ICL System 25

MANAGEMENT SUMMARY

The System 25 series of small business computers, based on multiple microprocessors, is suited to a wide variety of commercial applications. Computers of this new range can act as terminals to the products of other manufacturers using IBM and other protocols.

System 25 is compatible with ICL's System Ten, which has been a popular small business machine, with nearly 10,000 systems shipped since its introduction. To enable System Ten programs to function on the System 25, which ICL claims is four times more powerful, ICL provides a System Ten compatible operating system, DMF II. The standard operating system for System 25 is DMF III.

The market for System 25 includes not only stand-alone business systems, distributed processing systems and the System Ten replacement market, but also point-of-sale (POS) and factory terminal installations, for which ICL already has specialized products which can be linked to System 25. For word processing, the System 25 can have special larger screens rather than its normal 12-inch 2000-character displays.

The architecture of the new range is based on two main microprocessors, other intelligent elements and a multibus structure. The main microprocessors are the control processor, which exercises overall control including terminal handling and communications, and the instruction processor, which processes program instructions on command from the control processor. System 25 has a minimum of 10 microprocessors; controllers and couplers (see Characteristics section) are microprocessor-based.

There are three buses. The main bus, five bytes wide, services the memory modules, the instruction processor, the control processor, the disk controllers and the ▷

ICL System 25 is a range of multi-micro-processor-based small business systems oriented towards communications, distributed computing and interactive processing.

MAIN MEMORY: 80K to 1.28M bytes
DISK CAPACITY: 35 to 1110 megabytes
WORKSTATIONS: Maximum 200, including up to 80 remote
PRINTERS: 55 to 200 cps; 300 to 600 lpm
OTHER I/O: ½" reel-to-reel magnetic tape, ¼" cartridge magnetic tape, floppy disks, specialized terminals

CHARACTERISTICS

MANUFACTURER: International Computers Ltd., ICL House, Puktney, London SW 15. Telephone (01) 788-7272.

MODELS: System 25 models 21, 41, 42, 52, 64, 65, 66, 71, 72, 73.

DATE ANNOUNCED: Models 51, 61, 62, 63 (now discontinued)—June 1981; Model 50 (now discontinued)—December 1981; Models 64, 65, 66—December 1981; Model 41—March 1982; Models 71, 72, 73—May 1982; Models 21, 42, 52—November 1982.

DATE OF FIRST DELIVERY: July 1981.

NUMBER INSTALLED TO DATE: Approximately 1,000.

DATA FORMATS

BASIC UNIT: 8-bit byte. This can be used to hold the 6-bit characters of System Ten programs.

INSTRUCTIONS: System 25 uses 2-address instructions of the form: F, A, B where F is the function code and A, B are operand addresses. An instruction occupies 10 bytes. The A, B addresses, in binary coded decimal, are held in bytes 1 to 4 and 6 to 9 respectively. The decimal digits are coded in bits 4 to 1 of the respective bytes, with bit 4 as the most significant bit. As in System Ten, arithmetic is decimal. ▶
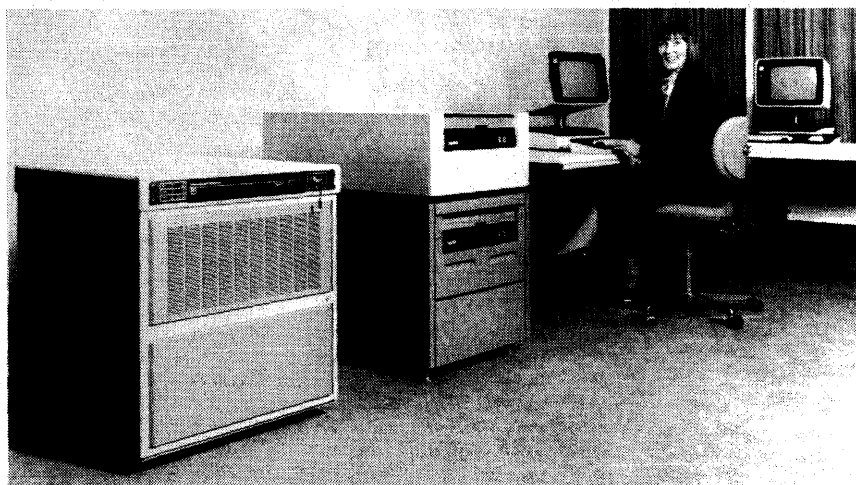
The System 25 configuration shown here is a Model 52 with system cabinet (left) housing CPU, two 35 MB Winchester disks and two magnetic tape cartridge drives. A separate disk storage unit houses a 65 MB exchangeable disk and a 130 MB fixed disk. Also featured are two Model 3485 local VDUs.

▷ magnetic tape controller. Maximum transfer rate is 10 megabytes per second. The second bus links the control processor to the controllers and couplers for terminals, communications, and the ¼″ cartridge tape drives. Maximum transfer rate is 100 kilobytes per second. The third bus links the disk controller to the disk drives and the floppy disk drives. Maximum transfer rate is 1.25 megabytes per second.

System 25 has an automatic fault diagnostic system which starts its checking as soon as the machine is switched on. Any faulty boards are identified by lights on the boards themselves.

