

ICL ME29 Series

MANAGEMENT SUMMARY

The ME29 Series is a family of medium-sized workstation-oriented systems designed for a variety of business and commercial applications. Installations can be flexibly configured to support not only general-purpose data processing workloads, but also the more rigorous demands of users requiring extensive storage, data base, and distributed processing facilities.

Announced by ICL on March 20, 1980, as an intended replacement for the 2903, 2904, and 2905 systems, the ME29 is upward-compatible with the 290X models and is competitive with the IBM System 38 and IBM 4300 Series.

ME29 memory capacity ranges from 384 kilobytes to 2 megabytes, while the disk storage capacity spans from 70 to 16,000 megabytes. Users needing even more capacity can install multiple ME29 systems.

Since the announcement of the ME29 Series, ICL has repackaged and expanded the product family, which now consists of four models: Model 29, Model 37, Model 45 and Model 54.

Compatible with ICL's 290X Series, the ME29 family supports batch processing, remote job entry, time-sharing, and transaction processing. In addition, the ME29 provides extensive communications network facilities. Distributed processing capabilities include remote job entry, remote session access (permitting the operator of any interactive terminal connected to one mainframe to access, on a per-session basis, a service provided to another remote host), message distribution, application distribution, and file transfers. Any ME29 can be accessed from any local terminal, provided the users have proper authorization. Languages available include RPG 2, Cobol, Algol, Basic, ➤

A medium-scale range of computers in ICL's networked product line, the ME29 consists of four compatible models. The series is competitive with IBM System 36, System 38 and IBM 4300 Series.

PRICE: From approximately £39,000 for a small system to over £200,000 for a large configuration.

MAIN MEMORY: 384KB-2MB.

DISK CAPACITY: Up to 16,000MB.

WORKSTATIONS: Up to 56 local, variable numbers of remote (dependent on coupler constraints).

PRINTERS: 120 cps to 1130 lpm.

OTHER I/O: Floppy disks, magnetic tape reel-to-reel, streaming cartridge tape, retained 1900 Series paper tape equipment and card reader.

CHARACTERISTICS

MANUFACTURER: International Computers Ltd., ICL House, Putney, London, SW15 1SW, England, Telephone 01 788 7272. Telex 22971.

MODELS: ME29/29, ME29/37, ME29/45, ME29/54.

DATE ANNOUNCED: ME29/35 (now withdrawn) and ME29/45, March 1980; ME29/37, mid-1981; ME29/29 and ME29/54, May 1982.

DATE OF FIRST DELIVERY: ME29/35 and ME29/45, August 1981; ME29/37, January 1982, ME29/29, October 1982; ME29/54, July 1983.

DATA FORMATS

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



The ME29 range of medium-scale workstation-oriented systems offers extensive communications facilities. On the left is the processor cabinet which contains the central processor and either one or two floppy disk drives. A multi-purpose workstation is on the control desk, which also houses two 35MB fixed disk drives. On the right is a 600 lpm line printer.

ICL ME29 Series

▷ and Fortran, and the available system software includes full versions and subsets of ICL's data base management system and data dictionary system. An optional Personal Data System allows non-technical personnel to define, load, and use a personal data base. ICL also offers a variety of application packages.

CONFIGURATIONS

A basic ME29/29 includes 384 kilobytes of memory; two integrated floppy disk drives; 128 kilobytes of microcode store; 70 megabytes of fixed disk storage; a 2,000-character VDU workstation (for transaction processing, time-sharing, direct data entry, system control, and remote access to other mainframes); and one matrix or band printer.

Memory can be expanded in 128K or 256K increments to a maximum of 1,024 kilobytes. A total of 16 workstations can be supported over local AMLCC (Asynchronous Multi-line Communications Coupler) lines.

The three larger models in the series, Models 37, 45 and 54, all offer the same increased possibilities in terms of configurations, the difference between models concerning only processing power. Maximum hardware complements, with the total configuration subject to coupler constraints, include up to two megabytes memory, 16,000 megabytes of disk storage, two streaming cartridge tape drives, four magnetic tape clusters, 56 local workstations or printers supported over AMLCC lines, four 1900 retained peripherals, two X.25/HDLC couplers for packet-switching networks and two ASA(SNA)/3270 couplers for communications with other mainframes.

COMPATIBILITY

An important element of the ME29 computers is their microprogrammed compatibility, which permits them to run in the 24-bit mode of the older 1900 and 290X (2903-2905) Series. Thus, the ME29 allows both 1900 and 290X users to move directly to an ME29, to take immediate advantage of the more modern hardware, and to run in 24-bit mode while they modify their software to meet ICL's "forward compatibility standards."

