

SEVENTH EDITION

MODERN
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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Boston Oxford Auckland Johannesburg Melbourne New Delhi

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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

waveshape of random noise and its amplitude is directly proportional to the bandwidth of the transmission system.

amplitude permeability—The relative permeability at a stated value of field strength and understated conditions, the field strength varying periodically with time and no direct magnetic-field component being present.

amplitude range—The ratio, usually expressed in decibels, between the upper and lower limits of program amplitudes that contain all significant energy contributions.

amplitude resonance—The condition that exists when any change in the period or frequency of the periodic agency (but not its amplitude) decreases the amplitude of the oscillation or vibration of the system.

amplitude response—The maximum output amplitude that can be obtained at various points over the frequency range of an instrument operated under rated conditions.

amplitude selection—The process of selecting that portion of a waveform which lies above or below a given value or between two given values.

amplitude separator—A television-receiver circuit that separates the control impulses from the video signal.

amplitude-shift keying—Abbreviated ask. The modulation of digital information on a carrier by changing the amplitude of the carrier.

amplitude-suppression ratio—In frequency modulation, the ratio of the magnitude of the undesired output to the magnitude of the desired output of an FM receiver when the applied signal is simultaneously amplitude and frequency modulated. Generally measured with an applied signal that is amplitude modulated 30 percent at a 400-hertz rate and is frequency modulated 30 percent of the maximum system deviation at a 1000-hertz rate.

amplitude versus frequency distortion—Distortion caused by the nonuniform attenuation or gain of the system, with respect to frequency under specified terminal conditions.

AM rejection ratio—The ratio of the recovered audio output produced by a desired FM signal with specified modulation, amplitude, and frequency to that produced by an AM signal, on the same carrier, with specified modulation index.

AM suppression—The ability of an FM tuner to reject AM signals. Expressed in decibels, it is the ratio between the tuner output with a 100-percent modulation FM signal to its output with a 30-percent modulated AM signal.

AM tuner—A device capable of converting amplitude-modulated signals into low-level audio frequencies.

amu—Abbreviation for atomic mass unit.

analog—1. In electronic computers, a physical system in which the performance of measurements yields information concerning a class of mathematical problems. 2. Of or pertaining to the general class of devices or circuits in which the output varies as a continuous function of the input. 3. The representation of numerical quantities by means of physical variables, e.g., translation, rotation, voltage, resistance; contrasted with *digital*. 4. A continuous representation of phenomena in terms of points along a scale, each point merging imperceptibly into the next. An analog voltage, for example, may take any value. Real-world phenomena, such as heat and pressure, are analog (compare with *digital*).

analog adder—An analog circuit or device that receives two or more inputs and delivers an output that is equal to their sum.

analog amplifier—A device whose output is continuously proportional to the input stimulus.

analog channel—A computer channel in which the transmitted information can have any value between the defined limits of the channel.

analog circuit—A circuit in which the output varies as a continuous function of the input, as contrasted with digital circuits.

analog communications—A system of telecommunications employing a nominally continuous electrical signal that varies in frequency, amplitude, etc., in some direct correlation to nonelectrical information (sound, light, etc.) impressed on a transducer.

analog computer—1. A computer operating on the principle of creating a physical (often electrical) analogy of the mathematical problem to be solved. Variables such as temperature, light, pressure, distance, angle, shaft speed, or flow are represented by the magnitude of a physical phenomenon such as voltage or current. The computer manipulates these variables in accordance with the mathematical formulas "analogued" on it. 2. A computer system in which both the input and output are continuously varying signals. 3. A computing machine that works on the principle of measuring, as distinguished from counting. 4. A computer that solves problems by setting up equivalent electric circuits and making measurements as the variables are changed in accordance with the corresponding physical phenomena. An analog computer gives approximate solutions, whereas a digital computer gives exact solutions. 5. A nondigital computer that manipulates linear (continuous) data to measure the effect of a change in one variable on all other variables in a particular problem. (Compare: *digital computer*.)

