

SEVENTH EDITION

M O D E R N
DICTIONARY
of
ELECTRONICS

RUDOLF F. GRAF



**MODERN
DICTIONARY
of
ELECTRONICS**

SEVENTH EDITION

REVISED AND UPDATED



Rudolf F. Graf is an author whose name is well-known to engineers, technicians, and hobbyists around the world. He graduated as an electronics engineer from Brooklyn Polytechnic Institute and did his graduate work New York University. Mr. Graf has been active in the electronics industry for more than fifty years in capacities ranging from design and consulting engineer, chief engineer, chief instructor at electronics and television schools, and consulting editor. He also held various sales and marketing positions. Mr. Graf is the author or co-author of more than 150 technical articles published by major magazines. He has written about 50 books on electricity and electronics, with more than 2 million copies in print, including the best-selling *Video Scrambling & Descrambling for Satellite & Cable TV, Second Edition* and the *Circuits* series of books, both published by Newnes. A number of his books have been translated into several European languages as well as Chinese, Japanese, and Russian.

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*It gives me great pleasure to dedicate this edition to
Allison, Sheryl, Daniel, David, Russell and Scott,
the loveliest children this side of heaven.*

Preface

When the first edition of this dictionary was published in 1961, today's everyday items like color TVs, VCRs, CD players, computers, FAX machines, ATMs, cordless and cell phones, pagers, tape recorders, digital watches, pocket calculators, lasers, and many others too numerous to mention, were non-existent or mere laboratory curiosities. Since then, electronics has undergone significant changes based primarily on the meteoric expansion of integrated circuits and their apparently limitless applications. Vacuum tubes were replaced by semiconductors, and numerous technologies like ferrite core or bubble memories were relegated to the electronics graveyard. No other industry has ever grown so much and matured so fast, paced by technological advances that occur at a feverish pace. The first edition of this dictionary contained about 10,000 definitions of then current terms. And now, a scant 38 years later, this seventh edition contains approximately 25,000 terms—a clear indication of the phenomenal growth of our industry.

As technologies evolve and fresh products and concepts are introduced, suitable terminology must be developed to be able to communicate. The originators of the new words give them their initial meaning, but their exact definitions change with technological advances and through actual use by others. The contents of this dictionary is thus an analysis of words and their meanings as determined by common usage, written in a modern and popular style to provide clear and concise explanations of each entry. Continual updating of a work such as this is vital, so that those involved in the world of electronics have the power to communicate with those about them and to grasp new concepts as they emerge.

All entries are allowed as much space as is necessary for complete and meaningful definitions. Terms are explained clearly and precisely without excessive technical jargon. Original entries from the previous edition have been reviewed and many were revised to keep pace with current usage. Where more than one definition exists for a term, they are arranged numerically. This method, however, does not necessarily imply a preferred order of meanings. Important words from formative technologies that are no longer in use are retained in this edition for their historical interest.

My thanks go out to Ms. Tara Troxler Thomas and to Charles Thomas whose dedication to this project and skill at the word processor made it possible to deliver the manuscript for this work to the publisher in a timely fashion.

Industry and technical sources—notably the IEEE and the ASA—generously aided in defining many terms during the preparation of earlier editions of this work.

While this volume is as up-to-date as possible at the time of writing, the field of electronics is expanding so rapidly that new terms are constantly being developed and older terms take on broader or more specialized meanings. It is the intention of the publisher to periodically issue revised editions of this dictionary; thus suggestions for new terms and definitions are always welcome.

Rudolf F. Graf
February 1999

auto light range—The range of light (e.g., sunlight to moonlight) over which a TV camera is capable of automatically operating at specified output.

autoluminescence—The luminescence of a substance that is produced by energy within it (e.g., radioactive material).

auto-man—A locking switch that controls the method of operation (i.e., automatic or manual).

automata—A plural form of automaton.

automated communications—Combination of techniques and facilities by which intelligence is conveyed from one point to another without human effort.

automatic—1. Self-regulating or self-acting; capable of producing a desired response to certain predetermined conditions. 2. Self-acting and self-regulating; operating without human intervention; often implying the presence of a feedback control system. 3. Pertaining to a process or device that, under specific conditions, performs its functions without intervention by a human operator.

