
	900 (96)				
2000 (48)	160	10	6 or 8	—	
1500 (72)					
1090 (108)					
OCR quality	132	10	6 or 8	—	
1570 (48)					
1180 (72)					
840 (108)	132	10	6 or 8	—	
360 (48)					
300 (64)					
225 (96)	132	10	6 or 8	—	
720 (48)					
600 (64)					
800 Q	440 (96)				

Technology facilitates installation and reduces overhead. Level 30 can be installed in a normal office environment without special air-conditioning. Since rear access to the machine is not required, it can be set against a wall, thus reducing space requirements. The capability of cabling to be run along the skirting of a wall eliminates the necessity of constructing an expensive false floor.

Fortran: This compiler is based on American National Standard (ANS) Fortran, and includes, among its enhancements, facilities for handling direct-access files. ICL also offers an Optimizing Fortran Compiler (OFC) that produces more efficient code but requires longer compilation times.

Pascal: The Pascal compiler is fully compatible with ISO standards, and conforms to the Jensen and Wirth compiler.

## ICL Series 39

▷ A Level 80 must be located in a computer room but its compactness and controlled heat dissipation often allows it to be installed next to an existing system.

ICL has not neglected software for the Series 39. A broad range of specialized and cross-industry application packages can be run on the Series 39. Software development is simplified through the use of ICL's Data Dictionary System. ICL's future plans of supporting Unix will also broaden the spectrum of applications that will run on the Series 39.

A limitation posed by the Series 39 arises from the non-compatibility of Level 80 with IBM systems, its major competitor. Conversions from VME to IBM operating systems would be quite expensive. The Level 30, to compete effectively against Digital Equipment Corporation's VAX machines, also needs more scientific software than is presently available for it. □

▶ **DATABASE MANAGEMENT:** ICL offers an integrated set of products constructed around the Data Dictionary System (DDS), which is a complete system for the documentation of all aspects of applications development.

**IDMS (Integrated Database Management System):** IDMS is a Codasyl implementation. An enhanced version, IDMSX, is available for high-throughput systems that require advanced recovery facilities.

**ReportMaster:** This system assists in the generation of reports and extraction of information from files.

**QueryMaster:** An online enquiry facility, QueryMaster can utilize the power of CAFS-ISP to speed up inquiries.

**PDS (Personal Data System):** PDS enables non-DP personnel to maintain their own data files. It includes data manipulation and enquiry facilities. Both PDS and QueryMaster use the same language, which gives a relational view of the data.

**RCI (Relational CAFS Interface):** RCI offers Cobol programs a relational interface to IDMS data and other files. CAFS-ISP is used to provide fast access.

**APPLICATIONS PROGRAMS:** ICL offers a variety of packages under VME for many areas, including accounting, business, central and local government, information processing, manufacturing industries, and management sciences. Brief descriptions of some of the programs follow:

- **BACSTER (Bankers Automated Clearing Services Transfer Exchange Routines):** A system of accounting, payroll, and personnel;
- **BUDGET 29:** Budgeting program which gives management and variance accounts, and includes individual company and account structures;
- **FINAPL:** A financial modeling package under APL;
- **PROSPER STAR:** A table-based financial modeling package;
- **DILIS:** Direct labor management package for local government;
- **HMIS:** Housing management system for local government housing, which includes management of rentals and repairs;

- **LAFIS:** Financial package including ledgers, analysis, budgeting, and statistical functions;
- **PLANAPS:** Planning Application System which generates minutes, reports, and letters;
- **SOCISIS:** Online Social Services System which holds records and offers assessment features;
- **UHBS:** Unified Housing Benefit System which automates handling of the U.K. Housing Benefits legislation;
- **BULLETIN:** ICL's private viewdata system which provides a window facility;
- **COMMITTEE MINUTES:** Storage and retrieval of meeting minutes and reports;
- **EXECUTIVE ACTION:** An office system that includes electronic filing, diary, mail, and telephone directory facilities;
- **STATUS:** A system for storing large files of text and retrieving selective information from these files;
- **OMAC 29:** A group of packages for online manufacturing which includes database, materials requirement, and multiple site/stock planning systems;
- **PLANNED MAINTENANCE:** Repair and maintenance scheduling system;
- **ICL ADVISER:** A program that offers specialized techniques for understanding regulations or procedures, including those requiring links to TP systems and databases;
- **PACKAGE X:** A system for the analysis and management of numerical data;
- **PERT:** A management system for the planning and control of projects;
- **REVEAL:** An advanced planning, forecasting, and analysis system for managers and professionals;
- **Application Master:** A fourth-generation system generator for online database systems;
- **Quickbuild:** A fast application development system for departmental applications;
- **ProgramMaster:** An integrated package for Cobol program development;
- **STRUCTURES:** An engineering package that performs analyses of skeletal structures for member and restraint reaction, forces and moments, as well as joint, linear, and rotational displacements; and
- **GINO:** A suite of programs containing routines which produce graphics charts and 2-D and 3-D drawings.

A wide range of third-party software is also available, covering applications for accounting, banks, central and local government, information processing, management sciences, manufacturing industries, and retail and distribution.

Packages are also supplied by ICL and third parties to run under the DME operating system.

In addition, the Concurrent Machine Environment (CME) operating system will be available as an option sometime in 1986. ICL also plans to provide the Unix operating system as well. ▶

## ICL Series 39

### ► PRICING

Series 39 systems can be purchased outright on a onetime payment or on a 3-year quarterly hire basis. Maintenance is separately charged on a quarterly basis. Software is subject to a license fee, normally charged on a quarterly basis. The charging of software fees is flexible, and several methods are available to licensees.

**TRAINING AND SUPPORT:** On-site Equipment Service, formulated around the concept of a teleservice, is available up to 24 hours a day, 7 days a week. ICL offers training services that accommodate over 40,000 people each year. The firm conducts approximately 120 regularly scheduled courses at training centers. Self-study training packages and customized training courses on customers' sites are also available.

## EQUIPMENT PRICES

	Selling Price (\$)	3-Year Quarterly Hire (\$)	Quarterly Equipment Service (£)
<b>ICL Series 39, Level 30, Single node</b>			
Package 1, 600MB	193,930	16,623	1,706.40
Package 2, 3100MB	294,610	25,251	2,397.30
Package 3, 600MB	255,430	21,894	1,920.30
<b>ICL Series 39, Level 30, Dual node</b>			
Package 1, 600MB	433,940	37,194	3,407.70
Package 2, 600MB	534,620	45,825	4,098.60
<i>Basic systems software for Series 39 Level 30 including VME, Run Time IDMS(X), TPMS, Cobol, and Fortran £2.727/quarter.</i>			
<b>ICL Series 39, Level 80, Single node</b>			
Package 1, 600MB	1,489,670	127,686	7,875.00
Package 2, 3100MB	1,590,790	136,353	8,565.90
<b>ICL Series 39, Level 80, Two nodes</b>			
Package 1, 3100MB	3,184,390	272,949	16,825.50
<i>Basic systems software for Series 39, Level 80 including VME, Run Time IDMS(X), TPMS, Cobol, and Fortran £23.562/quarter. ■</i>			