The functioning of System 25 depends on a partitioning scheme managed by the firmware. Main memory, which ranges from 80K to 1.28M bytes, can be divided into a maximum of 20 partitions plus a common area. A job can run in each of these partitions. The time allocated to each job is effected on a priority basis and by means of time-slicing. The control software includes the Interactive Configurator, which also allocates peripherals and other resources to the different partitions. The Interactive Configurator initially establishes the partitions.

System 25 will support up to 1110 megabytes of fixed and exchangeable disk storage, twin floppy disk drives, line and matrix printers, and nominally up to 200 terminals of which up to 80 may be remote.

ICL currently markets System 25 in 10 basic configurations, all of which are compatible. System may be upgraded by field enhancement. Differences between models concern variously the instruction processor, memory capacity and mass storage, but not peripherals nor communications. The large system packages, Models 71, 72 and 73, offer almost twice the disk capacity of the other seven models (maximum 1110MB rather than 590MB) and a faster instruction processor. The Model 21, which ICL calls a Retail Applications Processor, is a specialized system designed for use in a retail environment. It is a desktop model incorporating 5¼″ Winchester and floppy disk drives, one communications coupler, and supporting the connection of up to sixteen point-of-sale terminals from the ICL 9500 range. Model 21 is aimed at multiple-system sales to selected accounts in the retail market, and is not generally available. For this reason it is not detailed further in this report.

System 25 disk storage options include the following: 8″ floppy disk drives, 35MB (8″) Winchester disk drives, 65MB exchangeable disk drives, or 130MB fixed disk drives. A ¼″ cartridge tape unit, located in the system cabinet, is mandatory on all systems. This is used for software distribution and back-up storage. Reel-to-reel magnetic tape is optional on all models.

In a distributed processing environment, System 25 can act as a terminal controller. It presents the same user interface to both locally and remotely connected VDUs and printers, with the result that applications programs can access these devices directly. Local terminals are ▷

▶ INTERNAL CODE: ASCII

MAIN STORAGE

TYPE: MOS

CYCLE TIME: 500ns

CAPACITY: Model 41—80KB to 1.28MB. Other models— 320KB to 1.28MB. Increments come in 80KB modules, which use 16K-bit chips, or in 320KB modules, which use 64K-bit chips. Battery back-up against power supply failure is standard.

ORGANIZATION: System 25 storage consists of three main parts: control storage, common storage and up to 20 partitions. The size of the control storage (see Control Storage section) is fixed, but the user may alter the size of common storage and the size of partitions by using the Interactive Configurator (see Software section).

Common storage is an area of store which is accessible to all programs running in the system. It contains routines such as Input/Output and other subroutines and data which may be required by any partition. Common storage also contains an area known as the "mailbox," which may be used for passing information from one partition to another. The size of common storage may be from 1KB to 320KB, in multiples of 1KB. A practical minimum is 40KB.

There may be a maximum of 20 partitions containing applications programs. The size of the partitions, defined by the user through the Interactive Configurator (see Software section), can range from 1KB to 80KB, in multiples of 1KB. Each partition includes, in addition to the applications software, 300 bytes reserved for system information which is necessary for the execution of the application program and for identifying the logical addresses of peripheral devices. Normally there is also 2KB for use by the disk and file handling routines, in conjunction with LIOCS (Logical Input/Output Control System). Where space is not required for disk input/output, as in the case of a partition serving as a message buffer, the partition may occupy only the minimum 1KB.

Each partition acts as a separate entity, capable of executing its own programs independently of the others, but with the ability to access the common resources of the system and to communicate via the mailbox with programs running in other partitions. During the concurrent running of independent programs on System 25, the time allocated to each job is effected on a priority basis and by means of time-slicing. The user may set or change the amount of time allocated to a program using the Interactive Configurator program (see Software section) as the time-slice does not need to be the same for all partitions. A default value is otherwise assumed.

CHECKING: Parity checking is standard. Each byte contains one parity bit.

STORAGE PROTECTION: Each partition in main storage, defined by software, is hardware-protected against alteration or corruption by programs in other partitions. Any attempt to address a location beyond the extent of the partition will result in error conditions.

RESERVED STORAGE: Control storage occupies 3KB (see Control Storage section). DMF III or DMF II system software requires a minimum of 37KB for the Logical Input/Output Control System (LIOCS).

CENTRAL PROCESSORS

GENERAL: The functions conventionally performed by one central processor are carried out by two processors in ▶

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PERIPHERALS/TERMINALS

MODEL	DESCRIPTION & SPEED
VISUAL DISPLAY UNITS	
Model 3485 Local VDU	2000 character display, 25 lines, 80 characters per line, 9 x 7 dot matrix, 96 character subset of ASCII. The display is adjustable on its column. Free-standing keyboard. Maximum speed 1500 characters per second.
Model 3489 Dual Mode VDU	As 3485, but alternately usable as IBM 3278 Model 2 emulator
Model 3484 Remote VDU	2000 character display, 25 lines, 80 characters per line, 9 x 7 dot matrix, 96 character subset of ASCII. Free-standing keyboard. Asynchronous speeds up to 2400 bits per second, synchronous speeds up to 9600 bits per second.
Model 3487 Word Processing VDU	1920/3168 character display, 24 lines, 80/132 characters per line. 9 x 5 dot matrix, 128 full ASCII character set. Free-standing keyboard. Speed 600 characters per second.
PRINTERS	
Model 3443 Matrix Printer	9 x 9 dot matrix, up to 132 columns, 64/96 character set. Speed 120 characters per second.
Model 3444 Matrix Printer	9 x 9 dot matrix, up to 132 columns, 64/96 character set. Speed 200 characters per second.
Model 3445 Line Printer	Up to 132 columns, 64 character set. Speed 300/600 lines per minute.
Models 3441 and 3443 Hard Copy Printers	Desk-top matrix printers for direct connection to remote VDU (Model 3484). 80/132 columns, 96 character set. Speed 120 characters per second.
Model 7575 Daisy Wheel Printer	132 columns, 96 character set (per interchangeable daisy wheel). Speed 55 characters per second.
MAGNETIC TAPE EQUIPMENT	
Model 3451	Reel-to-reel, 9 track, Phase Encoded or NRZI, 1600 bpi (Phase Encoded) or 800 bpi (NRZI), 37.5 ips. Maximum data transfer rate 60KB per second.
Model 3452	10MB Cartridge tape, Modified Frequency Modulation, 6400 bpi, 30 ips (read/write) or 90 ips (search/rewind). Maximum data transfer rate 192KB per second.