analog computing—Computing system in which continuous signals represent mechanical (or other) parameters.

analog data—1. A physical representation of information such that the representation bears an exact relationship to the original information. The electrical signals on a telephone channel are an analog data representation of the original voice. 2. Data represented in a continuous form, as contrasted with digital data represented in a discrete (discontinuous) form. Analog data is usually represented by physical variables, such as voltage, resistance, rotation, etc.

analog input module—An I/O rack module that converts an analog signal from a user device to a digital signal that may be processed by the processor.

analog meter—An indicating instrument that employs a movable coil and pointer arrangement (or equivalent) to display values along a graduated scale.

analog multiplexer—1. Circuit used for time-sharing of analog-to-digital converters between a number of different analog information channels. Consists of a group of analog switches arranged with inputs connected to the individual analog channels and outputs connected in common. 2. Two or more analog switches with separate inputs and a common output, with each gate separately controllable. Multiplexing is performed by sequentially turning on each switch one at a time, switching each individual input to a common output. 3. A device that selects one of several analog signals according to a digital code. Analog multiplexers (amux) are available in many forms; their chief application is as a front end in data-acquisition systems, enabling a single analog-to-digital converter to monitor more than one information channel.

analog network—A circuit or circuits that represent physical variables in such a manner as to permit the expression and solution of mathematical relationships between the variables, or to permit the solution directly by electric or electronic means.

being plated by the substrate. Thickness of the plating is limited to 10 to 50 microinches (0.254 to 1.27 μm). 2. The chemical deposition of a thin metallic coating over certain base metals by a partial displacement of the base metal.

immersion pyrometer—An instrument for determining molten-steel temperature and normally consisting of a platinum-platinum rhodium bimetal thermocouple junction and a recording device for transposing the millivoltage into degrees of temperature.

immittance—A term that denotes both impedance and admittance. It is commonly applied to transmission lines, networks, and certain kinds of measuring instruments.

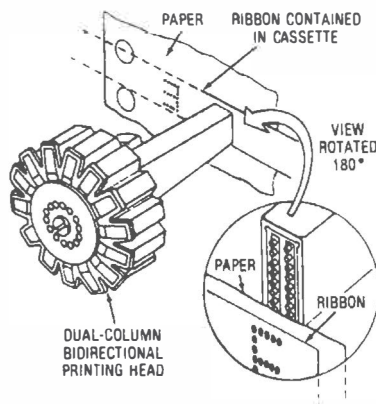
IMOS—See ion-implanted MOS.

impact excitation—The starting of damped oscillations by a sudden surge, such as by a spark discharge.

impact modulator amplifier—A fluidic device in which the impact plane position of two opposed streams is controlled to alter the output.

impact predictor—A device that can determine, in real time, the point on the earth's surface where a ballistic missile will impact if thrust is instantaneously terminated.

impact printer—1. Any type of printer that generates characters by using some form of stamping or inking through a ribbon by some sort of character slug, element, or hammer-needle. (Daisy-wheel printers are impact printers.) 2. Any mechanical imprinting device that forms characters by striking characters against a ribbon onto paper. 3. A mechanical printer operating at relatively low speeds—from 150 lines per minute to 1800 lines per minute. Has multiple copy capability and normally is capable of producing an original plus three copies. Impact printers are identified as letter-quality, dot-matrix, and line-printing types. No longer in common use.



Impact printer (dot-matrix).

impact printing—Printing that is produced by the impact of a key on an inked ribbon, transferring the impression of a character onto the paper located behind the ribbon.

impact resistance—Resistance to fracture under shock force.

IMPATT—Acronym for impact avalanche and transit time.