automatic-alarm receiver—Complete receiving, selecting, and warning device capable of being actuated automatically by intercepted radio-frequency signals forming the international automatic-alarm signal.

automatic-alarm-signal keying device—A device that automatically keys the radio-telegraph transmitter on board a vessel to transmit the international automatic-alarm signal.

automatic answer—A feature by which a communicating word processor, twx, etc., may receive text without an operator in attendance.

automatic back bias—A radar-receiver technique that consists of one or more automatic gain-control loops to prevent large signals from overloading a receiver, whether by jamming or by actual echoes.

automatic bass compensation—Abbreviated abc. 1. A circuit used in a receiver or audio amplifier to make the bass notes sound more natural at low-volume settings. The circuit, which usually consists of resistors and capacitors connected to taps on the volume control, automatically compensates for the poor response of the human ear to weak sounds. 2. A circuit used in some audio equipment to increase the amplitude of the bass notes to make them appear more natural at low volume settings.

automatic bias—See self-bias.

automatic brightness control—A circuit used in television receivers to keep the average brightness of the reproduced image essentially constant. Its action is similar to that of an automatic volume-control circuit.

automatic call—A communications feature that allows a transmission control unit to automatically establish a connection with one or more message recipients.

automatic call distributor—See ACD.

automatic calling unit—Abbreviated ACU. A dialing device, supplied by the communication common carrier, that permits a business machine to dial calls automatically over the communication networks.

automatic carriage—A control mechanism for a typewriter or other listing device that can automatically control the feeding, spacing, skipping, and ejecting of paper or preprinted forms.

automatic check—An operation performed by equipment built into an electronic computer to automatically verify proper operation.

automatic chrominance control—A color-television circuit that automatically controls the gain of the chrominance bandpass amplifier by varying the bias.

automatic circuit breaker—A device that automatically opens a circuit, usually by electromagnetic means, when the current exceeds a safe value. Unlike

auto light range — automatic digital network

a fuse, which must be replaced once it blows, the circuit breaker can be reset manually when the current is again within safe limits.

automatic coding—A technique by which a digital computer is programmed to perform a significant portion of the coding of a problem.

automatic color purifier—See automatic degausser.

automatic computer—A computer capable of processing a specified volume of work without a need for human intervention other than program changes.

automatic connections—Connections between users made by electronic switching equipment without human intervention.

automatic constant—In a calculator, a provision that allows the user to multiply or divide a series of numbers by the same divider or multiplier without reentering each time.

automatic contrast control—A television circuit that automatically changes the gain of the video intermediate-frequency and radio-frequency stages to maintain proper contrast in the television picture.

automatic controller—A device or instrument for measuring and regulating that operates by receiving a signal from a sensing device, comparing this signal with a desired value, and issuing signals for corrective action.

automatic crossover—1. A type of current-limiting circuit on a power supply provided with an adjustment for setting the short-circuit current to an adjustable maximum value. 2. A term applied to bimodal power supplies (constant voltage/constant current) that describes the transfer from one operating mode to the other at a predetermined value of load resistance. Usually the crossover point is preset by means of front panel controls.

automatic current limiting—An overload-protection mechanism designed to limit the maximum output current of a power supply to a preset value. Usually it automatically restores the output when the overload is removed.

automatic cutout—A device, operated by electromagnetism or centrifugal force, to automatically disconnect some parts of an equipment after a predetermined operating limit has been reached.

automatic data processing—Abbreviated ADP. The processing of digital information by automatic computers and other machines. Also called integrated data processing.

automatic data-processing system—A system that includes electronic data-processing equipment together with auxiliary and connecting communications equipment.

automatic degausser—Also called automatic color purifier and degausser. An arrangement of degaussing coils mounted around a color-television picture tube. These coils are energized only for a short while after the set is turned on. They serve to demagnetize any parts of the picture tube that may have been affected by the earth's magnetic field or the magnetic field of any nearby home appliance.

automatic dial—A communications feature whereby a calling unit has the ability to automatically establish a connection with one or more message recipients.

automatic dialer—1. Device that will automatically dial any of a group of preselected telephone numbers. 2. A device that automatically dials telephone numbers on a network.