▷ linked via the T coupler and can be up to 1500 meters away from the processor. Remote terminals and printers are linked via a remote VDU coupler.

System 25 can be linked to X25 networks, IBM networks and other ICL systems. If the IBM network is pre-SNA (that is, it uses BSC protocols) then the System 25 network coupler with BSC firmware and ICL software called CAM (Communications Access Manager) is used. With these, System 25 can also emulate an IBM 3271 cluster controller.

If the IBM network is SNA, then the network coupler is used with SDLC/SNA firmware and CAM. Emulation in this case will be of an IBM 3274 Model 1C cluster controller.

The network coupler is also used to communicate with ICL systems, such as the ME29 or 2900 series. System 25 supports IPA (ICL's Information Processing Architecture), which specifies how different computers in the ICL range should be linked at both operating systems level and at file access level. IPA enables a user to access files, applications and facilities on one ICL computer from another ICL computer. ▷

▶ System 25; the control processor and the instruction processor. These are linked by a 40-bit-wide bus which also services the main memory. Single-byte and five-byte-wide traffic is transferred via this bus at rates of 2 and 10 megabytes/second, respectively.

CONTROL PROCESSOR: Overall control of the System 25 is exercised by the control processor, an AMD bit-slice microporcessor, in conjunction with the operating system. The control processor performs the following functions:

● Partition switching i.e., the transfer of control from one partition to another.

● Initiation and completion of all input/output operations.

● Data transfer for slow peripherals, on an interrupt basis.

● Management of the system configuration, as defined in control storage, i.e., dynamic allocation of peripherals to partitions.

INSTRUCTION PROCESSOR: The instruction processor is another AMD bit-slice microprocessor, with a cycle time of 250 nanoseconds. Initiated by commands from the control processor, the instruction processor executes a sequence of program instructions.

REGISTERS: There are three index registers in each partition. They are referred to by number and occupy, in each partition, locations 11 to 14 (index register 1), 21 to 24 (index register 2), and 31 to 34 (index register 3). ▶

▷ Operating system functions and utilities are provided under the collective title of Data Management Facility (DMF) on System 25. Two versions of this system software exist: DMF 11 for ICL System Ten users who wish to retain compatibility at the software level, and DMF 111 for running System 25 applications.

Three system software packages of particular significance in terms of System 25's workstation and communications orientation are CSM (Conversational System Manager), IAS (Interative Applications Support) and the Interactive Configurator. CSM, which provides housekeeping and operating functions, is the main user interface to the system from conversational devices (various models of VDU). IAS, an optional development aid for the Assembler or Cobol programmer, enables device-independent applications to be produced. It manages variously access to a menu of applications, with security checks, from a VDU, multiple VDUs per Input/Output channel and a mix of different types of VDU or different types of printer. The Interactive Configurator is used to establish the relationship between the control processor and the peripheral units. Configurations can be defined in software terms by the user to suit any particular system requirements, within the physical constraints of the hardware components available.

Languages available with System 25 are Cobol, RPG II, Assembler III, and Assembler II. Cobol conforms to the low intermediate level of the ANSI 1974 standard and contains additional elements for interactive operation. RPG II is currently limited to its System Ten specification and does not fully exploit DMF III facilities. Assembler III is a macro language. System Ten programs written in Assembler II, a subset of Assembler III, may also run on System 25.

Application packages include word processing, point-of-sale (POS), factory data collection, and a wide range of commercial packages serving such areas as accountancy, banking, stockholding, printing, construction and motor dealing.

RELATIONSHIP TO CURRENT PRODUCT LINE

System 25, with its compatible DMF II operating system and Assembler II, offers an attractive upgrade path for System Ten users. Particular attractions are the vast increase in memory (1280KB rather than 200KB) and disk storage (1110MB rather than 160MB), the existence of Cobol, which is not provided on System Ten, and the general improvement in communications facilities. These new facilities depend on using the DMF III operating system.

System 25 is almost directly competitive in price terms with ICL's ME29/35 but is pitched well below the ME29/45 and the 2946 (the current entry point to the 2900 series). There is no direct compatibility between System 25 and other ICL ranges other than the System Ten, although networking compatibility is supported between System 25 and other ICL products. ▷

▶ ADDRESSING: Two-address instructions are used. The addresses are represented as decimal numbers in the range 00000 to 79,999, the first digit being a page number in the range 0 to 7. The whole address is stored in part of a 4-byte address word together with a marker indicating whether the address is relative to a partition base or to the Common base.