IMPATT diode—Impact avalanche and transmit time diode. 1. A pn-junction diode operated with heavy back bias so that avalanche breakdown occurs in the active region. To prevent burnout, the device is so

constructed that the active region is very close to a good heat sink. For the same reason, the bias supply must be a constant-current type. 2. A device whose negative resistance characteristic is produced by a combination of impact avalanche breakdown and charge-carrier transit-time effects. Avalanche breakdown occurs when the electric field across the diode is high enough for the charge carriers (holes or electrons) to create electron-hole pairs. With the diode mounted in an appropriate cavity, the field patterns and drift distance permit microwave oscillations or amplification. 3. A semiconductor microwave diode that, when its junction is biased onto avalanche, exhibits a negative resistance over a frequency range determined by the transit time of charge carriers through the depletion region.



IMPATT diode.

IMPATT oscillator—An oscillator in which the active element is an IMPATT diode operating in a negative resistance mode. Dc to rf conversion efficiencies are normally less than 20 percent. Present devices operate above 5 GHz.

impedance—1. The total opposition (i.e., resistance and reactance) a circuit offers to the flow of alternating current at a given frequency; the ratio of the potential difference across a circuit or element of a circuit to the current through the circuit or element. It is measured in ohms, and its reciprocal is called admittance. Symbol: Z . 2. The combination of resistance and reactance. 3. Combined opposition to current resulting from resistance, capacitance, and inductance. 4. The sinusoidal terminal voltage of a circuit divided by the current through it. 5. A speaker's resistance to an alternating current, which varies with frequency. A speaker's rated impedance is usually the value measured at 400 Hz. 6. The opposition to alternating current in a circuit, generally categorized as either high or low, and measured in ohms. 7. The total opposition that a circuit offers to the flow of alternating current or any other varying current at a particular frequency. It is a combination of resistance, R , and reactance, X , measured in ohms.

impedance angle—Angle of the impedance vector with respect to the resistance vector. Represents the phase angle between voltage and current.

impedance at the intermediate frequency—In a mixer semiconductor diode, the impedance measured at the output terminals of a mixer circuit when the device is driven by a local oscillator under specified conditions.

impedance bridge—A device for measuring the combined resistance and reactance of a component part of a circuit.

impedance characteristic—A graph of impedance versus frequency of a circuit or component.

impedance coil—A coil whose inductive reactance is used to hinder the flow of alternating current in or between circuits.

impedance compensator—1. An electric network used with a line or another network to give the impedance of the combination a certain characteristic over a desired frequency range. 2. A circuit that ensures that a transmission line is a proper electrical load for its communicating devices. It is connected in parallel with the devices.

impedance coupling—A method of coupling using an impedance as the coupling device common to both the primary and secondary circuits. This type of coupling is usually limited to audio systems, where high gain and limited bandpass are required.

impedance drop—The vector sum of the resistance drop and the reactance drop. (For transformers, the resistance drop, the reactance drop, and the impedance drop are, respectively, the sum of the primary and secondary drops reduced to the same terms. They are usually expressed in percent of the secondary-terminal voltage.)

impedance ground—An earth connection made through an impedance of predetermined value usually chosen to limit the current of a short-circuit to ground.

impedance irregularities—Breaks or abrupt changes that occur in an impedance-frequency curve when unlike sections of a transmission line are joined together or when there are irregularities on the line.

impedance match—The condition in which the impedance of a component or circuit is equal to the internal impedance of the source or the surge impedance of a transmission line, thereby giving maximum transfer of energy from sources to load, minimum reflection, and minimum distortion.

impedance matching—1. The connection across a source impedance of another impedance having the same magnitude and phase angle. If the source is a transmission line, reflection is thereby avoided. 2. The process of adjusting the impedances of a load and of its power source so that they are equal. This permits the greatest possible transfer of power. 3. Making the impedance of a terminating device equal to the impedance of the circuit to which it is connected in order to achieve optimum signal transfer.

impedance-matching transformer—A transformer used to match the impedance of a source and load.