ICL's commitment to a networked product line includes compatibility between the ME29 Series and the DM/1 systems scheduled for introduction in 1984. ME29 and DM/1 will be able to be linked in networks, running programs under either the TME or VME 2900 operating systems.

TME (Transaction Machine Environment) is an operating system that provides compatibility with Exec 3S and offers new capabilities. Programs written to run under Exec 3S can run under TME using the same job control instructions, even though TME has a new job control language. TME provides a new transaction processing system, but supports programs written for 290X Multiple Transaction System applications.

▶ **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 an 8-bit signed exponent; floating-point arithmetic is performed by executive subroutines ("extracode") or directly by microcode.

INSTRUCTIONS: One word. Instruction formats are as follows:

	Operation Code	Address	Accumulator	Accumulator used as index register
Memory reference instruction	7 bits	12 bits	3 bits	2 bits
Branch instruction	6 bits	15 bits	3 bits	—

INTERNAL STORAGE: 6-bit extended BCD.

MAIN STORAGE

TYPE: MOS.

CYCLE TIME: 650 nanoseconds per 24-bit-word read, 750 nanoseconds write.

CAPACITY: ME29/29, 384KB to 1MB; ME29/37, ME29/45, ME29/54, 512KB to 2MB; 128KB to 256KB increments.

CHECKING: Two parity bits per word are standard. The processor halts upon detection of a parity error in an area of storage 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.

STORAGE PROTECTION: None. However, since each program's addresses are relative to the contents of its own data 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 in 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.

PROCESSORS

GENERAL: The ME29 uses a microprogrammed Order Code Processor (OCP) which is sufficiently fast not to need pipelining techniques to overlap instruction execution. Processing speeds are in excess of three million instructions per second, and internal data transfers are performed at a rate of 320 million bits per second. Peripheral transfers can take place at a maximum of 34 million bits per second. The resultant target order code is processed at between 110 and 360 KIPS depending on the model.

▶ A diagnostic board provides a link between the processor control panel and the ME29 processor logic. The diagnostic ▶

ICL ME29 Series

Table 1 PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION
MULTI-PURPOSE LOCAL WORKSTATION 3572 & 3573	2,000-character screen, 80 columns x 25 rows; various character sets are available; 9 x 7 dot matrix; 9600 bps. Detached keyboard connected to VDU by two meter cables. Alphanumeric keys, numeric keypad and software controlled function keys. Model 3572 is an earlier model and may not be connected by an Extended Local Terminal Controller.
VARIOUS REMOTE WORKSTATIONS	The most common remotely-connected intelligent workstations are the ICL 7181, 7500, and DRS ranges of terminals. DRS 20 Models 16, 30, 40 and 50 may be connected to the ME29 via the Synchronous Multiline Communications Coupler. They can act as either a cluster of remote VDUs and printers, a bulk data terminal using ICL Range RJE standards to transfer data, or a bulk data terminal using 2780 protocols.
PRINTERS	
3541	Matrix printer for interactive printing; 80 print positions, 120 cps bi-directionally, 96 characters, multi-national character sets available; 72 lpm with full 80 character line, 180 lpm with 20 character line; 10 characters/inch; 6 lines per inch.
3543	Matrix printer for interactive printing; 132 print positions, 120 cps bi-directionally; 96 characters print, multi-national character sets available 45 lpm with full 132 character line, 72 lpm with 80 character line; 10 characters/inch; 6 lines per inch.
3542	Matrix printer for bulk system printing; 132 print positions, 180 cps bi-directionally; standard 96-character set; 75 lpm with full 132 character line, 300 lpm with 20 character line; 10 characters/inch; 6 or 8 lines per inch.
PBS 360	Band printer for bulk system printing; 132 print positions, 300 lpm with a 64-character set; 48 and 96 character sets available.
PBS 720	Band printer for bulk system printing; 132 print positions, 600 lpm with a 64-character set; 48 and 96 character sets available.
PBS 1130	Band printer for bulk system printing; 132 print positions, 1130, 900 or 660 lpm; 48, 64 and 96 character sets available.
1900 SERIES RETAINED PERIPHERALS	
PRINTER, 2430	High speed train printer, 132 or 160 character positions, 64 EBCDIC characters, 1500 lpm or 1100 lpm with 96 ASCII characters.
CARD READER, 2104	80 column cards, 600 cpm; hopper and stacker hold 1,000 cards.
PAPER TAPE READERS, 1915/1916	300/1000 cps.
PAPER TAPE PUNCH, 1925	110 cps.
CUSTOMIZED PERIPHERALS	A variety of special hardware connections have been provided for ME29 users, the most common being the connection of teletype compatible devices to the Synchronous Multiline Communications Coupler.

