Dictionary of COMPUTING

Data Communications
Hardware and Software Basics
Digital Electronics

Edited by
FRANK J. GALLAND

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Preface

This dictionary is designed to assist the student of programming, systems analysis, operating, or field engineering to obtain more knowledge from the instruction manuals, books, magazines, and product specifications that he/she will encounter. It is intended to be useful to both beginning and advanced students. The dictionary may also be useful to technical writers, instructors, managers, members of data processing staff, and others who have a need to deal with the terms and technology of modern computing.

The dictionary has been compiled by British and American technical authors with extensive current experience in writing instruction manuals and training manuals in the fields of mainframe and minicomputer software, microprocessor systems, word processing, and data communications hardware and software. Valuable assistance has been provided by British Telecom and the U.K. training departments of International Computers Limited, Digital Equipment Corp., and Honeywell Information Systems in arranging for members of staff to read and comment on relevant portions of the typescript in progress.

Many manufacturers of computers, computer equipment, and supplies have assisted by providing glossaries, product specifications, and instruction manuals. We wish to particularly thank International Business Machines, International Computers, Honeywell Information Systems, Digital Equipment Corp. Racal-Milgo, Hewlett Packard, Data Recording Instruments, Control Data Corp., Texas Instruments, Computer Technology, Ltd., Data General Corp., 3M Data Recording Products, and Motorola Semiconductor Products. Major inputs have been obtained from books/documents produced by the International Organization for Standardization (ISO), the Consultative

Committee on International Telephone and Telegraph (CCITT), the British Standards Institution (BSI), the National Computing Centre (NCC), and the Infotech State-of-the-Art Reports. Many entries have been obtained from the British and American computer press; particular mention is due to Systems International, Datamation, New Electronics, EDN, Computer Weekly, and Computing.

We have attempted to include the 'computer room' and jargonistic usages as well as the terms of more formal application. An illustration is provided where it can be of help in explaining an operation, device, or concept. Extensive cross-referencing is provided to assist in following a topic of interest or in locating supporting entries. Every effort has been made to ensure that definitions are accurate, clearly written, and understandable without prior knowledge of the subject.

Any errors of fact or interpretation are the responsibility of the Editors and Datology Press and not of the sources of information.

Windsor, April 1982

THE EDITORS

General Editor: *Frank J. Galland*

Associate and Contributing Editors:

Christopher M. Johnson

Erica W. Holding

Peter J. Bloxsom

The word list - The word list has been obtained from the publications of recognised international organisations, the British and American computer and electronics press, and the product specifications and instruction manuals of the major software development organisations and manufacturers of computers, computer peripherals, data communications equipment, data media, and microelectronic devices. The dictionary contains more than nine thousand definitions.

Definitions - The language of definition is kept as simple as possible, consistent with completeness and precision and the avoidance of repetition of more basic material contained in other entries. Where applicable, cross references are provided to identify the location of more basic information. All specialised or technical terms used in definitions are, themselves, defined elsewhere in the dictionary.

Basics - Often the understanding of a computer or electronic operation requires a degree of familiarity with more basic principles. A number of basic entries are, therefore, provided to improve the utility of the dictionary for persons who may lack this familiarity. For examples of basic entries, see *electricity, magnet,* and *binary.*

Current and historical usage - Unless of significant historical interest, a term that is no longer in current use has been excluded from the word list. Unfortunately, it is not always possible to determine when a technology or practice has been finally abandoned and, where doubt exists, an entry is treated as current. When of historical interest, but no longer in common use, this is indicated in the language of definition. For examples, see *magnetic drum, store and forward,* and *delay line memory.*

Abbreviations - Treatment of abbreviations varies widely among publishers and equipment manufacturers, and between the U.S. and the U.K. For consistency, most abbreviations are in capital letters and without periods (a

solidus may be included). If the abbreviation has current acceptance in another form, it is included in parentheses immediately following. The first (or only) parenthetical form is usually the one of widest acceptance. For examples, see *AC, BPS, CL,* and *OPS.*

Substandard usage - No judgements are made as to merit, or relative merit, of terms except that a term that would be considered questionable by many computer practitioners may be so identified by a 'sometimes' or 'has been'. For examples of treatment, see *direct access, graunch, bucket brigade,* and *command (def. 5).*

Terms of narrow application - A term that is used by a single manufacturer (or, possibly, by a small minority of manufacturers) is usually so identified by the term 'in some systems'. For examples, see *index field* and *instruction processor.*

Synonyms and equivalent terms - When two terms are synonyms or identify essentially the same unit of hardware or software, usually only a single definition is provided and this definition identifies the other terms following an 'Also'. The other terms have individual entries with a reference to the 'main' entry. For examples, see *electron tube* and *hesitation.*

Terms with multiple meanings - All known meanings of a term that apply to computing and related fields are included. When the meanings are closely related and/or when second and subsequent meanings are of infrequent application, the definitions are numbered within a single entry. The ordering is by approximate frequency of use. When there are two or more reasonably significant meanings that are not closely related, separate entries are used. For examples, see *array, block, key,* and *filter.*

Examples of context - An example of context is given wherever the correct (common) usage of a term is not obvious from the definition. Such terms are often 'spoken' or jargonistic. Multiple examples are also used to indicate differences in application. For examples, see *active, delete, package,* and the several *load* entries.

Examples - Examples are provided to show differences between similar meanings, to indicate type or class, and to help explain operations. A 'work-through' example is provided for each mathematical operation. See *automatic, bind, binary arithmetic,* and *Hamming code.*

Cross references - A reference to another entry is provided following a 'See' at the end of a definition. A reference may be to a more basic term, to specific entries included in a generic term, to a synonym that includes a full definition, or to an entry that defines a related item or concept. For examples, see *printer, block parity,* and *clock.*

Illustrations - An attempt has been made to provide an illustration wherever it would be helpful in explaining a device, electronic circuit, operation, or concept. For examples, see *analogue loop test, band, liquid crystal display,* and *operational amplifier.*

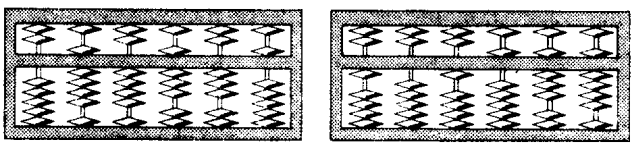
Tables - Tables are provided to illustrate number systems, logic operations, and codes. For examples, see *hexadecimal, biquinary code, truth table,* and the *Logic Operation Table.*

Collating sequence - Spaces collate before letters; for example, *answer tone* collates before *answerback*. The solidus and hyphens used to form prefixes do not collate; for example, *de-suspend* collates after *destructive read*. All other hyphens collate after spaces; for example, *high-threshold logic* collates before *highlight*.