impedance plethysmograph—An instrument used to detect the increased blood volume in the tissues of the body during a contraction of the heart. *See also* electrical-impedance cephalography; finger plethysmograph.

impedance transformer—A transformer that transfers maximum energy from one circuit to another.

impedance triangle—A diagram consisting of a right triangle. The sides are proportional to the resistance and reactance in an ac circuit, with the hypotenuse representing the impedance.

imperfect dielectric—A dielectric in which part of the energy required to establish its electric field is converted into heat instead of being returned to the electric system when the field is removed.

imperfection—In a crystalline solid, any deviation in structure from an ideal crystal (one that is perfectly periodic in structure and contains no foreign atoms).

implantable pacemaker—A miniature pulse generator surgically implanted beneath the skin and provided with output leads that connect directly to the heart muscle. The electrodes may contact either the outer wall of the

impedance characteristic — impulse excitation

heart muscle (myocardial electrodes) or the inner surface of the heart chamber (endocardiac electrodes).

implied AND—Also called dot AND or wired AND. A logic element in which the combined outputs are true if and only if all outputs are true. (Sometimes improperly called dot OR or wired OR.)

implied OR—Also called wired OR. A logic element in which the combined outputs are true if one or more of the outputs are true.

implode—The inward bursting of a picture tube due to its high vacuum.

import—To copy data created by one computer program or file into another.

impregnant—1. A substance, usually a liquid, used to saturate the paper dielectric of a capacitor and replace the air between its fibers, thereby increasing the dielectric strength and the dielectric constant of the capacitor. 2. A substance intended to replace the air as dielectric between the electrodes of a capacitor.

impregnate—1. To fill voids and air spaces (of a capacitor or transformer) with a material having good insulating properties commonly called an impregnant. 2. To fill the voids and interstices of a material with a compound. This does not imply complete fill or complete coating of the surfaces by a hole-free film.

impregnated coils—Coils that have been permeated with an electric grade varnish or other protective material to protect them from mechanized vibration, handling, fungus, and moisture.

impregnating—Complete filling of even the smallest voids in a component or closely packed assembly of parts. Low-viscosity compounds, usually liquids, are used. The process is frequently accomplished by a vacuum process in which all air is removed before introducing the impregnating material. Typical examples of impregnating are the filling of capacitors or transformer windings.

impregnation—1. The process of coating the insides of coils and closely packed electronic assemblies by dipping them into a liquid and letting it solidify. 2. The process of completely filling all interstices or a part or assembly with a thin, liquid, electrically insulating material. The process is best accomplished by first removing all air (creating a vacuum), then introducing the impregnant, and finally applying atmospheric or elevated pressures to completely force-fill the system.

impressed voltage—The voltage applied to a circuit or device.

improvement threshold—A characteristic of FM radio receivers that determines the minimum rf signal power required to overcome the inherent thermal noise. For increasing values of rf power above this point, an improvement of signal-to-noise ratio is obtained.

impulse—1. A pulse that begins and ends within so short a time that it may be regarded mathematically as infinitesimal. The change produced in the medium, however, is generally of a finite amount. 2. A current surge of unidirectional polarity. *See also* pulse.

impulse bandwidth—The area divided by the height of the voltage-response selectivity as a function of frequency. It is used in the calculation of broadband interference.

impulse-driven clock—An electric clock in which the hands are moved forward at regular intervals by current impulses from a master clock.

impulse excitation—Also called shock excitation. 1. A method of producing oscillatory current in which the duration of the impressed voltage is relatively short compared with that of the current produced. 2. The sudden application of a momentary steep-wavefront voltage to a resonant circuit, resulting in a damped oscillation.

same or different material, but meant to be played at the same time (e.g., those used for stereophonic recording).

multiple stack—*See* multiple pileup.

multiple switchboard—A manual telephone switchboard in which each subscriber line is connected to two or more jacks so that they are within reach of more than one operator.

multiple tube counts—Spurious counts induced in a radiation counter by previous tube counts.

