ICL ME29 Series

MANAGEMENT SUMMARY

UPDATE: *The principal changes that have occurred in the ICL ME29 Series are in the area of software. Through agreements with software suppliers Cobra, Ramphurst, and Duport, ICL has assembled a group of software programs under the title, Masterpack, which supplies applications software for the ME29's TME operating system. Masterpack includes application development tools, system management facilities, database management tools, and TP system control. ICL has also furnished users with the means to upgrade to the VME operating system, if they choose to do so.*

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 work loads, but also the more rigorous demands of users requiring extensive storage, database management, and distributed processing facilities.

Announced by ICL in March 1980 as a 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 512KB to 4MB, while the disk storage capacity extends from 70MB to 16,000MB. 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 33, Model 37, Model 45, and Model 54. ▷

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

A medium-scale range of computers in ICL's networked product line, the ME29 consists of four compatible models. The series is designed for a variety of business and commercial applications.

MODELS: ME29/33, ME29/37, ME29/45, and ME29/54.
CONFIGURATION: A basic ME29 includes 512KB of memory, 1 integrated disk drive, 128KB of microcode store, 120MB exchangeable disk storage, 2,000-character VDU workstation, and 1 matrix or band printer. Memory can be expanded in 256K or 512K increments to a maximum of 2MB.
COMPETITION: IBM System/36, IBM System/38, and IBM 4300 Series.
PRICE: From approximately £40,000 for a small system to over £200,000 for a large configuration.

CHARACTERISTICS

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▷ Compatible with ICL's 290X Series, the ME29 family supports batch processing, remote job entry, timesharing, and transaction processing. In addition, the ME29 provides extensive communications network facilities. Distributed processing capabilities include remote job entry, remote session access, 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, and Fortran, and the available system software includes full versions and subsets of ICL's database management system and data dictionary system. An optional Personal Data System allows nontechnical personnel to define, load, and use a personal database.

ICL also offers a variety of applications packages, the most recent of which is Masterpack, developed through agreements with Cobra, Ramphurst, and Duport software houses. Masterpack consists of a series of programs for application development, system management, database management, and TP system control.

A basic ME29 system consists of 512KB of memory, one integrated diskette drive, 128KB of microcode store, 120MB of exchangeable disk storage, a 2,000-character VDU workstation (for transaction processing, timesharing, direct data entry, system control, and remote access to other mainframes), and one matrix or band printer.

Memory can be expanded in 256K or 512K increments to a maximum of 2MB, and disk capacity can be expanded to 8000MB. A total of 16 workstations can be supported over local AMLCC (Asynchronous Multiline 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 main difference between these models relating only to processing power. Maximum hardware complements, with the total configuration subject to coupler constraints, include up to 4MB of memory, 16,000MB of disk storage, 4 magnetic tape clusters, 56 local workstations or printers supported over AMLCC lines, four 1900 retained peripherals, 2 X.25/HDLC couplers for packet switching networks, and 2 ASA (SNA)/3270 couplers for communications with other mainframes.

An important element of the ME29 computers is their microprogrammed compatibility, which enables them to run in the 24-bit mode of the older ICL 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 Series 39 range. The ME29 and Series 39 can be linked in networks running programs under the TME or VME 2900 operating systems. ▷

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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.

DISTRIBUTORS: Approximately 500 dealers worldwide as part of ICL's TraderPoint marketing scheme.

MODELS: ME29/33, ME29/37, ME29/45, ME29/54.

DATE ANNOUNCED: ME29/45—March 1980; ME29/37—Mid-1981; ME29/54—May 1982; ME29/33—September 1983.

DATE OF FIRST DELIVERY: ME29/45—August 1981; ME29/37—January 1982; ME29/54—July 1983; ME29/33—October 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.

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: ME29/33—512KB to 2MB; ME29/37 and ME29/45—512KB to 4MB; ME29/54—768KB to 4MB.

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 execu- ▶

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▷ Series 39 includes a TME interface via the CME capabilities of VME, enabling users to move TME work loads across to the Series 39, while continuing to run it, to gain the benefits of VME's superior application development systems.

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

In addition to batch, multiaccess computing (timesharing), and transaction processing, TME supports Direct Data Entry (DDE), Wordskill Manager, an electronic mail system, X.25 packet switched networks, and Bulletin, a private viewdata system which uses 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 database for retrieval of data in tabular form.

ME29 models can support the attachment of multiline 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 that allow access to X.25 and SNA networks. Interactive terminals are supported on multiple lines using ICL full XBM procedures.