Indexing - Each right-hand (odd numbered) page contains a thumb index with the first letters of the first entry on the facing left-hand (even numbered) page and of the last entry on the indexed page. This indexing method permits rapid location of required entries. (Individual entries must be checked to locate an entry in a sequence of pages in which the first letters remain unchanged.)

A

abacus A device for performing addition and subtraction by moving beads (counters) on rods. It is a biquinary device; a bead above a dividing bar is equal to five beads below the bar. Each rod holds the beads that total a decimal digit and, as in conventional representation, the leftmost rod holds the most significant digit. If a decimal point is required, the position can be marked or remembered. A bead is selected (used to form a digit) by moving it towards the bar. Whenever a rod holds '10',



it is cleared (by moving its beads toward the frame) and a single, lower bead is moved towards the bar on the next rod to the left. In the Ilustration on the left, the bead positions represent 94835. The illustration on the right shows the positions after adding 6754. The device shown is the Chinese 'suan-pan'. The Japanese 'sorobon' has only four beads below the bar and a single bead above it and, thus, eliminates the (unnecessary) facility for holding '10' on a rod.

abandon With respect to an operation; to terminate it before completion; to deallocate resources and leave it in an unfinished state. See *abend; abort.*

abend *ABnormal END of task.* Termination of a task prior to its completion because of an error condition that cannot be resolved by the recovery facilities that operate during execution. See *abort; recovery; error; restart.*

abnormal condition Any condition (hardware or software) that requires correction before processing can continue

abnormal end of task See *abend.*

abnormal ending See *abend.*

abnormal termination With respect to processing; termination before results are produced or before the usual end condition is reached.

abort (1)To discontinue program execution, release allocated main storage, and close files at a point during execution other than a normal exit point. It is usually done because of an error condition that prevents further execution. (2)To terminate any operation prematurely. See *abandon.*

ABS *Air Bearing Surface.*

absolute addressing (1)The addressing of main storage locations by their absolute addresses; the method of a control unit after any required address modification has been completed. See *address modification; direct addressing.* (2)Addressing in which instructions in object code are absolute addresses. (3)The addressing mode of absolute coding.

absolute coding Also *absolute programming; specific coding.* Source coding that makes use of no programming language;

coding in which the programming input consists of absolute addresses and operators in their machine code (bit pattern) form. It may be used to code a patch or to write a (simple) program for a microprocessor.

absolute data In computer graphics; display data in which all display elements are expressed as coordinates (X and Y displacements) from a common origin. See *relative data; vector scan.*

2

absolute error (1)The algebraic difference between a value that is in error and the true or correct value; the error described by its magnitude and without considering whether the error value is greater or less than the true or correct value. (2)An error expressed in the same units as the value to which it relates (and not as a ratio or percentage). See *relative error.*

absolute generation number a generation number in sequence from the first generation number assigned to a file; it is incremented by one each time a new generation is created. See *generation.*

absolute instruction An effective instruction; an instruction in final, executable form.

absolute language Machine language.

absolute operator In an instruction; an operator that is in its executable, machine code form.

absolute program A non-relocatable program; an object program in which the addresses are absolute (hardware) addresses. See *absolute address; relocatable program.*

absolute programming Absolute coding.

absolute term A term whose value is not affected by relocation of the program in which it is contained.

absolute value (1)An absolute term. (2)A value considered only with respect to magnitude and not to sign.

absolute vector In computer graphics; a vector (line segment) with end coordinates specified as X and Y displacements from a point designated as the origin.

absolute zero The temperature (--273° C.) at which molecular activity ceases; the temperature just below the boiling point of hydrogen. See *cryogenic memory.*

abstract symbol A symbol without a generally established meaning or significance; a symbol that must be defined for the application in which it is used.

AC (A.C.) *Alternating Current.*

ACC *ACCumulator.*

acceleration time (1)With respect to a magnetic tape access; that part of access time in which the tape speed is increased to the speed required for reading or writing. (2)With respect to a magnetic disc drive that has been stopped; the time required for the spindle to reach the speed at which normal read and write operations can be performed.

accept By a task; to receive an input without a detected error.

access (1)With respect to a unit of code or data; to locate it in computer storage and use it in processing. The term may be applied to action by a user, user program, member of DP staff, or system software and the unit of code or data can be anything from a subroutine to a data base. (2)To identify a backing storage location and a main storage location and initiate a transfer from the backing storage location to the main storage location. In this sense, the term applies to an action by user program or system software and refers to the transfer of such units as blocks, buckets, pages, and segments. See *direct access.* (3)Also *address.* By an instruction during decoding; to produce an address of a storage location to or from which a transfer is to be made. See *address (Data transfers); reference.* (4)By a control unit; to receive or derive two addresses and transfer bit patterns between them. Unless otherwise indicated, one address is in main storage and the other is of a control unit or arithmetic unit register. See *store; fetch.* (5)With respect to a file; to write records to it or read records from it. See *sequential access; serial access.* (6)With respect to a storage medium; the physical operation of writing bits to it or reading bits from it.

access arm Also *seek arm.* The element of a movable-head magnetic disc unit that supports one or more read/write heads and is moved by the servo unit when changing cylinders. See *magnetic disc unit.*

access bits Also *access control bits.* Bits associated with an identifier of a volume or unit of code or data (page; segment) in an index or table to specify the type of access (read; write; execute) permitted. See *access restriction; use bits.*

access control (1)The process of defining and limiting the access rights of individuals or programs to the data in computer storage. See *access right; access restriction; storage protection; access control register.* (2)The process of limiting the rights of individuals to enter areas or use equipment.

access control levels See *storage protection; access control register.*

access control register (ACR) In some systems; a register used to hold dynamically changeable values that specify the access

rights of concurrent programs during the various phases of their execution. For example, during most of its processing time a program may have a high number that restricts it to its own code and data, while, during certain phases, it may have a lower number that permits it to access certain system routines or shareable segments. (The lowest numbers that permit broad access are reserved for the operating system.) Such numbers may be termed **access control levels**. See *protection rings; storage protection.*

access frequency loading The ordering of records in magnetic disc files in such a way that those most frequently accessed are in storage locations with short access times. Typically, it involves placing such records in home locations on the same track or cylinder to reduce seeks and table lookups.