multiple-tuned antenna—A low-frequency antenna with one horizontal section and several tuned vertical sections.

multiple-twin quad—Quad cable in which the four conductors are arranged in two twisted pairs, and the two pairs are twisted together.

multiple-unit semiconductor device—A semiconductor device having two or more sets of electrodes associated with independent carrier systems. It is implied that the device has two or more output functions that are independently derived from separate inputs (e.g., a duotriode transistor).

multiple-unit steerable antenna—Abbreviated MUSA. An antenna unit composed of a number of stationary antennas, the major composite lobe of which is electrically steerable..

multiple-unit tube—Also called a duodiode, duotriode, diode-pentode, duodiode-triode, duodiode-pentode and triode-pentode. An electron tube containing two or more groups of electrodes associated with independent electron streams within one envelope.

multiplex—Abbreviated mux. 1. To carry out several functions simultaneously in an independent but related manner. 2. To interleave or transmit two or more messages simultaneously on a single channel. 3. A technique for transmitting two or more signals at the same time on the same carrier frequency. *See* FM stereo. 4. Transmission of two or more channels on a single carrier so that they may be recovered independently by a tuner. In FM stereo, transmission of left-plus-right (sum) signal and left-minus-right (difference) signal on main carrier and subcarrier, respectively. The multiplex decoder in the tuner recovers independent left and right stereo channels from the multiplex signal. 5. To combine two or more electrical signals into a single, composite signal. This may be done on a frequency basis (frequency-division multiplexing) or on a time basis (time-division multiplexing). 6. The system used to transmit two stereo program channels on a single FM carrier in such a form that the complete program (left plus right channels) can be heard on a mono FM tuner. A multiplex demodulator in the tuner converts the composite received program to its two-channel form.

multiplex adapter—A circuit incorporated in an FM tuner or receiver to permit two-channel, or stereophonic, reception from a station transmitting multiplex broadcasts. The other audio channel is produced by demodulating the transmitted subcarrier.

multiplex code transmission—The simultaneous transmission of two or more code messages in either or both directions over the same transmission path.

multiplexed line—A data-communication line equipped with multiplexers at each end.

multiplexer—Abbreviated mux. 1. A device for accomplishing simultaneous transmission of two or more signals over a common transmission medium. 2. An analog or linear device for selecting one of a number of inputs and switching its information to the output; the output voltage follows the input voltage with a small error. 3. A digital device that can select one of a number of inputs and pass the logic level of that input-channel. Selection usually is presented to the device in binary weighted form

multiple stack — multiplex printing telegraphy

and decoded internally. The device acts as a single-pole multiposition switch that passes digital information in one direction only. 4. A device that will interleave (time division) or simultaneously transmit (frequency division) two or more messages on the same communications channel. 5. A device that uses several communication channels at the same time and transmits and receives messages and controls the communication lines. This device itself may or may not be a stored-program computer. 6. A device that can combine several low-speed inputs into one high-speed output. Multiplexers can also function in reverse, a process called demultiplexing. 7. A decision-making type of digital building block that routes data from its one input to any one of several outputs. 8. The device or technique used to share a resource (usually a memory or a bus). 9. In television, a specialized optical device that makes it possible to use a single television camera in conjunction with one or more motion-picture projectors and/or slide projectors in a film chain. The camera and projectors are in a fixed relationship, and prisms or special (dichroic) mirrors are used to provide smooth and instantaneous nonmechanical transition from one program source to the other. 10. A device for selecting a single signal from one of many sources (similar to a multiposition switch). 11. A hardware device that allows the transmission of a number of different signals simultaneously over a single channel. 12. A combination of hardware and software that allows simultaneous transmission and reception of two or more data streams on a single channel.

multiplex filter—*See* MPX filter.