ICL ME29 Series

➤ In addition to batch, multi-access computing (time-sharing), and transaction processing, TME supports Wordskill Manager, an electronic mail system, X.25 packet-switched networks and private viewdata systems which use modified black-and-white or color TV sets as terminals.

Only a small part of TME is resident. The rest of the control software is divided into 1K leaves (pages) that are fetched when needed. Compilers, utilities, and user programs are not paged. The concept, which ICL calls the "Leaf Addressing Mode," offers many of the characteristics of virtual memory without the need for expensive hardware facilities.

User-friendly features simplify system operation. Menus allow a user to select a job from a displayed list, to enter parameters, and to run the job. Users needing more help can call up the User Guide. The Personal Data System, which runs under the transaction processing system, allows a user to build a personal data base and to retrieve data from it in tabular form.

COMMUNICATIONS

ME29 models can support the attachment of multi-line synchronous links for communications with an ICL or IBM mainframe or with another ME29 system. ICL 7500 and DRS 20 ranges of intelligent terminal systems can be concurrently supported for bulk data transfers. Protocols available include ICL full XBM for communicating with a larger ICL system, and IBM 3780 or HASP emulation for communicating with an IBM mainframe. Facilities are also provided which enable access to X.25 and SNA networks. Interactive terminals are supported on multiple lines using ICL full XBM procedures.

The ME29 competes with systems such as the IBM Systems 36, 38 and 4300 Series, as well as with Sperry's, System 80 and Honeywell's DPS4.

ADVANTAGES AND RESTRICTIONS: The four models in the ME29 Series offer both hardware and software compatibility. The system can be expanded to support up to 56 workstations and a number of viewdata terminals. There is peripheral compatibility between the ME29 and the ICL 2900 Range, thus making it cheaper for a user to migrate from the ME29 to the more powerful 2900 if necessary. A wide range of applications software packages for business problems are available with the ME29.

The ME29 range is, to some extent, an anomaly in the current ICL picture, since machines from other ICL ranges can be chosen in place of virtually all the ME29 models. In particular, the DRS 20 and System 25 ranges overlap models up to the 29/45. The 2956 and 2957 also overlap the 29/45 and 29/54.

USER REACTION

The 1982 Datapro survey of British computer users brought responses from 38 ICL ME29 series users. A total of 43 systems were represented, and the average number of months that the systems had been installed was 21.7. User ➤

➤ board is a self-contained unit with its own microprocessor and is programmed to detect and locate hardware faults and to communicate the results to the operator on the processor control panel.

The ME29 processor is microcoded to access main memory and peripherals via a highway converter board. The highway converter translates the ECL (Emitter Coupled Logic) signals into TTL (Transistor-Transistor Logic) levels. On the Model 45 a further circuit board (Model 45 power boost) is added to drive the calculation and control units. This power boost automatically selects the microcode routine which performs the instructions and presents the results back to the program. On the smaller ME29 machines, Models 29 and 37, the selection of microcode routines is performed by microprogram, so the power boost on the Model 45 enables the processing rate of ME29 order code to be increased considerably. On the Model 54 a further increase in performance is obtained by additional ECL logic and a bit-slice microprocessor (model 54 power boost) which can execute target machine instructions at high speed, overlapped with other OCP operations.

The processor performance of Models 37, 45, and 54, relative to the entry level Model 29, is 1.2, 1.8 and 3.3 times, respectively.

CONTROL STORAGE: Each of the four models has 128 KB of control store. The cycle time is normally 155 ns, but is effectively reduced to 93 ns when prefetching.

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

ADDRESSING: Like the 2903 Series computers, the ME29 systems 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 ME29 Series uses an extension of the standard 290X instruction set which has 111 instructions, including 85 fixed-point arithmetic, branching, shifting, logical, and code conversion (between decimal and binary) instructions; 11 input/output instructions; four control instructions; and eight floating-point arithmetic instructions which invoke "extracode" when the microcode option is not present.

PHYSICAL SPECIFICATIONS: The ME29 in its basic form consists of a single integrated unit designed to operate in a normal office environment. This consists of a logic and control cabinet, a table unit, and a visual display unit. The CPU is 59.1 inches high, 25.6 inches wide, and 30.8 inches deep and weighs 116 pounds. Power requirements are either 50 Hz—198V to 268V—or 60 Hz—104V to 127V. The operating temperature range is 10 to 35 degrees C., with a non-condensing relative humidity of 20 to 80 percent.