automatic dialing unit—Abbreviated ADU. A device capable of generating dialing digits automatically.

automatic digital network—Automatic communications network for end-to-end message-switched digital data communication.

brush discharge—An intermittent discharge of electricity that starts from a conductor when its potential exceeds a certain value but is too low for the formation of an actual spark. It is generally accompanied by a whistling or crackling noise.

brush-discharge resistance—See corona resistance.

brush fluxing—A specialized wave-solder technique. A 360° bristled brush rotates in a foaming flux head to transfer the flux to the board. See also spray fluxing; wave fluxing; foam fluxing.

brush rocker—A movable rocker, or yoke, on which the brush holders of a dynamo or motor are fixed so that the position of the brushes on the commutator can be adjusted.

brush station—In a computer, a position where the holes of a punched card are sensed, particularly when this is done by a row of brushes sweeping electrical contacts.

brute force—The use of seemingly inefficient design in order to achieve a desired result. Sometimes this is done in order to avoid involved design procedures, critical adjustments, or the like, but often it is the only possible approach. For example, the miniaturization of low-frequency speakers requires brute force in the form of greatly increased amplifier power.

brute-force filter—A type of power-pack filter that depends on large values of capacitance and inductance to smooth out pulsations, rather than on the resonant effects of a tuned filter.

brute supply—A power supply that is completely unregulated. It employs no circuitry to maintain the output voltage constant with a changing input line or load variations. The output voltage varies in the same percentage and in the same direction as the input line voltage. If the load current changes, the output voltage changes inversely—an increase in load current drops the output voltage.

BSC—Abbreviation for binary synchronous communications. A line-control procedure for communicating, expressed in eight-bit EBCDIC, seven-bit U.S. ASCII, or six-bit transcode. The data code selected must include the required line-control characters, used according to specified rules.

B-scope—A type of radarscope that presents the range of an object by a vertical deflection of the signal on the screen, and the bearing by a horizontal deflection.

"B" service—FAA service pertaining to transmission and reception by teletype or radio of messages containing requests for and approval to conduct an aircraft flight, flight plans, in-flight progress reports, and aircraft arrival reports.

B-spline—A mathematical representation of a smooth curve.

B-spline surface—The mathematical description of a three-dimensional surface that passes through a set of B-splines.

BSS—See broadcasting-satellite service.

B supply—A source for supplying a positive voltage to the anodes and other positive electrodes of electron tubes. Sometimes called B+ supply.

BT-cut crystal—A piezoelectric plate that is cut from a quartz crystal at an angle of rotation (about the x-axis) of -49°. At approximately 25°C it has a zero temperature coefficient of frequency.

bubble—See dot, 2.

bubble logic—An obsolete form of magnetic logic.

bubble memory—1. A bubble-memory chip surrounded by the two orthogonal coils, sandwiched between two permanent-bias magnets, which provide nonvolatility and stable domains. The coils create a rotating magnetic

field that moves bubbles or cylindrical magnetic domains through a film on the chip. Films may consist of magnetic metals or synthetic ferrite or garnet crystals. In addition, control functions are located in aluminum-copper elements on the magnetic film. This entire grouping is then enclosed in a magnetic shield to prevent external magnetic fields (up to about 20 oersteds) from affecting the data. 2. A device that stores data as the absence or presence of tiny right-cylindrical domains of magnetization in a magnetic medium. Bubble memories operate as shift registers with complex control signals for the various magnetic fields required. 3. A nonvolatile storage technique that uses magnetic fields to create regions of magnetization. A pulsed field breaks the regions into isolated bubbles, free to move along the surface of the crystal sheet that contains the regions. The presence or absence of a bubble represents digital (bit, not bit) information. External electromagnetic fields manipulate the bubbles (information) past read/write locations within the memory. 4. Serial-access nonvolatile memory storing data in magnetic domains (bubbles) of opposite polarity from the rest of the cell. It is characterized by very low access times and high cost, but is able to store data after power is removed. This nonvolatility makes it well suited for portable applications in which disk storage is impractical. (Note: Bubble memories are no longer used.)

bubble sort—A sorting algorithm for putting the elements of a file in order.

buck—To oppose, as one voltage bucking another, or the magnetic fields of two coils bucking each other.