multiplexing—Abbreviated mux. 1. A method of signaling characterized by the simultaneous and/or sequential transmission and reception of multiple signals over a communication channel with means for positively identifying each signal. The signaling may be accomplished over a wire path or radio carrier or combination of both. 2. The division of a transmission facility into two or more channels either by splitting the frequency band transmitted by the channel into narrower bands, each of which is used to constitute a distinct channel (frequency-division multiplexing) or by allotting this common channel to several different information channels, one at a time (time-division multiplexing). 3. Combining two or more channels onto one transmission facility. 4. The time-shared scanning of a number of data lines into a single channel. Only one data line is enabled at any instant. 5. The combination of two or more measurements for transmission along a single wire, path, or carrier. The combination of information signals for transmission on one channel. 6. The act of combining a number of individual message circuits for transmission over a common transmission path. 7. A technique for the concurrent transmission of two or more signals in either or both directions, over the same wire, carrier, or other communication channel. The two basic multiplexing techniques are time-division multiplexing and frequency-division multiplexing.

multiplex operation—Simultaneous transmission of two or more messages in either or both directions over the same transmission path.

multiplexor—A device used for division of a transmission facility into two or more subchannels, either by splitting the frequency band into narrower bands (frequency division) or by allotting a common channel to several different transmitting devices one at a time (time division).

multiplex printing telegraphy—The form of printing telegraphy that uses a line circuit to transmit one character (or one or more pulses of a character) for each of two or more independent channels.

multiplex radio transmission — The simultaneous transmission of two or more signals over a common carrier wave.

multiplex stereo — A system of broadcasting both channels to a stereo program on a single carrier. This is commonly done by modulating an ultrasonic subcarrier — either with the signals of one of the stereo channels, or by a different signal composed of the two channels combined out of phase, or subtractively.

multiplex telegraphy — Telegraphy employing multiplex code transmission.

multiplex transmission — The simultaneous transmission of two or more signals within a single channel. Multiplex transmission as applied to FM broadcast stations means the transmission of facsimile or other signals in addition to the regular broadcast signals.

multiple x-y recorder — A recorder that plots a number of independent charts simultaneously, each showing the relation of two variables, neither of which is time.

multiplication point — A mixing point whose output is obtained by multiplication of its inputs.

multiplier — 1. A device in which the output represents the product of the magnitudes represented by the two or more input signals. 2. A series register placed in a voltmeter to increase the voltage range. 3. A fixed resistance, connected in series with the moving coil of a voltmeter, to enable measurements over a larger voltage range.

multiplier phototube — Also called photomultiplier. 1. Phototube with one or more dynodes between its photocathode and the output electrode. The electron stream from the photocathode is reflected off each dynode in turn, with secondary emission adding electrons to the stream at each reflection. 2. A tube consisting of an evacuated envelope with a photocathode that emits electrons when exposed to light. These electrons are accelerated by a positive electrostatic field and fall on a metal surface, where they emit secondary electrons that are again accelerated to generate more electrons at the next metal surface, and so on. The whole arrangement thus acts as a combination of a simple photocell with a high-gain amplifier in a self-contained unit.

multiplier-quotient register — In a computer, a register used for operations that involve multiplication and division.

multiplier resistor — See multiplier, 2.

multiplier traveling-wave photodiode — A device in which increased sensitivity is obtained by combining the construction of a traveling-wave tube with that of a multiplier phototube.

multiplier tube — A vacuum tube in which sequential secondary emission from a number of electrodes is used to obtain increased output current. The electron stream is reflected from the first electrode of the multiplier to the second, and so on.

multiplying factor — The number by which the reading of a meter must be multiplied to obtain the true value.

multiport — Describes a network configuration in which several transmission facilities connect several end stations to a master station.

multiport circuit — A circuit interconnecting several locations, wherein information transmitted is available at all locations simultaneously.

multiport line — See multidrop line.

multiport recorder — A data recorder that uses a single pen to record the values of several parameters by multiplexing of the inputs, that is, by sequentially switching the inputs so that one parameter is recorded for a brief period, then the next, and so forth. Since the curves may cross each other and make identification

of parameters a problem, various methods of identifying each trace have been developed.