access method A method by which an item of data is located in storage. See *access mode.*

access mode (1)The type of physical access being performed (read; write; execute). (2)The type of file access being performed (serial; sequential; skip sequential). (3)Access right (def. 3).

access path A sequence of pointers that can be followed to access items of a certain type in a data structure. See *pointer; chain; net; tree.*

access restriction (1)A limitation on the code or data that can be accessed by a program during execution. (2)A limitation on the type of access that can be made to a volume or other unit of storage; the usual ones are 'read' and' 'execute'. (3)A limitation on the use of computer equipment or presence in computer areas.

access right (1)The right of an individual or group to use the resources of a computer system; for example, to have batch jobs run or to make enquiries via a terminal. (2)The right of a user or program to access a particular unit of code or data. See *storage protection.* (3)Also *access mode.* The type of access permitted to a program with respect to a unit of code or data; the usual ones are 'execute', 'read', 'write', 'read/write', and 'append'.

access time (1)The time between receipt of an instruction in a control unit register and the completion of transferring a bit pattern between two internal storage locations, at least one of which is identified in the instruction. (2)The time between the generation of an address of a location in backing storage by a control unit or peripheral controller and the completion of a data transfer between the location and main storage. (3)The time for a read signal to go from the external interface of a storage unit or device to the storage medium and to read the first bit (or first bit pattern, if reading is bit-parallel) back out across the interface. The following are some representative access times: (A single figure indicates that the storage is experimental or no longer in common use.)

BIPOLAR SEMICONDUCTOR	
Emitter-Coupled Logic (ECL)	15-30 ns.
Schottky TTL	25-50 ns.
Transistor-Transistor Logic (TTL)	30-90 ns.
Integrated Injection Logic (I^2L)	30-150 ns.
Resistor-Transistor Logic (RTL)	40-100 ns.
Diode-Transistor Logic (DTL)	50-100 ns.
ROM (Mask programmed)	25-50 ns.
PROM (Fusible link)	40-100 ns.
Memory cycle (TTL RAM)	300-500 ns.
UNIPOLAR SEMICONDUCTOR	
Gallium arsenide	100 ps.
N-Channel MOS (NMOS) Static RAM	55-500 ns.
N-Channel MOS (NMOS) Dynamic RAM	150-400 ns.
Complementary MOS (CMOS) Static RAM	180-350 ns.
P-Channel MOS (PMOS) Static RAM	300-1000 ns.
ROM (NMOS Mask programmed)	50-80 ns.
PROM (Fusible link)	50-100 ns.
EPROM (FAMOS, U.V. erasable)	300-600 ns.
EAROM (MNOS)	350-2000 ns.
Memory cycle (NMOS Static RAM)	350-650 ns.
MAGNETIC	
Plated Wire	125-250 ns
Three-dimensional Core	200-400 ns.
Two-dimensional Core	500-750 ns.
Thin Film	250-400 ns.
Memory cycle (3D Core)	500-1000 ns.
BEAM ACCESSED	
Holographic	20 ns.
BEAMOS	50 ns.
Electrostatic	4-10 μs.
Photodigital	1-10 sec.

RECIRCULATING

Cryogenic	10 ps.
Charge Coupled Device	400-800 μs.
Sonic Delay Line	750 μs.
Bubble	4-20 ms.

MAGNETISABLE SURFACE

Magnetic Drum	8-10 ms.
Fixed-head Disc	8.3-12 ms.
Movable-head Disc	30-75 ms.
Flexible Disc	100-800 ms.
Magnetic Card	100-450 ms.
Magnetic Tape	1-50 sec.

accessor In a mass storage system; the mechanism that transports data cells between their storage locations and the read/write location.

account (1)A record of debits and credits to a particular customer or to some aspect of an organisation's operations; ('the Redfern account'; 'the Vehicle Operations account'). (2)A user; an individual or organisation to which computer services are supplied.

account number In some systems; a customer identification number.

accounting (1)The profession or activity involved in establishing and verifying financial records. (2)The operations by a computer operating system and/or operators relating to recording usage of computer resources for purposes of charging or debiting users.

accounting check digit A self-check digit.

accounting computer See *visible record computer.*

accounting machine A non-computerised, keyboard-actuated office machine used to perform calculations and prepare accounting records; for example, a billing machine or a tabulator.

accumulate (1)To gather together in one place. (2)To form the results of an operation in an accumulator.

accumulator (1)An arithmetic-unit register that has an associated full adder. It is used to hold operands and partial results when performing arithmetic and logic operations. See *register; adder.* (2)In some systems; a main storage location in which the results of arithmetic/logic operations are 'accumulated'.

ACK *ACKnowledge.* A transmission control character indicating that a block or message has been received without a detected error. See *NAK.*

acknowledge (1)By a terminal operator or computer; to send a character or other short message to indicate that the previous message has been received. (2)By a console operator; to press a key or otherwise indicate to an operating system that a message has been received. (3)By receiving hardware in a data link; to send a short message indicating that a message or block has been received without a detected error. See *ACK.*

acoustic Concerning audible sound and its generation, transmission, or use.

acoustic coupler An elementary low-speed modem used with an ordinary telephone to couple an asynchronous terminal (say, a Teletype) to a dialed circuit. When a call is connected, the handset is placed in a cradle on the device to send and receive data.

acoustic delay line A delay line in which signals move at the speed of sound through some medium such as mercury. See *delay line.*

acquisition See *data acquisition.*

ACR *Access Control Register.*

acronym A pronouncable 'word' made up of letters taken from a word or group of words (say, a name or phrase), usually in the order in which they appear. For example, 'COBOL' is an acronym formed from 'Common Business Oriented Language'. See *symbol; mnemonic.*

action paper Carbonless copy paper.

activate (1)To prepare a system or functional unit for use. (2)To place a unit of hardware or software into operation. (3)To execute a module of reentrant code.

active (1)Being used; ('an active line'; 'an active peripheral'). (2)Characterised by frequent use; ('an active file'). (3)Resident in main storage or being processed; ('an active program'; 'an active segment'). (4)Not passive; ('an active element').

active element See *element.*

active element group (a.e.g.) One storage cell or one logic gate (in an integrated circuit).

active job A job that is being processed or in the job queue.

active set See *virtual storage system—processing units.*

activity (1)That which is done or performed; ('a data control activity'). (2)A process. See *process (Processing unit).*

actual address A real address. See *address.*

actual decimal point A decimal point that is represented by a coded character and thus occupies a byte or character of storage, as contrasted to an assumed decimal point. See *assumed decimal point.*

actual storage Also *real storage; physical storage.* Any hardware addressable storage in a virtual storage system.