COMPETITIVE POSITION

The ME29 competes with systems such as the IBM Systems/36, /38, and 4300 Series, as well as with the Sperry System 80 and Honeywell DPS 4. To enhance its competitive position against the System/38, ICL has added the Masterpack line of interrelated software.

ADVANTAGES AND RESTRICTIONS

Although a small mainframe, the ICL ME29 has sold very well throughout the five years it has been on the market. Its popularity accounts for the fact that ICL has freshened the ▷

▶ tive, 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 that it does not 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 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, another 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 33 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, an additional 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 33, is 1.2, 1.8, and 3.3 times, respectively.

CONTROL STORAGE: Each of the four models has 128KB of control storage. 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 nonaddressable registers are implemented in the processor's microcode, including a program address register, main and intermediate accumulators, an instruction register, and a data register.

ADDRESSING: Like the 290X 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.

▷ series with the addition of the Masterpack software. Instead of encouraging users of the ME29 to upgrade to the Series 39, a more powerful system, ICL has remembered its base of users who need smaller systems to accommodate them. Users of the larger ME29 systems have not been forgotten; they can upgrade to VME from TME through CME.

The Data Dictionary, which is at the core of the Masterpack software, supplies users with a database about the particular application, as well as layouts of screens and reports. The flexibility afforded by Masterpack is a distinct advantage to users who want to retain their ME29 equipment.

The four models in the ME29 Series are hardware- and software-compatible, thereby protecting users' investments. The ME29 systems can grow with the user to support a maximum of 56 workstations and a number of viewdata terminals. Users wishing to migrate from the ME29 to the more powerful 2900 are assured of peripheral compatibility between the two ranges. Software needs are also handled through a wide range of applications software packages for financial modeling, statistical analysis, project control, manufacturing, electronic mail, government, payroll, inventory, and many other activities.

Our most current survey of British Users of Mainframes generated responses from 99 users of the ME29 Series. The ratings are as follows:

USER REACTION

	WA
Ease of operation	3.00
Reliability of mainframe	3.36
Reliability of peripherals	2.98
Maintenance service:	
Responsiveness	3.02
Effectiveness	2.87
Technical support:	
Troubleshooting	2.23
Education	2.52
Documentation	2.07
Manufacturer's software:	
Operating system	2.95
Compilers & assemblers	2.91
Applications programs	2.02
Ease of programming	2.59
Ease of conversion	2.37
Overall satisfaction	2.85

Weighted averages on a scale of 4.0 for Excellent. □

▶ 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. These include: 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 unit 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 for 50 Hz are 198 V to 268 V; for 60 Hz, 104 V to 127 V. The operating temperature range is 10 to 35 degrees C, with a noncondensing relative humidity of 20 to 80 percent.

The cabinet contains: the Order Code Processor (OCP) with its associated microcode or control store; and the main memory, with data buses and couplers. One or two diskette drives are also incorporated, each supporting up to one megabyte of storage capacity.

The table unit provides housing for communications connections. The top can be used as a working surface to support a multipurpose 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 6 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 microprogram-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 diskette coupler, hard disk couplers, magnetic tape couplers, 1900 Standard Interface couplers for the connection of band printers and 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 33, 37, 45, and 54 employ the same structure, and differ only in processor speed and the ability to support peripherals.

The processor cabinet has a limited space for fitting store modules and couplers. This constraint places restrictions on the number of peripherals that can be configured on a system. Models 37, 45, and 54 can be supplied with an extension cabinet that houses further couplers. Store modules cannot 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 20 disk coupler (connects two drives); and

• Magnetic tape coupler (connects one cluster comprising a master and a maximum of 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 (256KB/512KB)

• Asynchronous Multiline Communications Coupler, AMLCC (connects locally a maximum of 40 VDUs/low-speed printers)

• Synchronous Multiline Communications Coupler, SMLCC (maximum eight local/remote lines for various peripherals)

• Diskette coupler (connects up to two drives)

• 1900 Standard Interface coupler (connects a line printer or retained 1900 peripherals, either one device or a cluster)

• X.25/HDLC coupler (provides one X25 line)

• ASA(SNA)/3270 coupler (provides two lines)

ME29/33: 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*—allows data to be entered directly into the Model 33, to be immediately checked, and then sent to a larger computer for further processing; *Local TP System*—intended to provide transaction processing facilities at local and remote terminals; *General Purpose System*—designed for a user who requires a combination of the aforementioned modes.