The cabinet contains the Order Code Processor (OCP), its associated microcode or control store, and the main memory, together with the data buses and couplers which effect communication between the various system components, diagnostic and self-test aids, sequence controller, and power supply. One or two floppy disk drives are also incorporated, each supporting up to one megabyte of storage capacity. ➤

ICL ME29 Series

➤ responses are shown below as a Weighted Average, based on a scale of 4.0 for Excellent, 3.0 for Good, 2.0 Fair, and 1.0 Poor.

System Ratings (4.0-1.0)

Ease of operation	3.18
Reliability of Mainframe	3.37
Reliability of Peripherals	3.00
Maintenance service:	
Responsiveness	2.68
Effectiveness	2.63
Technical support:	
Trouble-shooting	2.21
Education	2.58
Documentation	2.43
Manufacturer's Software:	
Operating system	2.95
Compilers & Assemblers	2.95
Applications Programs	2.65
Ease of programming	2.81
Ease of conversion	3.11
Overall satisfaction	3.05
Did the system do what you expected it to do? (%)	
Yes	86.84
No	5.26
Haven't decided	7.89
Would you recommend system to another user? (%)	
Yes	92.11
No	5.26
Haven't decided	2.63 □

➤ The table unit provides housing for communications connections. The top can be used as a working surface to support a multi-purpose workstation.

Provision is made in the basic unit to support a range of peripheral devices including disks, magnetic tapes, and line printers.

The standard ME29 workstation includes a 2,000-character display that can be adjusted for the operator's comfort, and a cable-connected typewriter keyboard with separate numeric pad and control keys. The visual display unit is 15.75 inches high, 14.25 inches wide, and 15.50 inches deep and weighs 40 pounds. The keyboard is 20.8 inches wide, 7.5 inches deep, and weighs six pounds.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The main input/output bus ("X2 highway") is the connection point for all peripheral devices and subsystems. Each peripheral type has an associated micro-program-controlled coupler for handling communications, allowing data and control information to be sent to or from the device or line via the bus.

The following devices can be supported by the I/O bus: printer couplers, a floppy disk coupler, hard disk couplers, magnetic tape couplers, 1900 Standard Interface couplers for the connection of retained 1900 equipment. Asynchronous Multiline Communications Couplers (AMLCC), Synchronous Multiline Communications Couplers (SMLCC), X.25/HDLC couplers, and ASA(SNA)/3270 couplers.

An AMLCC supports up to eight local channels for the connection of VDU workstations and low-speed printers.

Each channel can support a single device or up to five multidropped devices via an Extended Local Terminal Controller. An SMLCC can support up to eight local or remote communications lines for the connection of a wide variety of peripherals.

CONFIGURATION RULES

Models 29, 37, 45 and 54 employ the same structure, and differ in only processor speed and the ability to support peripherals.

The processor cabinet has a limited space for fitting store modules and couplers. This places restrictions on the number of peripherals which can be configured on a system. Models 37, 45 and 54 can be supplied with an extension cabinet which houses further couplers. Store modules may not be housed in the extension cabinet.

Each cabinet can house a Universal Fixed and Exchangeable Disk Store coupler (UFEDS) which connects a maximum of 16 drives, and two of the following:

- Interface board for a chain of up to eight fixed disk drives;
- Interface board for a chain of up to eight EDS60 exchangeable disk drives;
- Module 10 disk coupler (connects two drives);
- 3551 magnetic tape coupler (connects one cluster comprising a master and a maximum three slaves).

Additionally, there is provision for 11 of the following modules and couplers in the basic cabinet, or a total of 20 if an extension cabinet is configured:

- store module (128KB/256KB);
- Asynchronous Multiline Communications Coupler, AMLCC (connects locally maximum 40 VDUs/low speed printers);
- Synchronous Multiline Communications Coupler, SMLCC (maximum eight local/remote lines for various peripherals);
- floppy disk coupler (connects up to two drives);
- PBS printer coupler (connects one line printer);
- cartridge tape coupler (connects up to two cartridge streaming tape drives);
- 1900 Standard Interface coupler (connects retained 1900 peripherals, either one device or a cluster);
- X.25/HDLC coupler (provides one X25 line); and
- ASA(SNA)/3270 coupler (provides two lines).

ME29/29: This is the smallest model in the ME29 Series and is designed to be used in one of four modes:

Network Mode—allows a user with limited needs to access other machines in the network;

Data Capture System—data can be entered into the Model 29 directly, immediately checked, and then sent to a larger computer for further processing;

Local TP System—intended to provide transaction processing facilities at both local and remote terminals;

ICL ME29 Series

- **General Purpose System**—for a user who requires a combination of the above modes.