A/D *Analogue to Digital.*

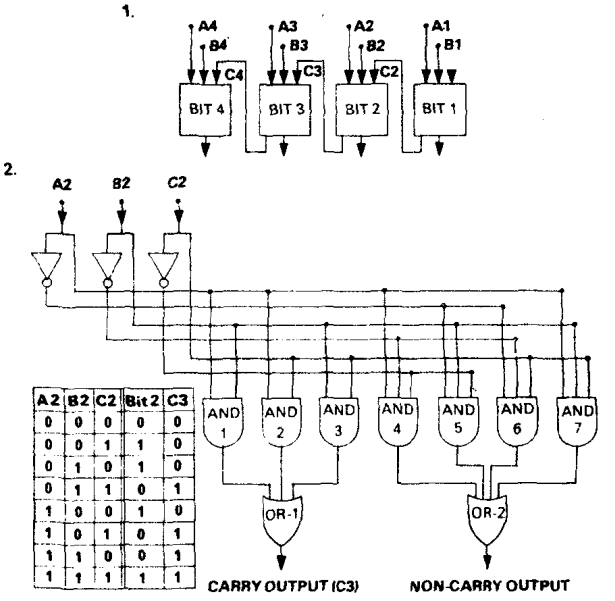
Ada A general-purpose, high-level language developed under U.S. military sponsorship and now available on many computers for scientific and industrial applications.

ADC *Analogue to Digital Converter.*

ADCCP *Advanced Data Communications Control Procedure.*

addend See *augend.*

adder **(1)**An element of an arithmetic unit that can add the contents (binary numbers) held in two registers. It may be a **carry-look-ahead adder** that adds the bits in all bit positions simultaneously or a **ripple-carry adder** (also **serial adder**) that adds the bits in the least-significant bit positions first and outputs the results to the next bit position with the operation performed in successively higher bit positions until the bits in all register positions have been added. Such an adder is shown in Fig. 1, it consists of multiple 'adders' by Def. 2. **(2)**A combining logic circuit that can input pulses representing bits and output pulses representing their sum. A **full adder** can input two bits and a carry bit (if there is one) and output a bit that represents their total plus a carry bit (if there is one) for the next stage of addition. A one-bit full adder is shown in Fig. 2. If A2 and B2 are both high (both represent 1-bits) then the only output is from AND-1 which is input to OR-1 to cause a high carry digit C3 which is input to the adder of next higher bit position. (Other inputs and results can be traced with the aid of the Truth Table.) A **half adder** is the same as a full adder except that it has no provision for outputting a carry digit.



A2	B2	C2	Bit 2	C3
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

address (Communications) The part of a message that identifies the intended recipient and/or the sender. See *interchange address; terminal address.*

address (Computer storage) A bit pattern that uniquely identifies a storage location, or a word, symbol, character, or number from which such a bit pattern can be derived. **absolute address** (1) An address in an instruction that is a hardware address (def. 1). (2) A hardware address (def. 1). **actual address** A real address. **base address** The lowest numbered location in a storage area; a value from which other addresses in the area are expressed as displacements. See *relative address.* **direct address** Also *one-level address.* An address in a machine code instruction that is converted to a hardware address in a single step (say, by adding it to a base address or applying an algorithm). **effective address** A hardware address (def. 1) obtained by address modification. See *presumptive address.* **hardware address** (1) Also *absolute address.* A bit pattern (binary number) that is interpretable by logic circuits in a control unit to set up a data transfer path to a location in main storage. (2) As definition 1 but including backing storage. **indirect address** Also *multilevel address.* An address in a machine code instruction that is a pointer to a location in a table or index that holds either an effective address or another pointer. See *address modification.* **physical address** A bit pattern interpretable by logic circuits in a control unit and/or peripheral controller to set up a data transfer path to a location in backing storage. **presumptive address** A symbolic address or an address in a machine code instruction that, when modified, produces an effective address. **real address** Also *actual address.* (1) A hardware address (def.

1); particularly in a virtual storage system. See *virtual storage addressing.* (2) An address other than a virtual address; a 'real address' (def. 1) or a physical address. **relative address** (1) In a machine code instruction; an address that is a displacement from another address. See *base address.* (2) In a low-level language; an address expressed as a displacement from another address; ('NAME + 6'). **relocatable address** An address that is intended to be changed to a (new) hardware address by applying a constant; for example, an address in a subroutine that is adjusted to make it relative to the base address of a program in which it is incorporated or an effective address that is changed when the module containing it is moved in main storage. **symbolic address** An address in source language coding; for example, 'TOTAL-A'; it is usually also a mnemonic. **virtual address** In a virtual storage system; any address other than a real or physical address. See *virtual storage addressing.*

address (Data transfers) Also, in some contexts, *access.* To identify a storage location and to initiate or effect a data transfer between it and some other location. The term may be used synonymously with 'access'; when the terms are differentiated, 'address' is location-oriented and 'access' is content-oriented; ('address a block on magnetic disc'; 'access a file').

address (Display) To cause a display element to appear on a display field; an electron beam 'addresses' points on the screen of a cathode ray tube. See *display; addressable point.*

address (Instruction) The place in a fixed-format instruction where an operand can be placed.

address mapping Address modification. See *mapping.*

address mapping table A mapping table.

address modification (1) Also *address computation; address transformation; address mapping.* An operation performed during execution in which an address in a machine code instruction is converted to a hardware address. When performed in a single step (as by adding a constant or applying an algorithm) it is **direct addressing** and when two or more steps are required (usually, table/index look-ups) it is **indirect addressing** (also **indirection**). See *pointer; modifier; index.* (2)Also *indexing.* The process of changing an operand address (usually, by incrementing a count) between successive performances of a loop in order to perform an operation on or with different operands. See *index register; loop.*

address register (1)A register that is used to hold an address; ('a current address register'). (2)In a movable-head magnetic disc unit; a register that holds the cylinder number to which the heads are positioned. See *seek.*

address space The range of addresses (virtual, relative, or absolute) used by, or assigned to, a program.