bucket—A general term for a specific reference in storage in a computer, such as a section of storage, the location of a word, a storage cell, etc.

bucket brigade—1. A shift register that transfers information from stage to stage in response to timing signals. 2. A technique of building a photosensing array using field-effect transistors (FETs). Two FET amplifiers are at each sensing area and are interconnected as an element of a shift register. The charges sensed by the FETs are successively clocked from element to element. The electrical charges representing bits of stored information are transferred from one element to the next by means of clock pulses that raise the level of each element in the correct sequence, in the same way as a firefighting brigade passes a bucket of water down the line.

bucket curve—A graphical presentation of noise within a microwave system, displayed in a form that permits separation and identification of the individual idle and intermodulation (IM or cross-modulation) impairments.

bucking—Counteracting one quantity (such as a current or voltage) by opposing it with a like quantity of equal magnitude but opposite polarity.

bucking coil—A coil connected and positioned in such a way that its magnetic field opposes the magnetic field of another coil. The hum-bucking coil of an electrodynamic speaker is an example.

bucking voltage—A voltage that is opposite in polarity to another voltage in the circuit and hence bucks, or opposes, the latter voltage.

buckling—The warping of the plates of a battery due to an excessively high rate of charge or discharge.

buffer—1. A circuit or component that isolates one electrical circuit from another. Usually refers to electron-tube amplifiers used for this purpose. 2. A vacuum-tube stage used chiefly to prevent undesirable interaction between two other stages. In a transmitter, it generally follows the master-oscillator stage. 3. An isolating circuit used in an electronic computer to avoid reaction of a driven circuit. 4. A storage device used to compensate for a difference in the rate of flow of information or the time

or occurrence of events when transmitting information from one device to another. 5. A computer circuit having an output and a multiplicity of inputs and designed so that the output is energized. Thus, a buffer performs the circuit function equivalent to the logical OR. 6. A noninverting digital circuit element that may be used to handle a large fanout or to invert input and output levels. Normally, a buffer is an emitter follower. 7. A storage device in which data is temporarily stored during data transfers between peripherals and computers. A means of temporarily storing data must be used when a peripheral device inputs data faster than the computer can process it, or when the computer sends data faster than a peripheral can receive it. 8. A soft fiber-optic material that mechanically isolates individual fibers in a fiber-optic cable or bundle from small geometrical irregularities, distortions, or roughness of adjacent surfaces. The buffer has no optical function. 9. A high-speed area of storage in a computer that is temporarily reserved for use in performing the input/output operation, into which data is read or from which data is written. 10. A storage area in a computer for data that is used to compensate for a speed difference when transferring data from one device to another. Usually refers to an area reserved for I/O operations, into which data is read, or from which data is written. 11. A temporary-storage device used to compensate for a difference in data rate and data flow between two devices (typically a computer and a printer). *See also* spooler.

buffer amplifier—1. An amplifier designed to isolate a preceding circuit from the effects of a following circuit. 2. An amplifier stage that is used to isolate a frequency-sensitive circuit from variations in the load presented by following stages. 3. A unity gain amplifier used to isolate the loading effect of one circuit from another.

buffer capacitor—A capacitor connected across the secondary of a vibrator transformer, or between the anode and cathode of a cold-cathode rectifier tube, to suppress voltage surges that might otherwise damage other parts in the circuit.

buffer circuitry—Circuitry necessary to adapt signals between two systems, e.g., between a test system and a board under test.

buffer computer—A computing system provided with a storage device so that input and output data may be stored temporarily to match the slower speed of input/output devices with the higher speed of the computer.

buffer/driver—A device used to increase the fanout or drive capability of a digital circuit.

buffered terminal—A terminal that contains storage equipment so that the rate at which it sends or receives data over its line does not need to agree exactly with the rate at which the data is entered or printed.

buffer element—A low-impedance inverting driver circuit. Because of its very low source impedance the element can supply substantially more output current than the basic circuit. As a consequence, the buffer element is valuable in driving heavily loaded circuits or minimizing rise-time deterioration due to capacitive loading.

buffer gate—A logic gate with a high output-drive capability, or fanout; a buffer gate is used when it is necessary to drive a large number of gate inputs from one gate function.