The minimum Model 29 configuration comprises:

ME29 processor, cabinet and desk; 384KB main memory; 128KB control storage; two floppy disk drives; two Module 10 disk drives; one printer; two workstations and one Asynchronous Multiline Communications Coupler.

The Model 29 can support the following maximum configuration, subject to coupler constraints: ME29 processor, cabinet and desk; 1MB main memory; two floppy disk drives; two Module 10 disk drives; one 3551 magnetic tape cluster; two cartridge tape streaming drives; one line printer or four matrix printers; 16 workstations; two Asynchronous Multiline Communications Couplers (multi-dropping via Extended Local Terminal Controller is not possible on Model 29); one Synchronous Multiline Communications Coupler; two X.25/HDLC couplers; and two ASA(SNA)/3270 couplers.

The three larger models in the ME29 Series (ME29/37, ME29/45 and ME29/54) all offer the following minimum configuration, the difference between models concerning only processing power: ME29 processor, cabinet and desk; 512KB main memory; 128KB control storage; one floppy disk drive; two disk drives of type Module 20 or larger, at least one of which is exchangeable; one printer; two workstations; and one Asynchronous Multiline Communications Coupler.

Models 37, 45 and 54 can support the following maximum hardware complements, subject to coupler constraints (that is, not all of the following may be configured simultaneously):

- ME29 processor, cabinet and desk;
- Extension cabinet;
- 2MB main memory;
- 128KB control storage;
- two floppy disk drives;
- 32 larger disk drives, Module 20 or larger;
- two Module 10 disk drives if retained from Model 29 or (now withdrawn) Model 35;
- four 3551 magnetic tape clusters;
- two streaming cartridge tape drives;
- three line printers;
- four 1900 retained peripherals;
- 56 local workstations
- a total of five Asynchronous Multiline Communications Couplers and Synchronous Multiline Communications Couplers, but not more than three of each;
- one Extended Local Terminal Controller for enabling multi-dropping from one Asynchronous Multiline Coupler;
- two X.25/HDLC couplers; and
- two ASA(SNA)/3270 couplers.

MASS STORAGE

FIXED DISK STORAGE

MODULE 10: A 35MB disk unit that contains three disks, recording data on five surfaces with 570 tracks per surface. Average access time, including rotational delay, is 51 milliseconds, and the peak data transfer rate is 920KB/second.

MODULE 40: A fixed disk store with a capacity of 120MB. It has two recording heads per surface. There are four disks per unit, with five available data recording surfaces. Average access time, including rotational delay, is 39 milliseconds, and the peak data transfer rate is 1.2MB/second.

MODULE 120: Provides 500MB of fixed disk storage. Containing 12 disks, the Module 120 records on 20 surfaces. Average access time, including rotational delay, is 34 milliseconds and the peak data transfer rate is 1.2MB/second.

FIXED/EXCHANGEABLE DISK STORAGE

MODULE 20/40: A 180MB fixed/exchangeable disk unit combining a Module 20 disk pack drive and a Module 40 fixed disk drive in a common cabinet.

EXCHANGEABLE DISK STORAGE

MODULE 20: A 60MB exchangeable disk store. Data is recorded on 803 tracks on each of five surfaces. Average access time, including rotational delay, is 39 milliseconds, and the peak data transfer rate is 1.2MB/second.

EDS60: A 60MB exchangeable disk unit retained from the 2900 Series which may be attached to the ME29. The EDS60 disk drive contains 11 disks, recording on 406 addressable tracks. It has an average access time of 48 milliseconds, including rotational delay, and a peak data transfer rate of 416KB/second.

FLOPPY DISK STORAGE

Single-sided, 256KB and double-sided, 7MB floppy disks are supported on the ME29. Average access time is 179 milliseconds and peak data transfer rates are 32 and 64KB/second, respectively. 256KB floppy disks may be used for data interchange with ICL 7500 terminal systems. In addition, floppy disks pre-formatted to IBM specification GA21-9388-0 can also be supported.

MAGNETIC TAPE STORAGE

Two types of magnetic tape system are available on the ME29: 9-track standard 1/2" tape and 1/4" cartridge streaming tape. Nine-track tape is used for data archiving and security, and may be accessed by user batch programs. Cartridge streaming tape is dedicated to system archiving and security and is used exclusively by the operating system. Cartridge tape may not be addressed by user programs.