address syllable The part of a source language instruction that contains an operand.

address transformation (1)A control unit and/or peripheral controller operation of producing a backing storage address from an address in an instruction. (2)Address translation. (3)Address modification (def. 1).

address translation (1)A compiler or assembler operation of changing the form of an address, usually from symbolic to relative or virtual. See *bind.* (2)Address modification (def. 1).

addressable cursor A facility of a VDU that allows external (computer) positioning of the cursor by sending X-Y coordinates.

addressable point An element of a raster; the smallest unit of the display surface of a raster-scan VDU screen that can be addressed (made bright or left dark) by the electron beam. See *raster; display.*

addrout file A file produced by an internal sort of a relative record file; a file consisting of relative record numbers (disc addresses) in the new order for file updating or revision.

ADLC *Advanced Data Link Control.*

ADP *Automatic Data Processing.*

ADT (1)*Application-Dedicated Terminal.* (2)*Active Disc Table.*

advanced data communications control procedure (ADCCP) A term applied to the operation of a data link using an advanced (SDLC; HDLC) protocol.

advanced data link control (ADLC) A link protocol as used in HDLC and SDLC systems.

advice language A language for communicating with a computer in which the system provides sophisticated guidance to a user to assist in locating items in a data base that are determined (directly or inferentially) to be of interest. See *conceptual language.*

AEG (1)*Allgemeine Elektricitats-Gesellschaft (AEG-Telefunken)* (Konstanz) (2)(a.e.g.) *Active Element Group.*

AFIPS *American Federation of Information Processing Societies.* (Montvale, New Jersey)

after journal (1)An after-look journal. (2)In some systems; a file identifying system resources and their permitted access/utilisation.

after-look journal A backup file to which changes are written for purposes of reconstructing a current master file in event of its corruption. See *before-look journal.*

after-look journalising When a file is updated; to record the new version of the updated parts in a journal file. See *journal; before-look journalising.*

agglomerate A defect in the magnetisable surface coating (say, on magnetic disc) consisting of a raised or thick area.

aggregate (1)A total. (2)A data aggregate.

aiming symbol A mark displayed on the screen of a graphics VDU and used in conjunction with a light pen to identify a point of interest.

air bearing surface (ABS) The contoured surface of the slider of a read/write head that supports the head on an air cushion in a hard-disc magnetic disc unit. See *head; fly; load.*

air boundary layer The air adjacent to a moving surface (magnetic disc) that is influenced by the surface texture and tends to move with the surface. See *fly; air cushion.*

air cushion The part of an air boundary layer that is 'trapped' between the rotating surface of a magnetic disc and the air bearing surface of a read/write head to support the head.

air gap The place in a magnet where the magnetic flux passes through air (or other non-ferrous medium). See *magnet.*

algebraic language A programming language in which many statements are constructed to resemble algebraic expressions; for example, FORTRAN and ALGOL.

ALGOL *ALGOrithmic Language.* A common programming language that makes extensive use of algorithms; it is used mainly for mathematical and scientific applications. The basic version is 'ALGOL 60' while 'ALGOL 68' is a more powerful version intended for general-purpose use.

algorithm A set of rules or procedural steps that are intended to be followed in sequence to solve a particular problem or to produce a particular result. In programming, it is usually implemented by a reentrant sequence of instructions.

algorithmic language A programming language with extensive algorithms; for example, FORTRAN or ALGOL.

alias (1)An alternate name or label by which an operating system recognises a data item, a sequence of instructions, or a device. (2)In a transmission by pulse code modulation; a spurious signal formed from harmonics of the signal frequency and the sample frequency.

alien (1)Not of the same manufacture as the other equipment; ('an alien computer'). (2)Not catered for by the facilities of the particular computer; ('an alien code').

aligned With respect to a data item in coordinate-addressable storage; placed so that its first or last bit is on an access-significant boundary. See *synchronised.*

allocatable space Also *free space.* Storage space available to an operating system for any purpose required.

allocation (1)The assignment of storage locations to programs. Unless otherwise indicated, the term, by this definition, refers to the assignment of main storage locations to user programs. The assignment of storage locations by their absolute (hardware) addresses is **absolute allocation.** A compiler function of assigning storage locations in relation to a common 'base address' is **relative allocation.** If the main storage assigned to a program remains unchanged during execution, it is **static allocation.** Allocation by an operating system to meet changing needs of programs in a multiprogramming system is **dynamic allocation.** (2)The assignment of any resource; for example, a peripheral, a communications line, or processing time.

allocation algorithm (1)An algorithm used to allocate space in primary storage to segments in a segmented virtual storage system. One such algorithm is **first fit** in which a new segment is placed in the first location (found in a free-space table) that is large enough to hold it. A **best fit** algorithm places a new segment in the smallest available space that is large enough to hold it. A **half-fit** algorithm places a new segment in the space that is closest to twice the size required to hold it. (The assumption is that segments are likely to be of about the same size during a particular phase of processing and the method thus leaves room for another segment of about the same size in the space.) See *partitioning; virtual storage partitioning.* (2)An algorithm for placing files on cylinders in magnetic disc storage.

allowance (1)The amount of a resource allocated to a user. (2)An unused portion of a budget. See *budget.*

alphabet (1)An ordered set of all the letters required to write a language, including any with diacritical marks (ä, ô) but not including punctuation marks. (2)A coded character set; for example, 'International Alphabet No. 2'.

alphabetic Of a group of characters; consisting only of letters or only of letters and spaces. See *numeric; alphanumeric.*

alphabetical order Of items consisting of letters or using letters as keys; arranged in the sequence in which the letters appear in

the alphabet. See *numerical order; collating sequence.*

alphameric Alphanumeric.

alphamosaic A term applied to a display that can contain alphanumeric characters and simple graphics elements.

alphanumeric (1)Of a character set or subset; consisting of letters and numbers and, possibly, punctuation marks and symbols. (2)Of a character string; consisting of characters from an alphanumeric set or subset. (The term may be applied to such a string that consists only of letters or only of numbers.) See *alphabetic; numeric.*

alphanumeric code A code containing both letters and numbers.

alphanumeric display device An alphanumeric VDU.