INSTRUCTION REPERTOIRE: There are 24 instructions, comprising those for arithmetic, logical, data transfer, branch and input/output operations.

INSTRUCTION TIMINGS: In the multiprocessor environment of the System 25, the time taken to execute instructions is dependent upon the control processor fetch time and the instruction processor execution time in addition to the size of the fields being manipulated. The size of the fields accounts for the wide range of execution times. Arithmetic is decimal. The following examples apply to all models except 71, 72 and 73:

- Add/Subtract: Minimum time ranges from 15.75 to 56.25 microseconds.

- Read/Write: Execution time is 28 microseconds plus the time taken to transfer data via the CPU buses.

- Multiple: 10 digit number x 5 digit number, 0.8 milliseconds; 2 digit number x 3 digit number, 49.25 microseconds.

- Divide: 10 digit number by 5 digit number, 1.4 milliseconds; 2 digit number by 3 digit number, 238 microseconds.

- Compare: Minimum execution time ranges from 3.75 to 26.0 microseconds.

CONTROL STORAGE: Occupying 3KB, control storage contains information concerning the size of common storage (see Main Storage section), the size of partitions, the assignment of peripherals to partitions, and addresses for Input/Output operations.

Control Storage is accessible to the Interactive Configurator (see Software section) but not to other system software of user programs.

INPUT/OUTPUT CONTROLLERS

Intelligent controllers provide the means of attaching disk drives and magnetic tape devices to the System 25. Direct Memory Access (DMA) allows data transfers to be performed directly from or to main storage, reducing the control processor's task to one of initiation of the command.

S CONTROLLER: The S Controller is used to connect System 25 disk drives via Disk Adaptors, which are specific to particular drive types (see Configuration section).

U CONTROLLER: The optional U controller is used to connect retained System Ten disk drives to the System 25.

M CONTROLLER: The M Controller is a single printed circuit board which supports up to two reel-to-reel magnetic tape units.

PHYSICAL SPECIFICATIONS

The basic cabinet of System 25 has a width of 65cm (26 inches), depth of 79cm (31 inches) and height of 76cm (30 inches). ▶

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▷ COMPETITIVE POSITION

With prices ranging from around £16,000 for an entry level system to £100,000 and upwards for typical larger configurations, the System 25 is a very strong competitor to IBM's System/34. It offers more main memory than the 34 and almost four times as much disk storage capacity. System 25 also offers competition to all models of the IBM System/38 and IBM 8100, and in some situations, Series I.

Products of other manufacturers with which System 25 competes include the Burroughs B 900 series, Nixdorf 8870 and Hewlett-Packard 3000 series.

USER REACTION

Datapro contacted three System 25 users in *September 1982* to determine their level of satisfaction with the systems. Two of the users had small systems, with three or four local and remote workstations each, which had been installed for three months and seven months only. The third had a larger system which was used as a distributed element in a distributed processing environment to control some twenty local and remote terminals. It had been installed for one year as a conversion from an ICL System Ten. The systems were used in government applications, in the following areas principally: accounting, purchasing, inventory control, payroll, timetabling and educational administration.

The large system was used in education, with application software produced by in-house personnel and contract programmers. The users were pleased with the System 25 response time and said that the system was easy to expand and reconfigure. They would recommend the system to other users and were intending to expand their own system.

Application software for the two smaller installations, which were used in government departments, was provided in one case by a combination of ICL packages and contract programming, and in the other case by proprietary packages. Although neither system had been installed for long, both users seemed satisfied so far. One actually found that the costs were less than expected, and the other noted that the system had a good response time and that it would be easy to expand the configuration.

Ratings were assigned to various aspects of the System 25 by the three users. The specific ratings were as follows:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	2	1	0	0	3.7
Reliability of mainframe	1	1	1	0	3.0
Reliability of peripherals	0	1	1	0	2.5
Maintenance service:					
Responsiveness	1	1	1	0	3.0
Effectiveness	0	2	1	0	2.7
Technical support:					
Trouble-shooting	0	2	1	0	2.7
Education	0	2	1	0	2.7
Documentation	0	2	1	0	2.7

*Weighted Average on a scale of 4.0 for excellent ▷

▶ INPUT/OUTPUT CONTROL

Intelligent couplers, controlled by the control processor, provided the means of attaching various types of peripheral devices to the System 25, via input/output channels housed in each coupler.

Before the peripherals can be used, an input/output channel and associated peripherals need to be allocated to a storage partition. The connection between input/output channels and partitions is logical, not physical. The user may change the allocations of input/output channels to partitions by means of the Interactive Configurator (see Software section).

T COUPLER: The single board T Coupler is provided in two versions as a means of attaching local non-magnetic peripherals (VDUs, printers, workstations) to the System 25. It consists of two or four independent input/output channels, each of which connects up to ten devices.

D COUPLER: The single board D Coupler is provided as a means of attaching local ICL Point Of Sale (POS) and factory terminals to the System 25. It consists of two independent input/output channels, each of which will drive 16 device lines.

R COUPLER: The R Coupler is a single printed circuit board provided as a means of attaching ¼" cartridge magnetic tape drives to the System 25. The coupler provides a single input/output channel able to support a maximum of two cartridge drives.