TYPE 3551 or 6522: A 9-track 1/2" magnetic tape system consisting of a master tape and up to three slaves. Data may be recorded in either Phase Encoded or NRZI formats, with data transfer rates of 60 and 30KB/second, respectively. Tape speed is 37.5 ips.

TYPE 2510/2511: A 9-track magnetic tape system retained from the 1900 Series, comprising one master tape and up to three slaves. Data may be recorded in either Phase Encoded or NRZI formats, with data transfer rates of 80 and 40KB/second, respectively. Tape speed is 37.5 ips and density is 1600 bpi (Phase Encoded) or 800 bpi (NRZI). ►

ICL ME29 Series

► **CARTRIDGE STREAMING TAPE:** The ¼" cartridge streaming tape available on ME29 systems has a maximum capacity of 20MB. Using "Serpentine" Phase Encoded format, an average data transfer rate of 95KB/second is achieved.

INPUT/OUTPUT UNITS

See Table 1 Peripherals/Terminals.

COMMUNICATIONS CONTROL

The ME29 provides extensive communications network facilities. Distributed processing capabilities include remote job entry, remote session access, message distribution, applications distribution, and file transfers. Any ME29 function can be accessed from any local terminal provided the user has proper authorization. An ME29 system can act as a host computer for small processors and terminals, or as a satellite to a larger mainframe.

Various communications line couplers can be used;

The Asynchronous Multiple-Line Communications Coupler (AMLCC) provides eight local asynchronous connections, each of which can be used to support one workstation or matrix printer directly, or five with multi-dropping using the Extended Local Terminal Controller. Up to three AMLCCs may be configured.

The Synchronous Multiple-Line Communications Coupler (SMLCC) provides connections for eight local or remote synchronous communications lines. Three SMLCC couplers may be configured. An SMLCC port may be connected to a Bulletin Link Unit (BLU), each BLU supporting up to eight Bulletin terminals which offer viewdata capabilities.

The X.25/HDLC coupler, when attached to an SMLCC channel, enables connection to a Public Packet Switched network using X.25 protocol. Remote Session Access, Distributed Transaction Services and File Transfer Facility (see Software section) are supported by this coupler. ICL's Information Processing Architecture, which provides facilities for communication with other ICL computers, uses full XBM protocol which may be carried either over a normal telephone line (switched or private wire) or over packet switched systems such as British Telecom's PSS or the French TRANSPAC using X.25 procedures.

The ASA(SNA)/3270 coupler enables connection to IBM-compatible mainframes using IBM SNA protocols. The ICL Associated Systems Architecture (Systems Network Architecture) coupler provides the interfacing so that the ME29 can emulate an IBM 3270 Information Display Station.

PROTOCOLS: A number of protocols are supported, including X.25, 3270, HDLC and Basic Mode (7181). Also available are 3780 protocol which enables ME29 to exchange data with a variety of non-ICL systems, and HASP protocol, which enables an ME29 to emulate a HASP multi-leaving workstation.

DIRECT DATA ENTRY KEYSTATIONS: The ME29 Direct Data Entry System (DDE) is a flexible key-to-disk data capture system available via the ME29 Multipurpose Workstation. Any 12 of the ME29 workstations can be used for direct data entry at any one time; in addition, the workstations can be used for making inquiries or for running jobs.

The DDE units are connected locally to the system at distances up to 300 meters. The workstation display format

consists of seven lines of 32 characters each, plus an eighth line of 30 characters for 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. Messages are available in English, French, or German.

SOFTWARE

OPERATING SYSTEM: ME29 runs under the TME (Transaction Machine Environment) operating system, which is compatible with Exec 3S of the 290X Series but offers additional facilities. Programs written to run under Exec 3S can be run under TME using the same job control language, even though TME has a new job control language.

TME offers workstation users batch and distributed processing facilities, multi-access computing (time-sharing) and user-friendly features such as menus, user guides, and a HELP facility to simplify system operation. The Personal Data System, which runs under the transaction processing system, allows a user to build a personal data base and to retrieve data from it in tabular form.

TME is offered in four variants: TME 10, which runs on the Model 29, TME 30, which runs on Model 37, TME 40 for Model 45 and TME 50 for Model 54.

The TME 10 operating system is based on the Module 10 disk system and does not support larger disk systems. TME 10 supports all basic CPU and I/O functions, ME29 Order Code, two batch streams, TME Transaction Processing System, TME Control Language, system filestore, output spooling to printer or screen, 384KB to 1MB of main memory, one or two floppy disk drives, one line printer, and 16 local workstations.