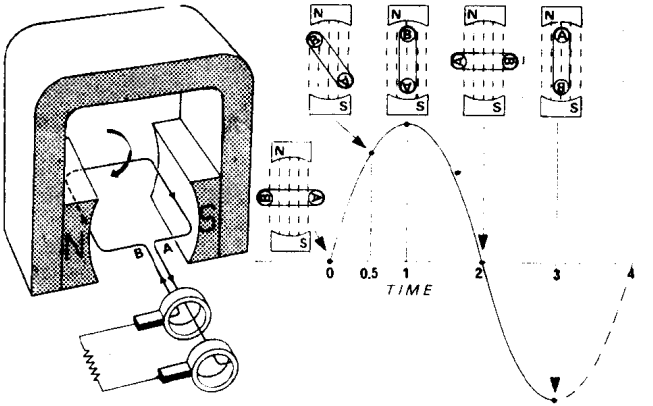
alphanumeric VDU Also *character VDU.* A VDU that can display only alphanumeric characters. See *graphics VDU.*

alternate key (1)A secondary key. (2)An auxiliary key.

alternate routing In a communications system; the use of a secondary circuit to carry messages when the primary circuit is unavailable.

alternate track On a magnetic disc; an otherwise unused track that is available as a substitute for a primary track that is found defective. See *initialisation.*

alternating current (A.C.) An electrical current that flows first in one direction and then in the other and 'alternates' rapidly between the two. Such a current is generated by an **alternator** that consists, essentially, of a coil of wire that turns in a magnetic field with each end of the coil attached to a 'slipring' by which the current is taken off through brushes. Though the term refers to current, its generation is best illustrated by the voltage generated. (Current is proportional to voltage.) The figure shows basic alternator components and the coil A-B in successive positions during rotation; the dashed vertical lines represent the magnetic flux between the poles of the alternator. At Time 0, no flux is being 'cut' by the coil and, hence, no voltage is being generated and no current flows through the external load. As the coil turns, it begins to cut lines of flux and the voltage rises, as shown at Time 0.5. A current then flows from A, through the external load, and back to B. As the coil continues to turn, the voltage at A reaches a maximum positive with respect to B at Time 1. At this time, the coil is cutting flux at the maximum rate. (At the same time, the voltage at B is maximum negative with respect to A; it is customary to assume that one side of the coil is at constant zero voltage and that all changes take place at the other end, in this case, at A.) Further rotation of the coil to Time 2 again brings it to a position in which no voltage is generated. As the coil continues to rotate, it starts cutting flux in the opposite direction and reaches Time 3 at which the voltage at A is maximum negative with respect to B. Further rotation to Time 4 brings the coil back to its starting point and one **cycle** of alternating current has been generated. The number of cycles generated per second is the **frequency** which is expressed in **Hertz** (Hz.) For example, the standard mains frequency in Europe is '50 Hz.' and in the U.S. it is '60 Hz.'. Alternating currents above about 400 Hz. are usually generated by 'oscillators' rather than rotating coils. See *sine wave; electricity; oscillator; direct current.*



alternator A generator that produces alternating current. See *alternating current.*

ALU *Arithmetic Logic Unit.*

AM *Amplitude Modulation.*

AMD *Advanced Micro Devices.* (Sunnyvale)

amend To change (to produce a better or more current version).

amendment A change or addition (to a file).

amendments file Also *changes file; update file; transaction file.* A file that contains changes that are to be used to update a master file. If, for example, the master file contains a parts inventory, the file would, typically, contain details of parts received and shipped during a certain period. Such a file may be prepared from source documents (say, weekly) by a data control department, or, in a transaction processing system, the

changes may be written as they occur. See *update*.

American National Standards Institute (ANSI) An organisation that formulates and publishes standards for voluntary acceptance by U.S. industry.

amorphous memory A memory in which the storage cells consist of some material (tellerium alloy; chalcogenide) with two stable states, amorphous and crystalline, with different electrical characteristics. See *ovonic memory*.

ampere (I; amp.) The standard unit of electric current; it is equal to a flow of electrons produced by one volt through a resistance of one ohm. See *electricity; current*.

ampere-turn In an electromagnetic device (motor; electromagnet); a current of one ampere passing through one turn (once around the iron part) of a coil. It is an indicator of the magnetic flux produced; '20 ampere-turns' could, for example, be produced by 1 amp. flowing through 20 turns or 10 amps. flowing through two turns. See *magnet*.

amplifier A device or electronic circuit that is used to increase the strength (voltage; amplitude) of weak signals; for example, a repeater in a telephone line or a **read amplifier** used to increase the strength of the weak signals obtained when reading cores in core memory. In its simplest form, it consists of a transistor with the weak signal applied to the base and the stronger signal obtained at the collector or emitter. See *transistor*.

amplitude The strength (voltage) of a signal or pulse or the amount by which a generated wave exceeds its average value. Amplitude is usually expressed relatively in 'decibels'. When signals or waves are converted to sound (as by a radio or telephone) 'amplitude' is synonymous with 'volume'; the greater the amplitude the louder the sound. See *decibel*.

amplitude equalizer A circuit in a modem transmitter or receiver that compensates for line-induced amplitude distortion of signals. See *equalizer; statistical equalizer*.

amplitude modulation (AM) A common system of modulation in which speech or data is transmitted as changes in amplitude of a carrier wave; it is the usual system of radio transmission. Where used in data transmission, AM is usually used in conjunction with frequency modulation. See *modulation*.

AN *AlphaNumeric*.