NETWORK COUPLER: The Network Coupler contains one input/output channel which controls one communications line (see Communications Control section).

REMOTE VDU COUPLER: This coupler supports up to 10 multi-point and/or multi-dropped remote VDUs on a single circuit. Matrix printers can optionally be attached to the VDUs.

SIMULTANEOUS OPERATIONS: With its software-controlled memory partitioning, System 25 can support up to 20 concurrent applications. Each partition can have an associated set of input/output devices, (re-allocation of devices being possible via the Interactive Configurator—see Software section), allowing programs to be called and data to be processed independently of applications running in other partitions.

Time slices are allocated to each partition using the Interactive Configurator or else a default value is given. Although each partition is normally allocated the same duration of time slice, the facility within the Interactive Configurator to allocate different periods allows the user to establish a priority system to favor important applications.

Partition switching is performed by the control processor. When a partition comes to the end of its time slice and a successful branch is executed or I/O is initiated an interrupt occurs. The address of the next instruction in the partition is automatically stored so that when the partition is next activated it continues processing as though no interruption had occurred.

CONFIGURATION RULES

All models in the System 25 range have two main processors: the control processor and the instruction processor. Main storage for each model, with minimum requirements as detailed in the basic System 25 configurations below, is provided by 80KB or 320KB modules.

In addition to the central processors and main storage, each system includes the following mandatory elements: a disk controller and adaptor, hard disk storage, a T Coupler for ▶

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	Excellent	Good	Fair	Poor	WA*
Manufacturer's software:					
Operating system	1	2	0	0	3.3
Compilers and assemblers	1	0	0	0	4.0
Ease of programming	0	1	1	0	2.5
Ease of conversion	1	0	1	0	3.0
Overall satisfaction	0	3	0	0	3.0

*Weighted Average on a scale of 4.0 for excellent

► local VDUs and printers, an R Coupler for ¼" cartridge tape, and a ¼" cartridge tape drive. Optional elements include further storage modules, floppy disk storage, additional hard disks, a second ¼" cartridge tape reel-to-reel tape (mandatory in Models 66 and 73 to back up the large fixed disk storage), and additional couplers for local and remote communications.

ICL refers to Models 41, 42 and 52 as small system packages, Models 64, 65 and 66 as medium system packages and models 71, 72 and 73 as large system packages. Differences between the various small and medium system packages concern memory capacity, disk storage and magnetic tape storage. Principal features of these packages are as follows:

- Model 41: 80KB memory
  35MB fixed disk drive
  10MB cartridge tape

- Model 42: 320KB memory
  35MB fixed disk drive
  10MB cartridge tape

- Model 52: 320KB memory
  2 x 35MB fixed disk drives
  10MB cartridge tape

- Model 64: 320KB memory
  2 x 65MB exchangeable disk drives
  10MB cartridge tape

- Model 65: 320KB memory
  65MB exchangeable disk drive
  130MB fixed disk drive
  10MB cartridge tape

- Model 66: 320KB memory
  2 x 130MB fixed disk drives
  10MB cartridge tape
  60KB/sec magnetic tape, reel-to-reel

Models 71, 72 and 73 offer the following features, which may also be provided as field upgrades with the smaller models: a faster instruction processor than the smaller models, expanded limits of Common storage (see Main Memory Organization section), two S Controllers (for System 25 disks). Other features of the packages are:

- Model 71: 320KB memory
  2 x 65MB exchangeable disk drives
  10MB cartridge tape

- Model 72: 320KB memory
  65MB exchangeable disk drive
  130MB fixed disk drive
  10MB cartridge tape

- Model 73: 320KB memory
  2 x 130MB fixed disk drives
  10MB cartridge tape
  60KB/sec magnetic tape, reel-to-reel

The card cage in the System 25 can hold a maximum of 22 printed circuit boards (PCBs) which can be mixed to provide a wide range of configurations subject to the following constraints:

	Maximum permitted	Number of Types
Control Processor	1	1
Instruction Processor	1	2
Memory Modules, 80KB or 320KB	4	1
S Controller (System 25 disks)	2	1
Small disk adaptor	1	1
Large disk adaptors	4	2
Floppy Disk Adaptor	1	1
T Couplers (VDUs and printers)		
2 I/O channel version	10	1
4 I/O channel version	5	1
Network and Remote VDU Couplers	8	1
D Couplers (specialized terminals)	9	1
U Controller (retained System Ten peripherals)	1	2
R Coupler (cartridge tape)	1	1
M Controller (reel-to-reel tape)	1	1
V Coupler (RS-232-C interface)	4	1
Clock	1	1

Under the operating system DMF III, the configuration of a System 25 is defined by the contents of Control Storage. This is an area of main storage which contains information about the current state of the computer, namely the sizes of memory partitions, the size of common store and the assignment of peripherals to partitions. The DMF III Interactive Configurator enables the user to define and to alter the information in Control Storage. In this way, the program provides user control over the configuration of a System 25. For further details see Software section.

A theoretical maximum of 200 VDU workstations or printers may be connected locally to the System 25 via T Couplers, each of which provides two or four independent input/output channels. Each channel supports up to ten devices. The theoretical maximum number of workstations and printers is also related to memory partitioning. Each of 20 partitions may support up to 10 of these devices.