The basic Model 33 configuration comprises: ME29 processor, cabinet, and desk; 512KB main memory; 128KB control storage; one diskette drive; two Module 20 disk drives; one printer; two workstations and one Asynchronous Multiline Communications Coupler.

The Model 33 can support the following maximum configuration, subject to coupler constraints: ME29 processor, cabinet and desk; 2MB main memory; two diskette drives; 16 disk drives; one magnetic tape cluster; one line printer or four matrix printers; 16 workstations; two Asynchronous Multiline Communications Couplers (multidropping via Extended Local Terminal Controller is not possible on Model 33); 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) offer the following basic configurations: ME29 processor, cabinet, and desk; 512KB main memory in Models 37 and 45, and 768KB in Model 54; 128KB control storage; one diskette drive; two disk drives 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 can be configured simultaneously):

• ME29 processor, cabinet, and desk

• Extension cabinet

• 4MB main memory

• 128KB control storage

• Two diskette drives

• 32 disk drives

• Four magnetic tape clusters

• 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 multidropping from one Asynchronous Multiline Coupler

• Two X.25/HDLC couplers

• Two ASA(SNA)/3270 couplers

MASS STORAGE

FIXED DISK STORAGE

MODULE 40: A fixed disk 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 1.2M bps.

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 1.2M bps.

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. 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 1.2M bps.

EDS60: A 60MB exchangeable disk unit retained from the 1900 Series which can 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 416K bps.

DISKETTE STORAGE

Single-sided 256KB and double-sided 1MB diskettes are supported on the ME29. Average access time is 179 milliseconds, and peak data transfer rates are 32K and 64K bps, respectively. 256KB diskettes can be used for data interchange with ICL 7500 terminal systems. In addition, diskettes preformatted to IBM specification GA21-9388-0 can also be supported. ►

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TABLE 1. PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION
MULTIPURPOSE LOCAL WORKSTATION 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.
VARIOUS REMOTE WORKSTATIONS	The most common remotely connected intelligent workstations are the ICL 7181, 7500, and DRS ranges of terminals. DRS 20 models can be connected to the ME29 via the Synchronous Multiline Communications Coupler. They can act as a cluster of remote VDUs and printers, a bulk data terminal using ICL Range RJE standards to transfer date, or a bulk terminal using IBM 2780 protocol.
PRINTERS	
3544	Matrix printer for interactive printing; 132 print positions, 120 cps bidirectionally; 96-character set, multinational character sets available; 45 lpm with full 132-character line, 72 lpm with 80-character line; 10 characters/inch; 6 or 8 lines per inch.
3542	Matrix printer for bulk system printing; 132 print positions, 180 cps bidirectionally; 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.
LW 400Q	Band printer for bulk system printing; 132 print positions, 300 lpm with a 64-character set; 48- and 96-character sets available.
LW800Q	Band printer for bulk system printing; 132 print positions, 600 lpm with a 64-character set; 48- and 96-character sets available.
1900 SERIES RETAINED PERIPHERALS	
PRINTER, 2430	High-speed train printer, 132 or 160 print 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.

► MAGNETIC TAPE STORAGE

Three types of magnetic tape systems are available on the ME29. Nine-track tape is used for data archiving and security, and can be accessed by user batch programs.

TYPE 3551 or 6522: A 9-track, ½-inch magnetic tape system consisting of a master tape and up to three slaves. Data can be recorded in either Phase Encoded or NRZI formats, with data transfer rates of 60K and 30K bps, 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 can be recorded in either Phase Encoded or NRZI formats, with data transfer rates of 80K and 40K bps, respectively. Tape speed is 37.5 ips and density is 1600 bpi (Phase Encoded) or 800 bpi (NRZI).

GTS-310: Consists of a controller and from two to four 9-track magnetic tape drives. Maximum transfer rate is 413K bps at a density of 6250 bpi. The GTS-310 was originally developed for the 2900 Series.

INPUT/OUTPUT UNITS

See Table 1 Peripherals/Terminals.

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▶ **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 Multiline 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 multidropping using the Extended Local Terminal Controller (ELTC). Up to three AMLCCs can be configured.

The Synchronous Multiline Communications Coupler (SMLCC) provides connections for eight local or remote synchronous communications lines. Three SMLCC couplers can be configured. An SMLCC port can be connected to a Bulletin Link Unit (BLU); each BLU is capable of 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 (IPA), which provides facilities for communication with other ICL computers, uses full XBM protocol which can 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 is a 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 multileaving 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, provided that they are not connected via an ELTC; 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. An eighth line of 30 characters handles commands, replies, 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, multiaccess computing (timesharing) 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 database and to retrieve data from it in tabular form.