buffering—1. Storing data between transfer operations. Data read from a disk is buffered before transfer to a system memory, and data to be written is buffered after transfer from a system memory. 2. The process of temporarily storing data in a software program or in RAM to allow transmission devices to accommodate differences in data transmission rates.

buffer storage—1. A synchronizing element used between two different forms of storage (usually internal and external). 2. An input device in which information from external or secondary storage is assembled and stored ready for transfer to internal storage. 3. An output device into which information from internal storage is copied and held for transfer to secondary or external storage. Computation continues during transfers from buffer storage to secondary or internal storage or vice versa. 4. A device for the purpose of storing information temporarily during data transfers. 5. *See* cache.

buffer storage unit—A computer unit used for temporary storage of data before transmission to another destination. The unit often is able to accept and give back data at widely varying rates so that data transfer takes place efficiently for each device connected to it; that is, a high-speed device is not slowed by the presence of a low-speed device in the same system unless the data transfer occurs directly between the two devices.

buffer stripper—A device that removes flat cable insulation from conductors; a unit of motorized buffing wheels that scrapes the insulation and brushes it away. Also called an abrasion stripper.

bug—1. A semiautomatic telegraph sending key consisting of a lever that is moved to one side to produce a series of correctly spaced dots, and to the other side to produce a dash. 2. A circuit fault due to improper design or construction. 3. An electronic listening device, generally small and concealed, used for commercial or military espionage. 4. To plant a microphone or other sound sensor or to tap a communication line for the purpose of surreptitious listening or audio monitoring; loosely, to install a sensor in a specified location. 5. The microphone or other sensor used for the purpose of surreptitious listening. 6. A device or system used for surreptitiously sensing and removing audio information from a target area. In the sense in which it is usually used, a bug transmits information from the target area to the listening post via radio; however, the information may be transmitted over dedicated wire by varying dc, as in an ordinary telephone circuit, or over power wiring by carrier current, as in a wireless intercom. The sensor in this system (transducer that changes sound into electrical impulses) is normally a microphone, but might be something that has another primary purpose, such as a telephone ringer. 7. A term used to denote a mistake in a computer program or a malfunction in a computer hardware component. 8. A defect in hardware or software that causes a program to malfunction.

bugging height—The distance between the hybrid substrate and the lower surface of the beam-lead device that occurs because of deformation of beam leads during beam-lead bonding.

build—The increase of diameter due to insulation.

building-out—Addition to an electric structure of an element or elements electrically similar to an element or elements of the structure to bring a certain property or characteristic to a desired value.

building-out circuit—A short section of transmission line, or a network that is shunted across a transmission line, for the purpose of impedance matching.

building-out network—A network designed to be connected to a basic network so that the combination will simulate the sending-end impedance, neglecting dissipation, of a line having a termination other than that for which the basic network was designed.

building-out section—A short section of transmission line, either open or short-circuited at the far end, shunted across another transmission line for use on an impedance-matching transformer.

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RUDOLF F. GRAF

"How do you improve on a classic? Rudy Graf has done just that in the fully updated seventh edition of his **Modern Dictionary of Electronics**. In his elegantly practical style he defines over 28,000 terms drawn from a broad range of fields. In a world where electronics technology is growing so rapidly, this authoritative book belongs on everyone's reference shelf!"

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For easy reference, the author has provided definitions for standard abbreviations and equations as well as tables of SI (International System of Units) units, measurements, and schematic symbols.

Rudolf F. Graf is an author whose name is familiar to electronics professionals and hobbyists alike. Mr. Graf graduated from Brooklyn Polytechnic Institute as an electronics engineer, and did his graduate work at New York University. He has been active in the electronics industry for more than fifty years in capacities ranging from design and consulting engineer to chief instructor at electronics and television schools, as well as in sales and marketing. He currently lives in New York. His many books offer a practical and enjoyable approach to often complex material. Other Newnes titles by Mr. Graf include **Video Scrambling and Descrambling, Second Edition**, and his full five-book series on electronics circuits.

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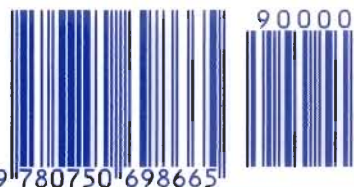


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