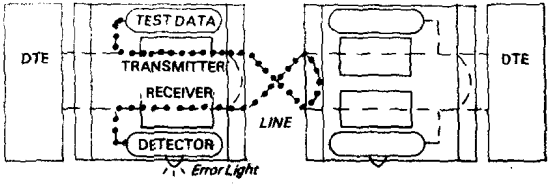
A/N *AlphaNumeric*.

analogue A term applied to a system or device in which the output at a particular time is directly proportional to the input(s) at that time. (It is a system that provides little if any storage.) The output scale or representation need not be the same as that of the input(s). In analogue, the outputs and inputs can have any values between limits as contrasted to the situation in digital devices and systems in which all values within limits can be represented only by a finite number of discrete values. Consider, for example, an analogue voltmeter and a digital voltmeter, both of which register 15 V. If the voltage increases by 0.1 V., the needle of the analogue will make a small corresponding (analogue) movement (if the device is sensitive enough) and will then record 15.1 V. If the digital meter can register only in 0.5 V. increments it will, by contrast, remain unchanged. If the digital voltmeter can register 0.1 V. increments, it will, like the analogue meter, register 15.1 V. but no matter how small the increment it can measure, there will always be some value (say, 15.11 V.) that can be registered by the analogue meter, if it is sensitive enough, that cannot be registered on the digital. Representation by analogue means can, then, be as fine as the sensitivity and calibration of the device permits whereas, in digital, it can be no finer than that represented by a change of one digit in the least-significant digit position. In addition to a 'needle' voltmeter, some other common analogue devices are a gear train, a thermometer, and a light meter. See *digital; quantising; analogue to digital; computer*.

analogue channel A communications channel used to carry speech; a channel in which signals can have any values within established limits. (As contrasted to a telegraph channel or a narrowband data channel.)

analogue computer A computer with continuously variable inputs and outputs (often voltage or gear movement).

analogue loop test A test of modem internal circuits and a telephone link by which an operator at one modem causes carrier wave or a test pattern to be transmitted to the other modem



which, in turn, retransmits it back to the testing modem. (It is used only in four-wire systems.) The modem test facilities

usually provide for the testing modem to send a distinctive command (tone or data group) which, when received, causes the other modem to assume the test mode. It is often used in conjunction with an error detection circuit that causes an error light to flash if an incorrect bit (say, a 0-bit in a sequence of 1-bits) is detected. See *digital loop test; end-to-end test.*

analogue to digital (AD; A/D) The process of converting an analogue input (voltage, most commonly) into digital form. The usual method involves a 'sample and hold' circuit in which instantaneous values are obtained at short intervals (say, every twenty milliseconds) and imposed on a capacitor. The capacitor is then discharged at a constant rate (through a fixed resistance) with a digital counter enabled during the discharge. At the end of discharge, the counter holds a digital word (commonly 6, 8, or 12 bits) that represents the time of discharge and, thus, the voltage that was imposed upon the capacitor. Other methods of conversion are 'successive approximation' in which known voltages are successively tested for equality with the voltage on the capacitor and 'flash' in which the sample voltage is applied directly to a number of parallel circuits, only one of which responds to any particular level. Analogue to digital conversion is a common operation in telemetry, process control, digital production effects, speech recognition, and in high-speed modems. See *digital to analogue.*

analogue to digital converter Also *digitiser.* A device that receives and measures an analogue input, divides it into levels or bands, and represents each level or band with a distinctive digital output. See *pulse code modulation.*

ancillary (1)A term applied to an operation or device that provides a supporting or additional function. (2)Auxiliary.

AND Also *conjunction.* A logic operation with an output that is 'true' if all of its inputs are 'true' and an output that is 'false' if any input is 'false'. See *logic operation.*

AND-NOT Exclusion (logic operation).

angstrom (Å) A unit of measurement of the wave length (and colour) of light; it is equal to 1×10^{-8} cm. (one-tenth of a nanometer; one ten thousandth of a micron). The visible spectrum extends from about 4000 Å (violet) to 7500 Å (red).

anisochronous transmission Data transmission in which there can be variable time intervals between characters and also between the bits that constitute a character. The common method of indicating when a character begins and ends is to use 'framing bits' and when these are used, it is a form of start-stop transmission. See *asynchronous transmission; isochronous.*

annotation (1)Notes made on a document for such purposes as providing references or explaining use. (2)Comment; source coding that does not result in executable code. See *comment.*

anode The part of a diode or similar device toward which electrons flow from a **cathode**; the element that is connected to positive in its most common use in circuits. See *diode.*

ANSI *American National Standards Institute.*

answer (1)To respond to an incoming telephone call by placing a telephone device in the 'off-hook' state. (2)To send a message in response to a received message.

answer mode Of a modem in a dial-up communications system; the condition in which it receives a telephone call and prepares to send or receive data. See *automatic answer; originate mode.*

answer tone In data communications on PSTN lines; a tone (2100 Hz. in Europe and 2025 Hz. in the U.S.) that can be sent by answering equipment to disable echo suppressors and to notify an operator or equipment at the other (originating) end to connect data to the line.

answerback (1)The action of providing data station or terminal identification when requested. (2)An action of a central site modem in providing a training sequence when requested by a (the) remote site modem. The request is, typically, made by either squelching carrier (point-to-point system) or sending a distinctive tone (multipoint system) when the remote site modem experiences degraded signal quality.

answerback memory A read-only memory in a unit of data terminal equipment that holds characters that identify the device or data station and which is automatically read for transmission when it is called.

anticipatory A term applied to an operation that is performed before it is needed.

anti-stream timer In a modem in a multipoint system; a timer that squelches main carrier after it has been high for some preset time (say, 3 minutes). See *stream.*

anvil A hammer; an element of an impact printer.

aperture (1)A hole. See *aperture card.* (2)A 1-bit or group of 1-bits in a mask; that which causes characters in the input to (selectively) appear in the output. See *mask.* (3)A timed period in which a state is enabled (in which an event can occur).

aperture card A card (often of standard punch card size and material) with an aperture in which a frame (or several frames)

of microfilm can be mounted for reading without removal from the card. Such cards are typically printed and/or punched to identify the microfilm; their most common use is to hold engineering drawings. See *COM.*

aperture time In a sample and hold circuit, the time after sampling that a stable 'hold' condition begins.

APL *A Programming Language.* A language designed primarily for mathematical applications, particularly ones using arrays.

apparent storage Storage in a virtual storage system as it appears to a user or user program; any storage other than real or physical storage. See *virtual storage terms.*

append To add at the end; particularly to add records at the end of a file. **append mode** An access mode in which additional records are written to a file following the last record currently in the file. See *access mode.*

application (1)A business or other operation that is performed by a computer (or with the aid of a computer) or an operation in which it appears practical to use a computer. By this definition, the term is applied to such things as preparing payrolls, maintaining inventory records, and reserving seats on aircraft. See *application package.* (2)The type of processing for which a computer is used. Examples by this definition include batch processing, transaction processing, and communications interfacing. (3)A common short form used for 'application program' and, less commonly, for 'application system', mainly in the plural; ('transfer applications to a new machine'; 'develop applications for. . .').

application data base See *subject data base.*

application-dedicated terminal (ADT) A terminal that can be used only for a specified purpose; a terminal with access limited to a particular application program or group of programs.

application package A set of programs sold as a group (package) to enable users of a particular model of computer to implement an application (def. 1) without the need to write all the necessary programs.

application program Also *application* (def. 3) and, in most cases, *user program.* A program that has been written or adapted for use in the processing required in an application (def. 1). See *user program.*

application programmer Also *programmer; problem programmer.* A person who is employed to write and/or maintain application (user) programs. See *system programmer; application program; programmer; coder.*

application suite An application system.

application system Also, often, *application package; application suite.* A group of related programs; particularly a group used to implement a large or complex application (def. 1).