The TME 30 operating system is similar to TME 10 but supports the larger disk systems via the Universal Fixed and Exchangeable Disk couplers. Facilities additional to or different from TME 10 include support for: five batch streams, up to 2MB main memory, two couplers for up to 32 Module 20, 40, 120, or EDS60 disk drives, and 56 local workstations.

The TME 40 operating system offers similar facilities to TME 30 but with additional firmware to support the Model 45 "power boost."

The TME 50 operating system offers the same facilities as TME 30 and TME 40, but has additional firmware to support the Model 54 "power boost."

A number of System Options are available to extend the basic facilities of TME. They are sub-divided into two main areas; *Peripheral Support Options* and *Service Options*.

Peripheral Support Options: The 3551 Magnetic Tape Support option provides TME support for the ICL Type 3551 or 6522 Magnetic Tape Controller, which may have one to four transports connected. This option is available on all TME Operating System variants.

Optionally available on the TME 30, TME 40 and TME 50 Operating System is support for 1900 SI 1933 and 2430 line printers, 1900 SI 2104 card readers, and 1900 SI 2510/2511 magnetic tape units. In addition, support is optionally available for the 1915, 1916, and 1925 paper tape reader and paper tape punch equipment. ►

ICL ME29 Series

► Additional PBS 360, 730, and 1130 printers (up to two) can also be supported by the TME 30, TME 40 and TME 50 Operating Systems, as can up to a total of 16 matrix printers.

Service Options: A fast floating-point option is available for all four of the TME Operating Systems. The floating-point instructions are performed within microcode instead of by the use of coding in the Executive, which is functionally slower.

Support of up to four local workstations operating under the Direct Data Entry Service is optionally available for all the TME Operating Systems.

Language variants for the DDE software are available in English, French, and German.

Options exist for an additional eight DDE keystations.

LANGUAGES: To enable the user to develop application programs, compilers for the following standard languages are available with ME29; Cobol, RPG2, Fortran, Basic, Algol and PLAN.

COBOL: Two types of Cobol compilers are offered for ICL ME29 systems: the 2903/1900 compiler and an ICL Range Standard Cobol compiler. Source conversion to Range Cobol proceeds through a conversion utility. Available Cobol options are a Cobol preprocessor, a data name cross reference, a Cobol library routine and a Cobol disk sort. The new Range Cobol provides for portability from DME (24-bit mode) to VME (32-bit mode) systems. It is largely compatible with the C2 compilers used for VME systems.

RPG2: ICL's RPG2 language, which is largely compatible with IBM's RPG II, can be used to program the remote use of VDUs and is also compatible with 1900 Series RPG. RPG2 diagnostics are available in English, French, or German.

PLAN: This is a low-level language which is available on ICL 1900 and 2903 Series computers and offers continuity to users of those machines who have installed an ME29.

DATA BASE MANAGEMENT: ICL's ME29 offers a comprehensive range of data management facilities supporting the creation, processing, and administration of sophisticated data bases.

IDMS: The ME29 supports Cullinane's Integrated Database Management System (IDMS). In addition to IDMS, the ME29 also supports a simplified data base system, TME-RAPID. This is based on IDMS and is designed for entry-level users wishing to gain experience in data base techniques.

DDS: The ICL Data Dictionary System (DDS) is used as an aid in the design, documentation, implementation, and maintenance of data processing systems. At the system design stage, it is used to ensure that the system design actually models the required real-world functions. At any stage in the development of a system, DDS is used to produce consistent, high-quality documentation for use both by those controlling and monitoring the system and for creating data definitions for input to Cobol and IDMS systems.

PDS: The ICL Personal Data System (PDS) is an easy-to-use data storage and retrieval system, designed for use by non-DP professionals operating from workstations. Such a person, without any DP training, will be able to define, load, and use a personal data base. The PDS facilities include:

- Ability to define/remove/display table formats.
- Ability to add, change, and delete table data.
- Ability to list table data or specific columns of data from a table.
- Ability to join tables together.
- Ability to select data using comparison operators, including the functions MAX, MIN, TOTAL, and COUNT, which operate on table columns.
- Natural-language dialogue with friendly error messages.
- A HELP facility.
- Ability to switch on/off varying levels of diagnostic aids.
- Use of user-defined macros.
- Dump and recovery mechanisms.
- Simple prompts from PDS to the user.

COMMUNICATIONS SOFTWARE: The ME29 Series provides extensive communications network facilities. Distributed processing capabilities include remote job entry, remote session access, message distribution, application distribution, and file transfers. In addition, any ME29 function can be accessed from any local terminal provided the user has proper authorization. ICL also offers communications between ME29 systems and IBM 360/370 host systems or IBM System/3's using the IBM 2780 RJE protocol or HASP multileaving procedures. Also available as an option is the ability to emulate an IBM 3270 interactive terminal.