At least one "blind" partition (a partition without any peripherals attached) will be required where Interactive Applications Support (see Software section) is used together with Cobol, i.e., in most System 25 configurations. Each blind partition reduces possible connections of the system by 10 peripheral ports.

D Couplers may be configured in order to connect local ICL point of sale (POS) or factory terminals. Two input/output channels, each of which will support 16 devices, are provided by each D Coupler. Up to nine such couplers are permitted, enabling connection of 288 POS or factory terminals.

Floppy disk storage is optional on all System 25 models. Either one or two floppy disk drives (Model 3464) may be configured, providing a total of up to 2MB of storage. They are housed in a free-standing desk-top unit.

Normally, the maximum number of hard disk drives in System 25 configurations, except where the second disk controller is fitted, is six; up to two 35MB 8" Winchester disks (Model 3461) which are built into the system cabinet, and up to four larger capacity fixed or fixed/exchangeable disks. The larger disks are housed in cabinets containing one or two disk drives, with up to two cabinets per system.

The cabinets available are:

- 65MB + 65MB exchangeable (Model 3462/33)

- 130MB + 65MB fixed/exchangeable (Model 3462/35)

- 130MB + 130MB fixed (Model 3463)   ►

▶ Back-up storage for the 130MB fixed disk store is provided by 65MB exchangeable disk drives or by reel-to-reel magnetic tape.

Minimum disk requirements for each model are as follows: Models 41 and 42—35MB; Model 52—2x35MB; Models 64 and 71—2x65MB; Models 65 and 72—65MB + 130MB; Models 66 and 73—2x130MB.

The S Controller is used to connect System 25 disks and diskettes to the system via disk adaptors, which are specific to particular drives. A maximum of four disk adaptors may be connected to one S Controller, with each adaptor supporting up to two disk drives. Disk adaptors available on System 25 support the following types of disk:

● Model 3464 floppy disks (1MB)
● Model 3461 fixed disks (35MB Winchester)
● Model 3462 exchangeable disks (65MB)
● Model 3463 fixed disks (130MB)

Two S Controllers are provided with System 25 models 71, 72 and 73, allowing connection of up to eight large disks. The second S controller is also a field-upgradeable option on smaller models. The maximum disk storage capacity of System 25 is 1110MB, on Model 73, composed of two 35MB and eight 130MB drives.

The U controller is used to connect retained System Ten disks to System 25. The controller has a System Ten (FAC) interface, to which retained disks (models 43 and 44) are connected via a System Ten Magnetic Disk Controller. This type of configuration provides the user with limited improved system performance (provided by the System 25 CPU and larger memory), while the customer's disk system is retained. This controller is only supported by the DMF II operating system, which does not provide many of the System 25 enhanced facilities.

At least one 10MB ¼" cartridge tape drive (3452) is provided with each System 25 package. It is housed in the system cabinet. A second 10MB cartridge tape is optional. The cartridges are linked to the system via the R Coupler.

All models are capable of supporting up to two reel-to-reel tapes (3451), connected to the system via an M Controller. For further details on magnetic tape devices, see Input/Output Units section.

A digital clock, a specialized input/output channel consisting of a module which can be plugged into the system, is optional in some System 25 configurations. It provides a real-time reference for a software clock. It is not configured in the specialized retail and factory systems. Battery back-up is provided to safeguard the contents of store in all configurations. ICL claims that 320KB of store may be preserved uncorrupted for at least eight hours if the battery is fully charged when power failure occurs.

MASS STORAGE

3464 FLOPPY DISK DRIVE: The 3464 is an 8" double sided floppy disk drive with a capacity of 1MB. It has an average access time of 180 milliseconds and a nominal data transfer rate of 60KB/second. The data format used conforms to the provisional ECMA specification for Extended Interchange (level 2) and to the IBM 3741 media interchange format.

3461 WINCHESTER DISK DRIVE: The 3461 is an 8" Winchester disk drive with a capacity of 35MB. It has an average access time of 50 milliseconds and a nominal data transfer rate of 929KB/second.

3462 EXCHANGEABLE DISK DRIVE, EDS 65: The 3462 is an exchangeable disk unit with a capacity of 65MB.

It has an average access time of 38 milliseconds and a nominal data transfer rate of 1.21MB/second.

3463 FIXED DISK DRIVE, FDS 130: The 3463 is a fixed disk unit with a capacity of 130MB. It has an average access time of 38 milliseconds and a nominal data transfer rate of 1.2MB/second.

INPUT/OUTPUT UNITS: ¼" cartridge tape is used for software distribution and for back-up storage on the smaller System 25 models. The tapes, not of the streamer variety, require at least 15 minutes to read or write their 10MB formatted capacity.

For details of magnetic tape units. VDUs, and printers, see Peripherals/Terminals table on page three of this report. In addition to the terminals listed in the table, System 25 supports specialist terminals for use in both retail and industrial environments. ICL's 9500 Retail Business Systems and 9600 Factory and Attendance Terminal Systems both comprise specialist terminals and supporting software.

COMMUNICATIONS CONTROL

A variety of facilities exist which permit connections between a System 25 and either a remote mainframe computer (both ICL and non-ICL) or a remote peripheral.

COMMUNICATIONS WITH ICL MAINFRAMES: ICL's Information Processing Architecture (IPA) includes a set of facilities which allow communication between System 25 and an ICL mainframe computer. Full XBM or X25 line protocols, together with the Communications Access Manager (CAM)—a combination of firmware for the network coupler and associated system software—form the basis of the IPA. Four major facilities are offered in IPA for System 25.