TME is offered in four variants: TME 20 for the Model 33, TME 30 for Model 37, TME 40 for Model 45, and TME 50 for Model 54.

The TME 20 operating system 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, 512KB to 2MB of main memory, up to 8GB of disk storage, one or two diskette drives, one line printer, and 16 local workstations.

The TME 30 operating system is similar to TME 20 but supports five batch streams; up to 4MB 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 subdivided 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 can 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 Systems 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.

Additional LW400Q and LW800Q printers (up to two) can also be supported by the TME 30, TME 40, and TME 50 Operating Systems, as can 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 through the use of coding in the Executive, which is functionally slower.

Support of a maximum of 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, and for up to eight RS-232-C/V.24 device connections. ▶

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► 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. 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. A TME version of the Cobol Interactive Testing System (ITS) is available to run on the ME29.

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 on ICL 1900 and 2903 Series computers and offers continuity to users of those machines who have installed an ME29.

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

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

• Ability to define, remove, and 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 supports 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.

APPLICATIONS SOFTWARE: The Masterpack software package was developed for ICL through individual agreements with these three software houses: Cobra, Ramphurst, and Duport. Masterpack offers application-built software for the TME operating system, including application development tools, system management aids, database management facilities, and TP system control. The heart of Masterpack is the Data Dictionary System (DDS). The DDS offers a database about the application and the environment in which it will operate, as well as providing information about screen and report layouts. It also offers data on the TP network and provides query facilities that allow users to access the ICL Querymaster.

Masterpack's TME-TP component handles the following functions: concurrent processing of multiple messages; management of shared access to files; control of the TP system when running; and user coding in Cobol. Masterpack also includes a set of 9 modules that supply features usually available to users of larger systems. ►

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▶ Ramphurst Computer System designed TMEX modules for Masterpack that offer job control program generation, job scheduling, tape and disk management, fault recording, and performance monitoring. ICL created the Interactive Testing System module to facilitate quicker program development through the use of Cobol Manager from Cobra, and OMEN-PLUS from Duport. Cobra's Report Manager simplifies the extraction and formatting of data for reports.

ICL offers users a number of other packages, dealing with such specific applications areas as finance, statistical analysis and project control, manufacturing and stock control, central and local government, and electronic mail.

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

COMPAY+ (U.K. only)—Processes payroll calculations including gross wages, net wages, national insurance payments, taxes, and pensions; and updates employee records.

BACSTER (U.K. 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 into the Bankers Automated Clearing Services (BACS).

PERT—Technical and Statistical Package 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.

OMAC 29—An online manufacturing control system that aids in the planning and controlling of production levels in manufacturing industries. OMAC 29 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.

Central and Local Government Packages: DILIS—A direct labor management package for local government which provides accounting, management and database facilities, and report and maintenance scheduling.

PLANAPS—Planning Application System which generates minutes, reports, and letters.

Information Processing Packages: WORDSKIL MANAGER—A product designed as a 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.

A wide range of third-party software running under TME is available.

SERVICE/SUPPORT

Basic maintenance covering support during office hours is priced separately for both purchased and leased ME29 systems.

Training courses, which are paid for separately by the user, can be held at ICL Customer Centers, or at user sites. Courses include practical training for operators and programmers, basic and advanced hardware and software instruction, and management level training. Audiovisual training packages are also available.

An ME29 System Event Evaluation Guide is provided with each system. Other manuals which ICL considers necessary include site preparation, installation, and system construction and maintenance. Documentation can also be purchased on software packages, languages, communications, data handling, and peripheral operation.

PRICING

POLICY: ICL offers the ME29 for purchase or lease. 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 local conditions.

EQUIPMENT: The price of the processor alone ranges from £17,000 for the ME29 to £63,000 for the ME29/54. Prices for typical small, medium, and large configurations are given below.

Small System: £37,000 for ME29/33 with 512KB main memory, four workstations, 120MB exchangeable disk storage, a 180-cps matrix printer, and the necessary couplers.

Medium System: £62,000 for ME29/37 with 768KB main memory, four workstations, a Module 20/40 disk providing 120MB-fixed and 60MB-exchangeable storage, a 300-lpm line printer and the necessary couplers.

Large Systems: £113,000 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; £162,000 for ME29/54 with 1.5MB main memory, eight workstations, four Module 20/40 disk drives providing 480MB-fixed and 240MB-exchangeable storage, a 600-lpm line printer and the necessary couplers. ■