REMOTE SESSION ACCESS (RSA): RSA permits the operator of any interactive terminal connected to one mainframe to access, on a per-session basis, a service provided in another remote mainframe (host) via a full Extended Basic Mode (XBM) communications link. The local ME29 system becomes transparent during the session.

DISTRIBUTED MESSAGE ROUTER (DMR): DMR handles message distribution. When the DMR detects that a user request cannot be processed locally, it automatically sends the message to the correct remote system and then relays the response back to the user.

DISTRIBUTED APPLICATION FACILITY (DAF): DAF allows an application program running in the local system to get data or processing help from a remote system.

FILE TRANSFER FACILITY (FTF): FTF, in conjunction with the DAF, can transfer entire files from one system to another.

VIEWDATA: ICL's private viewdata system, Bulletin, is implemented on television-type terminals which are connected to an ME29 through public or private telephone lines and an SMLCC port. A maximum of 192 terminals can be linked to each computer at one time. Bulletin operates concurrently with other applications. It displays both text and graphics in up to seven colors and is menu-oriented.

UTILITIES: Available utilities include disk 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. ►

ICL ME29 Series

- **APPLICATIONS SOFTWARE:** ICL offers users a number of packages, dealing with such specific applications areas as finance, statistical analysis and project control, manufacturing and stock control, and electronic mail.

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

PROSPER-E and PROSPER—Both of these systems are used for financial modeling, in applications such as cash flow forecasting, project selection, breakeven analysis, costing analysis, etc.

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

BACSTER (UK only)—Provides an interface for input into the BACS system. BACSTER 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 the Bankers Automated Clearing Services (BACS).

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

PACKAGE X—A system for the management and analysis of data, providing summary statistics (maximum and minimum values, means, standard deviation, number of missing values), tabulation, regression analysis, and significance tests. Output can be printed, and can include scatter diagrams and plots.

Manufacturing Packages: OMAC—An on-line manufacturing control system that aids in the planning and controlling of production levels in manufacturing industries. OMAC is modular in form, comprising the following seven subsystems:

- 1) The Bill of Materials Processor (BOMP) provides a list of all parts, subassemblies, and raw materials used to make up a given product and the operations involved in making the product.
- 2) 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.
- 3) The Work-in-Progress subsystem ensures that stock levels are kept at a sufficient level to meet production requirements.
- 4) The Requirements Planning subsystem provides production and purchasing schedules for finished product requirements.
- 5) Forward Load Analysis enables loadings to be placed in advance of production via requirements planning.

6) The Completion Time Estimator enables completion dates of production to be predicted. It also provides charts on trends in factory performance.

7) Cost Establishment gives standard costs for all items manufactured.

ORDERMASTER—Provides the customer with a comprehensive on-line sales order entry and purchase order processing system.

Information Processing Packages: 1900 WORKSKIL MANAGER—A product designed as a mainframe support package for the 7500 terminal executive known as WORDSKIL. WORDSKIL MANAGER is the mainframe utility that can be used to link several word processor units to a mainframe computer. A document from a word processor can be sent to the mainframe by a single command. When the document has been stored in the mainframe by a word processor unit it can be made available for retrieval by any or all of the other word processor units. In this way, an "electronic mail" facility is provided.

PRICING

POLICY: ICL offers the ME29 for purchase or, by arrangement, lease. Maintenance is priced separately for both purchased and 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 the U.K., and other countries develop their own products where necessary. Prices, terms, and available configurations may vary in other countries to suit location conditions.

EQUIPMENT: The price of the processor alone ranges from £21,000 for the ME29/29 to £45,000 for the ME29/54. Prices for typical small, medium and large configurations are given below.

SMALL SYSTEM: £39,950 for ME29/29 with 768KB main memory, four workstations, 2 x 35MB disks, a 200 cps matrix printer and the necessary couplers.

MEDIUM SYSTEM: £59,000 for ME29/37 with 768KB main memory, four workstations, a Module 20/40 disk providing 120MB fixed and 60MB exchangeable storage, a 360 lpm line printer and the necessary couplers.

LARGE SYSTEMS: £100,000 for ME29/45 with 1MB main memory, eight workstations, three Module 20/40 disk drives providing 360MB fixed and 180MB exchangeable storage, a 600 lpm line printer and the necessary couplers; £143,000 for ME29/54 with 1.5MB main memory, eight workstations, four Module 20/40 disk drives providing 480MB fixed and 240MB exchangeable storage, a 1130 lpm line printer and the necessary couplers. ■