Remote Session Access: This enables the user at a System 25 VDU to use the services residing in another IPA computer, to which he is not directly connected, on a session basis. This facility is sometimes known as a "pass through" facility; once the user has obtained access to a remote service, he/she is unaware of the existence of the intermediate computer (the System 25) for the duration of the session.

● Distributed Transaction Service (DTS): This enables applications running under Interactive Application Support (see Software section) to initiate inquiries in other transaction processing services and to receive replies. Messages may be routed not only to other applications running in the same computer, but also to different applications in other computers.

● General File Transfer: It is possible to transfer files between System 25 and another IPA system. This can be done interactively or from a job stream file.

● Application Data Interchange: This facility enables applications running on a System 25 to communicate with applications on other ICL computers without involving the Interactive Applications Support Software.

COMMUNICATIONS WITH NON-ICL MAINFRAMES: The network Coupler can be loaded with firmware to support the following: IBM BSC (3270) and SDLC protocols, emulation of IBM 3274 Model 1C cluster controller, and System Ten Synchronous Communications Adaptor and Aynchronous Adaptor.

Software is also provided for IPA-like facilities when working with IBM hosts, including support of IBM 3278 VDU emulation when using Model 3489 VDU.

COMMUNICATIONS WITH REMOTE PERIPHERALS: A protocol is available which enables connection of a ▶

cluster of remote VDUs (Model 3484) and printers over a dialed or leased line: ICL's Programmable Communications Adaptor (PCA/84) firmware. At the level of the application program, PCA/84 emulates the data formates of locally attached VDUs (models 3485 or 2385) and printers, thus allowing applications to be device independent.

The Remote VDU Coupler provides a means of connecting up to ten VDUs or printers to the System 25, using V24/RS-232-C interfaces. Matrix printers can optionally be attached to the VDUs.

SOFTWARE

OPERATING SYSTEM: Operating system functions and utilities are provided under the collective title of Data Management Facility (DMF) on System 25. Two versions of this system software exist; DMF II for ICL System Ten users who wish to retain compatibility at the software level, and DMF III for running System 25 applications. DMF III performs the following major functions: program loading and running, system maintenance and housekeeping, disk file management, utilities and programming aids, and system configuration utilities.

Normal system and program loading is performed by part of DMF III known as the Conversational System Manager (CSM), which also incorporates many of the system maintenance and housekeeping facilities. When the system is first started up or when any program sequence has come to an end, CSM displays a prompting message on the VDU. The user may then go on to another program or enter a command to perform some system function. CSM thus provides the main user interface to the system from a conversational device.

DSM provides the combined facilities of Conversational Loader and MAINT of the System Ten. Most previous functions are adopted and several others including a HELP facility, have been added.

The sequence of programs in a given job may be controlled using job stream files under DMF II or DMF III. Applications can be structured as job stream files containing control statements that will load the programs needed for the job in the required sequence, including all command statements.

Nested job stream files, as well as programs, may be called conditionally, depending on the results of previous job steps. The user may initiate the loading and execution of job stream files from within other job stream files.

System configuration software, the Interactive Configurator, enables the user to take advantage of the flexibility of System 25 in the re-allocation of peripherals. The user may arrange the store and peripherals to reflect the immediate system requirements. Partition store sizes can be changed and visual display units and printers may be exchanged between partitions when needed using the configuration software, though not on a dynamic basis.

The Interactive Configurator is used to establish the relationship between the control processor and the peripheral units. There are two separate stages in using this utility: a list of the hardware available, called the Hardware Map, is first created, then the deployment of those hardware resources is defined. These details, once created, are stored for everyday use in a disk file and are dumped onto the cartridge tape as back-up. Both types of record are easily changed. Configurations can thus be defined to suit any particular system requirements, within the physical constraints of the hardware components available.

DMF III contains a set of LIOCS (Logical Input/Output Control System) routines, called by macro-instructions, which handle file and record input/output operations in user programs. The following file structures are supported:

- **Extended Linked Sequential Files:** These files contain unblocked fixed-length records that are processed serially. They are used, for example, where transaction data files are required. These can be sorted into any particular sequence when needed to update permanent files.

- **Extended Relative Files:** These files contain fixed-length records which may be blocked. These records may be accessed serially or randomly.

- **Extended Direct Files:** This format is used when a file must be accessed randomly. Records may be added or deleted at any time.

- **Extended Variable Sequential Files:** The records in these files are always blocked and are usually accessed serially. These are normally used as transaction files in which the information to be stored is of variable length; e.g., in point-of-sale applications.

- **Mapped Relative Files:** These files are similar to extended relative files, and are used for random access. They have facilities for inserting and deleting records.

- **Loadable Format Files:** These are used specifically for program files, supporting fast, relocatable loading of programs and overlays. They can not be used as data files.

- **Index Files:** These permit random access to extended relative files. This is done using an index file which is separate from the data file, and where each entry is a pointer to a corresponding key in the data file. Such files are useful where it is necessary to access a file randomly while maintaining records in key sequence for serial processing. Index files are structured as relative files.

Files of these types are stored in "pools," which may be one of three types:

- **Extended Relative Pools:** These contain only one file, which can be extended relative, mapped relative, extended direct, extended variable sequential, or index in format. Such pools are used primarily by applications for holding data records.