multipolar — Having more than one pair of magnetic poles.

multiport — Refers to the capability of communications equipment to accept more than one input/output data line.

multiposition relay — A relay having more than one operate or nonoperate position, e.g., a stepping relay.

multiprocessing — 1. The simultaneous or interleaved execution of two or more programs or instruction sequences by a computer or computer network. It may be accomplished by multiprogramming, parallel processing, or both. 2. The operation of more than one processing unit within a single system. Separate processors may take over communications or peripheral control, e.g., while the main processor continues program execution. 3. A complex technique that permits more than one computer program to be executed simultaneously on more than one processor in a shorter period of time than is required for the overall sequentially organized task, for which time may not be available. 4. The operation of several CPUs or similar programmable processors operating relatively independently of one another but sharing common resources, such as memory and I/O, over a common multiple-processor bus. This arrangement is well suited for larger overall processing tasks for which one processor is not a cost-effective solution. In general, multiprocessing increases system reliability, improves the use of resources, and permits greater system performance. Through parallel action, it often multiplies system performance by the number of processors used. Multiprocessing permits system performance to greatly surpass that of a single CPU. 5. Two or more CPUs operating together either in a tightly coupled system, in which all I/O and memory share a parallel bus, and access is interleaved cycle by cycle, or in a loosely coupled system, in which CPUs have independent memory and I/Os and share parallel or serial bus links. 6. Independent and simultaneous processing accomplished by a computer configuration consisting of more than one arithmetic and logic unit, each being capable of accessing a common memory. 7. Computer operation in which two or more similar computers are hooked together. The individual computers can work on different parts of the same problem simultaneously, or on entirely different problems. Or each computer can specialize in a particular kind of task, or two computers can work on the same program and check each other. 8. The ability of an operating system to support multiple processors. Generally, in order to make the operating system task manageable, all processors are equivalent and interchangeable, although this is not a requirement. 9. A processing method in which program tasks are logically and/or functionally divided among a number of independent CPUs, with the programming tasks being simultaneously executed.

multiprocessor — 1. A computer capable of executing one or more programs simultaneously using two or more processing units under integrated control of programs or devices. 2. A system architecture that permits complex operations, like computation, to be carried on simultaneously at different nodes.

multiprogramming — 1. A method in which many programs are interleaved or overlapped so that they can be operated on within the same interval of time. This technique is the basis for time-shared operation. 2. A programming technique in which two or more programs are operated on a time-sharing basis, usually under control of a monitor that determines when execution of one program stops and another begins. 3. The technique of utilizing several interleaved programs concurrently in a single computer system. 4. Pertaining to the concurrent

used primarily in connection with the generation, transmission, and distribution of electric power.

switch hook — A switch associated with the structure on a telephone set that supports the receiver or handset. The switch is operated when the receiver or handset is removed from or replaced on the support.

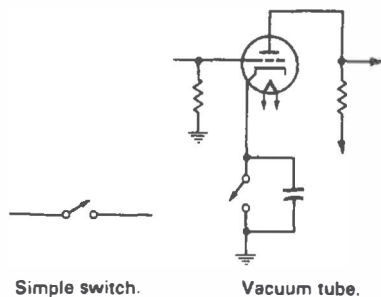
switching — 1. Making, breaking, or changing the connections in an electrical circuit. 2. The action of turning a device on and off.

switching amplifier — 1. One whose output stage rapidly switches output power between transistor saturation and cutoff. Average output current is varied by controlling switching frequency, pulse amplitude, duty cycle, or any combination of these factors. Usually, however, switching amplifiers control power by modulating either pulse width or pulse frequency. Switching rates can be varied up to about 100 kHz. Since a switching amplifier controls output power by varying on-off time ratio of the output pulses, amplifier heat dissipation varies little from a nominal rating and is much less than that of amplifiers that consume unused power. However, switching amplifiers generate transients that can upset the operation of nearby electronic circuits. 2. *See* class D amplifier.

switching center — 1. A location at which data from an incoming circuit is routed to the proper outgoing circuit. 2. A group of equipment within a relay station for automatically or semiautomatically relaying communications traffic. 3. A location where an incoming call/message is automatically or manually directed to one or more outgoing circuits. 4. *See* switching office.