APT *Automatically Programmed Tools.* A programming language used in numerical control systems for machine tools. See *numerical control.*

ARABSAT *ARAB SATellite.* A COMSAT project to provide a regional satellite communications service for the twenty-one countries of the Arab League.

architecture With respect to a computer system; a general term for the type, functions, and interconnections of the various units and devices; ('an architecture designed for batch processing'; 'new applictions requiring a changed architecture'; 'an architecture providing high resiliance').

archive Also *archives.* (1)A storage location for documents, magnetic tapes, etc. that are maintained for record purposes but seldom used. (2)Magnetic tapes (wherever located) that contain infrequently required data, files that have been temporarily deleted from direct access media, or data that must be retained for legal or other purposes. (3)A group of related documents or magnetic tapes in an 'archive' (def. 1). (4)To move data from magnetic disc storage to magnetic tape.

archive file A file in an archive (def. 1 or 2).

archiving (1)The process of writing data to an 'archive' (def. 2). (2)The process of making backup copies (for example, of disc files onto magnetic tape) regardless of purpose or the length of time the copies will be retained.

area (1)A group of contiguous locations in main storage; ('a work area'; 'an operating system area'). (2) Also *realm.* A unit of storage named in a schema. See *realm.*

argument (1)A value used to make a table lookup; for example, 'angle in degrees' is the 'argument' used to find the sine of an angle in a table of trigonometric functions. (2)An independent variable; in the expression 'a = b + c', both the 'b' and the 'c' are 'arguments'.

arithmetic The technique or operation of performing calculations. The term is usually understood to apply to addition, subtraction, multiplication, and division. See *compute.*

arithmetic check Also *mathematical check.* A programmed check in which some arithmetic operation is performed to verify that processing/transcription has been performed correctly. The term usually refers to a check performed on a

control total. See *control total.*

arithmetic fault A size error.

arithmetic instruction An instruction that specifies an arithmetic operation; an instruction with an arithmetic operator.

arithmetic logic unit (ALU) Also *arithmetic unit; mill.* That part of a central processor in which arithmetic, logic, and shift operations are performed. See *control unit; execution.*

12 **arithmetic operation** An operation with numeric inputs and outputs.

arithmetic operator An operator that specifies an arithmetic operation; for example, ADD, DIVIDE, or COMPUTE.

arithmetic overflow (1)An overflow of digits produced in an arithmetic operation. (2)The number of digits that overflow.

arithmetic register An accumulator; an arithmetic-unit register used to hold operands and intermediate results of arithmetic operations.

arithmetic scan A compilation step in which arithmetic expressions are examined to determine the order of dealing with the operators; typically, it consists of converting arithmetic expressions from infix notation to a Polish form. See *Polish notation.*

arithmetic shift See *shift.*

arithmetic unit See *arithmetic logic unit.*

ARQ *Automatic ReQuest for repetition.* A designation of a data communications system in which error control and recovery is by sending an ACK or a NAK after each block or message is received, and by the sending station retransmitting any block or message when a NAK is returned.

arrange To place items in some specified order; to make a new groupiing. See *series; sequence; sort; merge; collate.*

array (1)Also *table; dimensioned variable;* and other terms. A storage structure of one or more dimensions in which individual locations are addressed by an identifier of the structure plus one or more **subscripts** that identify particular locations or groups of locations; as many subscripts are required as there are dimensions in the array. A one-dimensional array may be termed a **string, list, row,** or **vector**, a two-dimensional array a **flat file, table** or **relation** (mainly data base usage), and an array of two or more dimensions a **matrix**. See *dimension; subscript.* (2)A unit of code or data in an 'array' (def. 1). (3)A unit of coordinate-addressable storage (core; semiconductor). (4)An integrated circuit or an assembly of integrated circuits used to accomplish a particular function; ('a programmable logic array'; 'a storage array').

array computer (1)A computer with multiple control and/or data streams. See *SIMD; MIMD.* (2)An array processor.

array processor Also *parallel processor; multiprocessor.* A small, specialised computer that is designed to perform arithmetic operations at high speed for another (mainframe) computer. Typically, such a processor consists of a number of individual microprocessors (often bit-slice devices) and their directly associated registers and microcode storage arranged in parallel 'lines', each of which performs floating-point arithmetic. All lines may perform the same operations simultaneously by multiple executions of a single set of instructions, or each line may be (microcode) programmed to perform a separate sequence of operations, each of which contributes to producing a final result. Array processors are particularly suited to performing fast Fourier transforms and other high-speed arithmetic operations as required in real-time image enhancement and manipulation of video signals and in seismic analysis and Xray tomography. Such a processor is normally dedicated to a particular function.

arrival An entrant in a queue. See *queue.*

artificial intelligence A term applied to the capability of a machine to learn (to remember what result was produced on a previous trial and to modify the operation accordingly in a subsequent trial) or to reason (to analyse the results produced in similar operations and select the most favourable).

artificial language A language that is created rather than a product of natural development; a language with a set of rules established by directive rather than determined from usage. See *language; natural language.*

ARU *Audio Response Unit.* An audio response terminal.

ASCII *American Standard Code for Information Interchange.* A standard 7-bit code (often 8-bit including parity) for data communications. The full code has 128 characters including upper and lower case letters, digits, symbols, and control characters. Most terminals use a 96-character subset that excludes the communications control characters; this subset is also a common internal storage code for minicomputers and microcomputers. Many word processors use a 64-character subset containing upper and lower case letters, numbers, and common symbols and punctuation. The code, with certain allocatable national characters, has been adopted by the International Standards Organization as ISO-7. See *code; EBCDIC.*