- **Extended Linked Sequential Pools:** These contain one or more linked sequential files, and are normally used for holding source programs, where records are frequently inserted and deleted.

- **Programs Pools:** These contain object program files.

A pool is a group of adjoining disk sectors. Together, the pools on a disk constitute a volume. Each volume has an index of all pools on that volume.

One volume is known as the System Residence Volume (SYSRES). This contains all the basic system software such as that required for loading. Other volumes may also be designated as SYSRES volumes.

LIOCS provides logical access to records in data files and allows simultaneous access to system resources by using contention control. The contention control feature also allows files to be shared between two or more programs running simultaneously and allows records to be added and updated by all the programs. Contention control is included automatically in all system support programs and all user-written programs which use the LIOCS routines.

The LIOCS package, which resides in the common area of store, occupies a minimum of 37KB. Mandatory modules ▶

▶ consist of the input/output software and the software for the more common disk access methods. Optional modules support the less common access methods.

LANGUAGES: These consist of Cobol ANSI 74, RPG II, Assembler III and Assembler II. The Cobol is a low level compiler (below Level 2). RPG II is currently limited to its System Ten specification and does not fully exploit DMF III facilities. Assembler III comprises the commands of System Ten's Assembler II with additional commands, taking advantage of the System 25 architecture. Assembler II programs can run on System 25.

UTILITIES: System maintenance and housekeeping facilities are included in the Conversational System Manager (see Operating System section).

The DMF III SORT program can be used to create a sorted output file on disk or to prepare print files.

The DMF III Text Editor utility (also called EDIT) is a source-program editor for interactive entry and modification of user programs. It can be used to add, modify or delete source statements. Text Editor is also used to edit job stream files, either as part of an application, or on-site by the user. All files used with Text Editor must be linked sequential and must reside in a linked sequential pool.

A Link Editor program is available on System 25 to allow "modular" programming; a program may be written as several separate relocatable modules which may be individually assembled, then linked into one executable program.

TESTER, a conversational debugging aid, can be used to run a program and provide a trace on all or selected program instructions as they are encountered. For each instruction traced, diagnostic information on the condition existing at that point in the program is provided.

Interactive Application Support (IAS) is an optional development aid for use by the Cobol or Assembler programmer. The application programmer can produce device independent applications, with IAS managing the configurations of multiple applications running on one VDU, multiple VDUs per Input/Output channel or a mix of different types of VDU or different types of printer. A number of validation routines, such as range checking and check digit routines, are also available, together with interfaces to high level languages and automatic reusable program testing facilities. The result of using IAS, according to ICL, is a considerable simplification and reduction in the amount of code which must be included in any application program and enhanced operational facilities. IAS can run concurrently with non-IAS applications.

For the inexperienced user, a HELP facility is available as part of the Conversational System Manager. On entering the command 'HELP,' the operator is provided with information concerning system commands and program and job stream file loading.

A CLOCK program is available on System 25 for use in realtime programming. It occupies a 3KB memory partition, receiving information from the clock input/output channel and updating a field in common storage once every second.

A spooling facility is available with models 71, 72 and 73. It enables spooling by intercepting print commands from selected individual partitions.

COMMUNICATIONS SOFTWARE: The Communications Access Manager (CAM), a combination of firmware for the network coupler and associated system software, provides various communications facilities between System 25 and either a remote mainframe computer (ICL or non-ICL) or a remote peripheral. For further details see Communications Control section.

Word processing, TEXT 25, is available on System 25 using specialized VDUs (Model 3487).

ICL's 9500 Retail Business System and 9600 Factory and Attendance Terminal Systems both comprise specialist terminals and supporting software. They may be driven by the System 25 as a terminal controller. The applications performed by the factory systems include job-logging, recording stock issue from stores, and checking time and attendance records.

ICL offers a wide range of business application packages for the System 25, many of which originate from System Ten. The following are among those areas served: accountancy, advertising, airlines, banking, brewing, chemicals, construction, department stores, engineering, food, footware, furniture, hardware, insurance, jewelry, law, mail order, mining, motor manufacture, office supplies, plumbing, printing, publishing, stockholding, transport, wines and spirits.

PRICING

POLICY: ICL offers the System 25 on a purchase or rental basis, 1-year, 3-year and 5-year schemes are available, with quarterly payments for the equipment and for maintenance.

SOFTWARE: System software is not included in the price of the System 25. It is licensed separately, with typical quarterly license charges for small, medium and large configurations as given in the Equipment Prices section.

EQUIPMENT PRICES: Prices of typical small, medium and large configurations are given below.

SMALL SYSTEM: System 25 Model 42 with 320KB memory, 2 local VDUs and a 120 cps matrix printer; purchase price £21,500. Quarterly maintenance charge £467. Quarterly license charge for system software; £96.

MEDIUM SYSTEM: System 25 Model 65 with 320KB memory, 8 local VDUs, a 300 lpm line printer and two additional 4 IOC T Couplers; purchase price £52,500. Quarterly maintenance charge £1,035. Quarterly license charge for system software; £126.

LARGE SYSTEM: System 25 Model 71 with 640KB memory, 8 local and 2 remote VDUs, 600 lpm line printer and remote 120 cps matrix printer, one additional 4 IOC T Coupler, network coupler; purchase price £88,000. Quarterly maintenance charge £1,588. Quarterly license charge for system software; £390.■