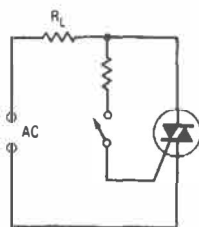
switching characteristics — An indication of how a device responds to an input pulse under specified driving conditions.

switching circuit — A circuit that performs a switching function. In computers, this is performed automatically by the presence of a certain signal (usually a pulse signal). When combined, switching circuits can perform a logical operation.



Simple switch.

Vacuum tube.



Triac.

Switching circuits.

switching coefficient — The derivative of applied magnetizing force with respect to the reciprocal of the

resultant switching time. It is usually determined as the reciprocal of the slope of a curve of reciprocals of switching times versus the values of applied magnetizing forces, which are applied as step functions.

switching control — An installation in a wire system where telephone or teletypewriter switchboards are installed to interconnect circuits.

switching current — The current through a device at the switching voltage point.

switching device — Any device or mechanism, either electrical or mechanical, that can place another device or circuit in an operating or nonoperating state.

switching differential — The difference between the operate and release points of a switch, caused by hysteresis. It can be in units of amperes, volts, inches, gaussses, etc. *See* hysteresis.

switching diode — A diode that has a high resistance (corresponding to an open switch) below a specified applied voltage but changes suddenly to a low resistance (closed switch) above that voltage.

switching equipment — Equipment located in the telephone company offices that makes the interconnection between the station equipment of two or more subscribers.

switching hysteresis — The principle associated with sensors, such that the operate point is not at the same level as the release point. In solid-state sensors it is accomplished with negative-resistance devices, and in mechanical switches it results from the storing of potential energy before the transition occurs.

switching mode — A way of utilizing a vacuum tube or transistor so that (except for negligibly small transition times) it is either in cutoff or saturation. A transistor operated in this mode can switch large currents with little power dissipation.

switching office — Also called switching center. A location where either toll or local telephone traffic is switched or connected from one line or circuit to another.

switching pad — A transmission-loss pad automatically inserted into or removed from a toll circuit for different desired operating conditions.

switching power supply — Also called switcher. A power supply (usually dc output) that achieves its output regulation by means of one or more active power-handling devices that are alternately placed in the off and on states. Distinguished from linear or dissipative power supplies, in which regulation is achieved by power-handling devices whose conduction is varied continuously over a wide range that seldom (if ever) includes the full off or full on condition. *See* figure on page 753.

switching regulator — A power supply design that achieves efficient regulation by commuting the input voltage into a filter circuit.

switching time — 1. The interval between the reference time and the last instant at which the instantaneous-voltage response of a magnetic cell reaches a stated fraction of its peak value. 2. The interval between the reference time and the first instant at which the instantaneous integrated-voltage response reaches a stated fraction of its peak value. 3. The time for a multiplexer to change from one channel to the next with the new output signal remaining within a specified percentage of its final value. Expressed for a maximum voltage transition.

switching transients — Transient voltage spikes that appear at a multiplexer's output when the multiplexer is switched from one channel to another and one of the switches is turned off. Such spikes may cause inaccurate measurements if output is sampled, digitized, or integrated during this time.

switching transistor — A three-terminal device with one terminal controlling the electrical impedance

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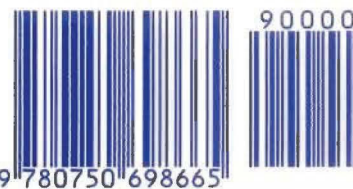


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